SERVICE MANUAL

Exhaust Aftertreatment System

BE Bus
CE Bus
CE Bus Propane Autogas
HC Bus
RE Bus

IC Bus, LLC

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Summary of Changes

Section	Change
Section 1.1	Added description of the PSI 8.8L LPG Engine exhaust system.
Section 7	Added section covering the PSI 8.8L LPG Engine horizontal dual catalytic converter system.

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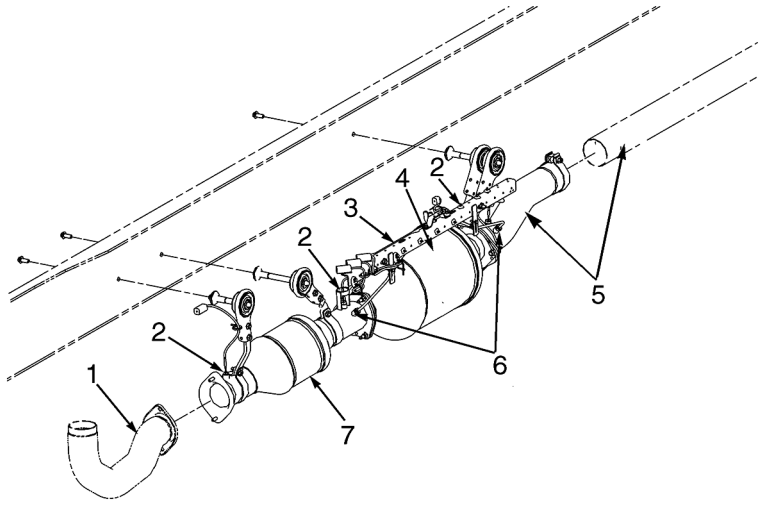
1. DESCRIPTION

NOTE – This manual is intended to be used for general instructions on exhaust aftertreatment systems and removal / installation procedures. The aftertreatment systems described in this manual are typical. Although some configurations may vary, the removal and installation of these components will be similar. Refer to the applicable engine diagnostic manual for specific system inspection and diagnostic procedures.

For 2010 vehicles, the Environmental Protection Agency requires a 50% reduction in emissions of nitrogen oxides and a 90% reduction in particulate matter. Oxides of nitrogen are created by the high temperature and speed of combustion. Once in the atmosphere, nitrogen oxide emissions result in ground-level ozone formation and smog. Emission particulates include unburned fuel and lube oil (liquid hydrocarbons), carbon soot from incomplete combustion (main contributor to smoke), water from combustion, and sulfur compounds from the lubrication oil.

To comply with these new regulations, many changes were made to truck specifications, including ultra-low sulfur diesel fuel, the engine, engine oil, vehicle design, and the exhaust system. The new exhaust system treats the engine exhaust and is referred to as an exhaust aftertreatment system. Stainless-steel tubing, used for heat and corrosion resistance, must be used throughout the system.



1. Turbo Pipe
2. Temperature Sensor
3. Sensor Junction Box
4. Diesel Particulate Filter (DPF)
5. Tailpipe
6. Pressure Sensor Port
7. Diesel Oxidation Catalyst (DOC)

Figure 1 Typical Aftertreatment System Including Diesel Particulate Filter (DPF) and Diesel Oxidation Catalyst (DOC).

The main components of the exhaust aftertreatment system consist of the turbo pipe, DOC, DPF, Temperature Control Device (TCD), temperature sensors, pressure sensors, sensor junction box, and wiring.

Aftertreatment exhaust system configurations are categorized by engine type and the horizontal or vertical orientation of the DPF and tailpipe. For example, when the DPF is mounted horizontally and the tailpipe is mounted vertically, it is referred to as a Horizontal/Vertical system.

Diesel Oxidation Catalyst (DOC): The DOC oxidizes carbon monoxide and hydrocarbons and converts nitrogen oxide to nitrogen dioxide for regeneration.

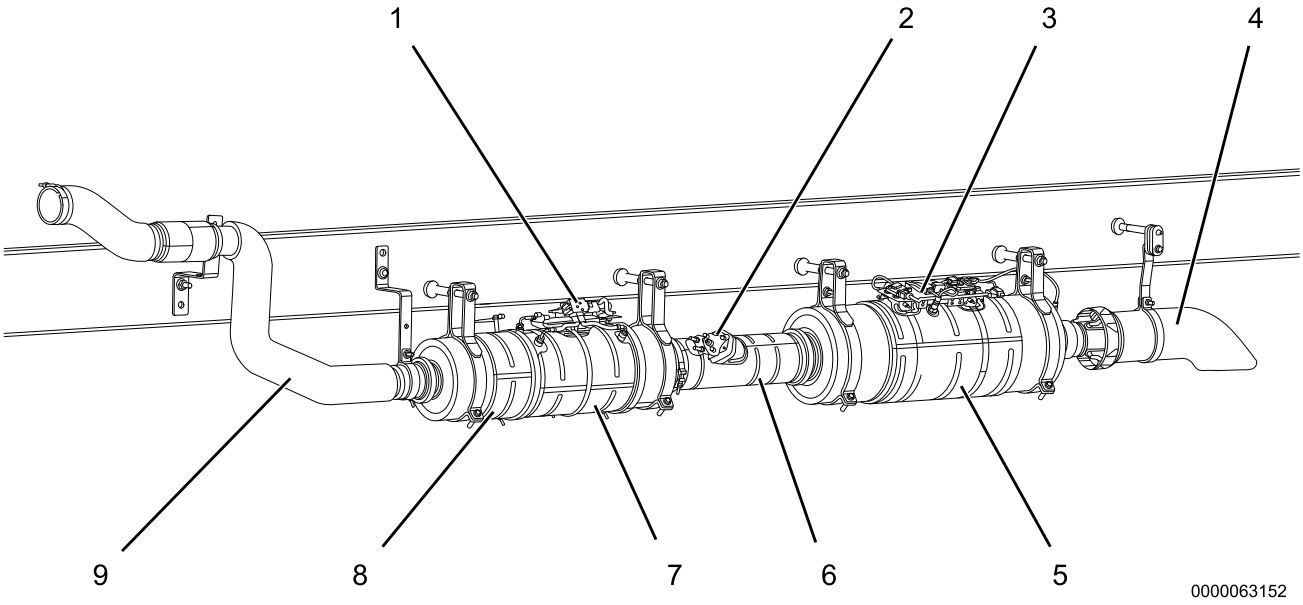
Diesel Particulate Filter (DPF): The DPF is a porous ceramic filter, housed in stainless steel, that replaces the muffler. Flow requirements force the inlet and outlet to be on opposite ends. Alternate channels of the filter are plugged, forcing the exhaust gas to flow through the porous wall, capturing the soot particles. The DPF burns soot with oxygen and nitrogen dioxide and catches the ash from burnt oil. The exhaust aftertreatment system monitors the efficiency of the DPF. A self-cleaning function (called regeneration) is used to keep the DPF functioning properly between regular ash clean-out maintenance intervals, which must be performed by service technicians. An optimal DPF size was chosen for low back pressure and to maximize ash storage capacity between periodic cleanings.

Tailpipe: Every exhaust system does not have a tailpipe because, in some cases, a new temperature control device replaces the actual tailpipe. However, some vertical exit systems however, will have a tailpipe only and some include a temperature control device. For all horizontal exit configurations, a horizontal temperature control device is included. If a horizontal system has a tailpipe, it is located between the DPF and the temperature control device.

Temperature Control Device: This device reduces exhaust gas temperatures as they exit the system. Not all vehicles have a temperature control device, as it is not as critical in vertical tailpipe applications. The temperature control device is the last component of the exhaust system and is mounted at the end of the exhaust system, after the tailpipe (if equipped). The temperature control device works on a venturi principal, mixing the exhaust gases with external air to reduce the overall exit temperature. The temperature control device is standard on all horizontal exit exhaust systems.

Sensors: Three temperature sensors are located on the exhaust aftertreatment system to monitor temperature levels at different points of the system. One pressure sensor, fed by two pressure lines to the pressure sensor ports, is used to monitor pressure levels at both ends of the DPF and to determine soot buildup.

Doser Control Unit: The Doser Control Unit (DCU) receives temperature and pressure sensor input from the Aftertreatment Control Module (ACM) or Engine Control Module (ECM) . When conditions are met or a manual regeneration is requested, the DCU initiates a regeneration cycle. The DCU sends voltage to the Aftertreatment Fuel Injector solenoid valve to open and inject fuel into the turbo exhaust pipe. See the applicable engine diagnostic manual for diagnostics on the DCU.



1. Diesel Particulate Filter (DPF) interface module
2. Diesel Exhaust Fluid (DEF) dosing valve
3. Selective Catalyst Reduction (SCR) interface module
4. Tailpipe
5. SCR canister
6. Decomposition reactor tube
7. DPF
8. Diesel Oxidation Catalyst (DOC)
9. Turbo pipe

Figure 2 Typical Aftertreatment System Including Selective Catalyst Reduction (SCR).

Selective Catalyst Reduction (SCR): This is a technology that uses a urea-based DEF and a catalyst to significantly reduce nitrogen oxide (NOx) emissions. The purpose of the SCR system is to reduce levels of NOx that are emitted from engines and are harmful to the environment. SCR is aftertreatment technology that treats exhaust gas downstream of the engine. Small quantities of DEF are injected into the exhaust upstream of a catalyst, where it vaporizes and decomposes to form ammonia and carbon dioxide. Ammonia is the desired product, which, in conjunction with the catalyst, converts NOx to harmless nitrogen and water.

Aftertreatment Control Module (ACM): The ACM (if equipped) controls the SCR diesel exhaust fluid dosing system. This device handles the dosing activity, controls the DEF tank heater valve, and monitors DEF tank level and ambient temperature. In this configuration, the ACM will also initiate the regeneration cycle when necessary. If the vehicle is not equipped with an ACM, these functions are performed by the Engine Control Module (ECM).

Decomposition Reactor Tube: The decomposition reactor tube is the section of exhaust pipe between the aftertreatment DPF and aftertreatment SCR catalyst. The aftertreatment decomposition reactor tube is designed to help atomize and mix DEF that is sprayed into the exhaust stream for complete NOx conversion.

Diesel Exhaust Fluid (DEF) Dosing Valve: The aftertreatment DEF dosing valve is used to spray DEF into the exhaust stream prior to the SCR catalyst inlet. The aftertreatment DEF dosing valve is located on the decomposition reactor tube.

Temperature Sensors: The temperature sensors feed information to the Aftertreatment Control Module (ACM) or Electronic Control Module (ECM) depending on the configuration, allowing the system to calculate the necessary dosing rate.

Nitrogen Oxide (NOx) Sensors: There are two NOx sensors used by this system, an aftertreatment intake NOx sensor and an aftertreatment outlet NOx sensor. The aftertreatment intake NOx sensor monitors emissions of nitrogen oxides entering the aftertreatment SCR system. The aftertreatment outlet NOx sensor monitors the emissions of nitrogen oxides exiting the aftertreatment SCR system. Should the system fail, the nitrogen oxide (NOx) sensors will indicate high emissions and that the vehicle needs servicing.

Ammonia (NH_3) Sensor: The ammonia (NH_3) sensor is used to detect ammonia in the SCR catalyst. This information is used by the ECM or ACM depending on the application, to determine dosing rates and monitor SCR system efficiency.

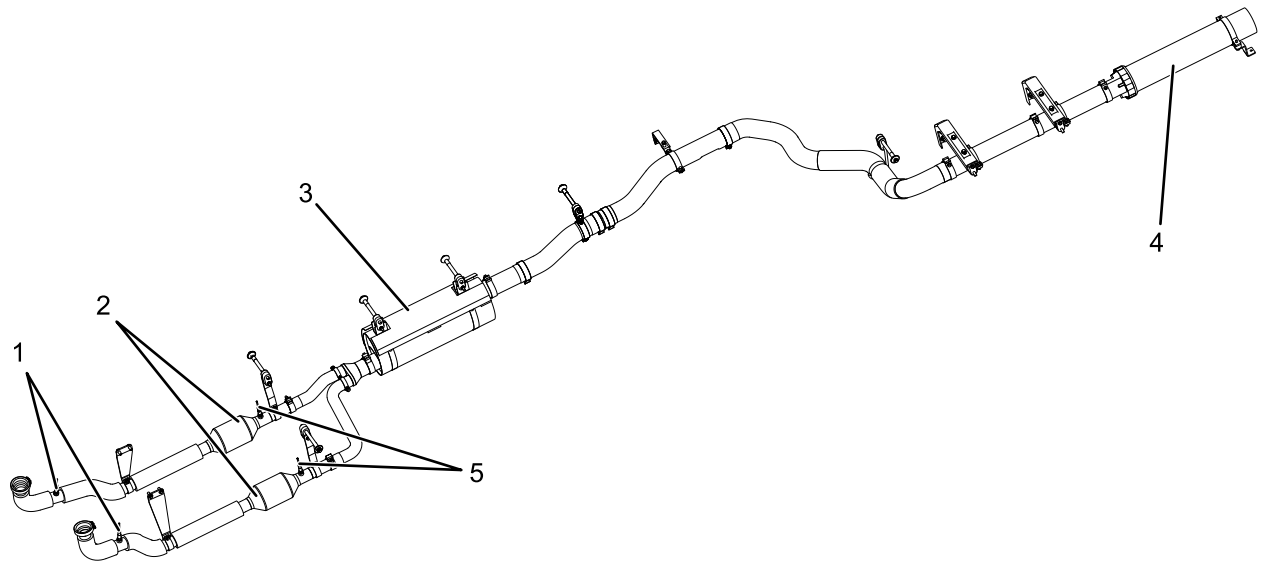


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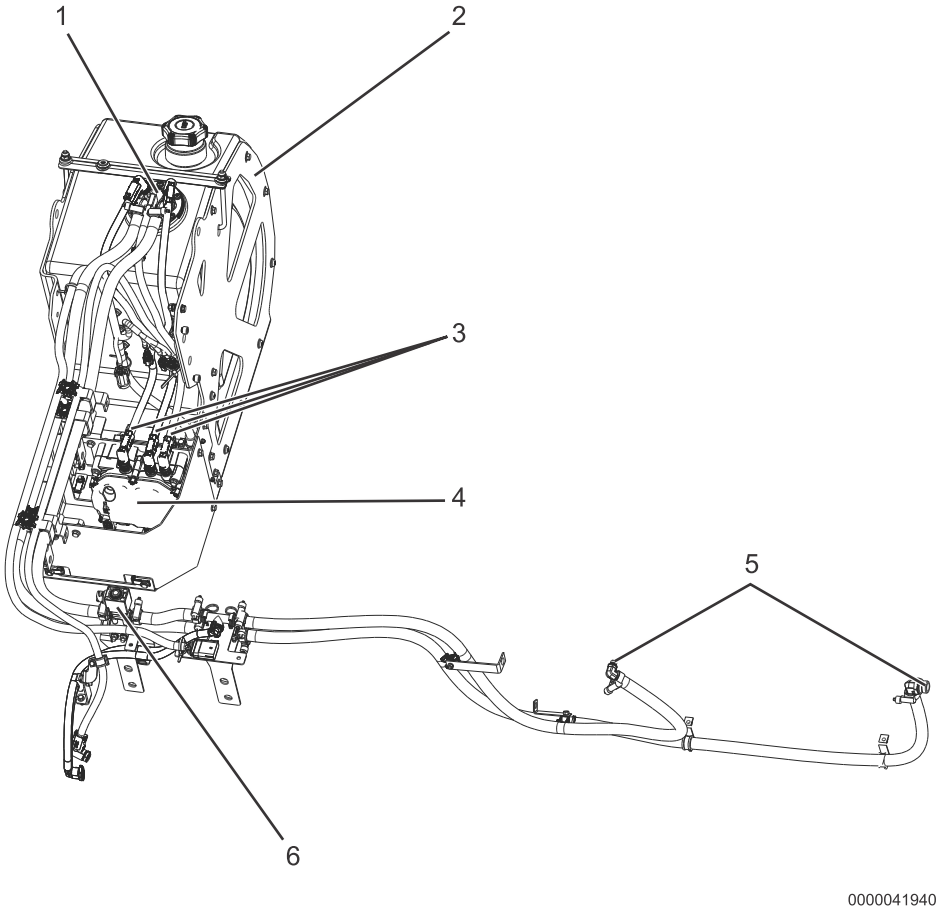
Figure 3 Typical Aftertreatment System Including Catalytic Converters.

Catalytic Converters: The catalytic converters are used to convert the nitrogen oxide (NO_x), carbon monoxide (CO), and hydrocarbons (HC) in the exhaust gases, into carbon dioxide (CO_2), water vapor (H_2O), and nitrogen gas (N_2). Inside a catalytic converter is a ceramic honeycomb that is coated with metals such as platinum, rhodium, and palladium. The metals are used as catalysts to initiate a chemical reaction that causes the NO_x, CO, and HC to convert to CO_2, H_2O, and N_2.

Muffler: The muffler is used to cancel out noise produced by the engine. Inside the muffler, sound waves are reflected in such a way that they collide and partially cancel themselves out, resulting in less engine noise exiting the tailpipe.

