

# SECTION CO

## ENGINE COOLING SYSTEM

### CONTENTS

<b>VK56VD</b>		<b>WATER PUMP</b> .....	<b>20</b>
<b>PRECAUTION</b> .....	<b>3</b>	Exploded View .....	20
<b>PRECAUTIONS</b> .....	<b>3</b>	Removal and Installation .....	20
Caution for Supplemental Restraint System (SRS) "AIR BAG" and "SEAT BELT PRE-TENSIONER" .....	3	Inspection .....	21
<b>PREPARATION</b> .....	<b>4</b>	<b>MULTI-WAY CONTROL VALVE</b> .....	<b>22</b>
<b>PREPARATION</b> .....	<b>4</b>	Exploded View .....	22
Special Service Tool .....	4	Removal and Installation .....	23
Commercial Service Tools .....	4	Inspection .....	24
<b>SYMPTOM DIAGNOSIS</b> .....	<b>5</b>	<b>COOLANT HEATER</b> .....	<b>25</b>
<b>OVERHEATING CAUSE ANALYSIS</b> .....	<b>5</b>	Exploded View .....	25
Troubleshooting Chart .....	5	Removal and Installation .....	25
<b>SYSTEM DESCRIPTION</b> .....	<b>7</b>	<b>SERVICE DATA AND SPECIFICATIONS (SDS)</b> .....	<b>27</b>
<b>DESCRIPTION</b> .....	<b>7</b>	<b>SERVICE DATA AND SPECIFICATIONS (SDS)</b> .....	<b>27</b>
Cooling Circuit .....	7	Periodical Maintenance Specification .....	27
Schematic .....	8	Radiator .....	27
<b>PERIODIC MAINTENANCE</b> .....	<b>9</b>	Multi-Way Control Valve .....	27
<b>ENGINE COOLANT</b> .....	<b>9</b>	<b>CUMMINS 5.0L</b>	
System Inspection .....	9	<b>PRECAUTION</b> .....	<b>28</b>
Changing Engine Coolant .....	11	<b>PRECAUTIONS</b> .....	<b>28</b>
<b>REMOVAL AND INSTALLATION</b> .....	<b>13</b>	Caution for Supplemental Restraint System (SRS) "AIR BAG" and "SEAT BELT PRE-TENSIONER" .....	28
<b>RADIATOR</b> .....	<b>13</b>	Caution for Liquid Gasket .....	28
Exploded View .....	13	<b>PREPARATION</b> .....	<b>30</b>
Removal and Installation .....	13	<b>PREPARATION</b> .....	<b>30</b>
Inspection .....	16	Special Service Tool .....	30
<b>COOLING FAN</b> .....	<b>17</b>	Commercial Service Tool .....	31
Exploded View .....	17	<b>SYSTEM DESCRIPTION</b> .....	<b>32</b>
Removal and Installation .....	17	<b>ENGINE COOLING SYSTEM</b> .....	<b>32</b>
Inspection .....	18	System Description .....	32

<b>COOLING CIRCUIT</b> .....	<b>36</b>	<b>COOLANT HEATER</b> .....	<b>57</b>
Cooling Schematic .....	36	Exploded View .....	57
<b>PERIODIC MAINTENANCE</b> .....	<b>39</b>	Removal and Installation .....	57
<b>ENGINE COOLANT</b> .....	<b>39</b>	<b>COOLANT THERMOSTAT</b> .....	<b>60</b>
System Inspection .....	39	Exploded View .....	60
Changing Engine Coolant .....	41	Removal and Installation .....	60
<b>REMOVAL AND INSTALLATION</b> .....	<b>43</b>	<b>WATER INLET CONNECTION</b> .....	<b>65</b>
<b>RADIATOR</b> .....	<b>43</b>	Exploded View .....	65
Exploded View .....	43	Removal and Installation .....	65
Removal and Installation .....	43	<b>COOLING FAN BELT TENSIONER</b> .....	<b>67</b>
<b>RESERVOIR TANK</b> .....	<b>46</b>	Exploded View .....	67
Exploded View .....	46	Removal and Installation .....	67
Removal and Installation .....	46	<b>PULLEY, FAN IDLER</b> .....	<b>70</b>
<b>ENGINE COOLING FAN ASSEMBLY</b> .....	<b>47</b>	Exploded View .....	70
Exploded View .....	47	Removal and Installation .....	70
Removal and Installation .....	47	<b>WATER TRANSFER CONNECTION</b> .....	<b>72</b>
<b>FAN SPACER AND PULLEY</b> .....	<b>49</b>	Exploded View .....	72
Exploded View .....	49	Removal and Installation .....	72
Removal and Installation .....	49	<b>WATER OUTLET CONNECTION</b> .....	<b>74</b>
<b>WATER PUMP</b> .....	<b>51</b>	Removal and Installation .....	74
Exploded View .....	51	<b>SERVICE DATA AND SPECIFICATIONS</b>	
Removal and Installation .....	51	<b>(SDS)</b> .....	<b>75</b>
<b>COOLANT PLUMBING</b> .....	<b>55</b>	<b>SERVICE DATA AND SPECIFICATIONS</b>	
Exploded View .....	55	<b>(SDS)</b> .....	<b>75</b>
Removal and Installation .....	55	Standard and Limit .....	75

# PRECAUTION

## PRECAUTIONS

### Precaution for Supplemental Restraint System (SRS) "AIR BAG" and "SEAT BELT PRE-TENSIONER"

INFOID:000000014081606

The Supplemental Restraint System such as "AIR BAG" and "SEAT BELT PRE-TENSIONER", used along with a front seat belt, helps to reduce the risk or severity of injury to the driver and front passenger for certain types of collision. Information necessary to service the system safely is included in the SR and SB section of this Service Manual.

**WARNING:**

- To avoid rendering the SRS inoperative, which could increase the risk of personal injury or death in the event of a collision which would result in air bag inflation, it is recommended that all maintenance and repair be performed by an authorized NISSAN/INFINITI dealer.
- Improper repair, including incorrect removal and installation of the SRS, can lead to personal injury caused by unintentional activation of the system. For removal of Spiral Cable and Air Bag Module, see the SR section.
- Do not use electrical test equipment on any circuit related to the SRS unless instructed to in this Service Manual. SRS wiring harnesses can be identified by yellow and/or orange harnesses or harness connectors.

### PRECAUTIONS WHEN USING POWER TOOLS (AIR OR ELECTRIC) AND HAMMERS

**WARNING:**

- When working near the Air Bag Diagnosis Sensor Unit or other Air Bag System sensors with the Ignition ON or engine running, DO NOT use air or electric power tools or strike near the sensor(s) with a hammer. Heavy vibration could activate the sensor(s) and deploy the air bag(s), possibly causing serious injury.
- When using air or electric power tools or hammers, always switch the Ignition OFF, disconnect the battery or batteries, and wait at least three minutes before performing any service.

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# PREPARATION

< PREPARATION >

[VK56VD]

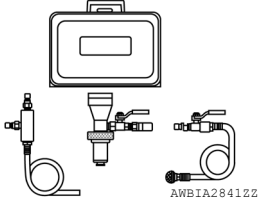
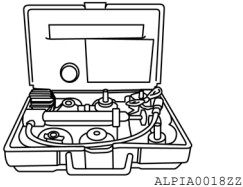
## PREPARATION

### PREPARATION

#### Special Service Tool


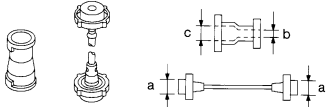
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The actual shape of the tools may differ from those illustrated here.

Tool number (TechMate No.) Tool name	Description
KV991J0070 (J-45695-A) Coolant refill tool	Refilling engine cooling system 
— (J-51771) Cooling system pressure test kit <ul style="list-style-type: none"> <li>• — (J-51771-1) Main body</li> <li>• — (J-51771-4) Small adapter</li> <li>• — (J-51771-5) Pump with quick release</li> <li>• — (J-51771-9) Radiator cap assembly with quick coupler</li> </ul>	Checking cooling system and radiator cap 

#### Commercial Service Tools

INFOID:000000013642815

Tool number (TechMate No.) Tool name	Description
Power tool	Loosening bolts, screws and nuts 
— (J-33984-A) Radiator pressure adapter	Adapting cooling system pressure tester to radiator cap and reservoir tank cap <b>a: 28 (1.10) diameter</b> <b>b: 31.4 (1.236) diameter</b> <b>c: 41.3 (1.626) diameter</b> Unit: mm (in) 

# OVERHEATING CAUSE ANALYSIS

< SYMPTOM DIAGNOSIS >

[VK56VD]

## SYMPTOM DIAGNOSIS

### OVERHEATING CAUSE ANALYSIS

#### Troubleshooting Chart

INFOID:0000000013642818

A

CO

		Symptom	Check items	
Cooling system parts malfunction	Poor heat transfer	Water pump malfunction	Worn or loose drive belt	—
		Multi-way control valve stuck	—	
		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 density
	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		

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# OVERHEATING CAUSE ANALYSIS

< SYMPTOM DIAGNOSIS >

[VK56VD]

		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	
				Powertrain system malfunction	—
				Installed improper size wheels and tires	
				Dragging brakes	
	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					

# DESCRIPTION

< SYSTEM DESCRIPTION >

[VK56VD]

## SYSTEM DESCRIPTION

### DESCRIPTION

#### Cooling Circuit

INFOID:000000013642816

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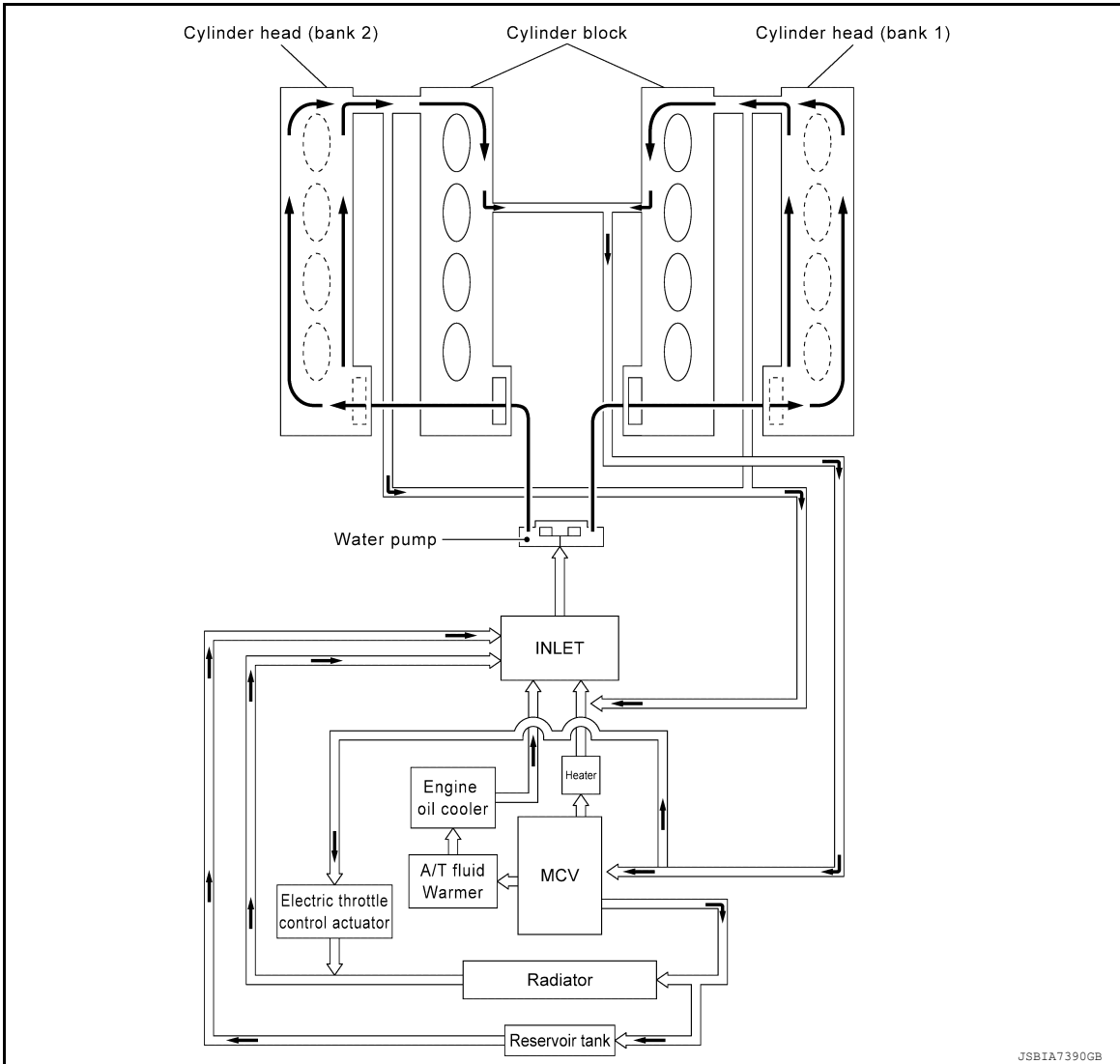
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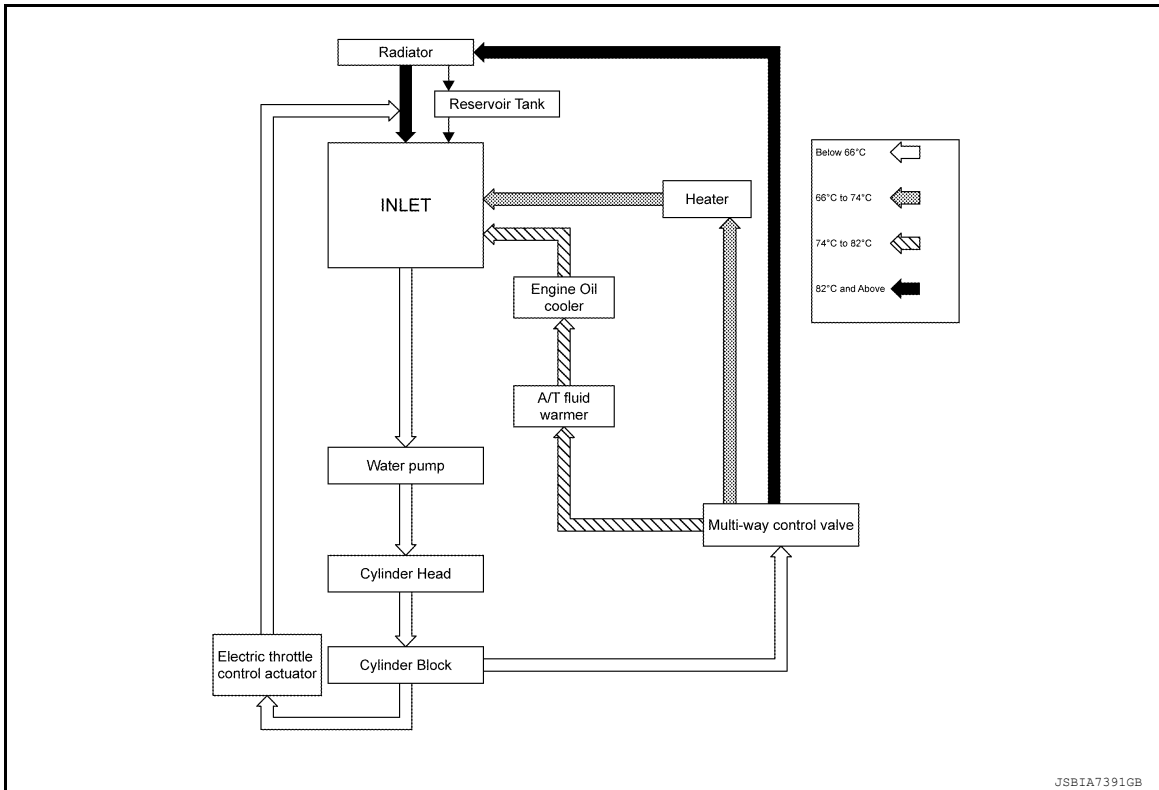
# DESCRIPTION

< SYSTEM DESCRIPTION >

[VK56VD]

## Schematic

INFOID:000000013968664





## PERIODIC MAINTENANCE

### ENGINE COOLANT

#### System Inspection

INFOID:000000013642819

#### WARNING:

- Do not remove the radiator cap or reservoir tank cap when the engine is hot. Serious burns could occur from high-pressure engine coolant escaping from the cooling system.
- When removing the radiator cap or reservoir tank cap, wrap a thick cloth around the cap and slowly turn it a quarter turn to allow built-up pressure to escape. Then carefully remove the cap by turning it all the way.

#### CHECKING COOLING SYSTEM HOSES

Check hoses for the following:

- Improper attachment
- Leaks
- Cracks
- Dents
- Bulges
- Internal obstruction
- Damage
- Loose connections
- Chafing
- Deterioration

#### CHECKING RESERVOIR LEVEL

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

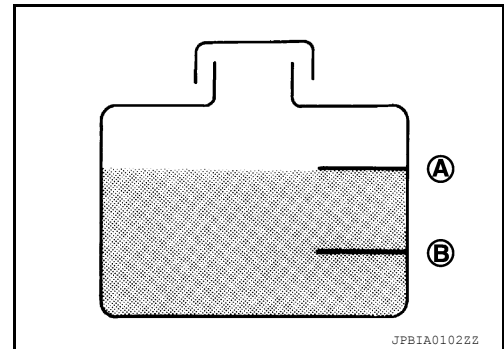
(A) : MAX

(B) : MIN

- Adjust coolant level (if necessary), to insure tht the engine coolant level is within the MIN to MAX range.

#### CAUTION:

Refill Genuine NISSAN Long Life Antifreeze/Coolant (blue) or equivalent in its quality mixed with water (distilled or demineralized). Refer to [MA-13, "VK56VD Gasoline Engine : Fluids and Lubricants"](#).



#### CHECKING COOLING SYSTEM FOR LEAKS

#### WARNING:

- Do not remove the radiator cap or reservoir tank cap when the engine is hot. Serious burns could occur from high-pressure engine coolant escaping from the cooling system.
- When removing the radiator cap or reservoir tank cap, wrap a thick cloth around the cap and slowly turn it a quarter turn to allow built-up pressure to escape. Then carefully remove the cap by turning it all the way.

To check the cooling system for leaks, apply pressure to the cooling system using Tools (A), (B), (C) and (D).

Tool number (A) : — (J-51771-5)

Tool number (B) : — (J-51771-9)

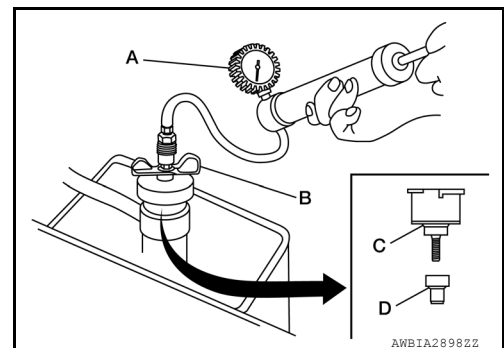
Tool number (C) : — (J-51771-1)

Tool number (D) : — (J-51771-4)

Leakage test pressure : Refer to [CO-27, "Radiator"](#).

#### CAUTION:

Higher pressure testing than specified may cause radiator damage.



# ENGINE COOLANT

< PERIODIC MAINTENANCE >

[VK56VD]

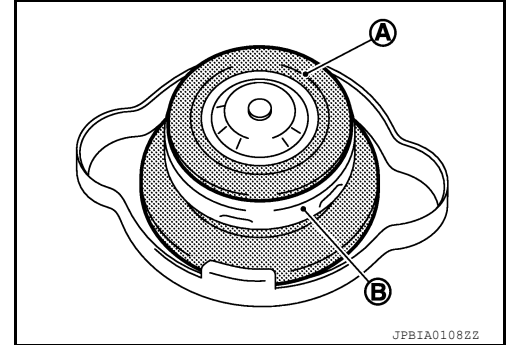
## CHECKING RESERVOIR TANK CAP

### WARNING:

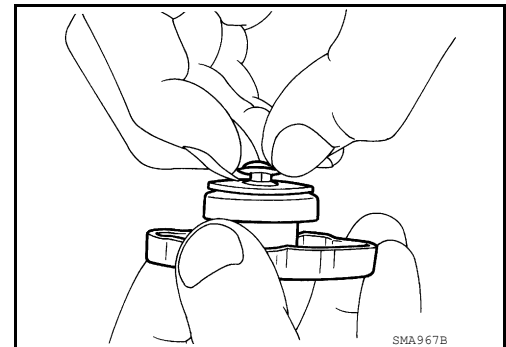
- Do not remove the radiator cap or reservoir tank cap when the engine is hot. Serious burns could occur from high-pressure engine coolant escaping from the cooling system.
- When removing the radiator cap or reservoir tank cap, wrap a thick cloth around the cap and slowly turn it a quarter turn to allow built-up pressure to escape. Then carefully remove the cap by turning it all the way.
- Check the pressure valve of the reservoir tank cap.
- Replace the reservoir tank cap if the metal plunger (B) on the pressure valve cannot be seen around the edge of the rubber gasket (A).
- Replace the reservoir tank cap if there is damage or deposits of foreign material on the rubber gasket or pressure valve.

### CAUTION:

Thoroughly wipe out the reservoir tank filler neck to remove any waxy residue or foreign material.

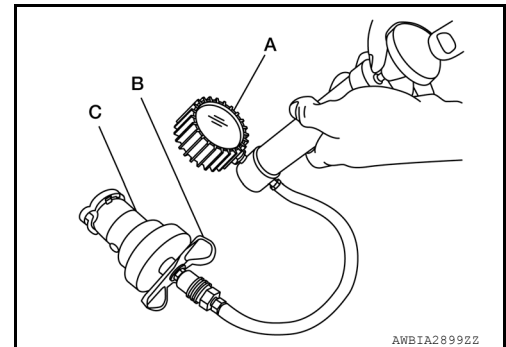


- Check the negative-pressure valve of the reservoir tank cap.
- Replace the reservoir tank cap if the negative-pressure valve does not close completely when pulled open and released.
- Replace the reservoir tank cap if there is damage or deposits of foreign material on the valve seat of the negative-pressure valve.
- Replace the reservoir tank cap if there is an abnormality in the operation of the negative-pressure valve.



- Check reservoir tank cap relief pressure.
- Check the reservoir tank cap relief pressure using Tools (A) and (B), and suitable tool (C).

- Tool number (A) : — (J-51771-5)
- Tool number (B) : — (J-51771-9)
- Tool number (C) : — (J-33984-A or equivalent)  
(commercially available)
- Reservoir tank cap relief pressure : Refer to [CO-27, "Radiator"](#).



- When connecting the reservoir tank cap to suitable tool (C), apply water or coolant to the reservoir tank cap seal surface.
- Replace the reservoir tank cap if the reservoir tank cap relief pressure is outside of specification.

## CHECKING RADIATOR

Check radiator for mud or clogging. If necessary, clean radiator as per the following:

- Be careful not to bend or damage radiator fins.
  - When radiator is cleaned without removal, remove all surrounding parts such as radiator cooling fan shroud. Then tape harness and 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.

# ENGINE COOLANT

< PERIODIC MAINTENANCE >

[VK56VD]

- Use compressed air lower than 490 kPa (5 kg/cm<sup>2</sup>, 71 psi) and keep distance more than 30 cm (11.8 in).
5. Blow air again into all the radiator core surfaces once per minute until no water sprays out.

## Changing Engine Coolant

INFOID:000000013642820

### DRAINING ENGINE COOLANT

#### WARNING:

- **Do not remove radiator cap and reservoir tank cap when engine is hot. Serious burns could occur from high-pressure engine coolant escaping from radiator.**
- **Wrap a thick cloth around the caps. Slowly turn them a quarter of a turn to release built-up pressure. Carefully remove the caps by turning it all the way.**

1. Open radiator drain plug at the bottom of radiator and then remove radiator cap and reservoir tank cap. (This is the only step required when partially draining the cooling system.)

#### CAUTION:

- **Do not allow coolant to contact drive belt.**
  - **Perform this step when engine is cold.**
2. Follow this step for heater core removal/replacement only. Disconnect the upper heater hose at the engine side and apply moderate air pressure [103.46 kPa (1.055 kg/cm<sup>2</sup>, 15 psi) maximum air pressure] into the hose for 30 seconds to blow the excess coolant out of the heater core.
  3. When draining all of the coolant in the system, remove reservoir tank and drain engine coolant and clean reservoir tank before installing.

#### NOTE:

When draining all of the engine coolant in the system, open water drain plug on cylinder block. Refer to [EM-120, "Exploded View"](#).

4. Check drained engine coolant for contaminants such as rust, corrosion or discoloration. If contaminated, flush the engine cooling system. Refer to [CO-11, "Changing Engine Coolant"](#).

### REFILLING ENGINE COOLANT

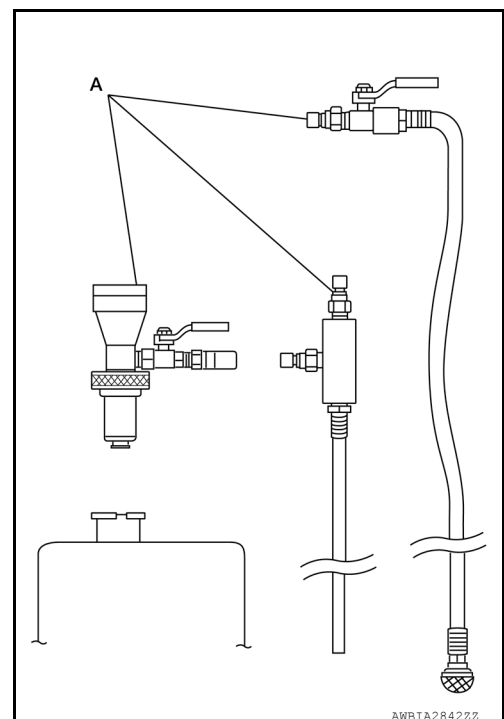
1. Install the following, if removed:
  - Cylinder block drain plugs, refer to [EM-120, "Exploded View"](#).
  - Reservoir tank, refer to [CO-13, "Exploded View"](#).
  - Cooling system hoses, refer to [CO-13, "Exploded View"](#).
  - Radiator drain plug, refer to [CO-13, "Exploded View"](#).
2. Set the vehicle heater controls to the full HOT and heater ON positions. Turn the vehicle ignition ON with the engine OFF as necessary to activate the heater mode.
3. Fill the cooling system with engine coolant using Tool (A), following the manufacturer's instructions included with the tool.

**Tool number (A) : KV991J0070 (J-45695-A)**

**Engine Coolant : Refer to [MA-13, "VK56VD Gasoline Engine : Fluids and Lubricants"](#).**

#### CAUTION:

- **Use recommended coolant or equivalent.**
  - **Do not use any cooling system additives such as radiator sealer. Additives may clog the cooling system and cause damage to the engine, transmission or cooling system.**
  - **The compressed air supply must be equipped with an air dryer.**
4. Remove the Tool (A) and top off the cooling system with engine coolant as necessary.



## ENGINE COOLANT

[VK56VD]

< PERIODIC MAINTENANCE >

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5. Install the radiator cap and reservoir tank cap.
6. Run the engine until it reaches normal operating temperature.

**CAUTION:**

**Do not allow the engine to exceed normal operating temperature or engine damage may occur.**

7. Stop the engine and allow it to cool.
8. Check the engine coolant level and adjust if necessary.

### FLUSHING COOLING SYSTEM

1. Install reservoir tank if removed and tighten drain plug.

**NOTE:**

If water drain plug on cylinder block was removed, install water drain plug and tighten. Refer to [EM-120, "Exploded View"](#).

