

EX

SECTION

EXHAUST SYSTEM

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< PRECAUTION >

PRECAUTION

PRECAUTIONS

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

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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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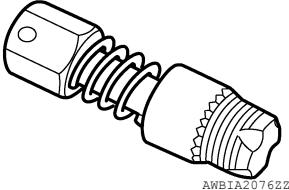
PREPARATION

PREPARATION

Special Service Tool

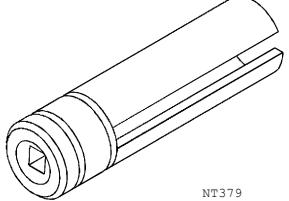
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The actual shape of the tools may differ from those illustrated here.

Tool number (TechMate No.) Tool name	Description
(J-43897-18) Oxygen sensor thread cleaner	<p>Reconditioning the exhaust system threads before installing a new oxygen sensor (Use with anti-seize lubricant shown below.)</p> <p>J-43897-18 (18 mm dia.)</p> 

Commercial Service Tool

INFOID:000000014418398

(TechMate No.) Tool name	Description
KV10117100 (J-36471-A) Heated oxygen sensor wrench	<p>Loosening or tightening heated oxygen sensor 2</p> <p>For 22 mm (0.87 in) hexagon nut</p> 
(—) Anti-seize lubricant (Permatex 133AR or equivalent meeting MIL specification MIL-A-907)	<p>Lubricating oxygen sensor thread cleaning tool when reconditioning exhaust system threads</p> 
(—) Power tool	Loosening nuts, screws and bolts

< PERIODIC MAINTENANCE >

PERIODIC MAINTENANCE

EXHAUST SYSTEM

Checking Exhaust System

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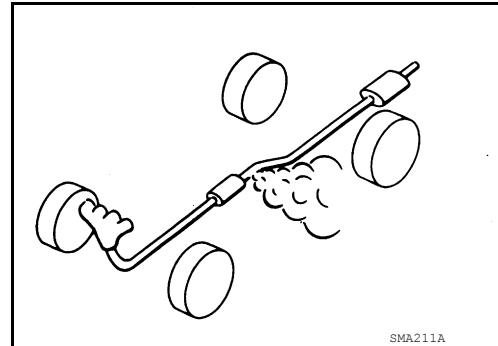
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Check exhaust downpipe, aftertreatment assembly, tailpipe and mounting for improper attachment, leaks, cracks, damage or deterioration.

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



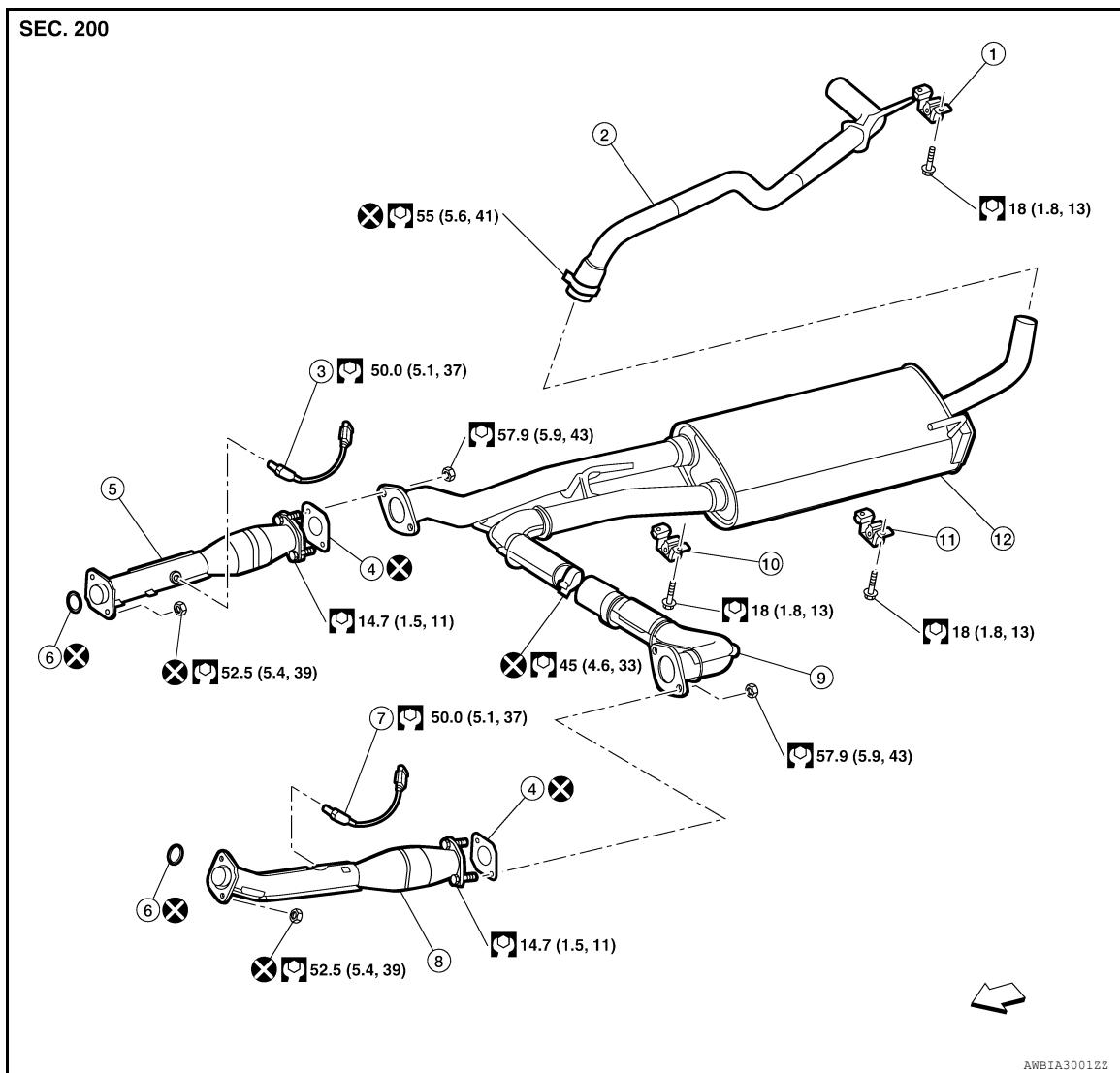
SMA211A

REMOVAL AND INSTALLATION

EXHAUST SYSTEM

Exploded View

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1. Tailpipe hanger bracket	2. Tailpipe	3. Heated oxygen sensor 2 (bank 2)
4. Gasket	5. Exhaust tube (bank 2)	6. Ring gasket
7. Heated oxygen sensor 2 (bank 1)	8. Exhaust tube (bank 1)	9. Center exhaust tube
10. Muffler hanger bracket front	11. Muffler hanger bracket rear	12. Main muffler

Front

Removal and Installation

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WARNING:

- Perform the operation with the exhaust system fully cooled. The system will be hot just after the engine stops.
- Be careful not to cut your hand on the heat insulator edge.

CAUTION:

- Be sure to use Genuine NISSAN exhaust system parts or equivalents which are specially designed for heat resistance, corrosion resistance, and shape.

< REMOVAL AND INSTALLATION >

REMOVAL

- Remove exhaust system components using power tool.
- Remove heated oxygen sensor 2 using suitable tool as needed.

INSTALLATION

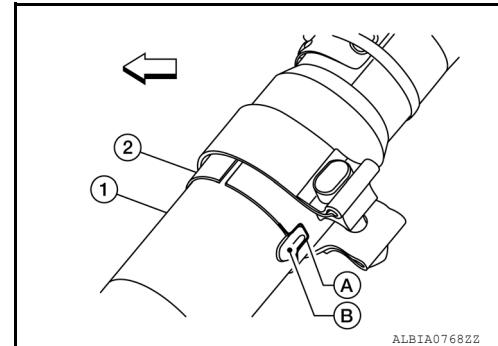
Installation is in the reverse order of removal.

CAUTION:

- Be careful when installing tailpipe (2) to main muffler (1). Align and seat cutout (A) to protrusion (B) fully. Over-installation may cause damage to tailpipe (2).



: Front



- Do not reuse gaskets.
- Do not reuse ring gaskets.
- Before installing a heated oxygen sensor 2, clean and lube the exhaust tube threads using Tool.

Oxygen sensor thread cutter : — (J-43897-18)

- Discard any heated oxygen sensor 2 which has been dropped from a height of more than 0.5 m (19.7 in) onto a hard surface such as a concrete floor; replace with a new one.
- Do not over-tighten the heated oxygen sensor 2. Doing so may damage the heated oxygen sensor 2, resulting in the MIL coming on.
- If any insulator is badly deformed, repair or replace it. If deposits such as mud pile up on the insulators, clean and inspect them.
- Temporarily tighten the nuts on the front and rear of the left front exhaust tube and right front exhaust tube. Check each part for interference with other components, and then tighten the nuts and bolts to specification.

INSPECTION AFTER INSTALLATION

- With the engine running, check exhaust tube joints for exhaust gas leaks and unusual noises.
- Check to ensure that mounting brackets and mounting rubbers are installed properly and free from undue stress. Improper installation could result in excessive noise and vibration.
- Position the mounting rubbers onto the mounting surface. Do not position the mounting rubbers to contact the mounting bracket.

< PRECAUTION >

PRECAUTION

PRECAUTIONS

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

INFOID:0000000014418402

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 Airbag Diagnosis Sensor Unit or other Airbag 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.

< PREPARATION >

PREPARATION**PREPARATION****Commercial Service Tool**

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(TechMate No.) Tool name	Description
(—) Anti-seize lubricant (Permatex 133AR or equivalent meeting MIL specification MIL-A-907)	 <p>AEM489</p> <p>Lubricating oxygen sensor thread cleaning tool when reconditioning exhaust system threads</p>
(—) Power tool	 <p>PIIB1407E</p> <p>Loosening nuts, screws and bolts</p>

< SYSTEM DESCRIPTION >

SYSTEM DESCRIPTION

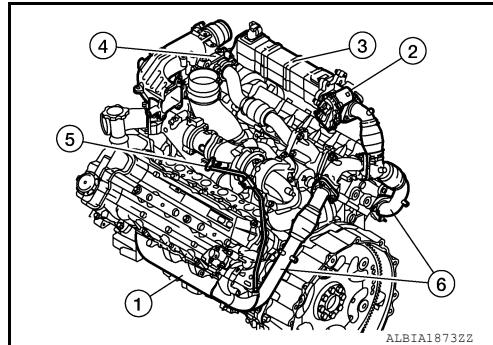
EXHAUST SYSTEM

System Description

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GENERAL INFORMATION

1. On an engine with Exhaust Gas Recirculation (EGR), the air intake system and exhaust system components work together to provide the correct amount of intake charge flow into the engine. This overview covers the major components of the exhaust system.
 - Exhaust manifold (1)
 - EGR valve (2)
 - EGR cooler (3)
 - EGR bypass valve (4)
 - Exhaust pressure sensor (5)
 - Exhaust bank up pipes (RH/LH) (6)
 - Rotary Turbine Control Valve (RTCV) (not shown).

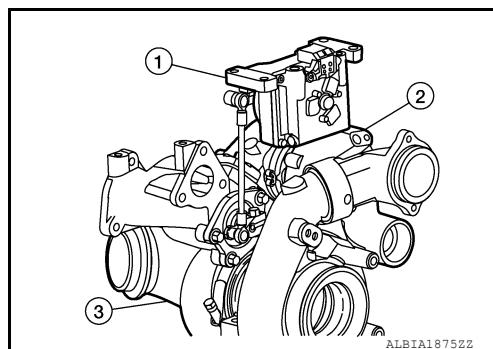
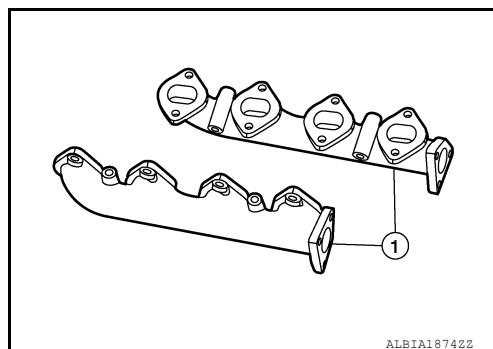


NOTE:

Use the following procedure for intake air components. Refer to [EM-182, "INTAKE AIR SYSTEM : Overview"](#).

This overview also covers the aftertreatment system components located off the engine in the exhaust system.

2. The exhaust manifold (1) routes individual cylinder exhaust ports toward the rear of the engine and connects to the exhaust bank up pipes (RH/LH). The exhaust bank up pipes (RH/LH) connect both exhaust manifolds to the rotary turbine control valve and the low-pressure turbocharger housing. Exhaust pressure in the exhaust manifold is measured by an exhaust pressure sensor. To maximize the longevity of the exhaust pressure sensor, the sensor does not mount directly in the exhaust manifold. The exhaust pressure sensor is connected by a tube to the exhaust bank up pipes (RH/LH) and the sensor is located on the intake manifold.
3. The rotary turbine control valve (1) controls the exhaust flow to the low-pressure (2) and high-pressure turbochargers (3).



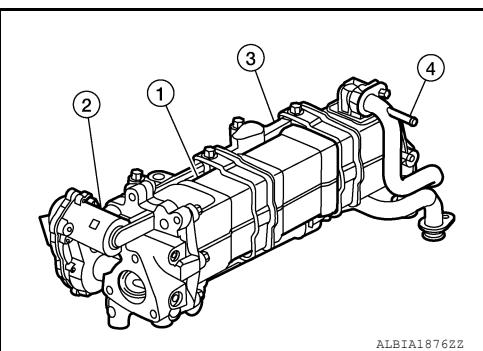
EXHAUST SYSTEM

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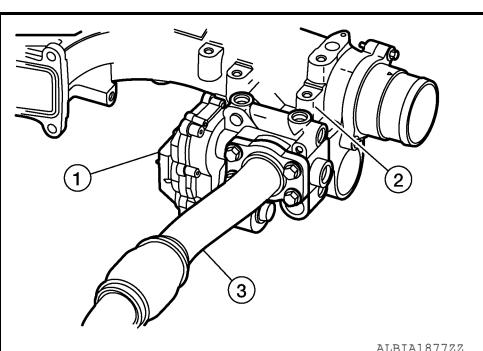
< SYSTEM DESCRIPTION >

4. The EGR cooler (1) cools the exhaust gases flowing after the EGR valve (2). The EGR cooler is mounted above the right exhaust manifold and is supported by the EGR cooler mounting bracket (3) attached to the cylinder head.

The EGR cooler has a de-aeration port (4) near the exhaust outlet of the EGR cooler. This port prevents air from being trapped in the cooler during coolant filling and engine operation by continuously flowing coolant to the reservoir tank of the vehicle cooling system.



5. The EGR bypass valve (1) is mounted on the air intake connection (2) and is connected to the exhaust bank up pipes (RH/LH) via the EGR bypass tube (3). The valve allows EGR gases to bypass the EGR cooler.

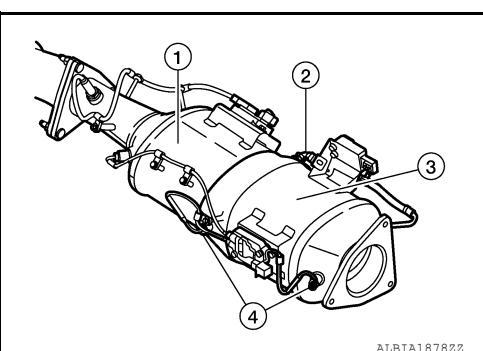


6. The Diesel Particulate Filter (DPF) system is used to reduce particulate emissions and is composed of four main components:

- Diesel Oxidation Catalyst (DOC) (1)
- DPF differential pressure sensor (2)
- DPF (3)
- DPF temperature sensors (4)

NOTE:

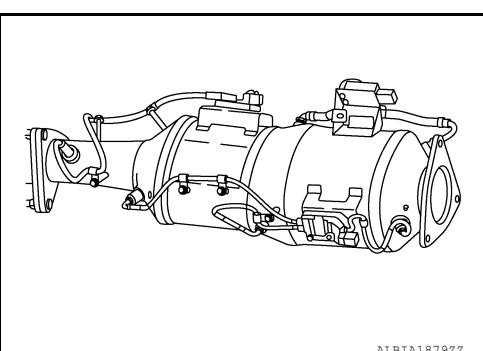
The DPF temperature sensor module and temperature sensor probes are not serviceable separately and must be replaced as an assembly.



7. Passive regeneration occurs when the exhaust temperatures are naturally high enough to oxidize the soot collected in the diesel particulate filter faster than the soot is collected.

Passive regeneration typically occurs when the temperature of the diesel particulate filter is above 300°C (572°F). This occurs during highway driving or when driving with heavy loads.

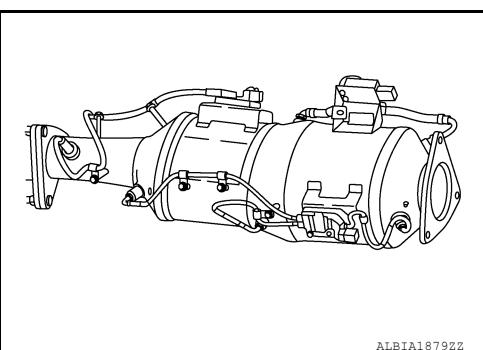
Since passive regeneration occurs naturally, it is considered to be normal engine operation. No fuel is added to the exhaust stream during passive regeneration.



8. Active regeneration occurs when the exhaust temperatures are not naturally high enough to oxidize the soot collected in the Diesel Particulate Filter (DPF) faster than it is collected.

Active regeneration requires assistance from the engine in order to increase the exhaust temperature. This is typically done by injecting a small amount of diesel fuel into the exhaust stream, which is then oxidized by the diesel oxidation catalyst. The oxidation of this additional fuel raises the exhaust temperatures to approximately 550°C (1,022°F), which is needed to regenerate the DPF.

For active regeneration to occur, the Engine Control Module (ECM) must detect that the DPF restriction has reached a speci-



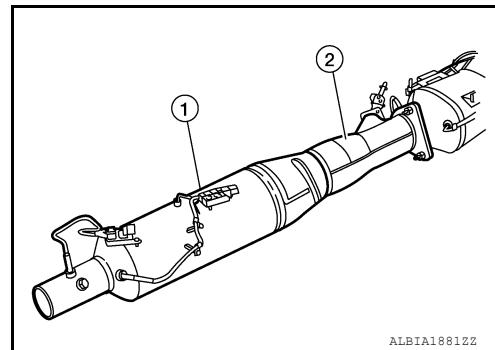
< SYSTEM DESCRIPTION >

fied limit. Once this limit is reached, the engine will alter its operation in order to create exhaust temperatures high enough to actively regenerate the DPF.

ACTIVE/STATIONARY REGENERATION

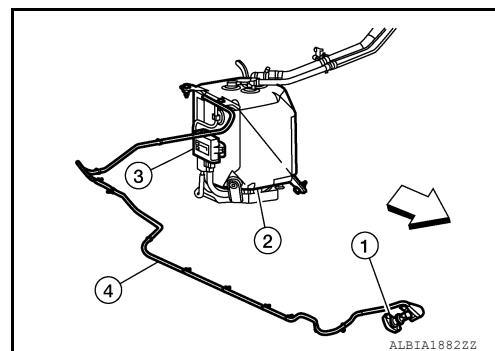
- During active regeneration, the engine ECM monitors the exhaust temperatures before and after the diesel particulate filter and maintains the temperatures in a range of approximately 482 to 649°C (900 to 1,200°F). The quantity of fuel used for aftertreatment injection will vary as the temperature is controlled within these limits.
- The temperatures achieved during active regeneration are typically higher than those achieved during passive regeneration. The conversion of soot to carbon dioxide occurs much faster as temperatures increase.
- A typical active regeneration event will take approximately 20 to 40 minutes to complete while the vehicle is operating. The vehicle operator may notice additional turbocharger noise during this time.
- The frequency at which an engine will require an active regeneration varies greatly from application to application. In general, vehicles with a low vehicle speed, such as urban vehicles or a low-load duty cycle, will require more active regeneration events than a heavily loaded vehicle or a vehicle with a highway speed duty cycle.
- The engine ECM also contains a time-based feature for active regenerations, which is used to verify correct operation when the vehicle duty cycle is typically high enough that active regeneration events are not necessary.
- If the engine has not completed an active regeneration within the last 24 hours of operation, the engine ECM will call for a time-based active regeneration event.
- The 24-hour timer resets each time the ECM detects that an active regeneration event has completed.
- Under some operating conditions, such as low-speed, low-load, or stop-and-go duty cycles, the engine may not have enough opportunity to regenerate the diesel particulate filter during normal vehicle operation. When this occurs, the engine illuminates the diesel particulate filter lamp to inform the vehicle operator that assistance is required, typically recommending to alter the duty cycle to a highway speed duty cycle for approximately 30 minutes. If the lamp persists after altering the duty cycle, the vehicle will require a stationary regeneration. Refer to [EC-888, "Aftertreatment DPF Regeneration Test"](#).
- If the engine needs to initiate an active regeneration event, but the vehicle speed is zero and the engine is at low idle speed, the engine will not immediately enter an active regeneration event. The ECM will wait until the engine speed increases to begin the active regeneration event. Once the active regeneration begins, and the exhaust temperatures have increased, the engine will maintain the active regeneration event, even if the vehicle speed returns to zero and the engine speed returns to idle.
- If the engine needs to initiate an active regeneration event, but the vehicle speed is zero, the engine will not immediately enter an active regeneration event. The ECM will wait until the vehicle speed is above 8 km/h (5 mph) before beginning the active regeneration event. Once the active regeneration begins and the exhaust temperatures have increased, the engine will maintain the active regeneration event, even if the vehicle speed returns to zero and the engine speed returns to idle. However, the temperatures being targeted are lowered if the vehicle speed drops below 8 km/h (5 mph).
- When the vehicle speed is greater than 8 km/h (5 mph), an active regeneration event can occur at any time.
- If a vehicle has a low vehicle speed or stop-and-go duty cycle, the engine may not have enough opportunity to perform or complete an active regeneration event. An engine in this situation can illuminate the diesel particulate filter lamp on a frequent basis, signaling the need for assistance.
- The aftertreatment warm-up feature activates during periods of extended idle time.
- The purpose of this feature is to increase the temperature of the aftertreatment system to remove any water condensation that has built up during the idle time.
- After the ECM detects that the exhaust temperature entering the aftertreatment system has been below 150°C (302°F) for approximately 2 hours, the ECM automatically increases the engine speed to between 1,000 and 1,100 rpm for approximately 10 minutes.
- For the aftertreatment warm-up feature to activate, the following conditions must be met:
 - The brake pedal is released.
 - The transmission is in N (neutral) or P (park).
 - The vehicle speed is zero.
 - The accelerator pedal is released.
- The aftertreatment warm-up feature is similar to stationary service regeneration because it uses the same engine speeds and inputs. However, the aftertreatment warm-up feature does not require aftertreatment injection as it does not require the higher temperatures that are needed during stationary service (parked) regeneration.
- Increasing the exhaust temperature entering the aftertreatment system to above 150°C (302°F) for approximately 10 minutes allows the aftertreatment warm-up to deactivate. This can be done by allowing the engine to operate in this condition for approximately 10 minutes or by driving the vehicle.

- The SCR (Selective Catalyst Reduction) system is designed to reduce the mono-nitrogen oxides (NOx) emissions from the engine exhaust into nitrogen and water. This is accomplished by two main systems: the SCR dosing system and the SCR exhaust system.
 - The SCR exhaust system mixes and converts the Diesel Exhaust Fluid (DEF) to eliminate unwanted gases from being released into the atmosphere. This system includes the SCR catalyst (1) and the decomposition tube (2).



- The SCR dosing system monitors and injects DEF into the exhaust stream. The SCR dosing system is comprised of the DEF dosing valve (1), DEF dosing unit (2) and tank, DEF controller (3), and DEF line (4).

↖ : Front



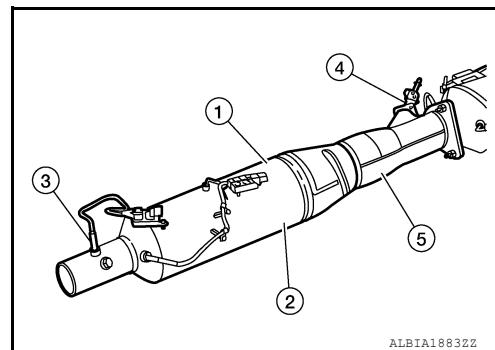
- The SCR is designed to reduce NOx emissions. The decomposition reactor tube is integrated into the SCR.

The DEF dosing valve is mounted to the decomposition reactor tube. The decomposition reactor tube contains a mixer to help DEF mists distribute evenly in the exhaust stream to convert DEF into ammonia. The main components of the decomposition reactor tube and SCR Assembly:

- SCR temperature sensor module (1)
- SCR catalyst (2)
- Outlet NOx sensor (3)
- DEF dosing valve (4)
- Decomposition tube (5)

NOTE:

The SCR temperature sensor module and temperature sensor probes are not serviceable separately and must be replaced as an assembly.



- During initial cold start-up, the engine will go into SCR warm-up condition. This condition will sound and act like an active diesel particulate filter regeneration. The SCR catalyst will need to have a temperature of over 150°C (302°F) in order to properly convert NOx in the exhaust stream.

The NOx sensors at the inlet of the DOC and outlet of the SCR catalyst will monitor the NOx output of the exhaust system and relay the information back to the ECM.

- DEF Controller:

- The controller has a purpose similar to the engine ECM. It will command the DEF dosing unit when to purge, prime, and maintain dosing while monitoring ambient conditions. The DEF controller also controls any necessary heating to defrost the dosing system. Any faults that are viewed by the DEF controller are communicated to the ECM via the J1939 data link.

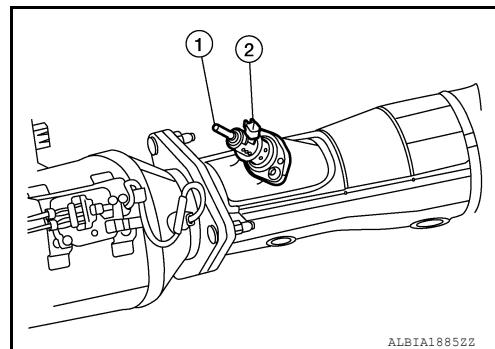
- DEF Dosing Valve:

EXHAUST SYSTEM

[CUMMINS 5.0L]

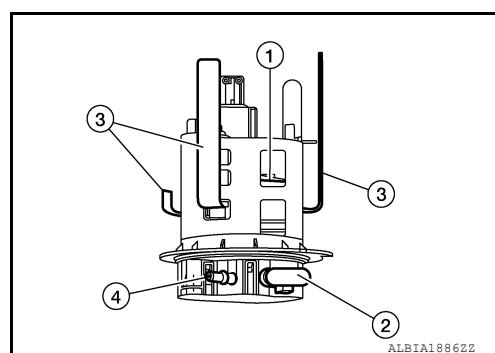
< SYSTEM DESCRIPTION >

- The DEF dosing valve is controlled by the ECM and sprays the correct amount of DEF into the exhaust stream.
- DEF supply line port (1)
- DEF dosing valve harness connector (2)



7. DEF Dosing Unit:

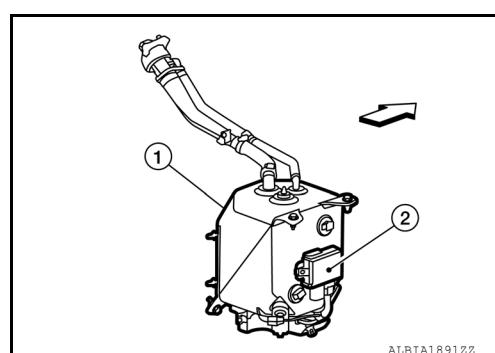
- The DEF dosing unit is the pumping mechanism of the dosing system. The DEF dosing unit draws DEF through its suction port and pressurizes it. The DEF dosing unit then filters the DEF, which is eventually sprayed into the exhaust stream via the pressure port. Any unused DEF is returned to the DEF tank through the return port.
- The main components of the DEF dosing unit:
 - DEF dosing unit filter (internal) (1)
 - Electrical connector (2)
 - Electrical heater (3)
 - Outlet port (4)



8. DEF Tank:

- The DEF tank (1) is designed to store DEF and report DEF tank level and DEF tank temperature to the DEF controller (2).
- If the tank level becomes too low, it will set P-codes followed by a power derate. Refer to [EX-75, "Removal and Installation"](#).
- If the tank is filled with the incorrect fluid (anything other than DEF), the aftertreatment system will fail to operate correctly. A fault will become active and power derates will follow.
- For DEF fluid recommendations. Refer to [EC-2000, "DEF"](#).

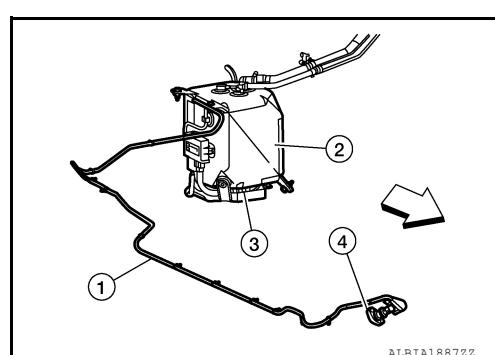
◀ : Front



9. DEF Lines:

- The DEF line (1) carries the DEF to and from the DEF tank (2), DEF dosing unit (3), and DEF dosing valve (4).
- DEF will fill the lines during a prime or operating state and then be removed in a purge state to prevent freezing of the lines.
- DEF line connectors, length, and design will vary by vehicle manufacturer. The DEF lines incorporate electrically heated elements.

◀ : Front



The SCR system is comprised of many components, but requires a minimal amount of servicing or operator intervention. The SCR system is comprised of four main states: priming, dosing, purging, and heating.

Priming State

- Once the SCR reaches a temperature of 150°C (302°F), the DEF controller will command the DEF dosing unit to start its priming process. The DEF dosing unit will draw DEF from the DEF tank, pressurize the DEF, and then filter the DEF to the DEF dosing valve. The DEF dosing valve will open and close to remove any air from the system. Once the system is able to build up pressure and has removed most of the air bubbles from the DEF lines, the DEF dosing system is capable of dosing.