Tailpipe: . The tailpipe is where the exhaust gas exits from the exhaust system.

Oxygen Sensors: In the exhaust system, oxygen sensors are used to monitor the amount of oxygen both after it exits the engine and after it passes through the catalytic converter. Oxygen sensors are used to determine if the engine is running efficiently and if the catalytic converter is operating properly.



1. Diesel Exhaust Fluid (DEF) tank pickup assembly
2. DEF tank assembly
3. DEF line (3)
4. DEF supply module
5. DEF coolant line (2)
6. DEF tank heater valve

Figure 4 Typical Diesel Exhaust Fluid (DEF) System.

NOTE – Actual component location may vary depending on vehicle configuration.

Diesel Exhaust Fluid (DEF): The DEF is the reactant necessary for functionality of the Selective Catalyst Reduction (SCR) system. It is a clear, nontoxic fluid, which is used to deliver ammonia to the SCR catalyst and is a 32.5% strength urea / water solution with high purity requirements.

Diesel Exhaust Fluid (DEF) Tank: The DEF tank is filled with DEF. The DEF tank houses the DEF tank pickup assembly.

Diesel Exhaust Fluid (DEF) Supply Module: The DEF fluid is provided to the entire SCR system by the DEF supply module. The DEF supply module directly controls flow or dosing rate of DEF.

Diesel Exhaust Fluid (DEF) Power Distribution Module (PDM): Contains relays and fuses for the aftertreatment system.

Diesel Exhaust Fluid (DEF) Tank Pickup Assembly: The DEF tank pickup assembly is mounted in the DEF tank. The assembly includes the DEF level sensor, urea quality sensor, pickup screen, and heating loop used to circulate coolant to heat and defrost DEF. These components are serviced as a complete assembly.

Diesel Exhaust Fluid (DEF) Lines: DEF lines supply DEF from the DEF tank to the DEF supply module and dosing valve.

Diesel Exhaust Fluid (DEF) Coolant Lines: DEF coolant lines supply coolant to the DEF tank and dosing valve to heat or defrost DEF.

Diesel Exhaust Fluid (DEF) Tank Heater Valve: An electronically controlled check valve that controls coolant flow to the DEF tank during temperatures below 23°F (-5°C). The valve is controlled by the ACM or ECM depending on the application.

Diesel Exhaust Fluid (DEF) Line Heater: The DEF line heater is used to heat the DEF lines when the ambient temperature is below 23°F (-5°C). The dosing system will not prime until the DEF lines are completely defrosted.

Delta Pressure Sensor: The Delta pressure sensor is used to monitor pressure levels at both ends of the DPF and to determine engine back pressure. The system is composed of one pressure sensor module, fed by two pressure lines routed to the pressure sensor ports.

1.1. THEORY OF OPERATION

The exhaust aftertreatment system, part of the larger exhaust system, processes engine exhaust to meet emissions requirements. The exhaust aftertreatment system traps particulate matter (soot) and prevents it from leaving the tailpipe. The soot buildup is monitored and, when required, can be burnt to ash through the regeneration process. The regeneration process is accomplished in different ways and is determined by manufacturers and / or engine type. Refer to the vehicle operator manual and engine operator manual for specific regeneration procedures. The DPF will continue to burn soot to ash until it is full. At this point, the DPF needs to be removed and cleaned or exchanged for a clean DPF.

MaxxForce® DT

The exhaust aftertreatment system injects fuel into the exhaust gas to increase the temperature necessary for DPF regeneration. The Doser Control Unit (DCU) receives temperature and pressure sensor data from the Aftertreatment Control Module (ACM) or Engine Control Module (ECM). When regeneration is required, the DCU activates the exhaust aftertreatment system fuel injector and fuel is injected into the exhaust system to increase the temperature and burn the soot to ash. See the applicable engine diagnostic manual for diagnostics.

MaxxForce® 7

The MaxxForce® 7 engine uses a cylinder enrichment system to regenerate the DPF. Regeneration is controlled by the Engine Control Module. See the applicable engine diagnostic manual for diagnostics.

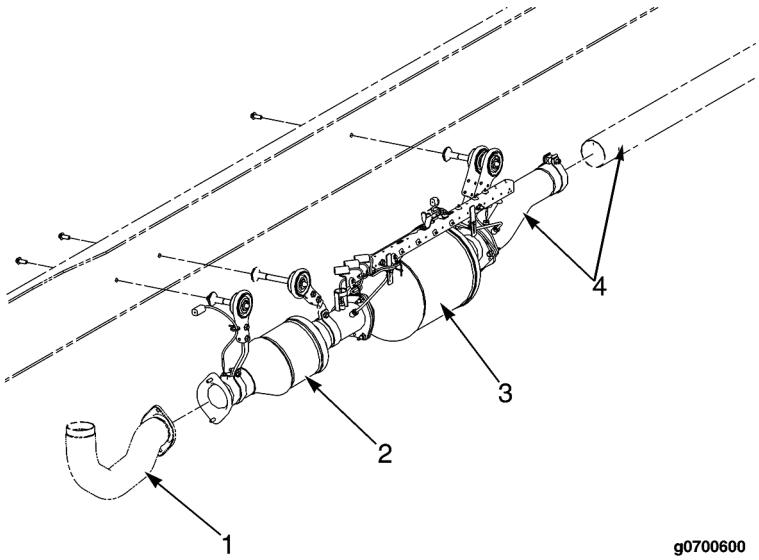
Cummins® ISB6.7

Cummins® ISB6.7 engines use a combination of Diesel Particulate Filter (DPF) and Selective Catalyst Reduction (SCR). The aftertreatment DPF system is used to reduce particulate emissions. If exhaust temperatures are naturally high enough to oxidize soot in the particulate filter, regeneration will occur during highway driving or heavy load conditions. This is called passive regeneration. If exhaust temperature is not high enough for passive regeneration, active regeneration will occur, and a small amount of fuel is injected into the exhaust stream. This oxidizes and creates heat necessary to regenerate the DPF. Under some operating conditions, the engine may not have the opportunity to regenerate the DPF and stationary (parked) regeneration would be required. Stationary (parked) regeneration requires operator interaction. Refer to the vehicle operator manual for specific regeneration procedures. For regeneration to occur, the ECM must detect DPF restriction by monitoring temperature and pressure sensors. SCR uses Diesel Exhaust Fluid (DEF) in order to convert nitrogen oxides (NOx) in the exhaust stream to nitrogen and water. A dosing valve is used to inject DEF into the exhaust stream. DEF mixes with exhaust gas and converts into ammonia, which neutralizes the NOx. Once ammonia reacts with NOx, it passes over the SCR catalyst and produces harmless nitrogen and water vapor.

PSI 8.8 LPG Engine

The PSI 8.8L LPG Engine uses two catalytic converters, four oxygen sensors, and a muffler. The catalytic converters treat the exhaust gases by converting nitrogen oxide (NO_x), carbon monoxide (CO), and hydrocarbons (HC) into carbon dioxide (CO_2), water vapor (H_2O), and nitrogen gas (N_2). Each engine bank has its own catalytic converter. The oxygen sensors monitor the exhaust gases for oxygen content both before and after each catalytic converter. The information is then relayed to the Engine Control Module (ECM) to determine if the engine and catalytic converters are operating efficiently. After the exhaust gases flow through the catalytic converters, they reach the muffler, which is used to help cancel out noise produced by the engine.

1.2. SINGLE HORIZONTAL / HORIZONTAL



1. Turbo pipe
2. Diesel Oxidation Catalyst (DOC)
3. Diesel Particulate Filter (DPF)
4. Tailpipe

Figure 5 Single Horizontal / Horizontal Two-Can System.

The single horizontal / horizontal exhaust system consists of a horizontal DPF and a horizontal tailpipe. There are several variations of single horizontal / horizontal exhaust aftereatment systems on different series of buses. All the variations have the same components and similar removal / installation procedures.

2. GENERAL SERVICE INFORMATION

WARNING

To prevent property damage, personal injury or death, park the vehicle on a flat, level surface. Make sure the engine ignition is in the Off position and the transmission is in Neutral, or in the Park position if the vehicle is equipped with an automatic transmission. Set the parking brake, install wheel chocks, and disconnect the batteries at the negative terminal before doing any service procedures on the engine or vehicle.

WARNING

To prevent property damage, personal injury or death, before working on the exhaust system, allow sufficient time for cool down. Working on the exhaust aftertreatment system while hot can result in burns.

WARNING

To prevent property damage, personal injury or death, use a suitable device for support and removal of the DPF. The DPF is heavy and contains a ceramic "brick" that is sensitive to shocks and impacts.

CAUTION

To prevent damage to sensors and other components of the system, care must be taken when removing any DPF.

NOTE – Before performing any work on the exhaust components, be sure to perform these following basic procedures:

1. **Park the vehicle on a flat, level surface.**
2. **Place transmission in Neutral (or Park, if automatic transmission).**
3. **Set the parking brake.**
4. **Turn off ignition.**
5. **Install wheel chocks.**
6. **Disconnect the batteries.**

2.1. EXHAUST AFTERTREATMENT SYSTEM MODIFICATIONS

Proper long-term operation of the exhaust aftertreatment system emissions control devices requires controlling exhaust stream temperatures and the exhaust flow pattern throughout the system. This determines the required location of the components, as well as the insulation of the various parts of the system. Navistar, Inc., will ensure correct factory installation of exhaust aftertreatment systems for compliance with the certification requirements.

Modified systems could void the warranty coverage and violate emissions requirements, as well as damage the engine, exhaust aftertreatment system, and other truck systems. For this reason, application guidelines for exhaust aftertreatment installations are much more complex and restrictive for vehicles incorporating these systems. Modifications to any part of the exhaust aftertreatment system must be approved by Navistar.

In comparison to vehicles produced prior to 2007, exhaust component surface temperatures and exhaust gas temperatures are considerably higher. As a result of the increased temperatures, clearances to exhaust components need to be increased by typically 40% to ensure that body and / or chassis parts are not damaged by heat.

- No equipment should be mounted within 8 inches (200 mm) of the exhaust pipe outlet to avoid damage from hot exhaust gases.
- Maintain other clearances as shown in the table below.

Table 2 Minimum Clearance Between Exhaust System Components and Other Chassis Components

Component	Minimum Clearance, in (mm)
Electric Harness	6 (150)
Electric Harness (with heat guard)	4 (100)
Mechanical Cable	2 (50)
Fuel Tube, Metal	6 (150)
Fuel Tube, Rubber or Plastic	6 (150)
Brake Tube, Metal	4 (100)
Brake Tube, Rubber or Plastic	4 (100)
Tire	4 (100)
Fuel Tank	4 (100)

2.2. DIESEL PARTICULATE FILTER (DPF) CLEANING

At some point in time, the DPF will fill and become plugged with ash. When this occurs, it must be removed and cleaned, or exchanged for a clean filter. This requires special handling techniques and cleaning equipment that may not be available at the service site. If available, follow the instructions for the specific cleaning equipment.

CAUTION

To prevent property damage, do not attempt to clean the DPF with a pressure washer or compressed air.

CAUTION

To prevent property damage, do not attempt to clean the DPF without proper training.

CAUTION

The ash contained within the DPF is considered a hazardous waste. Disposal should be in accordance with all local laws and regulations. Refer to http://www.epa.gov for more information.

For dealers that wish to purchase their own cleaning equipment, contact International Service Purchasing. FSX (TrapBlaster, TrapBurner, TrapTester, and SootSucker) systems are the recommended DPF cleaning systems. Dealers that already purchased the generation 1 Donaldson (Pulse Cleaner and Thermal Regeneration) system may continue using that system. Dealers wishing to purchase cleaning equipment should ensure that the system purchased can clean both a plugged filter and ash:

- FSX: TrapBlaster, TrapBurner, TrapTester, and SootSucker.
- Donaldson: Pulse Cleaner and Thermal Regeneration

NOTE – All DPFs are tracked and identified with a specific serial number. If a replacement DPF is installed, you must record the serial numbers of both the original and the replacement on the warranty report and in the ISIS® network.

Diesel Particulate Filter (DPF) and Diesel Oxidation Catalyst (DOC) Inspection

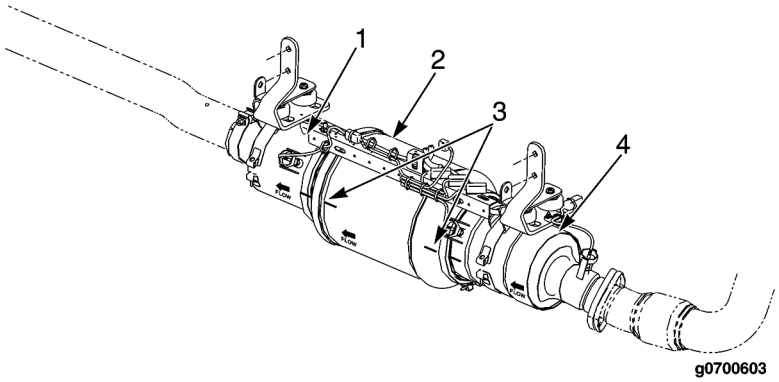
NOTE – Once the DPF and DOC have been removed from the exhaust aftertreatment system, perform a general inspection of components (for specific system inspection and diagnostic procedures, refer to applicable engine diagnostic manual) to determine if they are still serviceable, as follows:

- The DPF and DOC housings must be free of dents.
- Mounting flanges must be free of dents, cracks, or gouges to seal properly with gaskets.
- Replace any oil, fuel, or water-soaked DPF and / or DOC.
- Check the DPF for gouges on the inlet or outlet faces of the internal brick material. If gouges are present and exceed 1/8 in (3 mm) deep, replace the DPF.
- Inspect for face plugging. If face plugging is present, refer to applicable engine diagnostic manual for inspection and diagnostics.

2.3. GASKETS AND FASTENERS

Always use new gaskets and thoroughly clean the mating surfaces when replacing exhaust aftertreatment system components.

2.4. DIESEL PARTICULATE FILTER (DPF) INDEXING



1. Output exhaust can
2. Diesel Particulate Filter (DPF)
3. Index mark (2)
4. Diesel Oxidation Catalyst (DOC)

Figure 6 Indexing.

NOTE – Before removing a DPF that will be cleaned and reinstalled, the components must be indexed and marked to show the direction of exhaust flow. This ensures proper installation after the filter has been cleaned.

To index and mark direction of flow on the DPF, place a permanent index mark on all components to show how they should line up and draw an arrow showing flow direction. This important function will ensure that the diesel particular filter is properly installed during the installation procedures.

2.5. DECOMPOSITION REACTOR TUBE CLEANING

The decomposition reactor tube may become blocked by Diesel Exhaust Fluid (DEF) deposits. If the DEF deposits in the mixer area are blocking more than 50% of the decomposition reactor tube, the decomposition reactor tube must be cleaned.

CAUTION

To prevent property damage, do not use a metallic object to clean the decomposition reactor tube. This will scratch the surface of the decomposition reactor tube, which may cause future excessive DEF deposits.

If DEF deposits are present, carefully scrape with a non-metallic object to remove the majority of the DEF deposits. Use a pressure washer to dissolve the remaining DEF deposits. Use **only** water to remove deposits.

CAUTION

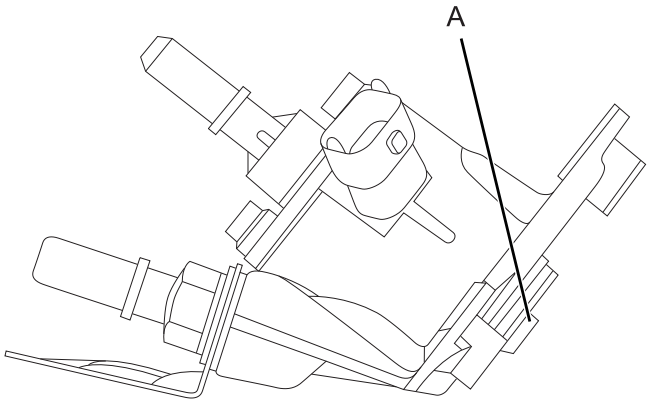
To prevent property damage, do not submerge the decomposition reactor tube in water or solvents, which can saturate the insulation.

Inspect the exhaust flanges for corrosion or other damage. Use a non-metallic abrasive pad to remove any residual gasket material from the flanges on the decomposition reactor tube.

CAUTION

To prevent property damage, do not grind on the flange surface. This can cause the connection to leak.

2.6. DIESEL EXHAUST FLUID (DEF) DOSING VALVE CLEANING



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1. DEF dosing valve tip

Figure 7 DEF Dosing Valve Tip.

If DEF deposits are found at the DEF dosing valve tip during inspection, the DEF dosing valve must be cleaned.