2. Fill radiator and reservoir tank with water and reinstall radiator and reservoir caps.
3. Run the engine and warm it up to normal operating temperature.
4. Rev the engine two or three times under no-load.
5. Stop the engine and wait until it cools down.
6. Drain water from the system. Refer to [CO-11, "Changing Engine Coolant"](#).
7. Repeat steps 1 through 6 until clear water begins to drain from radiator.

# RADIATOR

< REMOVAL AND INSTALLATION >

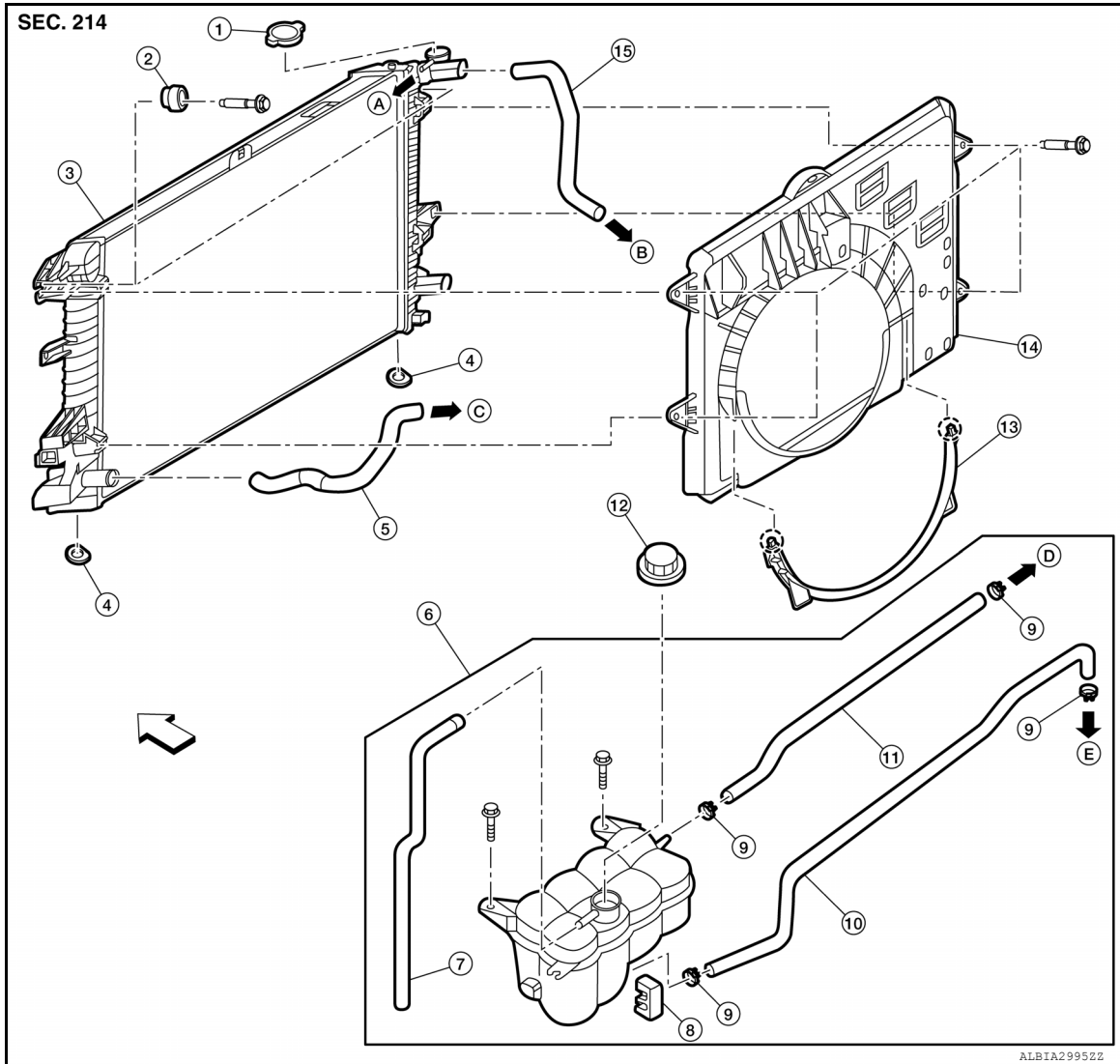
[VK56VD]

## REMOVAL AND INSTALLATION

### RADIATOR

Exploded View

INFOID:000000013642825



- |                                 |                            |                           |
|---------------------------------|----------------------------|---------------------------|
| 1. Radiator cap                 | 2. Mounting rubber (upper) | 3. Radiator               |
| 4. Mounting rubber (lower)      | 5. Radiator hose (lower)   | 6. Reservoir tank         |
| 7. Reservoir tank overflow hose | 8. Clip                    | 9. Clamp                  |
| 10. Reservoir tank hose         | 11. Radiator overflow hose | 12. Reservoir tank cap    |
| 13. Fan shroud (lower)          | 14. Fan shroud (upper)     | 15. Radiator hose (upper) |
| A. To radiator overflow hose    | B. To multi control valve  | C. To water suction pipe  |
| D. To radiator                  | E. To multi control valve  | ⇐ Front                   |

### Removal and Installation

INFOID:000000013642826

#### REMOVAL

#### **WARNING:**

**Do not remove radiator cap when engine is hot. Serious burns could occur from high-pressure engine coolant escaping from water inlet. Wrap a thick cloth around the cap. Slowly turn it a quarter of a turn**

# RADIATOR

[VK56VD]

## < REMOVAL AND INSTALLATION >

to release built-up pressure. Carefully remove radiator cap by turning it all the way. Note that the reservoir tank cap side is also under pressure.

### NOTE:

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

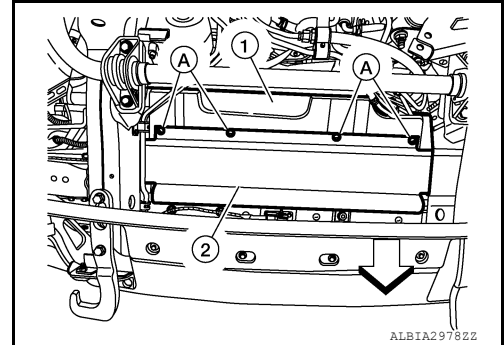
1. Drain engine coolant from radiator. Refer to [CO-11. "Changing Engine Coolant"](#).

### CAUTION:

- Perform this step when the engine is cold.
- Do not spill engine coolant on drive belts.

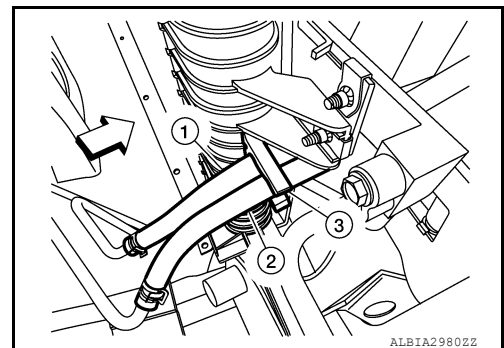
2. Remove front under cover. Refer to [EXT-28. "FRONT UNDER COVER : Removal and Installation"](#).
3. Remove radiator hose (lower).
4. Remove fan shroud (lower). Refer to [CO-13. "Exploded View"](#).
5. Remove clips (A) connecting the front air guide [lower (2)] to the fan shroud [upper (1)].

⇐ : Front



6. Disconnect reservoir tank hose from water inlet and the radiator overflow hose from the radiator.
7. Disengage reservoir tank hoses from fan shroud (upper) and remove reservoir tank bolts and reservoir tank.
8. Remove radiator hose (upper).
9. Remove fan shroud (upper) using the following procedure:
  - a. Disengage A/T fluid cooler hose D and A/T fluid cooler hose C from fan shroud (upper). Refer to [TM-495. "Exploded View"](#).
  - b. Remove fan shroud (upper) bolts and remove fan shroud (upper).
10. Disengage A/T fluid cooler hose D (1) and A/T fluid cooler hose C (2) from the radiator (3).

⇐ : Front



11. Remove radiator bolts.
12. Remove bolts connecting the condenser to the radiator. Refer to [HA-36. "Exploded View"](#).
13. Remove the radiator.

### CAUTION:

Be careful not to damage radiator core.

## INSTALLATION

Installation is in the reverse order of removal.

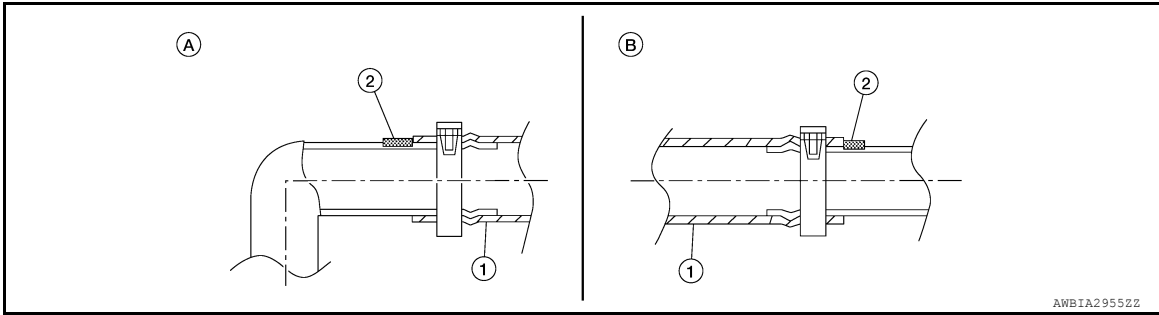
### NOTE:

- Insert the radiator hose [upper/lower (1)] all the way to the stopper (2).

# RADIATOR

< REMOVAL AND INSTALLATION >

[VK56VD]



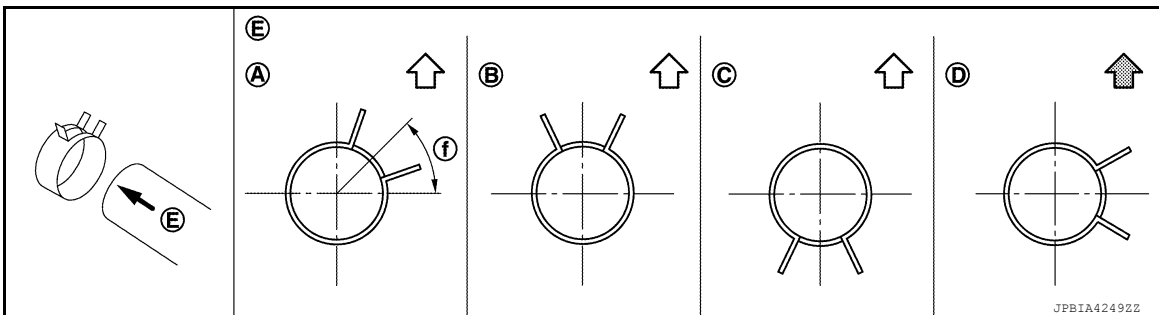
A. Radiator side

B. 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	B
	Engine side	Upper	A
Radiator hose (lower)	Radiator side	Lower	C
	Engine side	Left side	D

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



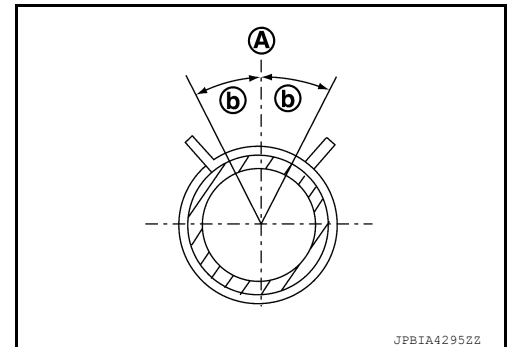
E. View E

F. 45°

↖ : Vehicle upper

↖ : Vehicle front

- The angle (b) created by the hose clamp pawl and the specified line (A) must be within  $\pm 15^\circ$  as shown in the figure.



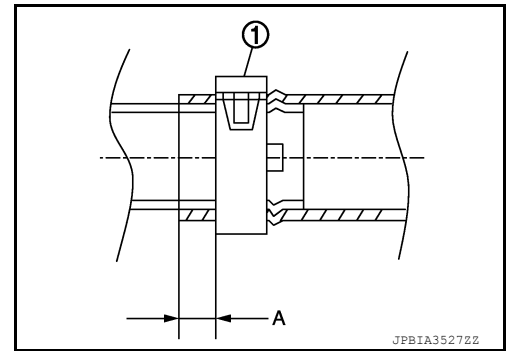
# RADIATOR

[VK56VD]

## < REMOVAL AND INSTALLATION >

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

(A) :  $5 \pm 2$  mm ( $0.20 \pm 0.08$  in)



## Inspection

INFOID:000000013642827

### INSPECTION AFTER INSTALLATION

- Check for engine coolant leaks. Refer to [CO-9. "System Inspection"](#).
- Start and warm up the engine. Visually check that there is no leakage of engine coolant.



# COOLING FAN

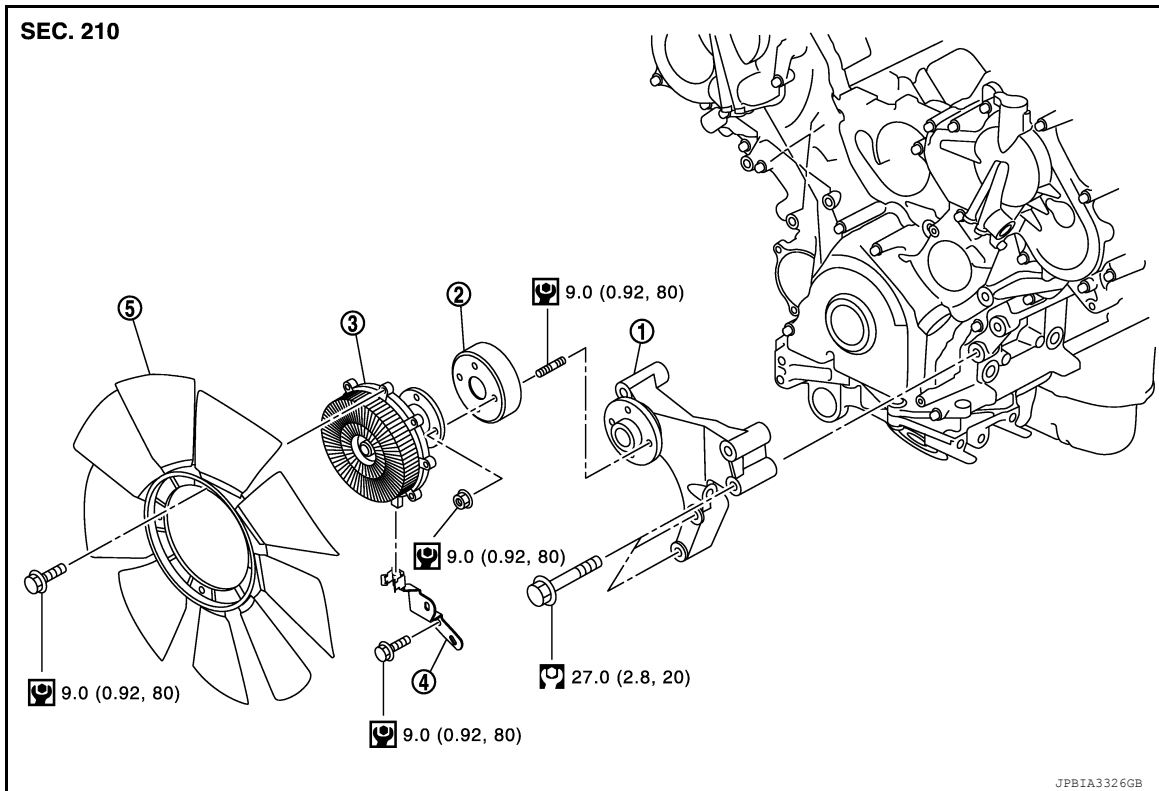
< REMOVAL AND INSTALLATION >

[VK56VD]

## COOLING FAN

### Exploded View

INFOID:000000013642828



- |                                |                       |                         |
|--------------------------------|-----------------------|-------------------------|
| 1. Cooling fan bracket         | 2. Cooling fan pulley | 3. Cooling fan coupling |
| 4. Cooling fan harness bracket | 5. Cooling fan        |                         |

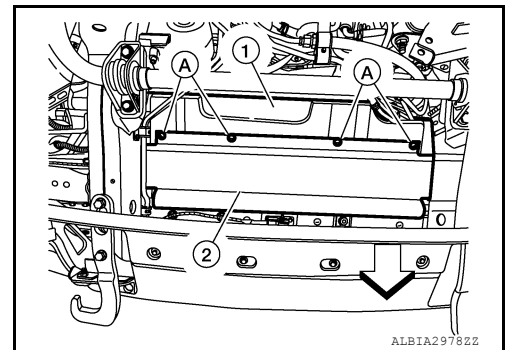
### Removal and Installation

INFOID:000000013642829

#### REMOVAL

1. Drain engine coolant. Refer to [CO-11, "Changing Engine Coolant"](#).
2. Remove front under cover. Refer to [EXT-28, "FRONT UNDER COVER : Removal and Installation"](#).
3. Remove fan shroud (lower). Refer to [CO-13, "Exploded View"](#).
4. Remove clips (A) connecting the front air guide [lower (2)] to the fan shroud [upper (1)].

← : Front



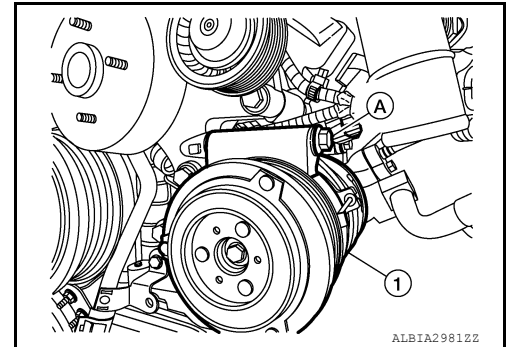
5. Remove radiator core support cover. Refer to [DLK-147, "Exploded View"](#).
6. Disconnect reservoir tank hose from water inlet and the radiator overflow hose from the radiator.
7. Disengage reservoir tank hoses from fan shroud (upper) and remove reservoir tank bolts and reservoir tank.
8. Remove fan shroud (upper) using the following procedure:

# COOLING FAN

[VK56VD]

## < REMOVAL AND INSTALLATION >

- a. Disengage A/T fluid cooler hose D and A/T fluid cooler hose C from fan shroud (upper). Refer to [TM-495, "Exploded View"](#).
- b. Remove fan shroud (upper) bolts and remove fan shroud (upper).
9. Remove cooling fan.
10. Remove drive belt. Refer to [EM-23, "Removal and Installation"](#).
11. Disconnect fan coupling harness connector.
12. Disconnect cooling fan harness bracket from fan coupling and remove bolt and cooling fan harness bracket.
13. Remove fan coupling.  
**NOTE:**  
After fan coupling is removed. Refer to [CO-18, "Inspection"](#).
14. Remove cooling fan pulley.
15. Remove the cooling fan bracket using the following procedure (if necessary):
  - Remove bolt (A) from A/C compressor (1).



- Remove idler pulley. Refer to [EM-25, "Exploded View"](#).
- Remove cooling fan bracket bolts and remove cooling fan bracket.

## INSTALLATION

Installation is in the reverse order of removal.

**A/C compressor bolt : 61.3 N·m (6.3 kg-m, 45 ft-lb)**

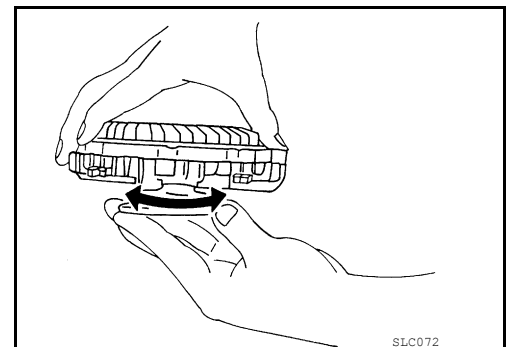
## Inspection

INFOID:000000013642830

## INSPECTION AFTER REMOVAL

### Fan Coupling

Inspect fan coupling for oil leakage and bimetal conditions.



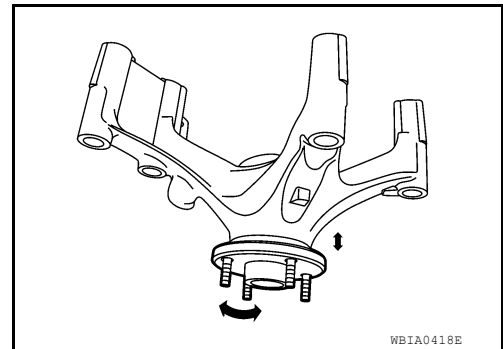
### Cooling Fan Bracket

## COOLING FAN

[VK56VD]

### < REMOVAL AND INSTALLATION >

- Visually check that there is no significant looseness in the fan bracket shaft, and that it turns smoothly by hand.
- If there are any unusual concerns, replace the cooling fan pulley.



### INSPECTION AFTER INSTALLATION

- Check for leaks of the engine coolant. Refer to [CO-9, "System Inspection"](#).
- Start and warm up the engine. Visually make sure that there are no leaks of the engine coolant.

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# WATER PUMP

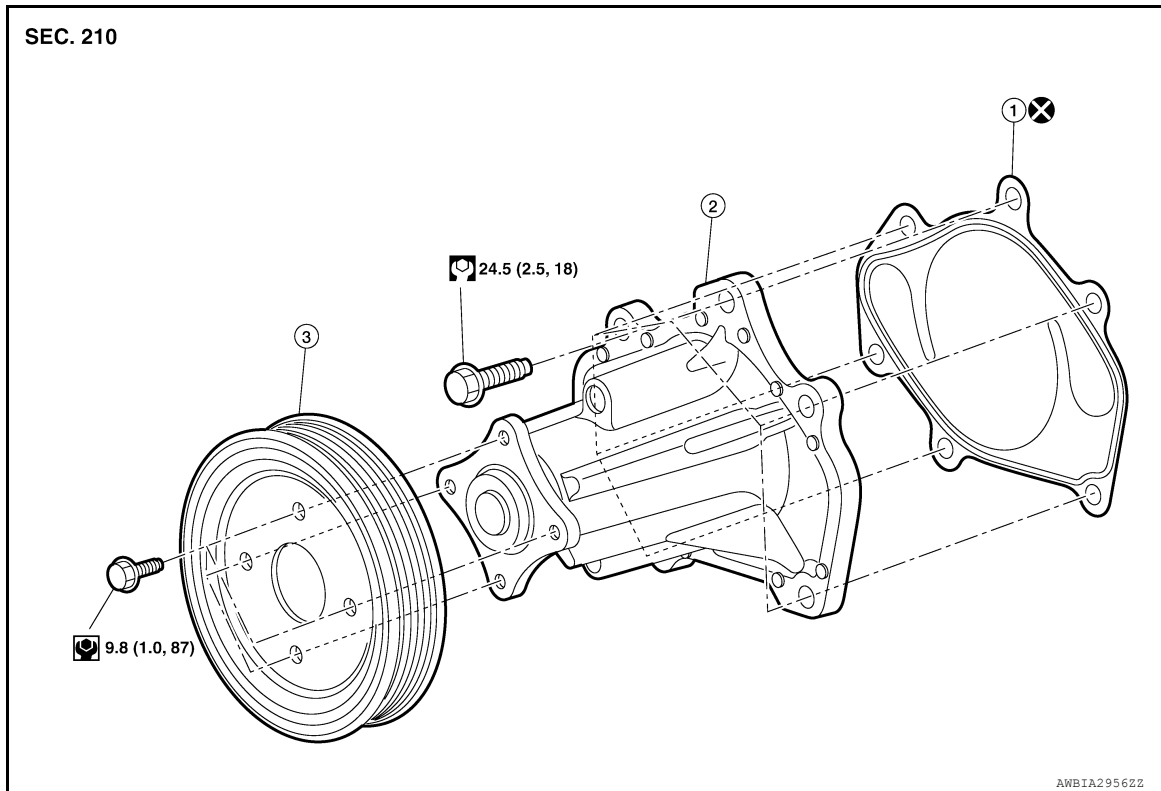
< REMOVAL AND INSTALLATION >

[VK56VD]

## WATER PUMP

### Exploded View

INFOID:000000013642831



1. Water pump gasket

2. Water pump

3. Water pump pulley

### Removal and Installation

INFOID:000000013642832

#### CAUTION:

- When removing water pump assembly, be careful not to get engine coolant on drive belts.
- Water pump cannot be disassembled and should be replaced as a unit.
- After installing water pump, connect hose and clamp securely, then check for leaks. Refer to [CO-9, "System Inspection"](#).

#### REMOVAL

1. Drain engine coolant. Refer to [CO-11, "Changing Engine Coolant"](#).  
**CAUTION:**
  - Perform this step when engine is cold.
  - Do not spill engine coolant on drive belt.
2. Remove fan coupling. Refer to [CO-17, "Removal and Installation"](#).
3. Remove multi-way control valve and multi-way control valve housing. Refer to [CO-23, "Removal and Installation"](#).
4. Remove water pump pulley.
5. Remove water pump.
  - Engine coolant will leak from cylinder block, so have a receptacle ready under vehicle.**CAUTION:**
  - Handle the water pump vane so that it does not contact any other parts.
  - Do not disassemble water pump.

#### INSTALLATION

Installation is in the reverse order of removal.

# WATER PUMP

< REMOVAL AND INSTALLATION >

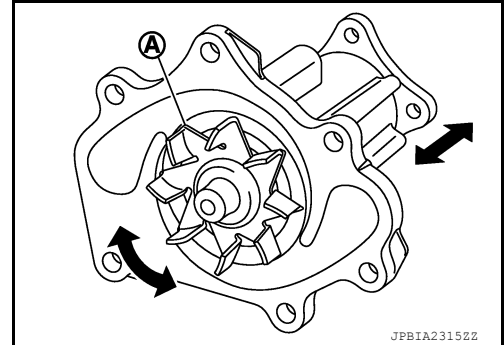
[VK56VD]

INFOID:000000013642833

## Inspection

### INSPECTION AFTER REMOVAL

- Visually check that there is no significant dirt or rusting on water pump body and vane (A).
- Check there is no slack in vane shaft, and that it turns smoothly when rotated by hand.
- If anything is found, replace water pump.



### INSPECTION AFTER INSTALLATION

- Check that the reservoir tank cap is tightened.
- Check for engine coolant leaks. Refer to [CO-9, "System Inspection"](#).
- Start and warm up the engine. Visually check that there are no leaks.