Dosing State

< SYSTEM DESCRIPTION >

- The DEF dosing valve will open and spray DEF in the exhaust stream when the engine ECM aftertreatment calibration limits are met. The DEF will then be chemically altered by the SCR catalyst to clean the exhaust gases. As long as the dosing system is in the dosing state, the DEF dosing unit will continue to run, regardless if the DEF dosing valve is or is not spraying DEF. DEF dosing rates are dependent on vehicle duty cycle. The dosing rates are not necessarily constant under most duty cycles. The DEF dosing valve will pulse the demanded amount of DEF into the exhaust stream. Any DEF that is not used by the DEF dosing valve is returned to the DEF tank.

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Purging State

- When the operator keys OFF, the dosing system will shut itself down with a purge cycle to prevent DEF from being left in the system, and in cold climates, potentially freezing. An audible click and pumping sound will be heard from the DEF dosing unit when it is in a purge cycle. The DEF dosing unit will slide its internal reverting valve and cause a change in the flow direction of the DEF. The DEF dosing unit will pull all of the DEF out of the DEF dosing valve and pressure line, then return the unused DEF to the DEF tank. In this process, the DEF dosing valve will open, eliminating the vacuum created in the lines for a more complete purge process. After a complete purge, the majority of the system will be free of any remaining DEF. If the main power to the DEF controller is removed, via battery cut off or other means, before the purging state is completed, an internal fault will be logged in the ECM. The incomplete purge counter can be viewed in CONSULT.

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Heating State

- DEF freezes at -11°C (12°F). If the operator starts the engine in a cold climate, the dosing heating state will be activated. If the ambient air temperature sensor reads ambient conditions are below -4°C (25°F), the DEF controller will command the dosing system to go into the defrost state. The DEF dosing unit will turn on its internal heater to defrost any remaining DEF that still may be inside it. The heated DEF lines will also be commanded on. The DEF dosing system will not prime until every component is completely defrosted. If ambient conditions continue to be cold after the system has primed, the DEF controller will command a maintenance heating feature to prevent the DEF dosing system from refreezing. This feature will cycle the heating on and off to the DEF lines, DEF tank, and DEF dosing unit.

INFOID:000000014418405

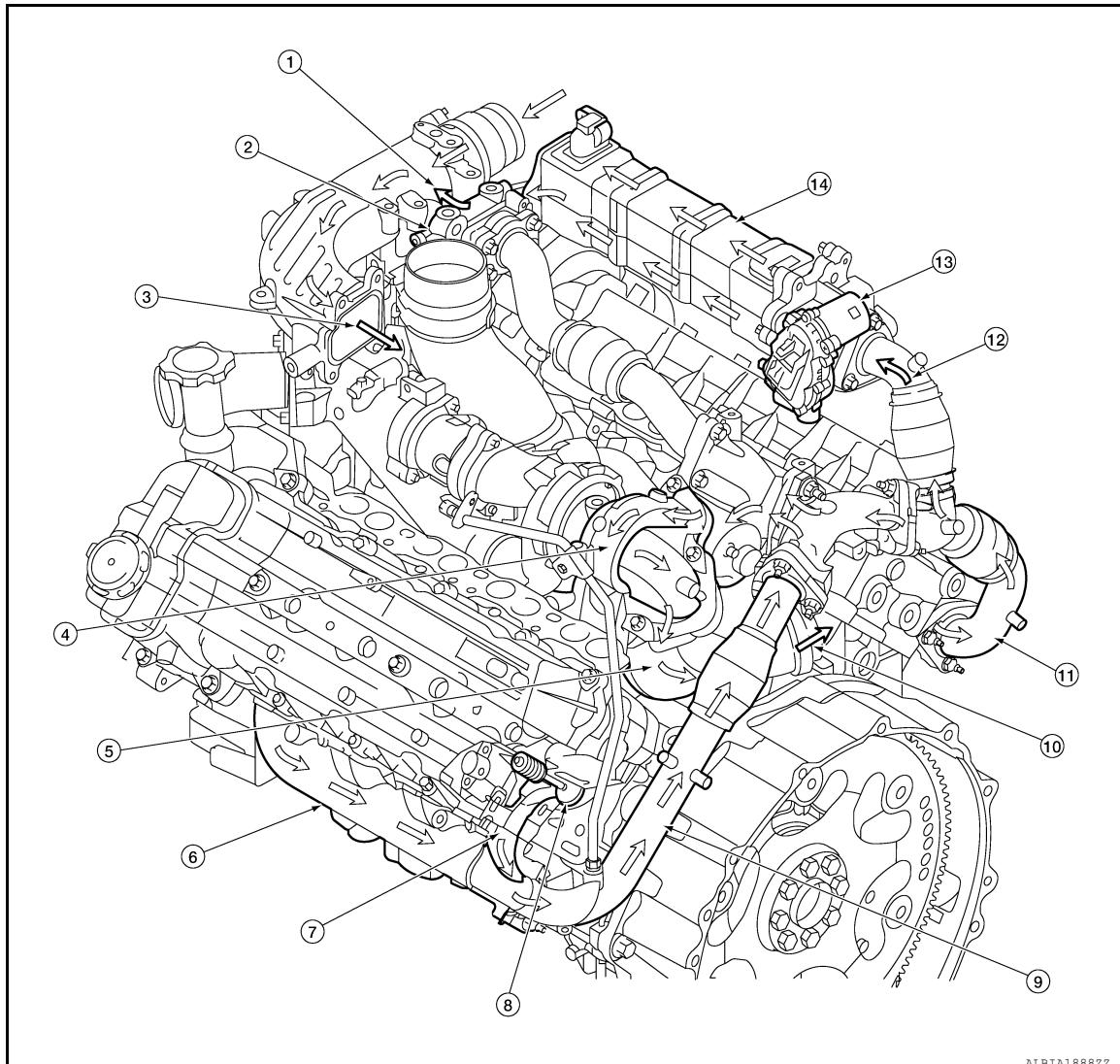
Exhaust Schematic

EXHAUST FLOW DIAGRAM

EXHAUST SYSTEM

< SYSTEM DESCRIPTION >

[CUMMINS 5.0L]

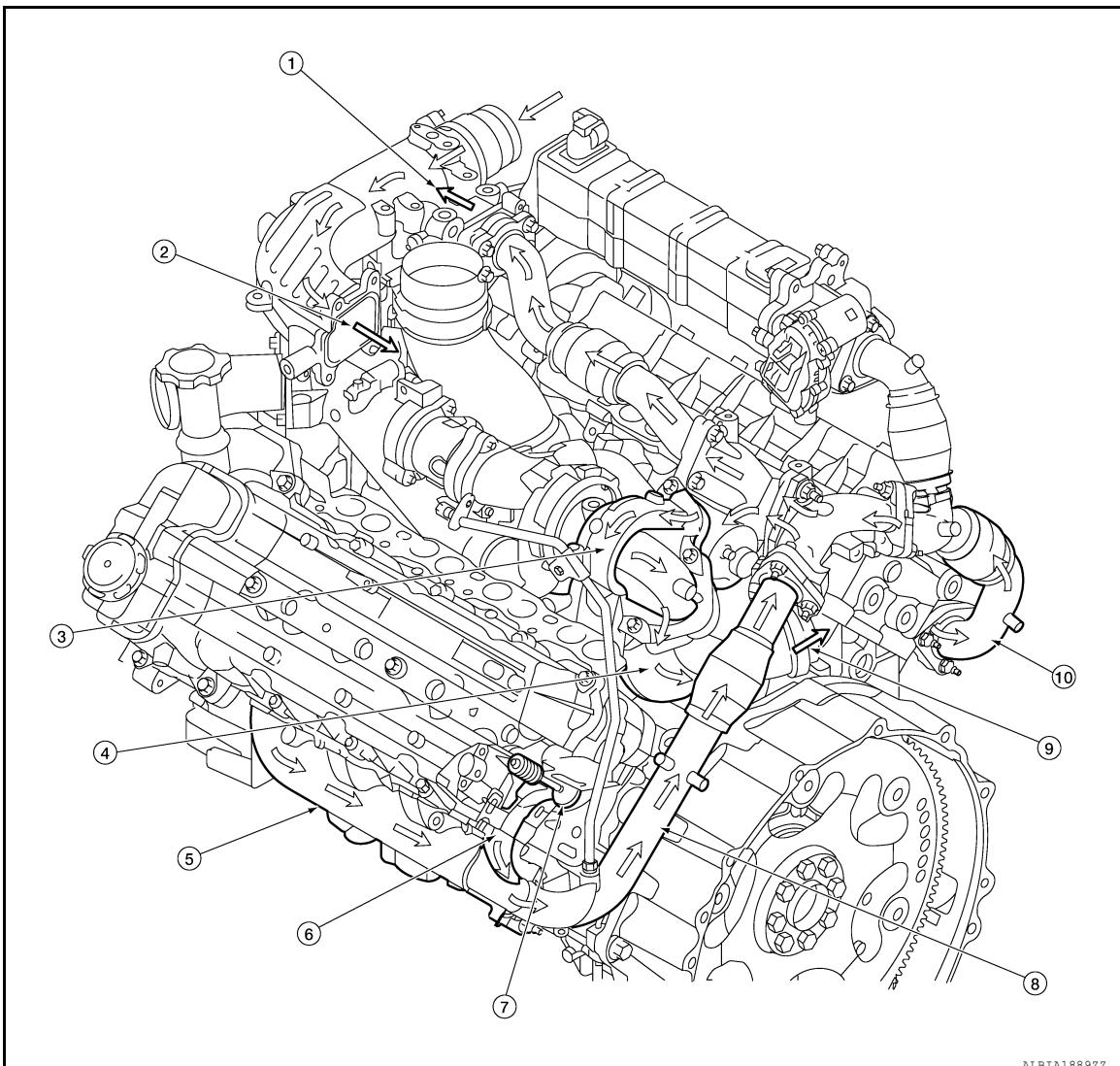


1. EGR cooled exhaust flow to intake connection
2. Exhaust Gas Recirculation (EGR) bypass valve assembly closed (air flows to low-pressure turbocharger and EGR valve)
3. Cooled exhaust flow to intake manifold
4. High-pressure turbocharger
5. Low-pressure turbocharger
6. Left bank exhaust manifold
7. Exhaust port
8. Exhaust valve
9. Left bank up pipe
10. Exhaust outlet to Diesel Oxidation Catalyst (DOC)
11. Right bank up pipe
12. Exhaust flow to EGR valve
13. EGR valve
14. EGR cooler

EXHAUST SYSTEM

[CUMMINS 5.0L]

< SYSTEM DESCRIPTION >

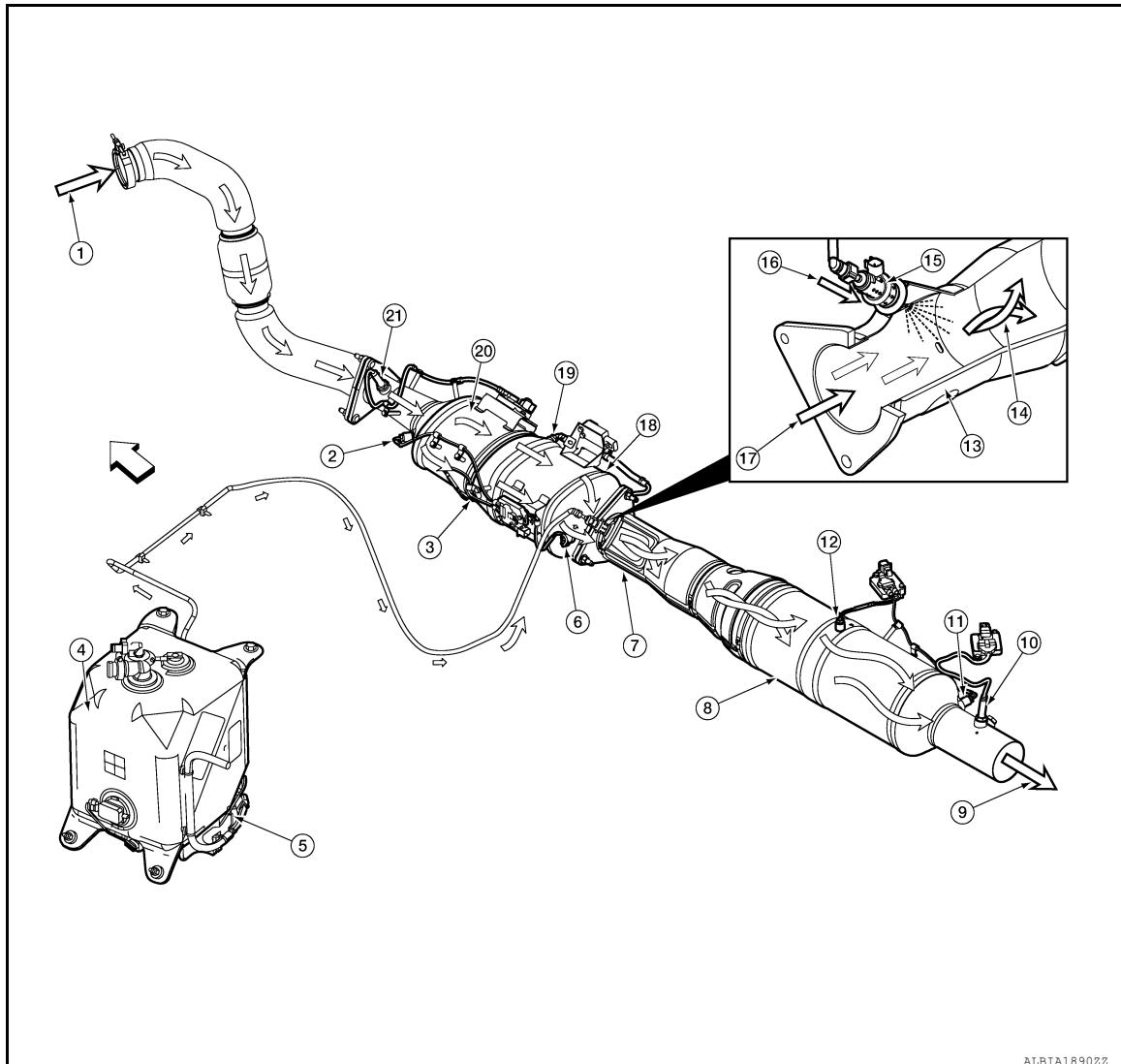


1. EGR bypass valve assembly open (air flows to the high-pressure turbocharger and intake connection)
2. Exhaust flow to intake manifold
3. High-pressure turbocharger
4. Low-pressure turbocharger
5. Left bank exhaust manifold
6. Exhaust port
7. Exhaust valve
8. Left bank up pipe
9. Exhaust outlet to DOC
10. Right bank up pipe

EXHAUST SYSTEM

< SYSTEM DESCRIPTION >

[CUMMINS 5.0L]



ALBIA1890ZZ

1. Exhaust gas flow from turbocharger	2. DOC intake temperature sensor	3. Diesel Particulate Filter (DPF) intake temperature sensor
4. Diesel Exhaust Fluid (DEF) tank	5. DEF pump	6. DPF outlet temperature sensor
7. Decomposition tube	8. SCR catalyst	9. Exhaust flow exiting the aftertreatment system
10. Outlet NOx sensor	11. SCR outlet temperature sensor	12. Selective Catalytic Reduction (SCR) intake temperature sensor
13. Decomposition tube	14. Exhaust gas and DEF mixture	15. DEF dosing valve
16. DEF supply from DEF tank	17. Exhaust gas flow from the DPF	18. DPF
19. DPF pressure sensor	20. DOC	21. Inlet mono-nitrogen oxides (NOx) sensor

← : Front

< PERIODIC MAINTENANCE >

PERIODIC MAINTENANCE

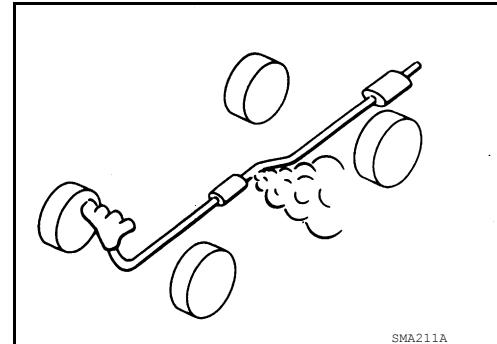
EXHAUST SYSTEM

Checking Exhaust System

INFOID:000000014418406

Check exhaust downpipe, aftertreatment assembly, tailpipe and mounting for improper attachment, leaks, cracks, damage or deterioration.

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



SMA211A

Aftertreatment SCR Performance Test

INFOID:000000014418407

GENERAL INFORMATION

- Use the following procedure for additional information on the aftertreatment system. Refer to [EX-42, "Removal and Installation".](#)
- The following procedure contains information on how to perform an SCR Performance Test using CONSULT.
- The CONSULT SCR Performance Test uses the intake nitrogen oxides (NOx) sensor and outlet NOx sensor readings to test the efficiency of the SCR catalyst.

INSPECTION

- Use CONSULT to check for fault codes. If any P-codes are present, follow the corresponding troubleshooting tree before performing any part of this procedure.
- The fault code troubleshooting tree, in some cases, will refer back to this procedure to complete the diagnostics.

TEST

WARNING:

Exhaust system components can become hot enough during operation and testing to cause burns or ignite and melt combustible materials. The exhaust and exhaust components can remain hot after the vehicle stops moving and has been shut down. To avoid the risk of fire, property damage, burns or other serious personal injury, allow the exhaust system to cool before beginning repairs or service. Make sure that no combustible materials are located where they are likely to come in contact with hot exhaust or exhaust components.

Before performing an SCR Performance Test, follow the steps listed below:

- Select an appropriate location to park the vehicle.
- On a surface that will not burn or melt under high temperatures (such as clean concrete or gravel, not grass or asphalt).
- Away from anything that can burn, melt, or explode.
- Nothing within 0.6 m (2 ft) of the exhaust outlet.
- Nothing that can burn, melt, or explode within 1.5 m (5 ft) (such as gasoline, wood, paper, plastics, fabric, compressed gas containers, and hydraulic lines).
- Park the vehicle securely.
- Set the parking brake.
- Place the transmission in P (Park).
- Set the wheel chocks at the front and rear of at least one tire.
- Set up a safe exhaust area.
- If bystanders can possibly enter the area, use barriers to keep people at least 1.5 m (5 ft) from the exhaust outlet during the SCR Performance Test.
- When indoors, attach an exhaust discharge pipe rated for at least 800°C (1500°F).
- Keep a fire extinguisher nearby.

< PERIODIC MAINTENANCE >

- Check exhaust system surfaces.
- Confirm that nothing is on or near the exhaust system surfaces (such as tools, rags, grease, or debris).
- Prepare for engine speed changes during the SCR Performance Test.
- Stay clear of the engine compartment.
- Begin the SCR Performance Test.
- CONSULT must be used to perform the SCR Performance Test.
- The engine will create enough heat to run the test. Engine speed will increase and the turbocharger can whistle loudly during the testing process. Once the test is complete, the engine will automatically return to normal idle speed.
- Monitor the area.
- Make sure that the vehicle and surrounding area is monitored during the SCR Performance Test. If any unsafe condition occurs, shut the engine OFF immediately.

To stop the test, engage the brake, or throttle pedal; or turn the engine OFF.

Once the test is complete, exhaust gas and exhaust surface temperatures will remain elevated for 3 to 5 minutes.

1. Before starting the SCR Performance Test, inspect the exhaust piping for leaks, cracks, and loose connections.

Tighten the exhaust clamps, if necessary. Inspect the exhaust and system for leaks. Tighten clamps as necessary. Refer to the appropriate procedure or equipment manufacturer service information for torque specifications. Any leaks in the exhaust system will cause the SCR Performance Test to be less efficient. This will result in the test running longer and possibly not completing.

2. The test can be found under the ECM Diagnostics Test menu in CONSULT. Follow the on-screen instructions to perform the test.

To stop the SCR Performance Test at any time during the test:

- Select the STOP button on the CONSULT monitor screen.
- Depress the brake.
- Depress the accelerator pedal.
- Turn the engine off.

3. The SCR Performance Test will perform the following actions:

Clean the aftertreatment system of any diesel exhaust fluid deposits.

- Cleaning the aftertreatment system of diesel exhaust fluid deposits can take up to 2 hours to complete. If deposits are detected after 2 hours of run time, the test will time out.

Perform a NOx sensor rationality test.

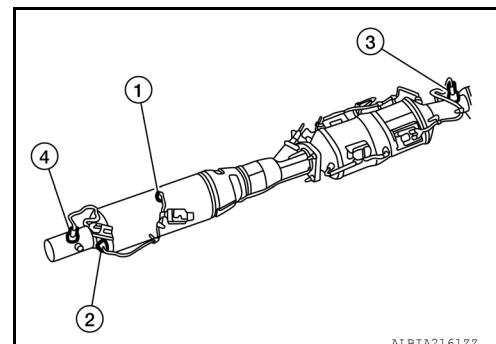
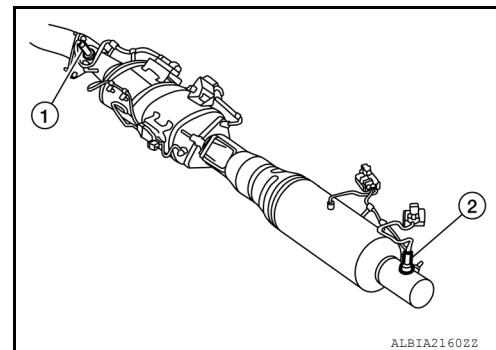
- The intake NOx sensor (1) and outlet NOx sensor (2) readings will be compared to determine if they are working properly.
- If one, or both, of the NOx sensors fail the rationality test, the test will stop and a pop-up message will be displayed, stating that the NOx sensor has failed and troubleshooting is required.

Check the SCR catalyst efficiency.

- Diesel exhaust fluid will be injected into the aftertreatment system and the outlet NOx sensor reading will be compared to the intake NOx sensor reading to determine the efficiency of the SCR catalyst.
- If the SCR catalyst fails the efficiency test, a pop-up message will be displayed, stating that the SCR catalyst must be replaced.

4. During the SCR Efficiency Test, the following will be monitored:

- SCR inlet temperature (1).
- SCR outlet temperature (2).
- Intake NOx sensor reading (3).
- Outlet NOx sensor reading (4).



5. Once the SCR Performance Test is started, follow CONSULT on-screen instructions. When the test is started, the engine idle speed will be raised automatically to the required level.

< PERIODIC MAINTENANCE >

- Through engine controls, the engine will operate in a manner to build exhaust heat. The turbocharger will emit a slight whining noise during this test. This is normal.
- Once the SCR Performance Test is complete, the engine will automatically return to normal idle speed.

6. Once the test is complete, check for active P-codes and/or engine indicator lamps. If any active P-codes are present, follow the appropriate P-code troubleshooting tree.

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Aftertreatment DPF Regeneration Test

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GENERAL INFORMATION

Use the following procedure for additional information on the after-treatment system. Refer to [EX-10, "System Description"](#).

The following procedure contains information about how to inspect the Diesel Particulate Filter (DPF) and perform a stationary regeneration.

There are two main steps when checking the DPF:

- The Initial Check section of this procedure is used to determine the condition of the DPF without removal of the Diesel Oxidation Catalyst and Diesel Particulate Filter Assembly (DOC and DPF Assembly). The Initial Check step should be used to determine if the DPF has malfunctioned due to progressive damage.
- The Test section of the procedure explains how to perform a stationary regeneration using an electronic service tool. The Test step should only be performed when troubleshooting procedures and/or engine indicator lamps indicate this is necessary.

If the DPF requires replacement, before replacement:

- Troubleshoot and clear all P-codes.
- Verify the correct fuel type is being used.
- Troubleshoot any oil consumption complaint.
- Troubleshoot any coolant consumption complaint.
- Inspect the Diesel Oxidation Catalyst (DOC) inlet. Refer to [EX-42, "Removal and Installation"](#).

The CONSULT electronic service tool DPF Stationary Regeneration Test can be used to:

- Regenerate an aftertreatment DPF.
- Recover the aftertreatment diesel oxidation catalyst and aftertreatment DPF after coolant contamination.
- Reset the stored soot load in the Engine Control Module (ECM).
- Check the aftertreatment diesel oxidation catalyst efficiency.
- Check for the presence of the DOC.
- Check for the correct installation of the temperature sensors.

The CONSULT electronic service tool DPF Stationary Regeneration Test can be used to regain functionality of the DOC and DPF, after either or both have been exposed to coolant.

The temperatures that are achieved during regeneration are high enough to evaporate the coolant out of both components and return them to normal operating specifications.

NOTE:

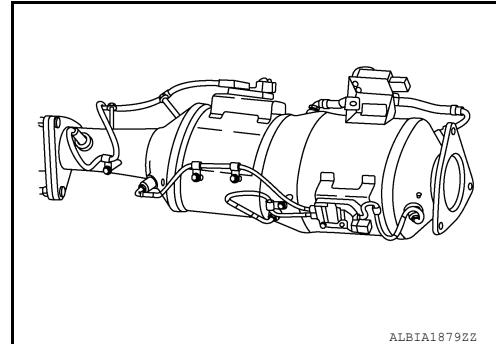
If these components are suspected of having coolant contamination, do not perform the snap acceleration test before performing the regeneration.

INITIAL CHECK

1. Use CONSULT electronic service tool to check for P-codes. If any P-codes are present, follow the corresponding troubleshooting tree before performing any part of this procedure.
 - The fault code troubleshooting tree, in some cases, will refer back to this procedure to complete the diagnostics.
 - Inspection of the exhaust system outlet can reveal the condition of the DPF. The exhaust system outlet should appear clean with little to no exhaust residue/soot buildup.
 - The DPF is not 100 percent efficient. Some accumulation of exhaust residue/soot is normal and does not indicate a malfunctioning DPF.
 - A heavy buildup of exhaust residue/soot can indicate a malfunctioning DPF.

To determine if the exhaust residue/soot accumulation on the exhaust system outlet is the result of a malfunctioning DPF, perform one of the following:

- Snap Acceleration Test. Refer to [EC-895, "Work Procedure"](#).
- Clean the last 152 - 254 mm (6 - 10 in) of the exhaust system outlet. Operate the vehicle for one shift or trip and inspect the exhaust system outlet for exhaust residue/soot accumulation.
- Inspect the aftertreatment DPF. Refer to [EX-42, "Removal and Installation"](#).



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TEST

WARNING:

Exhaust system components can become hot enough during operation and testing to cause burns or ignite and melt combustible materials. The exhaust and exhaust components can remain hot after the vehicle stops moving and has been shut down. To avoid the risk of fire, property damage, burns or other serious personal injury, allow the exhaust system to cool before beginning repairs or service. Make sure that no combustible materials are located where they are likely to come in contact with hot exhaust or exhaust components.

NOTE:

If the stationary regeneration is being performed to recover either the DOC or DPF, or both, after coolant contamination, the DOC does not need to be removed or inspected unless there are active faults that require inspection as part of the fault code troubleshooting steps.

Before performing stationary regeneration, follow the steps listed below:

- Select an appropriate location to park the vehicle.
- On a surface that will not burn or melt under high temperatures (such as clean concrete or gravel, not grass or asphalt)
- Away from anything that can burn, melt, or explode
- Nothing within 0.6 m (2 ft) of the exhaust outlet
- Nothing that can burn, melt, or explode within 1.5 m (5 ft) (such as gasoline, wood, paper, plastics, fabric, compressed gas containers, and hydraulic lines)
- Park the vehicle securely.
- Set the parking brake.
- Place the transmission in P (Park).
- Set the wheel chocks at the front and rear of at least one tire.
- Set up a safe exhaust area.
- If bystanders can possibly enter the area, use barriers to keep people at least 1.5 m (5 ft) from the exhaust outlet during regeneration.
- When indoors, attach an exhaust discharge pipe rated for at least 800°C (1,500°F).
- Keep a fire extinguisher nearby.
- Check exhaust system surfaces.
- Confirm that nothing is on or near the exhaust system surfaces (such as tools, rags, grease, or debris).
- Prepare for engine speed changes during regeneration.
- Stay clear of the engine compartment.
- Begin the stationary regeneration.
- CONSULT electronic service tool can be used to perform regeneration by starting the DPF Regeneration Test.
- The engine will create enough heat to regenerate the DPF. Engine speed will increase and the turbocharger can whistle loudly during the regeneration process. Once the DPF is regenerated, the engine will automatically return to normal idle speed.
- Make sure that the vehicle and surrounding area is monitored during regeneration. If any unsafe condition occurs, shut the engine off immediately.
- Monitor the area.
- Make sure that the vehicle and surrounding area is monitored during regeneration. If any unsafe condition occurs, shut the engine OFF immediately.

To stop a stationary regeneration, engage the brake, or throttle pedal; or turn off the engine.

Once regeneration is complete, exhaust gas and exhaust surface temperatures will remain elevated for 3 to 5 minutes.

1. The test can be found under the ECM Diagnostics Test menu in CONSULT electronic service tool. Follow the on-screen instructions to perform the test.
To stop the stationary regeneration test at any time during the test:
 - Select the stop button on CONSULT electronic service tool monitor screen.
 - Depress the brake.
 - Depress the accelerator pedal.
 - Turn the engine off.
2. During the Aftertreatment DPF Regeneration Test, the following will be monitored:
 - Aftertreatment DPF Soot Load: Informs the user of the current soot load of the filter:
 - Normal: No regeneration is necessary.
 - Above Normal: Least Severe Level - A stationary regeneration can be performed.
 - Above Normal: Moderately Severe Level - A stationary regeneration can be performed.

< PERIODIC MAINTENANCE >

- Above Normal: Most Severe Level - A stationary regeneration should not be performed unless the filter is cleaned or a new filter has been installed and the troubleshooting steps indicate it should be performed.
 - DPF Outlet Temperature
 - DPF Inlet Temperature
 - Diesel Oxidation Catalyst Inlet Temperature

3. Before starting the Aftertreatment DPF Regeneration Test, inspect the exhaust piping for leaks, cracks, and loose connections. Refer to [EX-19, "Checking Exhaust System"](#). Tighten the exhaust clamps (if necessary). Refer to [EX-24, "Exploded View"](#). Any leaks in the exhaust system will cause the Aftertreatment DPF Test to be less efficient in reducing the soot load of the filter. This will result in the test running longer and possibly not completing.

