

ENGINE

Cooling System

TABLE OF CONTENTS

Cooling System	6B-2
Service Precautions	6B-2
Functional Check	6B-5
A List of Defective Phenomena	6B-7
Main Data and Specifications	6B-7
Water Pump	6B-9
Components	6B-9
Removal	6B-10
Inspection	6B-11
Installation	6B-11
Torque Specifications	6B-13
Thermostat	6B-14
Components	6B-14
Removal	6B-14
Inspection	6B-14
Installation	6B-15
Torque Specifications	6B-16
Radiator and Intercooler	6B-17
Components	6B-17
Removal	6B-17
Inspection	6B-18
Installation	6B-19
Torque Specifications	6B-20
Drive Belt	6B-21
Components	6B-21
Inspection	6B-21
Adjustment	6B-22
Torque Specifications	6B-23

Cooling System

Service Precautions

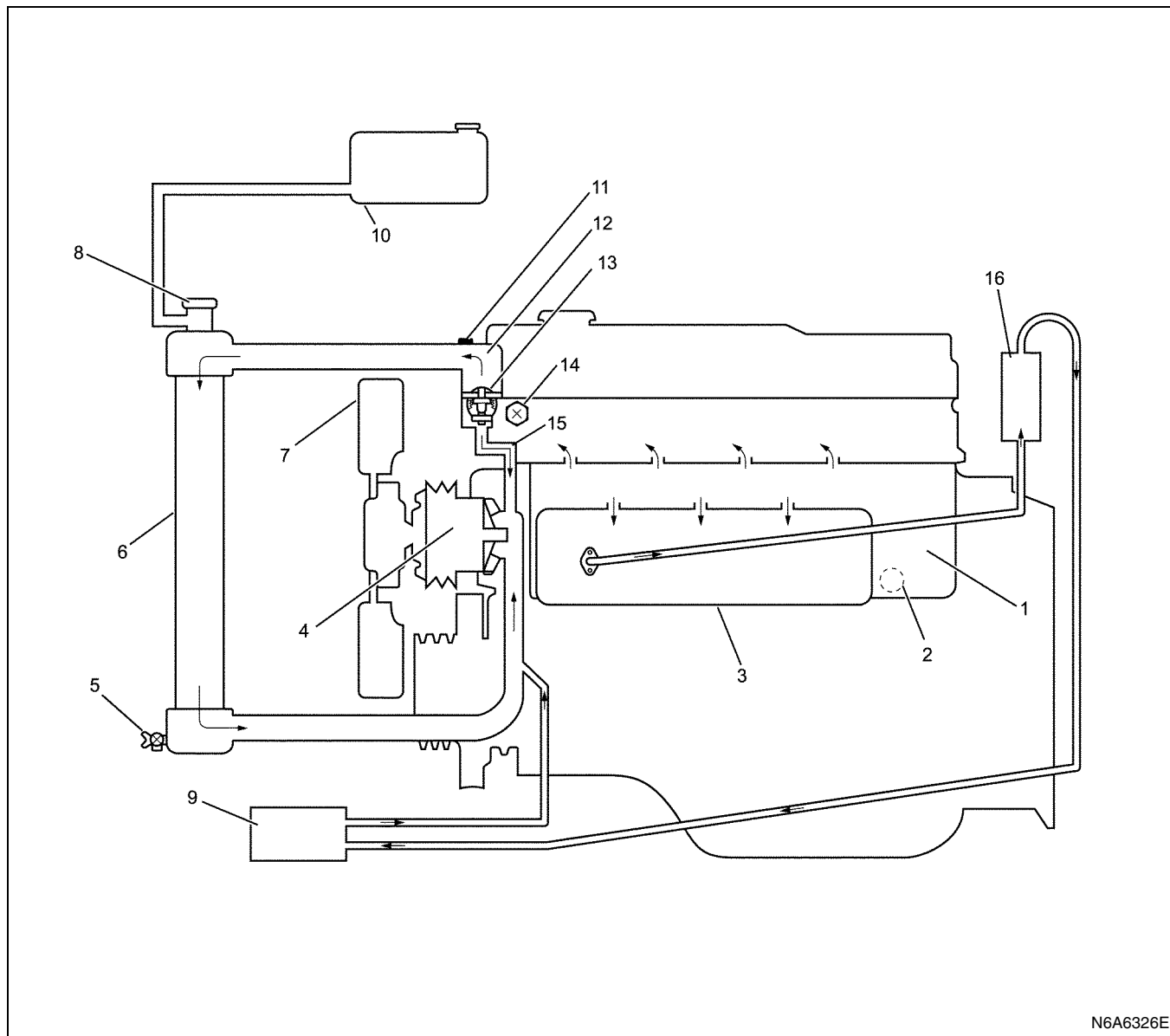
WARNING:

Do not remove the radiator cap when the cooling water is at high temperature. Steam or boiling water will gush out and you may be burnt. To open the radiator cap, cover the cap with a thick cloth when the cooling water is cool, release the pressure by slowly turning the cap, and then remove the cap.

Explanations on Functions and Operation

Cooling Water System

The cooling water system, which is the forced circulation system, consists of a water pump, thermostat, and radiator as its main components.



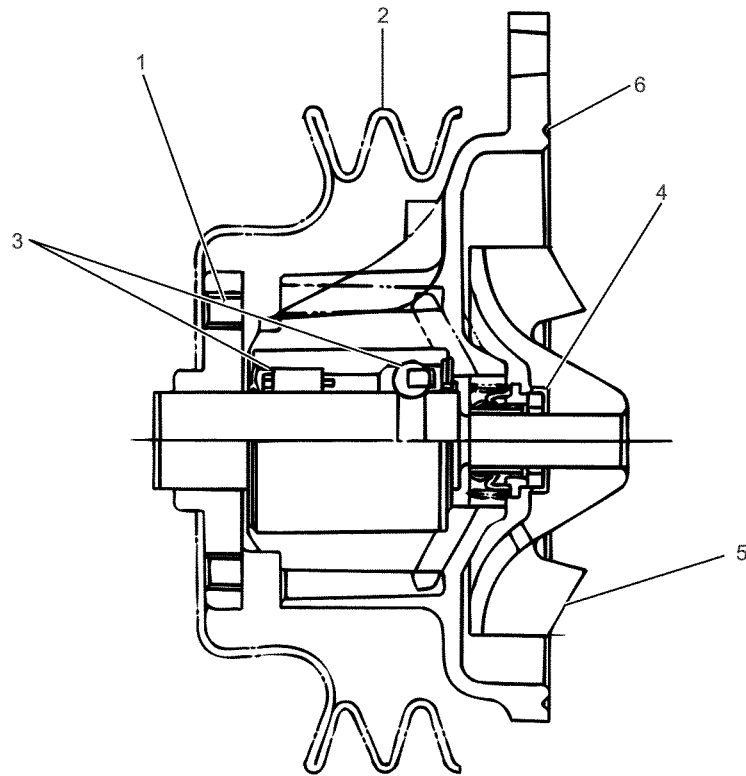
N6A6326E

Legend

- | | |
|-----------------|-------------------------|
| 1. Water Jacket | 9. Heater Core |
| 2. Drain Plug | 10. Reserve Tank |
| 3. Oil Cooler | 11. Air Bleeding Plug |
| 4. Water Pump | 12. Water Outlet Pipe |
| 5. Drain Cock | 13. Thermostat (2 nos.) |
| 6. Radiator | 14. Thermometer Unit |
| 7. Cooling Fan | 15. Bypass Route |
| 8. Radiator Cap | 16. EGR Cooler |

Water Pump

The water pump, which uses the centrifugal impeller system, is driven by the engine fan belt.



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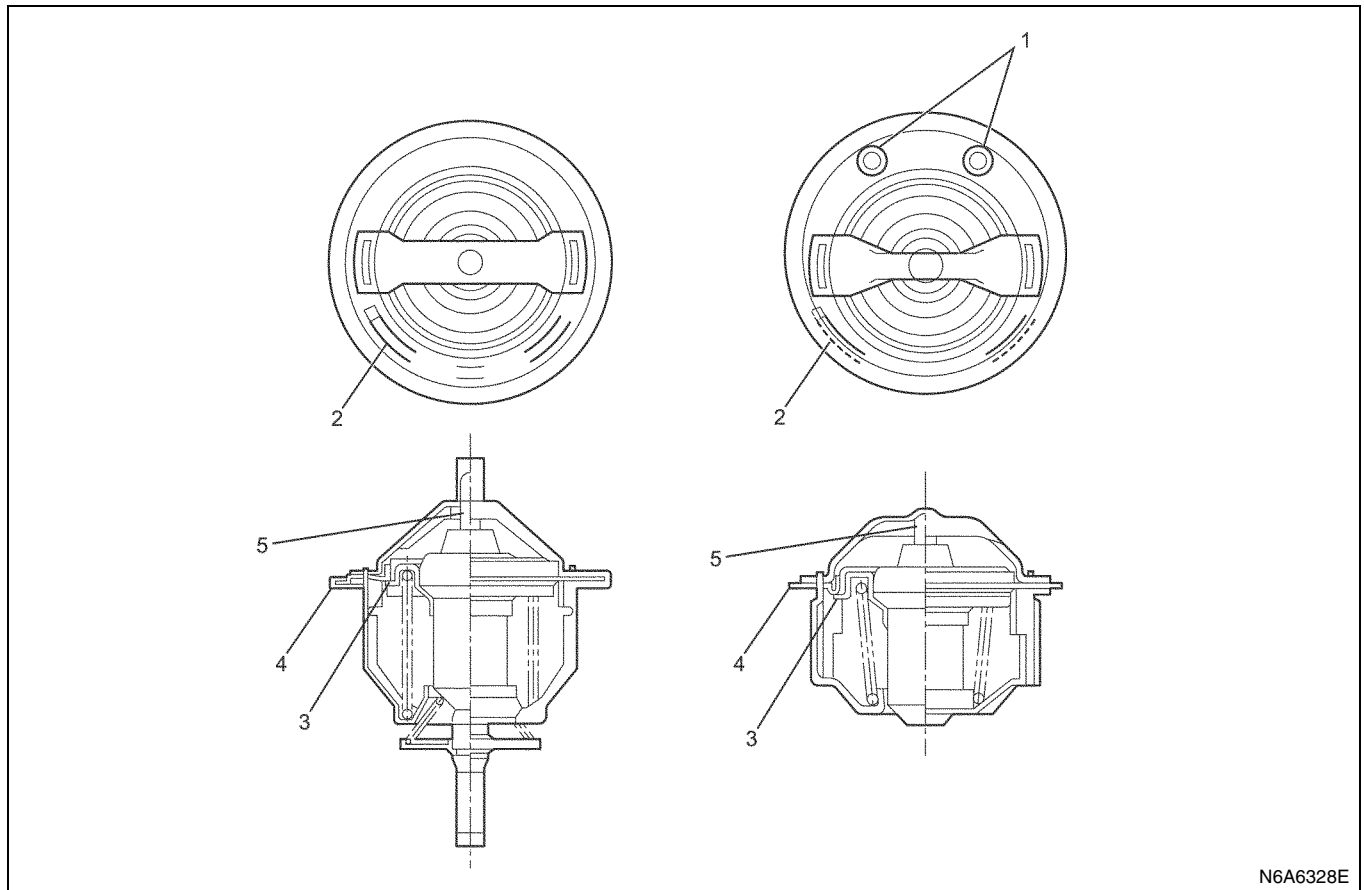
Legend

- | | |
|---------------|--------------|
| 1. Fan Center | 4. Seal Unit |
| 2. Fan Pulley | 5. Impeller |
| 3. Bearing | 6. Groove |

6B-4 Cooling System

Thermostat

The thermostat is a wax pellet type and consists of two units, in which one unit (bottom bypass type) has an valve initial opening temperature of 82 °C (180 °F) and the second (inline type) has an valve initial opening temperature of 85 °C (185 °F). It is designed such that the water temperature can be adjusted finely and it is mounted within the thermostat-housing unit.



