

BODY BUILDER INSTRUCTIONS

Mack Trucks



Body Builder; Engine, Cummins B6.7
MD
Section 2

Introduction

This information provides details for the Cummins B6.7 engine for MACK vehicles.

Note: We have attempted to cover as much information as possible. However, this information does not cover all the unique variations that a vehicle chassis may present. Note that illustrations are typical but may not reflect all the variations of assembly.

All data provided is based on information that was current at time of release. However, **this information is subject to change without notice**.

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General

Fuel and Oil



CAUTION

Diesel engines for 2006 and later model year vehicles are designed to operate only with ultra low sulfur diesel (ULSD) fuel. Use of fuel other than ULSD reduces the efficiency and durability of the engine, permanently damage the advanced emission control systems, reduce fuel economy and possibly prevent the engine from running at all. Manufacturer's warranties are likely to be rendered void by usage of improper or incorrect fuel, and usage of fuels other than ULSD fuel in diesel-powered vehicles is illegal and punishable with civil penalties. Use of fuel additives to compensate for the lower sulfur content is NOT recommended by Mack Trucks, Inc.

Fuel sold for use in diesel-powered engines for 2006 and later model year vehicles may only contain a maximum sulfur content of 0.0015% by weight. This was done to reduce particle emissions in the exhaust.

Engine Oil

EO-N (or VDS-3) diesel engine oil is mandatory for use in all 2017 emission-compliant engines. Chassis equipped with a 2017 emission-compliant engine, which can be identified by the presence of an aftertreatment selective catalytic reduction (SCR) system, also require the use of Ultra Low Sulfur Diesel (ULSD) fuel. EO-N oils exceed the new American Petroleum Institute (API) service category CJ-4.

Notes

Engine Overview



DANGER

Do not use ether or other combustible starting aids in any engine. Introduction of ether or similar starting aids could cause a fire or explosion resulting in severe property damage, serious personal injury or death.



CAUTION

DO NOT crank the engine for more than 30 seconds at a time; wait 15 minutes after each try to allow the starter to cool. Failure to follow these instructions could cause starter damage.

Note: Some starters are equipped with starter protection. If the engine is running, the starter temperature is too high, the transmission is not in neutral or the clutch pedal is not depressed, starter engagement is inhibited.

Allow the engine to slow down and idle for 3 to 5 minutes before shutting it off. This allows the turbocharger to cool down and the cooling system to dissipate the engine heat. Switch the engine off by turning the ignition key to the OFF position.



CAUTION

Shutting off an engine immediately after high speed or full load operation can damage the turbocharger and cause heat stress in the engine. Always let the engine idle for 3 to 5 minutes before shutting it off.

Mack Trucks, Inc. does not recommend the use of winterfronts, shutters or any other shield in front of the grille or radiator assembly under normal circumstances. Today's electronically controlled engines are designed to operate in cold temperatures without a winterfront. These devices, if not used properly, can cause higher exhaust gas temperatures, power loss, excessive fan usage, failure of the charge air cooler (CAC) and a reduction in fuel economy. Winterfronts can be used in the wintertime during very cold weather if used properly. In these cases, engine coolant and intake air temperatures must also be carefully monitored and controlled. Please see your authorized MACK Truck dealer for recommended winterfronts.



CAUTION

MACK is now using the ambient air temperature (AAT) sensor for on board diagnostic (OBD) monitoring. If a customer installs a winterfront or blocks the radiator opening and blocks airflow to the sensor, they will likely set an OBD diagnostic trouble code (DTC) for inaccurate sensor data due to restricted airflow across the sensor.

Engine Shutdown System

DANGER

Failure to take the necessary precautions when the STOP tell-tale is on can result in automatic engine shutdown and the loss of power steering. Vehicle crash can occur.

The engine shutdown system will automatically derate or stop the engine when one or more of the conditions listed below reaches a critical stage:

- High Engine Coolant Temperature (ECT)
- Low Engine Oil Pressure (EOP)
- Low Engine Coolant Level (ECL)
- High Crankcase Pressure (CCP)

When the shutdown is activated, the tell-tales come on along with display symbols and the buzzer is also activated. After a brief time, the engine shuts down. Find a safe place to pull off the road as soon as possible.