4. **NOTE:**
If the Aftertreatment DPF Regeneration Test will not initiate, see the Stationary Regeneration - Will Not Activate troubleshooting symptom tree. Refer to [EC-1930, "DTC Description"](#).

- Once the Aftertreatment DPF Regeneration Test is started, follow CONSULT electronic service tool on-screen instructions. When the test is started, the engine idle speed will be raised automatically to the required level.
- The engine will, through engine controls, operate in a manner to build exhaust heat. The turbocharger will emit a slight whining noise during this test. This is normal.
- Once the Aftertreatment DPF Regeneration Test is complete, the engine will automatically return to normal idle speed.

5. Once the test is complete, check for active fault codes and/or engine indicator lamps for high diesel particulate soot load after performing the Aftertreatment DPF Regeneration Test. If any active P-codes are present, follow the appropriate P-code troubleshooting tree.

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EXHAUST SYSTEM

< REMOVAL AND INSTALLATION >

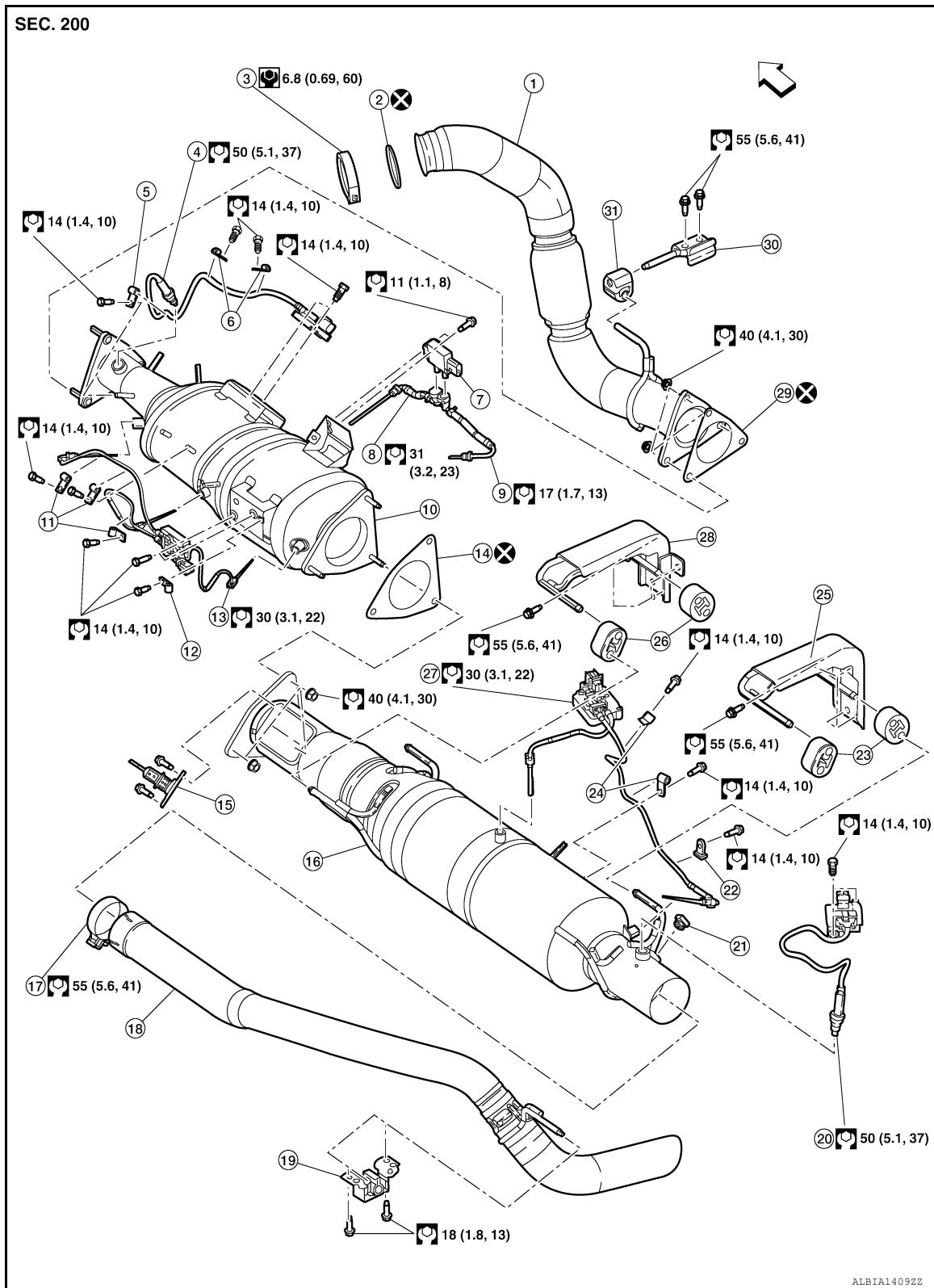
[CUMMINS 5.0L]

REMOVAL AND INSTALLATION

EXHAUST SYSTEM

Exploded View

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< REMOVAL AND INSTALLATION >

1. Exhaust downpipe	2. Gasket	3. V-band clamp
4. Inlet NOx sensor	5. Clamp	6. Clamp
7. DPF differential pressure sensor	8. DPF differential pressure sensor upstream tube	9. DPF differential pressure sensor downstream tube
10. DOC and DPF assembly	11. Clamp	12. Clamp
13. DPF temperature sensor module	14. Gasket	15. DEF dosing valve
16. Decomposition tube and SCR catalyst assembly	17. Clamp	18. Tailpipe
19. Tailpipe hanger	20. Outlet NOx sensor	21. Plug
22. Clamp	23. Insulator	24. Clamp
25. Exhaust hanger (RR)	26. Insulator	27. SCR temperature sensor module
28. Exhaust hanger (FR)	29. Gasket	30. Exhaust downpipe hanger
31. Insulator	◀ : Front	

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Removal and Installation

WARNING:

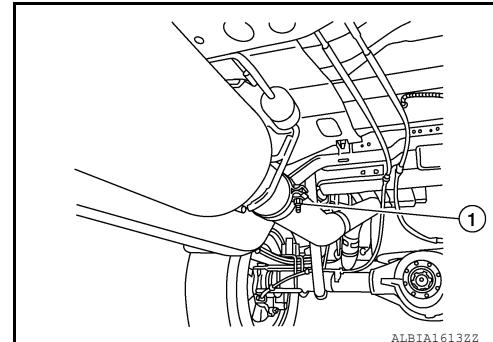
- Perform the operation with the exhaust system fully cooled. The system will be hot just after the engine stops.
- Be careful not to cut your hand on the heat insulator edge.

CAUTION:

- Be sure to use genuine exhaust system parts or equivalents which are specially designed for heat resistance, corrosion resistance, and shape.

REMOVAL

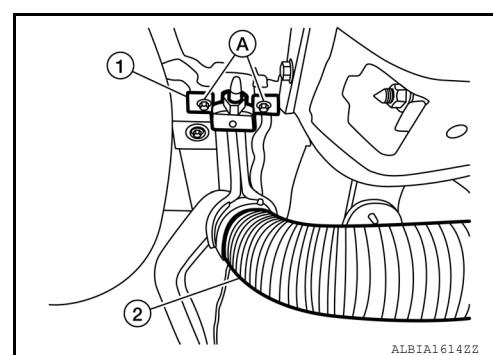
1. Disconnect the battery or batteries. Refer to [PG-185, "Battery Disconnect"](#).
2. Loosen the exhaust clamp (1).



3. Remove the bolts (A) from the tailpipe hanger bracket (1) and remove tailpipe (2).

CAUTION:

When removing tailpipe, do not damage surrounding parts.



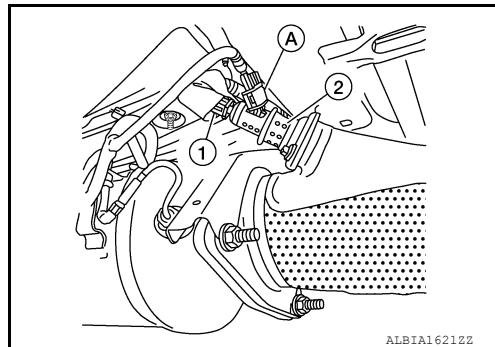
4. Disconnect the following harness connectors:
 - Inlet NOx sensor: Refer to [EX-45, "Removal and Installation"](#).
 - DPF temperature sensor module: Refer to [EX-52, "Removal and Installation"](#).
 - DPF differential pressure sensor: Refer to [EX-58, "Removal and Installation"](#).
5. Remove the following sensors from the frame assembly:
 - Outlet NOx sensor: Refer to [EX-48, "Removal and Installation"](#).
 - SCR temperature sensor module: Refer to [EX-55, "Removal and Installation"](#).

EXHAUST SYSTEM

[CUMMINS 5.0L]

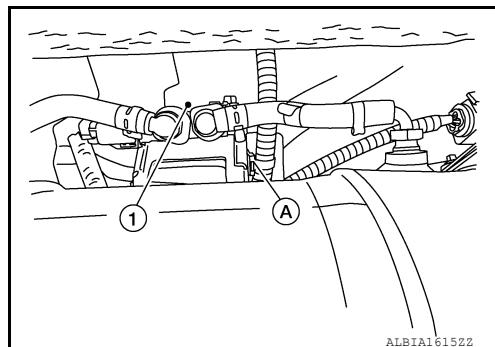
< REMOVAL AND INSTALLATION >

6. Disconnect the DEF valve supply hose (1) and harness connector (A) from the DEF valve (2).



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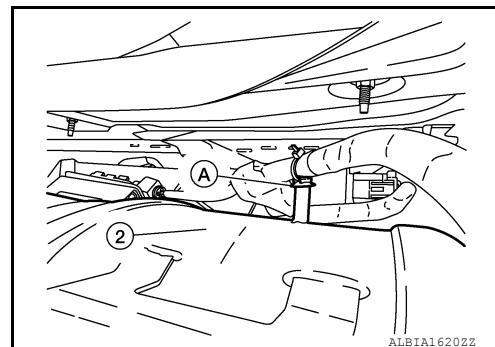
7. Remove the harness clips (A) from the DPF differential pressure sensor (1) and the top of the DOC and DPF assembly (2).



ALBIA1615ZZ

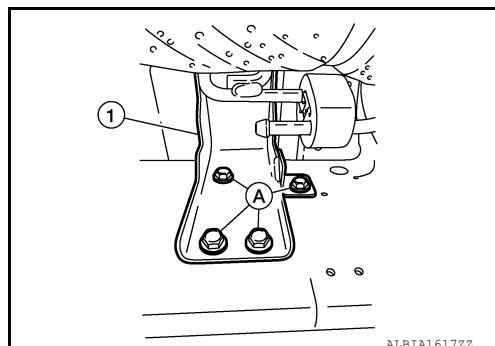
8. Remove nuts (A) connecting the exhaust downpipe (1) to the DOC and DPF assembly (2).

CAUTION:
Do not reuse gasket.



ALBIA1620ZZ

9. Remove bolts (A) from the decomposition tube and SCR catalyst assembly front hanger (1).



ALBIA1617ZZ

EXHAUST SYSTEM

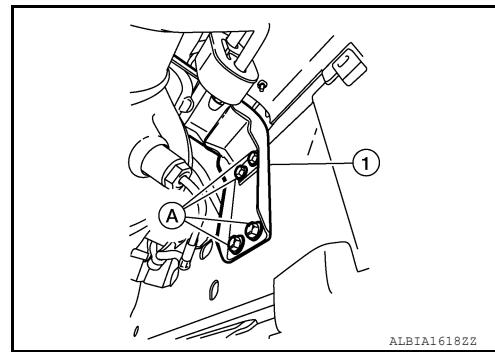
[CUMMINS 5.0L]

< REMOVAL AND INSTALLATION >

10. Remove bolts (A) from the decomposition tube and SCR catalyst assembly rear hanger (1).

CAUTION:

Support the decomposition tube and SCR catalyst assembly when removing the hanger.



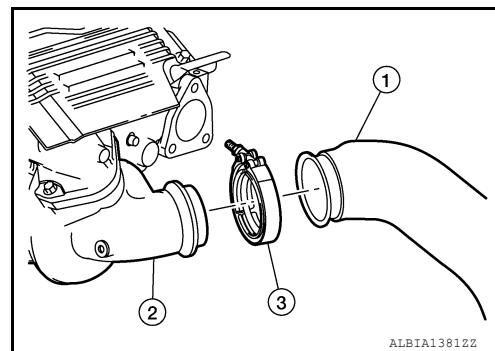
11. Remove the DOC and DPF assembly and the decomposition tube and SCR catalyst assembly together.

WARNING:

When removing DOC and DPF assembly and the decomposition tube and SCR catalyst assembly together, two people are required to avoid damaging the assembly.

12. Remove the center heat shield. Refer to [EX-32, "Removal and Installation"](#).

13. Remove the V-band clamp (3) connecting the exhaust downpipe (1) to the turbocharger turbine outlet (2) and remove the exhaust downpipe.



INSTALLATION

Installation is in the reverse order of removal.

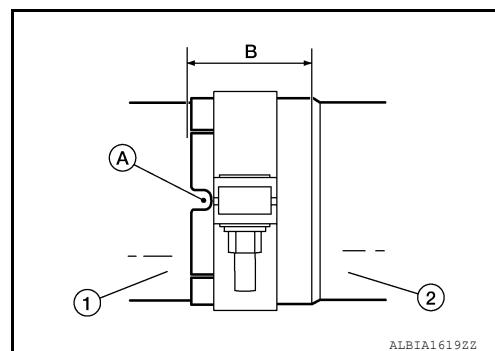
CAUTION:

- Do not reuse gaskets.
- If any mounting insulator is badly deformed, repair or replace it. If deposits such as mud pile up on the mounting insulators, clean and inspect them.
- Temporarily tighten the V-band clamp on the exhaust downpipe and the nuts on the vehicle side. Check each part for interference with other components, and then tighten the nuts and clamps to specification.

When installing tailpipe, note the following:

- Align tab (A) on decomposition tube and SCR catalyst assembly (1) with slot on tailpipe (2).

(B) : 50 mm (2.0 in)



INSPECTION AFTER INSTALLATION

- With the engine running, check exhaust tube joints for gas leakage and unusual noises.
- Check to ensure that mounting brackets and mounting rubbers are installed properly and free from undue stress. Improper installation could result in excessive noise and vibration.

EXHAUST DOWNPIPE

< REMOVAL AND INSTALLATION >

[CUMMINS 5.0L]

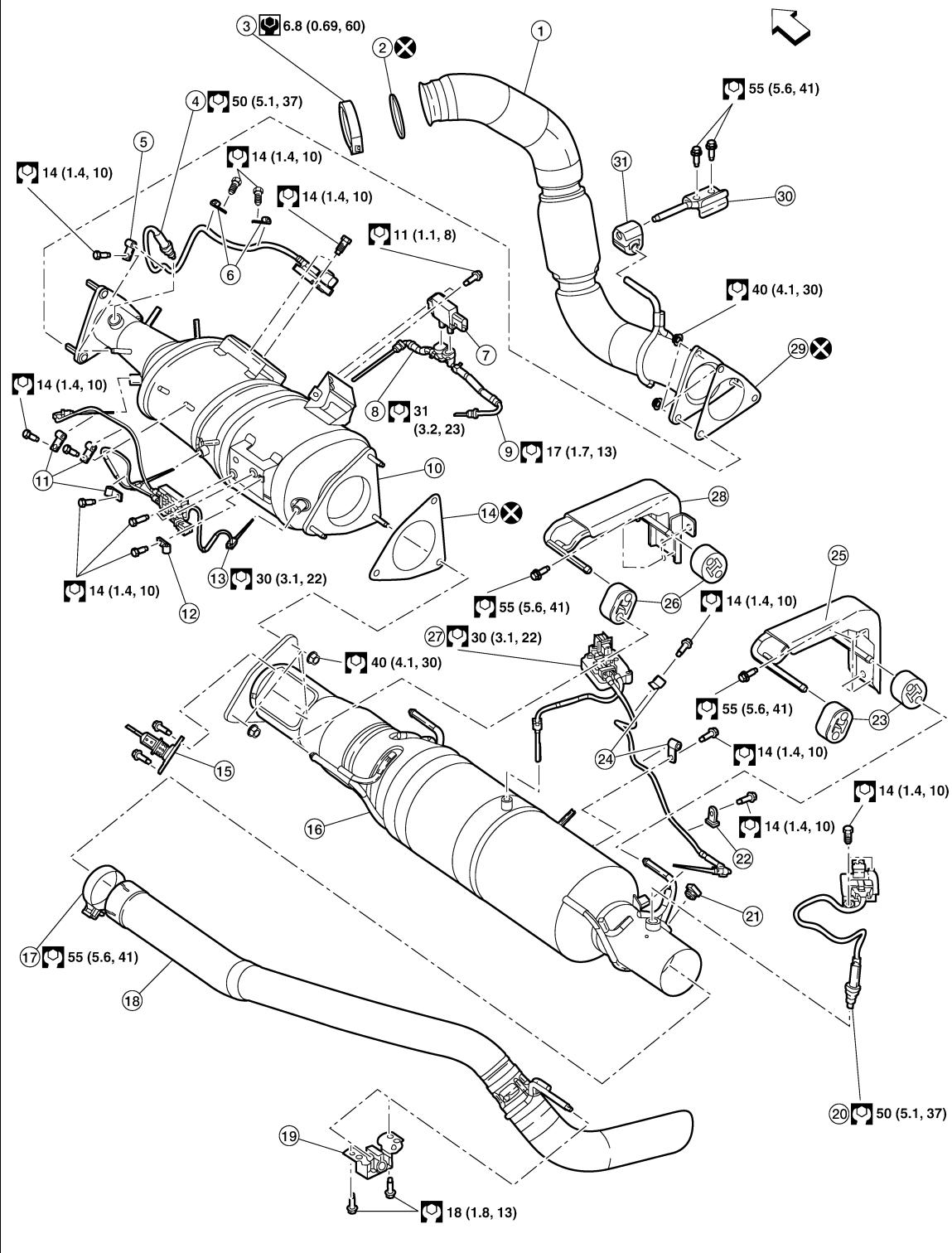
EXHAUST DOWNPIPE

Exploded View

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Exhaust Downpipe

SEC. 200



1. Exhaust downpipe	2. Gasket	3. V-band clamp
4. Inlet NOx sensor	5. Clamp	6. Clamp

EXHAUST DOWNPIPE

[CUMMINS 5.0L]

< REMOVAL AND INSTALLATION >

7. DPF differential pressure sensor	8. DPF differential pressure sensor upstream tube	9. DPF differential pressure sensor downstream tube
10. DOC and DPF assembly	11. Clamp	12. Clamp
13. DPF temperature sensor module	14. Gasket	15. DEF dosing valve
16. Decomposition tube and SCR catalyst assembly	17. Clamp	18. Tailpipe
19. Tailpipe hanger	20. Outlet NOx sensor	21. Plug
22. Clamp	23. Insulator	24. Clamp
25. Exhaust hanger (RR)	26. Insulator	27. SCR temperature sensor module
28. Exhaust hanger (FR)	29. Gasket	30. Exhaust downpipe hanger
31. Insulator	◀ : Front	

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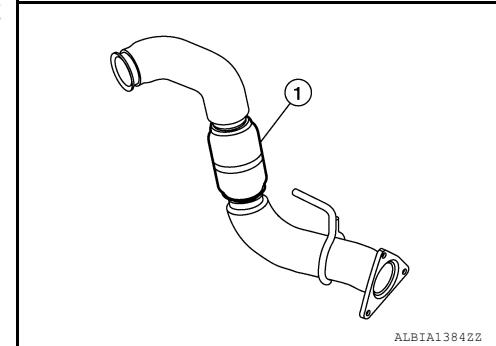
Removal and Installation

GENERAL INFORMATION

WARNING:

Exhaust system components can become hot enough during operation and testing to cause burns or ignite and melt combustible materials. The exhaust and exhaust components can remain hot after the vehicle stops moving and has been shut down. To avoid the risk of fire, property damage, burns or other serious personal injury, allow the exhaust system to cool before beginning repairs or service. Make sure that no combustible materials are located where they are likely to come in contact with hot exhaust or exhaust components.

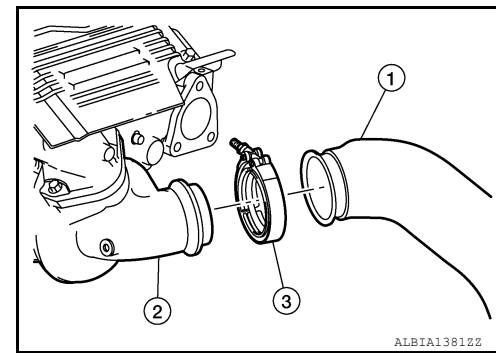
The exhaust downpipe (1) connects the turbocharger turbine outlet to the aftertreatment Diesel Oxidation Catalyst (DOC) inlet.



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REMOVAL

1. Remove the center heat shield. Refer to [EX-32, "Removal and Installation"](#).
2. Remove the V-band clamp (3) connecting the exhaust downpipe (1) to the turbocharger turbine outlet (2).



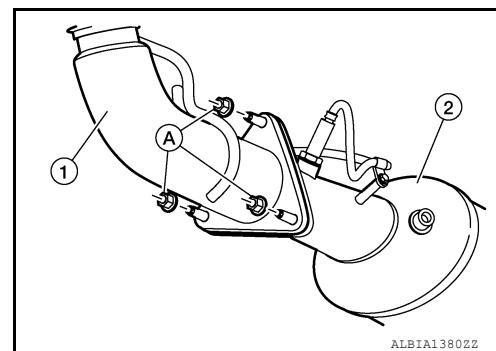
ALBIA1381ZZ

EXHAUST DOWNPIPE

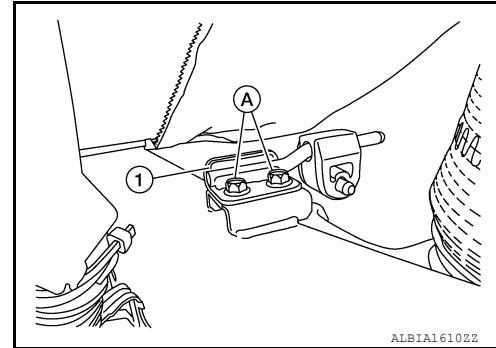
< REMOVAL AND INSTALLATION >

[CUMMINS 5.0L]

3. Remove the nuts (A) of the flange connecting the exhaust downpipe (1) to the DOC and DPF assembly (2) inlet.



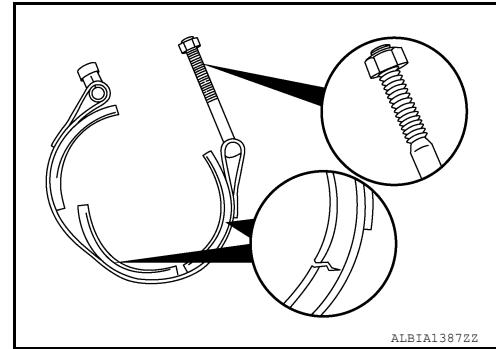
4. Remove the fender protector. Refer to [EXT-41, "Removal and Installation - Front Fender Protector"](#).
5. Remove the bolts (A) from the exhaust downpipe hanger (1).



6. Remove exhaust downpipe and exhaust downpipe hanger as an assembly.
7. Remove exhaust downpipe hanger and insulator from exhaust downpipe (if necessary).

INSPECTION AFTER REMOVAL

- Inspect the exhaust downpipe, exhaust insulators, and the flex joint for any cracks. Replace if any cracks are found.
- Inspect the exhaust downpipe for any engine oil or coolant.
- If a trail of engine oil or coolant can be seen exiting the turbocharger outlet, steam clean the exhaust downpipe.
- Inspect the V-band clamp for any cracks or other damage, and replace (if necessary).



INSTALLATION

CAUTION:

Do not reuse gaskets.

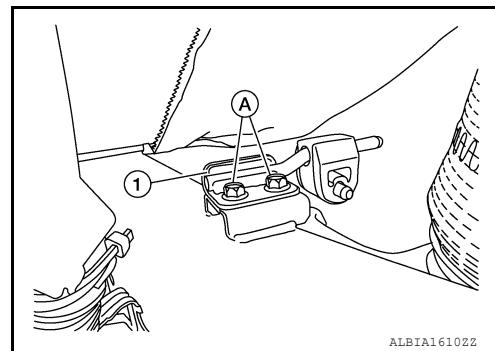
1. Install the exhaust downpipe and exhaust downpipe hanger as an assembly.

EXHAUST DOWNPIPE

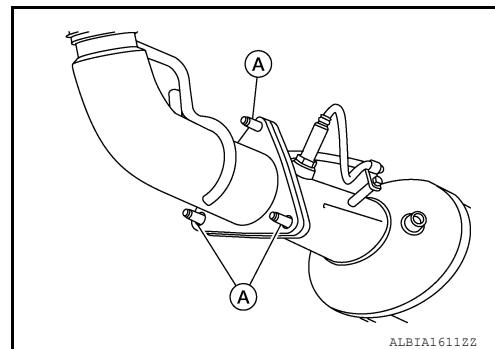
[CUMMINS 5.0L]

< REMOVAL AND INSTALLATION >

2. Install the bolts (A) for the exhaust downpipe hanger (1).

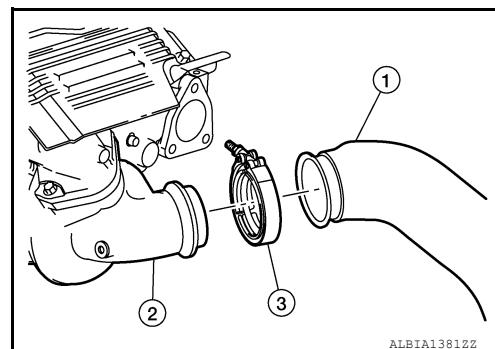


3. Apply a coating of anti-seize compound to the three studs (A) and loosely connect the three bolt flange to the DOC inlet.



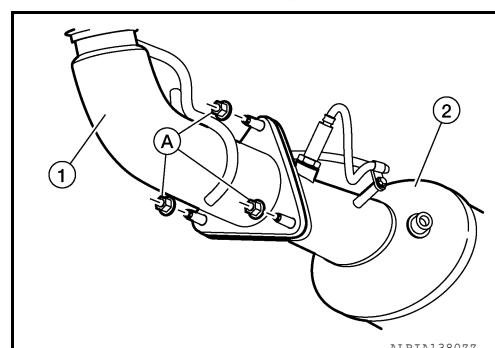
4. Connect the exhaust downpipe (1) to the turbocharger turbine outlet (2) with the V-band clamp (3).

V-band clamp : 9.0 N·m (0.9 kg-m, 80 in-lb)
(3)



5. Tighten the nuts (A) connecting the exhaust downpipe (1) to the DOC and DPF assembly (2).

Nuts (A) : 40 N·m (4.1 kg-m, 30 ft-lb)

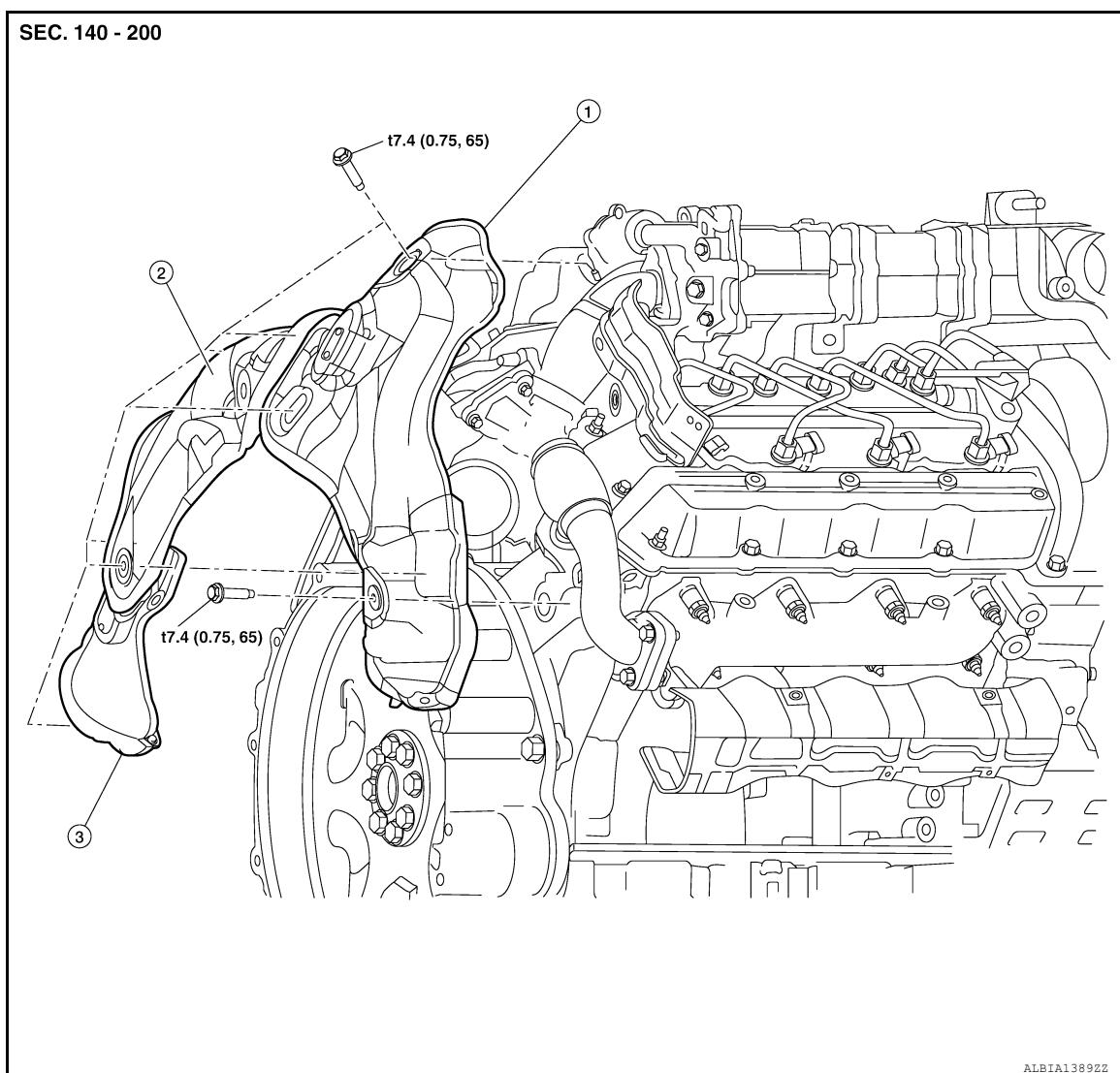


6. Operate the engine and check for leaks.

HEAT SHIELD

Exploded View

INFOID:0000000014418413



1. Heat shield (RH)

2. Center heat shield

3. Heat shield (LH)

ALBIA1389ZZ

Removal and Installation

INFOID:0000000014418414

GENERAL INFORMATION

WARNING:

Exhaust system components can become hot enough during operation and testing to cause burns or ignite and melt combustible materials. The exhaust and exhaust components can remain hot after the vehicle stops moving and has been shut down. To avoid the risk of fire, property damage, burns or other serious personal injury, allow the exhaust system to cool before beginning repairs or service. Make sure that no combustible materials are located where they are likely to come in contact with hot exhaust or exhaust components.