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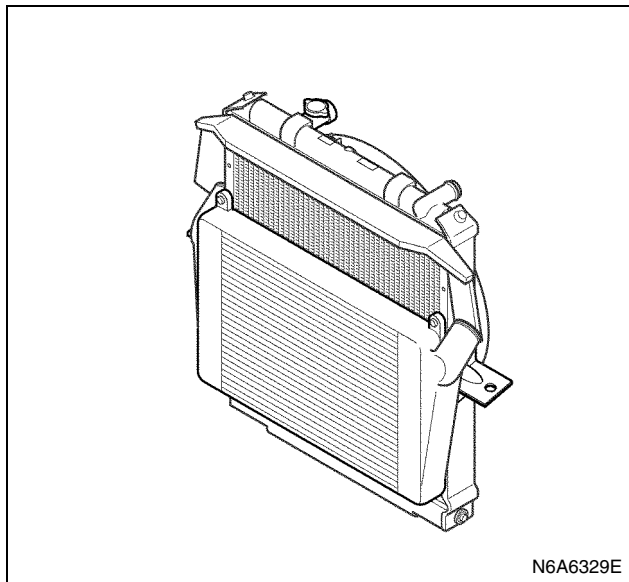
Legend

- 1. Jiggle Valve
- 2. Stamp Mark (Valve Initial Opening Temperature)
- 3. Valve

- 4. Gasket
- 5. Piston

Radiator

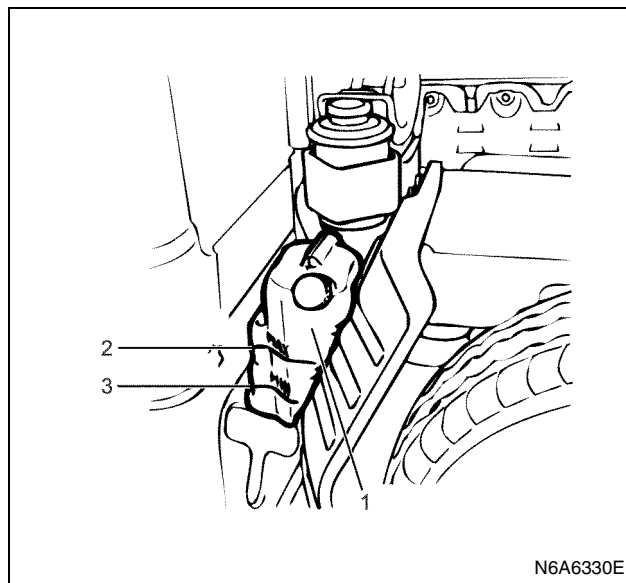
The radiator is a tube with corrugated fins. To increase the boiling point of the cooling water, a radiator cap of injection valve opening pressure of 108 ± 14.7 kPa (1.1 ± 0.15 kg/cm² / 15.7 ± 2.1 psi) is attached.



Functional Check

1. Cooling water level check
 - Check the cooling water level within the reserve tank and the level is appropriate when the cooling water level is within the MAX (upper limit) and MIN (lower limit) range. In case the volume of the cooling water is deficient, remove the reserve tank cap and replenish with a mixture of tap water and engine coolant in the ratio of 1:1 until the level comes close to the MAX line.

Standard value	
Cooling water level	17.6 liters (4.65 US gal. / 3.87 Imp gal.) (between MIN and MAX level)
Replacement period	Every two years or 40,000 kilometers (24,000 miles)



Legend

1. Reserve Tank
2. MAX Line (Upper Limit)
3. MIN Line (Lower Limit)

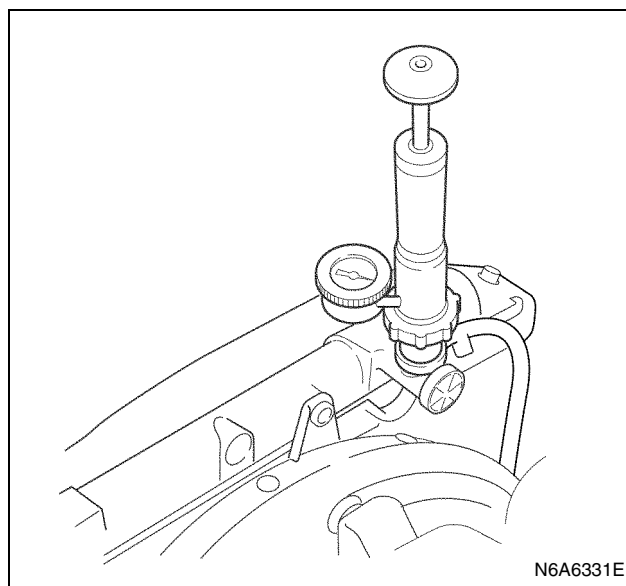
Inspection

Cooling water leak check

- Use the radiator cap tester and apply a pressure of 196 kPa (2.0 kg/cm² / 28.4 psi) and check for leaks in the locations given below. Check that the radiator hose and heater hose are not damaged or degraded and the hose clamp is not loose.

Inspection locations

- Radiator assembly, water pump assembly, radiator hose, and heater hose.

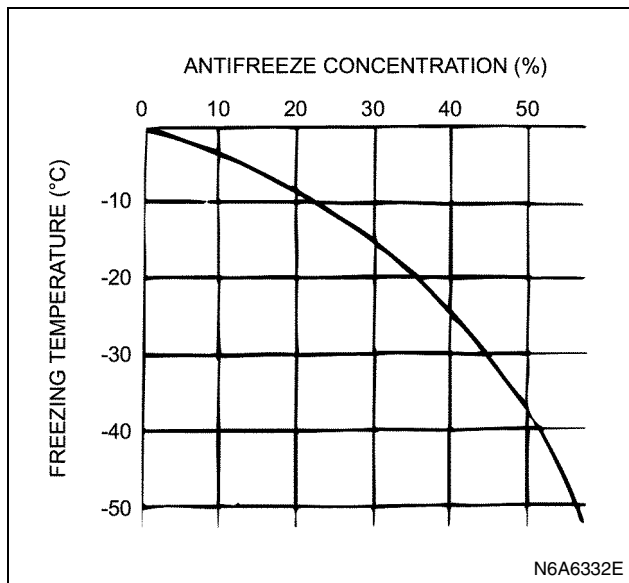


Coolant

1. About the engine coolant concentration

6B-6 Cooling System

- Take the concentration corresponding to the minimum temperature because the freezing temperature varies according to the concentration of the engine coolant.
- Use only genuine Isuzu engine coolant.
- Use engine coolant with a mix ratio in the range of 30 to 60% because over heating is likely to occur if the ratio is greater than 60% and corrosion prevention is inadequate if the ratio is less than 30%.



Freezing temperature guideline	Mix ratio Liter (qts)		Concentration of engine coolant
	Engine coolant	Tap water	
-18°C (-0.4°F)	4.2 (4.4)	7.8 (8.2)	35%
-25°C (-13°F)	5.0 (5.3)	7.0 (7.4)	42%
-35°C (-31°F)	6.0 (6.3)	6.0 (6.3)	50%
-40°C (-40°F)	6.4 (6.8)	5.6 (5.9)	53%

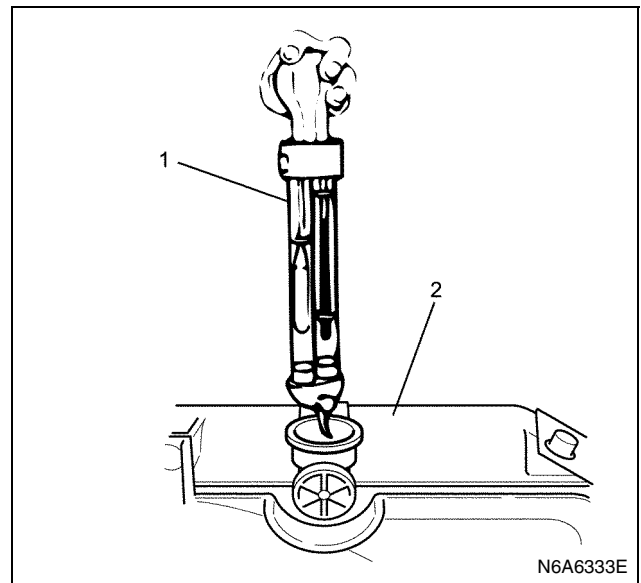
2. Engine coolant density measurement

Methods for measuring specific gravity

- Measure the specific gravity and the temperature of the cooling water using an anti-freeze specific gravity meter and thermometer.

Take precautionary measures as the boiled cooling water may gush out at high temperatures if the cap is removed.

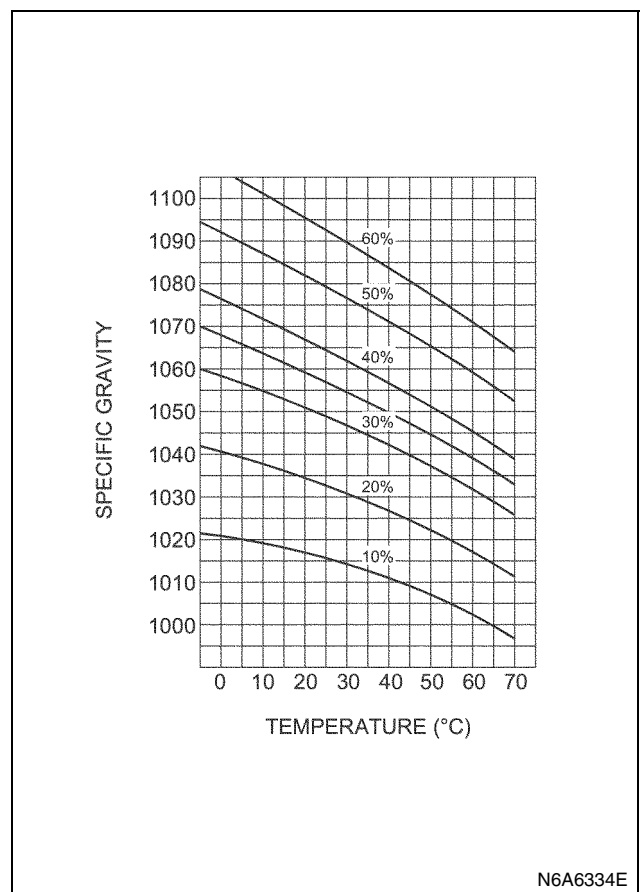
- Use a deep container to suit the height of the specific gravity meter.