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# MULTI-WAY CONTROL VALVE

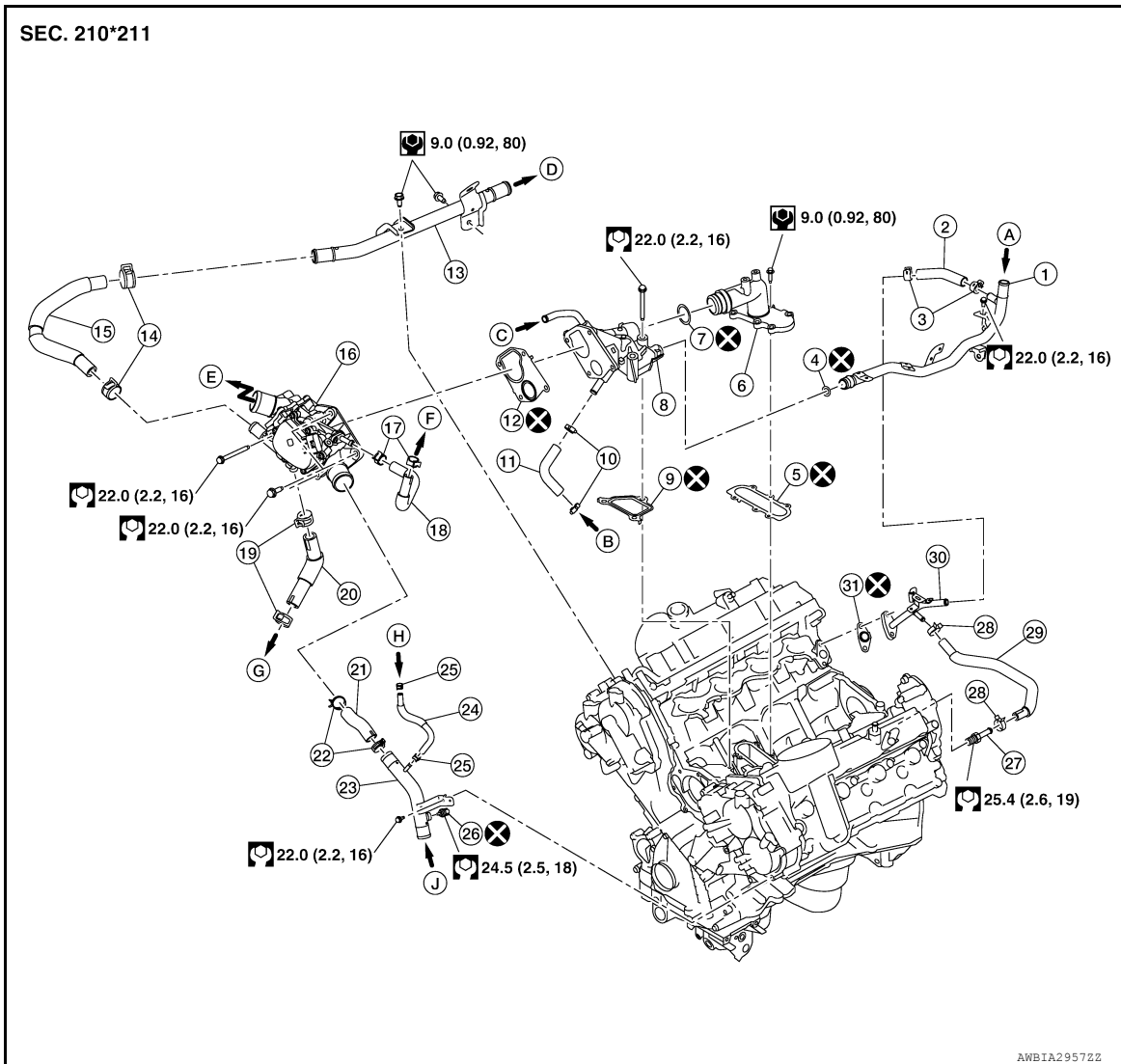
< REMOVAL AND INSTALLATION >

[VK56VD]

## MULTI-WAY CONTROL VALVE

Exploded View

INFOID:000000013642834



- |                              |   |  |
|------------------------------|---|--|
| 1. Heater pipe (outlet)      | 2. Water bypass hose (bank 2)           | 3. Clamp   |
| 4. O-ring                    | 5. Water connector gasket               | 6. Water connector   |
| 7. O-ring                    | 8. Multi-way control valve housing      | 9. Multi-way control valve housing gasket                    |
| 10. Clamp                    | 11. Oil cooler water hose (outlet)      | 12. Multi-way control valve gasket                           |
| 13. Heater pipe (inlet)      | 14. Clamp                               | 15. Heater hose (inlet)                                      |
| 16. Multi-way control valve  | 17. Clamp                               | 18. Electronic throttle control actuator water hose (inlet)  |
| 19. Clamp                    | 20. Oil cooler water hose (inlet)       | 21. Water suction hose                                       |
| 22. Clamp                    | 23. Water suction pipe                  | 24. Electronic throttle control actuator water hose (outlet) |
| 25. Clamp                    | 26. Engine coolant temperature sensor 2 | 27. Hose connector   |
| 28. Clamp                    | 29. Water bypass hose (bank 1)          | 30. Water bypass pipe  |
| 31. Water bypass pipe gasket | A. From heater core                     | B. From oil cooler   |
| C. From reservoir tank       | D. To heater core                       | E. To radiator   |

# MULTI-WAY CONTROL VALVE

< REMOVAL AND INSTALLATION >

[VK56VD]

F. To electric throttle control actuator G. To A/T fluid warmer

H. From electric throttle control actuator

J. From radiator

## Removal and Installation

INFOID:000000013642835

### REMOVAL

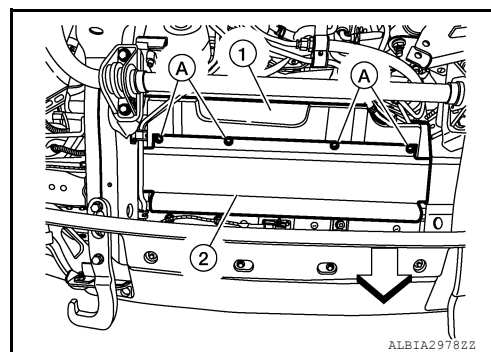
1. Remove engine cover. Refer to [EM-30, "Removal and Installation"](#).
2. Partially drain engine coolant. Refer to [CO-11, "Changing Engine Coolant"](#).

**CAUTION:**

- Perform this step when engine is cold.
- Do not spill engine coolant on drive belts.

3. Remove front under cover. Refer to [EXT-28, "FRONT UNDER COVER : Removal and Installation"](#).
4. Remove radiator hose (lower).
5. Remove fan shroud (lower). Refer to [CO-13, "Exploded View"](#).
6. Remove clips (A) connecting the front air guide [lower (2)] to the fan shroud [upper (1)].

← : Front



7. Disconnect reservoir tank hose from water inlet and the radiator overflow hose from the radiator.
8. Disengage reservoir tank hoses from fan shroud (upper) and remove reservoir tank bolts and reservoir tank.
9. Remove radiator hose (upper).
10. Remove fan shroud (upper) using the following procedure:
  - a. Disengage A/T fluid cooler hose D and A/T fluid cooler hose C from fan shroud (upper). Refer to [TM-495, "Exploded View"](#).
  - b. Remove fan shroud (upper) bolts and remove fan shroud (upper).
11. Disconnect radiator hose (upper) from multi-way control valve. Refer to [CO-13, "Exploded View"](#).
12. Disconnect heater hose (inlet), water suction hose, oil cooler water hose (inlet) and electronic throttle control actuator water hose (inlet) from multi-way control valve.
13. Disconnect the multi-way control valve harness connector.
14. Remove bolts and then remove the multi-way control valve and gasket.

**CAUTION:**

**Do not reuse gasket.**

15. If removing the multi-way control valve housing or water connector, refer to the following procedure:
  - a. Remove intake manifold. Refer to [EM-35, "Removal and Installation"](#).
  - b. Remove fuel feed tube (bank side) and fuel feed tube (pump side). Refer to [EM-54, "Exploded View"](#).
  - c. Disconnect the oil cooler water hose (outlet) and reservoir tank water hose from the multi-way control valve housing.
  - d. Disconnect the water bypass hose (bank 2), heater hose (outlet) and harness clips from the heater pipe (outlet) and remove the heater pipe (outlet).

**CAUTION:**

**Do not reuse O-ring.**

- e. Remove bolts from multi-way control valve housing and water connector and remove as an assembly.

**CAUTION:**

**Do not reuse gaskets.**

- f. Separate the multi-way control valve housing from the water connector (if necessary).

# MULTI-WAY CONTROL VALVE

< REMOVAL AND INSTALLATION >

[VK56VD]

**CAUTION:**

**Do not reuse O-ring.**

## INSTALLATION

Installation is in the reverse order of removal.

**CAUTION:**

**Do not reuse O-rings or gaskets.**

Water Connector and Heater Pipe (Outlet)

- First apply a neutral detergent to O-rings, then quickly insert the insertion parts of the water connector and heater pipe into the multi-way control valve housing.

## Inspection

INFOID:000000013642836

## INSPECTION AFTER INSTALLATION

- Check for engine coolant leaks. Refer to [CO-9. "System Inspection"](#).
- Start and warm up the engine. Visually check that there are no engine coolant leaks.



# COOLANT HEATER

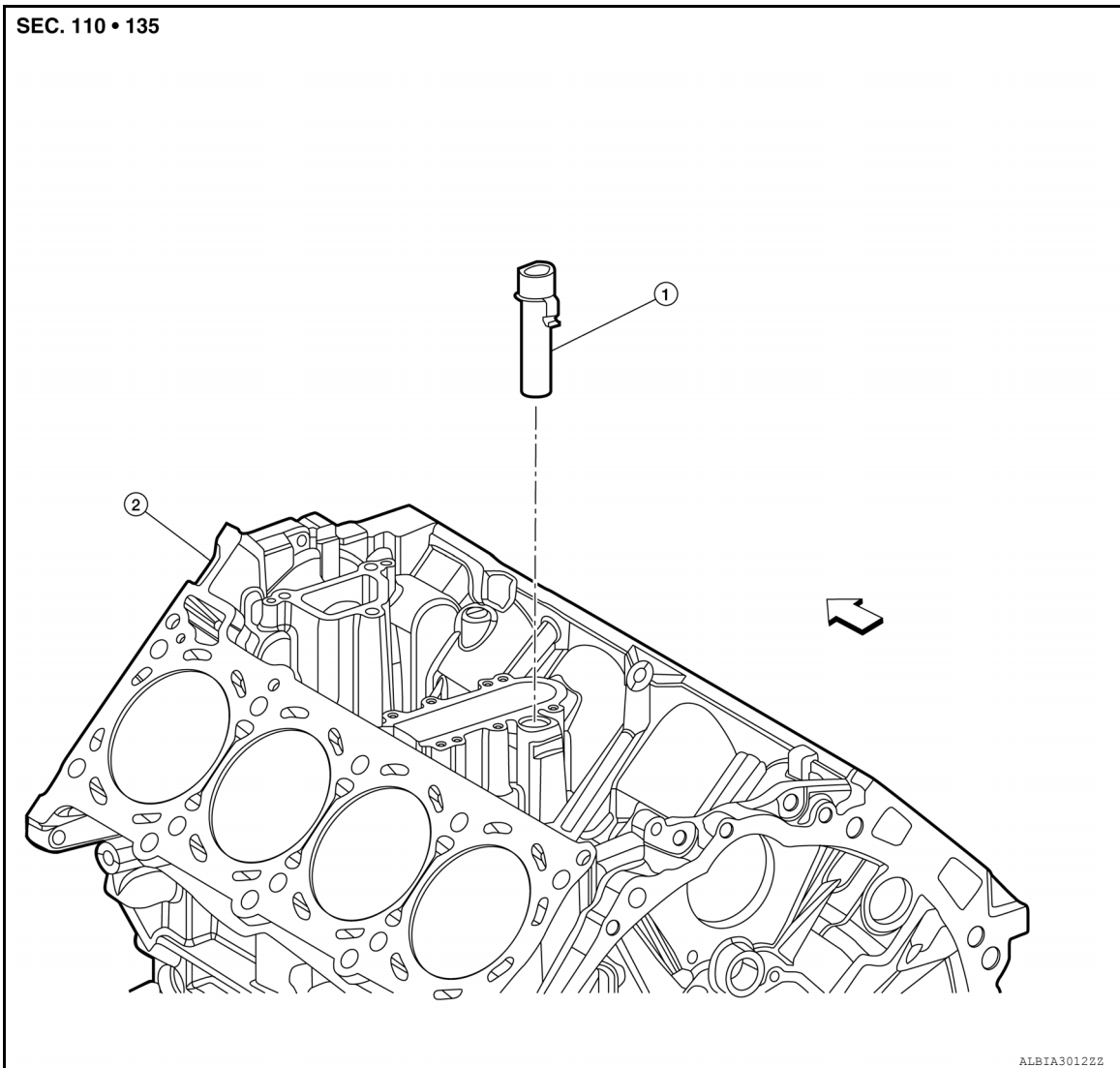
< REMOVAL AND INSTALLATION >

[VK56VD]

## COOLANT HEATER

Exploded View

INFOID:000000013954762



1. Coolant heater

2. Cylinder block

↩ Front

### Removal and Installation

INFOID:000000013967294

#### REMOVAL

1. Remove intake manifold. Refer to [EM-35. "Removal and Installation"](#).
2. Disconnect harness connector from coolant heater.
3. Remove coolant heater from cylinder block.

#### INSTALLATION

Installation is in the reverse order of removal.

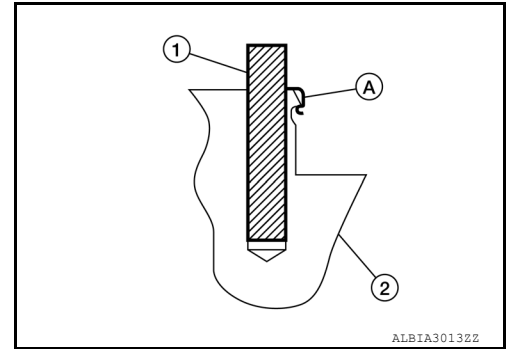
**NOTE:**

## COOLANT HEATER

< REMOVAL AND INSTALLATION >

[VK56VD]

When installing coolant heater (1), insert until clip (A) is locked into cylinder block (2).



# SERVICE DATA AND SPECIFICATIONS (SDS)

< SERVICE DATA AND SPECIFICATIONS (SDS)

[VK56VD]

## SERVICE DATA AND SPECIFICATIONS (SDS)

### SERVICE DATA AND SPECIFICATIONS (SDS)

#### Periodical Maintenance Specification

INFOID:0000000013642837

#### ENGINE COOLANT CAPACITY (APPROXIMATELY)

Unit: ℓ (US qt, Imp qt)

Engine coolant capacity (with reservoir tank at MAX level)	14.8 (15-5/8, 13)
Reservoir tank engine coolant capacity (at MAX level)	1.6 (1-3/4, 1-3/8)

#### Radiator

INFOID:0000000013642838

Unit: kPa (kg/cm<sup>2</sup>, psi)

Reservoir tank cap relief pressure	Standard	108.2 - 127.8 ( 1.1 - 1.3, 15.7 - 18.5)
	Limit	98 (1.0, 14)
Leakage testing pressure		186 (1.9, 27)

#### Multi-Way Control Valve

INFOID:0000000013642839

##### Standard

Valve opening temperature	80 -110°C (176 - 230°F)
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## PRECAUTION

### PRECAUTIONS

#### Precaution for Supplemental Restraint System (SRS) "AIR BAG" and "SEAT BELT PRE-TENSIONER"

INFOID:000000013094263

The Supplemental Restraint System such as "AIR BAG" and "SEAT BELT PRE-TENSIONER", used along with a front seat belt, helps to reduce the risk or severity of injury to the driver and front passenger for certain types of collision. Information necessary to service the system safely is included in the SR and SB section of this Service Manual.

**WARNING:**

- To avoid rendering the SRS inoperative, which could increase the risk of personal injury or death in the event of a collision which would result in air bag inflation, it is recommended that all maintenance and repair be performed by an authorized NISSAN/INFINITI dealer.
- Improper repair, including incorrect removal and installation of the SRS, can lead to personal injury caused by unintentional activation of the system. For removal of Spiral Cable and Air Bag Module, see the SR section.
- Do not use electrical test equipment on any circuit related to the SRS unless instructed to in this Service Manual. SRS wiring harnesses can be identified by yellow and/or orange harnesses or harness connectors.

#### PRECAUTIONS WHEN USING POWER TOOLS (AIR OR ELECTRIC) AND HAMMERS

**WARNING:**

- When working near the Air Bag Diagnosis Sensor Unit or other Air Bag System sensors with the Ignition ON or engine running, DO NOT use air or electric power tools or strike near the sensor(s) with a hammer. Heavy vibration could activate the sensor(s) and deploy the air bag(s), possibly causing serious injury.
- When using air or electric power tools or hammers, always switch the Ignition OFF, disconnect the battery or batteries, and wait at least three minutes before performing any service.

#### Precaution for Liquid Gasket

INFOID:000000013094264

#### REMOVAL OF LIQUID GASKET

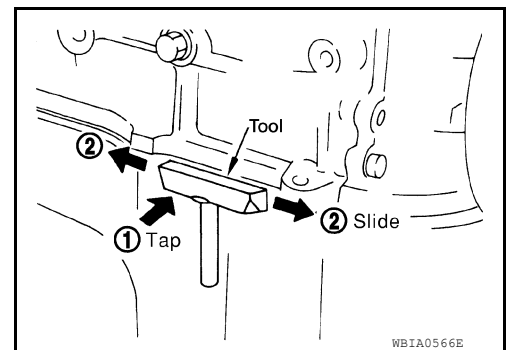
- After removing the bolts and nuts, separate the mating surface and remove the old liquid gasket using Tool.

Tool number : KV10111100 (J-37228)

**CAUTION:**

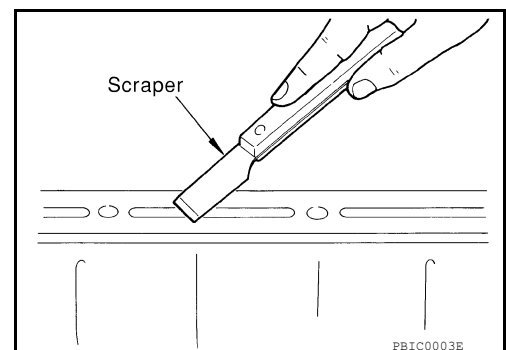
**Do not damage the mating surfaces.**

- Tap the seal cutter to insert it (1).
- In areas where the Tool is difficult to use, lightly tap to slide it (2).



#### LIQUID GASKET APPLICATION PROCEDURE

1. Remove the old liquid gasket adhering to the gasket application surface and the mating surface using suitable tool.
  - Remove the liquid gasket completely from the groove of the liquid gasket application surface, bolts, and bolt holes.
2. Thoroughly clean the mating surfaces and remove adhering moisture, grease and foreign material.



# PRECAUTIONS

[CUMMINS 5.0L ]

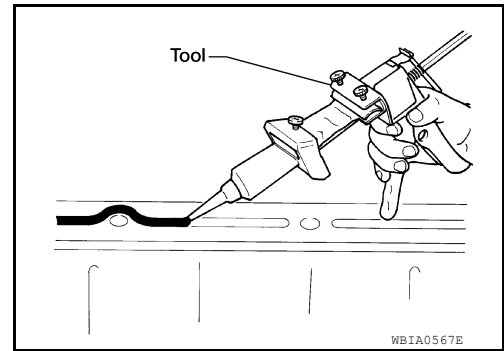
< PRECAUTION >

3. Attach the liquid gasket tube to the Tool.

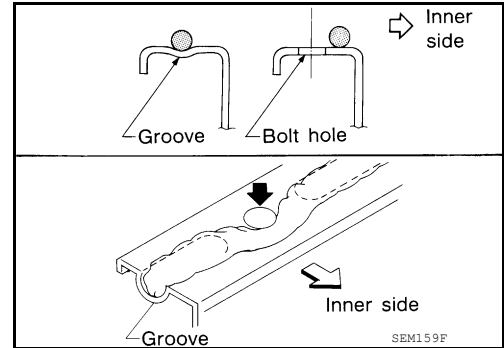
**Tool number : WS39930000 ( — )**

**Use Genuine RTV Silicone Sealant or equivalent. Refer to [GI-22, "Recommended Chemical Products and Sealants"](#).**

4. Apply the liquid gasket without breaks to the specified location with the specified dimensions.



- If there is a groove for the liquid gasket application, apply the liquid gasket to the groove.
- Normally apply the liquid gasket on the inside edge of the bolt holes. Also apply to the outside edge of the bolt holes when specified in the procedure.
- Within five minutes of liquid gasket application, install the mating component.
- If the liquid gasket protrudes, wipe it off immediately.
- Do not retighten after the installation.
- Wait 30 minutes or more after installation before refilling the engine with oil or coolant.



**CAUTION:**

**Carefully follow all of the warnings, cautions, notes, and procedures contained in this manual.**

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# PREPARATION

< PREPARATION >

[CUMMINS 5.0L ]

## PREPARATION

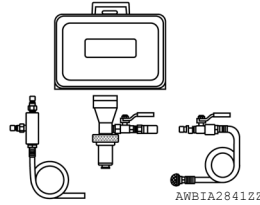
### PREPARATION

#### Special Service Tool

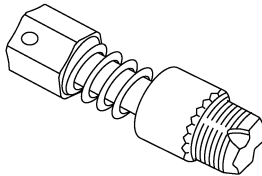
INFOID:000000013094266

The actual shape of the tools may differ from those illustrated here.

Tool number (TechMate No.) Tool name	Description
KV991J0070 (J-45695-A) Coolant refill tool	Refilling engine cooling system
— (J-43897-18) Oxygen sensor thread cutter	Reconditioning the exhaust system threads before installing a new oxygen sensor (Use with anti-seize lubricant) <b>M18x 1.5 threads</b>
— (J-51771) Cooling system pressure test kit <ul style="list-style-type: none"> <li>• —                              (J-51771-1)                              Main body</li> <li>• —                              (J-51771-4)                              Small Adapter</li> <li>• —                              (J-51771-5)                              Pump with quick release</li> <li>• —                              (J-51771-9)                              Radiator cap assembly with quick coupler</li> </ul>	Checking cooling system and radiator cap
KV991J0010 (J-23688) Engine coolant refractometer	Checking concentration of ethylene glycol in engine coolant
— (J-54480) Fan clutch removal tool	Used to remove the fan clutch



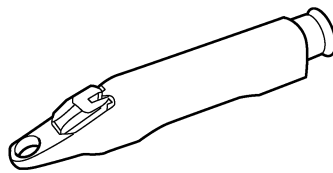
AWBIA2841ZZ



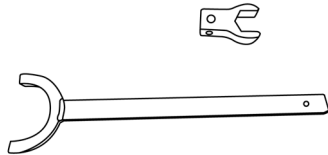
AWBIA1764ZZ



ALPIA0018ZZ



WBIA0539E



ALBIA2768ZZ

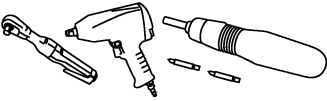
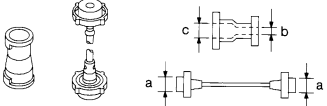
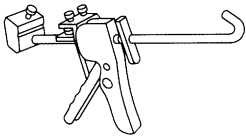
# PREPARATION

< PREPARATION >

[CUMMINS 5.0L ]

## Commercial Service Tool

INFOID:000000013094267

Tool name	Description
<p>Power tool</p>  <p>PIIB1407E</p>	<p>Loosening nuts, screws and bolts</p>
<p>— (J-33984-A) Radiator pressure adapter</p>  <p>S-NT564</p>	<p>Adapting cooling system pressure tester to radiator cap and reservoir tank cap  <b>a: 28 (1.10) diameter</b>  <b>b: 31.4 (1.236) diameter</b>  <b>c: 41.3 (1.626) diameter</b>                      Unit: mm (in)</p>
<p>Tube presser</p>  <p>S-NT052</p>	<p>Pressing the tube of liquid gasket</p>

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## SYSTEM DESCRIPTION

### ENGINE COOLING SYSTEM

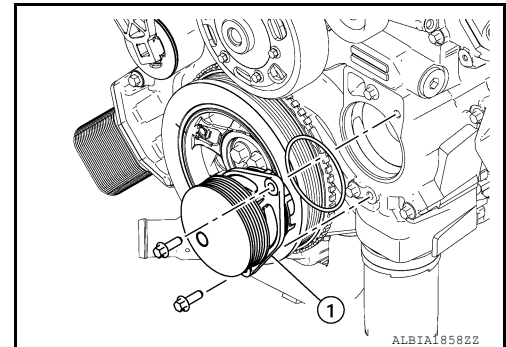
#### System Description

INFOID:000000013094268

The function of the cooling system is to maintain a specified operating temperature of 90.5°C to 105.5°C (195°F to 222°F) for the engine. Some of the heat generated by the engine is absorbed by the engine coolant flowing through the passages in the cylinder block and cylinder head. Heat is then removed from the engine coolant as it flows through the radiator.

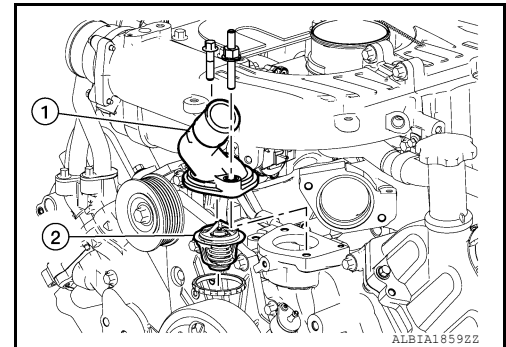
#### Water Pump

The water pump (1) is a belt-driven, centrifugal-type pump with the inlet and outlet as integral parts of the front gear cover. The water pump is located at the front of the engine and can **only** be replaced as an assembly.



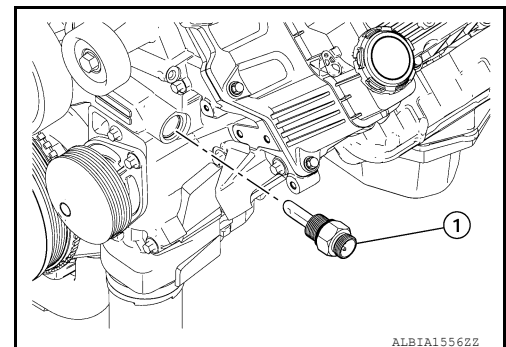
#### Thermostat

- The thermostat (2) controls the engine coolant temperature. The thermostat is located at the front of the engine at the top of the front cover. The opening and closing of the thermostat is controlled by a wax motor.
- When the coolant temperature is below the operating range of the thermostat, engine coolant is bypassed back to the inlet of the water pump. When the engine coolant temperature reaches the operating range, the thermostat opens, seals off the bypass, and forces engine coolant to flow through the water outlet connection (1) to the radiator.



#### Coolant Heater (For Canada)

A coolant heater (1) is available for engines operating in cold climate. A dedicated port in the front cover is available for the coolant heater.



#### Radiator Cap

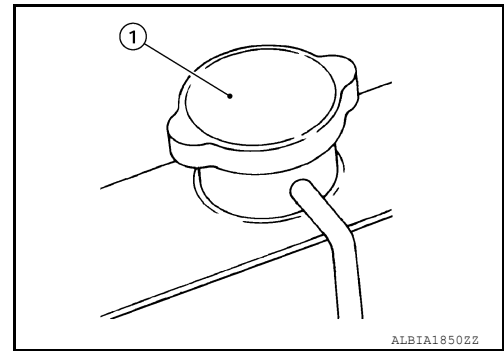


# ENGINE COOLING SYSTEM

## < SYSTEM DESCRIPTION >

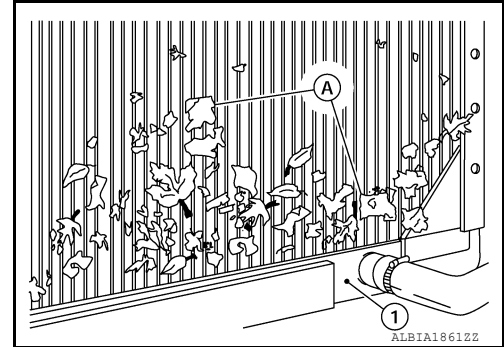
[CUMMINS 5.0L ]

- The cooling system is designed to use a radiator cap (1) to prevent boiling of the coolant. For radiator cap specifications. Refer to [CO-75, "Standard and Limit"](#).
- An incorrect or malfunctioning cap can result in the loss of coolant and an engine overheating condition.