CAUTION:

Wear goggles and protective clothing to reduce the possibility of personal injury.

- Heat shields reduce heat exposure to various components from the exhaust and Exhaust Gas Recirculation (EGR) components.
- The turbocharger turbine housing and exhaust transfer tubes are covered by a three-piece heat shield.

REMOVAL

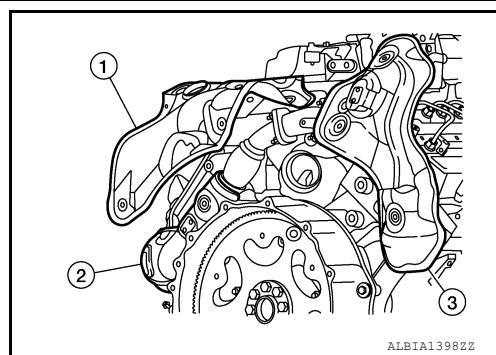
1. Remove cowl top. Refer to [EXT-35, "Removal and Installation - Cowl Top Cover".](#)

HEAT SHIELD

[CUMMINS 5.0L]

< REMOVAL AND INSTALLATION >

2. Remove the bolts for the center heat shield (1). Once the center heat shield is removed, the heat shield [RH (3)] and heat shield [LH (2)] can be removed.



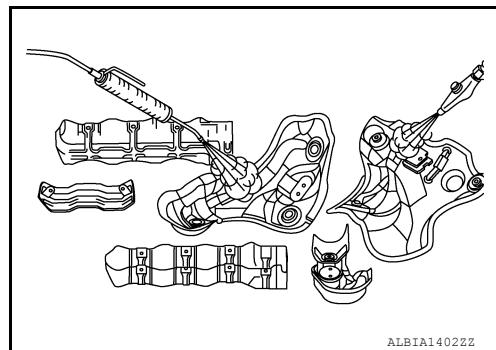
INSPECTION AFTER REMOVAL

- Inspect the heat shield for cracks or other damage.
- Replace the heat shield if any damage is found.
- Wash the heat shield in a hot, soapy water solution or steam clean if desired.
- Dry with compressed air.

WARNING:

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

- Do not exceed 207 kPa (30 psi).
- Wear appropriate eye protection and protective clothing including gloves.

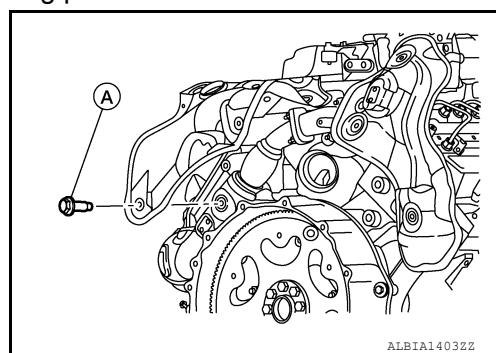


INSTALLATION

1. Install the heat shields (LH/RH).

NOTE:

Do **not** install a bolt (A) in this location; that bolt is a shared mounting point with the center heat shield.



2. Install the center heat shield.

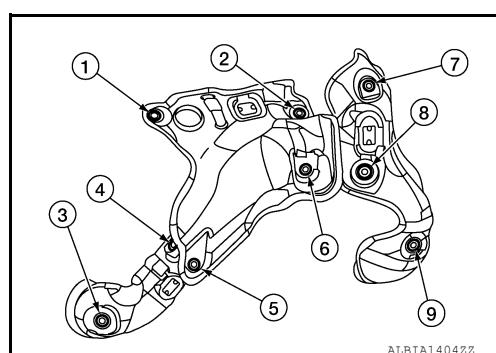
Tighten the bolts in the sequence shown.

NOTE:

Make sure bolt number 5 engages the heat shield (LH) and center heat shield.

Bolts

: 7.4 N·m (0.75 kg·m, 65 in-lb)



3. Install cowl top. Refer to [EXT-35, "Removal and Installation - Cowl Top Cover"](#).
4. Connect the battery or batteries. Refer to [PG-185, "Battery Disconnect"](#).

WARNING:

Battery acid and battery acid fumes are extremely dangerous and can cause severe burns and explosion. To help reduce the risk of personal injury:

- Wear appropriate goggles and protective clothing.
- Always properly ventilate the area where the service is being performed.
- Never allow battery fluid to come in contact with skin, eyes, fabrics or painted surfaces.
- To avoid arcing, remove the negative (-) battery cable first and attach the negative (-) battery cable last.
- If acid contacts eyes, skin or clothing, immediately flush with water for 15 minutes and seek medical attention.

DECOMPOSITION TUBE AND SCR CATALYST ASSEMBLY

< REMOVAL AND INSTALLATION >

[CUMMINS 5.0L]

DECOMPOSITION TUBE AND SCR CATALYST ASSEMBLY

Exploded View

INFOID:0000000014418415

A

EX

C

D

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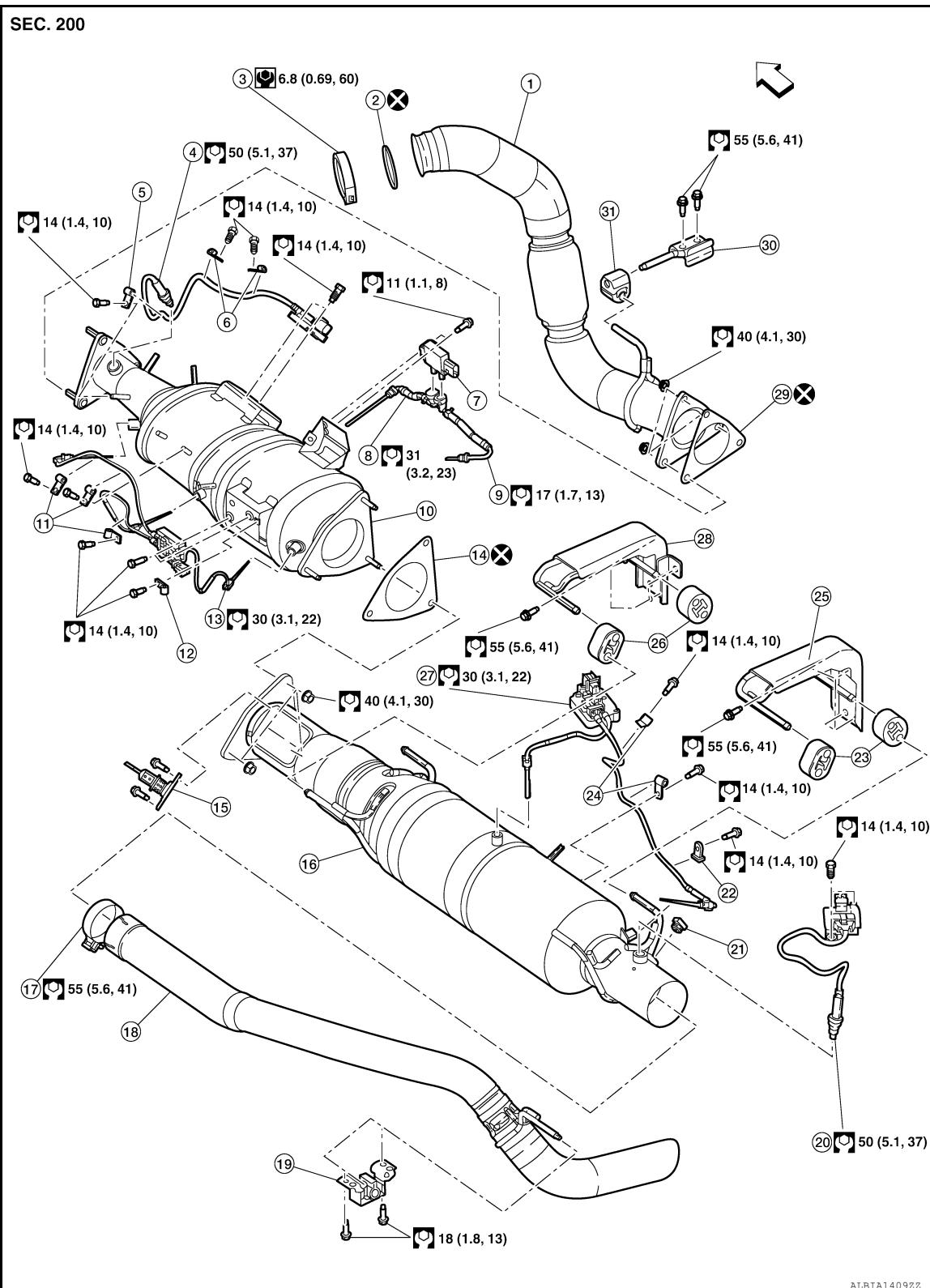
L

M

N

O

P



1. Exhaust downpipe
2. Gasket
3. V-band clamp
4. Inlet NOx sensor
5. Clamp
6. Clamp

DECOMPOSITION TUBE AND SCR CATALYST ASSEMBLY

[CUMMINS 5.0L]

< REMOVAL AND INSTALLATION >

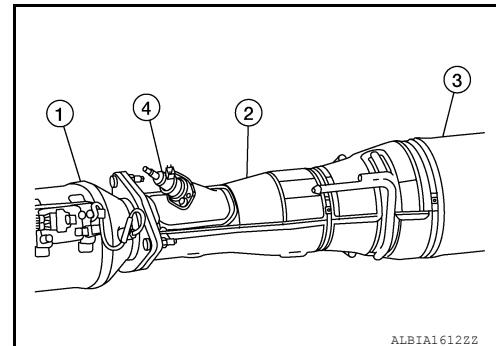
7. DPF differential pressure sensor	8. DPF differential pressure sensor upstream tube	9. DPF differential pressure sensor downstream tube
10. DOC and DPF assembly	11. Clamp	12. Clamp
13. DPF temperature sensor module	14. Gasket	15. DEF dosing valve
16. Decomposition tube and SCR catalyst assembly	17. Clamp	18. Tailpipe
19. Tailpipe hanger	20. Outlet NOx sensor	21. Plug
22. Clamp	23. Insulator	24. Clamp
25. Exhaust hanger (RR)	26. Insulator	27. SCR temperature sensor module
28. Exhaust hanger (FR)	29. Gasket	30. Exhaust downpipe hanger
31. Insulator	↳ : Front	

Removal and Installation

INFOID:000000014418416

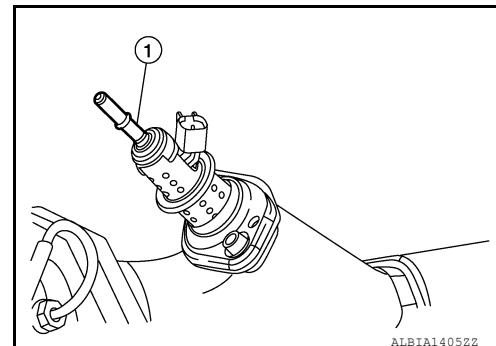
GENERAL INFORMATION

- The decomposition tube (2) is the section of exhaust pipe between the Diesel Particulate Filter (DPF) (1) and Selective Catalytic Reduction (SCR) catalyst (3).
- The decomposition tube is designed to help atomize and mix the Diesel Exhaust Fluid (DEF) being sprayed into the exhaust stream for complete mono-nitrogen oxides (NOx) conversion.
- The DEF dosing valve (4) is mounted on the decomposition tube and is positioned to spray DEF into the exhaust stream.
- The SCR catalyst (3) is where ammonia reacts with NOx and passes over the catalyst and converts NOx to nitrogen and water.



INSPECTION BEFORE REMOVAL

Inspect the DEF dosing valve (1) mount for any signs of leaks. Leaking DEF will leave white deposits.



REMOVAL

- Disconnect the battery or batteries. Refer to [PG-185, "Battery Disconnect"](#).

WARNING:

Battery acid and battery acid fumes are extremely dangerous and can cause severe burns and explosion. To help reduce the risk of personal injury:

- Wear appropriate goggles and protective clothing.
- Always properly ventilate the area where the service is being performed.
- Never allow battery fluid to come in contact with skin, eyes, fabrics or painted surfaces.
- To avoid arcing, remove the negative (-) battery cable first and attach the negative (-) battery cable last.
- If acid contacts eyes, skin or clothing, immediately flush with water for 15 minutes and seek medical attention.

DECOMPOSITION TUBE AND SCR CATALYST ASSEMBLY

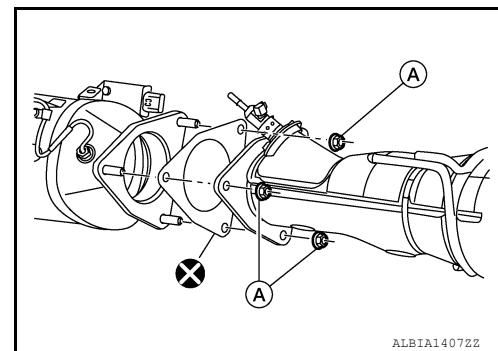
[CUMMINS 5.0L]

< REMOVAL AND INSTALLATION >

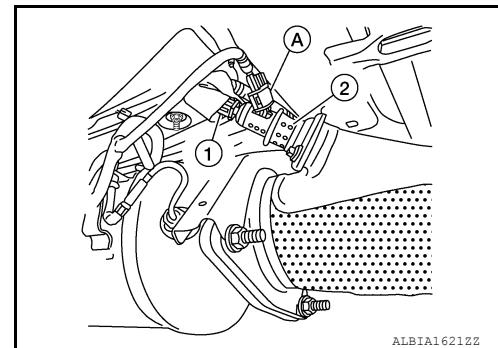
2. Support the decomposition tube and SCR catalyst assembly with a suitable tool.
3. Remove the nuts (A) that connect the DOC and DPF assembly to the decomposition tube and SCR catalyst assembly.

CAUTION:

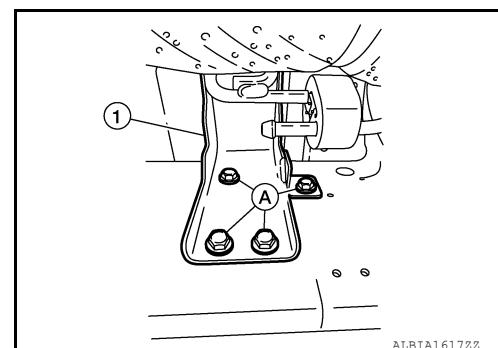
Do not reuse gasket.



4. Remove the exhaust tailpipe. Refer to [EX-25, "Removal and Installation"](#)
5. Remove the following sensors from the frame assembly:
 - Outlet NOx sensor: Refer [EX-48, "Removal and Installation"](#).
 - SCR temperature sensor module: Refer to [EX-55, "Removal and Installation"](#).
6. Disconnect the DEF dosing valve supply hose (1) and harness connector (A) from the DEF dosing valve (2).



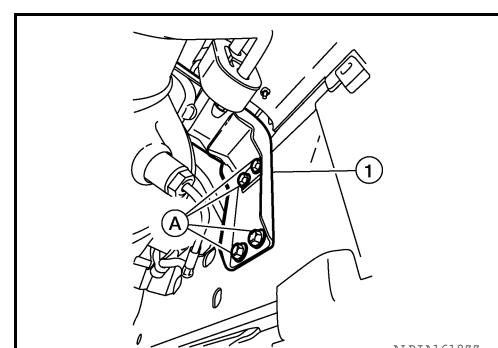
7. Remove bolts (A) from the decomposition and SCR catalyst assembly front hanger (1).



8. Remove bolts (A) from the decomposition tube and SCR catalyst assembly rear hanger (1).

CAUTION:

The decomposition tube and SCR catalyst assembly needs to be supported when removing the hanger.



9. Remove the decomposition tube and SCR assembly and hangers as an assembly.

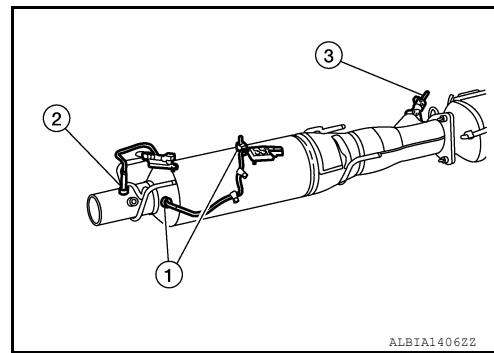
DISASSEMBLY

DECOMPOSITION TUBE AND SCR CATALYST ASSEMBLY

[CUMMINS 5.0L]

< REMOVAL AND INSTALLATION >

1. Remove the following from the decomposition tube and SCR catalyst assembly when replacing:
 - Remove the SCR temperature sensor probes (1). Refer to [EX-55. "Exploded View"](#).
 - Remove the outlet NOx sensor probe (2). Refer to [EX-48. "Exploded View"](#).
 - Remove the DEF dosing valve (3). Refer to [EX-64. "Removal and Installation"](#).
 - Remove clamps.



ALBIA1406ZZ

INSPECTION AFTER REMOVAL

- Remove any residual gasket material from the flange on the aftertreatment DPF and the inlet of the aftertreatment decomposition tube with a suitable tool.

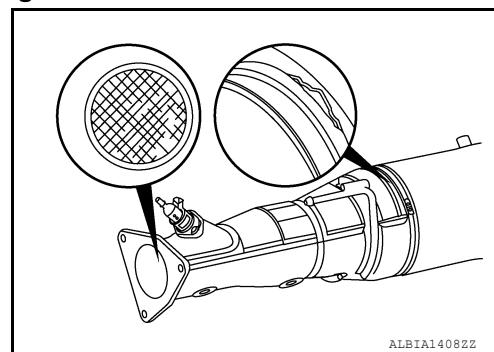
CAUTION:

Avoid dropping fragments of gasket material into the aftertreatment DPF or the aftertreatment decomposition tube inlet. Debris in the system can cause damage.

- Inspect the SCR catalyst for cracks or puncture holes, especially around the weld areas. Replace the decomposition tube and SCR assembly if it is damaged.
- Replace the decomposition tube and SCR assembly if it is soaked with oil, fuel, or coolant.
- Inspect the decomposition tube inlet for DEF deposits.
- If buildups are present, carefully scrape the buildup with a non-metallic object to remove the majority of the buildup from the catalyst.

NOTE:

Do **not** use a mechanical device to remove DEF deposits from the aftertreatment SCR catalyst.



ALBIA1408ZZ

NOTE:

Do **not** use water to remove DEF deposits from the decomposition tube and SCR assembly.

NOTE:

If crystallization buildup was present after installation, complete a stationary regeneration to make sure that any of the remaining DEF crystallization has been removed from the aftertreatment SCR catalyst. Refer to [EX-21. "Aftertreatment DPF Regeneration Test"](#).

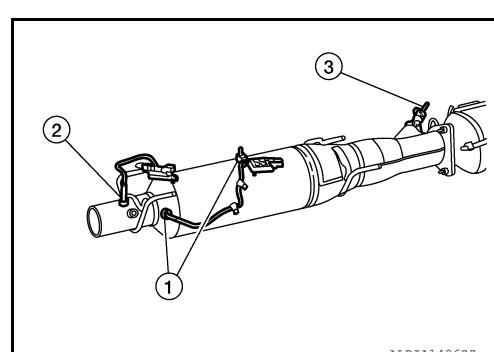
ASSEMBLY

Install the following onto the decomposition tube and SCR catalyst assembly:

CAUTION:

Before installing the outlet NOx sensor and SCR temperature probes, make sure threads are clear of debris and apply anti-seize lubricant.

- Install the DEF dosing valve (3). Refer to [EX-64. "Removal and Installation"](#).
- Install the outlet NOx sensor probe (2). Refer to [EX-48. "Removal and Installation"](#).
- Install the SCR temperature sensor probes (1). Refer to [EX-55. "Removal and Installation"](#).
- Install clamps and tighten bolts.



ALBIA1406ZZ

Bolt : 11 N·m (1.1 kg-m, 8 ft-lb)

INSTALLATION

CAUTION:

Do not reuse gasket.

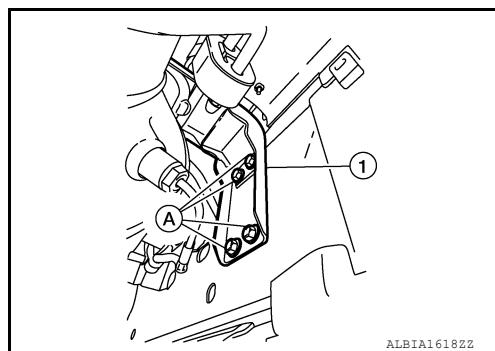
DECOMPOSITION TUBE AND SCR CATALYST ASSEMBLY

[CUMMINS 5.0L]

< REMOVAL AND INSTALLATION >

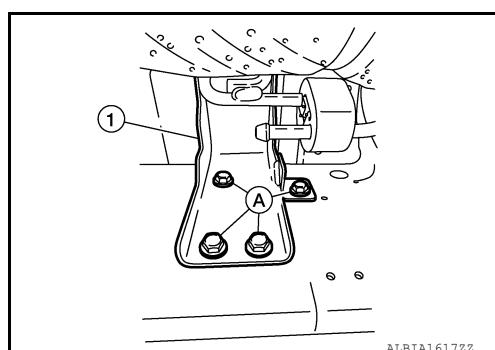
1. Install bolts (A) from the decomposition tube and SCR catalyst assembly rear hanger (1).

Bolts (A) : 55 N·m (5.6 kg-m, 41 ft-lb)



2. Install bolts (A) from the decomposition tube and SCR catalyst assembly front hanger (1).

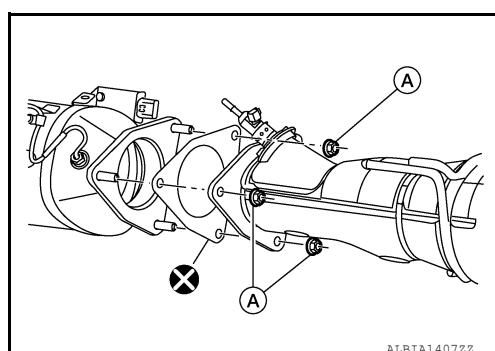
Bolts (A) : 55 N·m (5.6 kg-m, 41 ft-lb)



3. Partially tighten the nuts (A) that connect the DOC and DPF assembly to the decomposition tube and SCR catalyst assembly.

CAUTION:

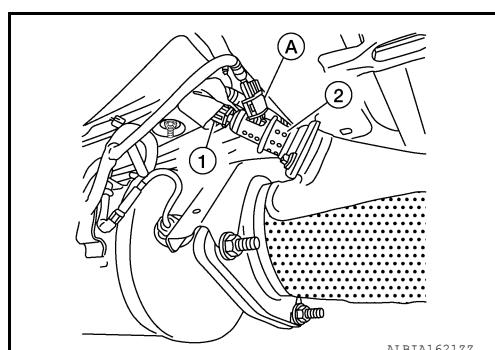
Do not reuse gasket.



4. Install the following sensors from the frame assembly:

- Outlet NOx sensor: Refer to [EX-48, "Removal and Installation"](#).
- SCR temperature sensor module: Refer to [EX-55, "Removal and Installation"](#).

5. Connect the DEF dosing valve supply hose (1) and harness connector (A) to the DEF dosing valve (2).



6. Install the exhaust tailpipe. Refer to [EX-25, "Removal and Installation"](#).

7. Tighten the nuts that connect the DOC and DPF assembly to the decomposition tube and SCR catalyst assembly.

Nuts : 40 N·m (4.1 kg-m, 30 ft-lb)

8. Connect the battery or batteries. Refer to [PG-185, "Battery Disconnect"](#).

WARNING:

DECOMPOSITION TUBE AND SCR CATALYST ASSEMBLY

< REMOVAL AND INSTALLATION >

[CUMMINS 5.0L]

Battery acid and battery acid fumes are extremely dangerous and can cause severe burns and explosion. To help reduce the risk of personal injury:

- **Wear appropriate goggles and protective clothing.**
- **Always properly ventilate the area where the service is being performed.**
- **Never allow battery fluid to come in contact with skin, eyes, fabrics or painted surfaces.**
- **To avoid arcing, remove the negative (-) battery cable first and attach the negative (-) battery cable last.**
- **If acid contacts eyes, skin or clothing, immediately flush with water for 15 minutes and seek medical attention.**

9. Operate the engine and check for leaks.

DOC AND DPF ASSEMBLY

< REMOVAL AND INSTALLATION >

[CUMMINS 5.0L]

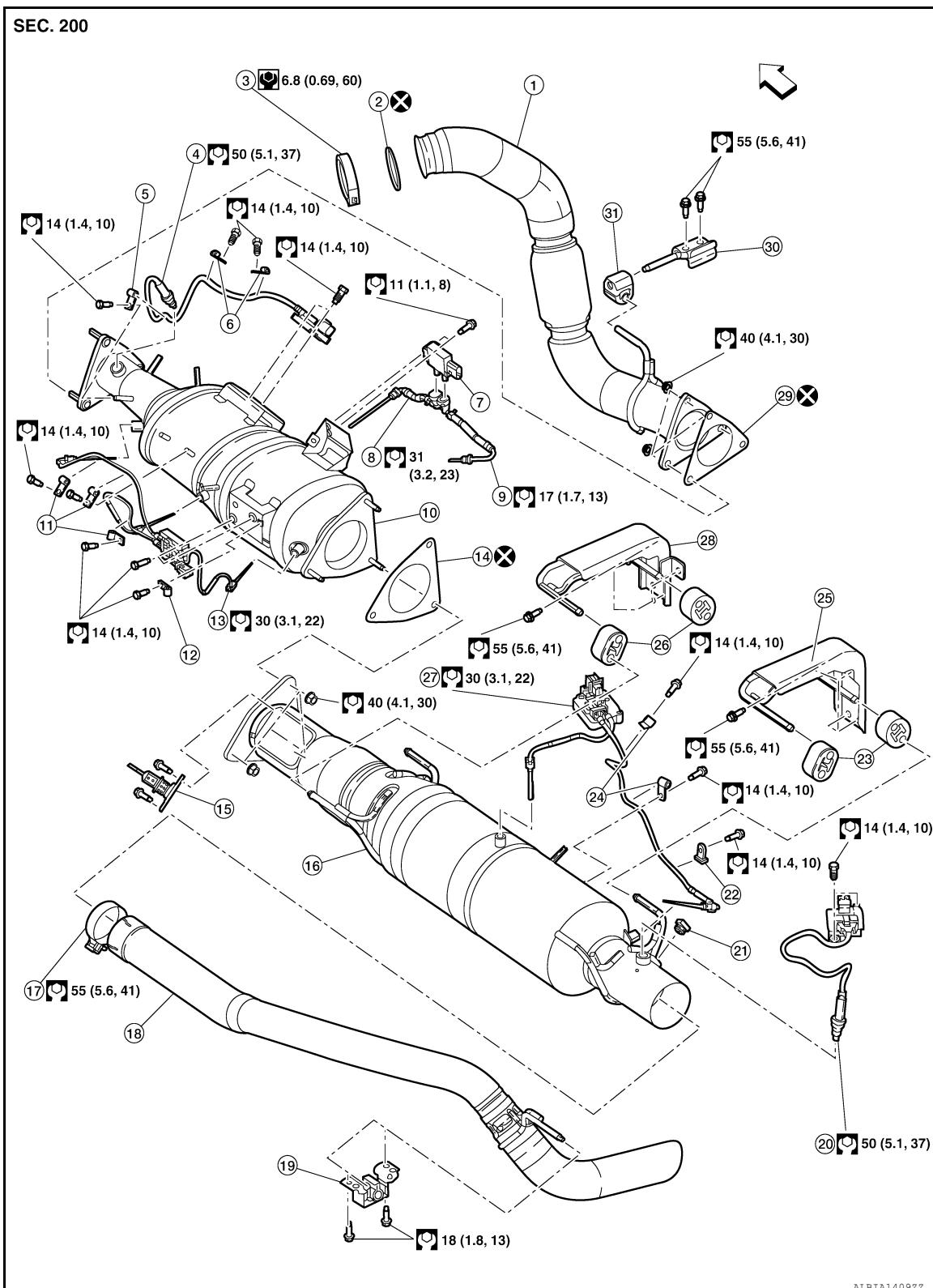
DOC AND DPF ASSEMBLY

Exploded View

INFOID:0000000014418417

EX

A
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1. Exhaust downpipe
2. Gasket
3. V-band clamp
4. Inlet NOx sensor
5. Clamp
6. Clamp

DOC AND DPF ASSEMBLY

[CUMMINS 5.0L]

< REMOVAL AND INSTALLATION >

7. DPF differential pressure sensor	8. DPF differential pressure sensor upstream tube	9. DPF differential pressure sensor downstream tube
10. DOC and DPF assembly	11. Clamp	12. Clamp
13. DPF temperature sensor module	14. Gasket	15. DEF dosing valve
16. Decomposition tube and SCR catalyst assembly	17. Clamp	18. Tailpipe
19. Tailpipe hanger	20. Outlet NOx sensor	21. Plug
22. Clamp	23. Insulator	24. Clamp
25. Exhaust hanger (RR)	26. Insulator	27. SCR temperature sensor module
28. Exhaust hanger (FR)	29. Gasket	30. Exhaust downpipe hanger
31. Insulator	◀ : Front	

INFOID:000000014418418

Removal and Installation

REMOVAL

WARNING:

- During regeneration, exhaust gas temperature can reach 800°C (1,500°F), and exhaust system surface temperature can exceed 700°C (1,300°F), which is hot enough to ignite or melt common materials, and to burn people. The exhaust and exhaust components can remain hot after the vehicle has stopped moving. To avoid the risk of fire, property damage, burns, or other serious personal injury, allow the exhaust system to cool before beginning this procedure or repair and make sure that no combustible materials are located where they are likely to come in contact with hot exhaust or exhaust components.
- Battery acid and battery acid fumes are extremely dangerous and can cause severe burns and explosion. To help reduce the risk of personal injury:
 - Wear appropriate goggles and protective clothing.
 - Always properly ventilate the area where the service is being performed.
 - Never allow battery fluid to come in contact with skin, eyes, fabrics or painted surfaces.
 - To avoid arcing, remove the negative (-) battery cable first and attach the negative (-) battery cable last.
 - If acid contacts eyes, skin or clothing, immediately flush with water for 15 minutes and seek medical attention.
- Wear appropriate eye and face protection when using compressed air. Flying debris and dirt can cause personal injury.