Legend

1. Radiator
2. Anti-Freeze Specific Gravity Meter

- Fix the temperature of the cooling water being measured in the range of 0 to 50 °C (32 to 122 °F).
- Measure the temperature and specific gravity and determine the concentration from the table given below.



Coolant scooping method

- Measure the concentration using the coolant scoop.

A List of Defective Phenomena

- Engine overheats
- Engine overcools

Engine overheats

Condition	Possible Cause	Correction
Engine overheats	Cooling water volume is deficit.	Replenish.
	Thermometer unit is defective.	Replace.
	Thermostat is defective.	Replace.
	Water pump is defective.	Replace.
	Radiator is clogging.	Clean or replace.
	Radiator cap is defective.	Replace.
	Engine oil volume is deficient or incorrect engine oil is used.	Replenish or change the engine oil.
	Cylinder head gasket is defective.	Replace.
	The fan belt is loose.	Adjust.
	Exhaust system is clogging.	Clean or replace.
	The fuel injection quantity is in surplus.	Diagnose the engine control system.
	Fuel injection timing is incorrect.	Diagnose the engine control system.
	Starting pressure of fuel injection is low.	Diagnose the engine control system.

Engine overcools

Condition	Possible Cause	Correction
Engine overcools	Thermostat is defective.	Replace.

Main Data and Specifications**Main Data and Specifications**

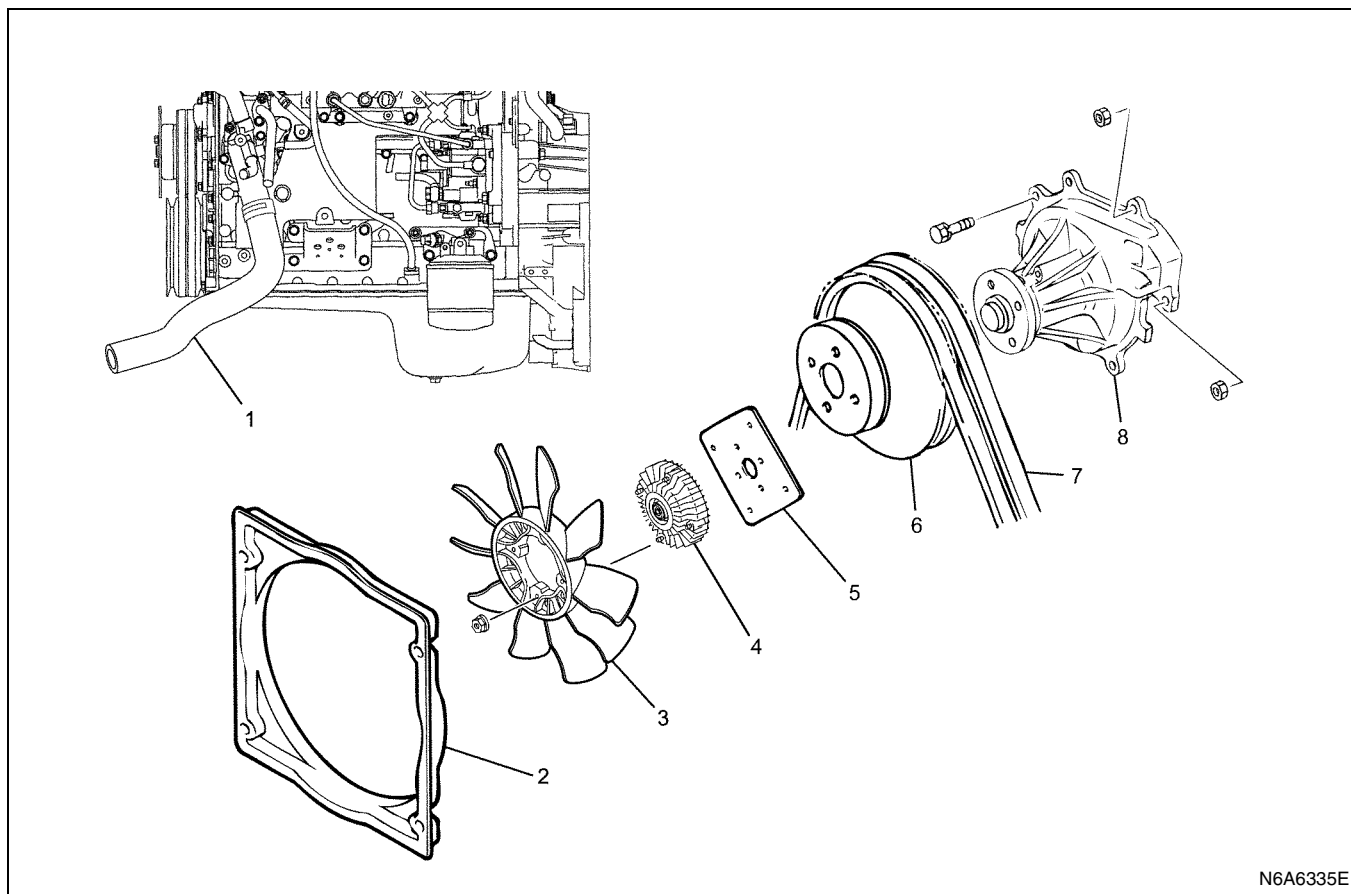
Cooling methods		Forced circulation system
Radiator		Tubes with corrugated fins
Radiation capacity	kW (kcal/h)	120 (103200)
Radiation area	m ² (ft ²)	17.78 (191.3)
Frontal area	m ² (ft ²)	0.367 (4.05)
Dry mass	N (lb)	196 (44.1)
Radiator cap		
Valve opening pressure	kPa (kg/cm ² / psi)	108 ± 14.7 (1.1 ± 0.15 / 15.7 ± 2.1)
Cooling water capacity	Liters (US / Imp gal.)	3.2 (0.85 / 0.70)
Water pump		Centrifugal impeller system
Pulley ratio		1.190

6B-8 Cooling System

Thermostat		Wax pellet system
Valve opening temperature	°C (°F)	With jiggle valve 85 (185) Without jiggle valve 82 (180)
Temperature when fully open	°C (°F)	With jiggle valve 100 (212) Without jiggle valve 95 (203)
Cooling water total capacity	Liters (US / Imp gal.)	17.6 (4.65 / 3.87)

Water Pump

Components



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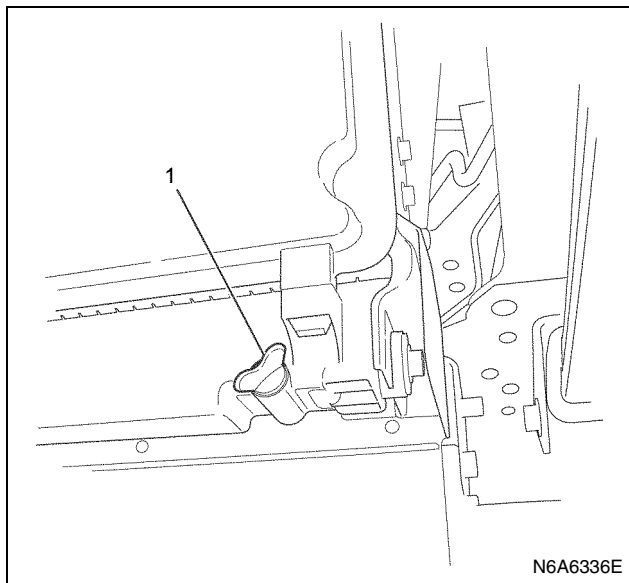
Legend

- | | |
|------------------------|------------------------|
| 1. Radiator Lower Hose | 5. Setting Plate |
| 2. Fan Guide | 6. Water Pump Pulley |
| 3. Fan | 7. Fan Belt |
| 4. Cooling Fan Clutch | 8. Water Pump Assembly |

6B-10 Cooling System

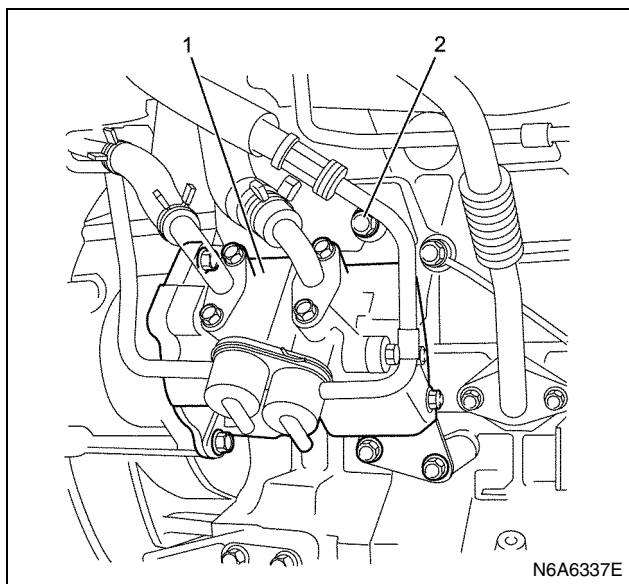
Removal

1. Drain the coolant water.



Legend

1. Radiator Drain Cock

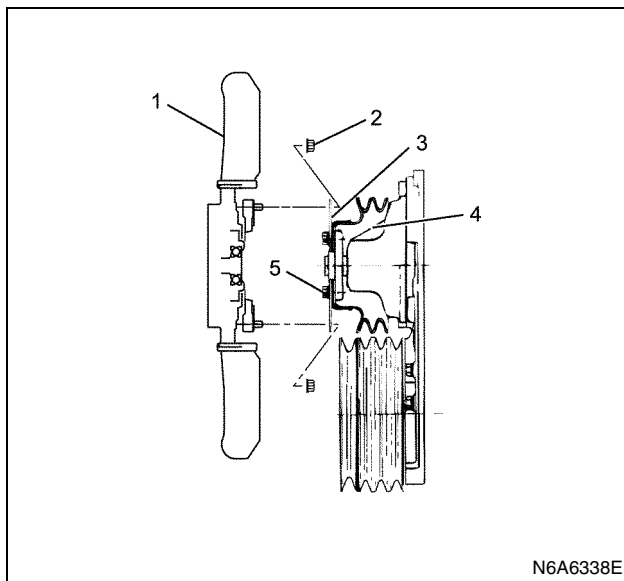


Legend

1. Power Steering Pump
2. Drain Plug

2. Remove the radiator lower hose on the radiator side.
3. Take out the fan guide from below.

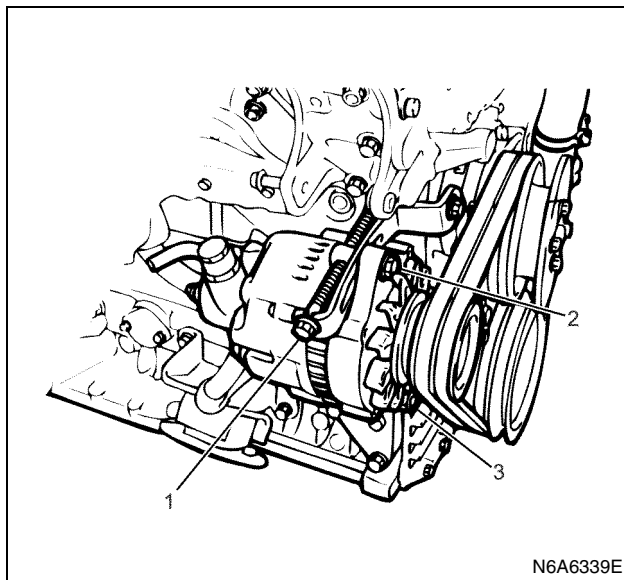
4. Remove the four mounting nuts and then the fan assembly. Also, loosen the four bolts for tightening the setting plate and water pump pulley together.



