SECTION CO
ENGINE COOLING SYSTEM

CONTENTS

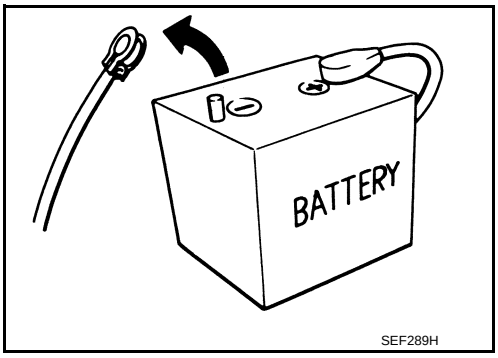
HR12DE

PRECAUTION

PRECAUTIONS

Precautions for Removing Battery Terminal

INFOID:0000000010362204



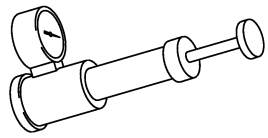
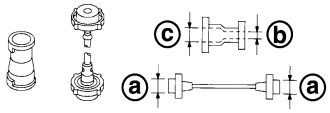
- When removing the 12V battery terminal, turn OFF the ignition switch and wait at least 30 seconds.
  NOTE:
  ECU may be active for several tens of seconds after the ignition switch is turned OFF. If the battery terminal is removed before ECU stops, then a DTC detection error or ECU data corruption may occur.
- For vehicles with the 2-batteries, be sure to connect the main battery and the sub battery before turning ON the ignition switch.
  NOTE:
  If the ignition switch is turned ON with any one of the terminals of main battery and sub battery disconnected, then DTC may be detected.
- After installing the 12V battery, always check "Self Diagnosis Result" of all ECUs and erase DTC.
  NOTE:
  The removal of 12V battery may cause a DTC detection error.

PREPARATION

PREPARATION

Commercial Service Tools

INFOID:0000000010339402

Tool name	Description
Radiator cap tester  PBIC1982E	Checking radiator and radiator cap
Radiator cap tester adapter  JSBIA5474ZZ	Adapting radiator cap tester to radiator cap and radiator filler neck ⓐ: **28 (1.10) dia.** ⓑ: **31.4 (1.236) dia.** ⓒ: **41.3 (1.626) dia.** Unit: mm (in)