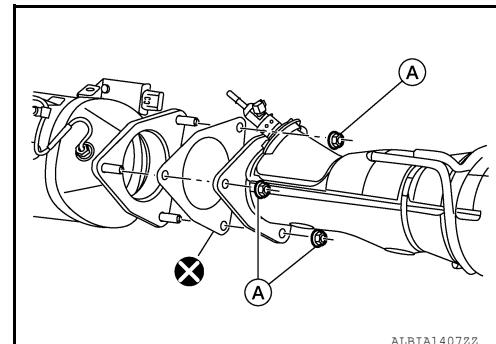
CAUTION:

The DEF dosing valve is a fragile item. Use great care when handling this part. Avoid putting stresses on the fluid connectors, as damage to the component may result.

- Disconnect the battery or batteries. Refer to [PG-185, "Battery Disconnect"](#)
- Remove the DOC and DPF assembly and the decomposition tube and SCR catalyst assembly together. Refer to [EX-25, "Removal and Installation"](#).
- Remove the nuts (A) that connect the DOC and DPF assembly to the decomposition tube and SCR assembly.

CAUTION:

Do not reuse gasket.



- Once the DOC and DPF assembly is removed from the vehicle, inspect the assembly.

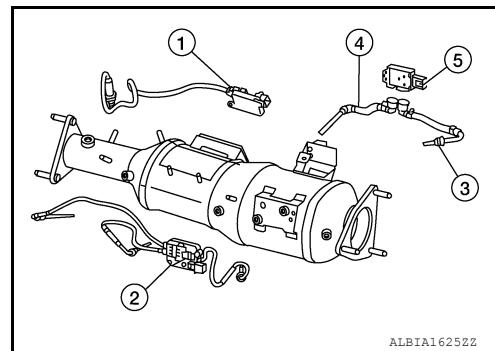
DOC AND DPF ASSEMBLY

[CUMMINS 5.0L]

< REMOVAL AND INSTALLATION >

If it **must** be replaced, follow the steps below:

- Remove the DPF temperature sensor module (2). Refer to [EX-52, "Removal and Installation"](#).
- Remove the DPF differential pressure sensor upstream (4) and downstream (3) tubes. Refer to [EX-58, "Exploded View"](#).
- Remove the DPF differential pressure sensor module (5). Refer to [EX-58, "Removal and Installation"](#).
- Remove the inlet NOx sensor (1). Refer to [EX-45, "Removal and Installation"](#).
- Remove clamps.



INSPECTION AFTER REMOVAL

- Remove any residual gasket material from the flanges on the DPF and DOC assembly inlet and outlet with a suitable tool (A).

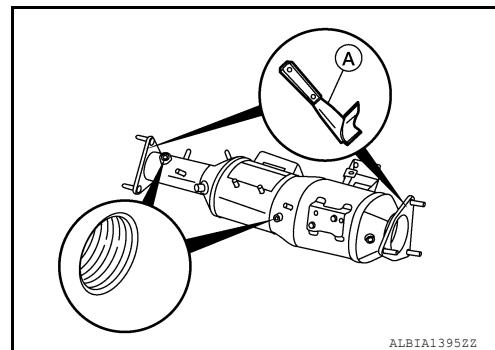
WARNING:

Do not drop fragments of gasket material into the DOC and DPF assembly.

- Inspect all boss threads for damage.
- If thread damage is found on the sensor boss threads, repair threads or replace component as required.

NOTE:

- If the DOC and DPF assembly is being inspected due to progressive damage that introduced engine oil or excessive fuel into the exhaust, inspect the tailpipe from the turbocharger outlet to the DOC and DPF assembly. Refer to [EX-41, "Exploded View"](#).
- Inspect the DOC and DPF assembly inlet face for soot face plugging. If the face is face-plugged above 50%, replace the DOC and DPF assembly.
- Inspect DOC and DPF assembly outlet for soot accumulation. If a significant amount of soot is present, replace the DOC and DPF assembly.



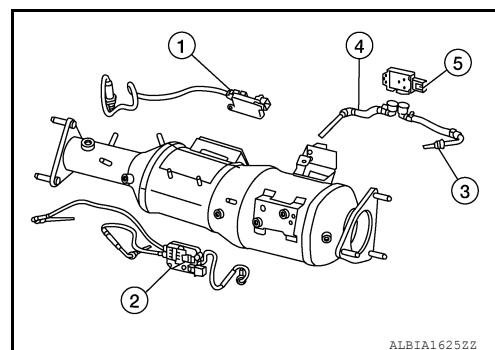
INSTALLATION

CAUTION:

Do not reuse exhaust gaskets.

1. If removed from DOC and DPF assembly, note the following:

- Install the DPF temperature sensor module (2). Refer to [EX-52, "Removal and Installation"](#).
- Install the DPF differential pressure sensor upstream (4) and downstream (3) tubes. Refer to [EX-58, "Exploded View"](#).
- Install the DPF differential pressure sensor module (5). Refer to [EX-58, "Removal and Installation"](#).
- Install the inlet NOx sensor (1). Refer to [EX-45, "Removal and Installation"](#).
- Install clamps and bolts.



Bolts : 11 N·m (1.1 kg-m, 8 ft-lb)

CAUTION:

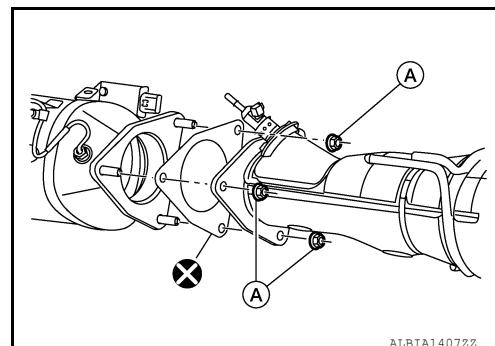
Apply anti-seize to the threads of the DPF temperature sensor probes, DPF differential pressure sensor probes and inlet NOx sensor before installation.

2. Install the nuts (A) that connect the DOC and DPF assembly to the decomposition tube and SCR assembly.

Nuts (A) : 40 N·m (4.1 kg-m, 30 ft-lb)

CAUTION:

- **Apply anti-seize to the studs on the decomposition tube and SCR catalyst assembly.**
- **Do not reuse gasket.**



< REMOVAL AND INSTALLATION >

3. Installation of the remaining parts is in the reverse order of removal.
4. Connect the battery or batteries. Refer to [PG-185, "Battery Disconnect"](#).

WARNING:

Battery acid and battery acid fumes are extremely dangerous and can cause severe burns and explosion. To help reduce the risk of personal injury:

- **Wear appropriate goggles and protective clothing.**
- **Always properly ventilate the area where the service is being performed.**
- **Never allow battery fluid to come in contact with skin, eyes, fabrics or painted surfaces.**
- **To avoid arcing, remove the negative (-) battery cable first and attach the negative (-) battery cable last.**
- **If acid contacts eyes, skin or clothing, immediately flush with water for 15 minutes and seek medical attention.**

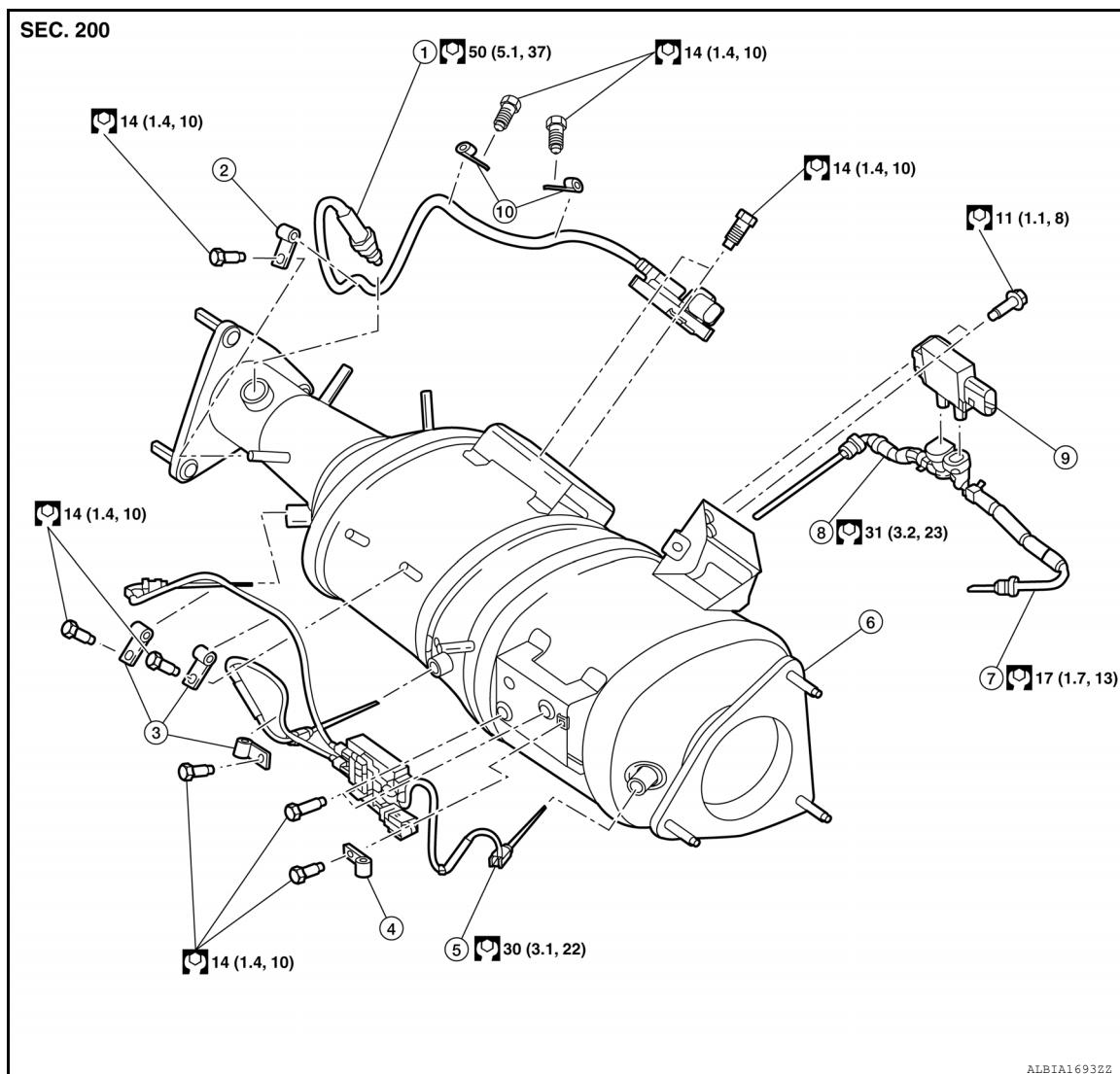
5. Operate the engine and check for fault codes and exhaust leaks.

< REMOVAL AND INSTALLATION >

INLET NOX SENSOR

Exploded View

INFOID:0000000014418419



1. Inlet NOx sensor	2. Clamp	3. Clamp
4. Clamp	5. DPF temperature sensor module	6. DOC and DPF assembly
7. DPF differential pressure sensor downstream tube	8. DPF differential pressure sensor upstream tube	9. DPF differential pressure sensor
10. Clamp		

Removal and Installation

INFOID:0000000014418420

GENERAL INFORMATION

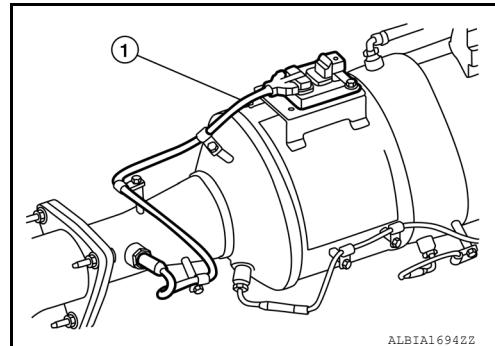
WARNING:

- This is used to indicate the presence of a hazard that could cause death or serious injury. To avoid or reduce the risk, the procedures must be followed precisely.
- Exhaust system components can become hot enough during operation and testing to cause burns or ignite and melt combustible materials. The exhaust and exhaust components can remain hot after the vehicle stops moving and has been shut down. To avoid the risk of fire, property damage, burns or other serious personal injury, allow the exhaust system to cool before beginning repairs or service. Make sure that no combustible materials are located where they are likely to come in contact with hot exhaust or exhaust components.

< REMOVAL AND INSTALLATION >

CAUTION:**Do not underseal or coat/paint any part of the NOx sensor or incorrect sensor readings will occur.**

- The inlet mono-nitrogen oxides (NOx) sensor is located downstream of the turbocharger turbine outlet and mounted at the inlet of the Diesel Oxidation Catalyst (DOC).
- The inlet NOx sensor (1) is made up of a small electronic module wired to a sensor body that is installed in the exhaust system. These two parts are permanently connected and cannot be separated.

**REMOVAL**

- Disconnect the battery or batteries. Refer to [PG-185, "Battery Disconnect"](#).

WARNING:

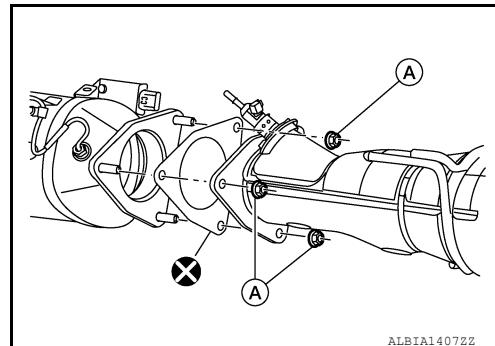
Battery acid and battery acid fumes are extremely dangerous and can cause severe burns and explosion. To help reduce the risk of personal injury;

- Wear appropriate goggles and protective clothing.
- Always properly ventilate the area where the service is being performed.
- Never allow battery fluid to come in contact with skin, eyes, fabrics or painted surfaces.
- To avoid arcing, remove the negative (-) battery cable first and attach the negative (-) battery cable last.
- If acid contacts eyes, skin or clothing, immediately flush with water for 15 minutes and seek medical attention.

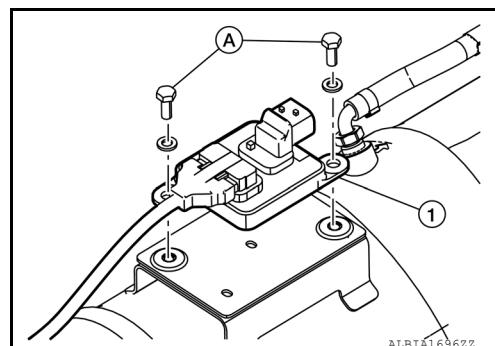
- Remove the DOC and DPF assembly and the decomposition tube and SCR catalyst assembly together. Refer to [EX-25, "Removal and Installation"](#).
- Remove the nuts (A) that connect the DOC and DPF assembly to the decomposition tube and SCR assembly.

CAUTION:

Do not reuse gasket.

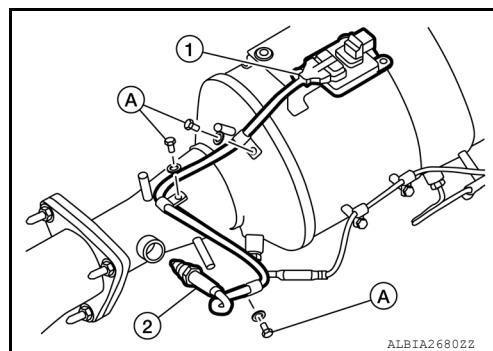


- Disconnect the harness connector from the inlet NOx sensor (1).
- Remove bolts (A) that secure the inlet NOx sensor module.



< REMOVAL AND INSTALLATION >

6. Loosen the bolts (A) and remove the inlet NOx sensor probe (2) from the exhaust outlet connection.
- NOTE:**
Take note of harness routing for correct installation.
7. Disconnect any clamps that are securing the wire between the sensor body and the electronic module and remove the inlet NOx sensor (1).



INSPECTION AFTER REMOVAL

CAUTION:

Do not clean the NOx sensor with any kind of fluid. Do not immerse the NOx sensor in water or any kind of chemical wash. Do not jet-wash or steam clean the NOx sensor.

- Inspect the vehicle harness connector and sensor for the following:
 - Cracked or broken connector
 - Missing or damaged connector seals
 - Dirt, debris, or moisture in or on the connector pins
 - Corroded, bent, broken, pushed back, or expanded pins
 - Chipped, cracked, extruded, or damaged sensor
- Repair or replace parts as necessary.
- Check the inlet NOx sensor for oil spray on the tip of the sensor. If oil is present, refer to [EX-45, "Removal and Installation"](#).

NOTE:

This sensor is placed before the diesel particulate filter. It is **not** uncommon to have soot on the tip of the sensor. Do **not** try to clean the inlet NOx sensor tip unless directed to do so by fault codes or other troubleshooting symptoms.

INSTALLATION

1. Apply a light coating of anti-seize compound to the threads of the inlet NOx sensor.

CAUTION:

Install supporting P-clips to prevent wires from contacting hot components which will result in damage to the wiring.

2. Install the inlet NOx sensor probe to the exhaust system and tighten the retaining nut.
3. Install the inlet NOx sensor module to the mounting bracket with the two fasteners.
4. Route the inlet NOx sensor wire in the same configuration as when removed to avoid hot objects and wear areas and install the P-clips.
5. Connect the inlet NOx sensor module connector to the vehicle wiring harness.
6. Connect the battery or batteries. Refer to [PG-185, "Battery Disconnect"](#).

WARNING:

Battery acid and battery acid fumes are extremely dangerous and can cause severe burns and explosion. To help reduce the risk of personal injury;

- **Wear appropriate goggles and protective clothing.**
- **Always properly ventilate the area where the service is being performed.**
- **Never allow battery fluid to come in contact with skin, eyes, fabrics or painted surfaces.**
- **To avoid arcing, remove the negative (-) battery cable first and attach the negative (-) battery cable last.**
- **If acid contacts eyes, skin or clothing, immediately flush with water for 15 minutes and seek medical attention.**

OUTLET NOX SENSOR

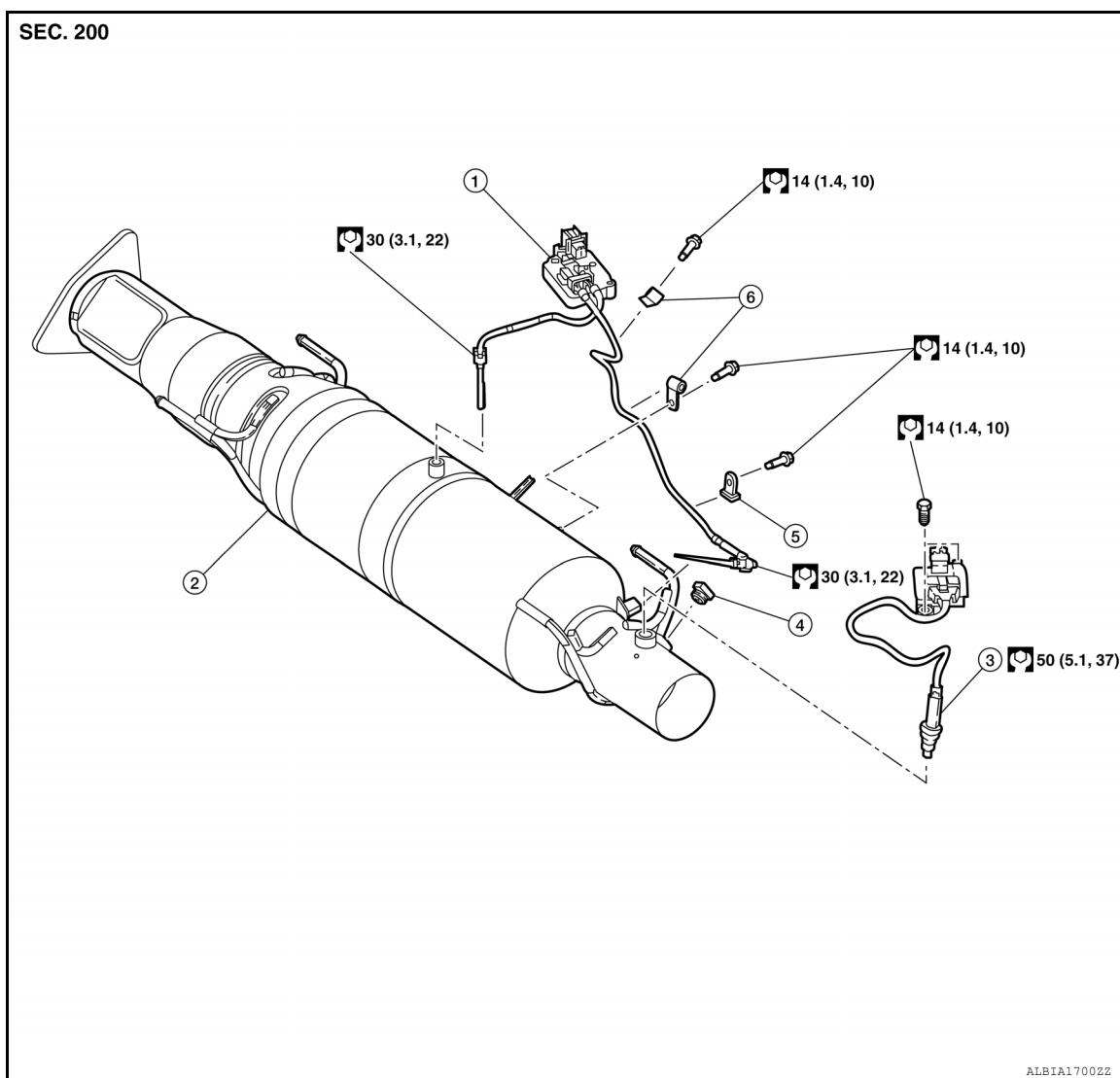
< REMOVAL AND INSTALLATION >

[CUMMINS 5.0L]

OUTLET NOX SENSOR

Exploded View

INFOID:0000000014418421



1. SCR temperature sensor module
2. Decomposition tube and SCR catalyst assembly
3. Outlet NOx sensor
4. Plug
5. Clamp
6. Clamp

Removal and Installation

INFOID:0000000014418422

WARNING:

- This is used to indicate the presence of a hazard that could cause death or serious injury. To avoid or reduce the risk, the procedures must be followed precisely.
- Exhaust system components can become hot enough during operation and testing to cause burns or ignite and melt combustible materials. The exhaust and exhaust components can remain hot after the vehicle stops moving and has been shut down. To avoid the risk of fire, property damage, burns or other serious personal injury, allow the exhaust system to cool before beginning repairs or service. Make sure that no combustible materials are located where they are likely to come in contact with hot exhaust or exhaust components.

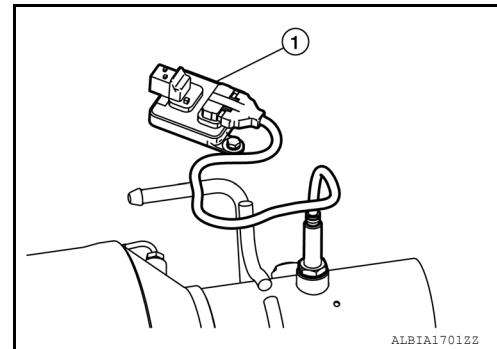
CAUTION:

Do not underseal or coat/paint any part of the outlet NOx sensor or incorrect sensor readings will occur.

< REMOVAL AND INSTALLATION >

GENERAL INFORMATION

- The outlet mono-nitrogen oxides (NOx) sensor (1) is located after the Selective Catalytic Reduction (SCR) catalyst.
- The outlet NOx sensor (1) is made up of two parts: a small electronic module and a wired connection to the sensor body that is installed in the exhaust system. The two parts are permanently connected and cannot be separated.



REMOVAL

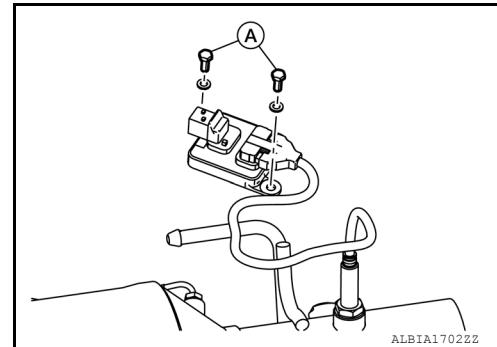
- Disconnect the battery or batteries. Refer to [PG-185, "Battery Disconnect"](#).

WARNING:

Battery acid and battery acid fumes are extremely dangerous and can cause severe burns and explosion. To help reduce the risk of personal injury:

- Wear appropriate goggles and protective clothing.
- Always properly ventilate the area where the service is being performed.
- Never allow battery fluid to come in contact with skin, eyes, fabrics or painted surfaces.
- To avoid arcing, remove the negative (-) battery cable first and attach the negative (-) battery cable last.
- If acid contacts eyes, skin or clothing, immediately flush with water for 15 minutes and seek medical attention.

- Disconnect the harness connector from the outlet NOx sensor.
- Remove bolts (A) and outlet NOx sensor.
- Loosen nut and remove outlet NOx sensor probe from the exhaust system.



INSPECTION AFTER REMOVAL

CAUTION:

- Do not clean the outlet NOx sensor with any kind of fluid or damage to the outlet NOx sensor will occur.
- Do not immerse the outlet NOx sensor in water or any kind of chemical wash or damage to the outlet NOx sensor will occur.
- Do not jet-wash or steam clean the outlet NOx sensor or damage to the outlet NOx sensor will occur.
- Inspect the vehicle harness connector and sensor for the following:
 - Cracked or broken connector
 - Missing or damaged connector seals
 - Dirt, debris, or moisture in or on the connector pins
 - Corroded, bent, broken, pushed back, or expanded pins
 - Chipped, cracked, extruded, or damaged sensor
- Repair or replace parts as necessary.

INSTALLATION

- Apply a light coating of anti-seize compound to the threads of the outlet NOx sensor.
- Install the outlet NOx sensor to the exhaust system and tighten the retaining nut.
- Connect the outlet NOx sensor connector to the vehicle harness.

CAUTION:

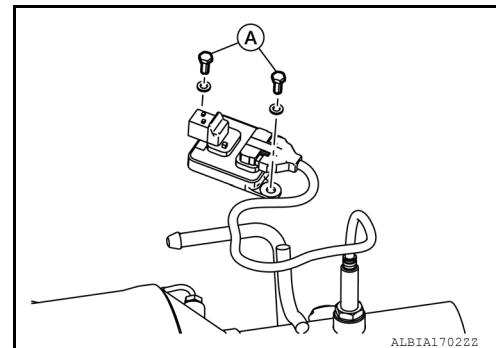
OUTLET NOX SENSOR

< REMOVAL AND INSTALLATION >

[CUMMINS 5.0L]

Install supporting P-clips to prevent the wires from contacting hot components which will result in damage to the wiring.

4. Install bolts (A).



5. Route the outlet NOx sensor wire in the same configuration as when removed to avoid hot objects and wear areas and install the clamps.
6. Connect the battery or batteries. Refer to [PG-185, "Battery Disconnect"](#).

WARNING:

Battery acid and battery acid fumes are extremely dangerous and can cause severe burns and explosion. To help reduce the risk of personal injury:

- Wear appropriate goggles and protective clothing.
- Always properly ventilate the area where the service is being performed.
- Never allow battery fluid to come in contact with skin, eyes, fabrics or painted surfaces.
- To avoid arcing, remove the negative (-) battery cable first and attach the negative (-) battery cable last.
- If acid contacts eyes, skin or clothing, immediately flush with water for 15 minutes and seek medical attention.