### Radiator

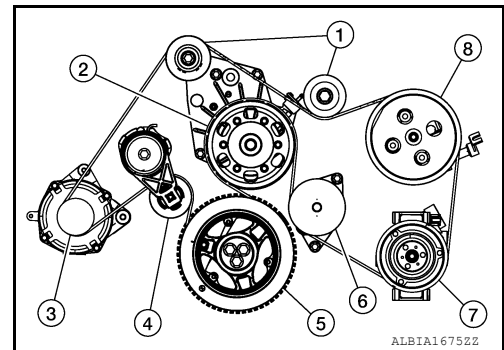
- Air forced through the fins of the radiator (1) by a fan cools the coolant flowing through the radiator. Environmental debris (A) (such as paper, straw, lint, and dust) can obstruct the fins and stop the flow of air, which will reduce the cooling effect of the radiator.
- For maintenance, removal, and/or installation of the radiator. Refer to [CO-43, "Removal and Installation"](#).



### Drive Belt (Cooling Fan, Water Pump, Alternator)

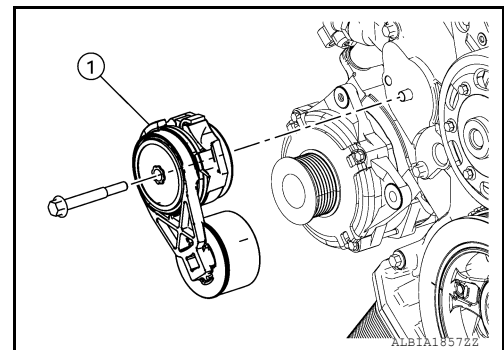
The drive belt is a six rib design commonly referred to as a serpentine belt and is used to drive the various front engine-mounted accessories. To make sure the drive belt is routed correctly upon installation, make a diagram of the cooling fan belt routing prior to removing the belt, as shown in the illustration. The cooling fan belt routing consists of the following components:

- Crankshaft pulley/vibration damper (5).
- Vacuum pump/fan pulley (2).
- Water pump pulley (6).
- A/C compressor pulley (7).
- Alternator pulley (3).
- Drive belt auto tensioner pulley (4).
- Power steering pump pulley (8).
- Idler pulley (1).



### Drive Belt Auto Tensioner

A drive belt auto tensioner (1) is used to maintain proper drive belt tension. The tensioner maintains proper drive tension through an internal spring. The drive belt auto tensioner is mounted on the front cover of the engine. The drive belt auto tensioner winds in the direction that the spring tang is bent over the tensioner body. To loosen the tension on the belt, rotate the tensioner to wind the spring tighter.



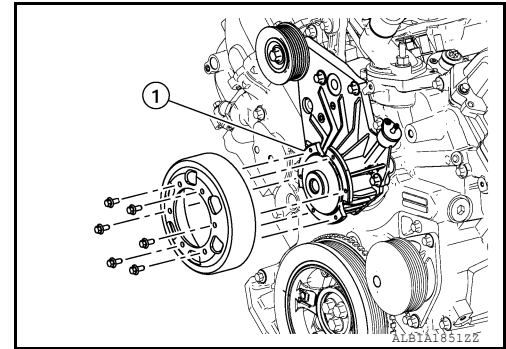
### Fan Hub

# ENGINE COOLING SYSTEM

< SYSTEM DESCRIPTION >

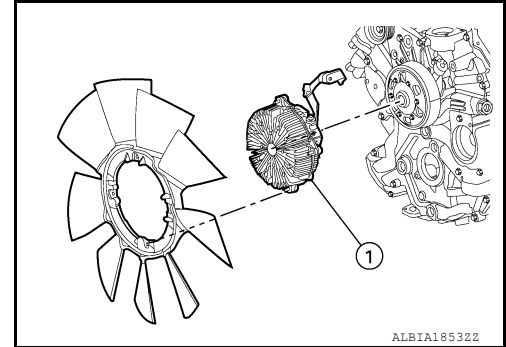
[CUMMINS 5.0L ]

The fan hub (1) is integrated into the vacuum pump on the front gear cover of the engine. The fan hub supports the cooling fan and drive belt configuration.



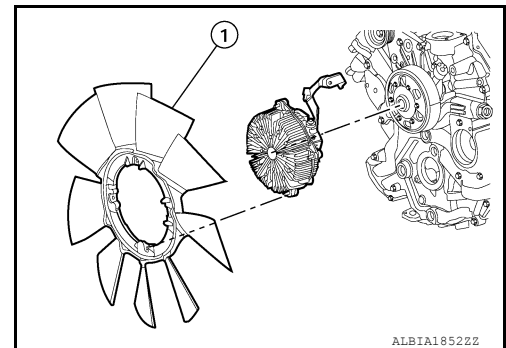
## Cooling Fan Clutch

This application utilizes a cooling fan clutch (1) to control cooling fan operation. This fan clutch is controlled by the engine control module (ECM). The ECM monitors coolant temperature and intake manifold temperature to determine when to engage the cooling fan. This application also has additional sensors monitored by the ECM for fan control (for example, air conditioner pressure and transmission temperature). The fan clutch is an electro-viscous fan clutch.



## Cooling Fan

The cooling fan (1) is mounted at the front of the engine and is driven by the drive belt.



## CAUTION:

**Do not operate the engine without a thermostat. Without a thermostat, the coolant will not flow to the radiator and the engine will overheat.**

## Coolant System Flow

- Cylinder Block and Water Pump
  - Through the water/coolant inlet connection, engine coolant is drawn into an integral water pump cavity machined into the front gear cover. The front gear cover-mounted-water pump is belt driven and pressurizes the coolant before flowing into the cylinder block water jacket. The coolant first flows through the lubricating oil cooler and enters the water jacket cavity around the cylinders. Coolant flows around and between the cylinders. From the cylinder block water jacket, the coolant flow continues through holes around and between each cylinder in the cylinder block combustion deck to the cylinder head.
- Cylinder Head and Gasket
  - From the cylinder block, the coolant flows into the cylinder heads through orifices in the cylinder head gaskets. The orifices in the cylinder head gaskets control the coolant flow from the cylinder block to the cylinder heads.
- Thermostat Bypass
  - Before the engine reaches thermostat-opening temperature, a bypass port is opened to allow engine coolant to flow back to the inlet of the water pump. Until the thermostat opens, engine coolant is continuously circulated through the engine **only**. Once the engine reaches the thermostat-opening temperature, the thermostat opens, allowing the coolant to flow to the radiator. This action also closes the bypass passage to the water pump.
- EGR Cooler

# ENGINE COOLING SYSTEM

[CUMMINS 5.0L ]

## < SYSTEM DESCRIPTION >

- From a port in the front cover, coolant is supplied to the exhaust gas recirculation (EGR) cooler support bracket through an external coolant tube. Coolant flows through the EGR cooler support bracket and into the EGR cooler and EGR valve, and the EGR bypass valve. Coolant flow exiting the EGR cooler is directed to the front cover through an external coolant tube.
- The EGR cooler is equipped with a de-aeration port that is connected to the reservoir tank. This port constantly flows coolant to the top tank to make sure air is **not** trapped in the coolant system and plumbing during coolant fill and operation.

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# COOLING CIRCUIT

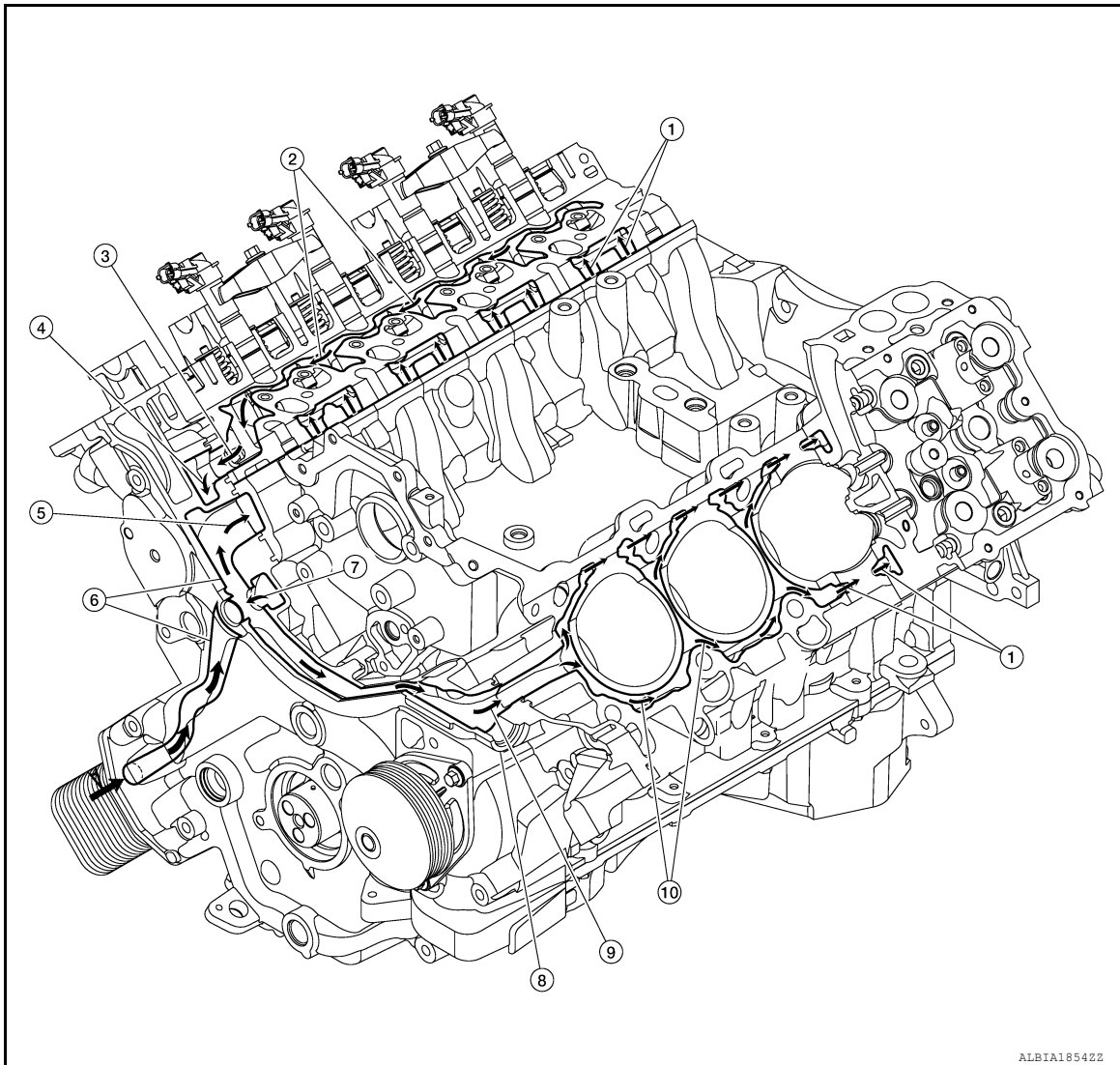
< SYSTEM DESCRIPTION >

[CUMMINS 5.0L ]

## COOLING CIRCUIT

### Cooling Schematic

INFOID:000000013094269

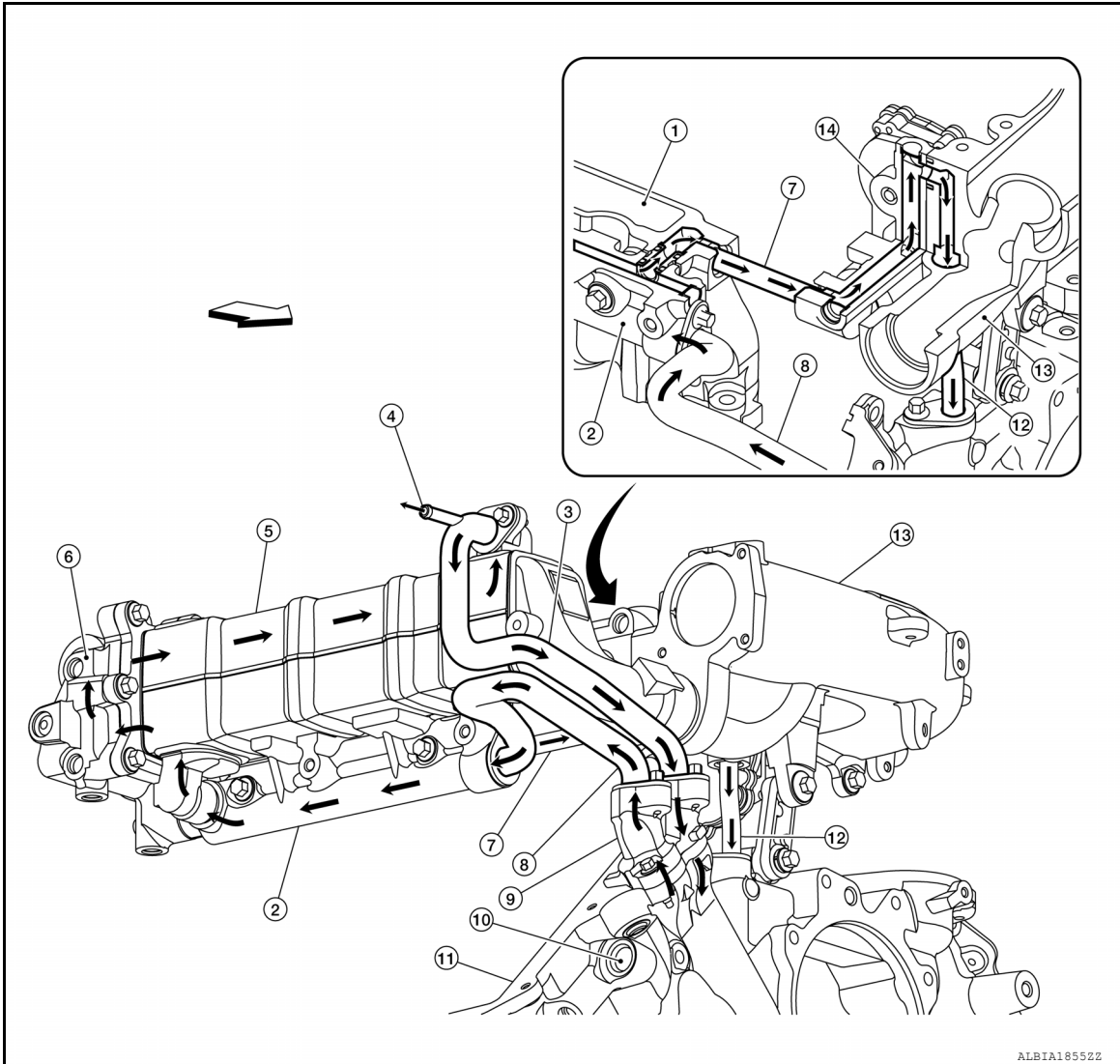


- |                                    |  |   |
|------------------------------------|--|---|
| 1. Coolant supply to cylinder head | 2. Coolant flow through cylinder head          | 3. Right bank cylinder head coolant flow to front cover (left bank similar) |
| 4. Coolant flow to thermostat      | 5. Coolant supply to right bank cylinder block | 6. Front cover coolant passage block  |
| 7. Oil cooler coolant outlet       | 8. Coolant heater location (if equipped)       | 9. Coolant supply to left bank cylinder block                               |
| 10. Coolant flow around cylinders  |  |   |

# COOLING CIRCUIT

< SYSTEM DESCRIPTION >

[CUMMINS 5.0L ]

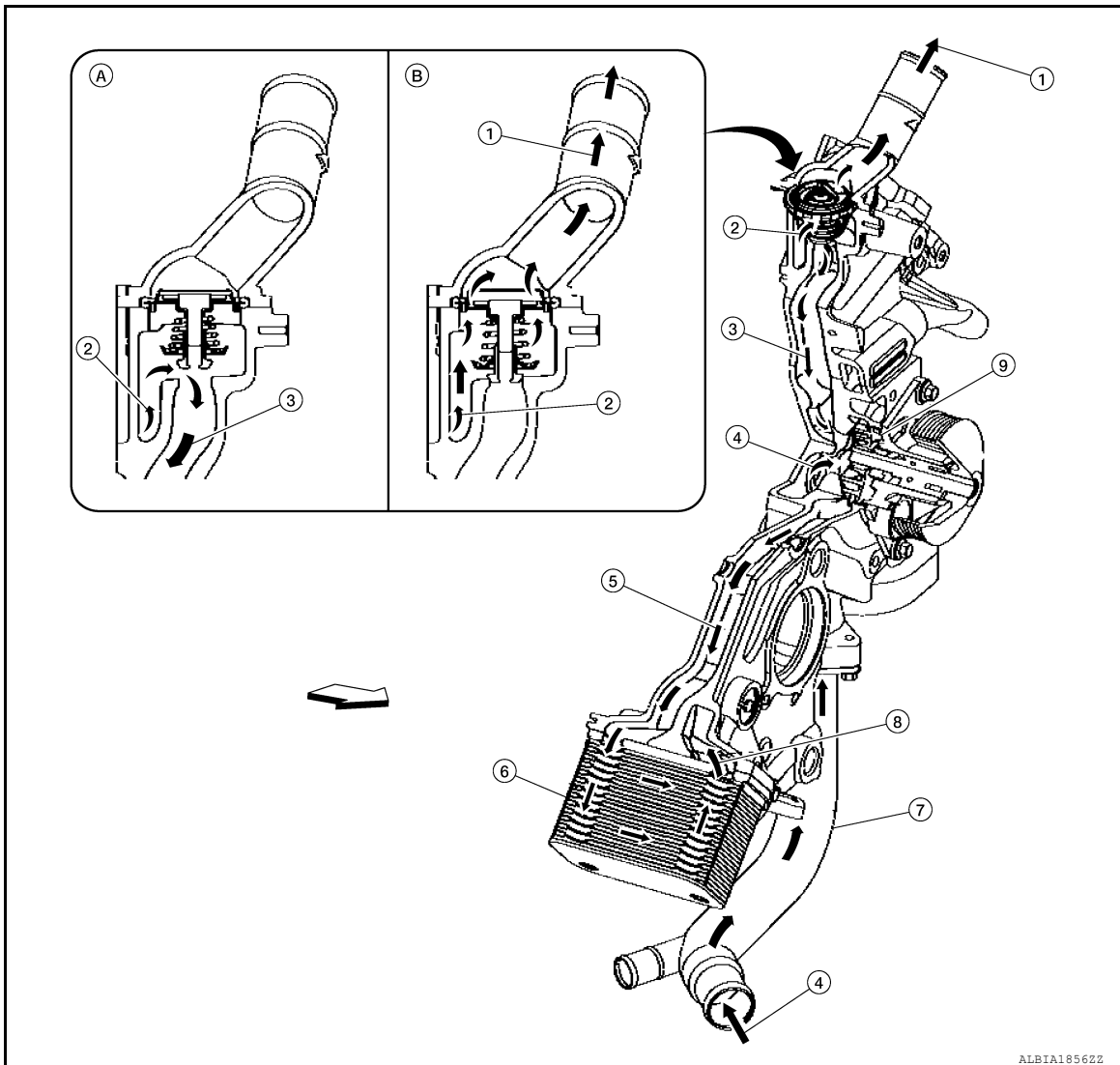


- |   |   |  |
|---|---|--|
| 1. Air intake manifold                  | 2. EGR coolant manifold                   | 3. EGR coolant return to front cover through water transfer connection |
| 4. De-aeration port (to reservoir tank) | 5. EGR cooler                             | 6. EGR valve   |
| 7. Coolant flow to EGR bypass valve     | 8. Coolant supply to EGR coolant manifold | 9. Water transfer connection   |
| 10. Coolant outlet for cab heater       | 11. Front cover                           | 12. EGR bypass valve coolant return to front cover                     |
| 13. Air intake manifold                 | 14. EGR bypass valve                      | ⇐ Front  |

# COOLING CIRCUIT

< SYSTEM DESCRIPTION >

[CUMMINS 5.0L ]



- |                                |   |  |
|--------------------------------|---|--|
| 1. Coolant outlet to radiator. | 2. Coolant inlet from cylinder head         | 3. Coolant return to water pump                |
| 4. Coolant inlet from radiator | 5. Coolant supply to lubricating oil cooler | 6. Coolant flow through lubricating oil cooler |
| 7. Water inlet connection      | 8. Coolant outlet to cylinder block         | 9. Water pump impeller                         |
| A. Thermostat closed           | B. Thermostat open                          | ⇐ Front  |

## PERIODIC MAINTENANCE

### ENGINE COOLANT

#### System Inspection

INFOID:0000000013245627

#### WARNING:

- Do not remove the radiator cap or reservoir tank cap when the engine is hot. Serious burns could occur from high-pressure engine coolant escaping from the cooling system.
- When removing the radiator cap or reservoir tank cap, wrap a thick cloth around the cap and slowly turn it a quarter turn to allow built-up pressure to escape. Then carefully remove the cap by turning it all the way.

#### CHECKING COOLING SYSTEM HOSES

Check hoses for the following:

- Improper attachment
- Leaks
- Cracks
- Dents
- Bulges
- Internal obstruction
- Damage
- Loose connections
- Chafing
- Deterioration

#### CHECKING RESERVOIR LEVEL

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

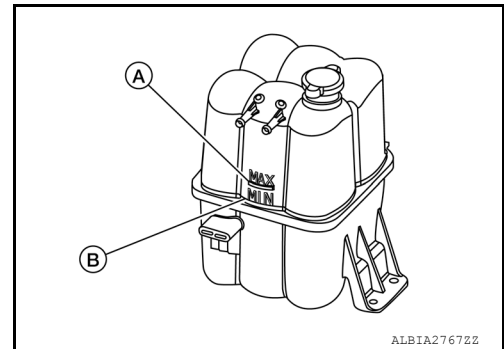
(A) : MAX

(B) : MIN

- Adjust coolant level (if necessary), to ensure that the engine coolant level is within the MIN to MAX range.

#### CAUTION:

Refill Genuine NISSAN Long Life Antifreeze/Coolant (blue) or equivalent in its quality mixed with water (distilled or demineralized). Refer to [MA-59, "Cummins \(5.0L V8D\) Engine : Fluids and Lubricants"](#).



#### CHECKING COOLING SYSTEM FOR LEAKS

#### WARNING:

- Do not remove the radiator cap or reservoir tank cap when the engine is hot. Serious burns could occur from high-pressure engine coolant escaping from the cooling system.
- When removing the radiator cap or reservoir tank cap, wrap a thick cloth around the cap and slowly turn it a quarter turn to allow built-up pressure to escape. Then carefully remove the cap by turning it all the way.

To check the cooling system for leaks, apply pressure to the cooling system using Tools (A), (B), (C) and (D).

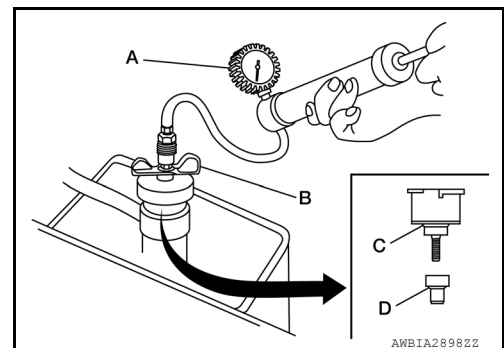
Tool number (A) : — (J-51771-5)

Tool number (B) : — (J-51771-9)

Tool number (C) : — (J-51771-1)

Tool number (D) : — (J-51771-4)

Leakage test pressure : Refer to [CO-75, "Standard and Limit"](#).



#### CAUTION:

Higher pressure testing than specified may cause radiator damage.

# ENGINE COOLANT

< PERIODIC MAINTENANCE >

[CUMMINS 5.0L ]

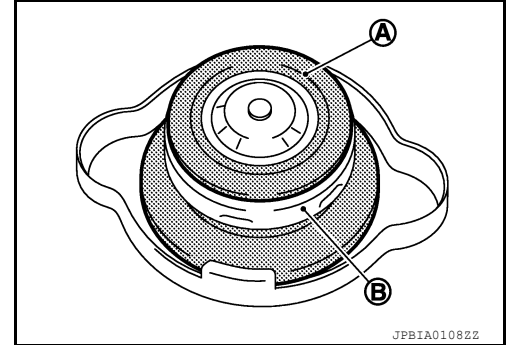
## CHECKING RESERVOIR TANK CAP

### WARNING:

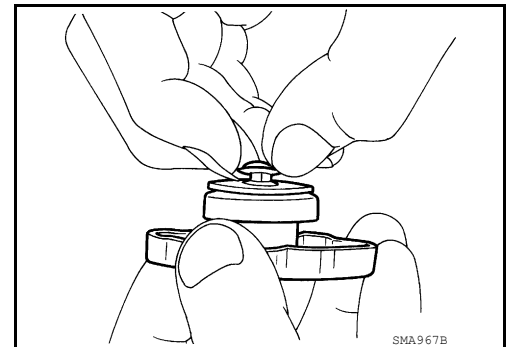
- Do not remove the radiator cap or reservoir tank cap when the engine is hot. Serious burns could occur from high-pressure engine coolant escaping from the cooling system.
- When removing the radiator cap or reservoir tank cap, wrap a thick cloth around the cap and slowly turn it a quarter turn to allow built-up pressure to escape. Then carefully remove the cap by turning it all the way.
- Check the pressure valve of the reservoir tank cap.
- Replace the reservoir tank cap if the metal plunger (B) on the pressure valve cannot be seen around the edge of the rubber gasket (A).
- Replace the reservoir tank cap if there is damage or deposits of foreign material on the rubber gasket or pressure valve.

### CAUTION:

Thoroughly wipe out the reservoir tank filler neck to remove any waxy residue or foreign material.

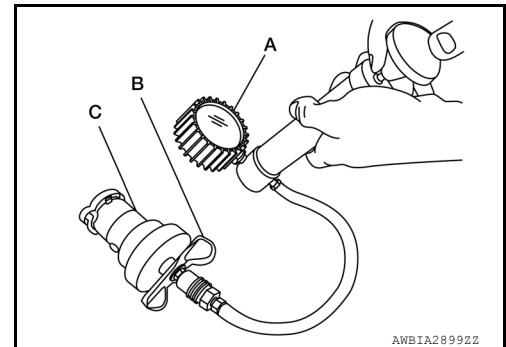


- Check the negative-pressure valve of the reservoir tank cap.
- Replace the reservoir tank cap if the negative-pressure valve does not close completely when pulled open and released.
- Replace the reservoir tank cap if there is damage or deposits of foreign material on the valve seat of the negative-pressure valve.
- Replace the reservoir tank cap if there is an abnormality in the operation of the negative-pressure valve.



- Check reservoir tank cap relief pressure.
- Check the reservoir tank cap relief pressure using Tools (A) and (B), and suitable tool (C).

- Tool number (A) : — (J-51771-5)
- Tool number (B) : — (J-51771-9)
- Tool number (C) : — (J-33984-A or equivalent) (commercially available)
- Reservoir tank cap relief pressure : Refer to [CO-75, "Standard and Limit"](#).



- When connecting the reservoir tank cap to suitable tool (C), apply water or coolant to the reservoir tank cap seal surface.
- Replace the reservoir tank cap if the reservoir tank cap relief pressure is outside of specification.

## CHECKING RADIATOR

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

### CAUTION:

- Be careful not to bend or damage the radiator fins.
  - When radiator is cleaned on-vehicle, remove surrounding parts in order to access the radiator core. Tape the harness and electrical connectors to prevent water from entering.
1. Spray water to the back side of the radiator core using a side-to-side motion from the top down.
  2. Stop spraying when debris no longer flows from radiator core.
  3. Blow air into the back side of radiator core using a side-to-side motion from the top down.