Sealant or/and Lubricant

INFOID:0000000010451892

Name	Description	Note
Strength thread locking sealant	cooling fan	—

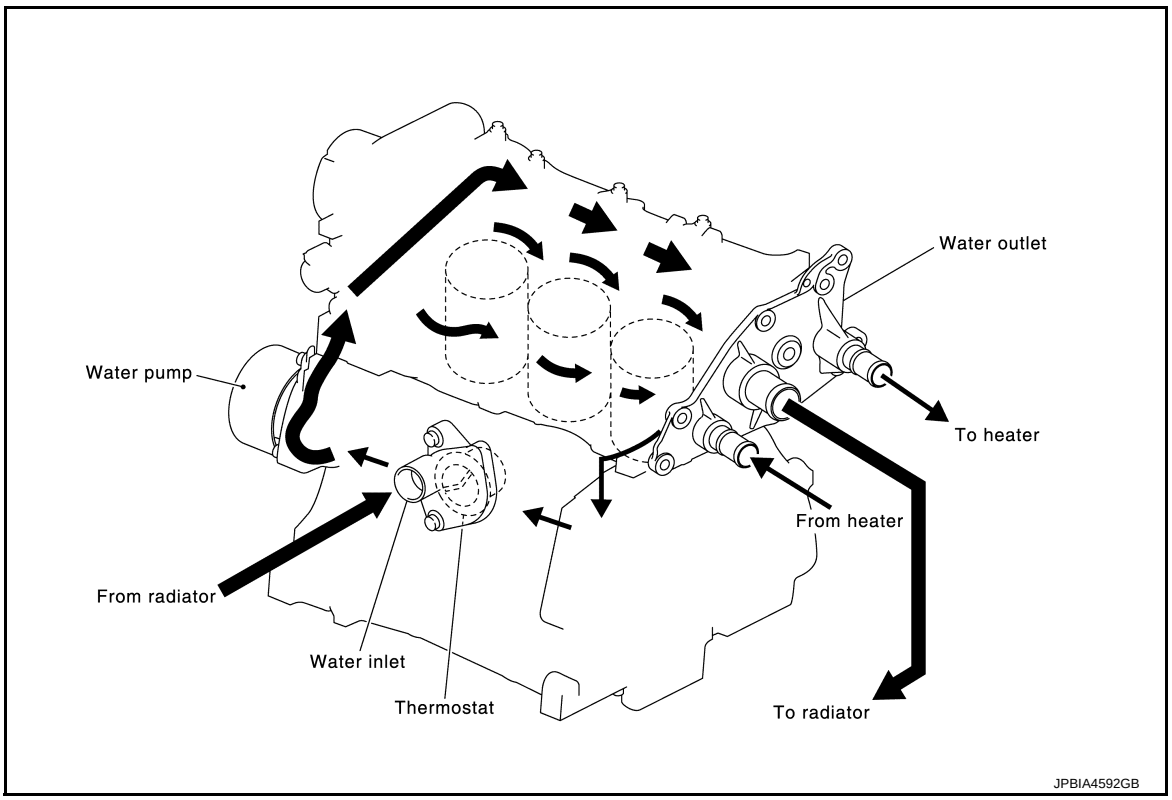
SYSTEM DESCRIPTION

DESCRIPTION

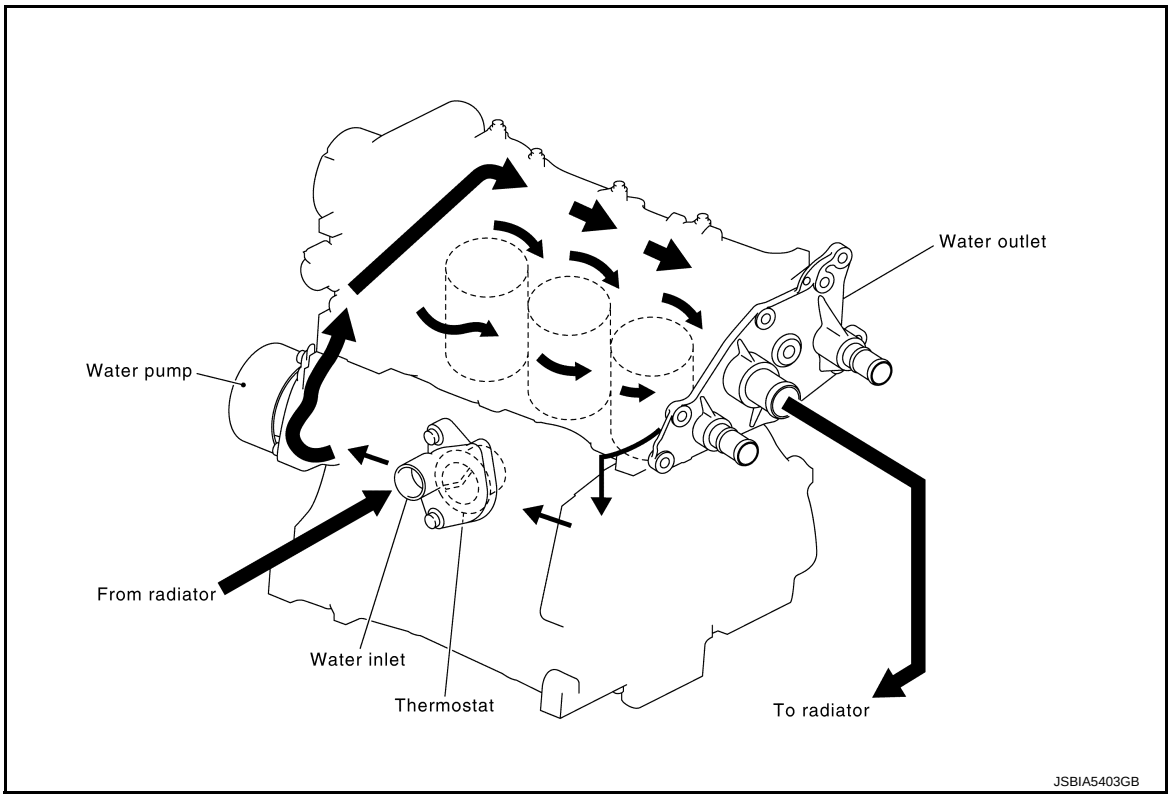
Engine Cooling System

INFOID:0000000010339403

EXCEPT FOR INDONESIA MODELS



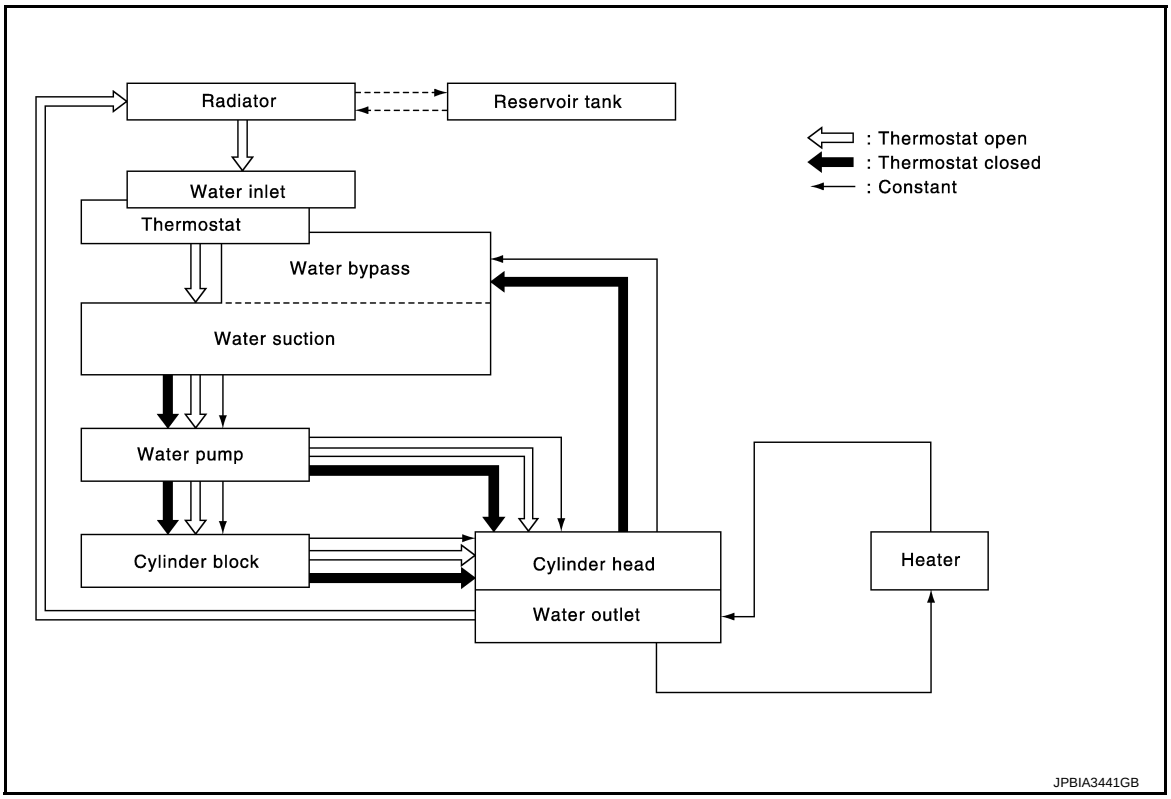
FOR INDONESIA MODELS



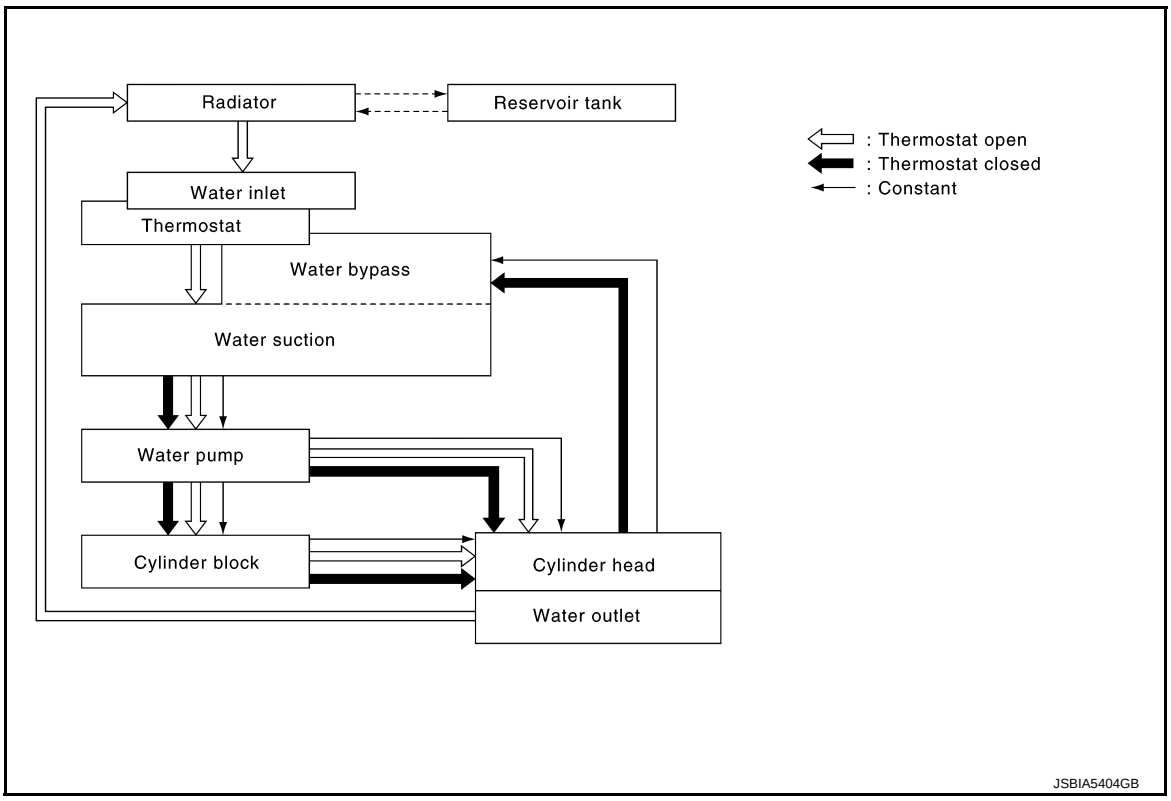
Engine Cooling System Schematic

INFOID:0000000010339404

EXCEPT FOR INDONESIA MODELS



FOR INDONESIA MODELS



SYMPTOM DIAGNOSIS

OVERHEATING CAUSE ANALYSIS

Troubleshooting Chart

INFOID:0000000010339405

	Symptom		Check items	
Cooling system parts malfunction	Poor heat transfer	Water pump malfunction	Worn or loose drive belt	—
		Thermostat and water control valve stuck closed	—	
		Damaged fins	Dust contamination or paper clogging	
			Physical damage	
		Clogged radiator cooling tube	Excess foreign material (rust, dirt, sand, etc.)	
	Reduced air flow	Cooling fan does not operate	Fan assembly	—
		High resistance to fan rotation		
		Damaged fan blades		
	Damaged radiator shroud	—	—	—
	Improper engine coolant mixture ratio	—	—	—
	Poor engine coolant quality	—	Engine coolant viscosity	—
	Insufficient engine coolant	Engine coolant leakage	Cooling hose	Loose clamp
				Cracked hose
			Water pump	Poor sealing
			Radiator cap	Loose
				Poor sealing
			Radiator	O-ring for damage, deterioration or improper fitting
				Cracked radiator tank
				Cracked radiator core
			Reservoir tank	Cracked reservoir tank
		Overflowing reservoir tank	Exhaust gas leakage into cooling system	Cylinder head deterioration
				Cylinder head gasket deterioration

	Symptom		Check items	
Except cooling system parts malfunction	—	Overload on engine	Abusive driving	High engine rpm under no load
				Driving in low gear for extended time
				Driving at extremely high speed
			Power train system malfunction	—
			Installed improper size wheels and tires	
			Dragging brakes	
			Improper ignition timing	
	Blocked or restricted air flow	Blocked bumper	—	—
		Blocked radiator grille	Installed car brassiere	
			Mud contamination or paper clogging	
		Blocked radiator	—	
		Blocked condenser	Blocked air flow	
		Installed large fog lamp		

PERIODIC MAINTENANCE

ENGINE COOLANT

Inspection

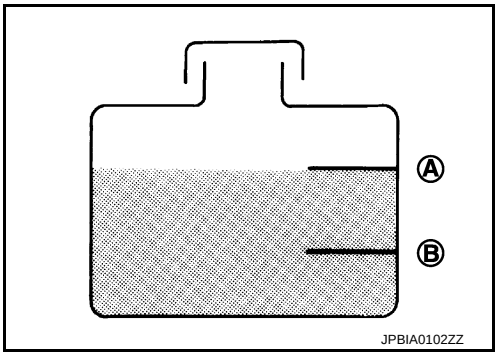
INFOID:0000000010339406

LEVEL

- Check that the reservoir tank engine coolant level is within the “MIN” to “MAX” when the engine is cool.