7. Operate the engine and check for leaks.

DPF TEMPERATURE SENSOR MODULE

< REMOVAL AND INSTALLATION >

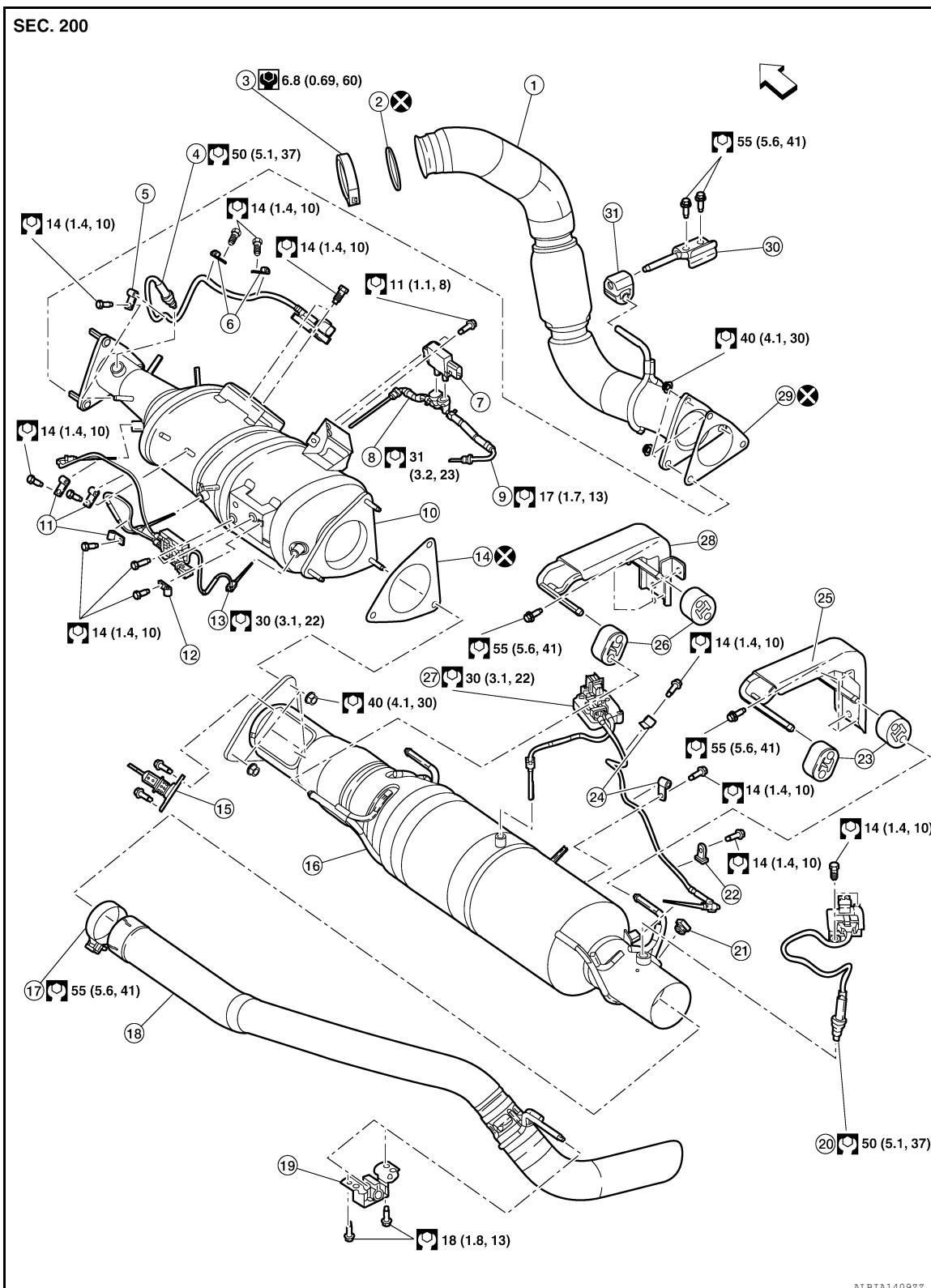
[CUMMINS 5.0L]

DPF TEMPERATURE SENSOR MODULE

Exploded View

INFOID:0000000014418423

EX



1. Exhaust downpipe	2. Gasket	3. V-band clamp
4. Inlet NOx sensor	5. Clamp	6. Clamp

DPF TEMPERATURE SENSOR MODULE

[CUMMINS 5.0L]

< REMOVAL AND INSTALLATION >

7. DPF differential pressure sensor	8. DPF differential pressure sensor upstream tube	9. DPF differential pressure sensor downstream tube
10. DOC and DPF assembly	11. Clamp	12. Clamp
13. DPF temperature sensor module	14. Gasket	15. DEF dosing valve
16. Decomposition tube and SCR catalyst assembly	17. Clamp	18. Tailpipe
19. Tailpipe hanger	20. Outlet NOx sensor	21. Plug
22. Clamp	23. Insulator	24. Clamp
25. Exhaust hanger (RR)	26. Insulator	27. SCR temperature sensor module
28. Exhaust hanger (FR)	29. Gasket	30. Exhaust downpipe hanger
31. Insulator	◀ : Front	

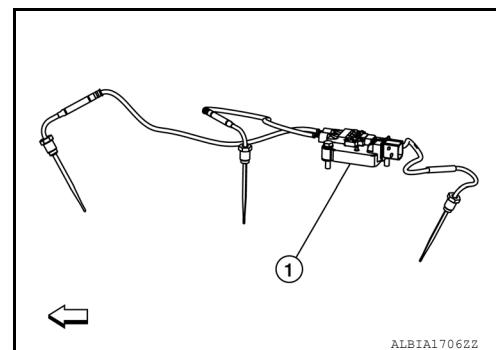
Removal and Installation

INFOID:0000000014418424

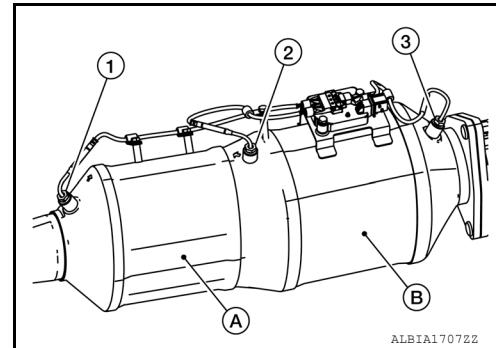
GENERAL INFORMATION

- The DPF temperature sensor assembly (1) is located on the DPF and consists of a module and three temperature sensor probes.

◀ : Front



- The temperature sensor module and temperature sensor probes are **not** serviceable separately and **must** be replaced as an assembly.
- Exhaust gas temperature sensor assemblies are used to measure the temperature of exhaust gas.
- The Diesel Oxidation Catalyst (DOC) intake temperature sensor probe (1) is located on the inlet cone of the DOC.
- The DPF intake temperature sensor probe (2) is located between the DOC (A) and DPF (B).
- The DPF outlet temperature sensor probe (3) is located in the outlet of the DPF.



INSPECTION BEFORE REMOVAL

- Use CONSULT to monitor the value of the exhaust gas temperature sensors with the ignition switch in the ON position and the engine OFF.
- The engine **must** be off long enough for coolant temperature to be equal to the local ambient air temperature.
- Replace any exhaust gas temperature sensor if the value is out of specification.
- The exhaust gas temperature sensors should read within 20°C (68°F) of the local ambient air temperature on a cold engine.

REMOVAL

DPF TEMPERATURE SENSOR MODULE

< REMOVAL AND INSTALLATION >

[CUMMINS 5.0L]

1. Loosen the retaining nuts and remove the exhaust gas temperature sensor probes (A) from the system.

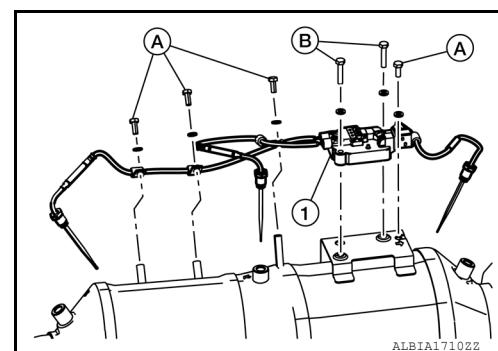
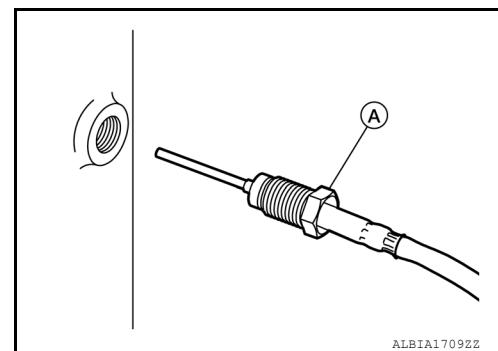
WARNING:

During regeneration, exhaust gas temperature can reach 800 °C (1500°F), and exhaust system surface temperature can exceed 700 °C (1300°F), which is hot enough to ignite or melt common materials, and to burn people. The exhaust and exhaust components can remain hot after the vehicle has stopped moving. To avoid the risk of fire, property damage, burns or other serious personal injury, allow the exhaust system to cool before beginning this procedure or repair and make sure that no combustible materials are located where they are likely to come in contact with hot exhaust or exhaust components.

NOTE:

Record the location where it was installed to make sure it is installed again in the same location.

2. Disconnect the temperature sensor connector from the vehicle harness.
3. Remove bolts (A) and release clamps securing the exhaust gas temperature sensor probe wires from the sensor table or canister.
4. Remove the bolts (B) securing the exhaust gas temperature sensor assembly (1) to the sensor table.



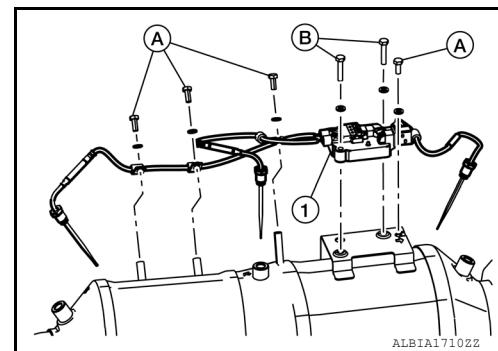
INSPECTION AFTER REMOVAL

- Inspect the vehicle harness connector and sensor for the following:
- Cracked or broken connector
- Missing or damaged connector seals
- Dirt, debris, or moisture in or on the connector pins
- Corroded, bent, broken, pushed back, or expanded pins
- Chipped, cracked, extruded, or damaged sensor
- Repair or replace parts as necessary.

INSTALLATION

1. Connect the temperature sensor connector to the vehicle harness.
2. Install the exhaust gas temperature sensor assembly (1) to the sensor table.
3. Install and tighten bolts (B).

(A) : Bolts



DPF TEMPERATURE SENSOR MODULE

< REMOVAL AND INSTALLATION >

[CUMMINS 5.0L]

4. Install the exhaust gas temperature sensor probes (A).

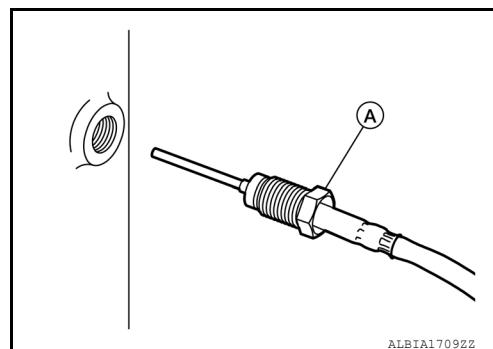
CAUTION:

The temperature sensors must be connected to the proper locations. After treatment system damage can result.

NOTE:

Apply a coating of anti-seize compound to the sensor threads prior to assembly.

5. Tighten the nut that secures the sensor.



ALBIA1709ZZ

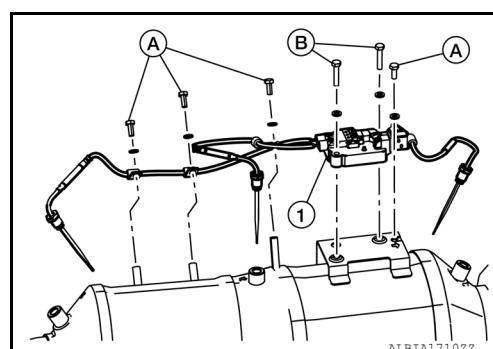
6. Install the clamps using bolts (A) to secure the exhaust gas temperature sensor probe wires to the sensor table or canister.

NOTE:

Make sure the exhaust gas temperature sensor probe wires are properly secured, so that they do **not** come in contact with hot components.

(1) : Exhaust gas temperature sensor assembly

(B) : Exhaust gas temperature sensor bolts



ALBIA1710ZZ

7. Connect the battery or batteries. Refer to [PG-185, "Battery Disconnect"](#).

WARNING:

Battery acid and battery acid fumes are extremely dangerous and can cause severe burns and explosion. To help reduce the risk of personal injury;

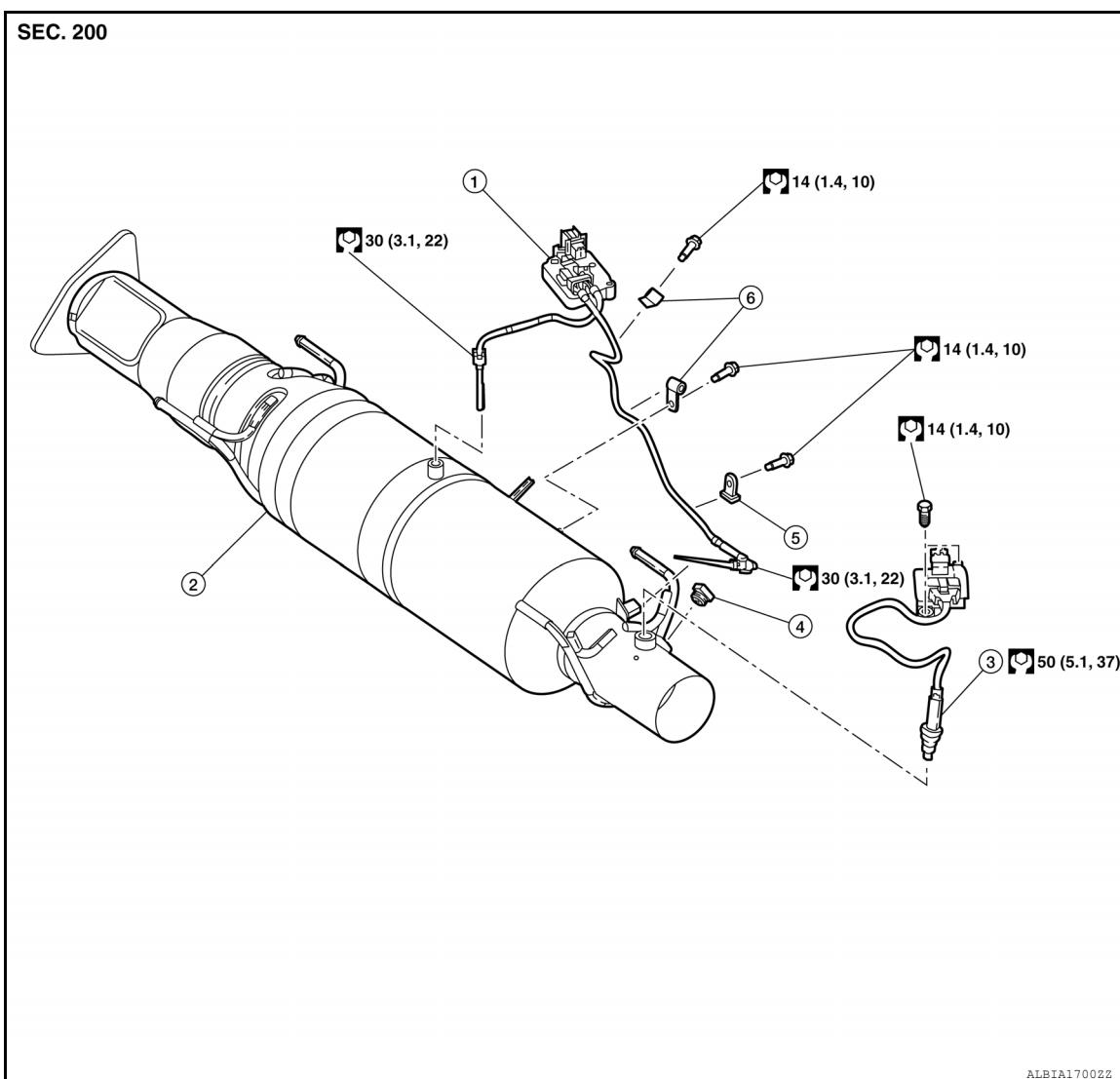
- Wear appropriate goggles and protective clothing.
- Always properly ventilate the area where the service is being performed.
- Never allow battery fluid to come in contact with skin, eyes, fabrics or painted surfaces.
- To avoid arcing, remove the negative (-) battery cable first and attach the negative (-) battery cable last.
- If acid contacts eyes, skin or clothing, immediately flush with water for 15 minutes and seek medical attention.

8. Operate the engine and check for leaks.

SCR TEMPERATURE SENSOR MODULE

Exploded View

INFOID:000000014418425



1. SCR temperature sensor module	2. Decomposition tube and SCR catalyst assembly	3. Outlet NOx sensor
4. Plug	5. Clamp	6. Clamp

Removal and Installation

INFOID:000000014418426

GENERAL INFORMATION

- The SCR catalyst temperature sensor assembly is located on the SCR catalyst and consists of a module and two temperature sensor probes.
- The temperature sensor module and temperature sensor probes are **not** serviceable separately and **must** be replaced as an assembly.
- Exhaust gas temperature sensor assemblies are used to measure the temperature of exhaust gas.
- The SCR catalyst intermediate temperature sensor probe is located in the middle of the SCR canister.
- The SCR catalyst outlet temperature sensor probe is located in the outlet cone of the SCR canister.

INSPECTION BEFORE REMOVAL

- Use CONSULT to monitor the value of the exhaust gas temperature sensors with the ignition switch in the ON position and the engine OFF.
- The engine **must** be off long enough for coolant temperature to be equal to the local ambient air temperature.
- Replace any exhaust gas temperature sensor if the value is out of specification.

SCR TEMPERATURE SENSOR MODULE

[CUMMINS 5.0L]

< REMOVAL AND INSTALLATION >

- The exhaust gas temperature sensors should read within 20°C (68°F) of the local ambient air temperature on a cold engine.

REMOVAL

- Disconnect the battery or batteries. Refer to [PG-185, "Battery Disconnect"](#).

WARNING:

Battery acid and battery acid fumes are extremely dangerous and can cause severe burns and explosion. To help reduce the risk of personal injury;

- Wear appropriate goggles and protective clothing.
- Always properly ventilate the area where the service is being performed.
- Never allow battery fluid to come in contact with skin, eyes, fabrics or painted surfaces.
- To avoid arcing, remove the negative (-) battery cable first and attach the negative (-) battery cable last.
- If acid contacts eyes, skin or clothing, immediately flush with water for 15 minutes and seek medical attention.

- Remove the decomposition tube and SCR catalyst assembly. Refer to [EX-36, "Removal and Installation"](#).
- Loosen the retaining nuts and remove the exhaust gas temperature sensor probes (A) from the system.

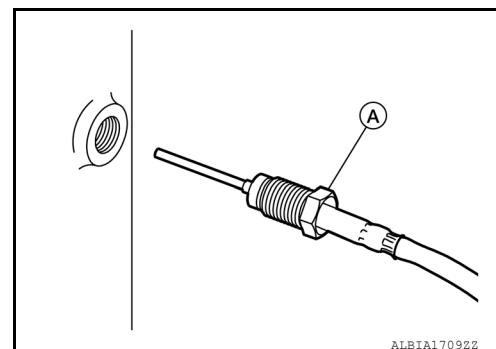
WARNING:

During regeneration, exhaust gas temperature can reach 800 °C (1500°F), and exhaust system surface temperature can exceed 700 °C (1300°F), which is hot enough to ignite or melt common materials, and to burn people. The exhaust and exhaust components can remain hot after the vehicle has stopped moving. To avoid the risk of fire, property damage, burns or other serious personal injury, allow the exhaust system to cool before beginning this procedure or repair and make sure that no combustible materials are located where they are likely to come in contact with hot exhaust or exhaust components.

NOTE:

Record the locations where it was installed to make sure it is installed again in the same location.

- Remove bolts and release clamps securing the SCR temperature sensor probe wires from the decomposition tube and SCR catalyst assembly and remove the SCR temperature sensor module.



INSPECTION AFTER REMOVAL

- Inspect the vehicle harness connector and sensor for the following:
 - Cracked or broken connector
 - Missing or damaged connector seals
 - Dirt, debris, or moisture in or on the connector pins
 - Corroded, bent, broken, pushed back, or expanded pins
 - Chipped, cracked, extruded, or damaged sensor
- Repair or replace parts as necessary.

INSTALLATION

- Install the SCR temperature sensor probes (A) into the decomposition tube and SCR catalyst assembly and tighten the probes.

CAUTION:

The temperature sensors must be connected to the proper locations. Aftertreatment system damage can result.

NOTE:

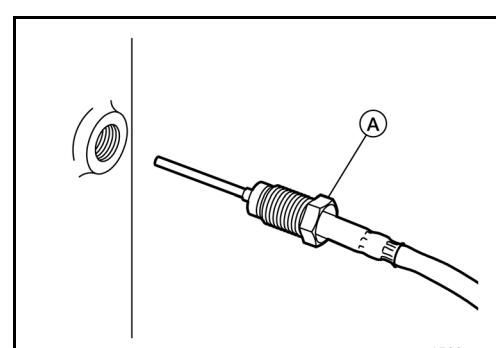
Apply a coating of anti-seize to SCR temperature sensor probes before installation.

- Install the clamps using bolts to secure the exhaust gas temperature sensor probe wires to the sensor table or canister.

NOTE:

Make sure the exhaust gas temperature sensor probe wires are properly secured, so that they do **not** come in contact with hot components.

- Install the decomposition tube and SCR catalyst assembly. Refer to [EX-36, "Removal and Installation"](#).
- Connect the battery or batteries. Refer to [PG-185, "Battery Disconnect"](#).



WARNING:

Battery acid and battery acid fumes are extremely dangerous and can cause severe burns and explosion. To help reduce the risk of personal injury:

- Wear appropriate goggles and protective clothing.
- Always properly ventilate the area where the service is being performed.
- Never allow battery fluid to come in contact with skin, eyes, fabrics or painted surfaces.
- To avoid arcing, remove the negative (-) battery cable first and attach the negative (-) battery cable last.
- If acid contacts eyes, skin or clothing, immediately flush with water for 15 minutes and seek medical attention.

5. Operate the engine and check for leaks.

A

EX

C

D

E

F

G

H

I

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K

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M

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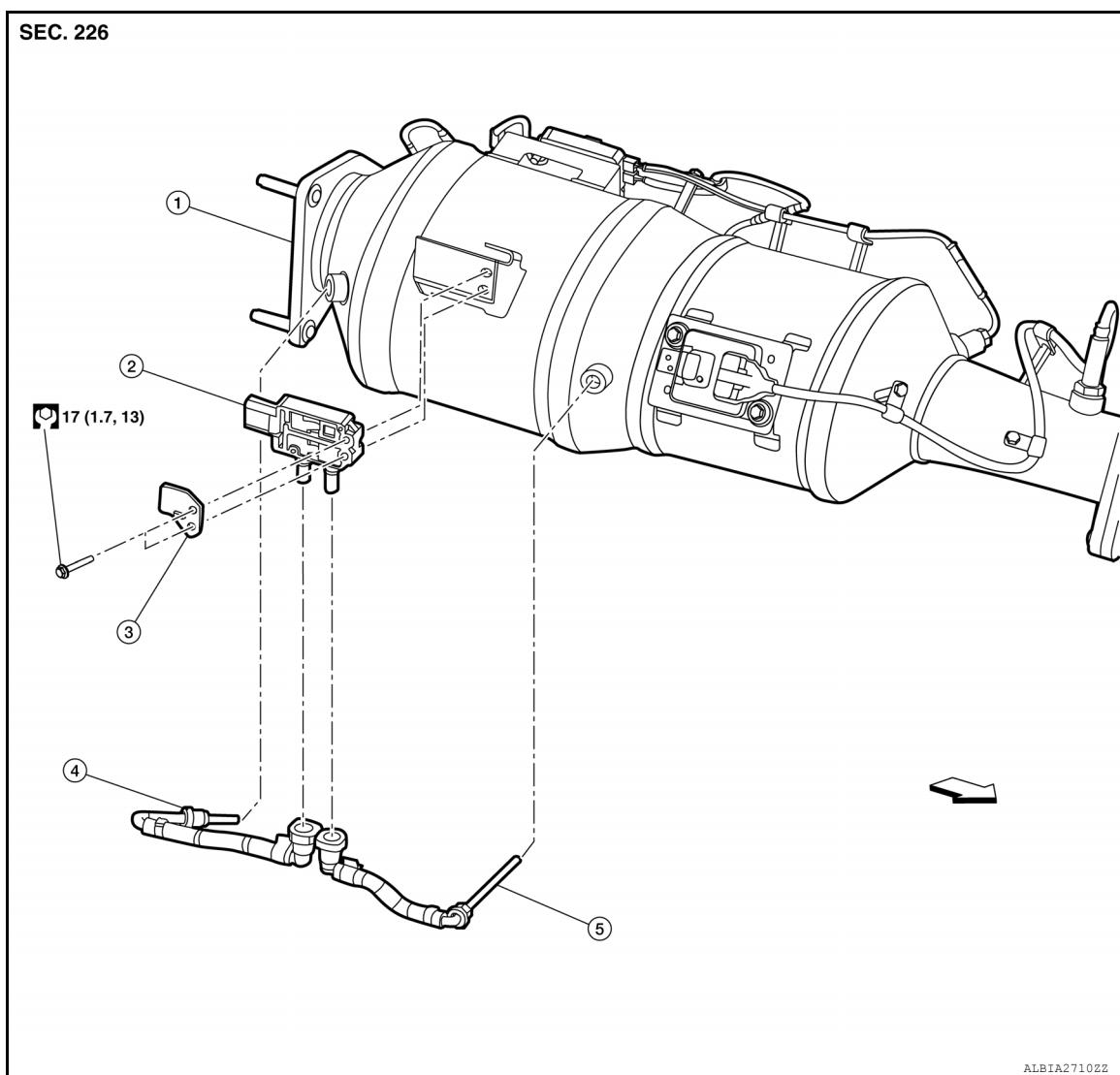
O

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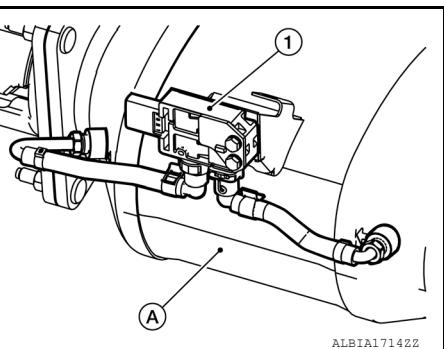
DPF DIFFERENTIAL PRESSURE SENSOR

Exploded View

INFOID:0000000014418427



1. DOC and DPF assembly
2. DPF differential pressure sensor
3. Cover
4. DPF differential pressure sensor downstream tube
5. DPF differential pressure sensor upstream tube



Removal and Installation

INFOID:0000000014418428

GENERAL INFORMATION

- The Diesel Particulate Filter (DPF) differential pressure sensor (1) is a combination sensor that monitors the differential pressure across the DPF and the pressure at the outlet of the DPF.
- The DPF differential pressure sensor is located on the DPF (A).

< REMOVAL AND INSTALLATION >

INSPECTION BEFORE REMOVAL

- Use CONSULT to monitor the value of the DPF differential pressure sensor with the ignition switch in the ON position and the engine OFF.
- The value of the DPF differential pressure should meet the following specification with the ignition switch in the ON position and the engine OFF.

A

EX

DPF Differential Pressure (Nominal) : $0 \pm 2.89 \text{ kpa}$ (0.03 kg/cm^2 , $0 \pm 0.42 \text{ psi}$)

- If either value is out of specification, inspect the DPF differential pressure hoses for blockage. Refer to [EX-61, "Removal and Installation"](#).
- If the DPF differential pressure hoses are **not** blocked, and if either sensor reading is out of specification, replace the DPF differential pressure sensor.

C

D

REMOVAL

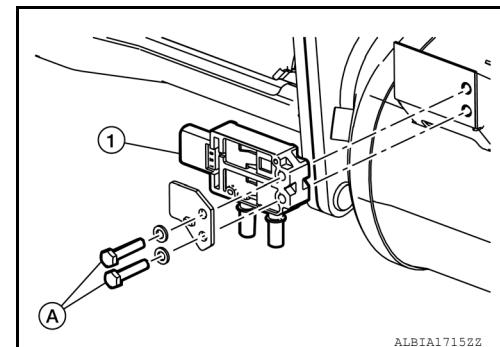
1. Disconnect the battery or batteries. Refer to [PG-185, "Battery Disconnect"](#).

WARNING:

Battery acid and battery acid fumes are extremely dangerous and can cause severe burns and explosion. To help reduce the risk of personal injury:

- Wear appropriate goggles and protective clothing.
- Always properly ventilate the area where the service is being performed.
- Never allow battery fluid to come in contact with skin, eyes, fabrics or painted surfaces.
- To avoid arcing, remove the negative (-) battery cable first and attach the negative (-) battery cable last.
- If acid contacts eyes, skin or clothing, immediately flush with water for 15 minutes and seek medical attention.

2. Remove the quick-disconnect fittings of the differential pressure sensor hoses from the differential pressure sensor by pressing in the locking tangs on the quick-disconnect fitting.
3. To remove the DPF differential pressure sensor (1):
 - a. Remove the bolts (A) from the bracket.



- b. Disconnect the harness connector from the DPF differential pressure sensor.

INSPECTION AFTER REMOVAL

- Inspect the hoses for cuts or holes. Replace the hoses if damage is found.
- Inspect the inside of the hoses for plugging and soot accumulation. If plugging or soot accumulation is present, the hoses **must** be cleaned.
- Inspect the vehicle harness connector and sensor for the following:
 - Cracked or broken connector
 - Missing or damaged connector seals
 - Dirt, debris, or moisture in or on the connector pins
 - Corroded, bent, broken, pushed back, or expanded pins
 - Chipped, cracked, extruded, or damaged sensor
- Repair or replace parts as necessary.

M

N

O

P

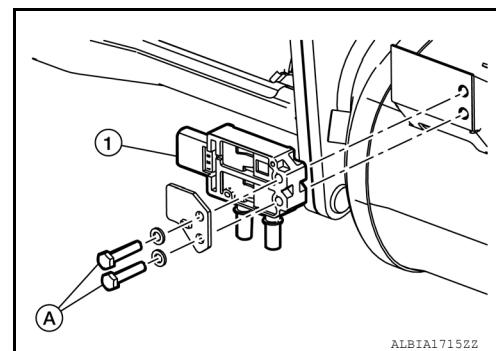
INSTALLATION

DPF DIFFERENTIAL PRESSURE SENSOR

< REMOVAL AND INSTALLATION >

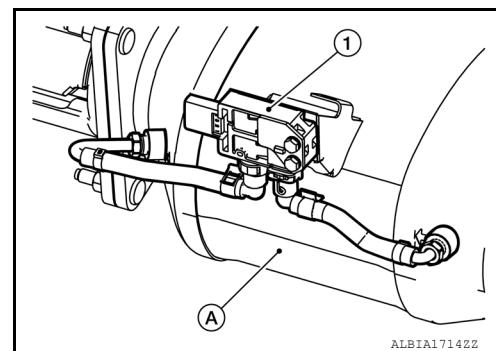
[CUMMINS 5.0L]

1. Install the DPF differential pressure sensor (1).
2. Install and tighten bolts (A) to the bracket.



3. Install the quick-disconnect fittings of the differential pressure sensor tubes to the differential pressure sensor (1).

(A) : DPF canister



4. Connect the harness connector to the DPF differential pressure sensor.
5. Connect the battery or batteries. Refer to [PG-185, "Battery Disconnect"](#).