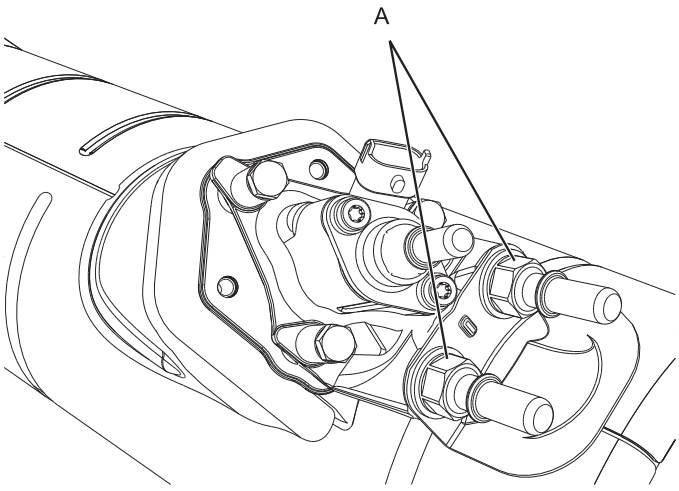
CAUTION

To prevent property damage, do not submerge the DEF dosing valve in solvent or water.

Use a brass brush and warm distilled water to clean the bottom and the tip of the aftertreatment DEF dosing valve. Wipe any debris away with a clean shop towel soaked in distilled water.

CAUTION

To prevent property damage, only use 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.



1. DEF dosing coolant fittings

Figure 8 DEF Dosing Valve Coolant Passages.

The DEF dosing valve coolant passages can be cleaned with a safety solvent and pipe cleaner. Once cleaning is complete, perform the following:

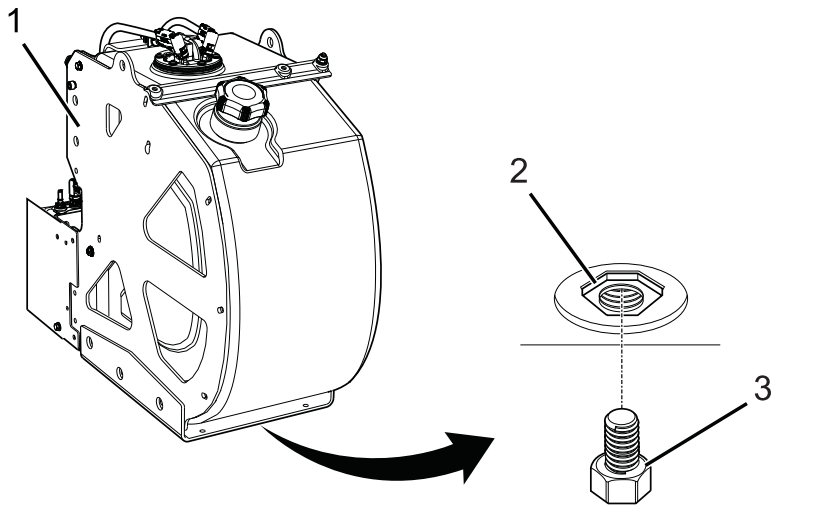
1. Position the DEF dosing valve so that the coolant passages are pointing upward.
2. Pour safety solvent in one coolant port until the safety solvent begins to flow out of the opposite port.
3. Dry the DEF dosing valve with compressed air.

NOTE – If safety solvent does not flow as one continuous stream, the coolant passage may still be restricted or blocked. Repeat the pipe cleaner and safety solvent cleaning process again and inspect. If safety solvent does not flow after multiple cleaning attempts, replace the DEF dosing valve.

2.7. DIESEL EXHAUST FLUID (DEF) TANK DRAINING

WARNING

To prevent personal injury or death, avoid contact with Diesel Exhaust Fluid (DEF) / urea. Do not get DEF in eyes. In case of eye contact, immediately flush eyes with large amounts of water for a minimum of 15 minutes. DEF contains urea. Do not swallow. If DEF is ingested, contact a physician immediately. Reference the Material Safety Data Sheet (MSDS) for additional information.



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1. DEF tank
2. DEF tank drain plug bung
3. DEF tank drain plug

Figure 9 DEF Tank and Drain Plug (if equipped).

If it is necessary to drain the DEF tank during service, the drain plug (if equipped) is located on the bottom of the DEF tank.

CAUTION

To prevent property damage, while removing or installing the DEF tank drain plug, the DEF tank drain plug bung must be held in place with a wrench. If the DEF tank drain plug bung is not held in place, it may cause a leak.

CAUTION

To prevent property damage, disposing of Diesel Exhaust Fluid (DEF) should always be in accordance with all local laws and regulations. Refer to http://www.epa.gov for more information.

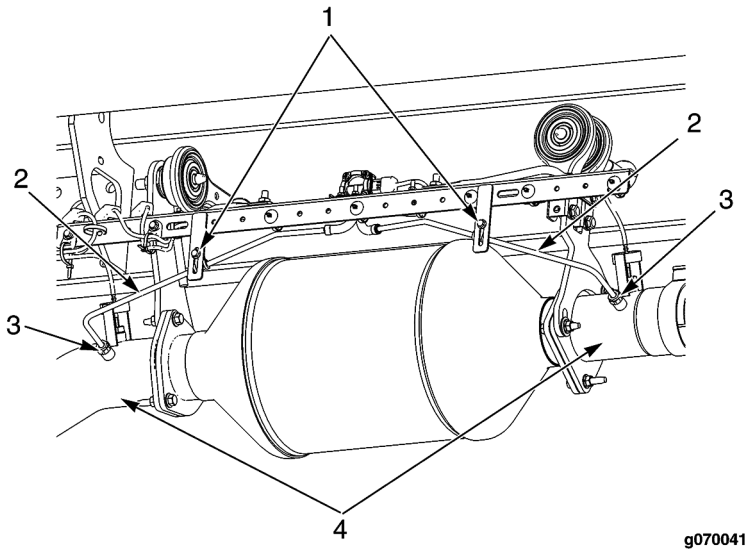
3. COMPONENT REPLACEMENT

NOTE – It may be necessary to remove the heat shield from the exhaust aftertreatment system prior to removing any components. Refer to the applicable Diesel Particulate Filter (DPF) removal procedures for the configuration on which you are working to remove the heat shield.

3.1. MAXXFORCE® 7 OR DT SYSTEMS

These removal and installation procedures show a typical exhaust aftertreatment system for the MaxxForce® 7 and DT engines. Although some configurations may vary, the removal and installation of these components will be similar.

Pressure Tubes and Pressure Sensor – Removal

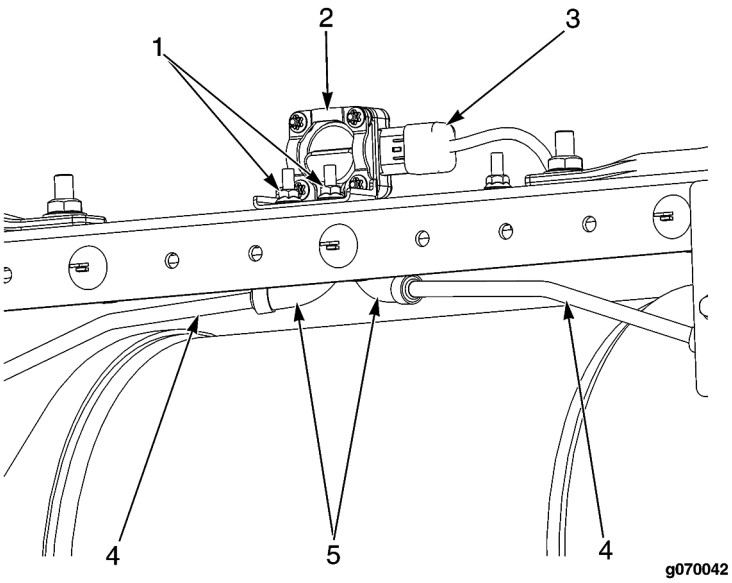


1. Nut, bolt, and p-clamp (2)
2. Pressure tube (2)
3. Pressure nut (2)
4. Exhaust pipe

Figure 10 Pressure Tubes.

1. Remove two bolts, nuts, and P-clamps from two pressure tubes.

2. Remove two pressure nuts from two exhaust pipes.



1. Nut and bolt
2. Pressure sensor
3. Electrical connector
4. Pressure tube
5. Hose clamp and hose

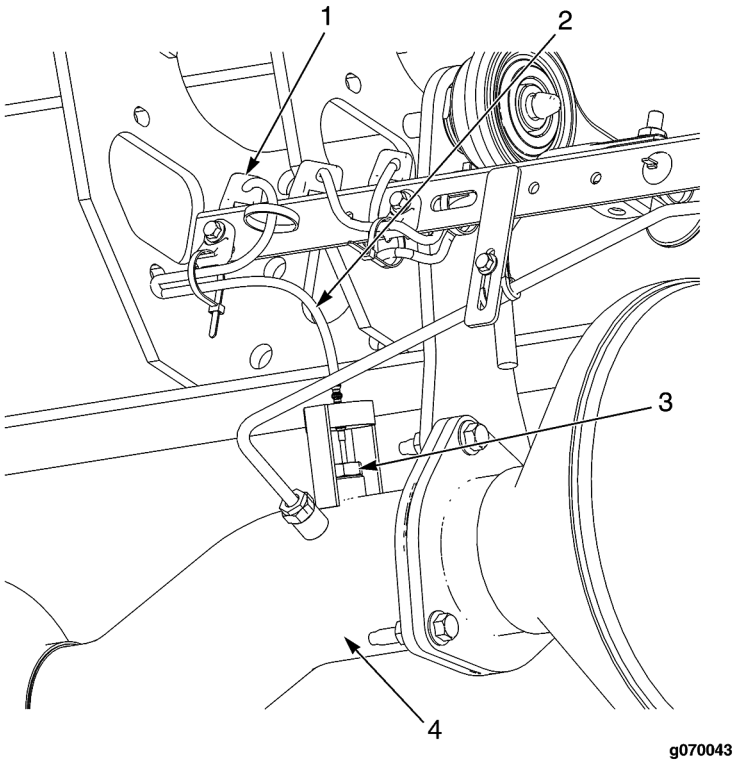
Figure 11 Pressure Sensor.

3. Disconnect electrical connector from pressure sensor.
4. Remove two hose clamps and hoses from pressure sensor.
5. Remove two pressure tubes.
6. Remove two nuts and bolts from pressure sensor.
7. Remove pressure sensor.

Pressure Tubes and Pressure Sensor – Installation

1. Install pressure sensor and secure with two nuts and bolts (Figure 11) (Items 1 and 2). Torque bolts to 84 to 96 lb-in (9 to 11 N•m).
2. Align two pressure tubes and secure to pressure sensor with two hoses and hose clamps (Figure 11) (Items 2, 4, and 5).
3. Connect electrical connector to pressure sensor (Figure 11) (Items 2 and 3).
4. Install two pressure tubes on two exhaust pipes and secure with two pressure nuts (Figure 10) (Items 2, 3, and 4). Torque pressure nuts to 12 lb-ft ± 3 lbf-ft (16 N•m ± 4 N•m).
5. Secure two pressure tubes with two bolts, nuts, and P-clamps (Figure 10) (Items 1 and 2). Torque bolts to 84 to 96 lb-in (9 to 11 N•m).

Temperature Sensor – Removal



1. Electrical connector
2. Wiring
3. Temperature sensor
4. Exhaust pipe

Figure 12 Temperature Sensor.

1. Disconnect electrical connector.
2. Remove wire ties as needed from wiring.
3. Remove temperature sensor from exhaust pipe.

Temperature Sensor – Installation

1. Apply anti-seize compound to bottom three threads of temperature sensor.
2. Install temperature sensor on exhaust pipe (Figure 12) (Items 3 and 4). Torque temperature sensor to 18 - 30 lb-ft (25 - 40 N•m).

CAUTION

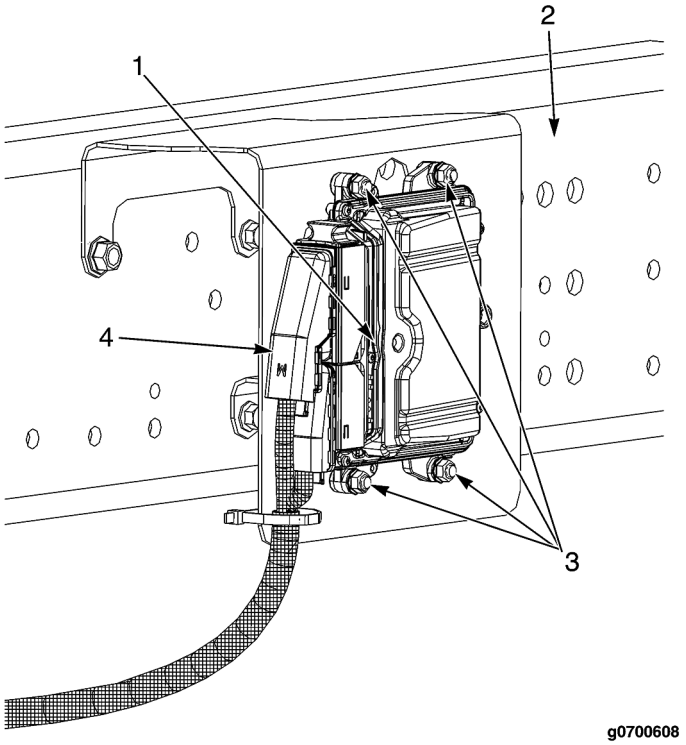
To prevent damage to temperature sensor or wiring when securing the temperature-sensor wiring, ensure that the wiring is neither pulled tight nor has excessive slack at the temperature sensor.

3. Connect electrical connector (Figure 12) (Item 1).
4. Secure wiring as needed with wire ties (Figure 12) (Item 2).

Doser Control Unit (DCU) (CE and BE) – Removal

NOTE – The DCU is part of the MaxxForce® DT exhaust aftertreatment system only (the Maxxforce® 7 is not equipped with one). The DCU for the CE / BE bus is located on the inside of the passenger-side frame rail.

1. Remove wire ties as necessary.



1. Doser Control Unit (DCU)
2. Passenger-side frame rail
3. Nut (4)
4. Electrical connector

Figure 13 Doser Control Unit (DCU) (CE and BE).

2. Disconnect two electrical connectors from the DCU.

3. Remove four nuts securing DCU to bracket on passenger-side frame rail.

4. Remove D0CU.

Doser Control Unit (DCU) (CE and BE) – Installation

NOTE – If a new DCU is being installed, programming is required after replacement. Refer to the applicable engine diagnostic manual for DCU programming instructions.

1. Secure DCU to bracket on passenger-side frame rail with four nuts (Figure 13) (Items 1, 2, and 3). Torque nuts to 17 to 21 lb-ft (23 to 29 N•m).

NOTE – Attach 53-way electrical connector first, then 86-way electrical connector (Figure 13) (Item 4).

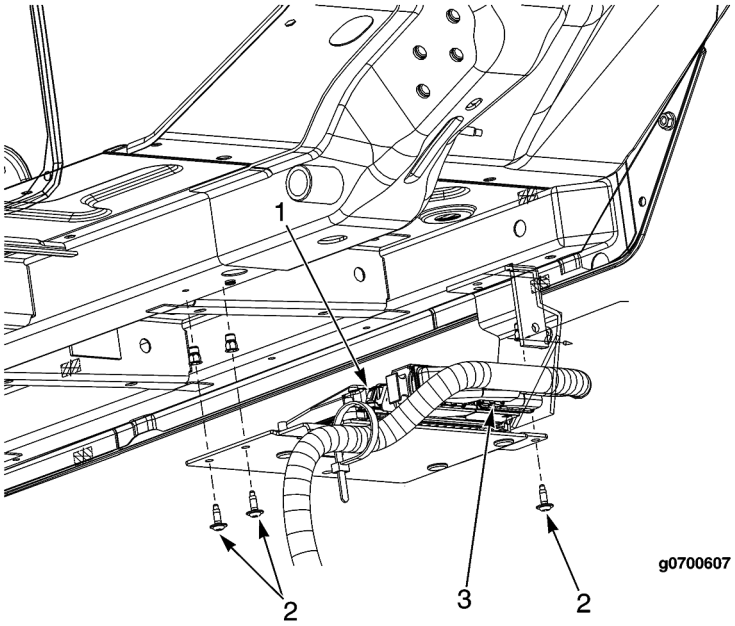
2. Connect two electrical connectors to DCU (Figure 13) (Items 1 and 4).

3. Secure all wiring and cables with wire ties as necessary.

Doser Control Unit (DCU) (HC) – Removal

NOTE – The DCU is part of the MaxxForce® DT exhaust aftertreatment system only (the Maxxforce® 7 is not equipped with one). The DCU for the HC bus is located on the driver side, underside of the cab.

1. Remove wire ties as necessary.



1. Doser Control Unit (DCU)
2. Torx screw (3)
3. Electrical connector

Figure 14 Doser Control Unit (DCU) (HC)

2. Disconnect two electrical connectors from the DCU.

3. Remove three Torx screws securing DCU to driver side, underside of cab.

4. Remove DCU from driver side, underside of cab.

Doser Control Unit (DCU) (HC) – Installation

NOTE – If a new DCU is being installed, programming is required after replacement. Refer to the applicable engine diagnostic manual for programming instructions.

1. Secure DCU to underside of cab with three torx screws (Figure 14) (Items 1 and 2). Torque torx screws to 48 - 72 lb-in (6 - 8 N•m).

NOTE – Attach 53-way electrical connector first, then 86-way electrical connector (Figure 14) (Item 2).