Ⓐ : MAX

Ⓑ : MIN



JPBIA0102ZZ

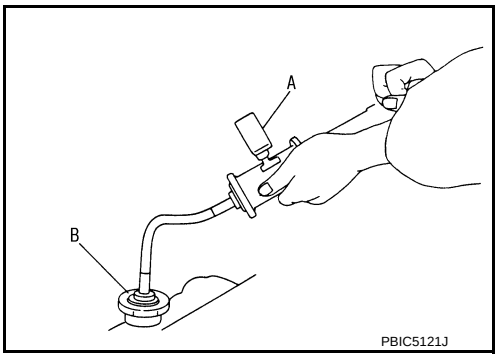
- Adjust the engine coolant level if necessary.

CAUTION:

Refill Genuine NISSAN Long Life Antifreeze/Coolant (blue) or equivalent in its quality mixed with water (distilled or demineralized). Refer to MA-11, "Fluids and Lubricants".

LEAKAGE

- To check for leakage, apply pressure to the cooling system with the radiator cap tester (commercial service tool) (A) and the radiator cap tester adapter (commercial service tool) (B).



PBIC5121J

Testing pressure: Refer to CO-24, "Radiator".

WARNING:

Never remove radiator cap when engine is hot. Serious burns may occur from high-pressure engine coolant escaping from engine cooling syatem.

CAUTION:

Higher test pressure than specified may cause radiator damage.

NOTE:

In a case that engine coolant decreases, replenish radiator with engine coolant.

- If anything is found, repair or replace damaged parts.

Draining

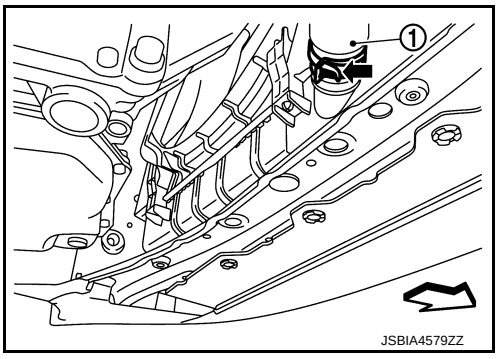
INFOID:0000000010339407

WARNING:

- **Never remove radiator cap when engine is hot. Serious burns may occur from high-pressure engine coolant escaping from engine cooling system.**
- **Wrap a thick cloth around the radiator cap. Slowly turn it a quarter of a turn to release built-up pressure. Then turn it all the way.**

1. Disconnect radiator lower hose ① at position (⬅) to drain engine coolant, and then remove radiator cap.

⇦ : Vehicle front



JSBIA4579ZZ

CAUTION:

Perform this step when engine is cold.

- When draining all of engine coolant in the system, open water drain plugs on cylinder block. Refer to EM-85, "Setting".

2. Remove reservoir tank if necessary, and drain engine coolant and clean reservoir tank before installing. Refer to CO-13, "Exploded View".
3. Check drained engine coolant for contaminants such as rust, corrosion or discoloration. If contaminated, flush the engine cooling system. Refer to CO-10, "Flushing".

Refilling

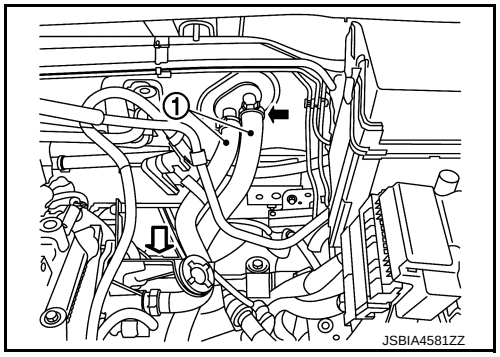
INFOID:0000000010339408

CAUTION:
- **Before start working, turn off the automatic air conditioner and the blower motor.**
- **Do not put additive such as waterleak preventive, since it may cause cooling waterway clogging.**
- **Refill Genuine NISSAN Long Life Antifreeze/Coolant (blue) or equivalent in its quality mixed with water (distilled or demineralized). Refer to MA-11, "Fluids and Lubricants".**

1. Install reservoir tank if removed.
   NOTE:
   If water drain plugs on cylinder block are removed, close and tighten them. Refer to EM-93, "Disassembly and Assembly".
2. Check that each hose clamp has been firmly tightened.
3. Remove air duct (inlet) and air cleaner cover and body assembly. Refer to EM-25, "Removal and Installation".
4. Disconnect heater hose ① at position (⬅) in the figure.

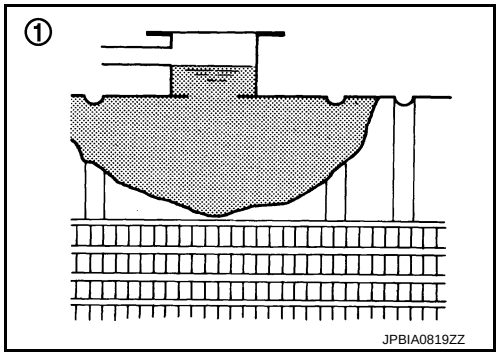
   ⇦ : Vehicle front

   - Enhance heater hose as high as possible.



5. Fill radiator ① to specified level.
   CAUTION:
   Never adhere the engine coolant to electronic equipments (alternator etc.).
   - **Pour coolant slowly of less than 2 ℓ (1-3/4 Imp qt) a minute to allow air in system to escape.**
   - **When engine coolant overflows disconnected heater hose, connect heater hose, and continue filling the engine coolant.**

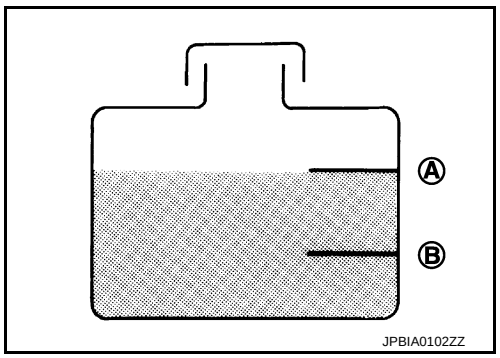
   Engine coolant capacity
   (With reservoir tank at "MAX" level)
   Refer to CO-24, "Periodical Maintenance Specification".



6. Refill reservoir tank to "MAX" level line with engine coolant.

   Ⓐ : MAX
   Ⓑ : MIN

   Reservoir tank engine coolant capacity
   (At "MAX" level)
   Refer to CO-24, "Periodical Maintenance Specification".



7. Install air duct (between air cleaner case and electric throttle control actuator). Refer to EM-25, "Removal and Installation".
8. Install radiator cap and reservoir tank cap.
9. Warm up engine until opening thermostat. Standard for warming-up time is approximately 10 minutes at 3,000 rpm.

- Check thermostat opening condition by touching radiator hose (lower) to see a flow of warm water.

CAUTION:
Watch water temperature gauge so as not to overheat engine.

10. Stop the engine and cool down to less than approximately 50°C (122°F).
    - Cool down using fan to reduce the time.
    - If necessary, refill radiator up to filler neck with engine coolant.

    CAUTION:
    Never adhere the engine coolant to electronic equipments (alternator etc.).
11. Refill reservoir tank to “MAX” level line with engine coolant.
12. Repeat steps 5 through 10 two or more times with radiator cap installed until engine coolant level no longer drops.
13. Check cooling system for leakage with engine running.
14. Warm up the engine, and check for sound of engine coolant flow while running engine from idle up to 3,000 rpm with heater temperature controller set at several position between “COOL” and “WARM”.
    - Sound may be noticeable at heater unit.
15. Repeat step 14 three times.
16. If sound is heard, bleed air from cooling system by repeating step 5 through 10 until reservoir tank level no longer drops.