WARNING:

Battery acid and battery acid fumes are extremely dangerous and can cause severe burns and explosion. To help reduce the risk of personal injury:

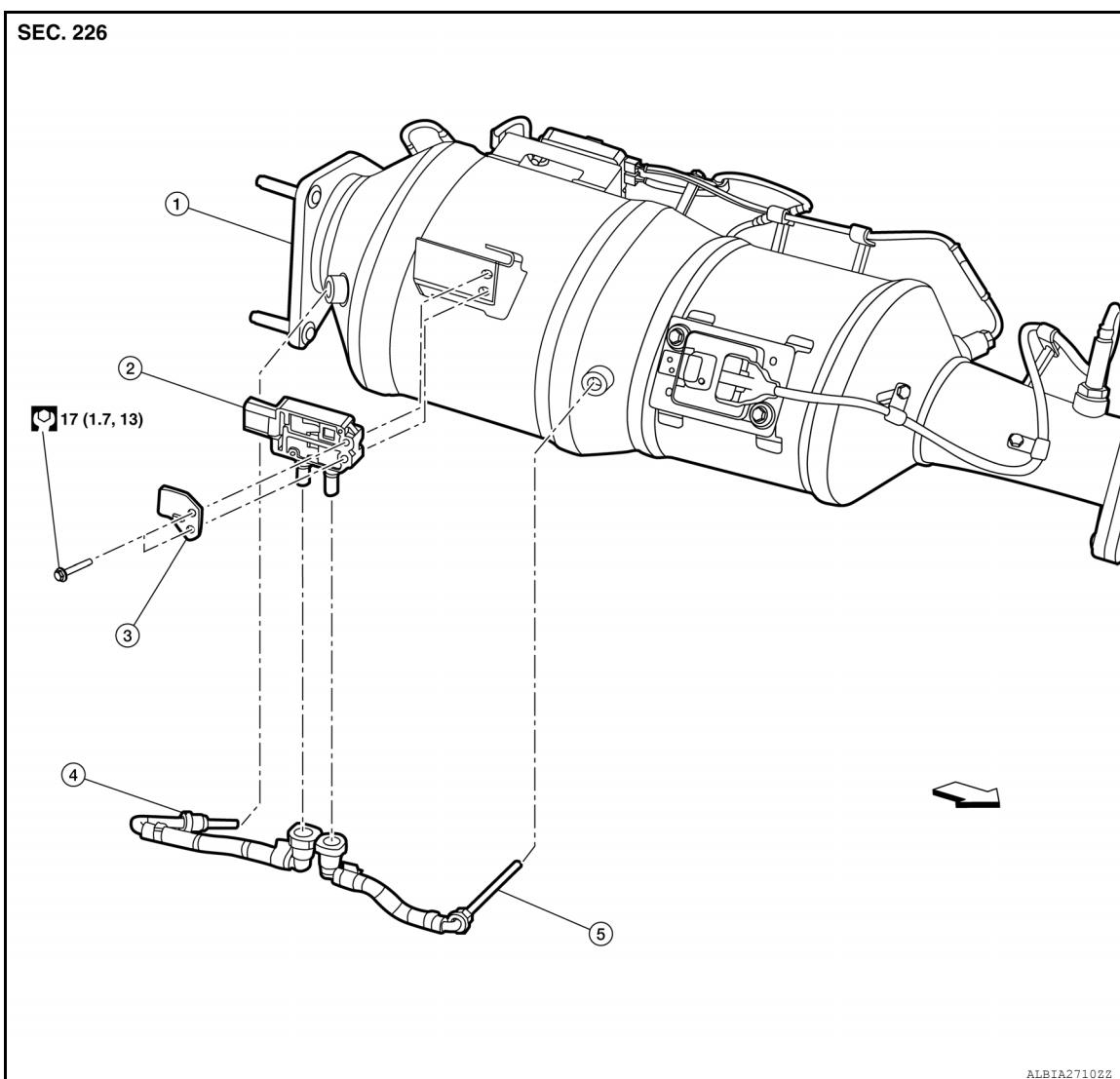
- Wear appropriate goggles and protective clothing.
- Always properly ventilate the area where the service is being performed.
- Never allow battery fluid to come in contact with skin, eyes, fabrics or painted surfaces.
- To avoid arcing, remove the negative (-) battery cable first and attach the negative (-) battery cable last.
- If acid contacts eyes, skin or clothing, immediately flush with water for 15 minutes and seek medical attention.

6. Operate the engine and check for leaks.

DPF DIFFERENTIAL PRESSURE SENSOR TUBES

Exploded View

INFOID:000000014418429



- 1. DOC and DPF assembly
- 2. DPF differential pressure sensor
- 3. Cover
- 4. DPF differential pressure sensor downstream tube
- 5. DPF differential pressure sensor upstream tube

ALBIA2710ZZ

Removal and Installation

INFOID:000000014418430

GENERAL INFORMATION

WARNING:

During regeneration, exhaust gas temperature could reach 800°C (1500°F), and exhaust system surface temperature could exceed 700°C (1300°F), which is hot enough to ignite or melt common materials, and to burn people. The exhaust and exhaust components can remain hot after the vehicle has stopped moving. To avoid the risk of fire, property damage, burns or other serious personal injury, allow the exhaust system to cool before beginning this procedure or repair and make sure that no combustible materials are located where they are likely to come in contact with hot exhaust or exhaust components.

WARNING:

The material captured in a diesel particulate filter may contain elevated concentrations of metals, primarily zinc and molybdenum, and possibly polynuclear aromatic hydrocarbons that may be regulated. These materials must be characterized, handled, and disposed of according to applicable local regulations. In addition, due to the presence of the above-listed chemicals and other potentially toxic com-

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DPF DIFFERENTIAL PRESSURE SENSOR TUBES

< REMOVAL AND INSTALLATION >

[CUMMINS 5.0L]

Components such as oxides of calcium, zinc, phosphorous, silicone, sulfur, and iron, exhaust filter maintenance must be completed only by appropriately trained personnel.

- The Diesel Particulate Filter (DPF) differential pressure sensor tubes connect the DPF differential pressure sensor to the ports on the system. There are two DPF differential pressure sensor tubes. One tube connects to the system upstream of the DPF and the other connects downstream of the DPF.
- Excessive carbon deposits inside the DPF differential pressure sensor tubes can cause a malfunction indicator light (MIL).

REMOVAL

1. Disconnect the battery or batteries. Refer to [PG-185, "Battery Disconnect"](#).

WARNING:

Battery acid and battery acid fumes are extremely dangerous and can cause severe burns and explosion. To help reduce the risk of personal injury:

- Wear appropriate goggles and protective clothing.
- Always properly ventilate the area where the service is being performed.
- Never allow battery fluid to come in contact with skin, eyes, fabrics, or painted surfaces.
- To avoid arcing, remove the negative (-) battery cable first and attach the negative (-) battery cable last.
- If acid contacts eyes, skin or clothing, immediately flush with water for 15 minutes and seek medical attention.

2. Remove the DOC and DPF assembly. Refer to [EX-42, "Removal and Installation"](#).

3. Loosen the DPF differential pressure sensor tube nuts.

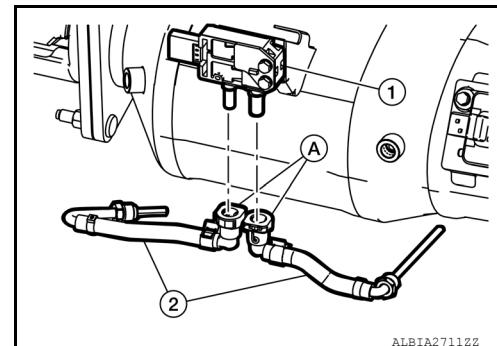
WARNING:

During regeneration, exhaust gas temperature could reach 800°C (1500°F), and exhaust system surface temperature could exceed 700°C (1300°F), which is hot enough to ignite or melt common materials, and to burn people. The exhaust and exhaust components can remain hot after the vehicle has stopped moving. To avoid the risk of fire, property damage, burns or other serious personal injury, allow the exhaust system to cool before beginning this procedure or repair and make sure that no combustible materials are located where they are likely to come in contact with hot exhaust or exhaust components.

CAUTION:

The aftertreatment DPF differential sensor will not operate properly if the aftertreatment DPF differential pressure sensor tubes are not connected to the correct port. Mark the aftertreatment DPF differential pressure sensor tube connection port locations before disconnecting.

4. Remove the quick-disconnect fittings (A) from the DPF differential pressure sensor (1) and remove the DPF differential pressure sensor tubes (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 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.

WARNING:

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

- Do not exceed 207 kPa (30 psi).
- Wear appropriate eye protection and protective clothing including gloves.
- Inspect the inside of the tube for any debris or saturation.

DPF DIFFERENTIAL PRESSURE SENSOR TUBES

< REMOVAL AND INSTALLATION >

[CUMMINS 5.0L]

- Dry the tube with compressed air.
- Check the tube for cracks and thread damage. Replace the tube if damage is found.

NOTE:

To make sure of proper function of the drain holes and condensate drainage in the pressure sensor and related tubing, the DPF device **must** be mounted such that the tubes integral to the pressure sensor are oriented downward. Horizontally-mounted devices **must** be installed such that the axis of the housing and the pressure sensor are within ± 10 degrees of vertical.

- Inspect the inside of the threaded bosses on the canister.
- Clean debris with a lint-free cloth from the inside of the threaded bosses, while being careful **not** to damage the threads.

CAUTION:

When cleaning the threaded bosses, be careful to not drop any debris inside the canister. Aftertreatment system damage can result.

INSTALLATION

1. Install the DPF differential pressure sensor tubes into the DOC and DPF assembly and tighten the nuts.

CAUTION:

The aftertreatment DPF differential sensor will not operate properly if the aftertreatment DPF differential pressure sensor tubes are not connected to the correct port. Install the aftertreatment DPF differential pressure sensor tubes as noted during disassembly.

CAUTION:

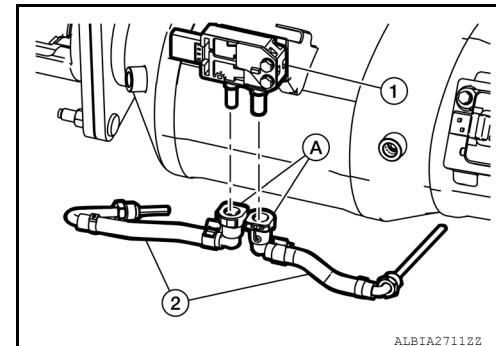
The aftertreatment system must be installed so the aftertreatment DPF differential pressure sensor tubes slope downward to drain condensation away from the aftertreatment DPF differential pressure sensor.

NOTE:

- Apply a coating of anti-seize to the threads on the DPF differential pressure sensor tubes prior to assembly. Do **not** allow anti-seize to enter the inside of the DPF differential pressure sensor tubes. This can cause a blockage.
- Minimum anti-seize temperature range specifications: 870°C (1600°F).
- Make sure the DPF differential pressure sensor tubes are **not** making contact with each other or any other vehicle components prior to tightening the DPF differential pressure sensor tube nuts.

2. Install the quick-disconnect fittings (A) onto the DPF differential pressure sensor module (1).

(2) : DPF differential pressure sensor tubes



3. Install the DOC and DPF assembly. Refer to [EX-42, "Removal and Installation"](#).
4. Connect the battery or batteries. Refer to [PG-185, "Battery Disconnect"](#).

WARNING:

Warning: Battery acid and battery acid fumes are extremely dangerous and can cause severe burns and explosion. To help reduce the risk of personal injury:

- Wear appropriate goggles and protective clothing.
- Always properly ventilate the area where the service is being performed.
- Never allow battery fluid to come in contact with skin, eyes, fabrics, or painted surfaces.
- To avoid arcing, remove the negative (-) battery cable first and attach the negative (-) battery cable last.
- If acid contacts eyes, skin or clothing, immediately flush with water for 15 minutes and seek medical attention.

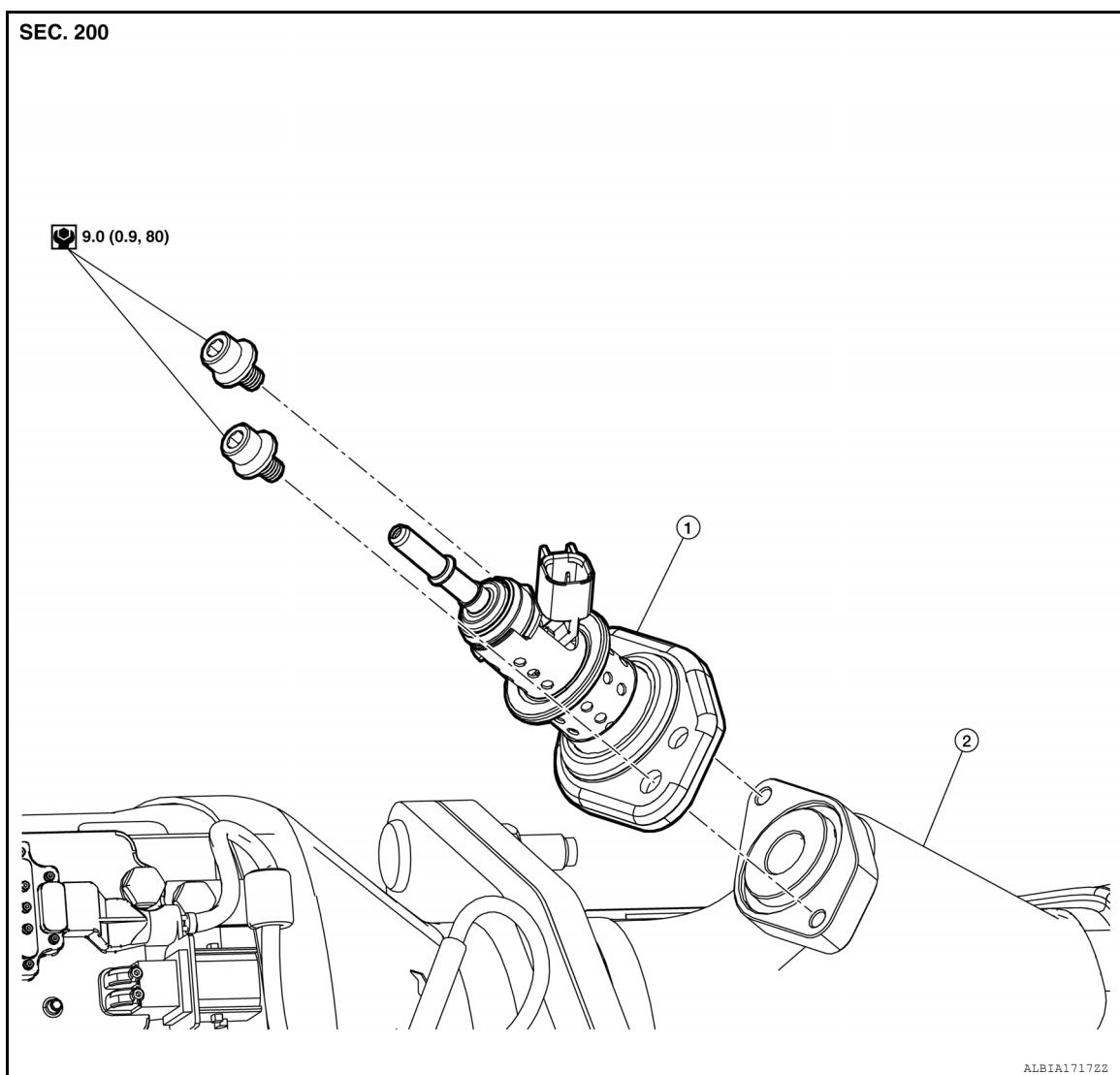
5. Operate engine and check for leaks.

< REMOVAL AND INSTALLATION >

DEF DOSING VALVE

Exploded View

INFOID:0000000014418431



1. DEF dosing valve
2. Decomposition tube and SCR catalyst assembly

Removal and Installation

INFOID:0000000014418432

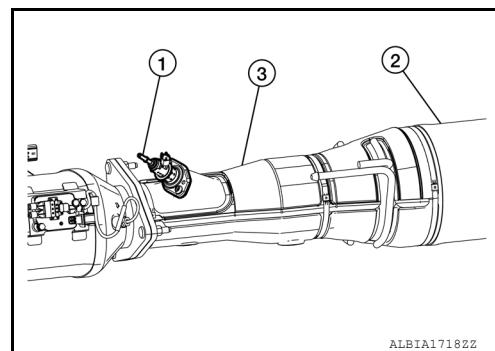
GENERAL INFORMATION

CAUTION:

Use care when handling and/or disconnecting the diesel exhaust fluid line from the aftertreatment diesel exhaust fluid dosing valve. The diesel exhaust fluid supply connector of the aftertreatment diesel exhaust fluid dosing valve can be easily damaged.

< REMOVAL AND INSTALLATION >

- The Diesel Exhaust Fluid (DEF) dosing valve (1) is used to spray DEF into the exhaust flow prior to the intake of the Selective Catalyst Reduction (SCR) catalyst (2). The DEF dosing valve is located on the decomposition tube (3), mounted on a flange with three bolts.
- There are two primary connections at the DEF dosing valve:
 - A 2-pin harness connection, which connects the DEF dosing valve to the Engine Control Module (ECM)
 - A DEF supply line, which connects the DEF dosing valve to the DEF dosing unit
- Use the following procedure for further information on the operation of the DEF dosing valve. Refer to [EX-10, "System Description"](#).
- Use the following procedure for information on handling incorrect or contaminated DEF. Refer to [EX-15, "Exhaust Schematic"](#).



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INSPECTION BEFORE REMOVAL

WARNING:

During regeneration, exhaust gas temperature can reach 800°C (1500°F), and exhaust system surface temperature can exceed 700°C (1300°F), which is hot enough to ignite or melt common materials, and to cause serious personal injury. The exhaust and exhaust components can remain hot after the vehicle has stopped moving. To avoid the risk of fire, property damage, burns or other serious personal injury, allow the exhaust system to cool before beginning this procedure or repair and make sure that no combustible materials are located where they are likely to come in contact with hot exhaust or exhaust components.

CAUTION:

Do not use the flow test portion of CONSULT Diesel Exhaust Fluid Doser Pump Override Test to check the system for leaks. This will spray DEF into the exhaust system at temperatures too low to evaporate, resulting in deposit formations in the exhaust system.

NOTE:

DEF deposits could possibly be left over from a previous DEF spill or repair. Verify active leaks before replacing any components.

- Inspect the area around the DEF line connection location at the DEF dosing valve.
- Inspect for signs of leaks and/or white deposits. Inspect the body and around the base of the DEF dosing valve. Check for signs of exhaust leaks and white deposits.
- If mud is found in the dosing valve body, use water to wash it off.
- A DEF leak in this area may derive from:
 - The connection between the DEF line and the DEF dosing valve
 - The DEF dosing valve joints between the valve and the decomposition tube
 - Due to deposit buildups possibly masking the source of the leak, it may be necessary to remove the deposits and clean the area with warm water.

RESISTANCE CHECK

- Pull the locking tab on the harness connector to disconnect the 2-pin harness connector.
- Use a suitable tool to check the resistance of the DEF dosing valve.

NOTE:

- Resistance specification: 9 to 15 ohms.
- If the measured resistance is out of specification, the DEF dosing valve may have been overheated.

NOTE:

The resistance **must** be measured at room temperature (approximately 25°C [77°F]).

- If the measured value is **not** within specifications, replace the DEF dosing valve.
- Test drive the vehicle for a minimum of 15 minutes to get the SCR system up to temperature. Check the area again for the source of the leak.

NOTE:

The DEF dosing system will **not** dose DEF until the correct SCR temperatures are reached.

- Once the source of the DEF leaks and/or deposits are identified, reference the Inspection after Removal section of this procedure.

REMOVAL

WARNING:

- To reduce the risk of personal injury, do not get Diesel Exhaust Fluid (DEF) in your eyes as it contains urea. In case of contact, immediately flush eyes with large amounts of water for a minimum of

DEF DOSING VALVE

[CUMMINS 5.0L]

< REMOVAL AND INSTALLATION >

15 minutes. Do not swallow. In the event DEF is ingested, contact a physician immediately. Reference the Safety Data Sheet (SDS) for additional information.

- During regeneration, exhaust gas temperature can reach 800°C (1500°F), and exhaust system surface temperature can exceed 700°C (1300°F), which is hot enough to ignite or melt common materials, and to cause serious personal injury. The exhaust and exhaust components can remain hot after the vehicle has stopped moving. To avoid the risk of fire, property damage, burns or other serious personal injury, allow the exhaust system to cool before beginning this procedure or repair and make sure that no combustible materials are located where they are likely to come in contact with hot exhaust or exhaust components.
- The DEF line connecting the aftertreatment DEF dosing unit to the aftertreatment DEF dosing valve is under low pressure and should not be disconnected while the engine is running or before the system has completed the purge process after engine shutdown. Disconnecting the DEF line while under low pressure could cause DEF to spray.

1. Disconnect the battery or batteries. Refer to [PG-185, "Battery Disconnect"](#).

WARNING:

Battery acid and battery acid fumes are extremely dangerous and can cause severe burns and explosion. To help reduce the risk of personal injury;

- Wear appropriate goggles and protective clothing.
- Always properly ventilate the area where the service is being performed.
- Never allow battery fluid to come in contact with skin, eyes, fabrics or painted surfaces.
- To avoid arcing, remove the negative (-) battery cable first and attach the negative (-) battery cable last.
- If acid contacts eyes, skin or clothing, immediately flush with water for 15 minutes and seek medical attention.

NOTE:

Do not disconnect the vehicle batteries until the DEF dosing system has completed the purge cycle. Before beginning to remove and/or disconnect any components, wait at least 5 minutes after the keyswitch is turned OFF for the DEF dosing system to purge the DEF from the system. The purge cycle is an automatic process and does not require intervention to occur. The DEF dosing unit will create an audible pumping noise during the purging process.

2. Disconnect the DEF dosing valve harness connector and DEF supply line.

CAUTION:

To avoid damage, do not kink or bend fuel, lubrication air intake and exhaust tubing or lines. Ensure all tubes and lines are routed and installed properly and care is given during the disassembly and assembly process. Failure to do so can result in damage to the tubes, lines or surrounding components.

NOTE:

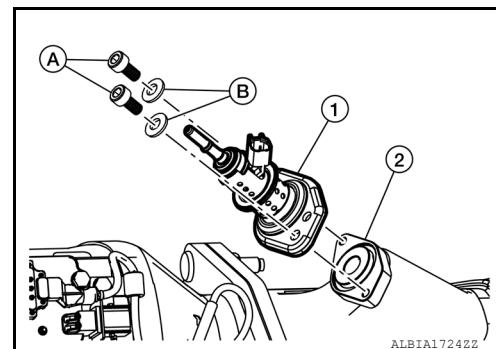
When removing components such as hoses, tubes/lines, etc., cap or plug openings to prevent fluid from spilling.

3. Remove the bolts (A) and washers (B) that secure the DEF dosing valve (1) to the decomposition tube.

NOTE:

- A small amount of DEF deposits is normal if observed on the DEF dosing valve face and around the gasket of the DEF dosing valve.
- Place a protective cap over the decomposition tube to prevent any dirt or debris from entering the system.

(2) : Gasket



4. Remove the DEF dosing valve.

CAUTION:

Do not set the aftertreatment DEF dosing valve down on the spray area of the aftertreatment DEF dosing valve. Damage can occur.

5. Remove the gasket.

NOTE:

- Do not reuse the gasket.

< REMOVAL AND INSTALLATION >

- The gasket can become brittle and adhere to either the decomposition tube or DEF dosing valve. Do **not** drop gasket material into the decomposition tube when removing. Apply an alcohol-based solution or water to the gasket to soften its composition. Using suitable tools, remove the gasket if necessary.
- Cover decomposition tube opening after removing gasket to prevent debris from entering.

A

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INSPECTION AFTER REMOVAL

- If leaks or deposits are found at the DEF line connection during the Inspection Before Removal section of this procedure, inspect the DEF line connection port for cracks or pitting.

C

- Inspect the harness connector on the vehicle harness for corrosion or other damage.

D

NOTE:

If damage/corrosion is found, replace part.

E

Cleaning DEF dosing valve

- Use a brass brush and warm water to clean the bottom and the tip of the DEF dosing valve.

F

NOTE:

Use **only** a brass brush to clean the tip of the DEF dosing valve. The use of a wire wheel will cause permanent damage to the DEF dosing valve.

G

- Wipe any debris away with a clean shop towel soaked in distilled water.

H

DEF dosing valve inspection

- Inspect the dosing valve tip for cracks or other damage. Replace if damage is found.
- If leaks or deposits are found at the base of the DEF dosing valve during the Initial Check section of this procedure, inspect the following:
 - The bottom of the DEF dosing valve around the gasket sealing surface for signs of heavy corrosion, pitting, and/or surface damage. Replace the DEF dosing valve if damage is found.
 - The DEF dosing valve mounting surface on the decomposition tube. Refer to [EX-64, "Removal and Installation"](#).
- Inspect the bolts for damaged threads, corroded surfaces, or a reduced shank diameter (due to bolts stretching).
- Replace if damage is found.

I

INSTALLATION

1. Remove any protective caps.

J

NOTE:

If the DEF dosing valve is not new and has sat unused for extended periods, manually fill with DEF and let soak for a minimum of 10 minutes before securing the DEF supply line.

K

Remove adhesive backing from the gasket. Align the gasket with the DEF dosing valve flange (adhesive-side down) and press firmly onto the DEF dosing valve flange to make sure there is flush adhesion with the DEF dosing valve flange sealing surface.

L

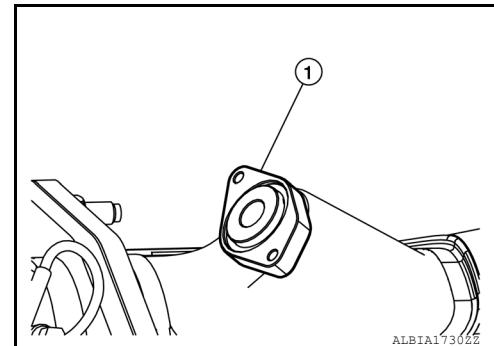
2. Make sure the DEF dosing valve port (1) is free of gasket material and other debris.

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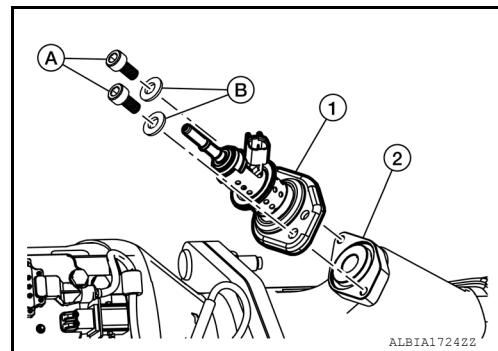
DEF DOSING VALVE

[CUMMINS 5.0L]

< REMOVAL AND INSTALLATION >

- Install the DEF fluid dosing valve (1) onto the decomposition tube (2).
NOTE:
 - Apply a coat of high temperature anti-seize compound to the DEF dosing valve bolts.
 - Hand-tighten both bolts with the washers (B) until the gasket is seated properly on the decomposition tube.
- Tighten the bolts (A).

Step 1 : 4.5 N·m (0.46 kg·m, 40 in-lb)
Step 2 : 9.0 N·m (0.9 kg·m, 80 in-lb)



- Connect the DEF supply line and DEF dosing valve harness connector.
- Connect the battery or batteries. Refer to [PG-185, "Battery Disconnect"](#).

WARNING:

Battery acid and battery acid fumes are extremely dangerous and can cause severe burns and explosion. To help reduce the risk of personal injury;

- Wear appropriate goggles and protective clothing.
- Always properly ventilate the area where the service is being performed.
- Never allow battery fluid to come in contact with skin, eyes, fabrics or painted surfaces.
- To avoid arcing, remove the negative (-) battery cable first and attach the negative (-) battery cable last.
- If acid contacts eyes, skin or clothing, immediately flush with water for 15 minutes and seek medical attention.

CAUTION:

Do not use the flow test portion of CONSULT Diesel Exhaust Fluid Doser Pump Override Test to check the system for leaks. This will spray DEF into the exhaust system at temperatures too low to evaporate, resulting in deposit formations in the exhaust system.

NOTE:

The DEF dosing system will **not** prime until the correct SCR temperatures are reached. To verify that the system is correctly installed and has **no** leaks, induce a stationary regeneration to get the SCR system up to temperature.

- Operate the engine and check for leaks.

DEF Dosing Unit Override Test

INFOID:0000000014418433

GENERAL INFORMATION

Perform a dosing cycle to check the:

- Diesel exhaust fluid (DEF) dosing valve spray characteristics
- Amount of DEF to be delivered in a specified time (6 minutes).
- The test can be accessed through CONSULT under engine control module (ECM) Diagnostic Tests. Follow the on-screen instructions to perform the test.

INSPECTION BEFORE REMOVAL

DEF supply line

- Check for any leaks, blockages, or restrictions in the DEF supply line between the DEF dosing unit and the DEF dosing valve.
- Repair as necessary.

DEF fluid

- Check for an adequate amount of DEF in the DEF tank prior to starting this test.
- Check the concentration and quality of the DEF.

REMOVAL

- Disconnect the battery or batteries. Refer to [PG-185, "Battery Disconnect"](#).

WARNING:

Battery acid and battery acid fumes are extremely dangerous and can cause severe burns and explosion. To help reduce the risk of personal injury;

- Wear appropriate goggles and protective clothing.

< REMOVAL AND INSTALLATION >

- Always properly ventilate the area where the service is being performed.
- Never allow battery fluid to come in contact with skin, eyes, fabrics or painted surfaces.
- To avoid arcing, remove the negative (-) battery cable first and attach the negative (-) battery cable last.
- If acid contacts eyes, skin or clothing, immediately flush with water for 15 minutes and seek medical attention.

NOTE:

Low battery voltage can cause the dosing volume to be low. Check the batteries.

2. Remove the DEF dosing valve. Refer to [EX-64, "Removal and Installation".](#)

FLOW TEST

1. Connect the DEF dosing valve harness connector (A) and DEF supply line (1).

WARNING:

To reduce the risk of personal injury, do not get Diesel Exhaust Fluid (DEF) in your eyes as it contains urea. In case of contact, immediately flush eyes with large amounts of water for a minimum of 15 minutes. Do not swallow. In the event DEF is ingested, contact a physician immediately. Reference the Safety Data Sheet (SDS) for additional information.