After the engine has been shut down by the system, turn the ignition key to the OFF position. If necessary, the engine can be restarted for a brief time so that the vehicle may be pulled off the road.

The alarm will remain activated until repairs have been made to correct the problem that caused the shutdown.

CAUTION

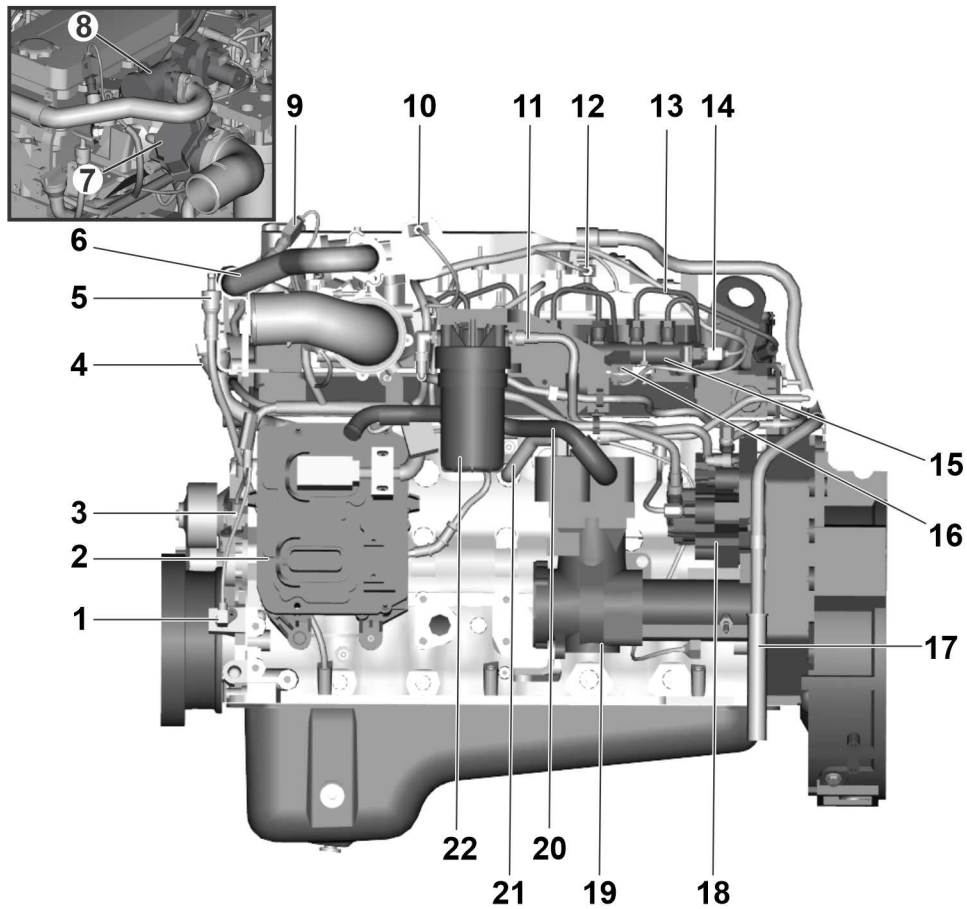
Continuously restarting the engine once the shutdown system is active may result in severe engine damage.

Refer to the driver information display (DID) manual for information about the display symbols.