Flushing

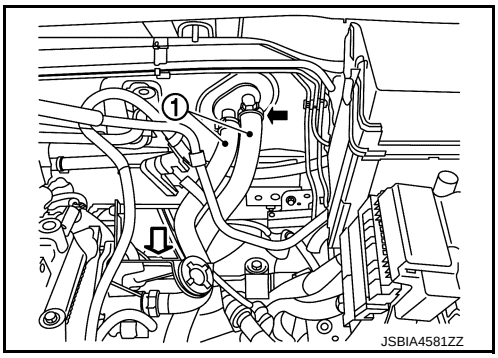
INFOID:0000000010339409

1. Install reservoir tank if removed.

   NOTE:
   If water drain plugs on cylinder block are removed, close and tighten them. Refer to EM-93, "Disassembly and Assembly".
2. Remove air duct (inlet) and air cleaner cover and body assembly. Refer to EM-25, "Removal and Installation".
3. Disconnect heater hose ① at position (⬅) in the figure.

   ⇦ : Vehicle front

   - Enhance heater as high as possible.



4. Fill radiator and reservoir tank with water and reinstall radiator cap.
   - When engine coolant over flows disconnected heater hose, connect heater hose, and continue filling the engine coolant.
5. Install air duct (between air cleaner case and electric throttle control actuator). Refer to EM-25, "Removal and Installation".
6. Run the engine and warm it up to normal operating temperature.
7. Rev the engine two or three times under no-load.
8. Stop the engine and wait until it cools down.
9. Drain water from the system. Refer to CO-8, "Draining".
10. Repeat steps 1 through 9 until clear water begins to drain from radiator.

RADIATOR

RADIATOR CAP

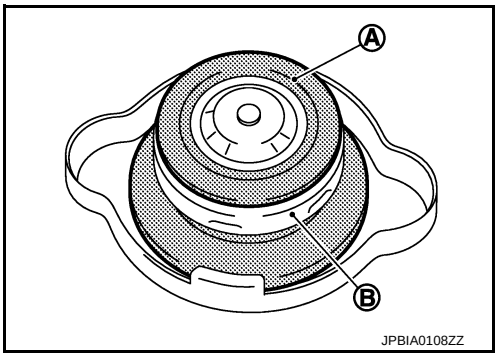
RADIATOR CAP : Inspection

INFOID:0000000010339410

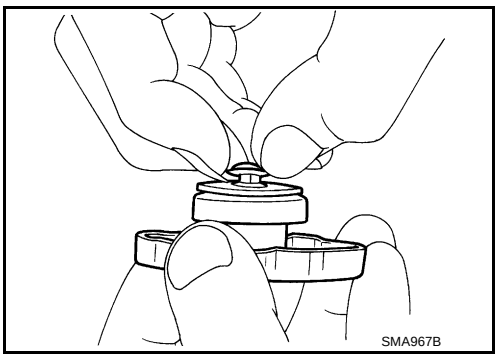
- Check valve seat Ⓐ of radiator cap.

Ⓑ : Metal plunger

- Check that valve seat is swollen to the extent that the edge of the plunger cannot be seen when watching it vertically from the top.
- Check that valve seat has no soil and damage.



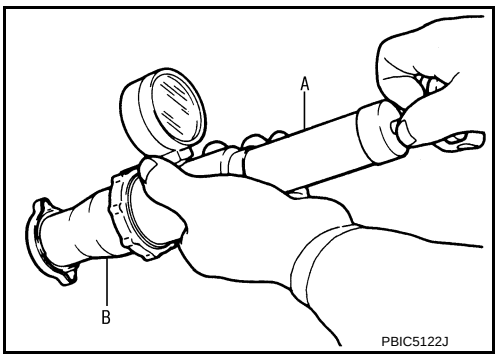
- Pull negative-pressure valve to open it, and check that it close completely when released.
- Check that there is no dirt or damage on the valve seat of radiator cap negative-pressure valve.
- Check that there are no unusualness in the opening and closing conditions of negative-pressure valve.



- Check radiator cap relief pressure.

Standard and Limit : Refer to CO-24, "Radiator".

- When connecting radiator cap to the radiator cap tester (commercial service tool) (A) and the radiator cap tester adapter (commercial service tool) (B), apply engine coolant to the cap seal surface.



- Replace radiator cap if there is an unusualness related to the above three.

CAUTION:

When installing radiator cap, thoroughly wipe out the radiator filler neck to remove any waxy residue or foreign material.

RADIATOR

RADIATOR : Inspection

INFOID:0000000010339411

Check radiator for mud or clogging. If necessary, clean radiator as follows.

CAUTION:

- **Be careful not to bend or damage radiator fins.**
- **When radiator is cleaned without removal, remove all surrounding parts such as radiator cooling fan assembly and horns. Then tape harness and harness connectors to prevent water from entering.**

1. Apply water by hose to the back side of the radiator core vertically downward.
2. Apply water again to all radiator core surfaces once per minute.
3. Stop washing if any stains no longer flow out from radiator.

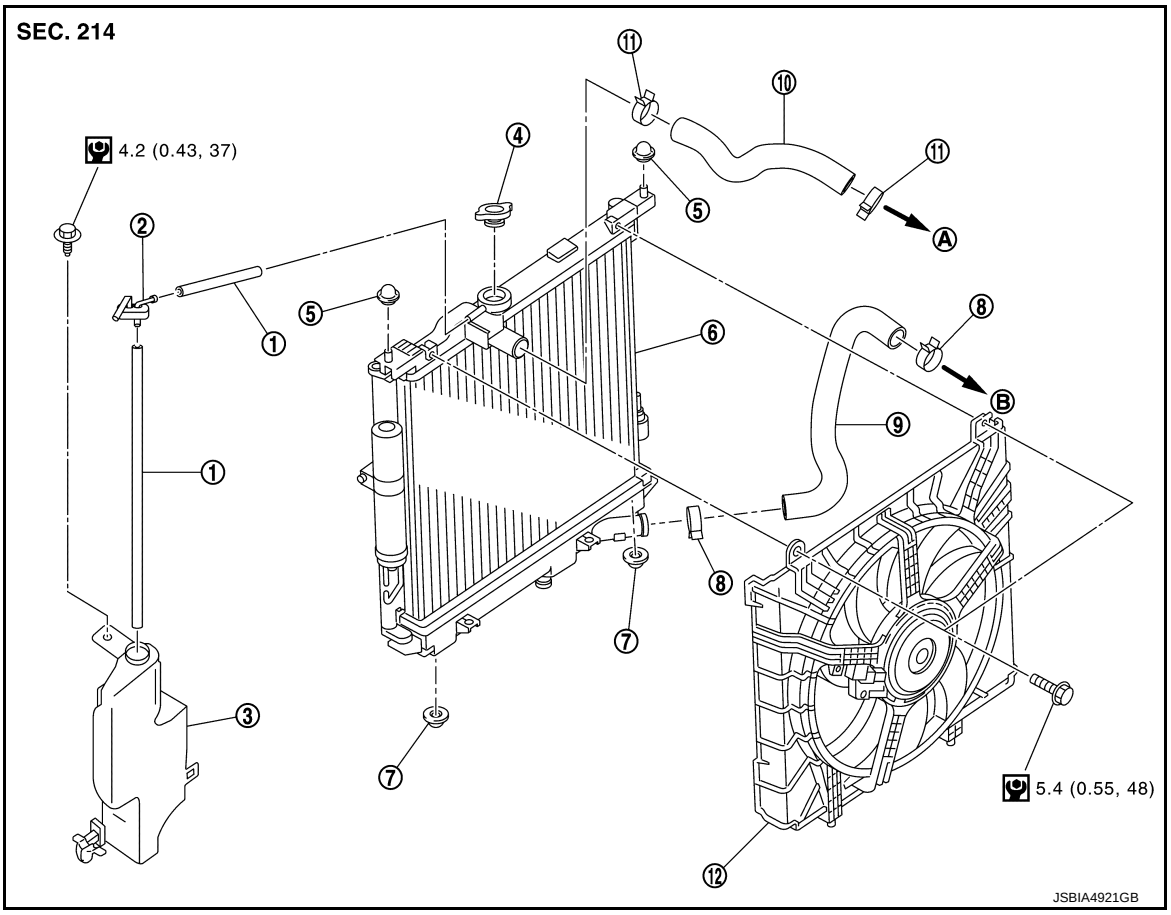
4. Blow air into the back side of radiator core vertically downward.
   - Use compressed air lower than 490 kPa (4.9 bar, 5 kg/cm^2, 71 psi) and keep distance more than 30 cm (11.81 in).
5. Blow air again into all the radiator core surfaces once per minute until no water sprays out.