# ENGINE COOLANT

< PERIODIC MAINTENANCE >

[CUMMINS 5.0L ]

- Use compressed air lower than 490 kPa (5 kg/cm<sup>2</sup>, 71 psi) and keep a distance of more than 30 cm (11.8 in).
- 4. Continue to blow air until no water sprays out.
- 5. Check for coolant leaks. Repair as necessary.

## Changing Engine Coolant

INFOID:000000013245628

### **WARNING:**

**Do not remove the radiator cap when the engine is hot. Serious burns could occur from high-pressure engine coolant escaping from the radiator. Wrap a thick cloth around the cap. Slowly push down and turn it a quarter turn to allow built-up pressure to escape. Carefully remove the cap by pushing it down and turning it all the way.**

### DRAINING ENGINE COOLANT

1. Remove the front under cover. Refer to [EXT-28, "FRONT UNDER COVER : Removal and Installation"](#).
2. Open the radiator drain plug at the bottom of the radiator and remove the radiator filler cap. This is the only step required when partially draining the cooling system (radiator only).

#### **CAUTION:**

- **Do not allow the coolant to contact the drive belts.**
  - **Perform this step when engine is cold.**
3. Follow this step for heater core removal/replacement only. Disconnect the upper heater hose at the engine side and apply moderate air pressure [103.46 kPa (1.055 kg/cm<sup>2</sup>, 15 psi) maximum air pressure] into the hose for 30 seconds to blow the excess coolant out of the heater core.
  4. When draining all of the coolant in the system, remove the reservoir tank and drain the coolant then clean the reservoir tank before installation.

#### **CAUTION:**

- **Do not allow the coolant to contact the drive belts.**
  - **Perform this step when engine is cold.**
5. When performing a complete cooling system drain, remove the water drain plugs on the cylinder block.
  6. Check the drained coolant for contaminants, such as rust, corrosion or discoloration. If the coolant is contaminated, flush the engine cooling system.

### REFILLING ENGINE COOLANT

1. Install the following, if removed:
  - Cylinder block drain plugs.
  - Reservoir tank, refer to [CO-43, "Exploded View"](#).
  - Cooling system hoses, refer to [CO-43, "Exploded View"](#).
  - Radiator drain plug, refer to [CO-43, "Exploded View"](#).
2. Set the vehicle heater controls to the full HOT and heater ON positions. Turn the vehicle ignition ON with the engine OFF as necessary to activate the heater mode.

# ENGINE COOLANT

< PERIODIC MAINTENANCE >

[CUMMINS 5.0L ]

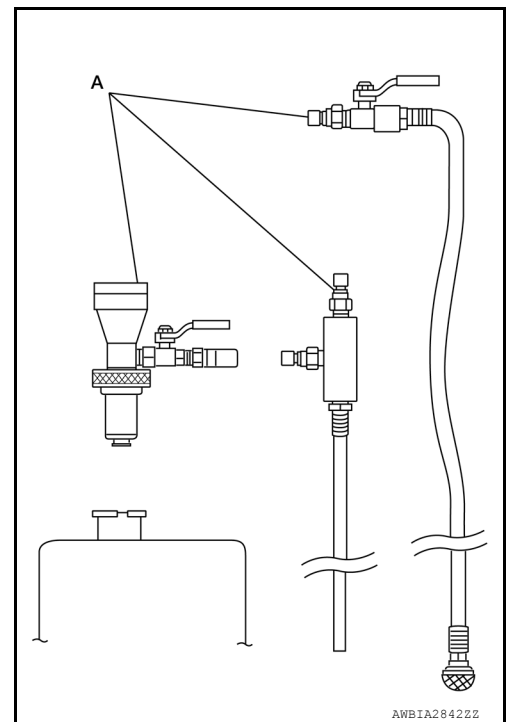
3. Fill the cooling system with engine coolant using Tool (A), following the manufacturer's instructions included with the tool.

**Tool number (A) : KV991J0070 (J-45695-A)**

**Engine Coolant : Refer to [MA-59, "Cummins \(5.0L V8D\) Engine : Fluids and Lubricants"](#).**

**CAUTION:**

- Use recommended coolant or equivalent.
  - Do not use any cooling system additives such as radiator sealer. Additives may clog the cooling system and cause damage to the engine, transmission or cooling system.
  - The compressed air supply must be equipped with an air dryer.
4. Remove the Tool (A) and top off the cooling system with engine coolant as necessary.



5. Install the radiator cap and reservoir tank cap.
6. Run the engine until it reaches normal operating temperature.

**CAUTION:**

**Do not allow the engine to exceed normal operating temperature or engine damage may occur.**

7. Stop the engine and allow it to cool.
8. Check the engine coolant level and adjust if necessary.

## FLUSHING COOLING SYSTEM

1. Fill the radiator from the filler neck above the radiator upper hose and reservoir tank with clean water and reinstall radiator filler cap.
2. Run the engine until it reaches normal operating temperature.
3. Rev the engine two or three times under no-load.
4. Stop the engine and wait until it cools down.
5. Drain the water from the system. Refer to [CO-41, "Changing Engine Coolant"](#).
6. Repeat steps 1-5 until clear water begins to drain from the radiator.

# RADIATOR

< REMOVAL AND INSTALLATION >

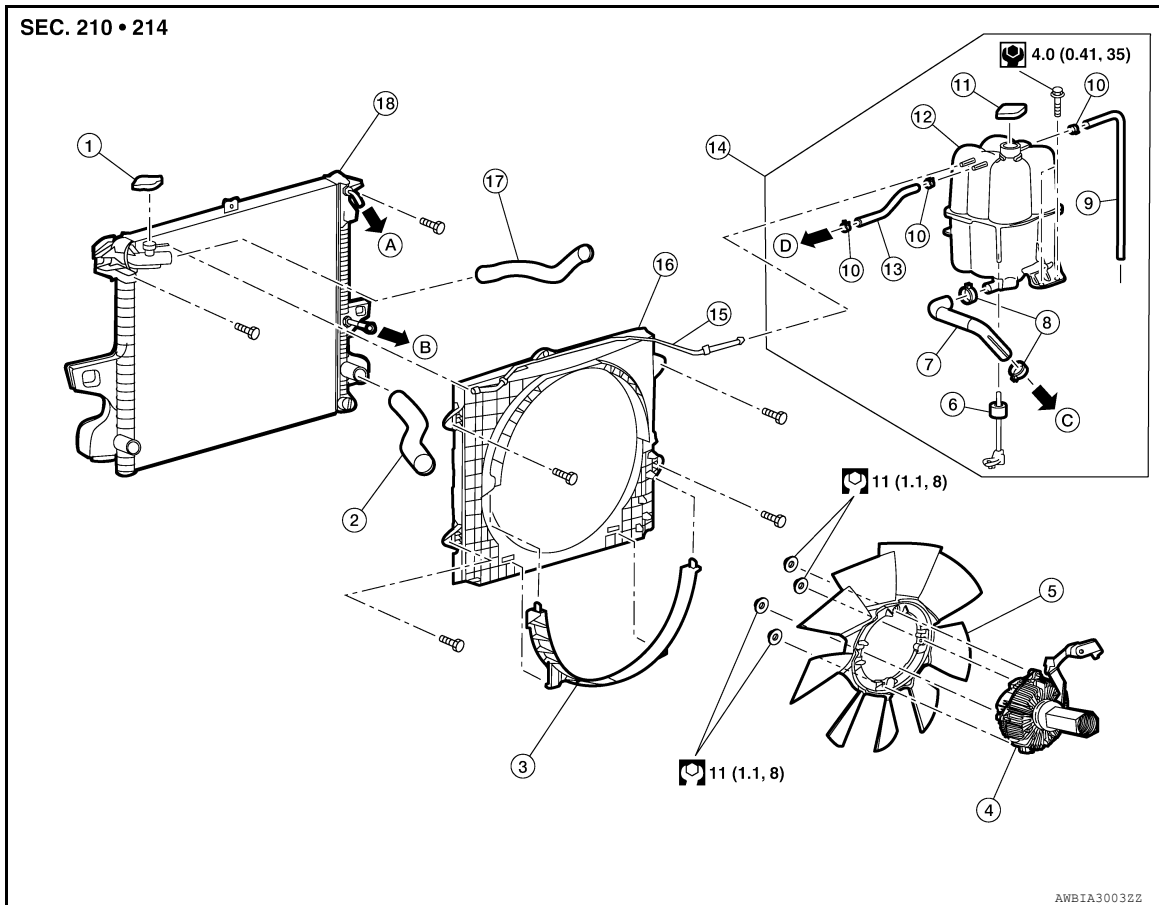
[CUMMINS 5.0L ]

## REMOVAL AND INSTALLATION

### RADIATOR

#### Exploded View

INFOID:000000013234130



- |                        |                             |                                |
|------------------------|-----------------------------|--------------------------------|
| 1. Radiator cap        | 2. Radiator hose (lower)    | 3. Radiator shroud (lower)     |
| 4. Fan clutch assembly | 5. Cooling fan              | 6. Reservoir tank level sensor |
| 7. Coolant hose        | 8. Clamp                    | 9. Reservoir tank overflow     |
| 10. Clamp              | 11. Reservoir cap           | 12. Reservoir tank             |
| 13. Coolant hose       | 14. Reservoir tank assembly | 15. Bypass hose                |
| 16. Radiator shroud    | 17. Radiator hose (upper)   | 18. Radiator                   |
| A. From A/T            | B. To A/T cooler            | C. To heater pipe              |
| D. From EGR cooler     |                             |                                |

#### Removal and Installation

INFOID:000000013234131

#### **WARNING:**

Do not remove the radiator cap when the engine is hot. Serious burns could occur from high-pressure engine coolant escaping from the radiator. Wrap a thick cloth around the radiator cap. Slowly turn it a quarter of a turn to release built-up pressure. Carefully remove radiator cap by turning it all the way.

#### **CAUTION:**

Perform when the engine is cold.

#### **NOTE:**

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

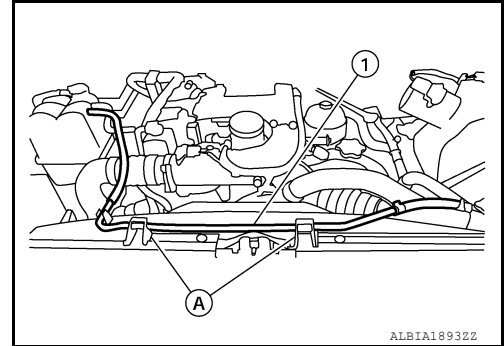
#### REMOVAL

# RADIATOR

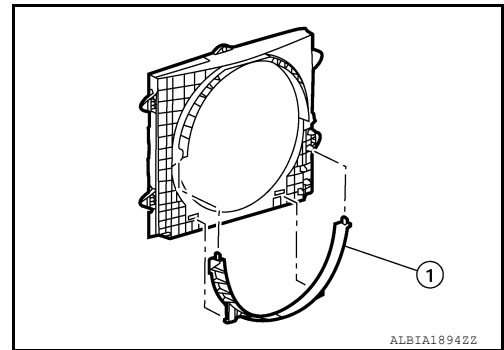
[CUMMINS 5.0L ]

## < REMOVAL AND INSTALLATION >

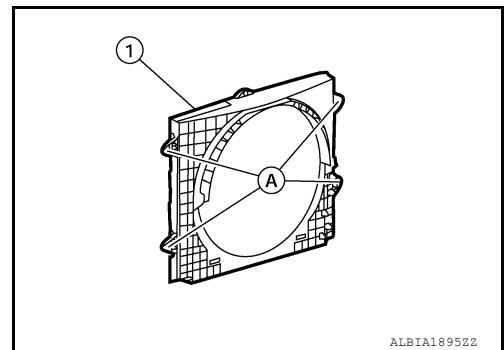
1. Drain engine coolant from the radiator. Refer to [CO-41, "Changing Engine Coolant"](#).
2. Remove core support cover. Refer to [DLK-165, "Exploded View"](#).
3. Remove reservoir tank hose from the radiator side and the reservoir tank.
4. Remove reservoir tank hose (1) from the radiator shroud (upper) (A).



5. Disconnect radiator hose (upper) from the radiator.  
**CAUTION:**  
**Do not allow coolant to contact drive belt.**
6. Remove air inlet tube and air outlet tube. Refer to charge air cooler.
7. Remove transmission tube from fan shroud (upper).
8. Remove radiator shroud (lower) (1).
  - Release the tabs, pull lower radiator shroud rearward and down to remove.



9. Disconnect the radiator hose (lower) from the radiator.  
**CAUTION:**  
**Do not allow coolant to contact drive belt.**
10. Remove the bolts (A) and remove the radiator shroud (upper) (1).



11. Remove the radiator pipe.
12. Disconnect harness connector from fan coupling.
13. Remove the cooling fan and fan coupling using Tool.

**Tool : — (J 54480 2 R1)**

14. Remove the transmission lines from the radiator.
15. Remove bolts from the radiator and remove the radiator.

## INSTALLATION

Installation is in the reverse order of removal.

# RADIATOR

< REMOVAL AND INSTALLATION >

[CUMMINS 5.0L ]

- Refill A/T fluid. Refer to [TM-217, "Changing the A/T Fluid \(ATF\)"](#).
- Refill engine coolant. Refer to [CO-41, "Changing Engine Coolant"](#).

## INSPECTION AFTER INSTALLATION

- Before starting engine, check oil/fluid levels including engine coolant and engine oil. If less than required quantity, fill to the specified level. Refer to [MA-59, "Cummins \(5.0L V8D\) Engine : Fluids and Lubricants"](#).
- Use procedure below to check for fuel leakage.
- Turn ignition switch ON (with engine stopped). With fuel pressure applied to fuel piping, check for fuel leakage at connection points.
- Start engine. With engine speed increased, check again for fuel leakage at connection points.
- Run engine to check for unusual noise and vibration.

### NOTE:

If hydraulic pressure inside timing chain tensioner drops after removal and installation, slack in the guide may generate a pounding noise during and just after engine start. However, this is normal. Noise will stop after hydraulic pressure rises.

- Warm up engine thoroughly to make sure there is no leakage of fuel, exhaust gas, or any oils/fluids including engine oil and engine coolant.
- Bleed air from passages in lines and hoses, such as in cooling system.
- After cooling down engine, again check oil/fluid levels including engine oil and engine coolant. Refill to specified level, if necessary.
- Summary of the inspection items:

Item		Before starting engine	Engine running	After engine stopped
Engine coolant		Level	Leakage	Level
Engine oil		Level	Leakage	Level
Transmission/ transaxle fluid	A/T and CVT Models	Leakage	Level/Leakage	Leakage
	M/T Models	Level/Leakage	Leakage	Level/Leakage
Other oils and fluids*		Level	Leakage	Level
Fuel		Leakage	Leakage	Leakage
Exhaust gas		—	Leakage	—

\*Power steering fluid, brake fluid, etc.

# RESERVOIR TANK

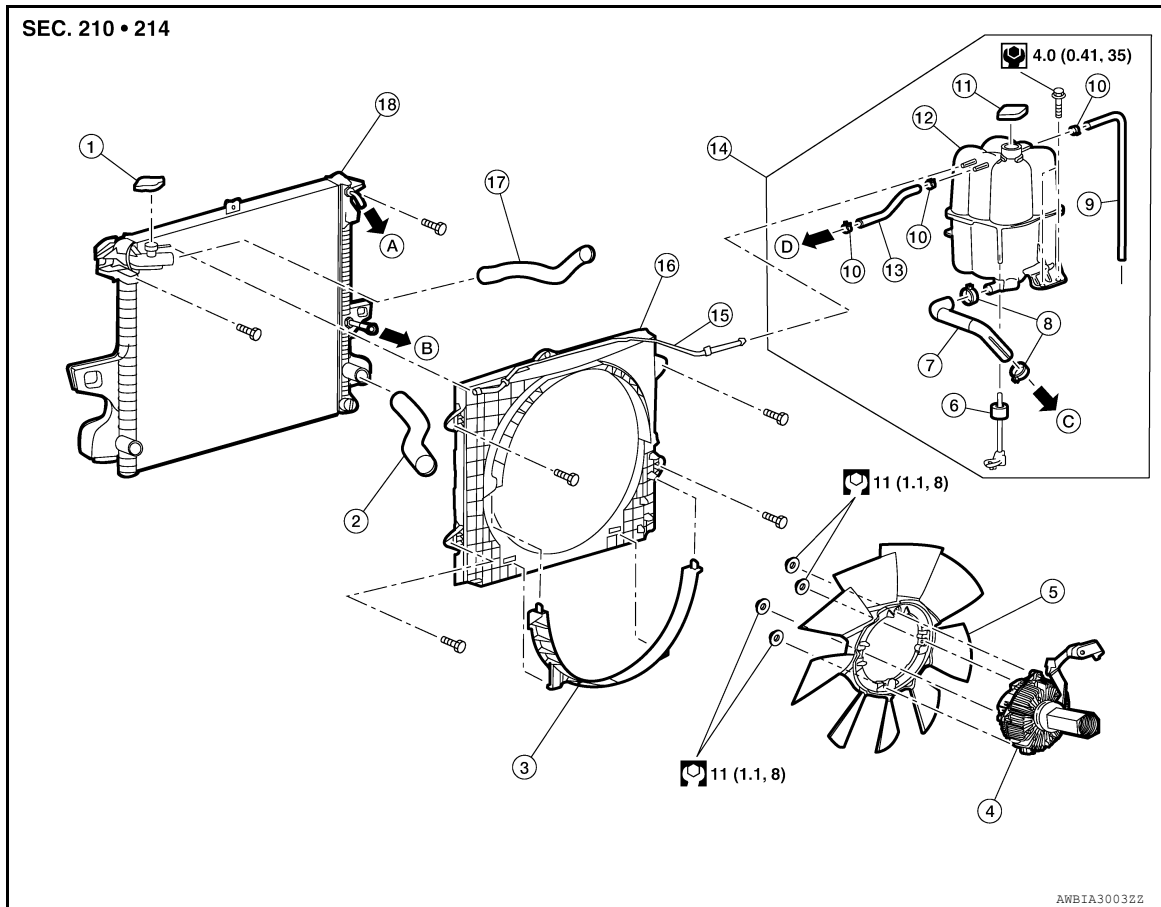
< REMOVAL AND INSTALLATION >

[CUMMINS 5.0L ]

## RESERVOIR TANK

Exploded View

INFOID:000000013500355



- |                        |                             |                                |
|------------------------|-----------------------------|--------------------------------|
| 1. Radiator cap        | 2. Radiator hose (lower)    | 3. Radiator shroud (lower)     |
| 4. Fan clutch assembly | 5. Cooling fan              | 6. Reservoir tank level sensor |
| 7. Coolant hose        | 8. Clamp                    | 9. Reservoir tank overflow     |
| 10. Clamp              | 11. Reservoir cap           | 12. Reservoir tank             |
| 13. Coolant hose       | 14. Reservoir tank assembly | 15. Bypass hose                |
| 16. Radiator shroud    | 17. Radiator hose (upper)   | 18. Radiator                   |
| A. From A/T            | B. To A/T cooler            | C. To heater pipe              |
| D. From EGR cooler     |                             |                                |

## Removal and Installation

INFOID:000000013237339

### REMOVAL

1. Drain engine coolant. Refer to [CO-41, "Changing Engine Coolant"](#).
2. Remove bypass hose.
3. Remove bolts from relay box and set aside.
4. Remove coolant return line from the reservoir tank.
5. Disconnect harness connector from the coolant level sensor.
6. Disconnect harness connector from the engine control No. 2 harness. Refer to [PG-121, "Harness Layout"](#).
7. Remove bolts from reservoir tank and remove reservoir tank.

### INSTALLATION

Installation is in the reverse order of removal.

# ENGINE COOLING FAN ASSEMBLY

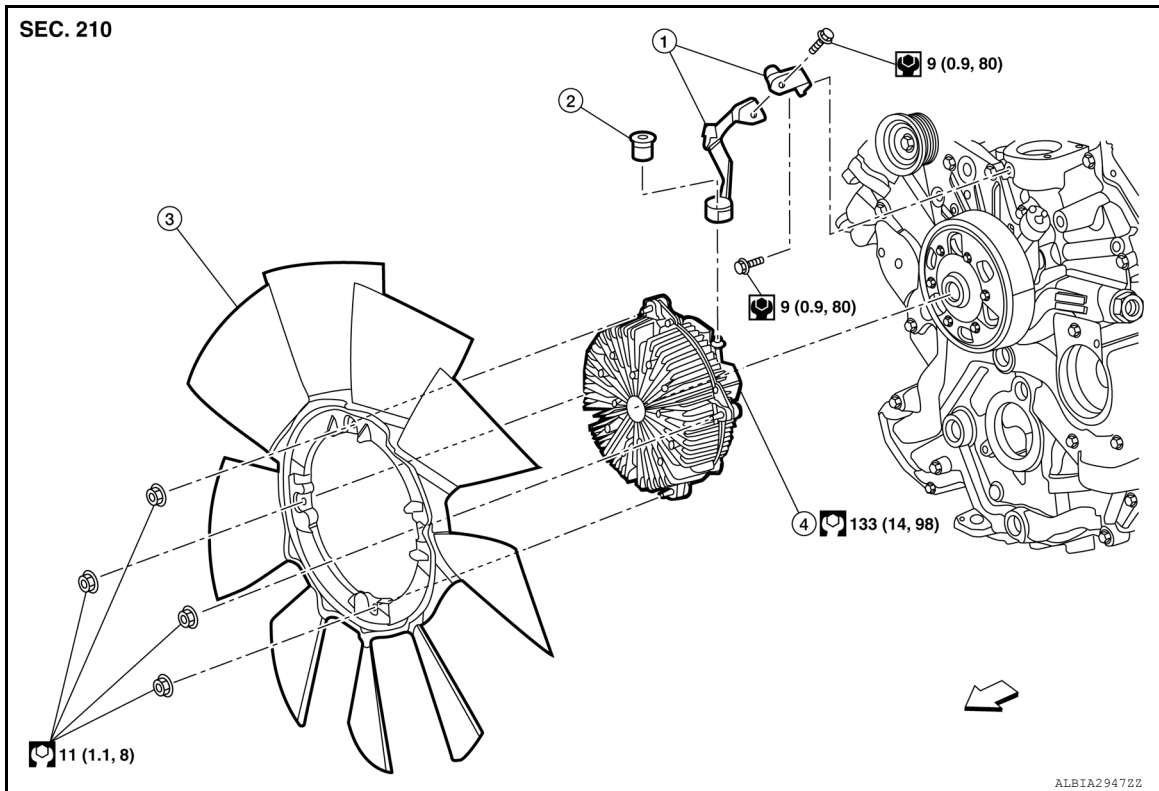
< REMOVAL AND INSTALLATION >

[CUMMINS 5.0L ]

## ENGINE COOLING FAN ASSEMBLY

Exploded View

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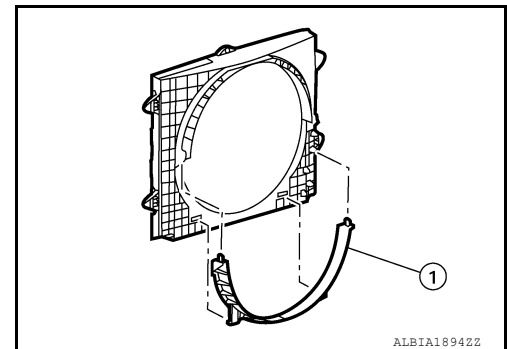
- 1. Bracket
  - 2. Clip
  - 3. Cooling fan
  - 4. Fan clutch assembly
- ⇐ Front

## Removal and Installation

INFOID:000000013525170

### REMOVAL

1. Disconnect the battery or batteries. Refer to [PG-174, "Battery Disconnect"](#).
2. Remove front under cover. Refer to [EXT-28, "FRONT UNDER COVER : Removal and Installation"](#).
3. Release tabs, pull the radiator shroud (lower) rearward and down and remove radiator shroud (lower) (1).



4. Disconnect the harness connector from the fan clutch assembly.
5. Remove fan clutch assembly and cooling fan using Tool.

**Tool number** : — (J-54480)

6. Remove cooling fan bolts and cooling fan.

### INSTALLATION

Revision: March 2016

CO-47

2016 Titan NAM

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# ENGINE COOLING FAN ASSEMBLY

< REMOVAL AND INSTALLATION >

[CUMMINS 5.0L ]

---

Installation is in the reverse order of removal.



# FAN SPACER AND PULLEY

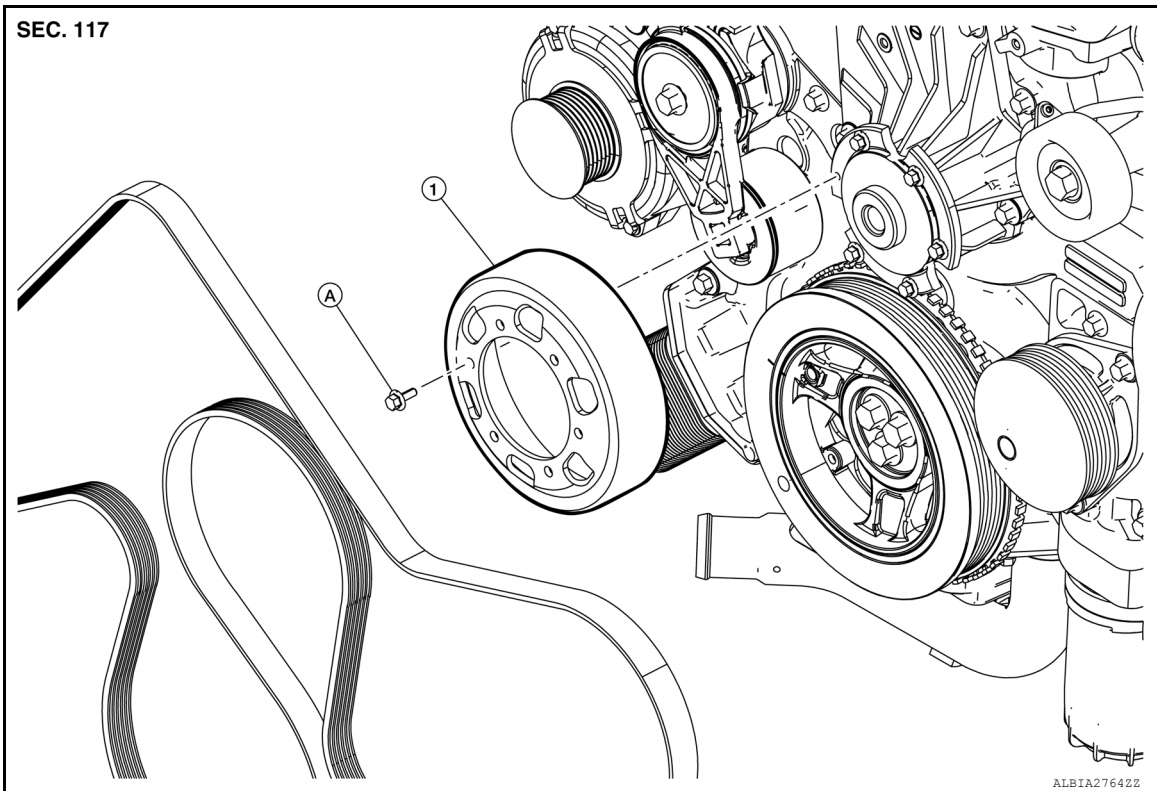
< REMOVAL AND INSTALLATION >

[CUMMINS 5.0L ]

## FAN SPACER AND PULLEY

Exploded View

INFOID:000000013234192



1. Fan spacer and pulley

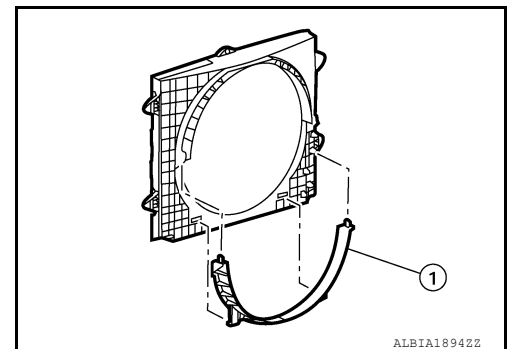
A. Refer to installation

## Removal and Installation

INFOID:000000013234132

### REMOVAL

1. Disconnect battery or batteries. Refer to [PG-174, "Battery Disconnect"](#).
2. Remove front undercover. Refer to [EXT-28, "FRONT UNDER COVER : Removal and Installation"](#).
3. Release tabs, pull the radiator shroud (lower) rearward and down and remove radiator shroud (lower) (1).