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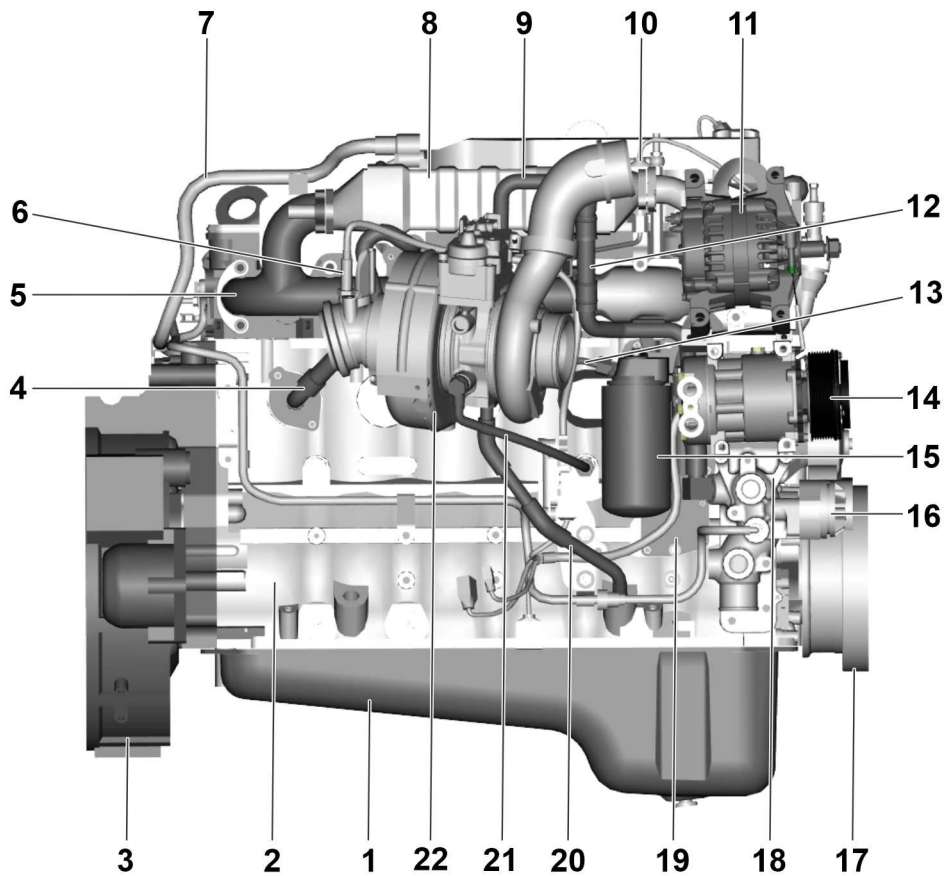
Engine Overview, Cummins B6.7 Left Side View



T2159313

1. Crankshaft position sensor	12. Oil pressure sensor
2. ECM (Engine Control Module)	13. High-pressure fuel lines, common rail
3. Camshaft speed sensor	14. High-pressure fuel sensor, common rail
4. Engine oil filler tube	15. Common rail
5. Dipstick	16. Boost pressure sensor, intake manifold
6. EGR Cooler Pipe	17. Drain tube, Crankcase Ventilation
7. Throttle valve	18. Fuel pump
8. EGR mixing chamber	19. Air compressor
9. EGR temperature sensor	20. Coolant supply line, air compressor
10. Exhaust pressure sensor	21. Coolant return line, air compressor
11. Fuel supply line	22. Fuel filter