Legend

1. Fan
2. Nut
3. Setting Plate
4. Water Pump Pulley
5. Bolt

5. (2) and (3) that tighten the setting plate and water pump together. Loosen the adjusting bolts (1) in the generator and remove the fan belt.

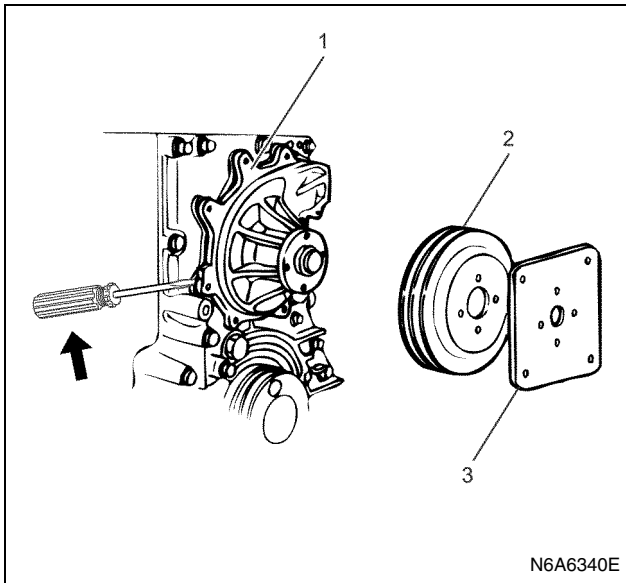


Legend

1. Adjusting Bolt (With A/C)
2. Lock Nut
3. Bolt

6. Remove the setting plate and water pump pulley.

7. Remove the water pump assembly while inserting and scraping with the driver at the position shown in the figure.

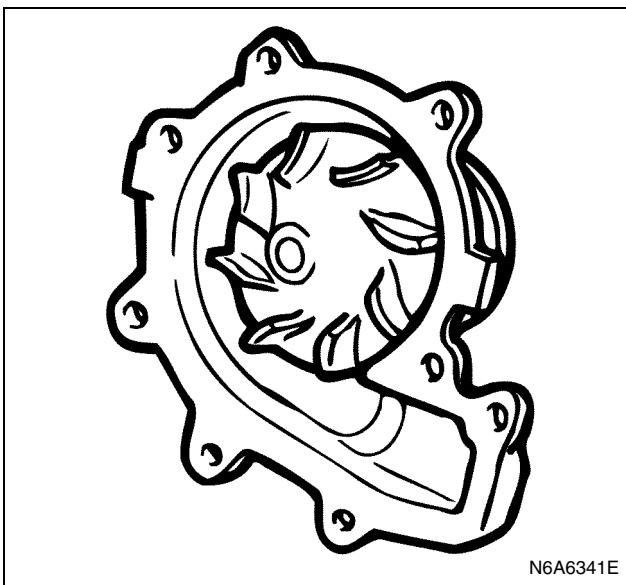


Legend

1. Water Pump
2. Water Pump Pulley
3. Setting Plate

Inspection

1. External check
 - Check for cracks or damage in the pump body.
 - Check for cracks and corrosion in the impeller.
 - Check for water leakage from the seal unit.
 - If you find abnormalities, replace with the water pump assembly.



2. Bearing nut check

- Rotate the fan center while pushing it along the radial direction. Confirm that there is no abnormal noise and no excessive play.

- If you find abnormalities, replace with the water pump assembly.

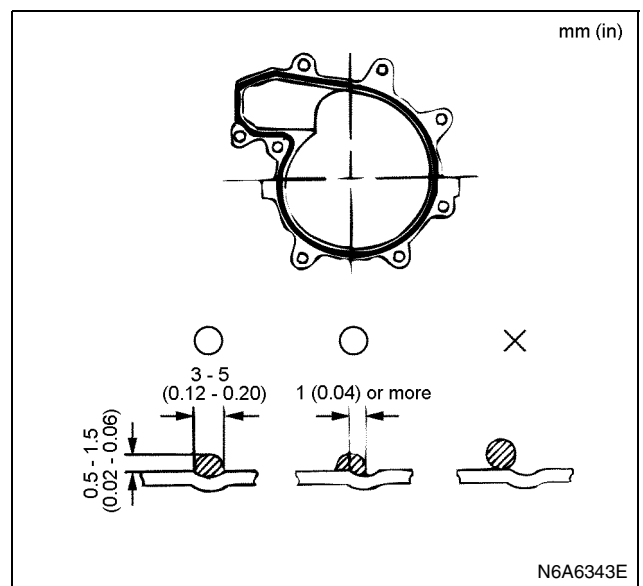


Installation

1. Mount the water pump assembly.
 - Coat the fluid gasket (ThreeBond 1207C or equivalent) to a bead diameter 3 to 5 mm (0.12 to 0.20 in) in the groove of the mounting surface of the water pump.
 - Mount the water pump to match with the studs of the front cover within 7 minutes after coating the fluid gasket.
 - Refer to the figure for the offset in position of the fluid gasket.

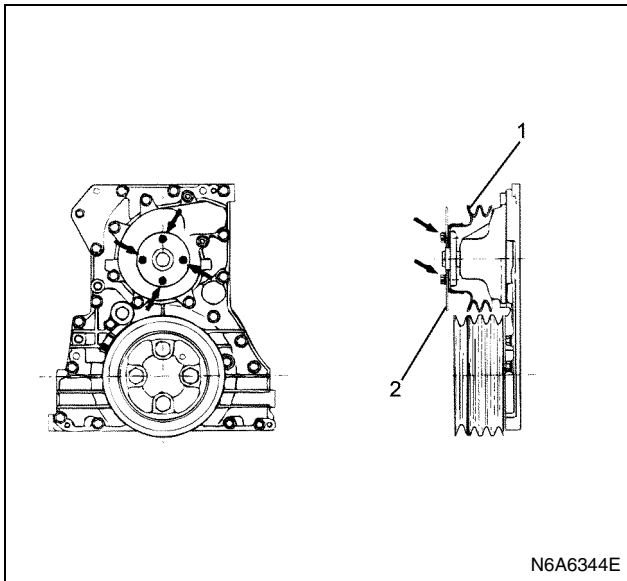
Tighten:

Bolts and nuts to 24 N·m (2.4 kg·m/17 lb·ft)



6B-12 Cooling System

- Temporarily fit the bolts until the water pump pulley and the setting plate are properly seated in the water pump assembly.



Legend

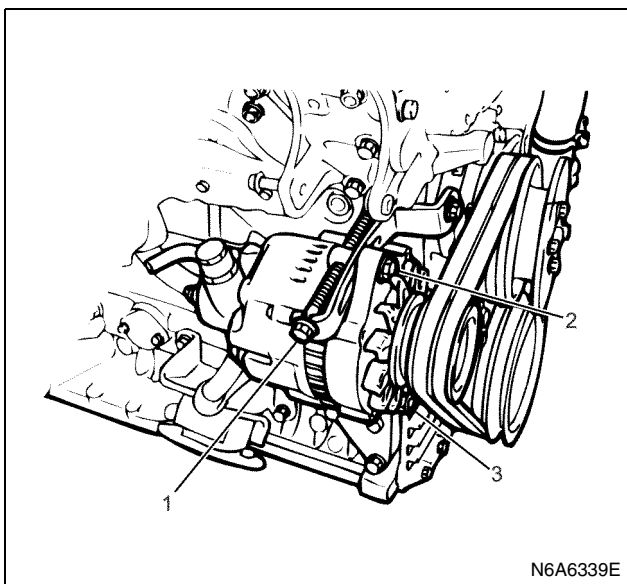
- Fan Pulley
- Setting Plate

- Mount the fan belt, tighten the adjusting bolts of the generator, and adjust the tension.
 - Refer to "Drive Belt" in Section 6B.
- After fan belt adjustments, tighten the generator using the specified torque.

Tighten:

Nut and bolt to 2 members: 24 N·m (2.4 kg·m / 17 lb·ft)

Nut and bolt to 3 members: 40 N·m (4.1 kg·m / 30 lb·ft)



Legend

- Adjusting Bolt (With A/C)
- Lock Nut
- Bolt

- After the fan belt adjustments, tighten the temporarily fitted fan pulley and setting plate using the specified torque.

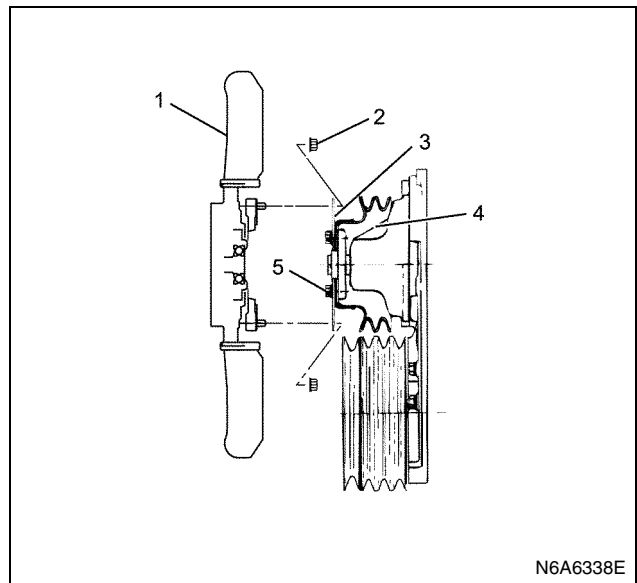
Tighten:

Bolt to 24 N·m (2.4 kg·m / 17 lb·ft)

- Tighten the fan assembly using the specified torque for mounting.