4. Remove the drive belt.
5. Remove fan clutch assembly and cooling fan using Tool.

**Tool number** : — (J-54480)

6. Remove bolts from the fan spacer and remove fan spacer.

### INSPECTION AFTER REMOVAL

# FAN SPACER AND PULLEY

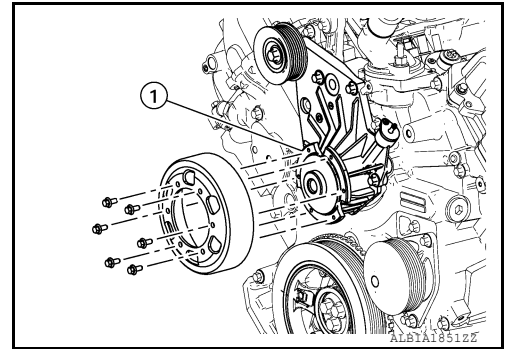
< REMOVAL AND INSTALLATION >

[CUMMINS 5.0L ]

1. Clean the fan pulley with solvent and dry with compressed air.

**WARNING:**

To avoid the risk of injury to eyes and skin, when using caustic solutions, solvents, acids, or alkaline materials follow the manufactures recommendations for use and wear appropriate eye protection and protective clothing. Some of these materials are also flammable. To avoid risk of fire or burns, never smoke or allow sparks or flames (such as pilot lights, electrical switches, or welding equipment) in the work area. Avoid spilling onto a hot exhaust manifold which can cause a fire.



1. Hub fan
2. Inspect the fan pulley for cracks near the bolt holes and for damage at the drive belt contact surface. If damage is found on the fan pulley, the vacuum pump **must** also be inspected. Refer to [EM-478](#), "[Removal and Installation](#)".  
Replace the pulley if any damage is found.

## INSTALLATION

Installation is in the reverse order of removal.

**Fan pulley bolts : 9.5 N·m (0.97 kg-m, 84 in-lb)**

# WATER PUMP

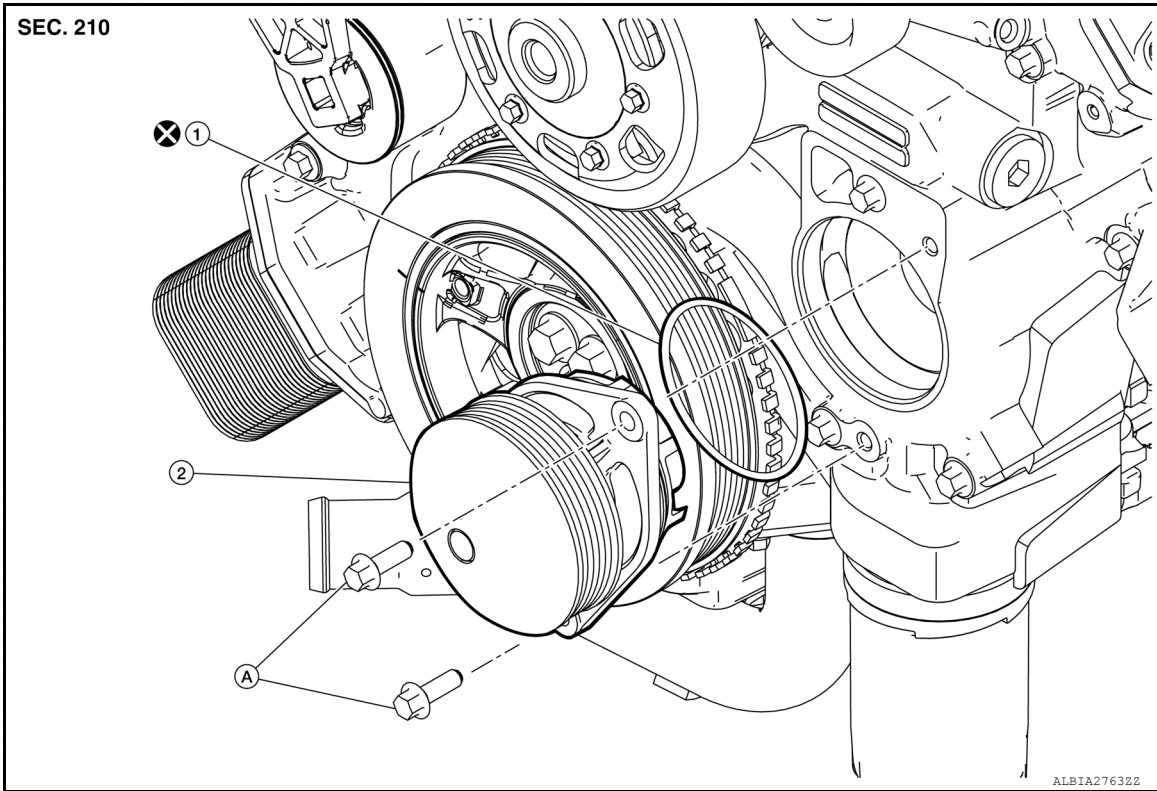
< REMOVAL AND INSTALLATION >

[CUMMINS 5.0L ]

## WATER PUMP

### Exploded View

INFOID:000000013237340



1. Water pump O-ring

2. Water pump

A. Refer to installation

### Removal and Installation

INFOID:000000013234137

#### INSPECTION BEFORE REMOVAL

1. Inspect the water pump housing for cracks and/or other damage.

(A) : NG

(B) : NG

Check the water pump seal weep hole. The water pump seal design requires a coolant film for lubrication and cooling. Therefore, it is normal to observe a minor chemical buildup or streaking at the weep hole.

#### NOTE:

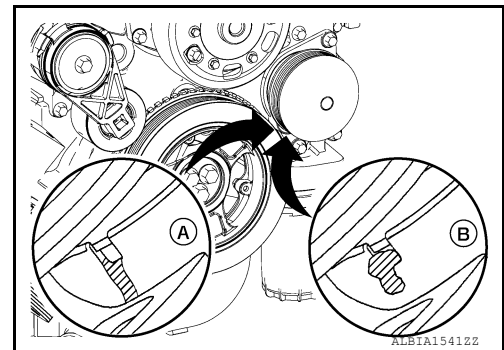
A streak or chemical buildup at the weep hole is **not** justification for water pump replacement.

Use the following guidelines to determine if water pump replacement is necessary: Make sure the weep hole is open.

#### NOTE:

A suitable tool can be used to remove any debris.

If no leakage is observed from the weep hole under operating conditions, do **not** replace the water pump.



#### REMOVAL

#### WARNING:

- Coolant is toxic and can be fatal if swallowed. Keep away from pets and children. If not reused, dispose of in accordance with local environmental regulations.

# WATER PUMP

< REMOVAL AND INSTALLATION >

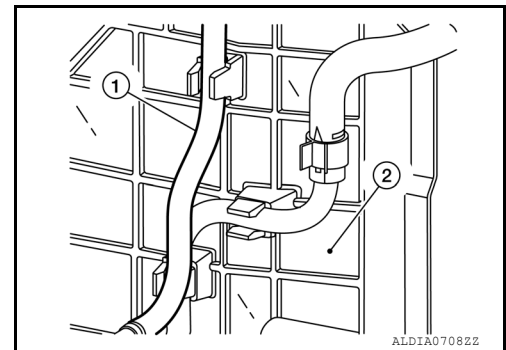
[CUMMINS 5.0L ]

- To avoid the risk of personal injury, do not remove the radiator cap when the engine is hot. Serious burns could occur from high-pressure engine coolant escaping from the radiator. Wrap a thick cloth around the cap. Slowly turn it a quarter of a turn to release built-up pressure. Carefully remove the radiator cap by turning it all the way.

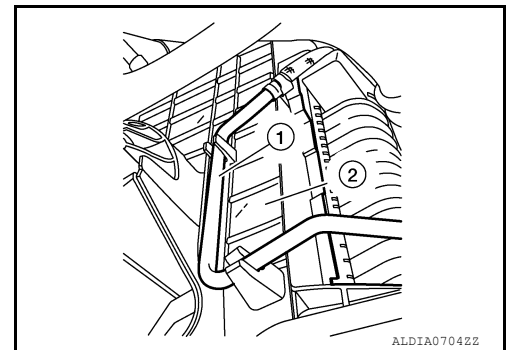
**NOTE:**

It is **not** practical to replace the components of the water pump; the water pump is serviced as an assembly. The water pump is a belt-driven, centrifugal-type pump with the inlet and outlet as integral parts of the front gear cover.

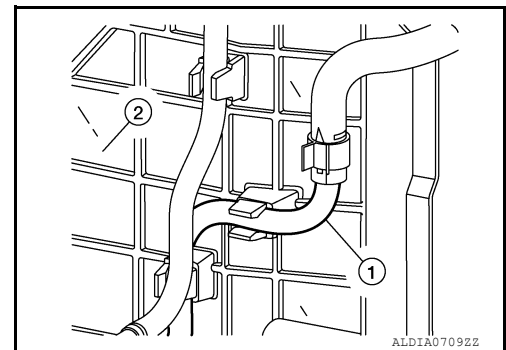
1. Drain engine coolant. Refer to [CO-41, "Changing Engine Coolant"](#).
2. Remove fan spacer and pulley. Refer to [CO-49, "Removal and Installation"](#).
3. Remove upper radiator cover.
4. Remove bypass hose. Refer to [CO-49, "Exploded View"](#).
5. Remove radiator hose (upper). Refer to [CO-49, "Exploded View"](#).
6. Remove radiator pipe. Refer to [CO-49, "Exploded View"](#).
7. Remove air inlet and outlet hoses. Refer to [EM-248, "Exploded View"](#).
8. Release hose clamp on radiator and un-clip fluid cooler tube E (1) from radiator shroud (2).



9. Release hose clamp connecting fluid cooler tube C (1) and fluid cooler hose C, un-clip fluid cooler tube C (1) and remove from radiator shroud (2).



10. Un-clip fluid cooler tube D (1) from radiator shroud (2) and remove fluid cooler tube D (1).

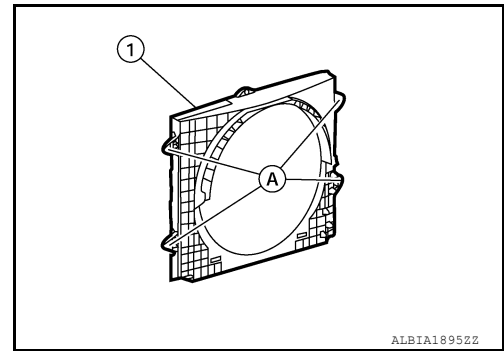


# WATER PUMP

## < REMOVAL AND INSTALLATION >

[CUMMINS 5.0L ]

11. Remove the bolts (A) and remove the radiator shroud (1).



12. Remove bolts and remove water pump.

### INSPECTION AFTER REMOVAL

• Clean the water pump with solvent. Dry with compressed air.

#### WARNING:

- To avoid the risk of injury to eyes and skin, when using caustic solutions, solvents, acids, or alkaline materials follow the manufacturer's recommendations for use and wear appropriate eye protection and protective clothing. Some of these materials are also flammable. To avoid risk of fire or burns, never smoke or allow sparks or flames (such as pilot lights, electrical switches, or welding equipment) in the work area. Avoid spilling onto a hot exhaust manifold which can cause a fire.

• When using compressed air for cleaning, to avoid the risk of personal injury from flying debris and dirt:

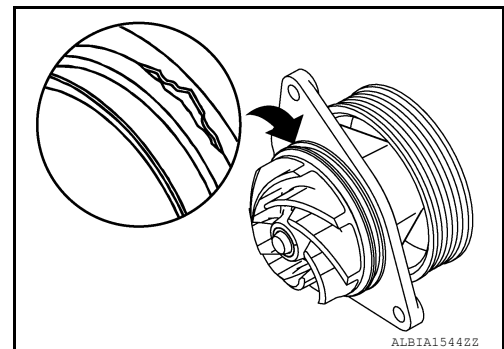
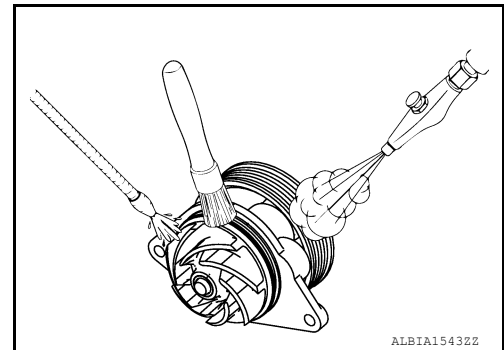
- Do not exceed 30psi (270 kPa).

- Wear appropriate eye protection and protective clothing including gloves.

#### 1. WARNING:

Wear appropriate eye and face protection when using compressed air. Flying debris and dirt can cause personal injury.

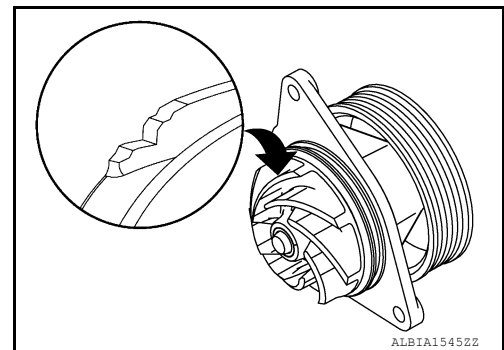
- Clean the o-ring sealing surface on the water pump housing.
- Inspect the sealing surface for damage.
- If damage is present, replace the water pump.
- Inspect the mounting and sealing locations on the front gear cover where the water pump is housed.
- If damage is present, replace the front cover. Refer to [EM-330, "Removal and Installation"](#).



- Inspect the impeller for cracks, missing blades, slippage on the shaft, and other types of damage.
- Inspect the water pump housing for cracks and/or other damage.
- Replace the water pump if any damage or malfunction is found.

#### NOTE:

If any damage to the impeller blades is found, make sure to inspect the front cover for damage.



### INSTALLATION

Installation is in the reverse order of removal.

A  
CO  
C  
D  
E  
F  
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H  
I  
J  
K  
L  
M  
N  
O  
P

# WATER PUMP

[CUMMINS 5.0L ]

## < REMOVAL AND INSTALLATION >

- Install new water pump O-ring (1).

**CAUTION:**

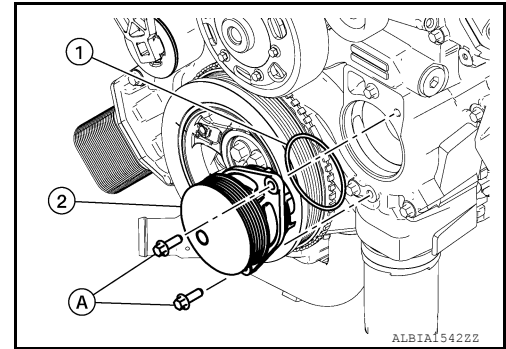
**Do not reuse water pump O-ring.**

**NOTE:**

Lubricate a new water pump O-ring.

**Water pump bolts (A) : 18 N·m (1.8 kg-m, 13 ft-lb)**

(2) : Water pump





# COOLANT PLUMBING

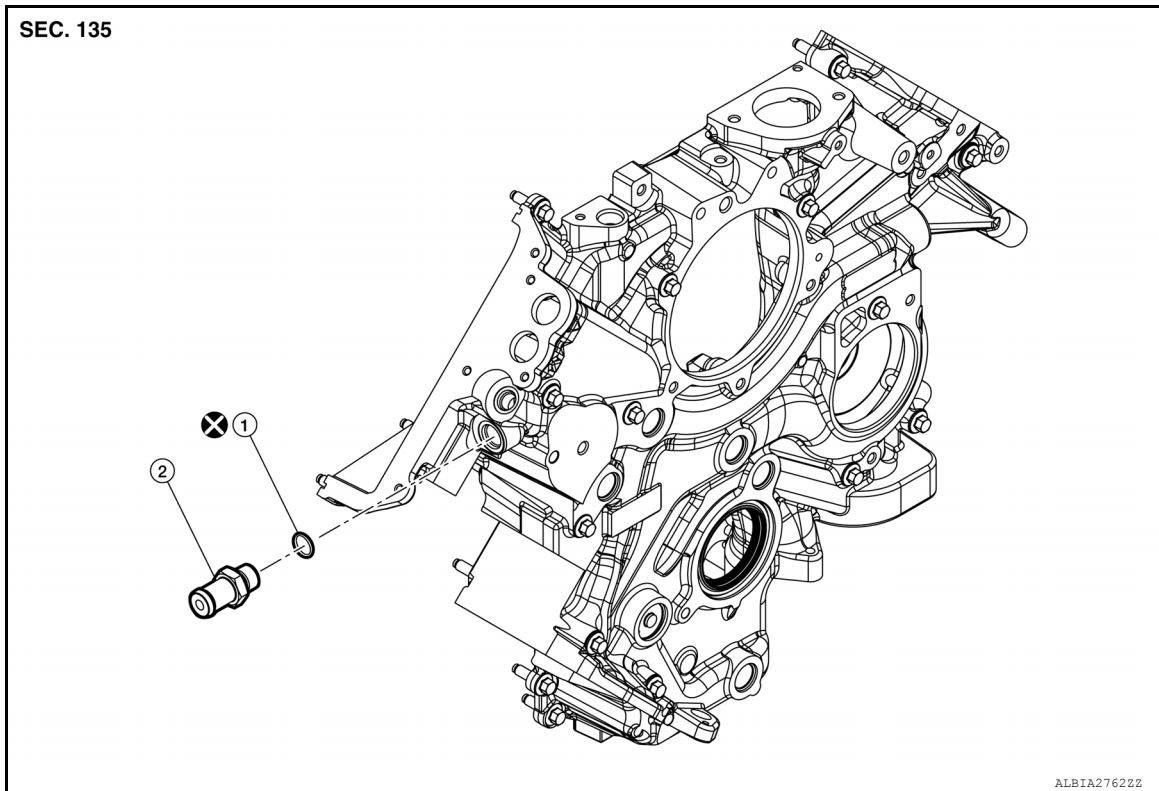
< REMOVAL AND INSTALLATION >

[CUMMINS 5.0L ]

## COOLANT PLUMBING

### Exploded View

INFOID:000000013237724



1. O-ring

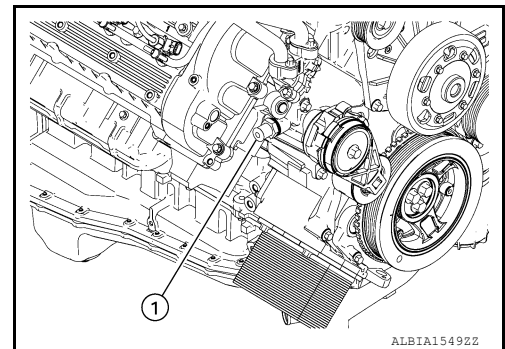
2. Coolant plumbing fitting

### Removal and Installation

INFOID:000000013234144

#### GENERAL INFORMATION

- The purpose of this procedure is to explain how to install and remove the coolant plumbing fitting (1) in the front gear cover that supplies coolant to the heater.
- The location of this coolant fitting is on the right side of the front cover.



#### REMOVAL

##### **WARNING:**

- To avoid the risk of personal injury, do not remove the radiator cap when the engine is hot. Serious burns could occur from high-pressure engine coolant escaping from the radiator. Wrap a thick cloth around the cap. Slowly turn it a quarter of a turn to release built-up pressure. Carefully remove the radiator cap by turning it all the way.
- Coolant is toxic and can be fatal if swallowed. Keep away from pets and children. If not reused, dispose of in accordance with local environmental regulations.

1. Partially drain the engine coolant. Refer to [CO-41, "Changing Engine Coolant"](#).
2. Remove the heater hose from the coolant plumbing fitting.

# COOLANT PLUMBING

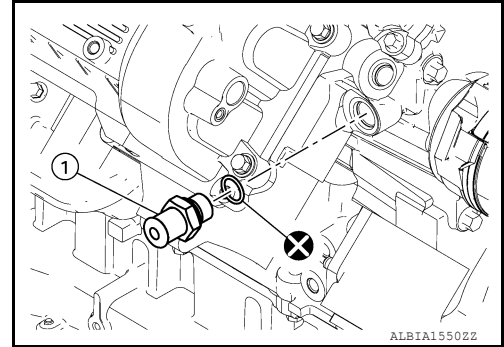
[CUMMINS 5.0L ]

## < REMOVAL AND INSTALLATION >

3. Remove the coolant plumbing fitting (1) from the front cover.

**CAUTION:**

Do not reuse O-ring.

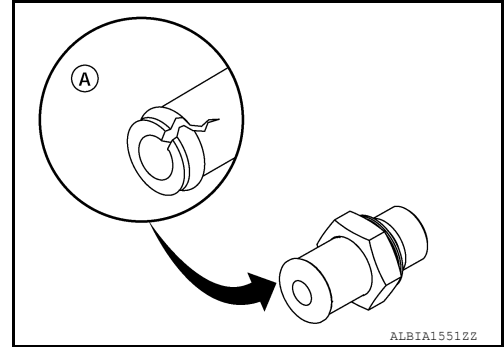


### INSPECTION AFTER REMOVAL

- Clean the fittings with cleaning solvent. Dry with compressed air.
- Inspect the fittings for cracks, corrosion, or other damage (A).
- If damaged, the part **must** be replaced.

**WARNING:**

- To avoid the risk of injury to eyes and skin, when using caustic solutions, solvents, acids, or alkaline materials follow the manufacturers recommendations for use and wear appropriate eye protection and protective clothing. Some of these materials are also flammable. To avoid risk of fire or burns, never smoke or allow sparks or flames (such as pilot lights, electrical switches, or welding equipment) in the work area. Avoid spilling onto a hot exhaust manifold which can cause a fire.
- When using compressed air for cleaning, to avoid the risk of personal injury from flying debris and dirt:
  - Do not exceed 30 psi (207 kPa).
  - Wear appropriate eye protection and protective clothing including gloves.



### INSTALLATION

1. Install O-ring to coolant plumbing fitting (1).

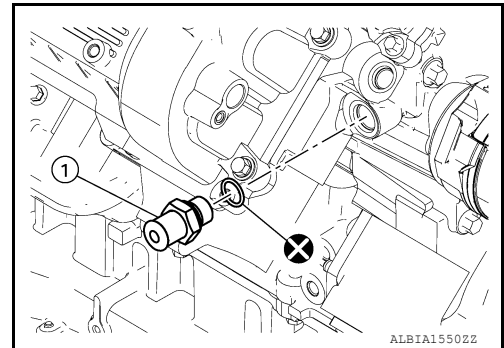
**CAUTION:**

Do not reuse O-ring.

**NOTE:**

Lubricate the o-ring with a water-based lubricant.

**Coolant plumbing fitting : 54 N·m (5.5 kg-m, 40 ft-lb)**



2. Installation of the remaining components is in the reverse order of removal.



# COOLANT HEATER

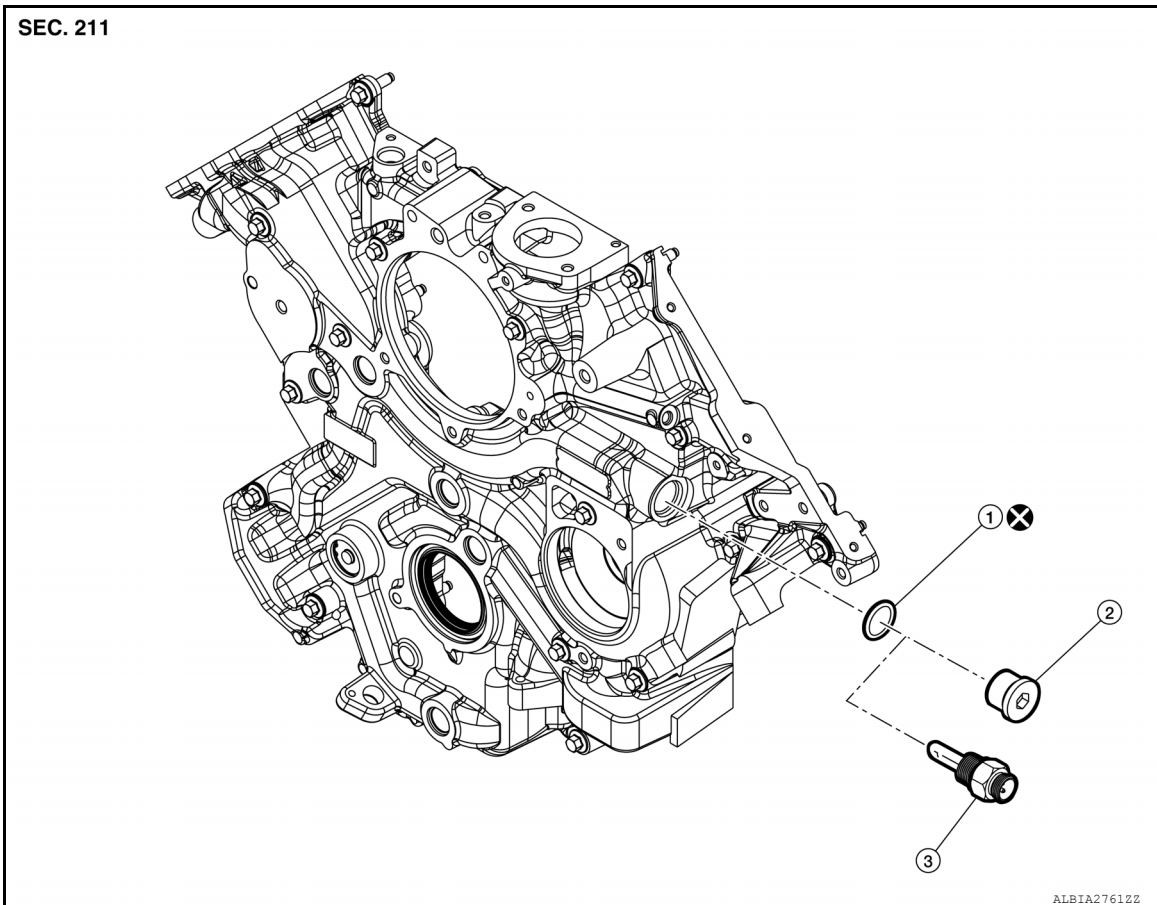
< REMOVAL AND INSTALLATION >

[CUMMINS 5.0L ]

## COOLANT HEATER

Exploded View

INFOID:000000013237741



1. O-ring

2. Plug (except Canada)

3. Coolant heater (for Canada)

## Removal and Installation

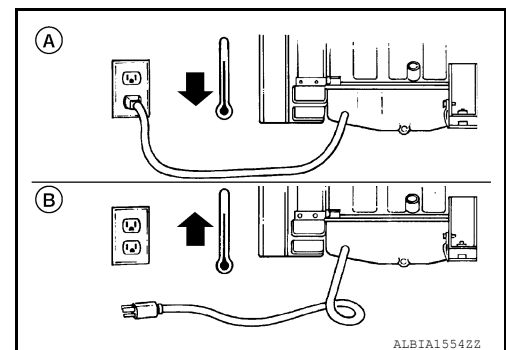
INFOID:000000013234150

### GENERAL INFORMATION

- Some heaters will operate continuously when plugged into the correct voltage electrical socket. Operate heater when the ambient temperature is at or below 0°C [32°F].