Engine Overview, Cummins B6.7 Right Side View

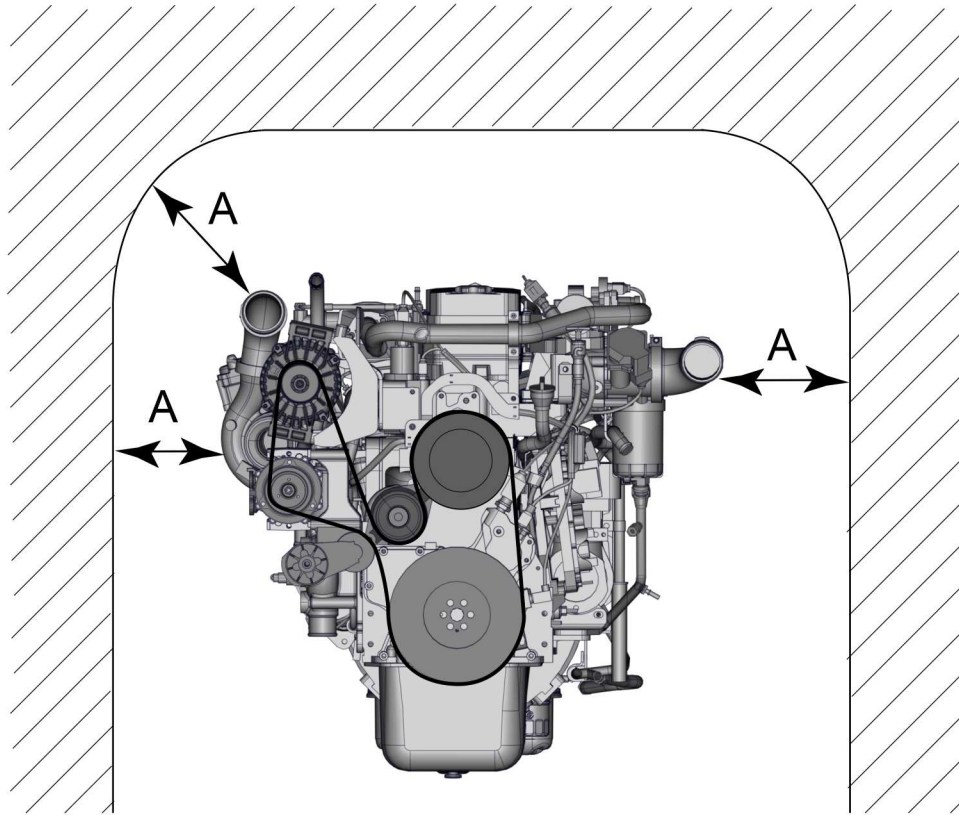


T2159312

1. Oil pan	12. Coolant line, thermostat
2. Engine cylinder block	13. Turbocharger oil supply line
3. Flywheel housing	14. AC Compressor
4. Coolant supply line, EGR cooler	15. Oil filter
5. Exhaust manifold	16. Coolant pump
6. Exhaust gas pressure sensor	17. Crankshaft damper
7. Outlet pipe, crankcase ventilation	18. Thermostat
8. EGR (Exhaust Gas Recirculation) cooler	19. Oil cooler
9. Coolant supply line, turbocharger	20. Oil return line, turbocharger
10. Exhaust temperature sensor	21. Coolant return line, turbocharger
11. Alternator	22. Turbocharger

Engine Clearance

A minimum of 40.64 mm (1.6 in) of clearance should be maintained around the engine. Additionally, no equipment should be installed that would restrict air flow through the radiator or to the engine air intake.