Tighten:

Nut to 24 N·m (2.4 kg·m / 17 lb·ft)

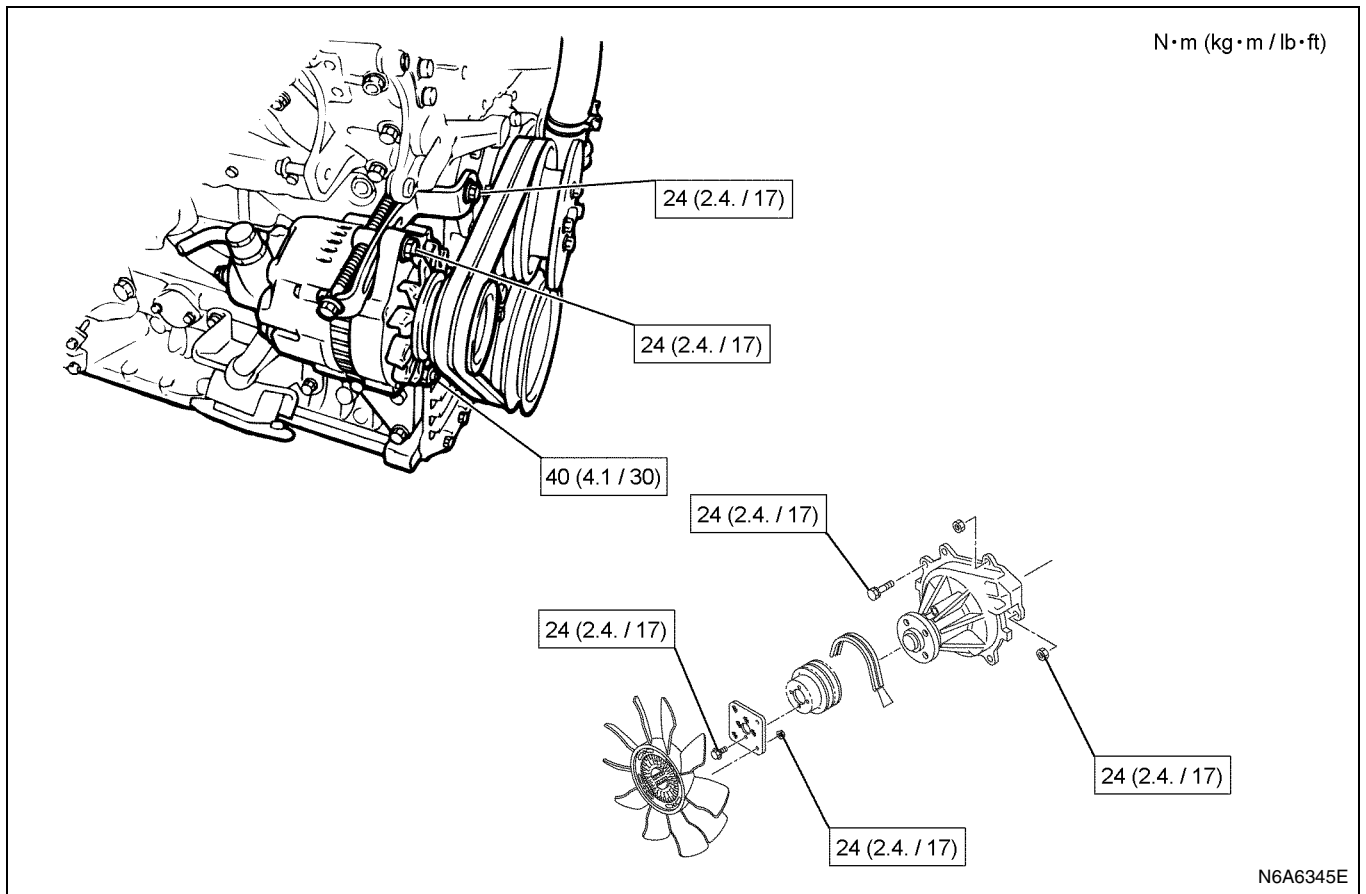


Legend

- Fan Assembly
- Nut
- Setting Plate
- Fan Pulley
- Bolt

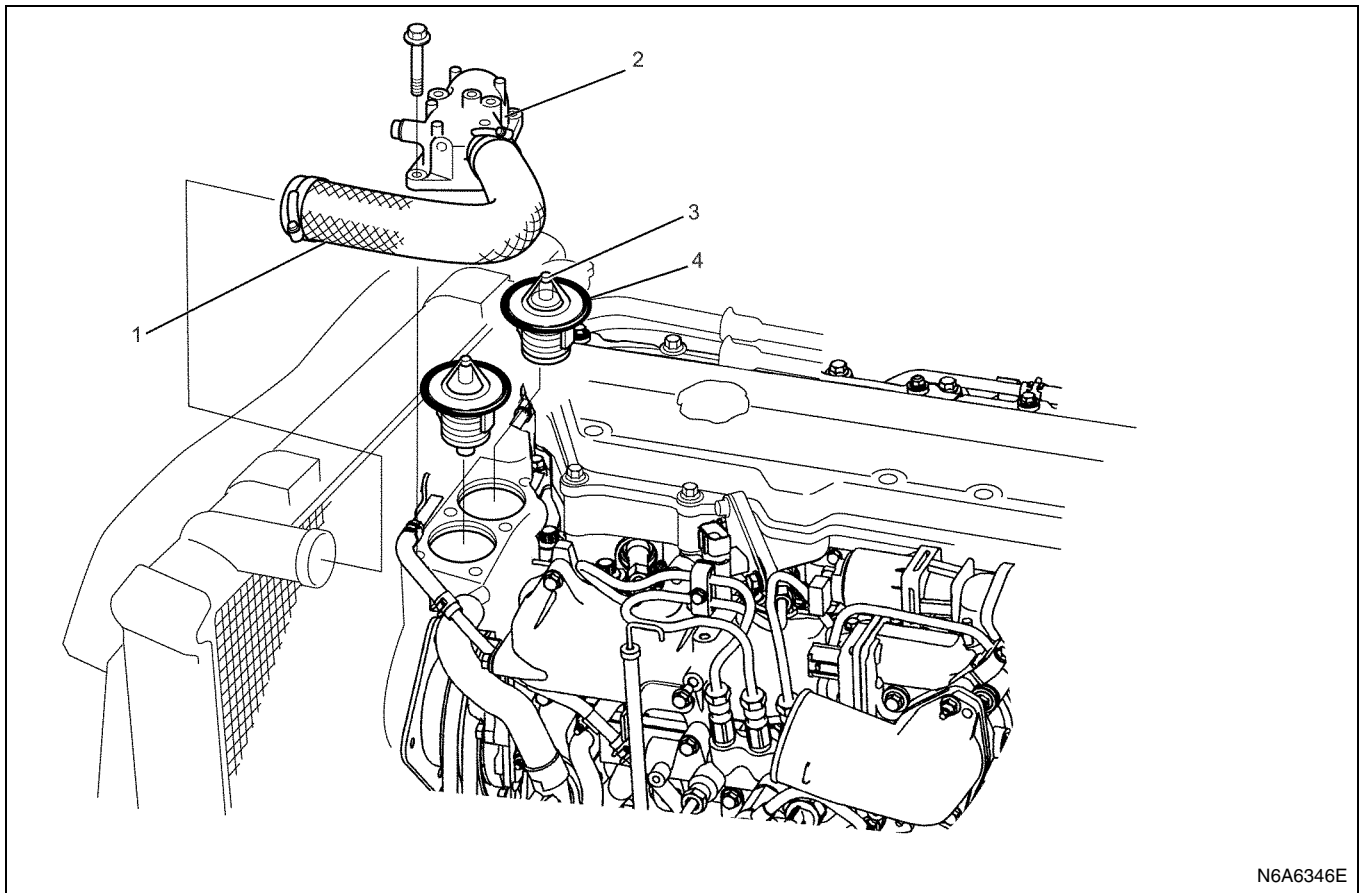
- Mount the fan guide.
- Mount the radiator lower hose.
- Fill the cooling water.

Torque Specifications



Thermostat

Components



Legend

- | | |
|------------------------|---------------|
| 1. Radiator Upper Hose | 3. Thermostat |
| 2. Water Outlet Pipe | 4. Gasket |

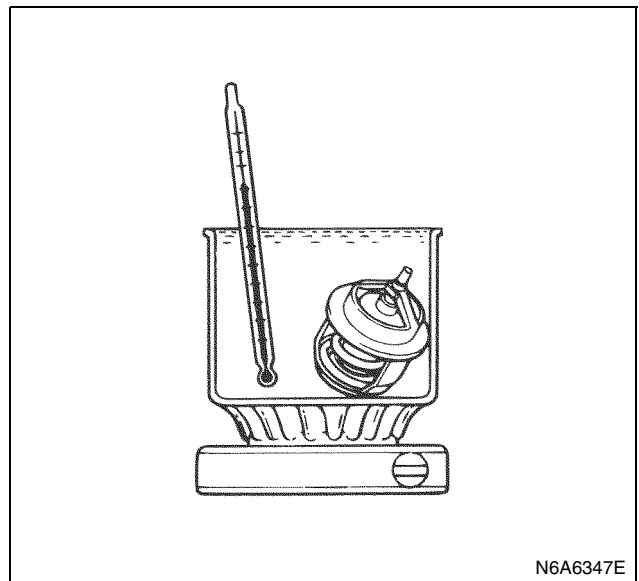
Removal

1. Drain the cooling water. Prepare the container for discharging and use it for replenishment when mounting the thermostat. Set the discharge of cooling water such that the water does not flow out of the thermostat housing.
2. Remove the radiator upper hose from the radiator side.
3. Remove the water outlet pipe.
4. Remove the thermostat.
5. Remove the gasket from the thermostat.

Inspection

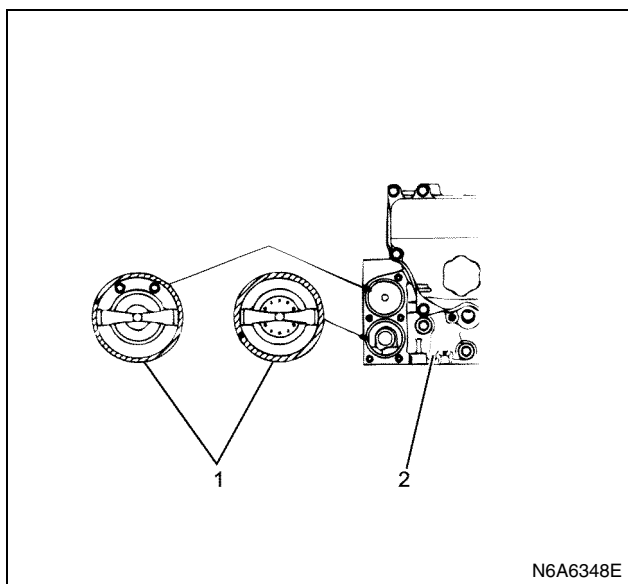
- Place the thermostat in water and increase the temperature while stirring it sufficiently.

- Measure the temperature when the valve is just opened and when it is fully open.



Installation

1. Mount the gasket on the thermostat and mount it at the position shown in the figure.
 - Mount the thermostat at the position shown in the figure, as there are two types of thermostats with different shapes.
 - Fit the thermostat gasket ensuring that it does not come out of and on top of the external housing on the cylinder head side.