2. Connect two electrical connectors to DCU (Figure 14) (Items 1 and 2).

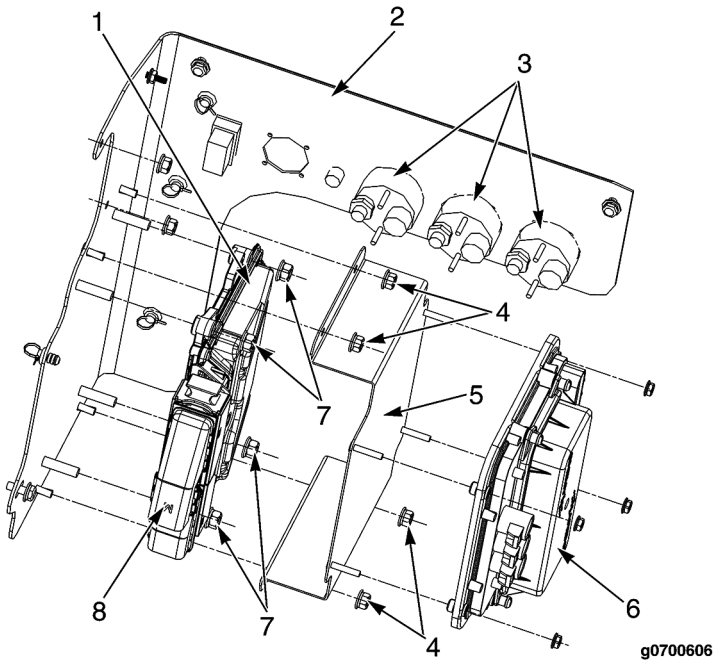
3. Secure wiring with wire ties as necessary.

Doser Control Unit (DCU) (RE) – Removal

NOTE – The DCU is part of the MaxxForce® DT exhaust aftertreatment system only (the Maxxforce® 7 is not equipped with one). The DCU for the RE bus is located in the engine compartment behind the engine compartment gauges.

NOTE – Refer to the applicable engine diagnostic manual DCU diagnostic and troubleshooting information.

1. Remove wire ties as necessary.



1. Doser Control Unit (DCU)
2. Engine compartment
3. Engine compartment gauge (3)
4. Bracket nut (4)
5. Bracket
6. Circuit breaker box
7. DCU nut (4)
8. Electrical connector

Figure 15 Doser Control Unit (DCU) (RE).

2. Remove four bracket nuts from bracket.

3. With wiring still attached, carefully position circuit breaker box and bracket out of way of DCU.

4. Disconnect two electrical connectors from the DCU.

5. Remove four DCU nuts from DCU.

6. Remove DCU from engine compartment.

Doser Control Unit (DCU) (RE) – Installation

NOTE – If a new DCU is being installed, programming is required after replacement. Refer to the applicable engine diagnostic manual for DCU programming instructions.

1. Secure DCU in engine compartment with four DCU nuts (Figure 15) (Items 1, 2, and 7). Torque nuts to 17 - 21 lb-ft (23 - 29 N•m).

NOTE – Attach 53-way electrical connector first, then 86-way electrical connector (Figure 15) (Item 8).

2. Connect two electrical connectors to DCU (Figure 15) (Items 1 and 8).

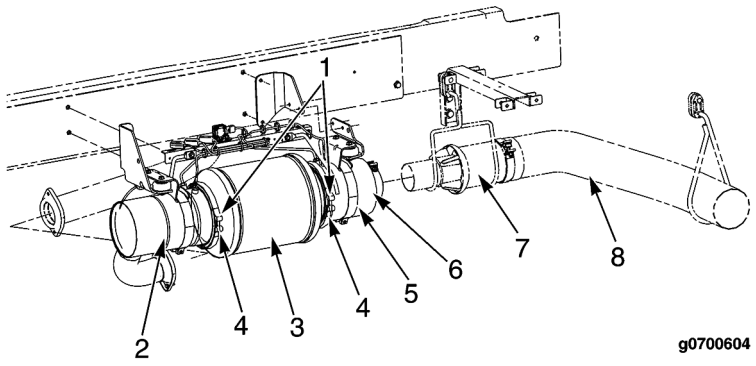
3. Position circuit breaker box with bracket over DCU and secure with four bracket nuts (Figure 15) . Torque nuts to 17 - 21 lb-ft (23 - 29 N•m).

4. Secure all wiring and cables with wire ties as necessary.

4. SINGLE HORIZONTAL / HORIZONTAL

4.1. MAXXFORCE® 7 OR DT ENGINE

Diesel Particulate Filter (DPF) (RE Bus) – Removal



1. V-clamp (2)
2. Diesel Oxidation Catalyst (DOC)
3. Diesel Particulate Filter (DPF)
4. Nut (2)
5. Mount band
6. Output exhaust can
7. Temperature control device
8. Tailpipe

Figure 16 Horizontal / Horizontal (One-Can System) (RE Bus).

1. Remove heat shields from DPF, if applicable.

NOTE – Place an index mark along the DPF and the DOC to help align the components during the installation procedure.

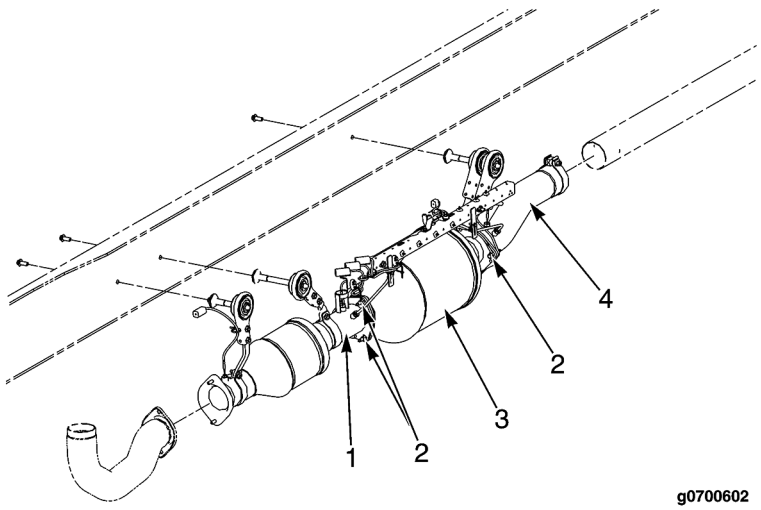
2. Support DPF with an appropriate floor jack.
3. Loosen two nuts and remove V-clamp on each end of DPF.
4. Loosen nut securing mount band to output exhaust can.
5. Slide output exhaust can rearward, approximately one inch (25 mm), to allow clearance for removal of DPF.
6. Remove DPF.
7. Remove two gaskets (not shown), one from each end of DPF. Discard gaskets.

Diesel Particulate Filter (DPF) (RE Bus) – Installation

NOTE – Use the index marks that were made during the removal procedures to align the DOC and DPF during installation.

1. Install two new gaskets, one on each end of DPF.
2. Using an appropriate floor jack, align DPF with DOC (Figure 16) (Items 2 and 3).
3. Install V-clamp on DPF and DOC and secure with nut (Figure 16) . Torque nut to 13 - 16 lb-ft (18 - 22 N•m).
4. Align the output exhaust can on the DPF and secure with V-clamp nut (Figure 16). Torque nut to 13 to 16 lbf-ft (18 to 22 N•m).
5. Install nut on mount band to secure mount band to output exhaust can (Figure 16) (Items 4, 5, and 6). Torque mount band nut to 65 - 80 lb-ft (88 - 108 N•m).
6. Install heat shields that were removed (if applicable).
7. Start engine and check exhaust system for leaks.

Diesel Particulate Filter (DPF) (BE, CE, and HC Bus) – Removal



1. Inlet pipe
2. Nuts and bolt (3 sets)
3. Diesel Particulate Filter (DPF)
4. Tailpipe

Figure 17 Diesel Particulate Filter (DPF) (Two-Can System).

1. Support DPF with an appropriate floor jack.
2. Remove three bolts and nuts from rear of DPF and tailpipe.
3. Remove three bolts and nuts from front of DPF and inlet pipe.
4. Carefully remove DPF from vehicle.
5. Remove two gaskets (not shown), one from each end of DPF. Discard gaskets.

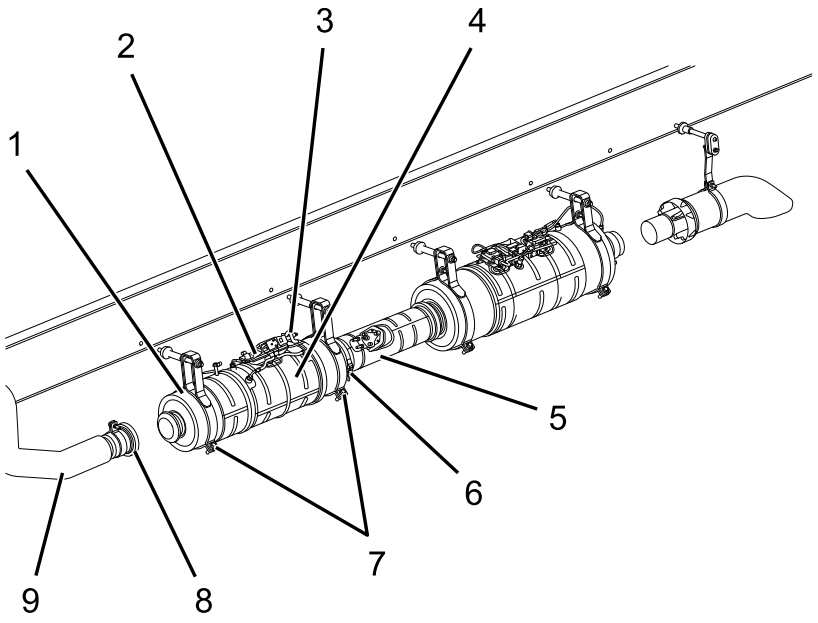
Diesel Particulate Filter (DPF) (BE, CE, and HC Bus) – Installation

1. Using an appropriate floor jack, align DPF with inlet pipe (Figure 17) (Items 1 and 3).
2. Install new gasket on front of DPF.
3. Secure DPF to inlet pipe with three bolts and nuts (Figure 17) (Items 1, 2, and 3). Torque bolts to 35 - 37 lb-ft (47 - 50 N•m).
4. Install new gasket on rear of DPF.
5. Align tailpipe with DPF and secure with three bolts and nuts (Figure 17) (Items 2, 3, and 4). Torque bolts to 35 - 37 lb-ft (47 - 50 N•m).
6. Start engine and check exhaust system for leaks.

5. IN–LINE

5.1. CUMMINS® ISB6.7 ENGINE

Diesel Particulate Filter (DPF) – Removal



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1. Diesel Oxidation Catalyst (DOC)
2. Diesel particulate filter (DPF) interface module
3. DPF interface module electrical connector
4. Diesel Particulate Filter (DPF)
5. Decomposition reactor tube
6. V–clamp
7. Mount band (2)
8. V–clamp
9. Turbo pipe

Figure 18 In–Line

NOTE – There are several configurations of the aftertreatment system for Cummins® ISB6.7 engine. All variations have similar removal / installation procedures.

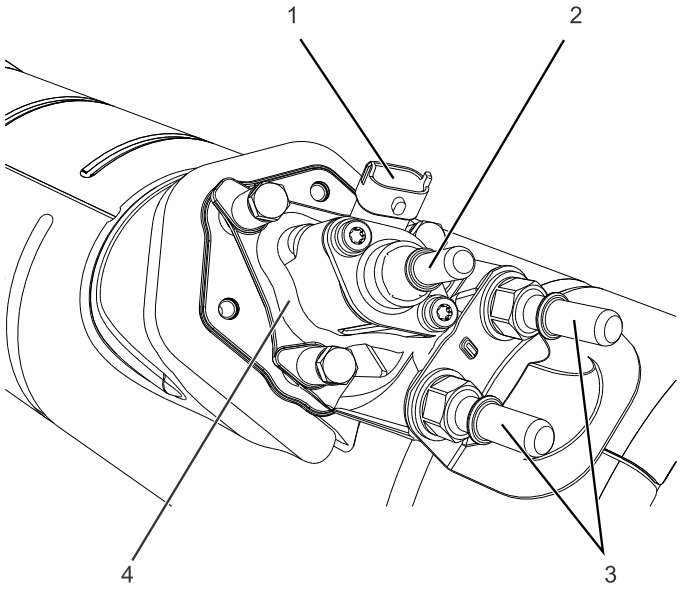
1. Loosen V-clamp securing turbo pipe to DOC.
2. Loosen V-clamp securing DPF to decomposition reactor tube.
3. Disconnect DPF interface module electrical connector from DPF interface module.
4. Support DPF with a suitable lifting device.
5. Loosen two mount bands securing DPF and DOC to mounting bracket.
6. Remove DPF and DOC from vehicle.

Diesel Particulate Filter (DPF) – Installation

1. Raise the DPF with a suitable lifting device.

2. Align DPF with decomposition reactor tube (Figure 18) (items 4 and 5).
3. Align DOC with turbo pipe (Figure 18) (items 1 and 9).
4. Secure DPF and DOC mounting bracket using two mount bands (Figure 18) (items 1, 4, and 7).
5. Secure DPF to decomposition reactor tube with V – clamp (Figure 18) (items 4 , 5, and 6).
6. Secure DOC to turbo pipe with V – clamp (Figure 18) (items 1, 8, and 9).
7. Connect DPF interface module electrical connector to DPF interface module (Figure 18) (items 2 and 3).

Decomposition Reactor Tube – Removal

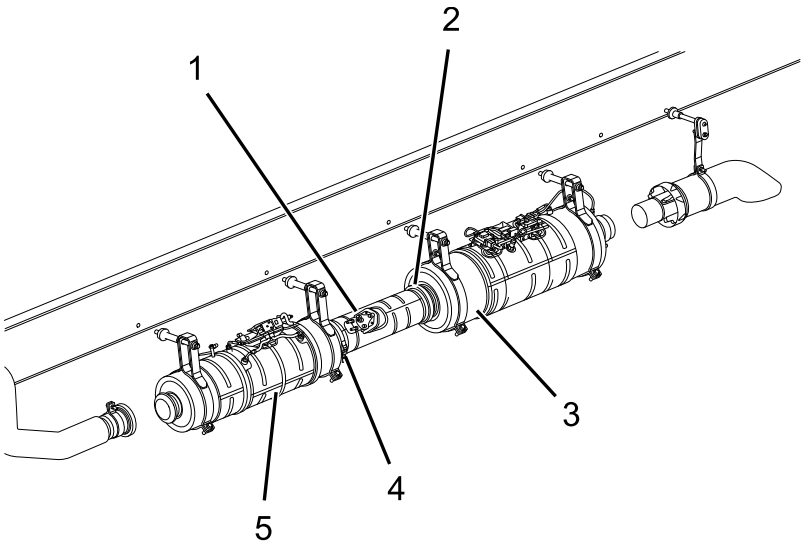


1. Diesel Exhaust Fluid (DEF) dosing valve electrical connector
2. DEF dosing valve pressure line
3. DEF dosing valve coolant line (2)
4. DEF dosing valve

Figure 19 Diesel Exhaust Fluid (DEF) Dosing Valve.

NOTE – To disconnect DEF lines from fittings, push inward on white quick-release clip.

1. Disconnect DEF pressure line from DEF dosing valve.
2. Disconnect two DEF coolant lines from DEF dosing valve.
3. Disconnect DEF dosing valve electrical connector from DEF dosing valve.



0000082550

1. Decomposition reactor tube
2. V-clamp
3. Selective Catalyst Reduction (SCR) canister
4, V-clamp
5. Diesel Particulate Filter (DPF)

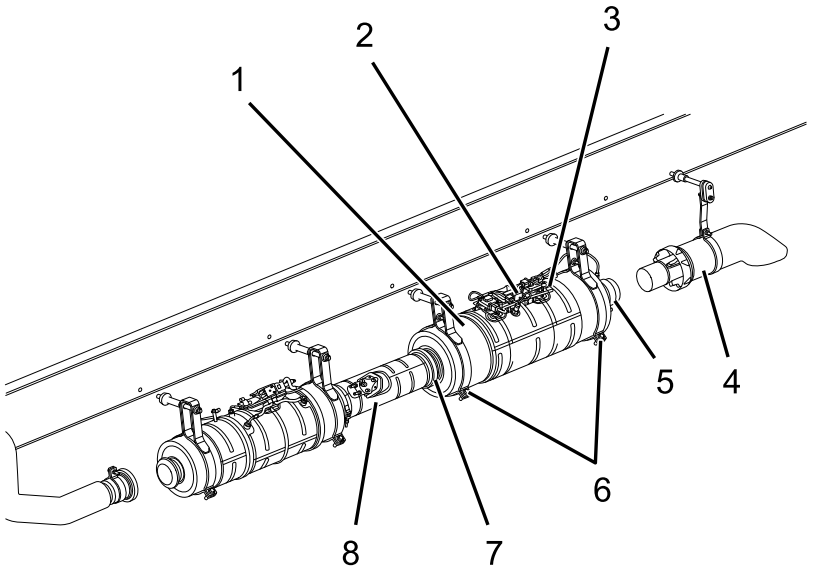
Figure 20 In-Line

4. Loosen V-clamp securing decomposition reactor tube to SCR canister.
5. Loosen V-clamp securing decomposition reactor tube to DPF.
6. Remove decomposition reactor tube.