(A) : Below -18°C [0°F]

(B) : Above -18°C [0°F]



### REMOVAL

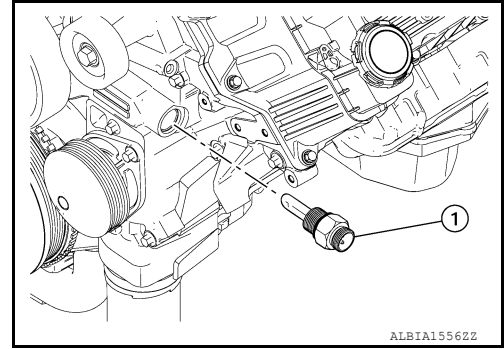
- Disconnect the battery or batteries. Refer to [PG-174, "Battery Disconnect"](#).
- Partially drain the engine coolant. Refer to [CO-41, "Changing Engine Coolant"](#).

# COOLANT HEATER

[CUMMINS 5.0L ]

## < REMOVAL AND INSTALLATION >

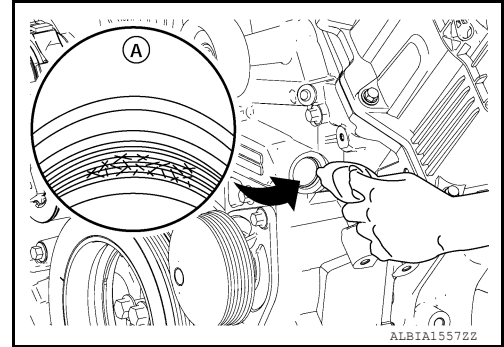
3. Disconnect the harness connector from the coolant heater (1).
4. Unscrew the coolant heater (1) from the front cover and remove the coolant heater (1).



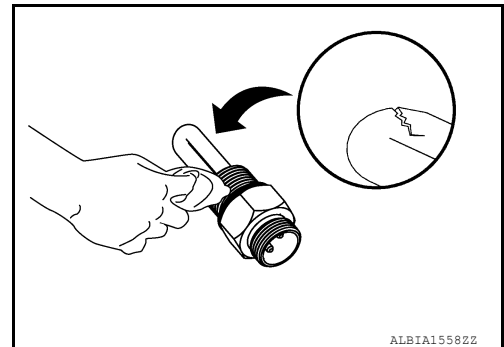
## INSPECTION AFTER REMOVAL

1. Clean the coolant heater port thoroughly with a clean rag. Make sure there are no burrs, metal shavings, or sharp edges that can cut the o-ring.

(A) : NG



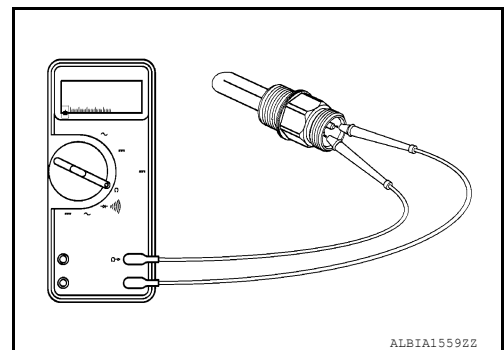
2. Clean the coolant heater thoroughly with a clean rag. Make sure the heating element is free of debris and buildup, and that the sealing area is clean. Check the coolant heater for cracks on the element.



3. Measure the coolant heater resistance. The resistance **must** read between 21.6 and 26.4 ohms.

### **WARNING:**

**To reduce the risk of personal injury or death from electric shock, do not touch electrical supply wires, injector solenoids or other electrical equipment. Do not wear jewelry or damp clothing, always wear appropriate protective equipment when performing electrical testing or repairs.**



Coolant Heater Resistance (Ohms)	
MIN	MAX
21.6	26.4

## INSTALLATION

Installation is in the reverse order of removal.

### **NOTE:**

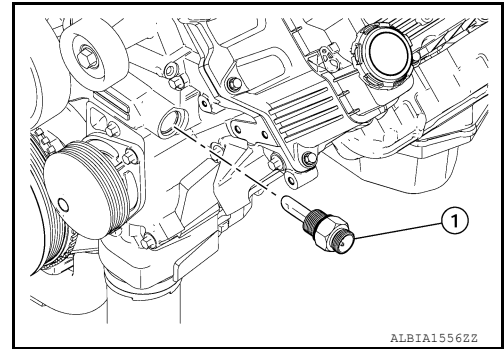
# COOLANT HEATER

## < REMOVAL AND INSTALLATION >

[CUMMINS 5.0L ]

Do **not** apply power to the coolant heater (1) until the cooling system is filled, and the engine has run long enough for the thermostat to open and allow the air to escape.

**Coolant heater (1) : 55 N·m (5.6 kg-m, 41 ft-lb)**



A

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F

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H

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L

M

N

O

P

# COOLANT THERMOSTAT

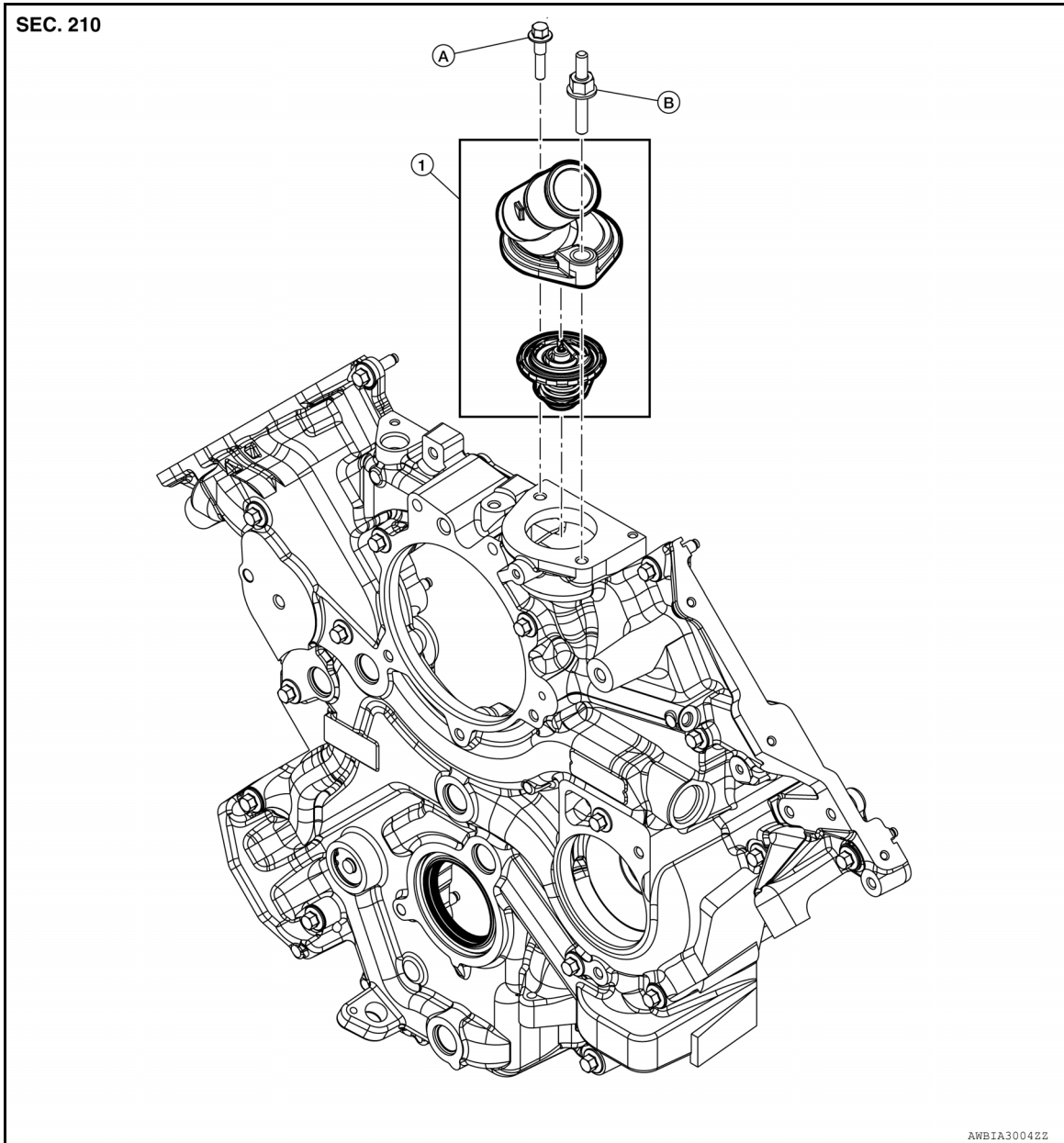
< REMOVAL AND INSTALLATION >

[CUMMINS 5.0L ]

## COOLANT THERMOSTAT

Exploded View

INFOID:000000013237795



1. Water outlet connection

A. Refer to INSTALLATION

B. Refer to INSTALLATION

## Removal and Installation

INFOID:000000013234156

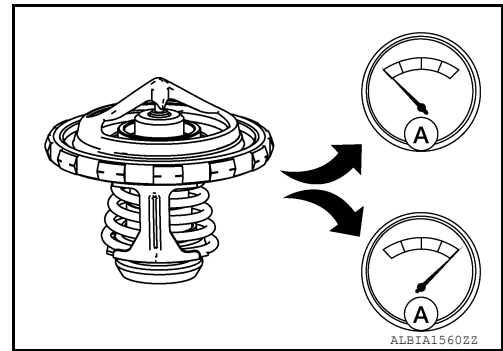
## GENERAL INFORMATION

# COOLANT THERMOSTAT

## < REMOVAL AND INSTALLATION >

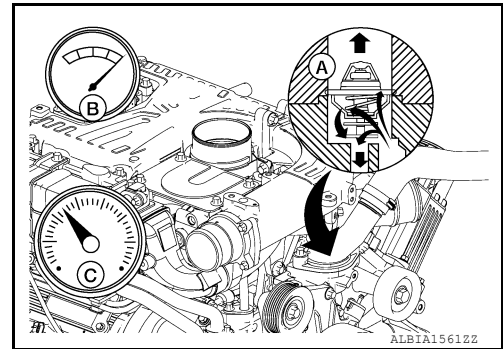
[CUMMINS 5.0L ]

1. The thermostat controls the engine coolant temperature. When the coolant temperature is below the operating range, engine coolant is bypassed back to the inlet of the water pump. When the engine coolant temperature reaches the operating range, the thermostat opens, seals off the bypass, and forces engine coolant to flow to the radiator.
2. An incorrect or malfunctioning thermostat can cause the engine to run too hot or too cold (A).



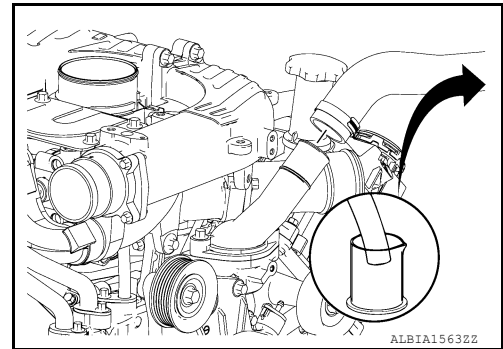
### CAUTION:

Do not operate the engine without a thermostat (A). Without a thermostat, the path of least resistance for the coolant is through the bypass to the water pump inlet. This can cause the engine to overheat (B/C).

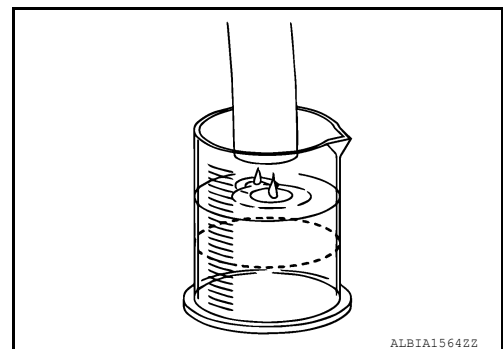


## INSPECTION BEFORE REMOVAL

1. If the thermostat is suspected to be leaking, the following steps can be performed to check for leaks.
  - The following check **must** be performed with the thermostat closed for 1 minute of engine operation.
  - Use consult to monitor the coolant temperature. The coolant temperature should be less than 38°C [100°F] to make sure the thermostat does **not** open during the test.
2. Disconnect the radiator hose (upper) from the water outlet connection.
  - Install a hose of the same size on the water outlet connection. It **must** be long enough to reach a remote, dry container that will be used to collect coolant.
  - Install and tighten a hose clamp on the outlet connection.
  - Place the other end of the hose in the container.



3. The coolant temperature should be monitored during this test to determine if the coolant temperature reaches the nominal opening temperature of the thermostat. If the thermostat opens during this test, the test is invalid and **must** be repeated. Refer to [CO-75, "Standard and Limit"](#).
  - Operate the engine at rated rpm for 1 minute.
  - Stop the engine and measure the amount of coolant collected in the container.
  - The amount of coolant **must not** be more than 100 cc [3.3 fl oz].
  - If more than 100 cc [3.3 fl oz] of coolant is collected, the thermostat is leaking and **must** be replaced.



## Removal

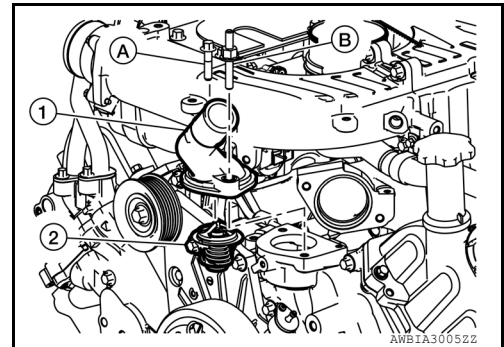
### WARNING:

# COOLANT THERMOSTAT

< REMOVAL AND INSTALLATION >

[CUMMINS 5.0L ]

- Coolant is toxic and can be fatal if swallowed. Keep away from pets and children. If not reused, dispose of in accordance with local environmental regulations.
  - To avoid the risk of personal injury, do not remove the radiator cap when the engine is hot. Serious burns could occur from high-pressure engine coolant escaping from the radiator. Wrap a thick cloth around the cap. Slowly turn it a quarter of a turn to release built-up pressure. Carefully remove the radiator cap by turning it all the way.
1. Partially drain the engine coolant. Refer to [CO-41, "Changing Engine Coolant"](#).
  2. Disconnect radiator hose (upper) from the water outlet connection.
  3. Thoroughly clean the area around the water outlet connection prior to removal.
  4. Remove the wiring harness clip from the studded bolt on the water outlet connection.
  5. Remove the water outlet connection bolts (A/B).
  6. Remove the water outlet connection (1).
  7. Remove the thermostat (2).

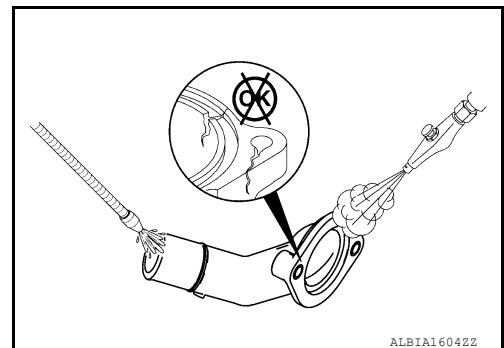


## INSPECTION AFTER REMOVAL

### WARNING:

- To avoid the risk of injury to eyes and skin, when using caustic solutions, solvents, acids, or alkaline materials follow the manufacturers recommendations for use and wear appropriate eye protection and protective clothing. Some of these materials are also flammable. To avoid risk of fire or burns, never smoke or allow sparks or flames (such as pilot lights, electrical switches, or welding equipment) in the work area. Avoid spilling onto a hot exhaust manifold which can cause a fire.
- when using compressed air for cleaning, to avoid the risk of personal injury from flying debris and dirt:
  - Do not exceed 30 psi (207 kPa).
  - Wear appropriate eye protection and protective clothing including gloves.

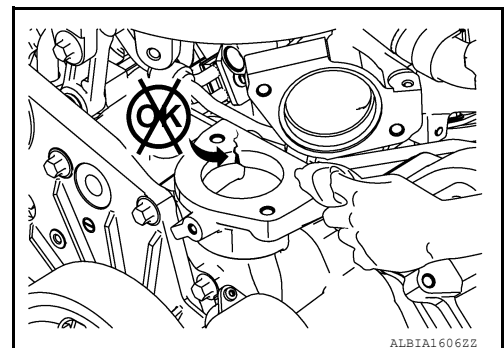
1. Clean the water outlet connection with solvent and dry with compressed air.
2. Inspect the outlet connection for damage. Replace the outlet connection and thermostat if damage is present.



3. Clean the mating surfaces on the front cover with a clean cloth. Inspect the front cover for corrosion, cracks, and other damage.

### CAUTION:

Do not let any debris fall into the thermostat cavity when cleaning the gasket surfaces. Damage to the cooling system and engine can occur.



# COOLANT THERMOSTAT

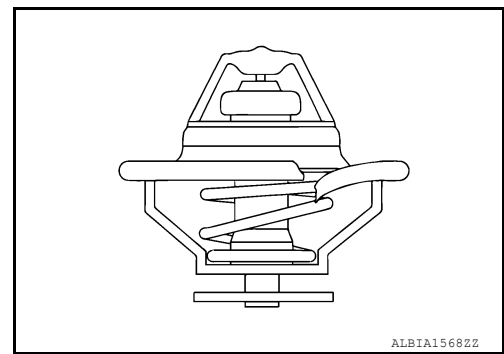
[CUMMINS 5.0L ]

## < REMOVAL AND INSTALLATION >

- Inspect the thermostat for external damage. Inspect for cracks, embedded debris, damaged seat, and other damage.
- Inspect thermostat seal for cracks or tears.

**CAUTION:**

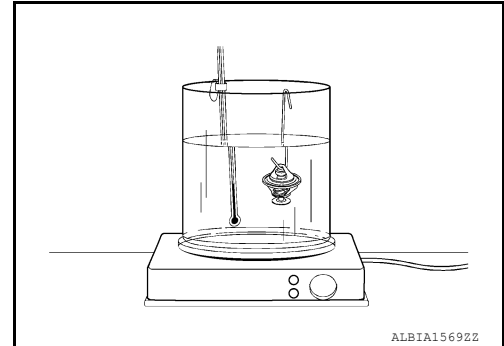
Replace the thermostat and water outlet connection if any damage is found.



- If the thermostat is suspected to be malfunctioning, measure the opening temperature of the thermostat to determine if the thermostat is functioning correctly. Suspend the thermostat and a 100°C [212°F] thermometer in a container of water.

**NOTE:**

Do **not** allow the thermostat or thermometer to touch the container.

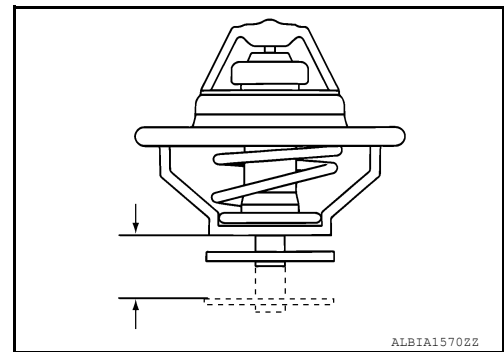


- Heat the water and check the thermostat as follows; the thermostat **must** meet the following specification:

**NOTE:**

The nominal operating temperature is stamped on the thermostat. To verify the correct temperature range thermostat is installed, make sure to reference the appropriate parts information resources.

**Thermostat Nominal Temperature** : Refer to [CO-75, "Standard and Limit"](#).



Thermostat Opening Temperature			
	mm		in
Initial Opening	90	MIN	195
	94	MAX	202
Fully Opened	106	MAX	222

## INSTALLATION

**CAUTION:**

Always use the correct thermostat and do not operate the engine without a thermostat installed. The engine can overheat if operated without a thermostat because the path of least resistance for the coolant is through the bypass to the pump inlet. An incorrect thermostat can cause the engine to overheat or run too cold.

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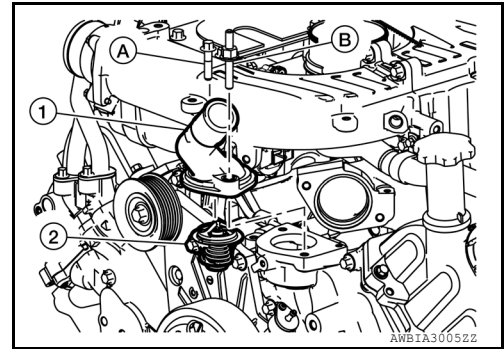
## COOLANT THERMOSTAT

[CUMMINS 5.0L ]

### < REMOVAL AND INSTALLATION >

1. Install the thermostat (2) into the counterbore in the water outlet connection (1). Be sure it is evenly seated in the water outlet connection.
2. Install the water outlet connection (1) and hand tighten the mounting bolts (A/B).
3. Tighten the bolts (A/B) to the specified torque.

**Bolts (A/B) : 18 N·m (1.8 kg-m 13 ft-lb)**





# WATER INLET CONNECTION

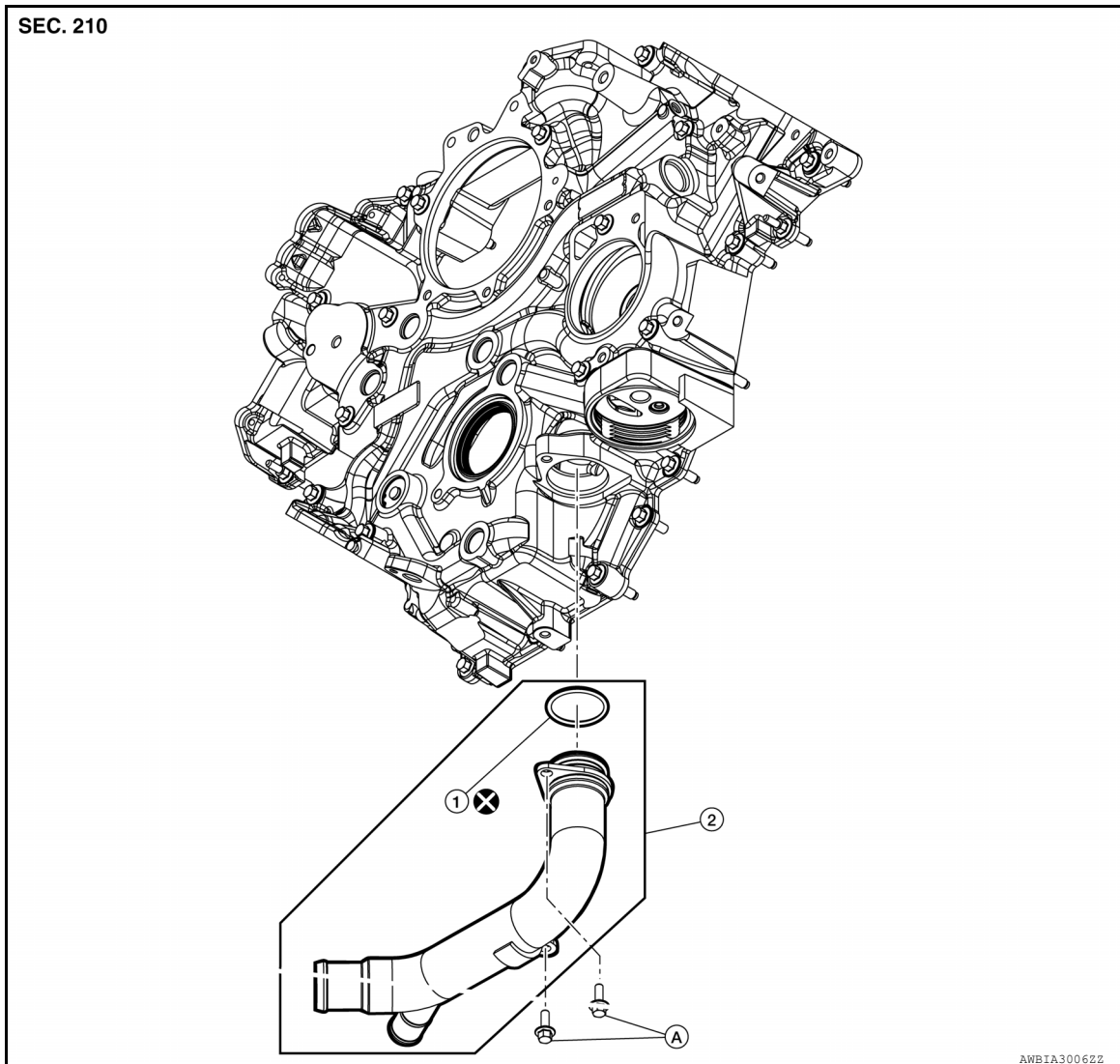
< REMOVAL AND INSTALLATION >

[CUMMINS 5.0L ]

## WATER INLET CONNECTION

Exploded View

INFOID:000000013237799



1. O-ring

2. Water inlet connection

A. Refer to INSTALLATION

## Removal and Installation

INFOID:000000013234164

### Removal

#### **WARNING:**

- Coolant is toxic and can be fatal if swallowed. Keep away from pets and children. If not reused, dispose of in accordance with local environmental regulations.
- To avoid the risk of personal injury, do not remove the radiator cap when the engine is hot. Serious burns could occur from high-pressure engine coolant escaping from the radiator. Wrap a thick cloth around the cap. Slowly turn it a quarter of a turn to release built-up pressure. Carefully remove the radiator cap by turning it all the way.

1. Drain engine coolant. Refer to [CO-41, "Changing Engine Coolant"](#).
2. Remove radiator hose (lower) from the water inlet connection.
3. Remove the coolant return line from the water inlet connection.

# WATER INLET CONNECTION

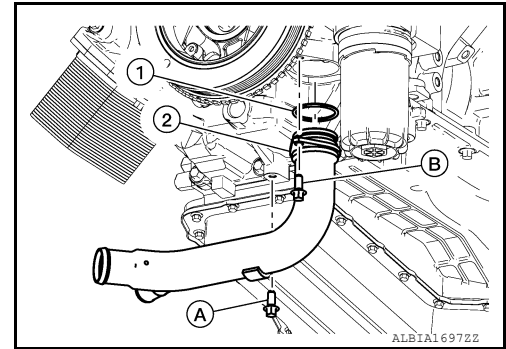
[CUMMINS 5.0L ]

## < REMOVAL AND INSTALLATION >

4. Remove bolt (A) securing water inlet bracket.
5. Remove the bolt (B) securing the water inlet (2) to the front cover.
6. Remove the water inlet (2) connection.

**WARNING:**

Do not reuse O-ring (1).



### Inspection After Removal

- Clean the water inlet connection and front gear cover mounting surface.
- Inspect the water inlet connection for damage. If damage is present, replace the water inlet connection.