Legend

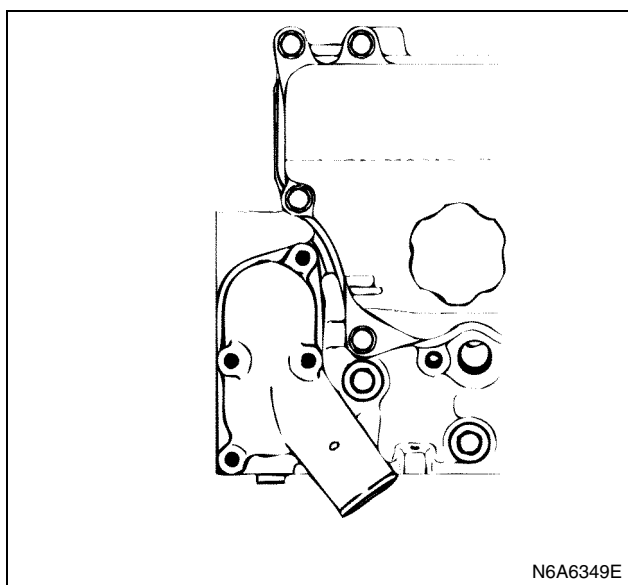
1. Thermostat
2. Cylinder Head

2. Mount the water outlet pipe.

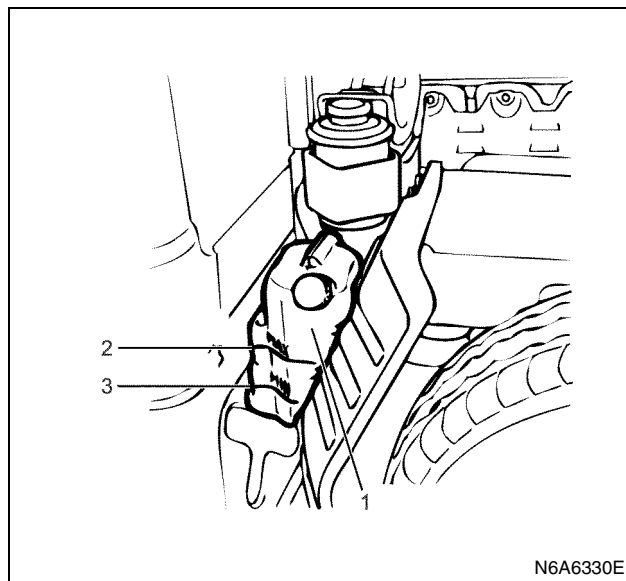
Tighten:

Bolt to 24 N·m (2.4 kg·m / 17 lb·ft)

3. Mount the radiator upper hose.



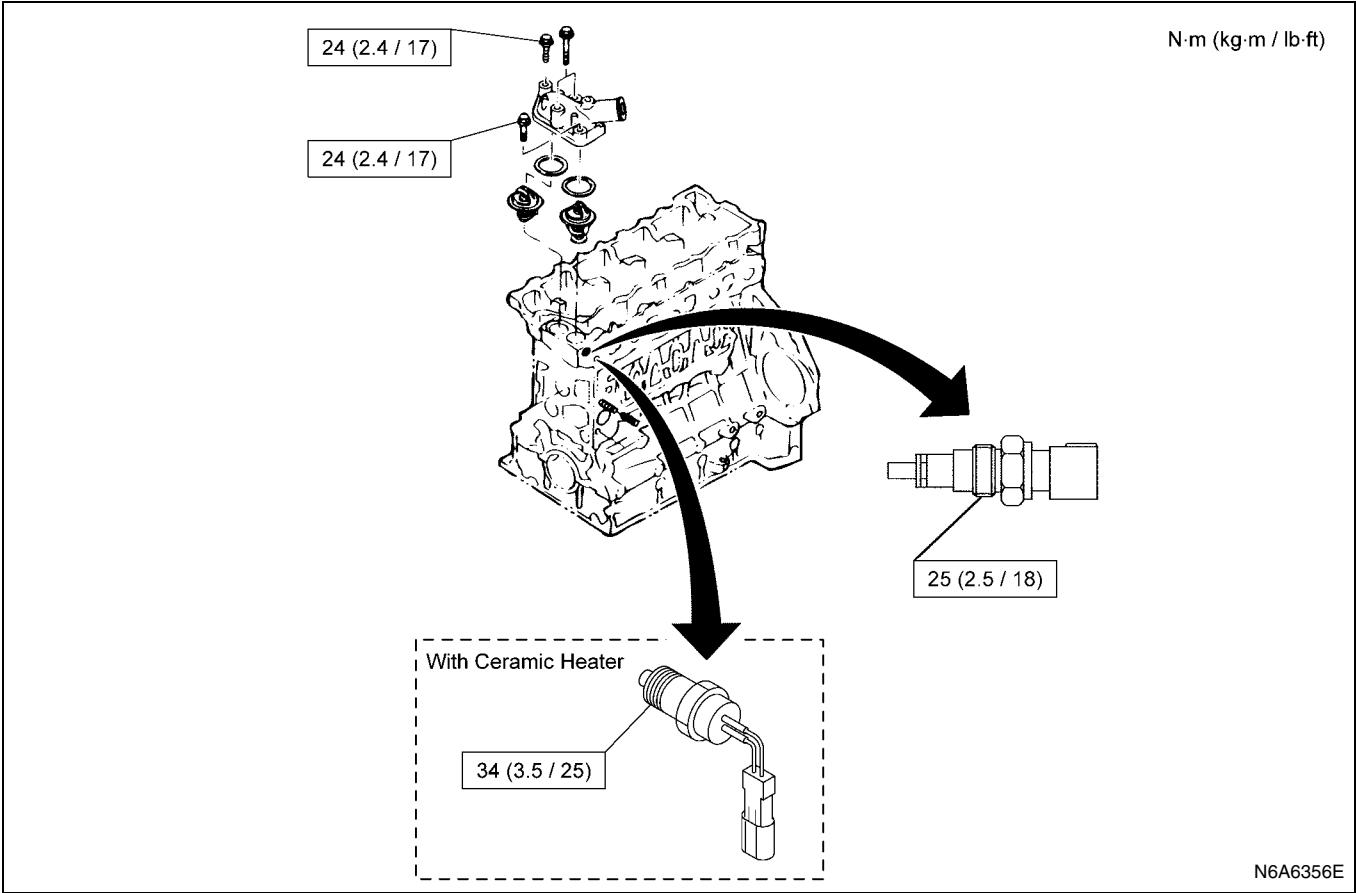
4. Replenish the cooling water stored during the discharge, and check the volume of the cooling water.



Legend

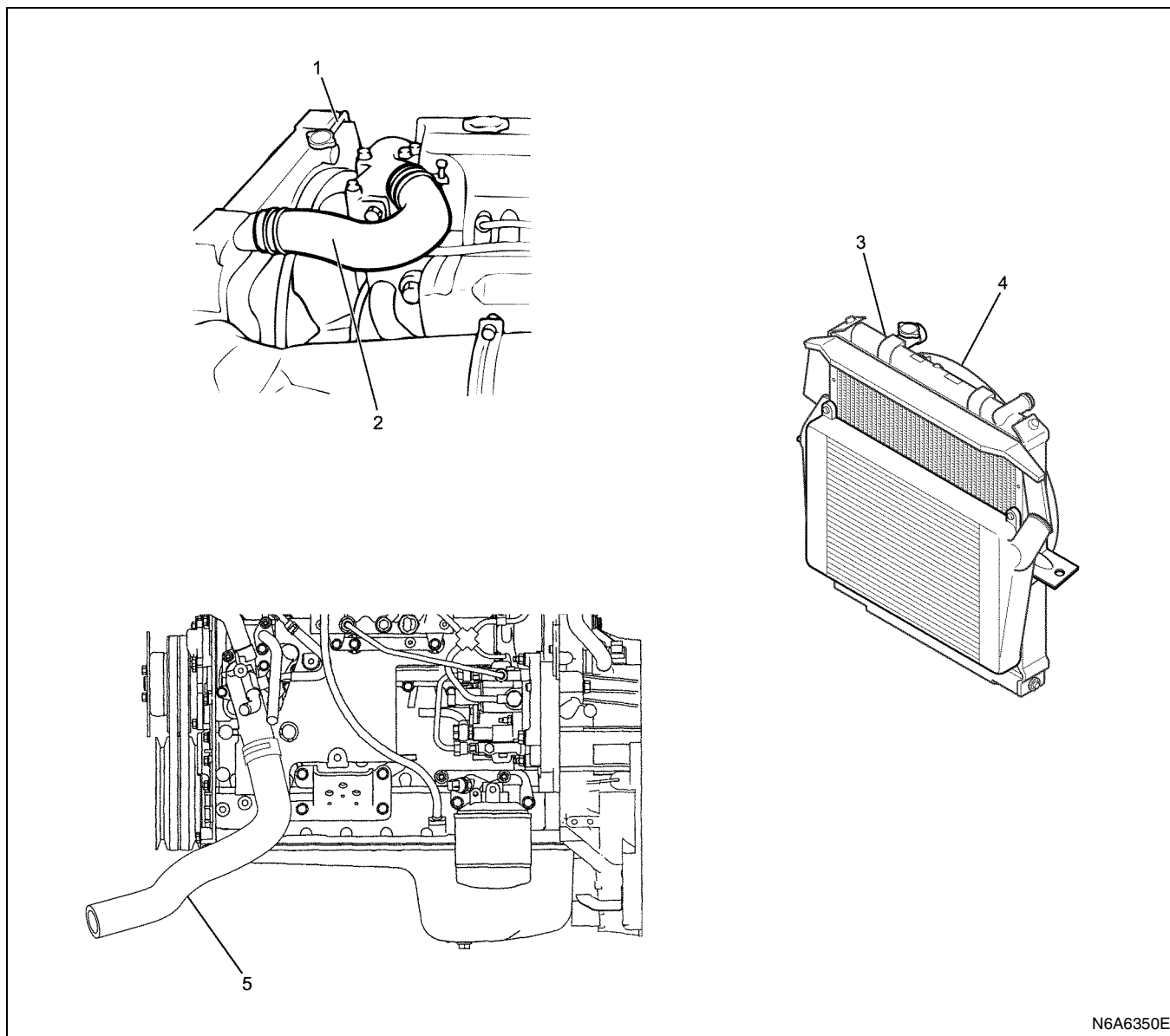
1. Reserve Tank
2. MAX Line (Upper Limit)
3. MIN Line (Lower Limit)

Torque Specifications



Radiator and Intercooler

Components



Legend

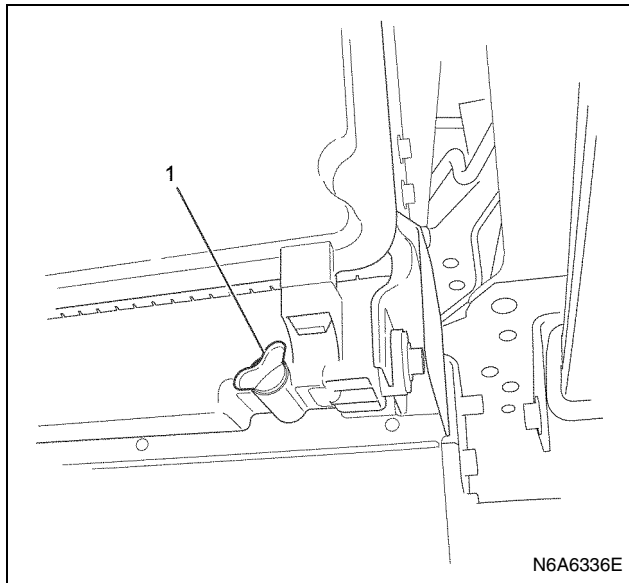
- | | |
|------------------------------|------------------------|
| 1. Coolant Reserve Tank Hose | 4. Fan Guide |
| 2. Radiator Upper Hose | 5. Radiator Lower Hose |
| 3. Radiator and Intercooler | |

Removal

1. Loosen the water drain plug (to the right of the engine toward the rear) and radiator drain plug, and discharge the cooling water completely.