Decomposition Reactor Tube – Installation

1. Align decomposition reactor tube to DPF (Figure 20) (items 1 and 5).
2. Secure decomposition reactor tube to DPF with V – clamp (Figure 20) (items 1, 4 and 5).
3. Align decomposition reactor tube to SCR canister (Figure 20) (items 1 and 3).
4. Secure decomposition reactor tube to SCR canister with V – clamp (Figure 20) (1, 4 and 5).
5. Connect two DEF coolant lines to DEF dosing valve (Figure 19) (items 3 and 4).
6. Connect DEF pressure line to DEF dosing valve (Figure 19) (items 2 and 4).
7. Connect DEF dosing valve electrical connector to DEF dosing valve (Figure 19) (items 1 and 4).

Selective Catalyst Reduction (SCR) Canister – Removal



0000068636

1. Selective Catalyst Reduction (SCR) canister
2. Selective Catalyst Reduction (SCR) interface module
3. Selective Catalyst Reduction (SCR) interface module connector
4. Tailpipe
5. V-clamp
6. Mount band (2)
7. V-clamp
8. Decomposition reactor tube

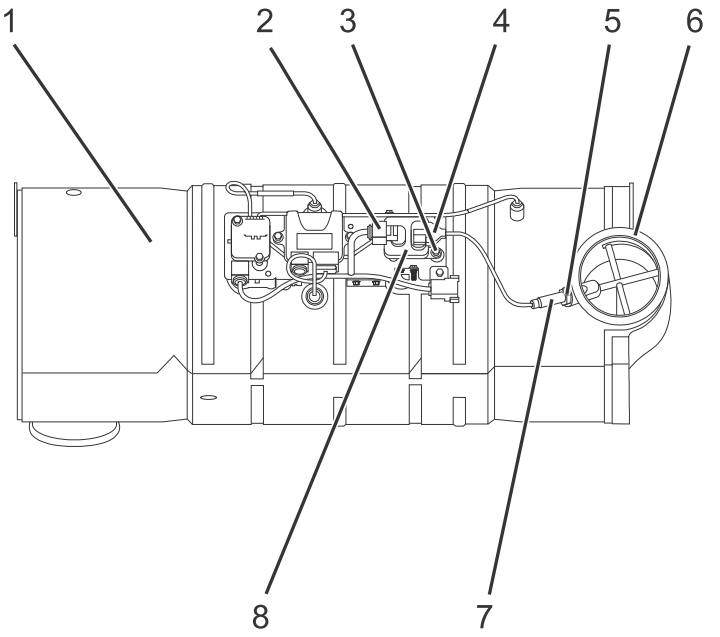
Figure 21 In-Line

1. Loosen V-clamp securing SCR canister to tailpipe.
2. Loosen V-clamp securing SCR canister to decomposition reactor tube.
3. Disconnect SCR interface module electrical connector from SCR interface module.
4. Support SCR canister with a suitable lifting device.
5. Loosen two mount bands securing SCR canister to mounting bracket.
6. Remove SCR canister from vehicle.

Selective Catalyst Reduction (SCR) Canister – Installation

1. Raise the SCR canister with a suitable lifting device (Figure 21) (item 1).
2. Align SCR canister to decomposition reactor tube (Figure 21) (items 1 and 8).
3. Align SCR canister to tailpipe (Figure 21) (items 1 and 4).
4. Secure SCR canister to mounting bracket using two mount bands (Figure 21) (items 1 and 6).
5. Secure SCR canister to decomposition reactor tube with V – clamp (Figure 21) (items 1, 7, and 8).
6. Connect SCR interface module electrical connector to SCR interface module (Figure 21) (items 2 and 3).

Selective Catalyst Reduction (SCR) NOx Out Sensor and Module – Removal



1. SCR canister
2. NOx out sensor harness electrical connector
3. NOx out sensor mounting bolt (2) (1 not shown)
4. NOx out sensor electrical connector
5. NOx out sensor mounting nut
6. SCR canister outlet
7. NOx out sensor
8. NOx out sensor module

Figure 22 Selective Catalyst Reduction (SCR) NOx Out Sensor and Module.

NOTE – The NOx out sensor and module are removed as a complete assembly.

1. Disconnect NOx out sensor harness electrical connector from NOx out sensor module.
2. Remove two NOx out sensor module mounting bolts from NOx out sensor module.
3. Remove NOx out sensor mounting nut from SCR canister outlet.
4. Remove NOx out sensor and module from the SCR canister.

Selective Catalyst Reduction (SCR) NOx Out Sensor and Module – Installation

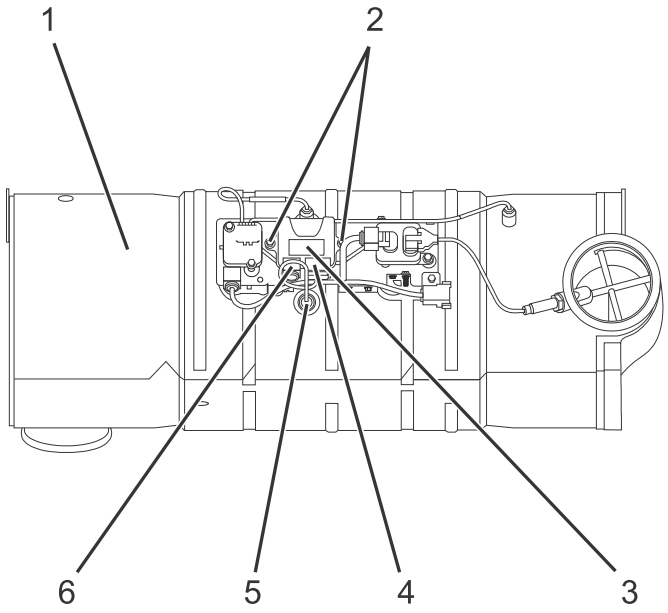
1. Install NOx out sensor module to SCR canister using two NOx out sensor mounting bolts (Figure 22) (items 1, 3, and 8).

2. Connect NOx out sensor harness electrical connector to NOx out sensor module (Figure 22) (items 4 and 8).

3. Install NOx out sensor into SCR canister outlet (Figure 22) (items 6 and 7).

4. Install NOx out sensor mounting nut into SCR canister outlet (Figure 22) (items 5 and 6).

Selective Catalyst Reduction (SCR) Ammonia (NH_3) Sensor Module – Removal



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1. SCR canister
2. Ammonia (NH_3) sensor module mounting bolt (2)
3. Ammonia (NH_3) sensor module
4. Ammonia (NH_3) sensor electrical connector
5. Ammonia (NH_3) sensor
6. Ammonia (NH_3) sensor module electrical connector

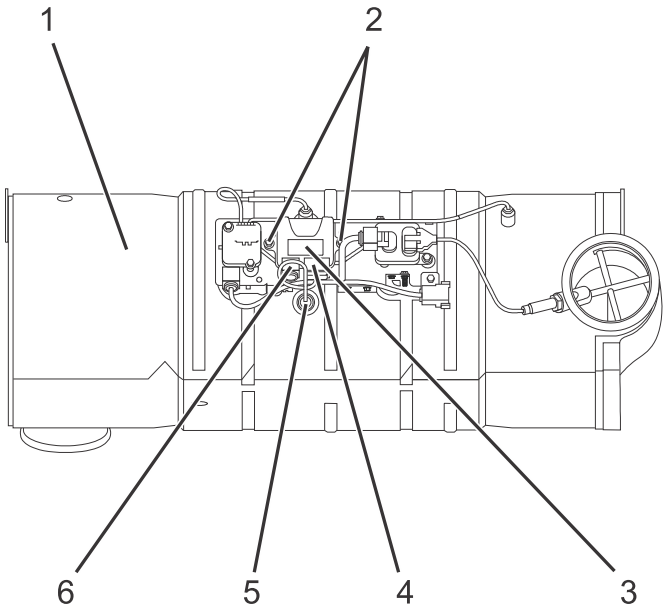
Figure 23 Selective Catalyst Reduction (SCR) Ammonia (NH_3) Sensor Module.

1. Disconnect ammonia (NH_3) sensor electrical connector from ammonia (NH_3) sensor module.
2. Disconnect ammonia (NH_3) sensor module electrical connector from ammonia (NH_3) sensor module.
3. Remove two ammonia (NH_3) sensor module mounting bolts from SCR canister.
4. Remove ammonia (NH_3) sensor module from SCR canister.

Selective Catalyst Reduction (SCR) Ammonia (NH_3) Sensor Module – Installation

1. Install ammonia (NH_3) sensor module to SCR canister using two ammonia (NH3) sensor module mounting bolts (Figure 23) (items 1, 2, and 3).
2. Connect ammonia (NH_3) sensor module electrical connector to ammonia (NH_3) sensor module (Figure 23) (items 3 and 6).
3. Connect ammonia (NH_3) sensor electrical connector to ammonia (NH_3) sensor module (Figure 23) (items 3 and 4).

Selective Catalyst Reduction (SCR) Ammonia (NH_3) Sensor – Removal



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1. SCR canister
2. Ammonia (NH_3) sensor module mounting bolt (2)
3. Ammonia (NH_3) sensor module
4. Ammonia (NH_3) sensor electrical connector
5. Ammonia (NH_3) sensor
6. Ammonia (NH_3) sensor module electrical connector

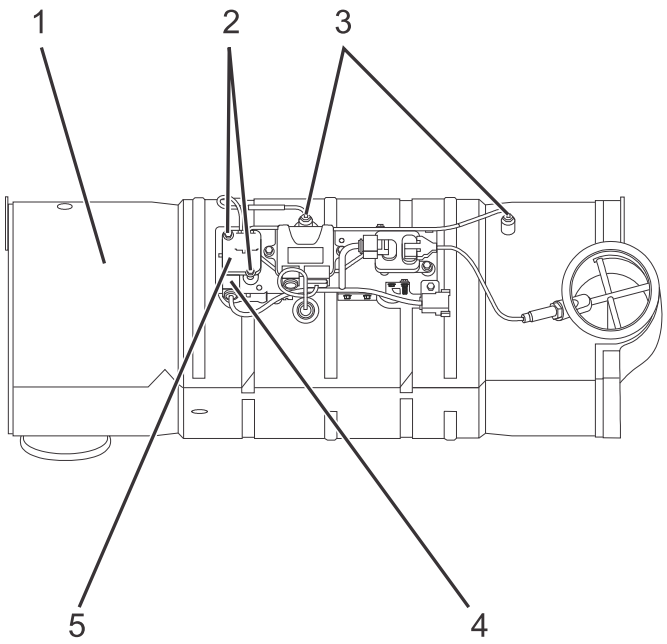
Figure 24 Selective Catalyst Reduction (SCR) Ammonia (NH_3) Sensor.

1. Disconnect ammonia (NH_3) sensor electrical connector from ammonia (NH_3) sensor module.
2. Remove ammonia (NH_3) sensor mounting nut from SCR canister.
3. Remove ammonia (NH_3) sensor from SCR canister.

Selective Catalyst Reduction (SCR) Ammonia (NH_3) Sensor – Installation

1. Install ammonia (NH_3) sensor into SCR canister (Figure 24) (items 1 and 5).
2. Install ammonia (NH_3) sensor mounting nut into SCR canister (Figure 24) (items 1 and 2).
3. Connect ammonia (NH_3) sensor electrical connector to ammonia (NH_3) sensor module (Figure 24) (items 3 and 4).

Selective Catalyst Reduction (SCR) Temperature Sensors and Module – Removal



1. SCR canister
2. SCR temperature sensor module mounting bolt (2)
3. SCR temperature sensor (2)
4. SCR temperature sensor module electrical connector
5. SCR temperature sensor module

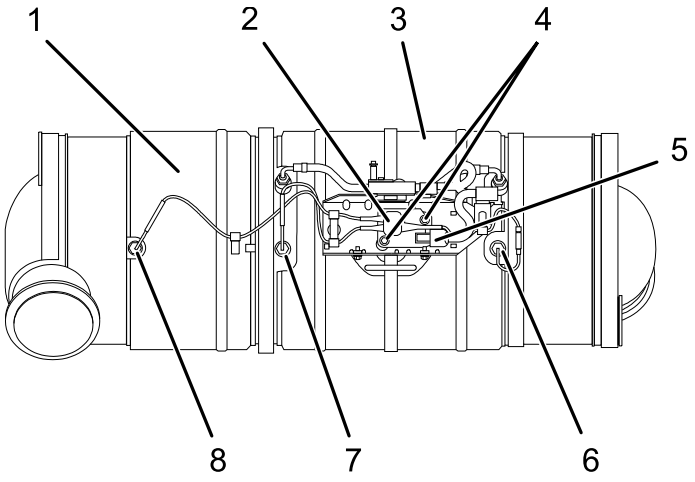
Figure 25 Selective Catalyst Reduction (SCR) Temperature Sensors and Module.

1. Disconnect SCR temperature sensor module electrical connector from SCR temperature sensor module.
2. Remove two SCR temperature sensor module mounting bolts from SCR temperature sensor module.
3. Remove one SCR temperature sensor mounting bolt from each SCR temperature sensor.
4. Remove SCR temperature sensor module and two SCR temperature sensors from SCR canister.

Selective Catalyst Reduction (SCR) Temperature Sensors and Module – Installation

1. Install two SCR temperature sensors into SCR canister (Figure 25) (items 1 and 3).
2. Install one SCR temperature sensor mounting nut into SCR canister for each SCR temperature sensor (Figure 25) (items 1 and 3).
3. Install SCR temperature sensor module to SCR canister using two SCR temperature sensor module mounting bolts (Figure 25) (items 1, 2, and 5).
4. Connect SCR temperature sensor module electrical connector to SCR temperature sensor module (Figure 25) (items 4 and 5).

Diesel Oxidation Catalyst (DOC) / Diesel Particulate Filter (DPF) Temperature Sensors and Module – Removal



1. Diesel Oxidation Catalyst (DOC)
2. DOC / Diesel Particulate filter (DPF) temperature sensor module
3. DPF
4. DOC / DPF temperature sensor mounting bolt (2)
5. DPF temperature sensor module electrical connector
6. DPF outlet temperature sensor and mounting nut
7. DPF inlet temperature sensor and mounting nut
8. DOC inlet temperature sensor and mounting nut

Figure 26 Diesel Oxidation Catalyst (DOC) / Diesel Particulate Filter (DPF) Temperature Sensors and Module.

1. Remove DOC inlet temperature sensor and mounting nut from DOC.
2. Remove DPF inlet temperature sensor and mounting nut from DPF.
3. Remove DPF outlet temperature sensor and mounting nut from DPF.
4. Remove two DOC / DPF temperature sensor module mounting bolts from DPF temperature sensor module.
5. Disconnect DOC / DPF temperature sensor module electrical connector from DPF temperature sensor module.
6. Remove DOC / DPF temperature sensor module from DPF.

Diesel Oxidation Catalyst (DOC) / Diesel Particulate Filter (DPF) Temperature Sensors and Module – Installation

1. Install DOC / DPF temperature sensor module to DPF using two DOC / DPF temperature sensor module mounting bolts (Figure 26) (items 2, 3, and 4).

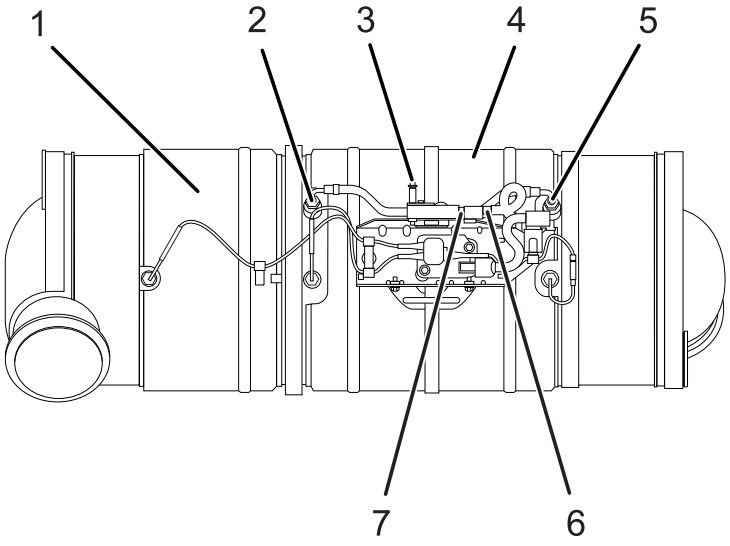
2. Connect DOC / DPF temperature sensor module electrical connector to DPF temperature sensor module (Figure 26) (items 2 and 5).

3. Install DPF outlet temperature sensor and mounting nut to DPF (Figure 26) (items 3 and 6).

4. install DPF inlet temperature sensor and mounting nut to DPF (Figure 26) (items 2 and 3).