**WARNING:**

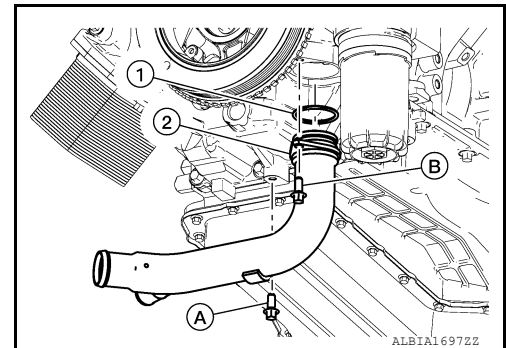
- **When using compressed air for cleaning, to avoid the risk of personal injury from flying debris and dirt:**
  - Do not exceed 30 psi (207 kPa)
  - Wear appropriate eye protection and protective clothing including gloves
- **To avoid the risk of injury to eyes and skin, when using caustic solutions, solvents, acids, or alkaline materials follow the manufactures recommendations for use and wear appropriate eye protection and protective clothing. Some of these materials are also flammable. To avoid risk of fire or burns, never smoke or allow sparks or flames (such as pilot lights, electrical switches, or welding equipment) in the work area. Avoid spilling onto a hot exhaust manifold which can cause a fire.**

### Installation

1. Lubricate the o-ring seal using water based lubricant, or equivalent, and install the o-ring on the water inlet connection.  
**NOTE:**  
Do **not** use a petroleum based lubricant on the water inlet seal.
2. Seat the o-ring (1) connection into the front cover and hand tighten bolts (A/B) to secure the water inlet connection (2) to the front cover.
3. Tighten bolts (A/B) to the specification shown.

**Bolts (A/B) : 18 N·m (1.8 kg-m, 13 ft-lb)**

4. Installation of remaining components is in the reverse order of removal.



# COOLING FAN BELT TENSIONER

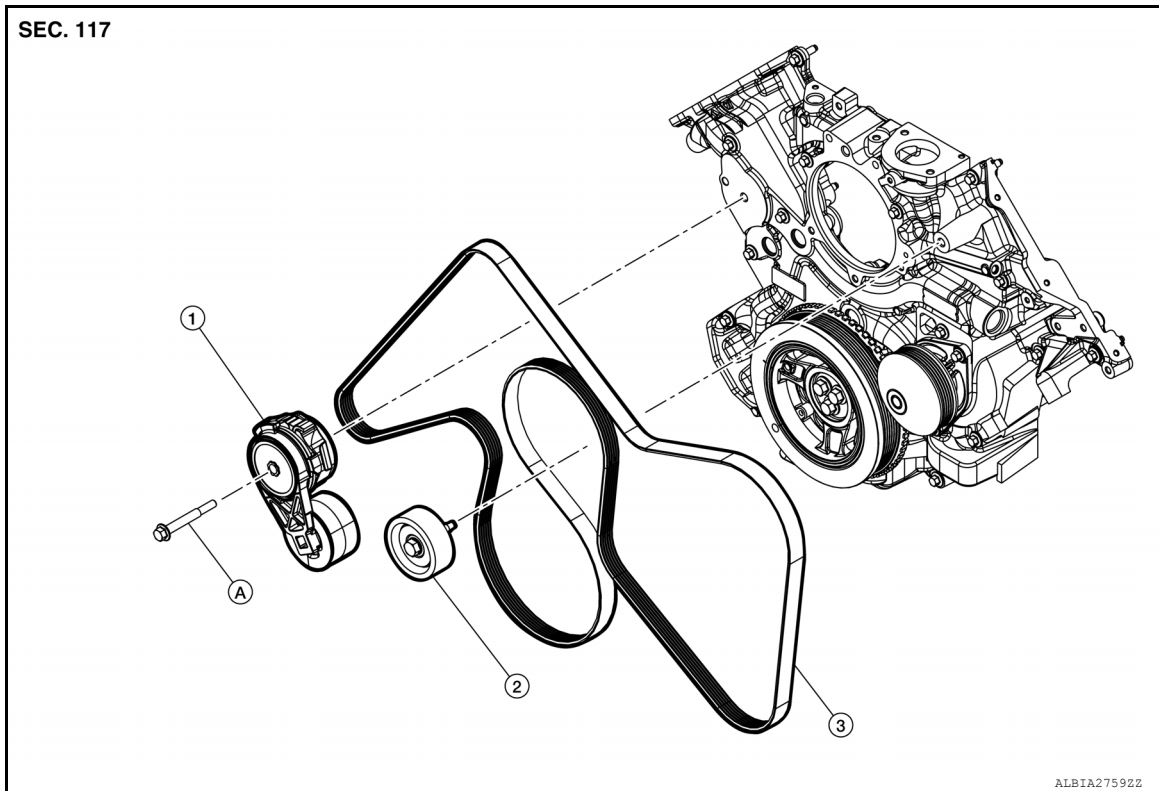
< REMOVAL AND INSTALLATION >

[CUMMINS 5.0L ]

## COOLING FAN BELT TENSIONER

Exploded View

INFOID:000000013237881



- 1. Belt tensioner
- 2. Pulley fan idler
- 3. Drive belt
- A. Refer to INSTALLATION

### Removal and Installation

INFOID:000000013234169

#### INSPECTION BEFORE REMOVAL

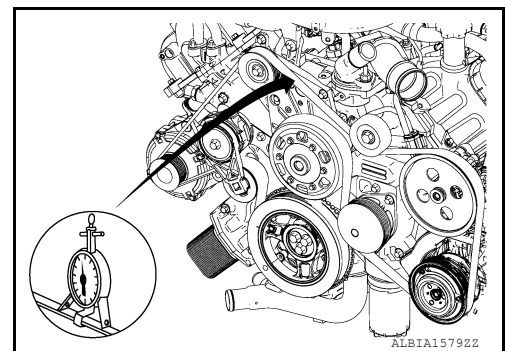
1. With the engine stopped and the belt installed, record the belt tension generated by the existing belt tensioner. Use a suitable tool to measure the tension in the drive belt.

**Belt tension minimum : 178 mm (40 in)**

**Belt tension maximum : 365 mm (82 in)**

**NOTE:**

If the measurement is out of the specified range, replace **only** the belt and perform the tension test again. If a new belt has been installed and the measurement is still outside of the specified range, replace the belt tensioner.

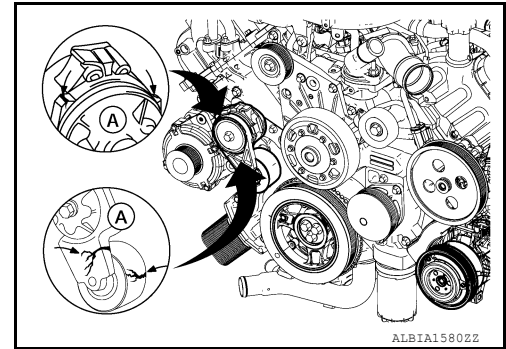


# COOLING FAN BELT TENSIONER

[CUMMINS 5.0L ]

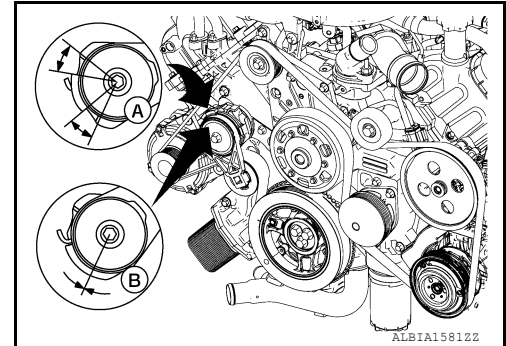
## < REMOVAL AND INSTALLATION >

2. With the engine stopped, check the cooling fan belt tensioner arm, pulley, and stops for cracks (A). If any cracks are found, the tensioner **must** be replaced.



3. With the belt installed, verify that neither cooling fan belt tensioner arm stop is in contact with the spring case stop (A). If either of the stops is touching:
  - Verify the correct belt part number is installed.
  - If the correct belt is installed, replace the belt. Refer to [EM-190. "Removal and Installation - Drive Belt"](#).

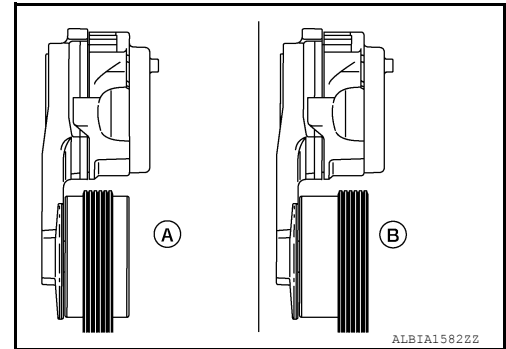
After replacing the belt, if the cooling fan belt tensioner arm stops are still in contact with the spring case stop (B), the cooling fan belt tensioner **must** be replaced.



4. Check the location of the drive belt on the cooling fan belt tensioner pulley. The belt should be centered (A) on, or close to the middle of, the pulley. Misaligned belts (B), either too far forward or backward, can cause belt wear, belt roll-offs, or increase uneven cooling fan belt tensioner bushing wear.

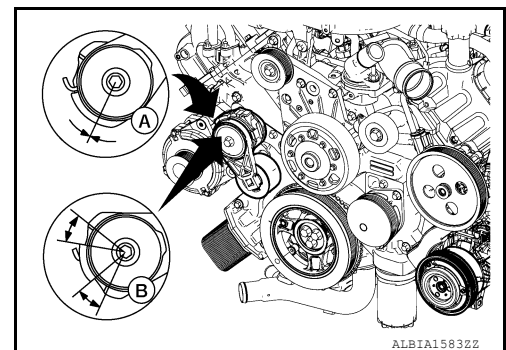
### NOTE:

Belt misalignment is **not always** a result of a malfunctioning or faulty cooling fan belt tensioner. Make sure the adjacent pulleys and mounting brackets are aligned and mounted correctly. Refer to [EM-189. "Inspection"](#).



5. Remove the drive belt. Refer to [EM-190. "Removal and Installation - Drive Belt"](#).

With the belt removed, verify that the cooling fan belt tensioner arm stop is in contact (A) with the spring case stop. If they are **not** touching (B), the cooling fan belt tensioner **must** be replaced.



## REMOVAL

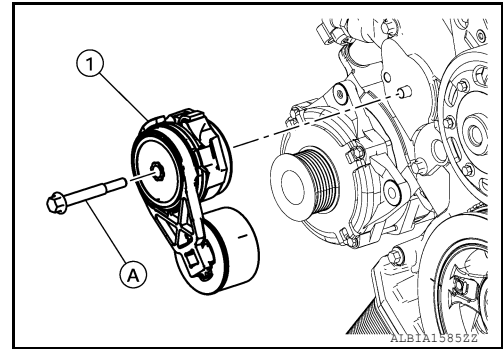
1. Disconnect the battery or batteries. Refer to [PG-174. "Battery Disconnect"](#).
2. Remove the front fender protector. Refer to [EXT-32. "Removal and Installation - Front Fender Protector"](#).
3. Remove the drive belt. Refer to [EM-190. "Removal and Installation - Drive Belt"](#).

# COOLING FAN BELT TENSIONER

## < REMOVAL AND INSTALLATION >

[CUMMINS 5.0L ]

4. Remove bolt (A) and then remove the cooling fan belt tensioner (1) from the front cover.



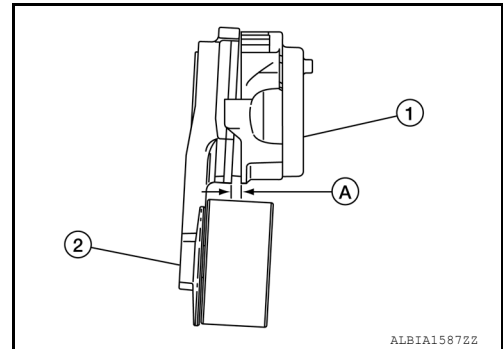
## INSPECTION AFTER REMOVAL

1. Inspect the cooling fan drive belt for reuse. Refer to [EM-189, "Inspection"](#).
2. Measure the clearance between the tensioner spring case (3) and the tensioner arm (2) to verify tensioner wear-out and uneven bearing wear. If the clearance at the measurement point 5 exceeds 3 mm (0.12 in) at any point, the tensioner is damaged and **must** be replaced as a complete assembly.

### NOTE:

Tensioners generally show a larger clearance gap (5) near the lower portion of the spring case, resulting in the upper portion rubbing against the tensioner arm.

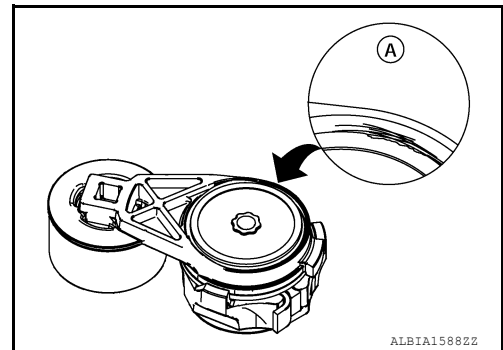
- (1) Tensioner cap
- (4) tensioner pulley



### NOTE:

**Always** replace the belt when a tensioner is replaced. However, it is **not** always necessary to replace a tensioner when a belt is replaced.

3. Inspect the tensioner for evidence of the tensioner arm contacting the tensioner cap. If there is evidence of the two areas making contact (A), the pivot tube bushing has malfunctioned and the tensioner **must** be replaced.



## INSTALLATION

Installation is in the reverse order of removal.

**Cooling fan belt tensioner bolt : 46 N·m (4.7 kg-m, 34 ft-lb)**



# PULLEY, FAN IDLER

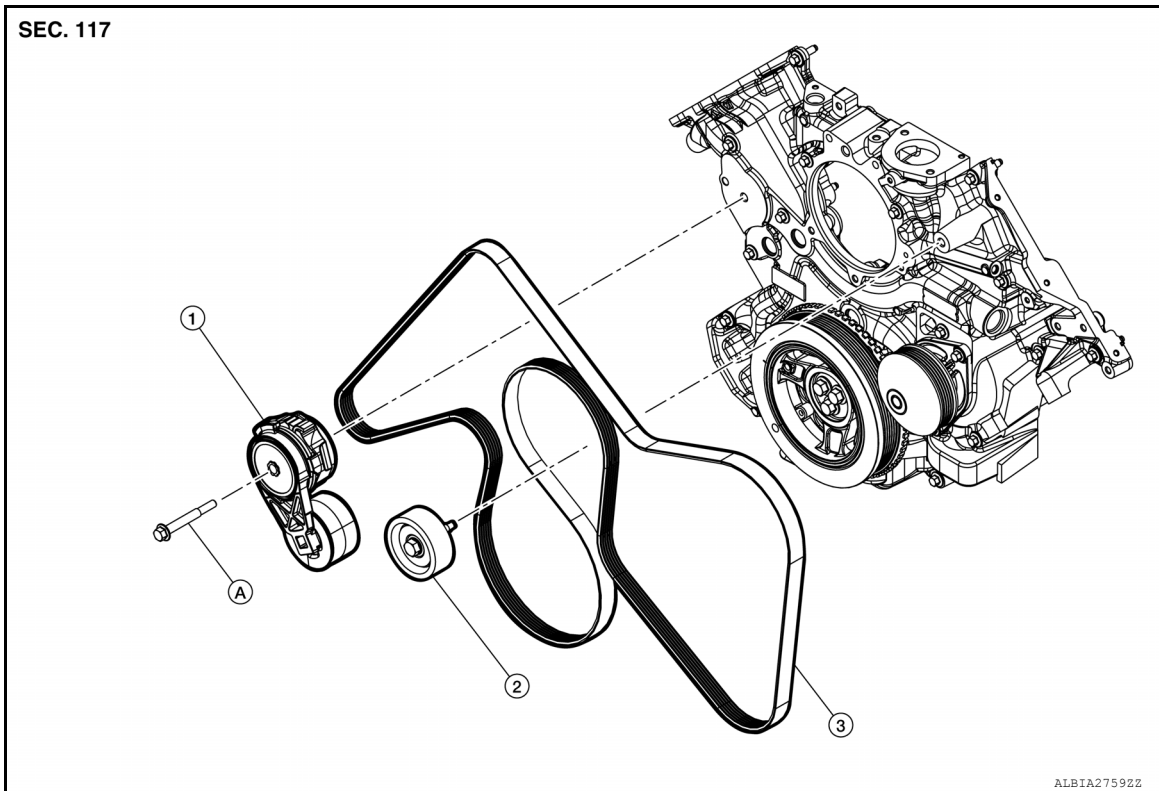
< REMOVAL AND INSTALLATION >

[CUMMINS 5.0L ]

## PULLEY, FAN IDLER

Exploded View

INFOID:000000013237882



1. Belt tensioner

2. Pulley, fan idler

3. Drive belt

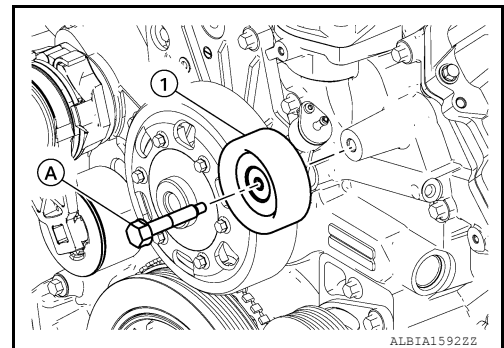
A. Refer to INSTALLATION

## Removal and Installation

INFOID:000000013234175

### REMOVAL

1. Disconnect the battery or batteries. Refer to [PG-174, "Battery Disconnect"](#).
2. Remove the front fender protector. Refer to [EXT-32, "Removal and Installation - Front Fender Protector"](#).
3. Remove the drive belt. Refer to [EM-190, "Removal and Installation - Drive Belt"](#).
4. Remove the idler pulley bolt (A) and remove the pulley, fan idler (1).



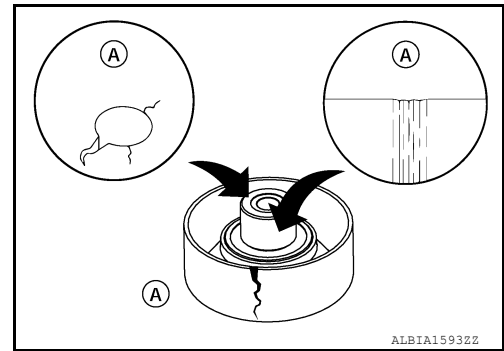
### INSPECTION AFTER REMOVAL

# PULLEY, FAN IDLER

[CUMMINS 5.0L ]

## < REMOVAL AND INSTALLATION >

- Inspect the pulley, fan idler for nicks, cracks (A), and/or other damage (A).
- Spin the pulley, fan idler to check for rough or noisy operation.
- Replace the pulley, fan idler if any damage is found.



## INSTALLATION

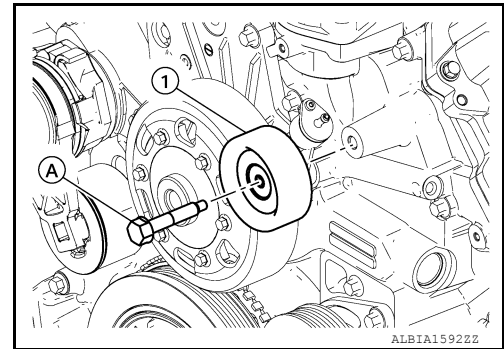
Installation is in the reverse order of removal.

### NOTE:

Operate the engine and check for proper operation.

**Pulley, fan idler bolt (A) : 34 N·m (3.5 kg-m, 25ft-lb)**

(1) : Pulley, fan idler



# WATER TRANSFER CONNECTION

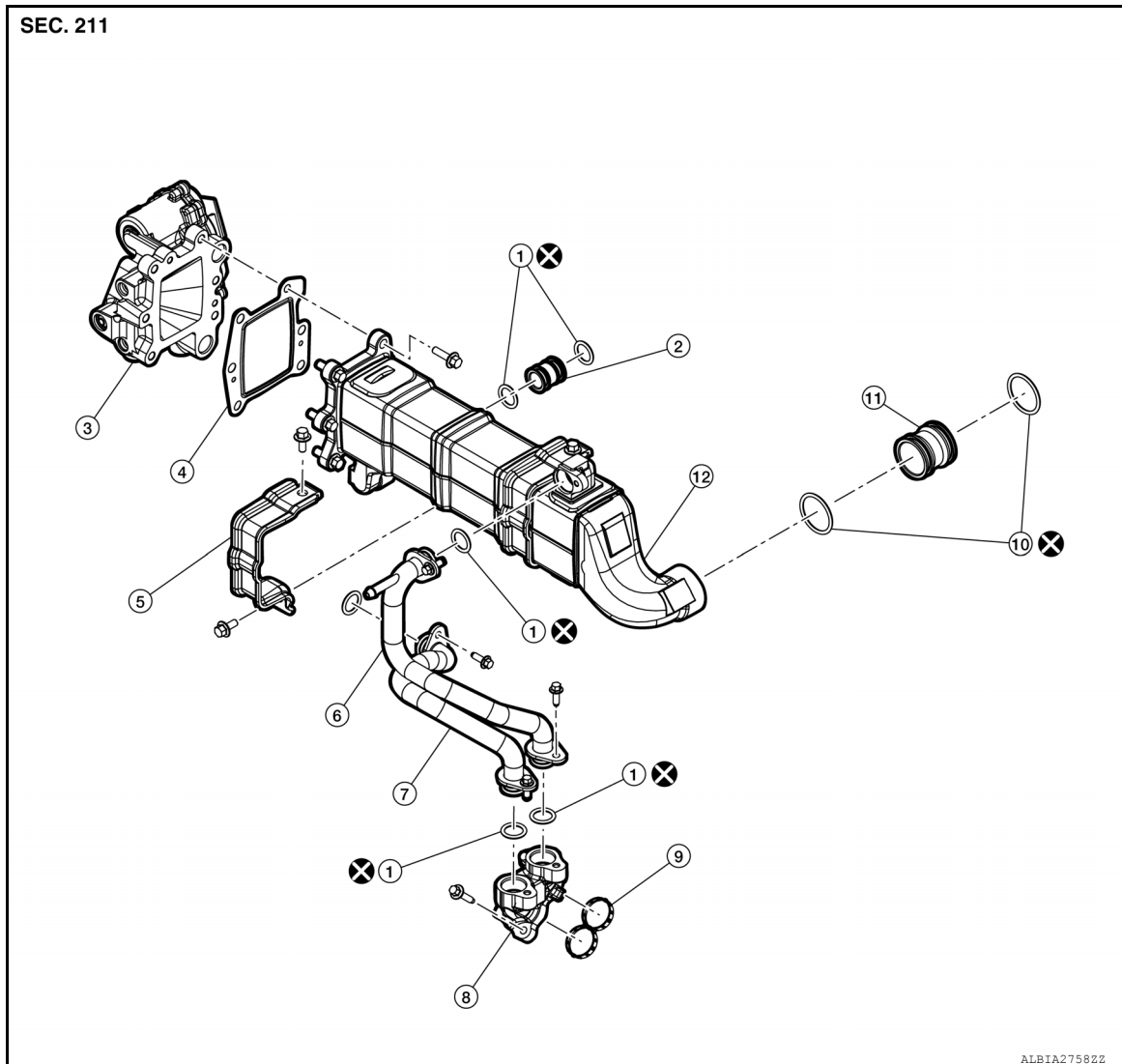
< REMOVAL AND INSTALLATION >

[CUMMINS 5.0L ]

## WATER TRANSFER CONNECTION

Exploded View

INFOID:000000013237927



- |                     |                              |                                     |
|---------------------|------------------------------|-------------------------------------|
| 1. O-ring           | 2. Tube connector            | 3. EGR valve                        |
| 4. EGR valve gasket | 5. EGR cooler bracket        | 6. Water outlet                     |
| 7. Water inlet      | 8. Water transfer connection | 9. Water transfer connection gasket |
| 10. O-ring          | 11. Tube connector           | 12. EGR cooler                      |

### Removal and Installation

INFOID:000000013234180

#### REMOVAL

1. Disconnect the battery or batteries. Refer to [PG-174, "Battery Disconnect"](#).
2. Drain the engine coolant. Refer to [CO-41, "Changing Engine Coolant"](#).

#### **WARNING:**

- To avoid the risk of personal injury, do not remove the radiator cap when the engine is hot. Serious burns could occur from high-pressure engine coolant escaping from the radiator. Wrap a thick cloth around the cap. Slowly turn it a quarter of a turn to release built-up pressure. Carefully remove the radiator cap by turning it all the way.
- Coolant is toxic and can be fatal if swallowed. Keep away from pets and children. If not reused, dispose of in accordance with local environmental regulations.



# WATER TRANSFER CONNECTION

< REMOVAL AND INSTALLATION >

[CUMMINS 5.0L ]

3. Remove the EGR coolant lines. Refer to [EM-275. "Removal and Installation - EGR cooler return line"](#).
4. Remove the bolts and remove the water transfer connection.

**CAUTION:**

**Do not reuse gasket.**

## INSPECTION AFTER REMOVAL

**WARNING:**

- To avoid the risk of injury to eyes and skin, when using caustic solutions, solvents, acids, or alkaline materials follow the manufactures recommendations for use and wear appropriate eye protection and protective clothing. Some of these materials are also flammable. To avoid risk of fire or burns, never smoke or allow sparks or flames (such as pilot lights, electrical switches, or welding equipment) in the work area. Avoid spilling onto a hot exhaust manifold which can cause a fire.
- when using compressed air for cleaning, to avoid the risk of personal injury from flying debris and dirt:
  - Do not exceed 30 psi (207 kPa).
  - Wear appropriate eye protection and protective clothing including gloves.
- Clean the water transfer connection with solvent and dry with compressed air.
- Inspect the water transfer connection for damage.
- Inspect the bores in the water transfer connection for damage.
- If damage is present, replace the water transfer connection.
- Clean the water transfer connection mounting surface on the front cover with solvent.
- Inspect the mating surface on the front cover for damage. If damage is present, replace the front cover. Refer to [EM-330. "Removal and Installation"](#).

## INSTALLATION

Installation is in the reverse order of removal.

**CAUTION:**

**Do not reuse gasket.**

**Water transfer connection bolts : 7.4 N·m (0.75 kg-m, 65 in-lb)**

**NOTE:**

Operate then engine to normal operating temperature and check for leaks and proper operation.

A  
CO  
C  
D  
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H  
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K  
L  
M  
N  
O  
P

## WATER OUTLET CONNECTION

< REMOVAL AND INSTALLATION >

[CUMMINS 5.0L ]

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### WATER OUTLET CONNECTION

#### Removal and Installation

INFOID:000000013094343

For removal and installation of the water outlet connection, refer to [CO-60. "Removal and Installation"](#).

# SERVICE DATA AND SPECIFICATIONS (SDS)

< SERVICE DATA AND SPECIFICATIONS (SDS)

[CUMMINS 5.0L ]

## SERVICE DATA AND SPECIFICATIONS (SDS)

### SERVICE DATA AND SPECIFICATIONS (SDS)

#### Standard and Limit

INFOID:0000000013094348

A

CO

#### ENGINE COOLANT CAPACITY (APPROXIMATE)

Unit: ℓ (US gal, Imp gal)

Coolant Capacity (with reservoir tank at max level)	16.5 (4-3/8, 3-5/8)
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C

#### THERMOSTAT

Standard Modulating Thermostat - Range	90.5° - 105.5°C (195° - 222°F)
Maximum Allowed Operating Temperature	118°C (245°)
Minimum Recommended Operating Temperature	71°C (160°F) or higher

D

E

#### RADIATOR

Unit: kPa (kg/cm<sup>2</sup>, psi)

Recommended Pressure Cap	118 (1.20, 17.1)
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F

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