REMOVAL AND INSTALLATION

RADIATOR

Exploded View

INFOID:0000000010339412



① Reservoir tank hose	② Reservoir tank cap	③ Reservoir tank
④ Radiator cap	⑤ Mounting rubber (upper)	⑥ Radiator
⑦ Mounting rubber (lower)	⑧ Clamp	⑨ Radiator hose (lower)
⑩ Radiator hose (upper)	⑪ Clamp	⑫ Cooling fan shroud assembly
Ⓐ To water outlet	Ⓑ To water inlet	

: N·m (kg-m, in-lb)

Removal and Installation

INFOID:0000000010339413

REMOVAL

WARNING:

- **Never remove radiator cap when engine is hot. Serious burns may occur from high-pressure engine coolant escaping from engine cooling system.**
- **Wrap a thick cloth around the radiator cap. Slowly turn it a quarter of a turn to release built-up pressure. Then turn it all the way.**

NOTE:

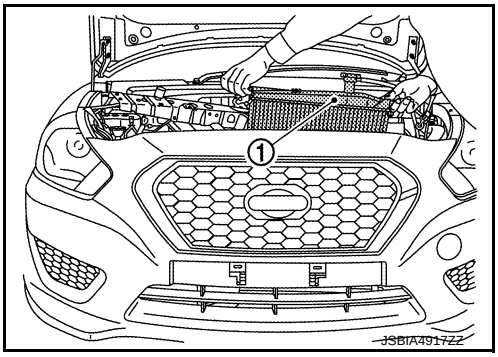
When removing components such as hoses, tubes/lines, etc., cap or plug openings to prevent fluid from spilling.

1. Drain engine coolant from radiator. Refer to CO-8, "Draining".

CAUTION:

- **Perform this step when the engine is cold.**
- **Never spill engine coolant on drive belt.**

2. Remove air duct (inlet). Refer to EM-25, "Removal and Installation".
3. Disconnect reservoir tank hose, and remove reservoir tank.
4. Disconnect harness connector from fan motor, and move harness aside.
5. Remove radiator hose (upper and lower).
6. Remove radiator core support (upper) and temporarily fasten it on the vehicle. Refer to DLK-39, "Removal and Installation".
7. Remove cooling fan shroud assembly.
   CAUTION:
   Be careful not to damage or scratch the radiator core.
8. Remove the radiator from the vehicle ①.
   CAUTION:
   Be careful not to damage radiator core and condenser assembly core.



INSTALLATION

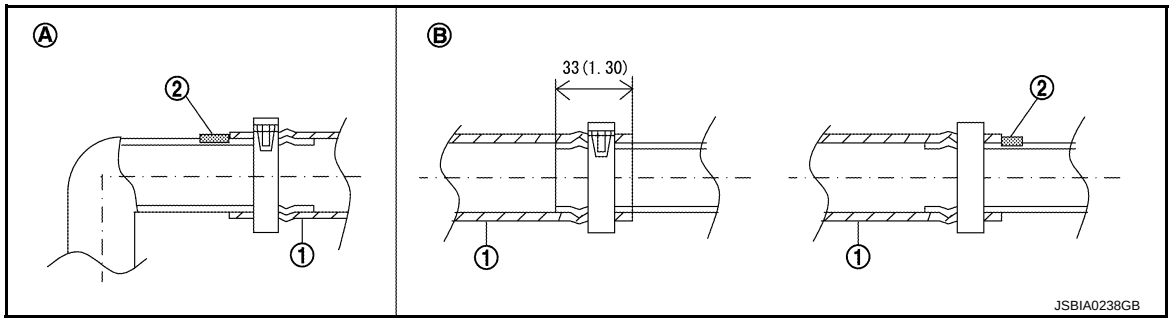
Note the following, and install in the reverse order of removal.

CAUTION:

- **Replace water hose clamp if it is removed.**
- **Use genuine mounting bolts for the cooling fan assembly and strictly observe the tightening torque. (Breakage prevention for radiator)**
- **Do not reuse O-ring.**

NOTE:

- Insert the radiator hose ① all the way to the stopper ② or by 33 mm (1.30in) (hose without a stopper)



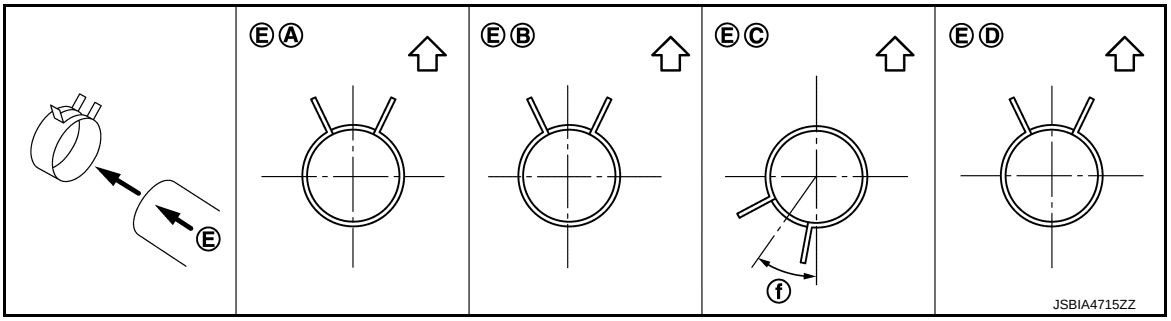
Unit: mm (in)

Ⓐ Radiator side Ⓑ Engine side

- For the orientation of the hose clamp pawl, refer to the figure.

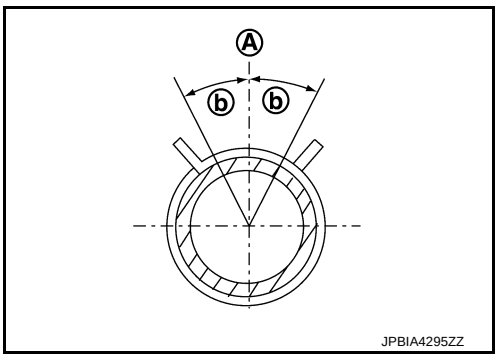
Radiator hose	Hose end	Paint mark	Position of hose clamp*
Radiator hose (upper)	Radiator side	Upper	Ⓐ
	Engine side	Upper	Ⓑ
Radiator hose (lower)	Radiator side	Lower	Ⓒ
	Engine side	Upper	Ⓓ

*: Refer to the illustrations for the specific position each hose clamp tab.



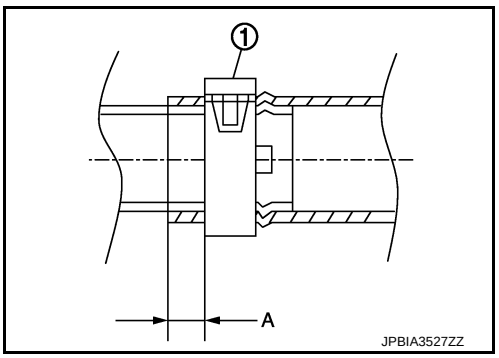
ⓕ 45°
Ⓔ View E
⇦ : Vehicle upper

- The angle ⓑ created by the hose clamp pawl and the specified line Ⓐ must be within ±30° as shown in the figure.



- To install hose clamps ①, check that the dimension (A) from the end of the hose clamp on the radiator hose to the hose clamp is within the reference value.