5. Install DOC inlet temperature sensor and mounting nut to DOC (Figure 26) (items 1 and 8).

Diesel Particulate Filter (DPF) Differential Pressure / Outlet Pressure Sensor Module – Removal



1. Diesel Oxidation Catalyst (DOC)
2. DPF differential pressure tube
3. DPF differential pressure / outlet pressure sensor mounting bolt (2) (1 not shown)
4. DPF
5. DPF differential outlet pressure tube
6. DPF differential pressure / outlet pressure sensor electrical connector
7. DPF differential pressure / outlet pressure sensor

Figure 27 DPF Differential Pressure / Outlet Pressure Sensor Module.

1. Remove two DPF differential pressure / outlet pressure sensor mounting bolts from DPF differential pressure / outlet pressure sensor module.

2. Disconnect DPF differential pressure / outlet pressure sensor module electrical connector from DPF differential pressure / outlet pressure sensor module.

3. Disconnect DPF differential pressure tube from DPF differential pressure / outlet pressure sensor module.

4. Disconnect DPF differential outlet pressure tube from DPF differential pressure / outlet pressure sensor module.

5. Remove the DPF differential pressure / outlet pressure sensor module from the DPF.

Diesel Particulate Filter (DPF) Differential Pressure / Outlet Pressure Sensor Module – Installation

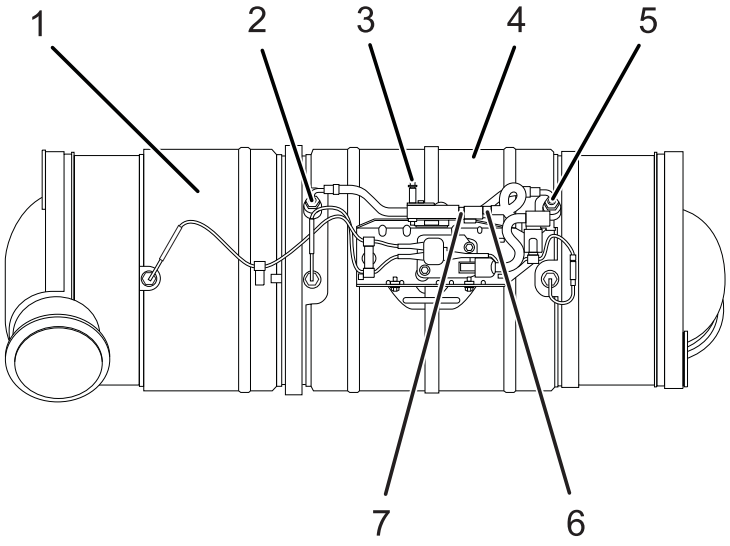
1. Connect DPF differential outlet pressure tube to DPF differential pressure / outlet pressure sensor module (Figure 27) (items 5 and 7).

2. Connect DPF differential pressure tube to DPF differential pressure / outlet pressure sensor module (Figure 27) (items 2 and 7).

3. Connect DPF differential pressure / outlet pressure sensor module electrical connector to DPF differential pressure / outlet pressure sensor module (Figure 27) (items 6 and 7).

4. Install two DPF differential pressure / outlet pressure sensor module mounting bolts to DPF differential pressure / outlet pressure sensor module (Figure 27) (items 3 and 7).

Diesel Particulate Filter (DPF) Differential Pressure Tube – Removal



1. Diesel Oxidation Catalyst (DOC)
2. DPF differential pressure tube
3. DPF differential pressure / outlet pressure sensor mounting bolt (2)
4. DPF
5. DPF differential outlet pressure tube
6. DPF differential pressure / outlet pressure sensor electrical connector
7. DPF differential pressure / outlet pressure sensor

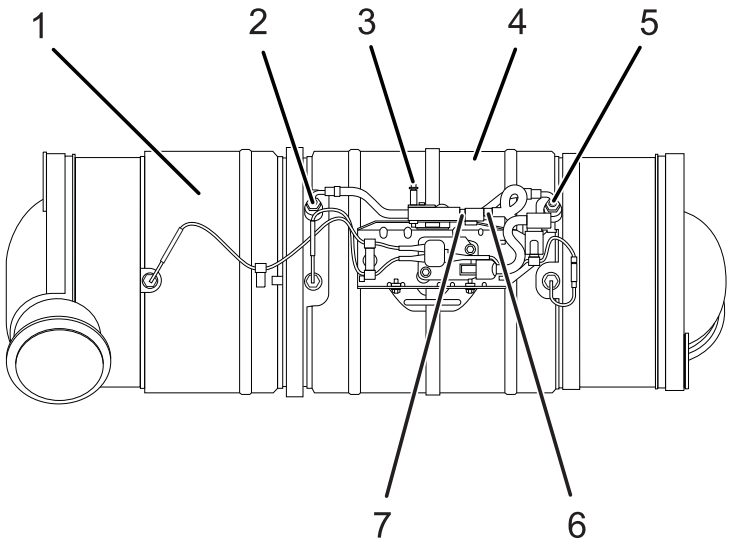
Figure 28 Diesel Particulate Filter (DPF) Differential Pressure Tube.

1. Disconnect DPF differential pressure tube from DPF differential pressure / outlet pressure sensor module.
2. Remove DPF differential pressure tube mounting nut from DPF.
3. Remove DPF differential pressure tube from DPF.

Diesel Particulate Filter (DPF) Differential Pressure Tube – Installation

1. Install DPF differential pressure tube mounting nut to DPF (Figure 28) (items 2 and 4).
2. Connect DPF differential pressure tube to DPF differential pressure / outlet pressure sensor module (Figure 28) (items 2 and 7).

Diesel Particulate Filter (DPF) Differential Outlet Pressure Tube – Removal



1. Diesel Oxidation Catalyst (DOC)
2. DPF differential pressure tube
3. DPF differential pressure / outlet pressure sensor mounting bolt (2)
4. DPF
5. DPF differential outlet pressure tube
6. DPF differential pressure / outlet pressure sensor electrical connector
7. DPF differential pressure / outlet pressure sensor

Figure 29 DPF Differential Outlet Pressure Tube

1. Disconnect DPF differential outlet pressure tube from DPF differential pressure / outlet pressure sensor module.

2. Remove DPF differential outlet pressure tube mounting nut from DPF.

3. Remove DPF differential outlet pressure tube from DPF .

Diesel Particulate Filter (DPF) Differential Outlet Pressure Tube – Installation

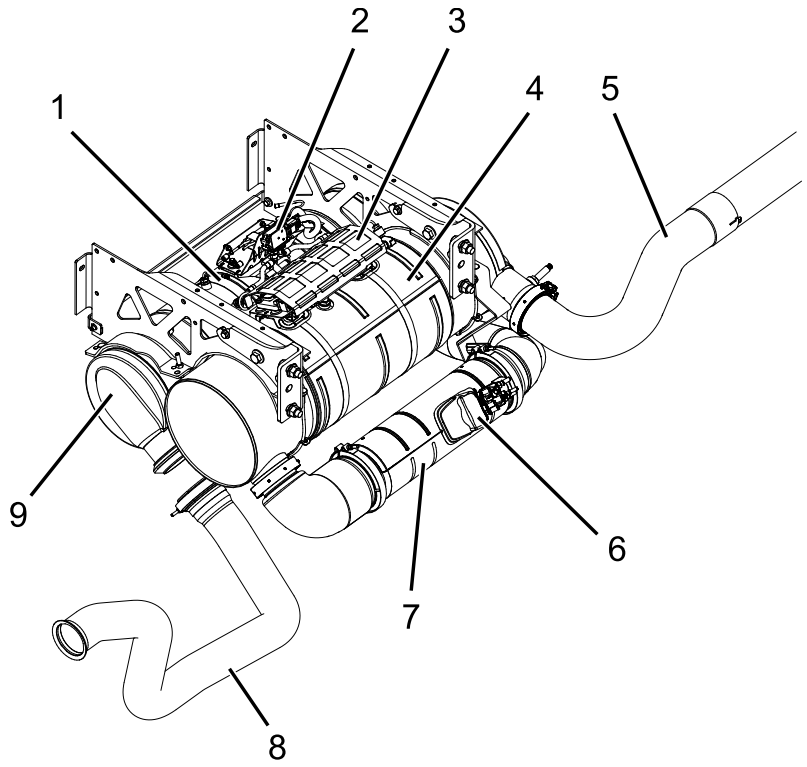
1. Install DPF differential outlet pressure tube mounting bolt to DPF (Figure 29) (items 4 and 5).

2. Connect DPF differential outlet pressure tube to DPF differential pressure / outlet pressure sensor module (Figure 29) (items 5 and 7).

6. SWITCHBACK / HORIZONTAL

6.1. CUMMINS® ISB6.7 ENGINE

Switchback / Horizontal



0000068638

1. Diesel Particulate Filter (DPF)
2. Diesel Particulate Filter (DPF) interface module
3. Selective Catalyst Reduction (SCR) interface module
4. Selective Catalyst Reduction (SCR) canister
5. Tailpipe
6. Diesel Exhaust Fluid (DEF) dosing valve
7. Decomposition reactor tube
8. Turbo pipe
9. Diesel Oxidation Catalyst (DOC)

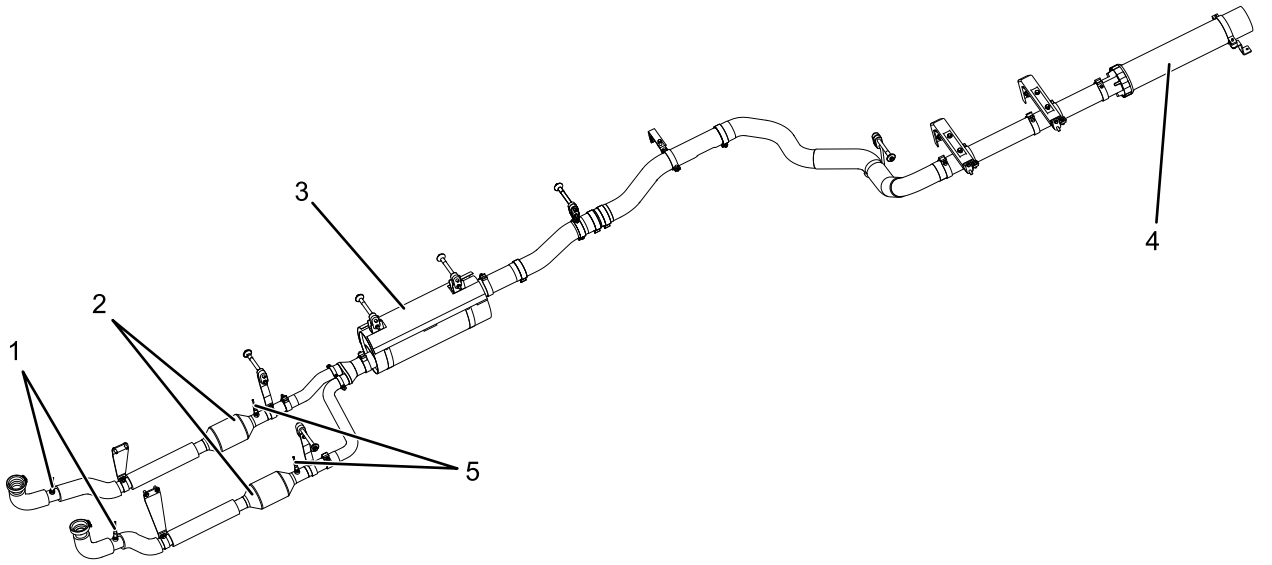
Figure 30 Switchback / Horizontal.

NOTE – Removal and Installation procedures for the Switchback / Horizontal system are similar to the In-Line system. Depending on vehicle configuration, specific component location may vary.

7. HORIZONTAL DUAL CATALYTIC CONVERTERS

7.1. PSI 8.8L LPG ENGINE

Horizontal Dual Catalytic Converters



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1. Pre - catalytic converter oxygen sensor (2)
2. Catalytic converter (2)
3. Muffler
4. Tailpipe
5. Post - catalytic converter oxygen sensor (2)

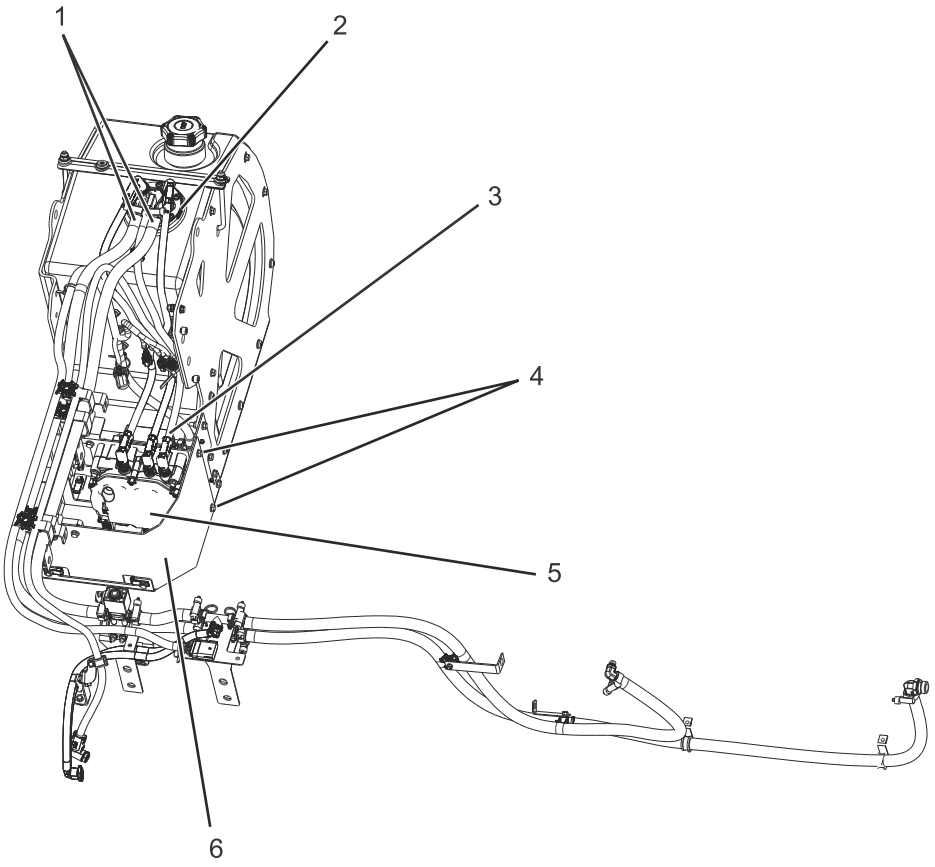
Figure 31 Horizontal Dual Catalytic Converters.

NOTE – Removal and Installation procedures for the horizontal dual catalytic converter system are similar to the other systems outlined within this manual. Depending on vehicle configuration, specific component location may vary.

8. DIESEL EXHAUST FLUID (DEF) SYSTEM

8.1. CUMMINS® ISB6.7

Diesel Exhaust Fluid (DEF) Tank – Removal



1. Diesel Exhaust Fluid (DEF) tank pickup assembly coolant line (2)
2. DEF tank pickup assembly
3. DEF supply module pressure line
4. DEF supply module cover bolt
5. DEF supply module
6. DEF supply module cover

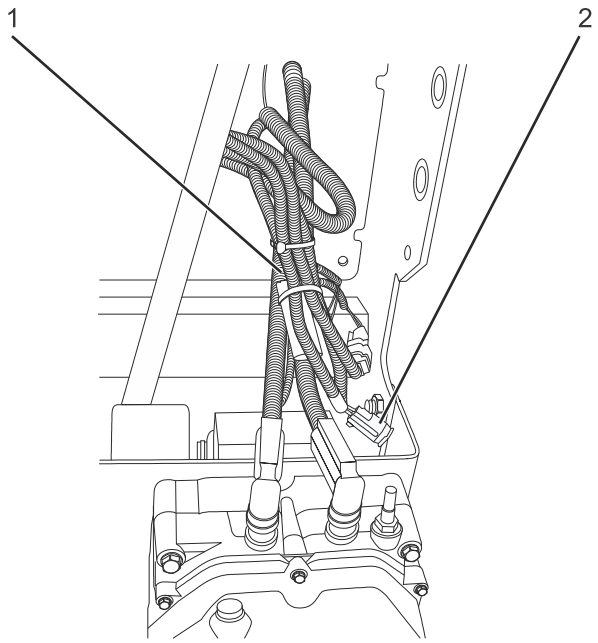
Figure 32 Diesel Exhaust Fluid (DEF) Tank and Lines.

NOTE – There are several configurations of the Diesel Exhaust Fluid (DEF) system for Cummins® ISB6.7 equipped vehicles. All variations have similar removal / installation procedures.