CAUTION:

- To avoid damage, do not kink or bend fuel, lubrication air intake and exhaust tubing or lines. Ensure all tubes and lines are routed and installed properly and care is given during the disassembly and assembly process. Failure to do so can result in damage to the tubes, lines or surrounding components.
- Do not connect a 12-VDC supply to the aftertreatment DEF dosing valve as this will cause permanent damage.

2. Obtain a clear plastic container (A) [large enough to hold the DEF dosing valve (1)] and a suitable tool for measuring DEF.

NOTE:

- A suitable tool that is marked in milliliters (ml) or ounces (oz) can also be used.
- It is usually easier to capture the DEF in a clean container and then transfer it to the measuring device for the final measurement.
- The measuring device **must** be capable of measuring between 0 ml (0.0 oz) and 500 ml (17.0 oz) in 5 ml (0.34 oz) increments.

Place the DEF dosing valve into the container.

3. When the test is being performed, the DEF dosing valve will spray a very fine mist of DEF. To prevent fine mist from escaping into the air and to make sure of an accurate measurement, place a clean shop towel or cover over the valve and container.

WARNING:

To reduce the risk of personal injury, do not get Diesel Exhaust Fluid (DEF) in your eyes as it contains urea. In case of contact, immediately flush eyes with large amounts of water for a minimum of 15 minutes. Do not swallow. In the event DEF is ingested, contact a physician immediately. Reference the Safety Data Sheet (SDS) for additional information.

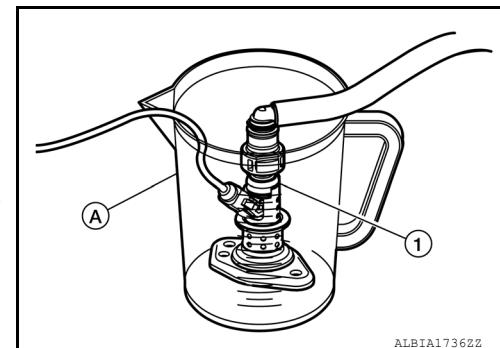
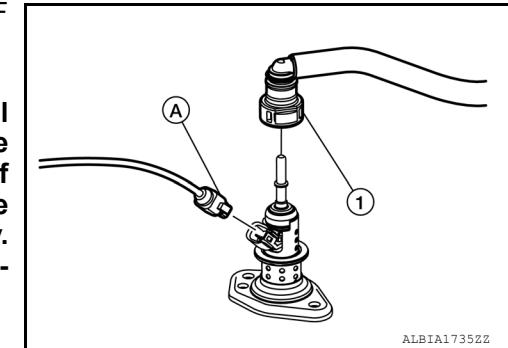
NOTE:

When the test is started, the dosing system will first prime. During this process, the DEF dosing valve will open intermittently to purge air from the system. In doing so, some DEF will be sprayed from the tip. This is a normal operating characteristic.

4. When the test begins, briefly monitor the spray pattern of the DEF exiting the aftertreatment DEF dosing valve. Check for the following:

- Signs of larger drops and/or dripping DEF from the tip
- Spray pattern that is **not** symmetrical (sprays more to one side)

If necessary, perform the test again and monitor the spray pattern. If the problem persists, replace the DEF dosing valve. Refer to [EX-64, "Removal and Installation".](#)



DEF DOSING VALVE

[CUMMINS 5.0L]

< REMOVAL AND INSTALLATION >

5. CONSULT will start the test and will inject the DEF for 6 minutes. CONSULT will automatically disable the injector at the end of the test. If the test needs to be stopped before finishing, click the Stop button.
 - Turn the keyswitch ON.
 - Connect CONSULT.
 - Locate the Diesel Exhaust Fluid Doser Pump Override Test under ECM Diagnostic Tests.
 - Follow the on-screen instructions to perform the test.

NOTE:

Prior to performing this test, if **not** already directed by a DTC Diagnosis Procedure, view and troubleshoot any fault codes with CONSULT.

6. After the test is complete (test runs for 6 minutes), measure the amount of DEF sprayed into the container.
 - Pour the DEF into a suitable measuring device.
 - Perform the test three times. The amount of DEF measured for each test **must** be within specification.

DEF Dosing Valve Volume Specifications

Minimum	: 85 mL (2.9 US fl oz, 3.0 Imp fl oz)
Maximum	: 115 mL (3.9 US fl oz, 4.0 Imp fl oz)

NOTE:

Do **not** pour the DEF back into the DEF tank. Dispose of the DEF in accordance with local environmental regulations.

7. If the amount of DEF is **not** within specification, verify the DEF filter is not plugged and check for leaks, blockages, or restrictions in the DEF line between the DEF dosing unit and the DEF dosing valve.

NOTE:

Low battery voltage can cause the dosing volume to be low. Check the batteries. Refer to [PG-175, "Work Flow"](#). View and troubleshoot any fault codes with CONSULT.

NOTE:

The DEF dosing valve may have been plugged by debris. Inspect the DEF dosing unit filter for signs of contamination and debris prior to installing the new DEF dosing valve. Refer to [EX-64, "Removal and Installation"](#).

8. After the test is complete, a light coating of DEF will cover the DEF dosing valve, DEF line, and harness. Prior to disconnecting anything, use a clean shop towel soaked in warm water to wipe the coating of DEF from the components.

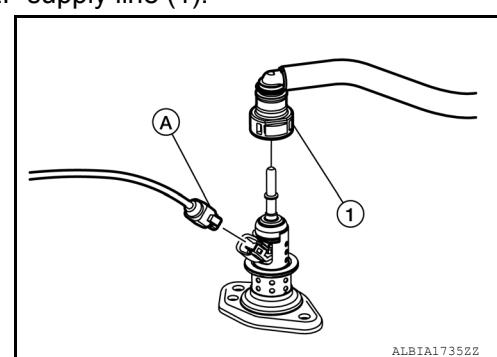
CAUTION:

Do not submerge the aftertreatment DEF dosing valve in solvent or water. Damage to the after-treatment DEF dosing valve will result.

9. Disconnect the DEF dosing valve harness connector (A) and DEF supply line (1).

NOTE:

Clean any tools used for this test with warm, distilled water before storage.



INSTALLATION

1. Install the DEF dosing valve. Refer to [EX-64, "Removal and Installation"](#).
2. Connect the battery or batteries. Refer to [PG-185, "Battery Disconnect"](#).

WARNING:

Battery acid and battery acid fumes are extremely dangerous and can cause severe burns and explosion. To help reduce the risk of personal injury;

- Wear appropriate goggles and protective clothing.

< REMOVAL AND INSTALLATION >

- Always properly ventilate the area where the service is being performed.
- Never allow battery fluid to come in contact with skin, eyes, fabrics or painted surfaces.
- To avoid arcing, remove the negative (-) battery cable first and attach the negative (-) battery cable last.
- If acid contacts eyes, skin or clothing, immediately flush with water for 15 minutes and seek medical attention.

A
EX

Air in DEF Test

INFOID:000000014418434

TEST

1. Remove the DEF supply line (1) from the DEF dosing valve.

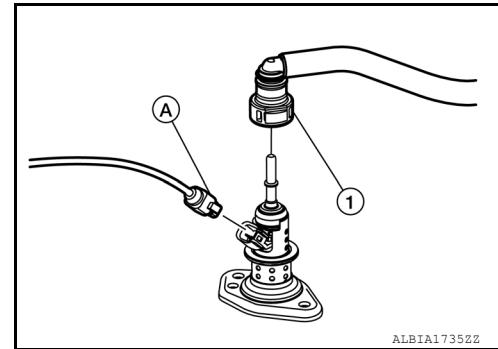
(A) : DEF dosing valve harness connector

CAUTION:

To avoid damage, do not kink or bend fuel, lubrication air intake and exhaust tubing or lines. Ensure all tubes and lines are routed and installed properly and care is given during the disassembly and assembly process. Failure to do so can result in damage to the tubes, lines or surrounding components.

NOTE:

Obtain a container suitable for collection of the DEF that exits the DEF supply line. A 3.8 L (1 US gal, 7/8 Imp gal) bucket is recommended.



ALBIA173522

2. Route the outlet of the DEF supply line into a suitable container.
3. Turn the keyswitch to the ON position and connect CONSULT and select the Diesel Exhaust Fluid Doser Pump Override test under the ECM Diagnostic Tests menu.

NOTE:

- This test will attempt to prime the dosing system. During this test, DEF will be drawn from the tank and pumped through the DEF supply line.
- Once the test is initiated, it will continue to pump DEF, even when attempting to stop the test with CONSULT. To stop the test, it is necessary to turn the keyswitch to the OFF position.
- If this test runs for an extended period of time, a P-code will become active. Limit the test time to 5 minutes or less.

4. Observe the DEF flow exiting the DEF supply line while the Override Test is running.

NOTE:

Bubbles are an indication of a leak that allows air to enter the dosing system. If bubbles are present, check the following components for damage or leaks:

- DEF tank fitting
- DEF tank supply line
- DEF tank assembly

Repair or replace any damaged components.

5. Turn the keyswitch to the OFF position to end the test.
6. Connect DEF supply line.
7. Dispose of the collected DEF in accordance with local environmental regulations.
8. Operate the engine and check for leaks.

DEF System Leak Test

INFOID:000000014418435

GENERAL INFORMATION

If the Diesel Exhaust Fluid (DEF) dosing system has been serviced or repaired, it will be necessary to prime the DEF dosing system, in order to check for proper operation.

TEST

1. Prior to running the test, check the following:
 - Make sure the DEF tank is full of DEF.
 - Make sure the DEF is **not** frozen. If the DEF is frozen, it will be necessary to run the engine to allow the system to thaw.

A
EX

< REMOVAL AND INSTALLATION >

- Make sure the DEF supply line is properly connected to the DEF tank and the DEF dosing valve.
- Connect CONSULT.

NOTE:

It may be necessary to allow the aftertreatment system time to cool to allow for accessibility to check for leaking components.

2. With the keyswitch ON and the engine OFF, select the Aftertreatment Diesel Exhaust Fluid System Leak Test found under the Engine Control Module (ECM) diagnostics test menu in CONSULT.

NOTE:

- This test will cause the DEF dosing unit to draw DEF from the tank and pressurize it in the DEF dosing valve supply line. During this test, the dosing unit will continuously run and all unused DEF will return to the tank. An audible pumping noise will be noticeable during the test.
- During the initialization of this test, a note will appear on the screen, indicating that the system has reached a primed state.
- The dosing system should prime in under 1 minute for a system without leaks. If the dosing system does **not** prime, it may be due to a leak in the dosing valve or supply line.

INSPECTION

1. While the test is running, inspect all DEF lines, fittings, and connections for external leaks. Refer to [EX-64, "Removal and Installation"](#) (DEF dosing valve) or [EX-75, "Removal and Installation"](#) (DEF tank). Repair and replace any leaking component(s).

NOTE:

If the system is unable to prime due to leaks, it will be necessary to turn the keyswitch OFF in order to stop the dosing unit. The dosing unit cannot be stopped using CONSULT.

2. Upon completion of inspecting the lines, fittings, and connections for leaks, press the stop button in CONSULT. The dosing unit will then purge the system of DEF. An audible purging noise will be noticeable.

NOTE:

- If the test is not stopped using CONSULT, it will continue to pump for 20 minutes and then automatically purge the system of DEF.
- If the system is able to successfully prime, a pop-up message will appear in CONSULT to notify the technician.

3. If the system cannot build pressure, it will attempt to prime multiple times before flagging a fault code. If any fault codes occur while running this test, reference the appropriate DTC Diagnosis Procedure.

NOTE:

- If the system fails to prime, a key cycle will be required before attempting to run the DEF System Leak Test again.
- The Aftertreatment DEF System Leak Test cannot be attempted twice consecutively. A key cycle will be required before attempting to run the Aftertreatment DEF System Leak Test again after two attempts.

4. During the test, a small quantity of DEF is sprayed into the decomposition tube. After completion of the test, it is necessary to run the engine at high idle for 5 minutes in order to prevent DEF deposits from forming in the decomposition tube.

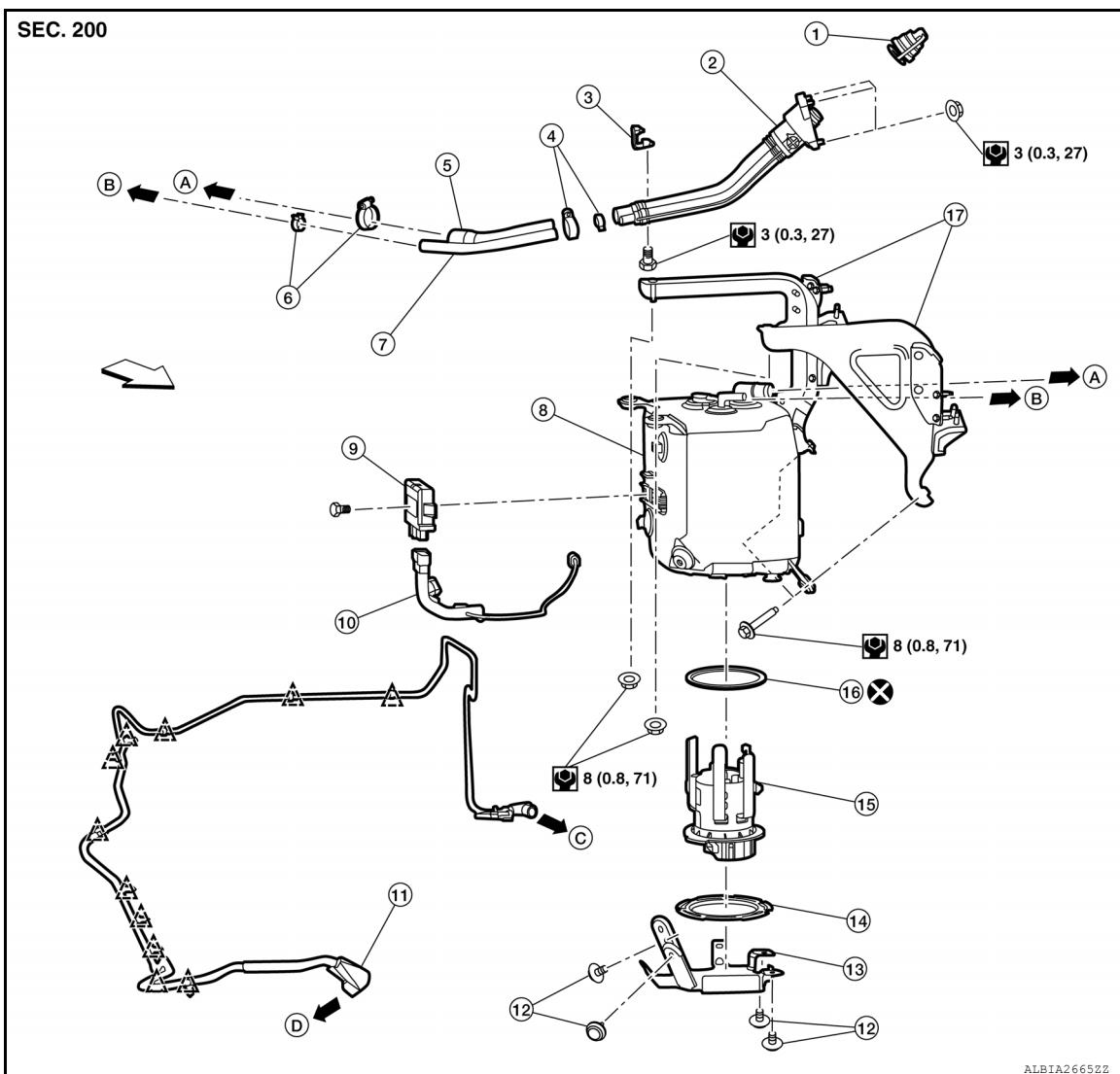
5. Check for P-codes.

< REMOVAL AND INSTALLATION >

DEF PUMP

Exploded View

INFOID:000000014418436



1. DEF tank filler cap	2. DEF tank filler neck	3. Filler neck support bracket
4. Clamp	5. DEF tank filler hose	6. Clamp
7. DEF tank breather hose	8. DEF tank	9. SCR control unit
10. Harness	11. DEF supply line	12. Clip
13. DEF pump shield	14. Lock ring	15. DEF pump
16. O-ring	17. DEF tank brackets	A. DEF tank filler neck
B. DEF tank breather	C. To DEF pump	D. To DEF dosing valve

Front

Removal and Installation

INFOID:000000014418437

REMOVAL

WARNING:

- To reduce the risk of personal injury, do not get Diesel Exhaust Fluid (DEF) in your eyes as it contains urea. In case of contact, immediately flush eyes with large amounts of water for a minimum of 15 minutes. Do not swallow. In the event DEF is ingested, contact a physician immediately. Reference the Safety Data Sheet (SDS) for additional information.
- The DEF line connecting the aftertreatment DEF dosing unit to the aftertreatment DEF dosing valve is under low pressure and should not be disconnected while the engine is running or before the sys-

DEF PUMP

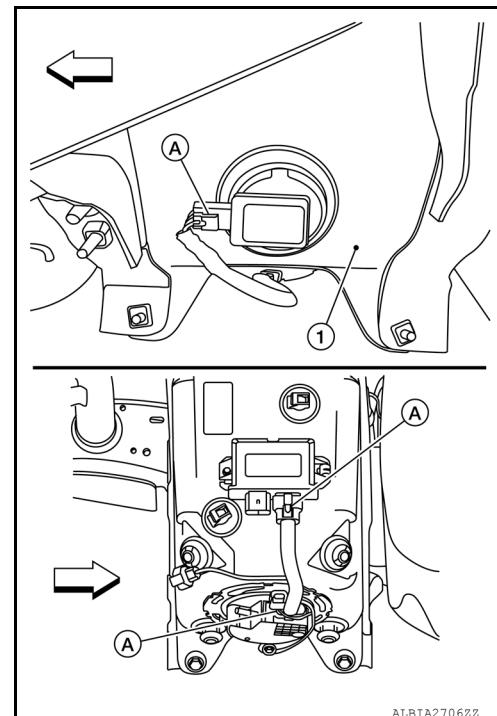
[CUMMINS 5.0L]

< REMOVAL AND INSTALLATION >

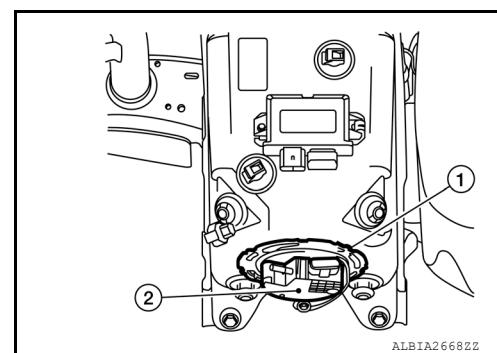
tem has completed the purge process after engine shutdown. Disconnecting the DEF line while under low pressure could cause DEF to spray.

1. Remove the DEF tank. Refer to [EX-75, "Removal and Installation"](#).
2. Disconnect the harness connectors (A) and remove the harness.

◀ : Front



3. Remove the lock ring (1) securing the DEF pump (2).



4. Remove DEF pump from the DEF tank.

NOTE:

When removing DEF pump from the DEF tank, make sure not to spill DEF fluid.

INSTALLATION

Installation is in the reverse order of removal.

- Connect the battery or batteries. Refer to [PG-185, "Battery Disconnect"](#).

NOTE:

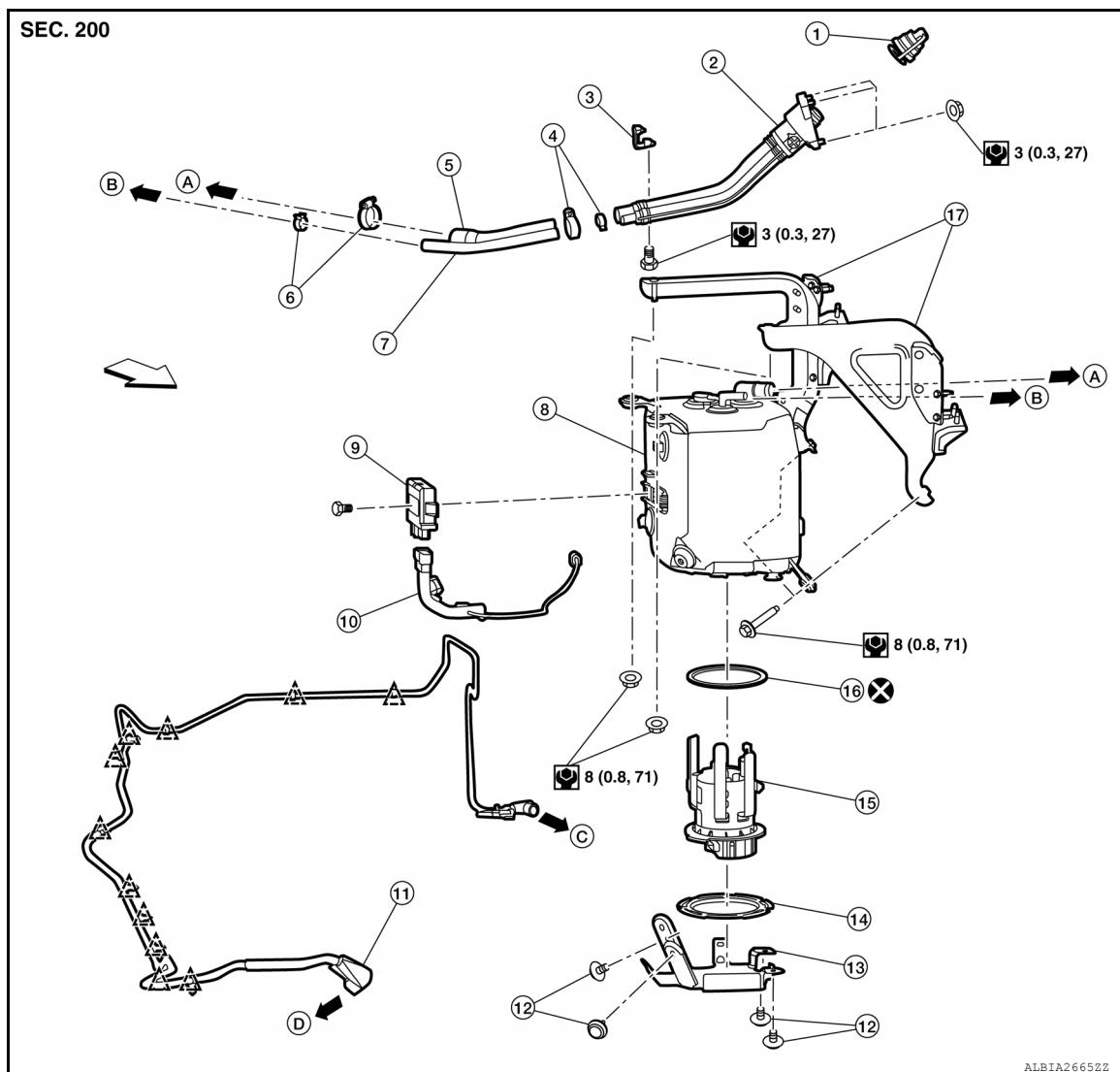
After installation, inspect DEF supply line and DEF pump for leaks.

< REMOVAL AND INSTALLATION >

DEF TANK

Exploded View

INFOID:000000014418438



1. DEF tank filler cap	2. DEF tank filler neck	3. Filler neck support bracket
4. Clamp	5. DEF tank filler hose	6. Clamp
7. DEF tank breather hose	8. DEF tank	9. SCR control unit
10. Harness	11. DEF supply line	12. Clip
13. DEF pump shield	14. Lock ring	15. DEF pump
16. O-ring	17. DEF tank brackets	A. DEF tank filler neck
B. DEF tank breather	C. To DEF pump	D. To DEF dosing valve

Front

Removal and Installation

INFOID:000000014418439

REMOVAL

WARNING:

- To reduce the risk of personal injury, do not get Diesel Exhaust Fluid (DEF) in your eyes as it contains urea. In case of contact, immediately flush eyes with large amounts of water for a minimum of 15 minutes. Do not swallow. In the event DEF is ingested, contact a physician immediately. Reference the Safety Data Sheet (SDS) for additional information.
- The DEF line connecting the aftertreatment DEF dosing unit to the aftertreatment DEF dosing valve is under low pressure and should not be disconnected while the engine is running or before the sys-

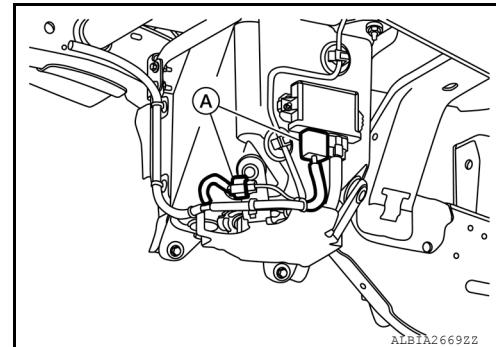
DEF TANK

< REMOVAL AND INSTALLATION >

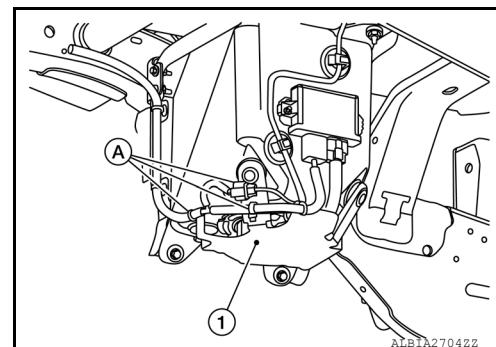
[CUMMINS 5.0L]

tem has completed the purge process after engine shutdown. Disconnecting the DEF line while under low pressure could cause DEF to spray.

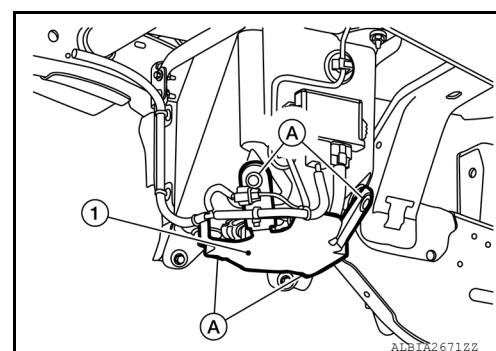
1. Disconnect the battery or batteries. Refer to [PG-185, "Battery Disconnect"](#).
2. Remove the wheel and tire (if necessary). Refer to [WT-69, "Removal and Installation"](#).
3. Remove the rear fender protector. Refer to [EXT-42, "Removal and Installation - Rear Fender Protector"](#).
4. Disconnect the harness connectors (A) from DEF pump.



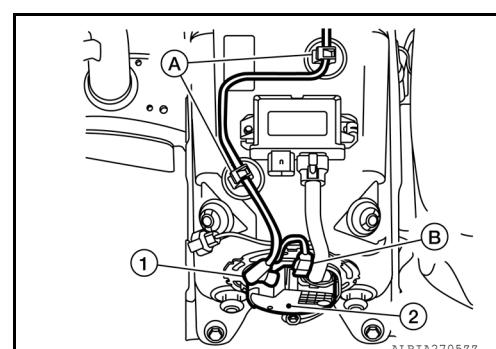
5. Remove the harness clips (A) from the DEF pump shield (1) and reposition the harness.



6. Remove the clips (A) and remove the DEF pump shield (1).



7. Disconnect the DEF supply line (1) and harness connector (B) from the DEF pump (2) and disengage DEF supply line from clamps (A).



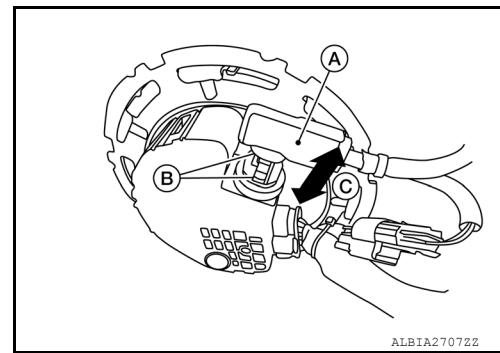
Disconnect quick connector as follows:

DEF TANK

[CUMMINS 5.0L]

< REMOVAL AND INSTALLATION >

- Hold the sides of the connector, press tabs (B) and pull out DEF supply line (A).



- If quick connector sticks to tube of DEF pump, push and pull (C) quick connector several times until it starts to move. Then disconnect by pulling it.

NOTE:

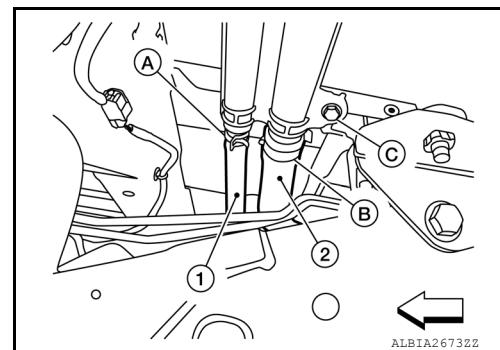
After disconnecting DEF supply line, cover end of line with bag or something similar to avoid damage or foreign materials.

8. Release clamp (A) and loosen clamp (B), then disconnect the DEF tank filler hose (2) and DEF tank breather hose (1).

NOTE:

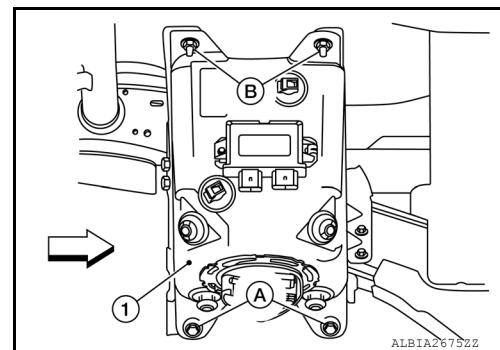
Remove bolt (C) if necessary to loosen clamp.

◀ : Front



9. Remove the bolts (A) and nuts (B) from the DEF tank (1) and remove the DEF tank.

◀ : Front



INSTALLATION

Installation is in the reverse order of removal.

- Connect the battery or batteries. Refer to [PG-185, "Battery Disconnect"](#).