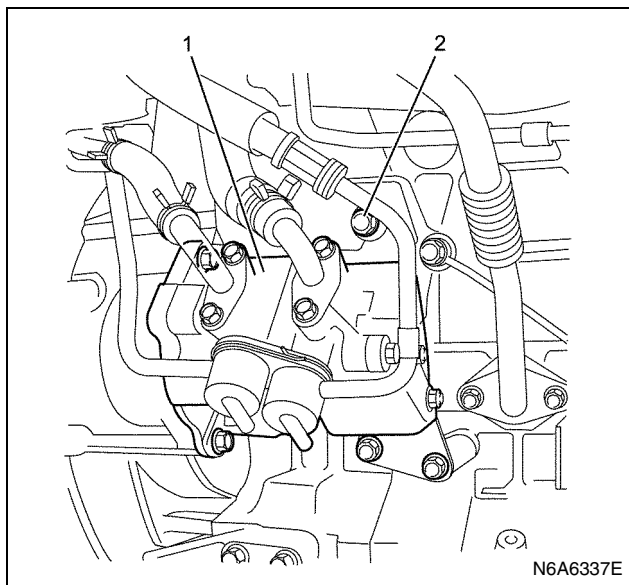
6B-18 Cooling System

- After discharging the water, tighten the drain cock.



Legend

1. Radiator Drain Cock

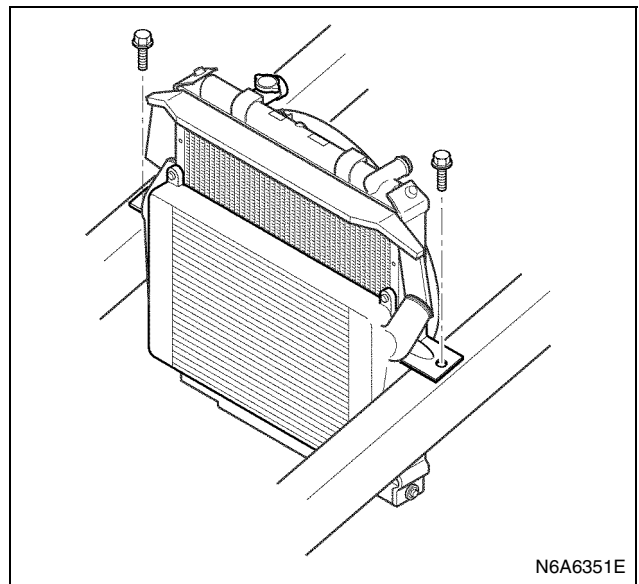


Legend

1. Power Steering Pump
2. Drain Plug

2. Remove the intake pipe from the intake manifold and inter-cooler (right side).
3. Remove the intake pipe from the turbo charger and inter-cooler (left side).
4. Remove the 2 transmission oil pipes on the underside of the radiator.
5. Remove the upper hose on the radiator side.
6. Remove the lower hose on the radiator side.
7. Remove the coolant reserve tank hose from the radiator side.

8. Take care to avoid damage to the radiator core from the fan blade, and remove the brackets on the right and left sides of the radiator. Simultaneously remove the radiator and inter-cooler.



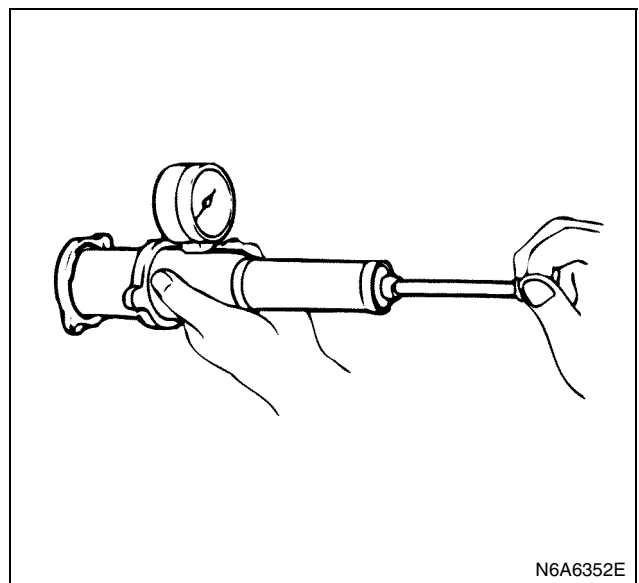
Inspection

Radiator cap

1. Check the valve opening pressure using the radiator cap tester. If the valve opening pressure deviates from the standard value, replace the radiator cap.

Valve opening pressure =

$108 \pm 14.7 \text{ kPa}$ ($1.1 \pm 0.15 \text{ kg/cm}^2$ / $15.7 \pm 2.1 \text{ psi}$)



2. Check the state of the negative pressure valve situated at the center on the valve seat side of the cap. If the valve seat does not function smoothly due to rust or dirt, clean or replace the radiator cap.

Radiator core

1. If the radiator fin is deformed, the radiation effect deteriorates causing overheating. Therefore, modify the fin. Make sure that the root base of the fin is not damaged during modification.
 - Eliminate dust or other foreign matter.

Washing the radiator

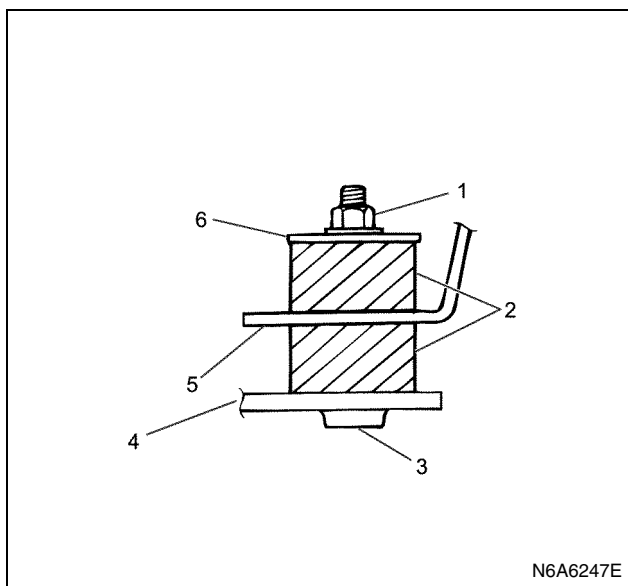
1. Wash the internal parts of the radiator and cooling water passage using water and detergent. Eliminate scale and rust completely.

Installation

1. Ensure that no damage occurs to the radiator core because of the fan blade. Mount the brackets on the left and right sides of the radiator on the frame according to the figure.

Tighten:

Bolts to 55 N·m (5.6 kg·m / 41 lb·ft)

**Legend**

1. Flange Nut
2. Rubber
3. Stud Bolt
4. Frame
5. Bracket on The Radiator Side
6. Washer

7. Install the intake pipe from the intake manifold and inter-cooler (right side).

Reference

Cooling water injection procedure (in case of changing the cooling water completely)

- Confirm that the engine has cooled.
- Open the radiator cap and the reserve tank cap.
- Pour the cooling water up to the filler neck.
- Pour the cooling water up to the "MAX" line in the reserve tank.
- Close the radiator cap and the reserve tank cap and start the engine. Stop the engine after running for about 2 to 3 minutes at the idling rpm. Open the radiator cap again and replenish if the water level is low.

WARNING:

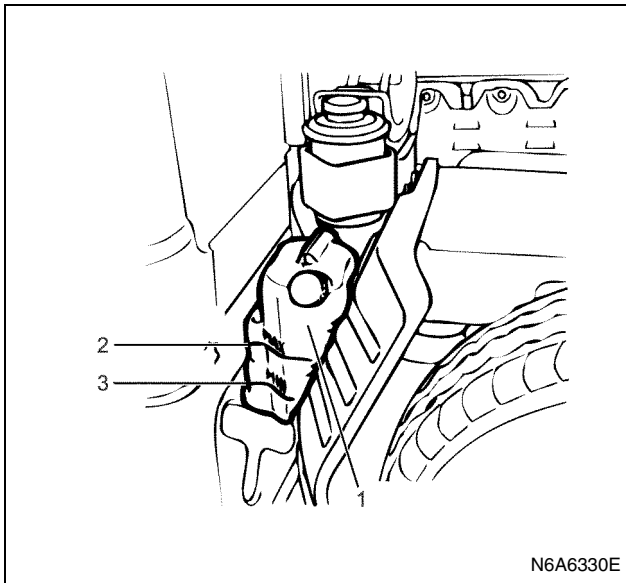
DO NOT LOOSEN OR REMOVE THE RADIATOR CAP WHEN THE TEMPERATURE OF THE COOLING WATER IS HIGH. STEAM OR BOILING WATER WILL GUSH OUT AND YOU MAY BE BURNT. TO OPEN THE RADIATOR CAP, COVER THE CAP WITH A THICK CLOTH WHEN THE COOLING WATER IS COOL, RELEASE THE PRESSURE BY SLOWLY TURNING THE CAP, AND THEN REMOVE THE CAP.

- After tightening the radiator cap, warm up the engine by running it at about 2000 rpm. Also, adjust the temperature of the heater to maximum temperature and circulate the cooling water even in the heater water conduit system.
- When the pointer of the thermometer crosses the median and the thermostat has activated, run at idling rpm for another 5 minutes, then stop the engine and leave it as-is.
- After the engine has cooled down sufficiently, check the water level in the filler neck part and replenish if necessary. If the level is extremely low, check for leaks in the cooling water conduit system and reserve tank hose.

2. Mount the reserve tank hose of the coolant on the radiator.
3. Mount the radiator lower hose.
4. Mount the radiator upper hose.
 - Fill the cooling water.
5. Install the 2 transmission oil pipes on the underside of the radiator.
6. Install the intake pipe from the turbocharger and inter-cooler (left side).