1. Disconnect two DEF coolant lines from DEF tank pickup assembly.

2. Remove DEF supply module cover bolts from DEF supply module bracket, and remove DEF supply module cover.

3. Disconnect DEF pressure line from DEF supply module.

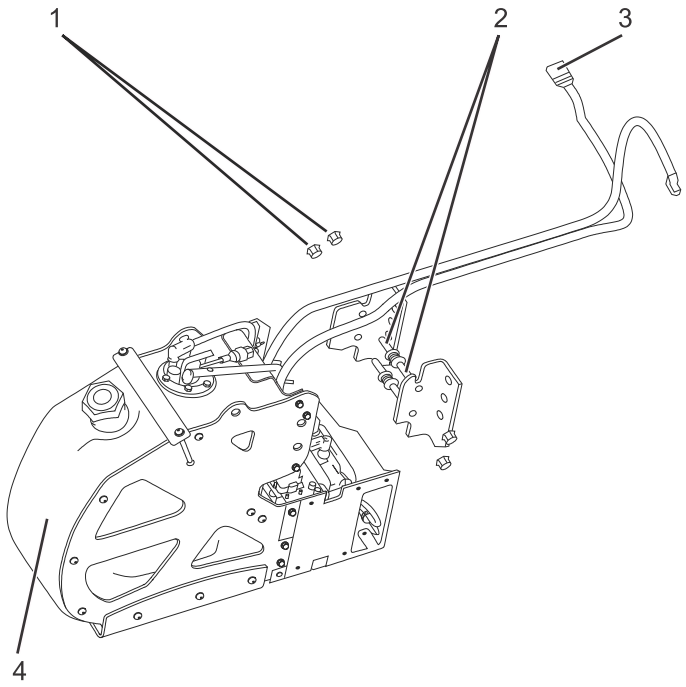


1. Diesel Exhaust Fluid (DEF) tank harness
2. DEF pressure line heater electrical connector

Figure 33 Diesel Exhaust Fluid (DEF) Tank Wiring Harness.

NOTE – DEF pressure line heater is routed within DEF pressure line harness.

4. Disconnect DEF pressure line heater electrical connector from DEF pressure line.



1. Diesel Exhaust Fluid (DEF) tank mounting bracket nut (4) (2 not shown)
2. DEF tank mounting bracket bolt
3. DEF tank assembly electrical connector
4. DEF tank assembly

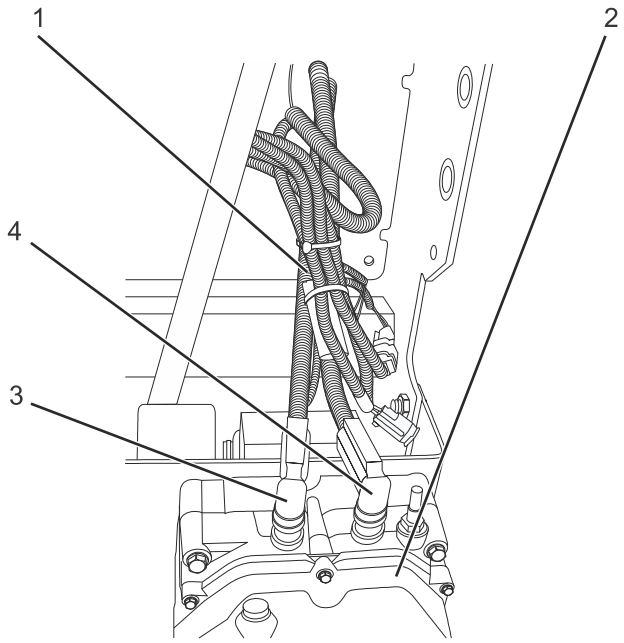
Figure 34 Diesel Exhaust Fluid (DEF) Tank.

5. Disconnect DEF tank assembly electrical connector.
6. Support DEF tank assembly with a suitable lifting device.
7. Remove DEF tank assembly mounting bracket bolts and nuts from vehicle frame.
8. Lower DEF tank assembly.

Diesel Exhaust Fluid (DEF) Tank – Installation

1. Raise DEF tank assembly with a suitable lifting device (Figure 34) (item 4).
2. Install four DEF tank assembly mounting bracket bolts and nuts to vehicle frame (Figure 34) (items 1 and 2).
3. Connect DEF tank assembly electrical connector (Figure 34) (item 3).
4. Connect DEF pressure line heater electrical connector to DEF pressure line harness (Figure 33) (item 2).
5. Connect DEF pressure line to DEF supply module (Figure 32) (items 3 and 5).
6. Install DEF supply module cover nuts to DEF supply module bracket (Figure 32) (item 4).
7. Connect two DEF coolant lines to DEF tank pickup assembly (Figure 32) (items 1 and 2).

Diesel Exhaust Fluid (DEF) Tank Wiring Harness – Removal



1. Diesel Exhaust Fluid (DEF) tank wiring harness
2. DEF supply module
3. DEF suction line
4. DEF return line

Figure 35 Diesel Exhaust Fluid (DEF) Tank Wiring Harness.

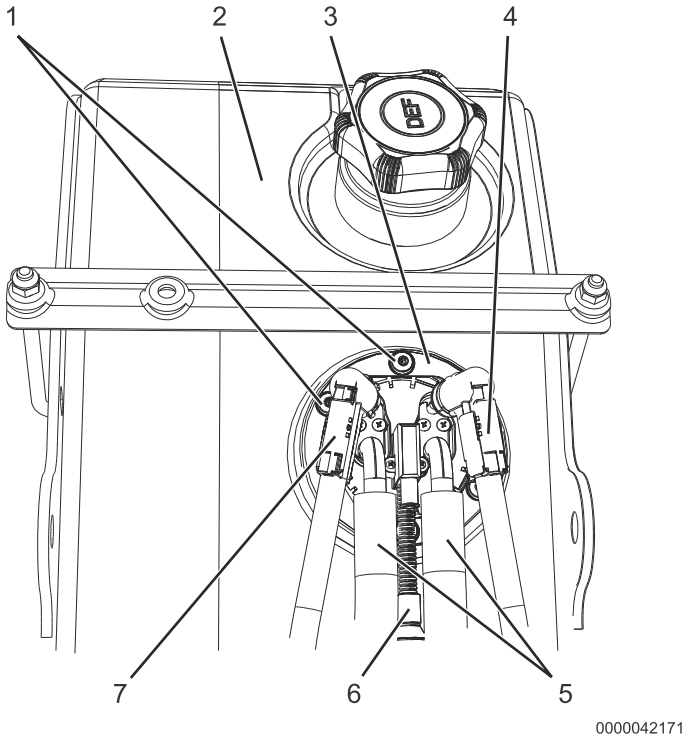
NOTE – There are several configurations of the Diesel Exhaust Fluid (DEF) system for Cummins ® ISB6.7 equipped vehicles. All variations have similar removal / installation procedures.

NOTE – Each DEF line will have an individual DEF line heater electrical connector that must be disconnected to separate DEF tank wiring harness from DEF tank lines.

1. Disconnect DEF supply module electrical connector from DEF supply module.

2. Disconnect DEF suction line heater electrical connector from DEF suction line.

3. Disconnect DEF return line heater electrical connector from DEF return line.



1. Diesel Exhaust Fluid (DEF) tank pickup assembly Torx screw (6) (4 not shown)
2. DEF tank
3. DEF tank pickup assembly
4. DEF suction line
5. DEF coolant line (2)
6. DEF tank pickup assembly electrical connector
7. DEF return line

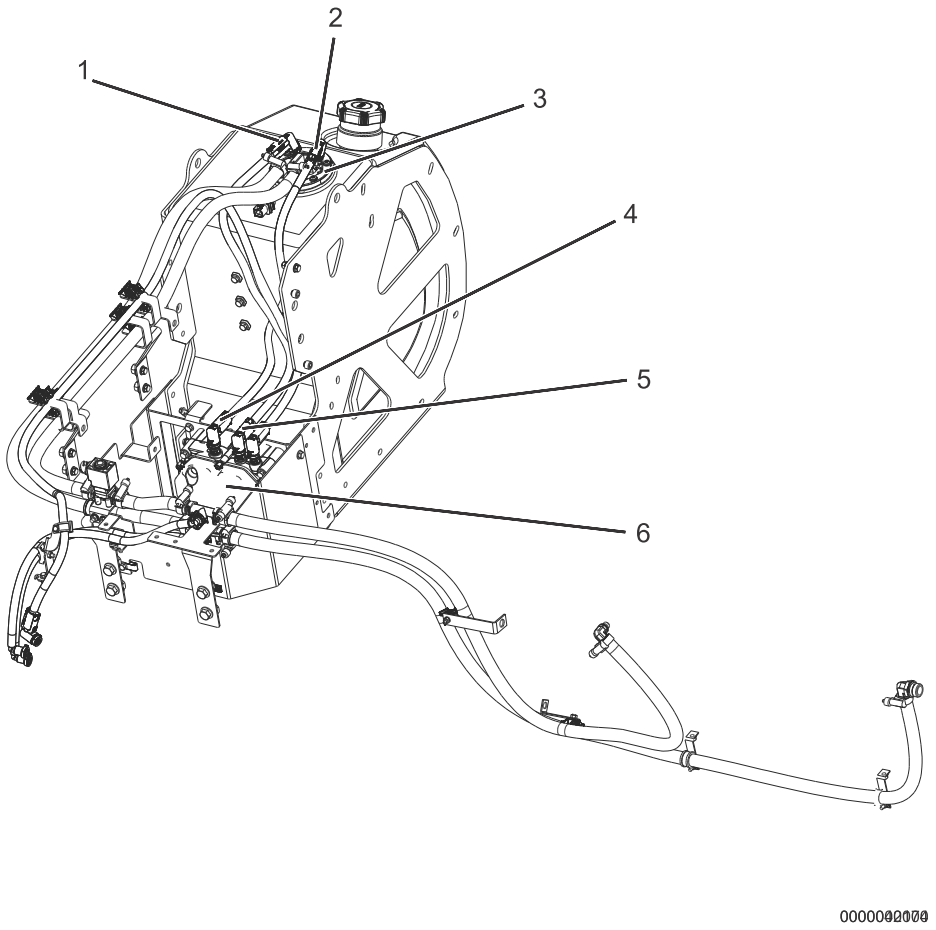
Figure 36 Diesel Exhaust Fluid (DEF) Tank Pickup Assembly.

4. Disconnect DEF tank pickup assembly electrical connector from DEF tank wiring harness.
5. Remove DEF tank wiring harness (Figure 35) (item 1).

Diesel Exhaust Fluid (DEF) Tank Wiring Harness – Installation

1. Connect DEF tank pickup assembly electrical connector to DEF tank wiring harness (Figure 36) (item 6).
2. Connect DEF return line heater electrical connector to DEF return line (Figure 35) (item 4).
3. Connect DEF suction line heater electrical connector to DEF suction line (Figure 35) (item 3).
4. Connect DEF supply module electrical connector to DEF supply module (Figure 35) (item 2).

Diesel Exhaust Fluid (DEF) Tank Lines – Removal



1. Diesel Exhaust Fluid (DEF) tank pickup assembly return line
2. DEF tank pickup assembly suction line
3. DEF tank pickup assembly
4. DEF supply module suction line
5. DEF supply module return line
6. DEF supply module

Figure 37 Diesel Exhaust Fluid (DEF) Tank Lines.

NOTE – There are several configurations of the DEF system for Cummins ® ISB6.7 equipped vehicles. All variations have similar removal / installation procedures.

NOTE – To disconnect DEF lines from fittings, push inward on white quick-release clip.

NOTE – Each DEF line will have an individual DEF line heater electrical connector that must be disconnected to separate DEF tank lines from the DEF tank wiring harness.

1. Disconnect DEF return line from DEF tank pickup assembly.

2. Disconnect DEF suction line from DEF tank pickup assembly.

3. Disconnect DEF return line from **white** DEF supply module return fitting.

4. Disconnect DEF suction line from **black** DEF supply module suction fitting.
5. Disconnect DEF return line heater electrical connector from DEF return line.
6. Disconnect DEF suction line heater electrical connector from DEF suction line (Figure 37)).
7. Remove DEF tank lines.

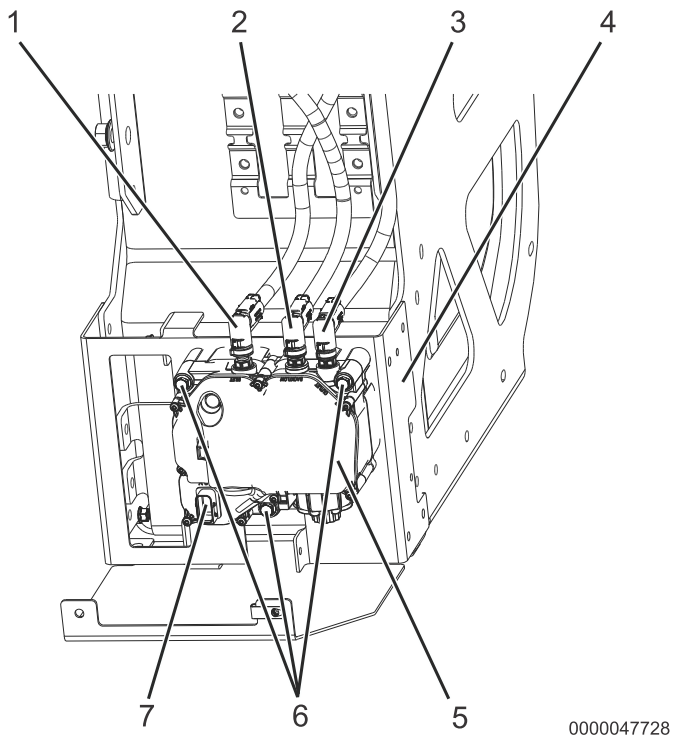
Diesel Exhaust Fluid (DEF) Tank Lines – Installation

1. Connect DEF suction line heater electrical connector to DEF suction line (Figure 37).
2. Connect DEF return line heater electrical connector to DEF return line (Figure 37) (items 5).

NOTE – Do not install suction or return lines on incorrect DEF supply module fittings, or damage to DEF supply module will occur.

3. Connect DEF suction line to **black** DEF supply module suction fitting (Figure 37) (items 4 and 6).
4. Connect DEF return line to **white** DEF supply module return fitting (Figure 37) (items 5 and 6).
5. Connect DEF suction line to DEF tank pickup assembly (Figure 37) (items 2 and 3).
6. Connect DEF return line to DEF tank pickup assembly (Figure 37) (items 1 and 3).

Diesel Exhaust Fluid (DEF) Supply Module – Removal



1. DEF supply module suction line
2. DEF supply module return line
3. DEF supply module pressure line
4. DEF supply module bracket
5. DEF supply module
6. DEF supply module mounting bolt (2)
7. DEF supply module electrical connector

Figure 38 Diesel Exhaust Fluid (DEF) Supply Module.

NOTE – There are several configurations of the DEF system for Cummins ® ISB6.7 equipped vehicles. All variations have similar removal / installation procedures.

NOTE – Do not install suction or return lines on incorrect DEF supply module fittings, or damage to DEF supply module will occur.

1. Disconnect DEF return line from **white** DEF supply module return fitting.
2. Disconnect DEF suction line from **black** DEF supply module suction fitting.
3. Disconnect DEF pressure line from DEF supply module pressure fitting.
4. Disconnect DEF supply module electrical connector from DEF supply module.
5. Remove three DEF supply module mounting bolts from DEF supply module.
6. Remove DEF supply module from DEF supply module bracket.

Diesel Exhaust Fluid (DEF) Supply Module – Installation

1. Install DEF supply module to DEF supply module bracket using three DEF supply module mounting bolts (Figure 38) (items 4, 5, and 6).

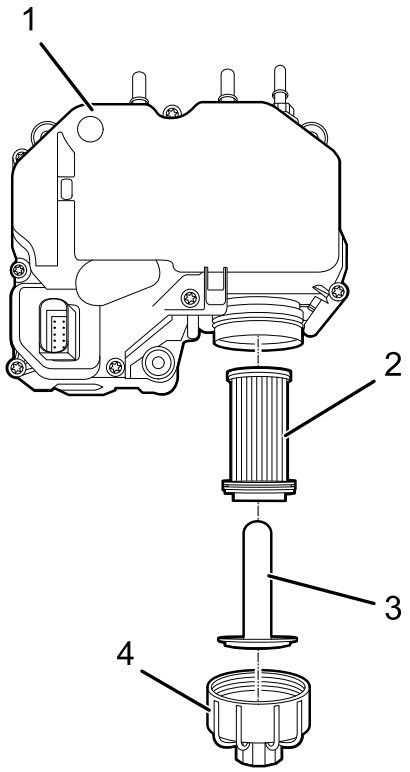
2. Connect DEF supply module electrical connector to DEF supply module (Figure 38) (items 5 and 7).

3. Connect DEF pressure line to DEF supply module pressure fitting (Figure 38) (item 3).

4. Connect DEF suction line to **black** DEF supply module suction fitting (Figure 38) (item 1).

5. Connect DEF return line to **white** DEF supply module return fitting (Figure 38) (item 2).

Diesel Exhaust Fluid (DEF) Dosing Unit Filter – Removal



0000060719

1. DEF supply module
2. DEF supply module filter
3. DEF supply module filter equalizing element
4. DEF supply module filter cap

Figure 39 Diesel Exhaust Fluid (DEF) Dosing Unit Filter.