Dimension "A" : 3 – 7 mm (0.12 – 0.28 in)



Inspection

INFOID:0000000010339414

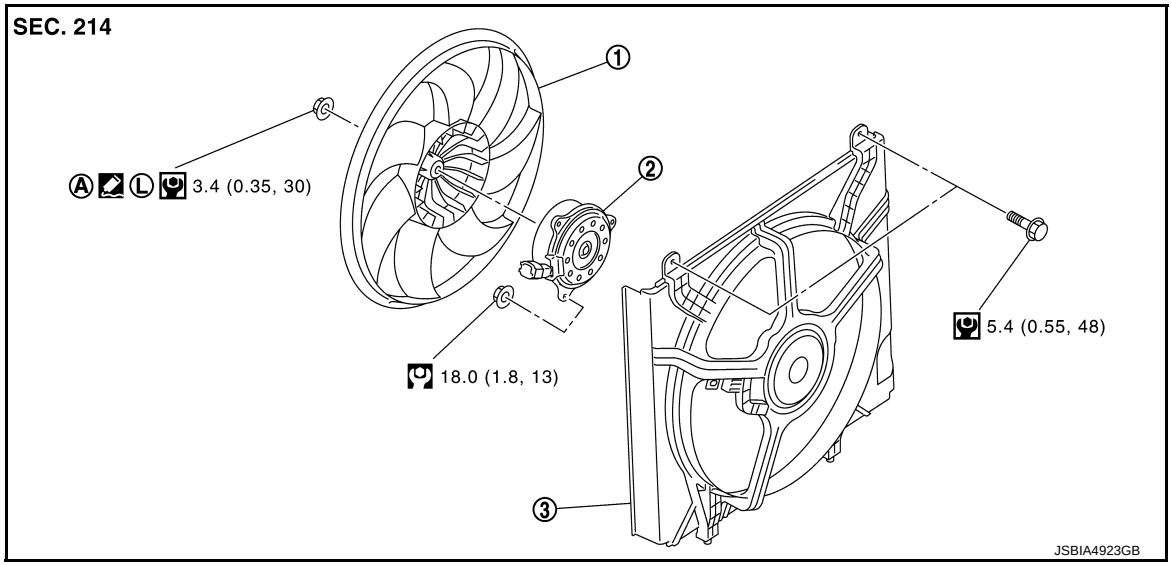
INSPECTION AFTER INSTALLATION

- Check for leakage of engine coolant using the radiator cap tester adapter (commercial service tool) and the radiator cap tester (commercial service tool). Refer to CO-8, "Inspection".
- Start and warm up the engine. Check visually that there is no leakage of engine coolant.

COOLING FAN

Exploded View

INFOID:0000000010339415



①	Cooling fan	②	Fan motor	③	Fan shroud

Ⓐ Apply on fan motor shaft

Ⓛ : Apply genuine high strength thread locking sealant or equivalent.

: N·m (kg-m, in-lb)

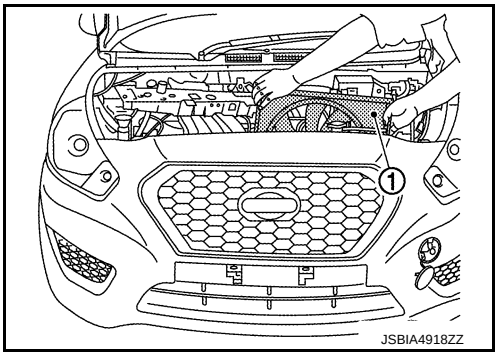
: N·m (kg-m, ft-lb)

Removal and Installation

INFOID:0000000010339416

REMOVAL

1. Drain engine coolant from radiator. Refer to CO-8, "Draining".
   CAUTION:
   - **Perform this step engine is cold.**
   - **Never spill engine coolant on drive belt.**
2. Remove air duct (inlet). Refer to EM-25, "Removal and Installation".
3. Disconnect reservoir tank hose radiator side, and remove reservoir tank. Refer to CO-13, "Exploded View"
4. Remove radiator hose (upper). Refer to CO-13, "Exploded View".
5. Disconnect harness connector from fan motor, and move harness to aside.
6. Remove radiator core support (upper) and temporarily fasten it on the vehicle. Refer to DLK-39, "Removal and Installation".
7. Remove cooling fan shroud assembly ①.
   CAUTION:
   Be careful not to damage or scratch on radiator core when removing.



INSTALLATION

Note the following, and install in the reverse order of removal.

CAUTION:

Only use genuine parts for fan shroud mounting bolt and observe the specified torque (Breakage prevention for radiator).

NOTE:

Cooling fan is controlled by ECM. For details, Refer to EC-33, "COOLING FAN CONTROL : System Description".

Disassembly and Assembly

INFOID:0000000010339417

DISASSEMBLY

1. Remove fan motor assembly from fan shroud.

ASSEMBLY

Assembly is the reverse order of disassembly.

Inspection

INFOID:0000000010339418

INSPECTION AFTER DISASSEMBLY

Fan Motor Assembly

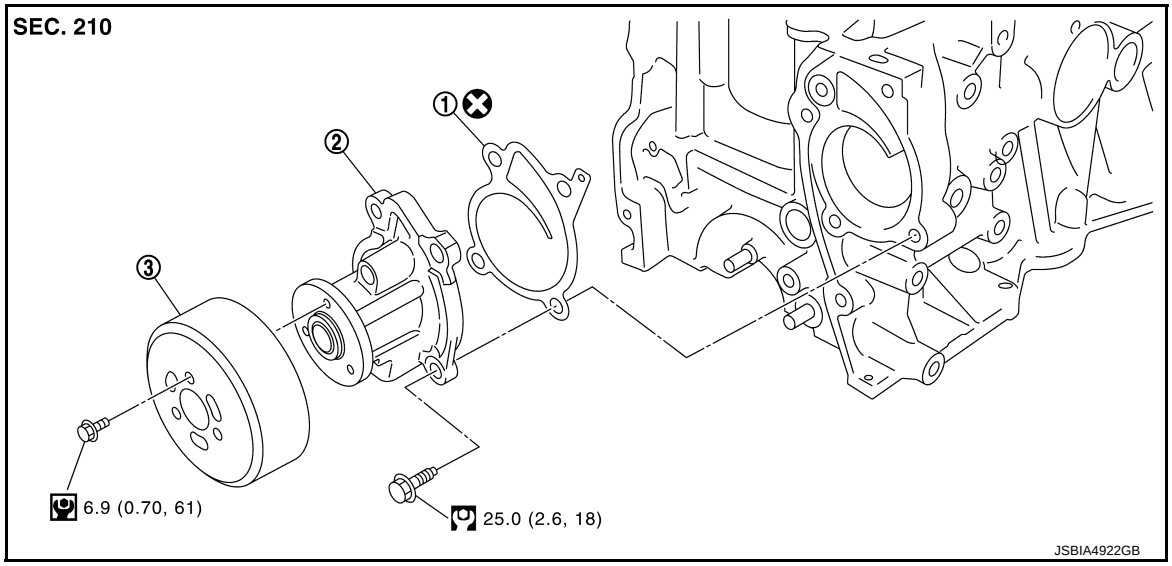
Inspect fan motor assembly for crack or unusual bend.

- If anything is found, replace fan motor assembly.

WATER PUMP

Exploded View

INFOID:0000000010339419



① Gasket ② Water pump ③ Water pump pulley

: Always replace after every disassembly.

:N-m (kg-m, in-lb)

:N-m (kg-m, ft-lb)

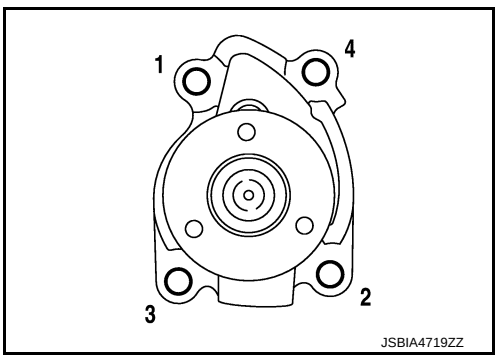
Removal and Installation

INFOID:0000000010339420

REMOVAL

1. Drain engine coolant from radiator. Refer to CO-8, "Draining".
   CAUTION:
   - **Perform this step when the engine is cold.**
   - **Never spill engine coolant on drive belt.**
2. Steer front wheel to the right.
3. Remove front fender protector (RH). Refer to EXT-19, "FENDER PROTECTOR : Removal and Installation".
4. Loosen mounting bolts of water pump pulley before loosening belt tension of drive belt.
5. Remove drive belt. Refer to EM-23, "Removal and Installation".
6. Remove water pump pulley.
7. Remove water pump.
   - Loosen mounting bolts in the order 4→1 as shown in the figure.
   - Engine coolant will leak from cylinder block, so have a receptacle ready below.