6B-20 Cooling System

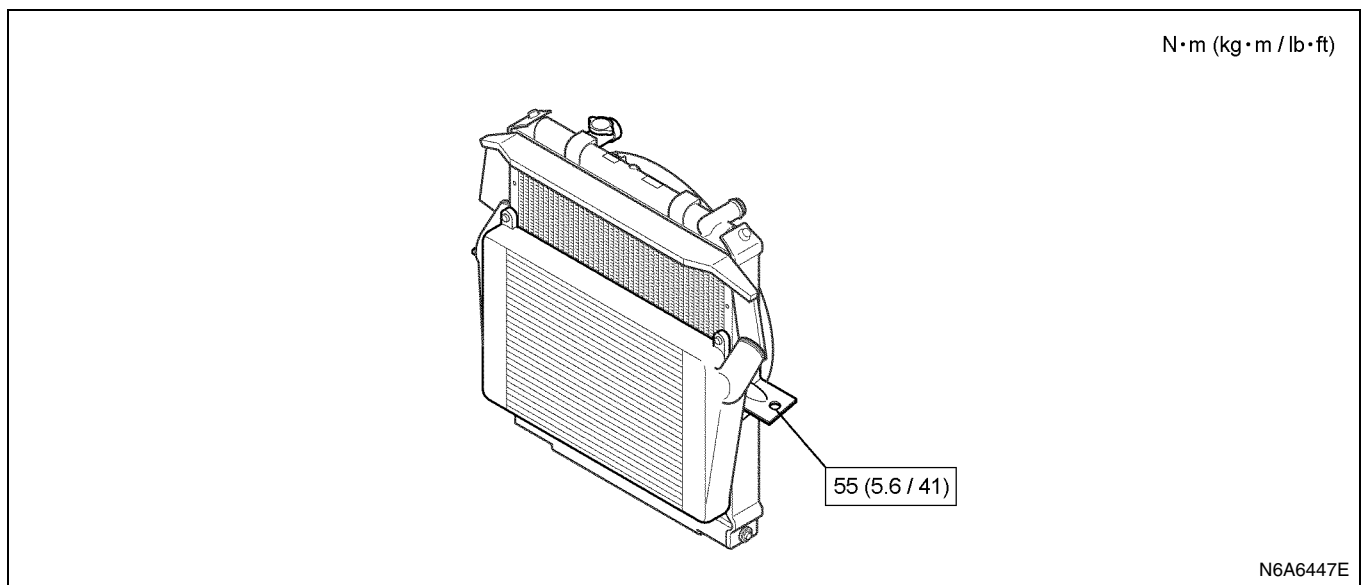
- Pour the cooling water up to the “MAX” line in the reserve tank again.



Legend

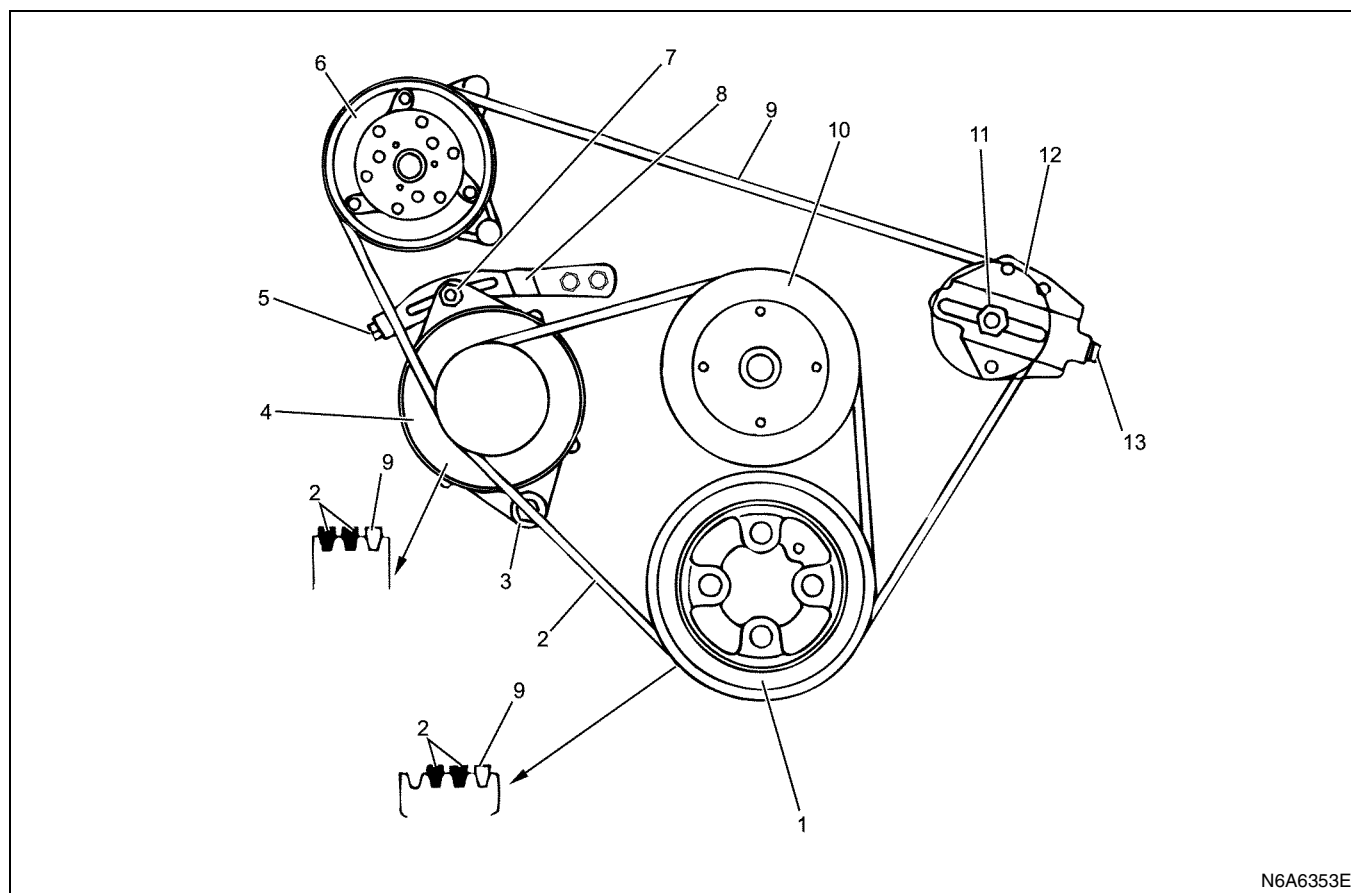
1. Reserve Tank
2. MAX Line (Upper Limit)
3. MIN Line (Lower Limit)

Torque Specifications



Drive Belt

Components



N6A6353E

Legend

- | | |
|-------------------------|------------------------------|
| 1. Crank Pulley | 8. Adjusting Plate |
| 2. Generator Drive Belt | 9. A/C Compressor Drive Belt |
| 3. Bolt | 10. Water Pump Pulley |
| 4. Generator | 11. Lock Nut |
| 5. Adjusting Bolt | 12. Tension Pulley |
| 6. A/C Compressor | 13. Adjusting Bolt |
| 7. Lock Nut | |

Inspection

Check for the presence of wear or damage in the drive belt and renew the parts if necessary.
Check the tension of the belt and adjust if necessary.

When the belt is new

8 to 12 mm (0.315 to 0.472 in)

When the belt is reused

10 to 14 mm (0.394 to 0.551 in)

Deflection Standard

Apply a pressure of 98 N (22 lb) at the center of the long span of each belt and check the deflection of the belt.

Deflection of A/C compressor drive belt

When the belt is new

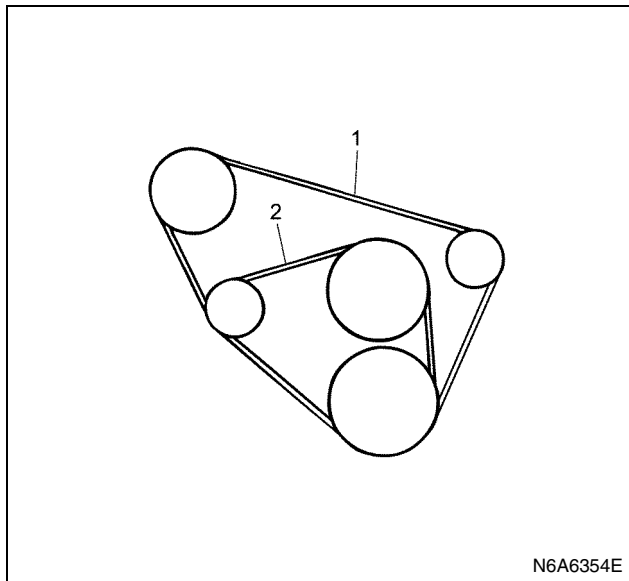
16 to 20 mm (0.630 to 0.787 in)

When the belt is reused

18 to 22 mm (0.709 to 0.866 in)

Deflection of generator drive belt

6B-22 Cooling System



Legend

1. A/C Compressor Drive Belt
2. Generator Drive Belt

Adjustment

Adjust simultaneously the generator drive belt and A/C compressor drive belt for adjustment of belt.

With A/C

1. Loosen the tension pulley lock nut and tension pulley adjusting bolt of the tension pulley of the A/C compressor drive belt and bring the belt to free state.
2. Loosen the adjusting plate lock nuts and the mounting bolts of generator on the underside of the generator.
3. Rotate the adjusting bolts of generator and adjust the belt (remove and fit).
 - When replacing the belt, you must always replace both the belts.
4. After adjustments, tighten the adjusting plate lock nuts and the mounting bolts of generator on the underside of the generator using the specified torque.

Without A/C

Fan belt tension is adjusted by moving the generator.

Tighten:

Nuts and bolts to 6 members: 24 N·m (2.4 kg·m / 17 lb·ft)

Nuts and bolts to 2 members: 40 N·m (4.1 kg·m / 30 lb·ft)

- Finally, adjust the tension of A/C compressor drive belt.

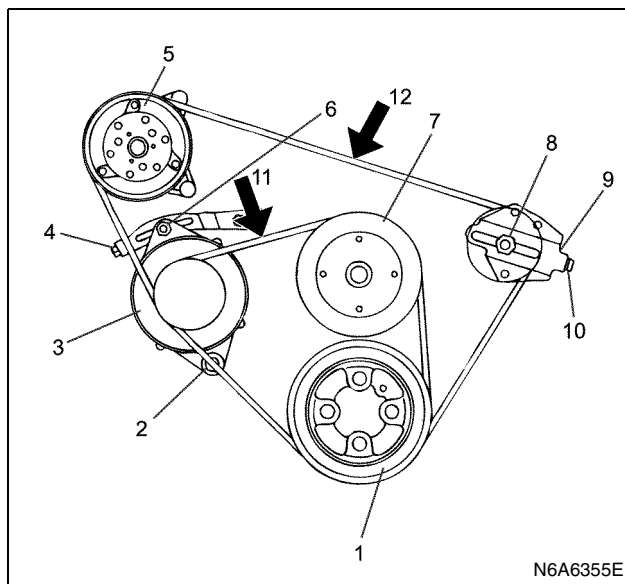
Caution:

You must adjust the tension of A/C compressor drive belt after adjusting generator belt.

- a. Rotate the tension pulley adjusting bolt of the tension pulley and adjust the belt (remove and fit).
- b. After adjustments, tighten the tension pulley lock nut using the specified torque.

Tighten:

Lock nut to 27 N·m (2.8 kg·m / 20 lb·ft)



Legend

1. Crank Pulley
2. Bolt
3. Generator
4. Adjusting Bolt
5. A/C Compressor
6. Lock Nut
7. Water Pump Pulley
8. Lock Nut
9. Tension Pulley
10. Adjusting Bolt
11. Generator Drive Belt
12. A/C Compressor Drive Belt

Torque Specifications