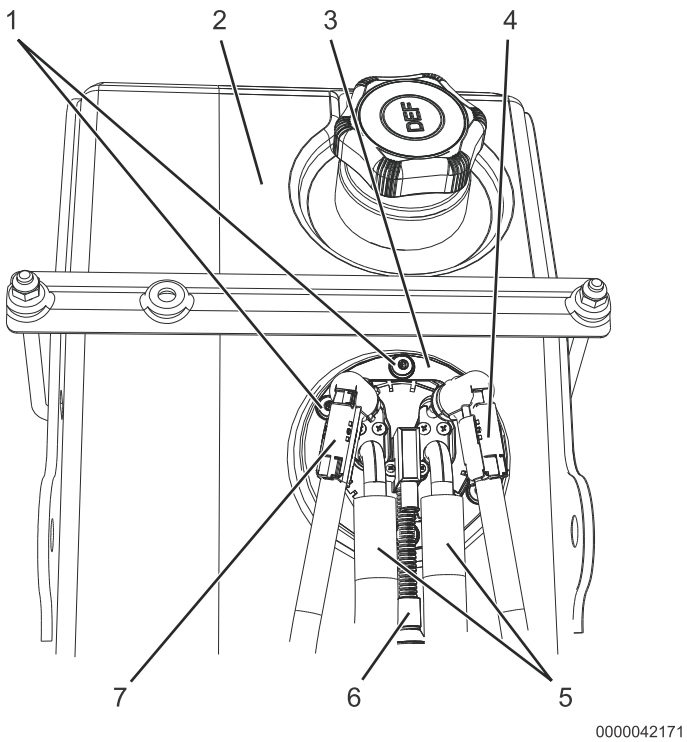
NOTE – If the filter element and equalizing element are removed from the DEF supply module, they must be discarded and replaced, regardless of condition.

1. Remove DEF supply module filter cap from DEF supply module.
2. Remove DEF supply module filter equalizing element from DEF supply module.
3. Remove DEF supply module filter from DEF supply module.

Diesel Exhaust Fluid (DEF) Dosing Unit Filter – Installation

1. Install DEF supply module filter equalizing element into DEF supply module filter (Figure 39) (items 2 and 3).
2. Install DEF supply module filter equalizing element and DEF supply module filter into the DEF supply module (Figure 39) (items 1, 2, and 3).
3. Install DEF supply module filter cap on DEF supply module (Figure 39) (items 1 and 4). Torque cap to 177 lb-in (20 N•m).

Diesel Exhaust Fluid (DEF) Tank Pickup Assembly – Removal



1. Diesel Exhaust Fluid (DEF) tank pickup assembly Torx screw (6) (4 not shown)
2. DEF tank
3. DEF tank pickup assembly
4. DEF suction line
5. DEF coolant line (2)
6. DEF tank pickup assembly electrical connector
7. DEF return line

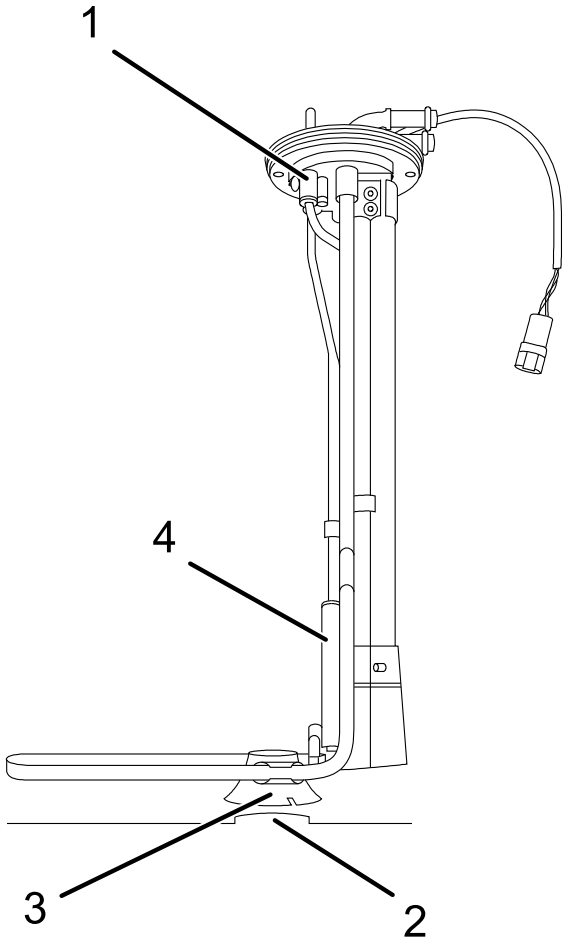
Figure 40 Diesel Exhaust Fluid (DEF) Tank Pickup Assembly.

NOTE – To disconnect DEF lines from fittings, push inward on white quick-release clip.

1. Remove DEF tank assembly from vehicle (See Diesel Exhaust Fluid (DEF) Tank – Removal, page 47).
2. Disconnect DEF return line from DEF tank pickup assembly.
3. Disconnect DEF suction line from DEF tank pickup assembly.
4. Disconnect DEF tank pickup assembly electrical connector from DEF tank wiring harness.
5. Remove six DEF tank pickup assembly Torx screws from DEF tank.
6. Remove DEF tank pickup assembly from DEF tank.

Diesel Exhaust Fluid (DEF) Tank Pickup Assembly – Installation

1. Install DEF tank pickup assembly in DEF tank (Figure 40) (items 2 and 3).



0000045746

1. Diesel Exhaust Fluid (DEF) tank pickup assembly
2. DEF tank pickup assembly rubber grommet
3. DEF tank molded boss
4. DEF tank pickup assembly filter

Figure 41 Diesel Exhaust Fluid (DEF) Tank Pickup Assembly.

2. Engage DEF tank pickup assembly rubber grommet to molded boss on bottom of DEF tank (Figure 41) (items 2 and 3).

3. Apply PTFE thread sealant (Loctite 565 or equivalent) to six DEF pickup assembly torx screws (Figure 40) (item 1).

4. Install six DEF tank pickup assembly torx screws to DEF tank (Figure 40) (items 1 and 2).

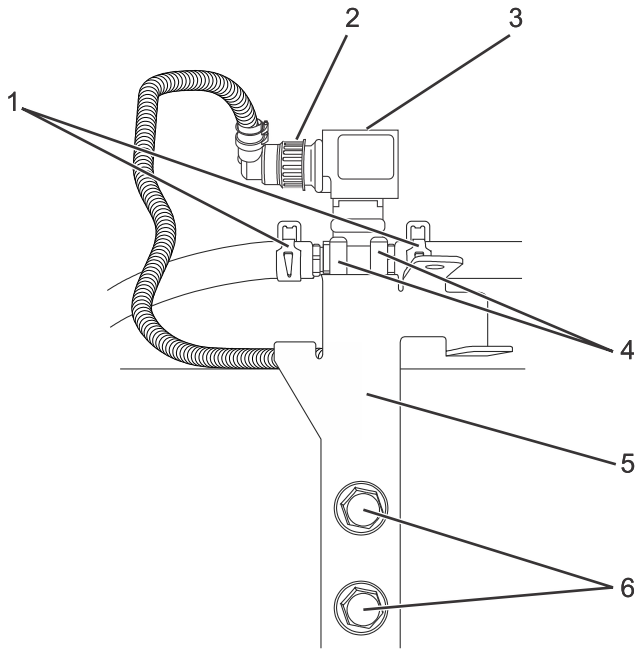
5. Connect DEF tank pickup assembly electrical connector to DEF tank wiring harness (Figure 40) (item 6).

6. Connect DEF suction line to DEF tank pickup assembly (Figure 40) (item 3 and 7).

7. Connect DEF supply line to DEF tank pickup assembly (Figure 40) (items 3 and 4).

8. Install DEF tank assembly to vehicle (See Diesel Exhaust Fluid (DEF) Tank – Installation, page 49).

Diesel Exhaust Fluid (DEF) Tank Heater Valve – Removal



1. Diesel Exhaust Fluid (DEF) coolant line (2)
2. DEF tank heater valve electrical connector
3. DEF tank heater valve
4. DEF tank heater valve mounting bolt (4) (2 not shown)
5. DEF tank heater valve mounting bracket
6. DEF tank heater valve mounting bracket bolt (2)

Figure 42 Diesel Exhaust Fluid (DEF) Tank Heater Valve.

1. Disconnect two DEF coolant lines from DEF tank heater valve.
2. Disconnect DEF tank heater valve electrical connector from DEF tank heater valve.
3. Remove two DEF tank heater valve mounting bolts from DEF tank heater valve mounting bracket.
4. Remove four DEF tank heater valve mounting bolts from tank heater valve.
5. Remove DEF tank heater valve.

Diesel Exhaust Fluid (DEF) Tank Heater Valve – Installation

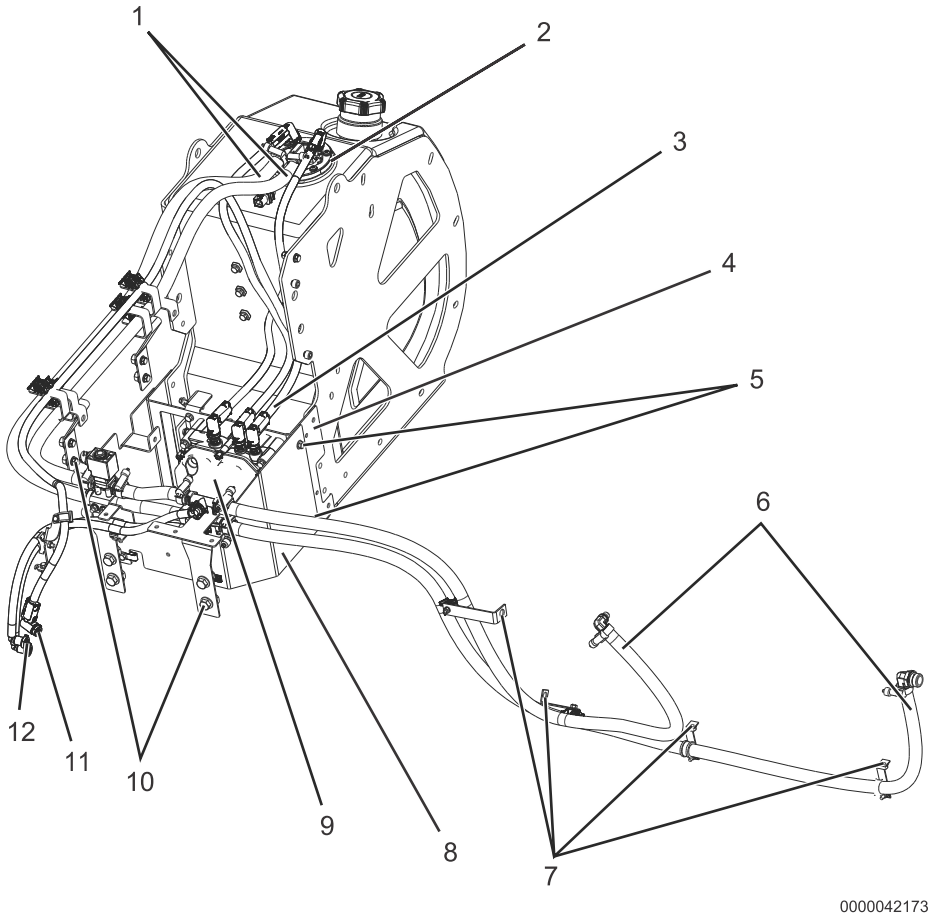
1. Install four DEF tank heater valve mounting bolts to DEF tank heater valve mounting bracket (Figure 42) (items 4 and 5).Torque nut to 62 lb-in (7 N•m).

2. Install two DEF tank heater valve mounting bracket bolts to vehicle frame (Figure 42) (item 6).

3. Connect DEF tank heater valve electrical connector to DEF tank heater valve (Figure 42) (items 2 and 3).

4. Connect two DEF coolant lines to DEF tank heater valve (Figure 42) (items 1 and 3).

Diesel Exhaust Fluid (DEF) Pressure Line and Coolant Lines – Removal



1. Diesel Exhaust Fluid (DEF) tank coolant line (2)
2. DEF tank pickup assembly
3. DEF supply module pressure line
4. DEF supply module bracket
5. DEF supply module cover bolt (4) (2 not shown)
6. DEF coolant line (2)
7. DEF coolant line support bracket (4)
8. DEF supply module cover
9. DEF supply module
10. DEF line and coolant line mounting bracket bolt (8) (6 not shown)
11. DEF dosing valve pressure line
12. DEF dosing valve coolant line (2) (1 not shown)

Figure 43 Diesel Exhaust Fluid (DEF) Pressure Line and Coolant Lines.

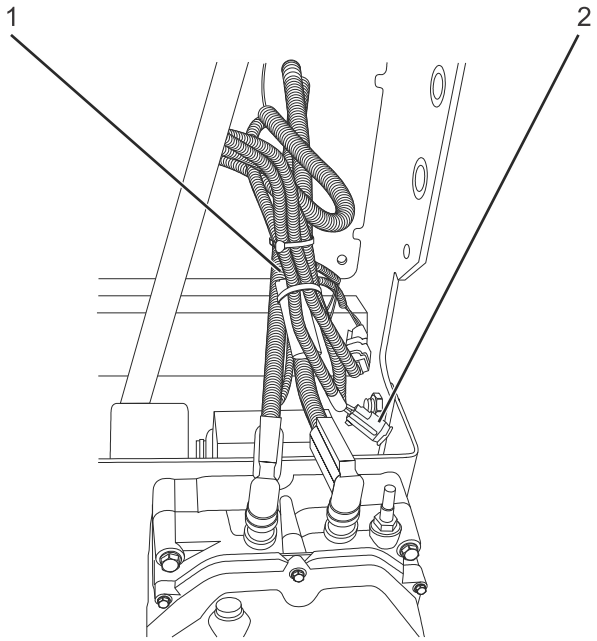
NOTE – To disconnect DEF lines from fittings, push inward on white quick-release clip.

NOTE – Depending on vehicle configuration, DEF coolant lines may be equipped with quick disconnect fittings. To disconnect fittings, press inward on release tab.

1. Disconnect two DEF coolant lines from DEF tank pickup assembly.

2. Disconnect DEF pressure line from DEF dosing valve.

3. Disconnect two DEF coolant lines from DEF dosing valve.
4. Remove eight DEF line and coolant line mounting bracket bolts from vehicle frame.
5. Remove four DEF coolant line support bracket bolts from engine block (Figure 43) (item 7).
6. Disconnect two DEF coolant lines from engine block coolant line fittings (Figure 43) (item 6).
7. Remove four DEF supply module cover bolts from DEF supply module bracket, remove DEF supply module cover (Figure 43) (items 4 and 5).
8. Disconnect DEF pressure line from DEF supply module (Figure 43) (items 3 and 9).



1. Diesel Exhaust Fluid (DEF) tank harness
2. DEF pressure line heater electrical connector

Figure 44 Diesel Exhaust Fluid (DEF) Tank Wiring Harness.

9. Disconnect DEF pressure line heater electrical connector from DEF tank wiring harness.
10. Remove DEF pressure line and DEF coolant lines from vehicle (Figure 43) (items 1, 3, 6, 11, and 12).

Diesel Exhaust Fluid (DEF) Pressure Line and Coolant Lines – Installation

1. Install eight DEF coolant lines and pressure line bracket mounting bolts to vehicle frame (Figure 43) (item 10).
2. Connect DEF pressure line heater electrical connector to DEF tank wiring harness (Figure 44)(items 1 and 2).
3. Connect DEF pressure line to DEF supply module (Figure 43) (items 3 and 9).
4. Install four DEF supply module cover bolts to DEF supply module bracket (Figure 43) (items 4 and 5).
5. Connect two coolant lines to engine block coolant fittings (Figure 43) (item 6).
6. Install four DEF coolant line support bracket bolts to engine block (Figure 43) (item 7).
7. Connect two DEF coolant lines to DEF dosing valve (Figure 43) (item 12).
8. Connect DEF pressure line to DEF dosing valve(Figure 43) (item 11).
9. Connect two DEF coolant lines to DEF tank pickup assembly (Figure 43) (items 1 and 2).

9. ACRONYM LIST

Table 3 Acronym List

Component	Abbreviation
Doser Control Unit	DCU
Aftertreatment Control Module	ACM
Selective Catalyst Reduction	SCR
Diesel Particulate Filter	DPF
Diesel Exhaust Fluid	DEF
Diesel Oxidation Catalyst	DOC
Engine Control Module	ECM

TORQUE

Table 4 Torque Chart

Location	lbf-ft / lbf-in	N•m
MaxxForce® 7 or DT Systems		
Bolt, Nut, and P-clamp	84 - 96 lbf-in	9 - 11
Pressure Nuts	12 ± 3 lb-ft	16 ± 4
Pressure Sensor Nut and Bolt	84 - 96 lb-in	9 - 11
Temperature Sensor	18 - 30 lb-ft	25 - 40
Doser Control Unit (DCU)(CE and BE) Nuts	17 - 21 lb-ft	23 - 29
Doser Control Unit (DCU) (HC) Torx Screws	48 - 72 lb-in	6 - 8
Doser Control Unit (DCU)(RE) DCU and Bracket Nuts	17 - 21 lb-ft	23 - 29
Diesel Particulate Filter (DPF) V-clamp Nut	13 - 16 lb-ft	18 - 22
Diesel Particulate Filter (DPF) Mount Band Nut	13 - 16 lb-ft	18 - 22
Diesel Particulate Filter (DPF) Nuts and Bolts	35 - 37 lb-ft	47 - 50