   CAUTION:
   - **Handle water pump vane so that it does not contact any other parts.**
   - **Water pump cannot be disassembled and should be replaced as a unit.**

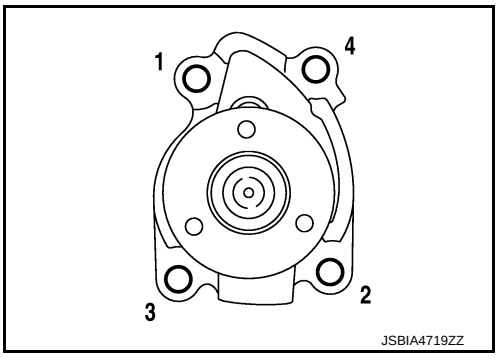


INSTALLATION

Note the following, and install in the reverse order of removal.

Water Pump

- Tighten mounting bolts in the order 1→4 as shown in the figure.

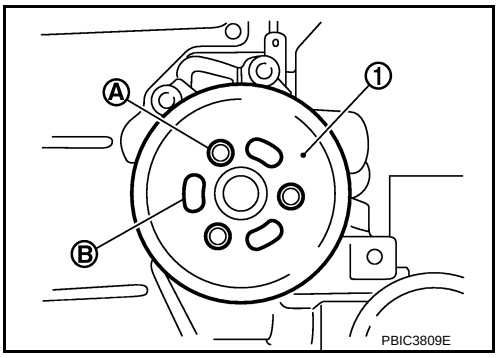


Water Pump Pulley

CAUTION:

Never install mounting bolts Ⓐ to oblong holes Ⓑ.

① : Water pump pulley

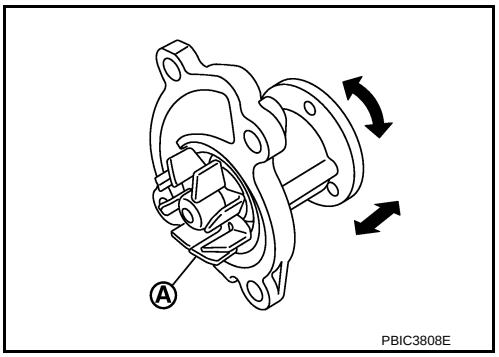


Inspection

INFOID:0000000010339421

INSPECTION AFTER REMOVAL

- Check visually that there is no significant dirt or rusting on water pump body and vane Ⓐ.
- Check that there is no looseness in vane shaft, and that it turns smoothly when rotated by hand.
- Replace water pump, if necessary.



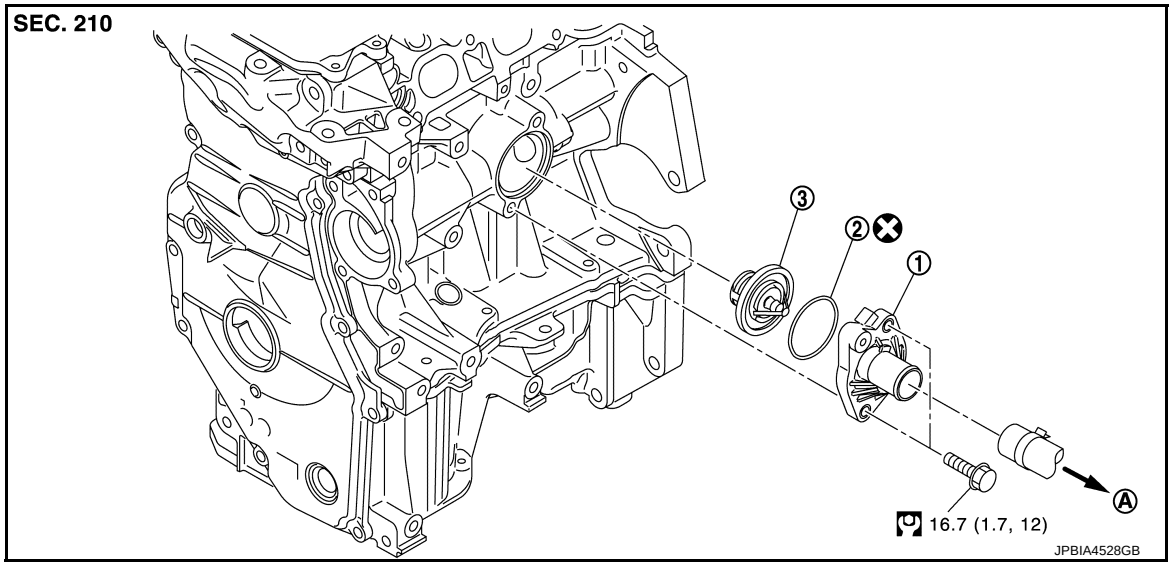
INSPECTION AFTER INSTALLATION

- Check for leakage of engine coolant using the radiator cap tester adapter (commercial service tool) and the radiator cap tester (commercial service tool). Refer to CO-8, "Inspection".
- Start and warm up the engine. Check visually that there is no leakage of engine coolant.

THERMOSTAT

Exploded View

INFOID:0000000010339422



① Water inlet ② Rubber ring ③ Thermostat

Ⓐ To radiator

: N·m (kg-m, ft-lb)

: Always replace after every disassembly.

Removal and Installation

INFOID:0000000010339423

REMOVAL

1. Drain engine coolant from radiator. Refer to CO-8, "Draining".
   CAUTION:
   Perform this step when engine is cold.
2. Remove air duct (inlet). Refer to EM-25, "Removal and Installation".
3. Disconnect radiator hose (lower) from water inlet. Refer to CO-13, "Removal and Installation".
4. Remove water inlet and thermostat.
   • Engine coolant leakage from cylinder block, so have a receptacle ready below.

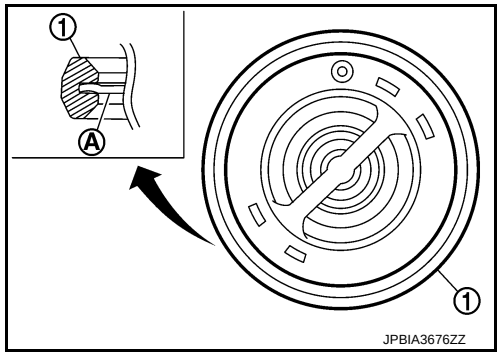
INSTALLATION

Note the following, and install in the reverse order of removal.

CAUTION:
Do not reuse rubberring.

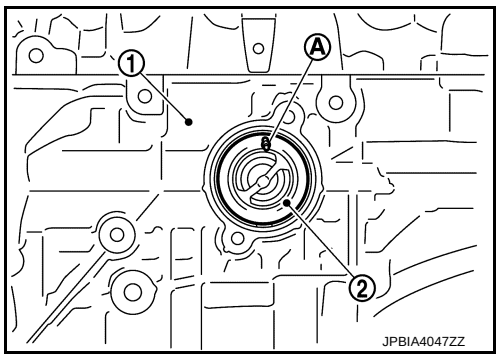
Thermostat

• Install thermostat with making rubber ring ① groove fit to thermostat flange Ⓐ with the whole circumference.



- Install thermostat ② with jiggle valve Ⓐ facing upwards.

① : Cylinder block

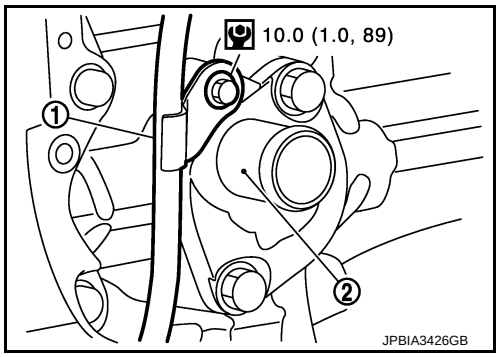


Water Inlet

After installation, install oil level gauge guide ① as shown in the figure.

② : Water inlet

: N·m (kg, in-lb)



Inspection

INFOID:0000000010339424

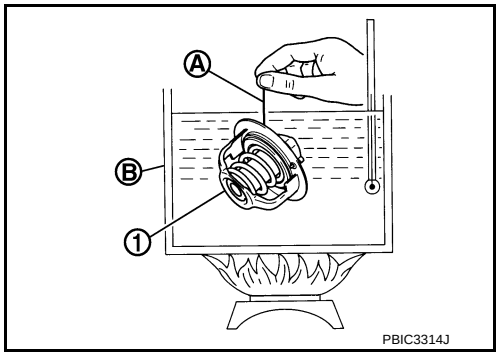
INSPECTION AFTER REMOVAL

Thermostat

- Place a thread Ⓐ so that it is caught in the valves of thermostat ①. Immerse fully in a container Ⓑ filled with water. Heat while stirring.
- The valve opening temperature is the temperature at which the valve opens and falls from the thread.
- Continue heating. Check the full open valve lift amount.
- After checking the maximum valve lift amount, lower the water temperature and check the valve closing temperature.

Standard: Refer to CO-24, "Thermostat".

- If out of the standard, replace thermostat.



INSPECTION AFTER INSTALLATION

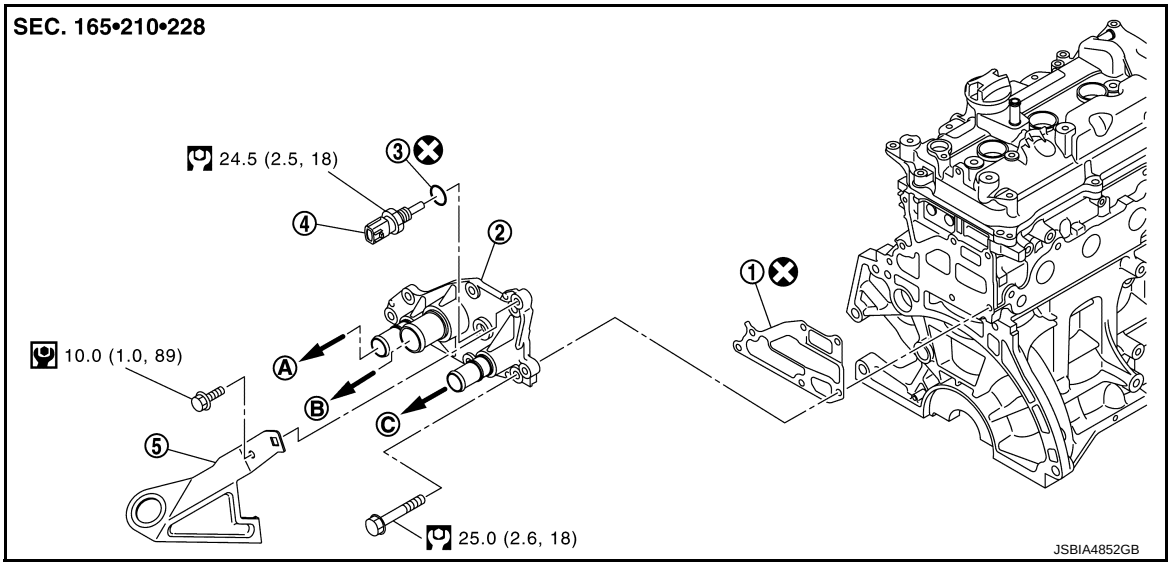
- Check for leakage of engine coolant using the radiator cap tester adapter (commercial service tool) and the radiator cap tester (commercial service tool). Refer to CO-8, "Inspection".
- Start and warm up the engine. Check visually that there is no leakage of engine coolant.

WATER OUTLET

Exploded View

INFOID:0000000010339425

EXCEPT FOR INDONESIA MODELS



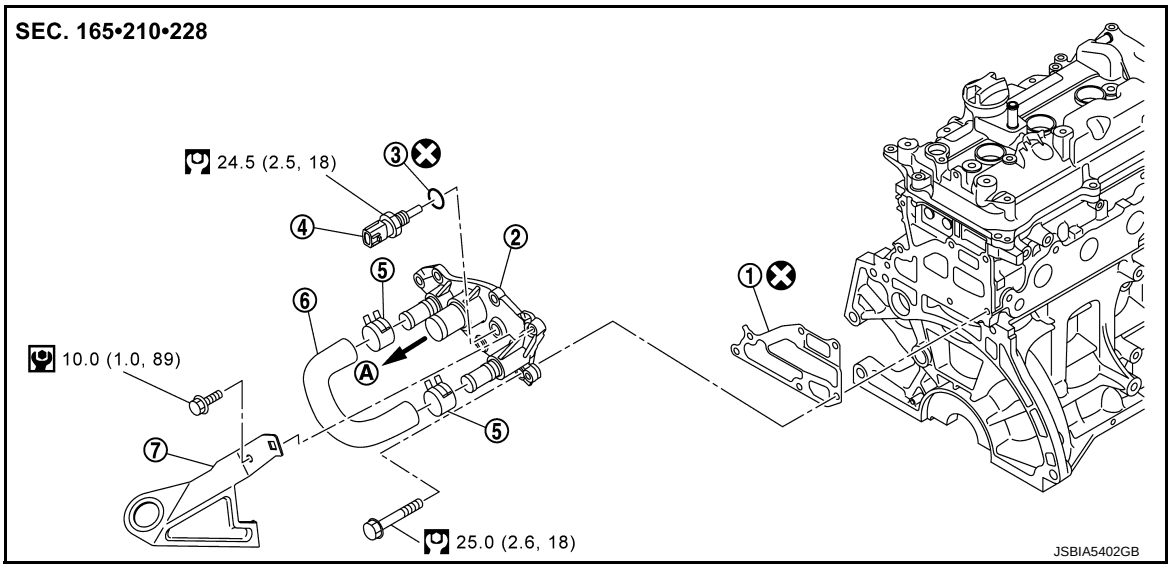
① Gasket ② Water outlet ③ O-ring
④ Engine coolant temperature sensor ⑤ Bracket
Ⓐ To heater hose Ⓑ To radiator hose (upper) Ⓒ To heater hose

: N·m (kg-m, ft-lb)

: N·m (kg-m, in-lb)

: Always replace after every disassembly.

FOR INDONESIA MODELS



① Gasket ② Water outlet ③ O-ring
④ Engine coolant temperature sensor ⑤ Clamp ⑥ Water bypass hose
⑦ Bracket
Ⓐ To Radiator hose (upper)

: N·m (kg-m, ft-lb)

: N·m (kg-m, in-lb)

: Always replace after every disassembly.

Removal and Installation

INFOID:0000000010339426

REMOVAL

1. Drain engine coolant from radiator. Refer to CO-8, "Draining".
   CAUTION:
   Perform this step when engine is cold.
2. Remove air duct (inlet) and air cleaner cover and body assembly. Refer to EM-25, "Removal and Installation".
3. Disconnect radiator hose (upper). Refer to CO-13, "Removal and Installation".
4. Disconnect harness connector from engine coolant temperature sensor.
5. Remove water outlet.
6. Remove engine coolant temperature sensor from water outlet, if necessary.
7. Remove water bypass hose from water outlet, if necessary (FOR INDONESIA MODELS).

INSTALLATION

Installation is the reverse order of removal.

CAUTION:
Do not reuse O-ring.

Inspection

INFOID:0000000010339427

INSPECTION AFTER INSTALLATION

- Check for leakage of engine coolant using the radiator cap tester adapter (commercial service tool) and the radiator cap tester (commercial service tool). Refer to CO-8, "Inspection".
- Start and warm up the engine. Check visually that there is no leakage of engine coolant.

SERVICE DATA AND SPECIFICATIONS (SDS)

SERVICE DATA AND SPECIFICATIONS (SDS)

Periodical Maintenance Specification

INFOID:0000000010339428

ENGINE COOLANT CAPACITY (APPROXIMATE)

Unit: ℓ (Imp qt)

Engine coolant capacity (With reservoir tank at “MAX” level)	Except for INDONESIA Models	5.3 (4-5/8)
	For INDONESIA Models	4.7 (4-1/8)
Reservoir tank engine coolant capacity (At “MAX” level)		0.7 (5/8)

Radiator

INFOID:0000000010339429

Unit: kPa (bar, kg/cm^2, psi)

Cap relief pressure	Standard	78 - 98 (0.8 - 1.0, 0.8 - 1.0, 11 - 14)
	Limit	59 (0.6, 0.6, 9)
Leakage testing pressure		98 (1.0, 1.0, 14)

Thermostat

INFOID:0000000010339430

Standard

Valve opening temperature	80.5 - 83.5°C (177 - 182°F)
Maximum valve lift	8.0 mm/95°C (0.315 in/203°F)
Valve closing temperature	77°C (171°F)