T2162326

Fig. 1 Allow Sufficient Clearance Around Engine

A. 40.64 MM (1.6 in) Minimum

Emissions Solution

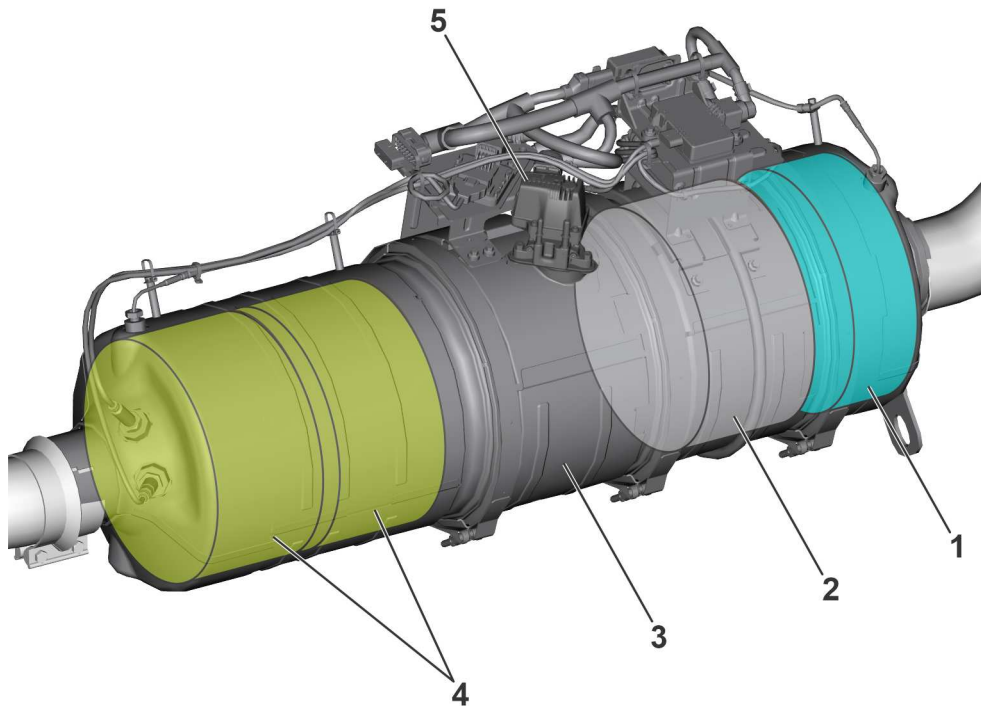
Exhaust Aftertreatment System

Your new MACK chassis is equipped with US2017 emission-compliant Cummins engine. The vehicle has one box EATS (Exhaust Aftertreatment System). The EATS consists of a DOC (Diesel Oxidation Catalyst), DPF (Diesel Particulate Filter), mixing chamber and SCR (selective catalytic reduction). The vehicles equipped with a DPF require the use of EO-N (or VDS-3) specification high-performance diesel engine oil and ultra low sulfur diesel (ULSD) fuel.

CAUTION

Use of diesel fuel other than ULSD and engine oils other than EO-N (or VDS-3), will adversely affect performance, efficiency and durability of the DPF system and the engine, to the point where the engine may not run at all. Manufacturer's warranties will also be rendered void due to usage of improper fuel. Unapproved fuel additives (including engine oil) are NOT permitted.

Cummins, Inc. offers One Box Combined Exhaust Aftertreatment System (DOC, DPF, mixing chamber and SCR).



T2159316

Combined aftertreatment system muffler

- 1 DOC (Diesel Oxidation Catalyst)
- 2 DPF (Diesel Particulate Filter)
- 3 Mixing chamber
- 4 SCR (Selective Catalytic Reduction)
- 5 DEF dosing unit

The DPF is used to meet EPA requirements to help reduce soot and particulate emissions into the atmosphere. The particulates from the exhaust gases are collected in the DPF unit. The collected particulates are oxidized during passive or active

regeneration. The electrical system and exhaust aftertreatment system of the vehicle will determine when regeneration is required.

Depending on how the vehicle is set up, aftertreatment DPF regeneration can occur while the vehicle is being driven (referred to as a "moving/passive" regeneration) or when the vehicle is parked and idling (referred to as a "parked/active" regeneration).



CAUTION

When aftertreatment DPF active regeneration occurs (with either system), the temperature of the exhaust will be elevated. DO NOT park the vehicle with the exhaust outlet under low hanging overhead flammable objects such as trees, awnings, etc., that could be damaged by elevated exhaust gas temperatures (EGTs). DO NOT remove the diffuser.



CAUTION

If the vehicle is in a location that may be hazardous when an aftertreatment DPF active regeneration begins (i.e., in close proximity to flammable materials or gases), the regeneration should be stopped by pushing the DPF switch to the "Stop Regeneration" position.

If an active regeneration is stopped by the vehicle operator, it should be initiated at a later time when the vehicle is in a safe location. However, if an active regeneration is stopped repeatedly, the vehicle may need to be taken to a MACK service facility. The service facility uses a service tool to manually initiate the regeneration.



WARNING

For chassis equipped with a heated dump body, be aware that temperature around the area where the exhaust enters the body, as well as the product contained in the body, may be elevated, particularly during aftertreatment DPF regeneration.

Extended Idling and Aftertreatment System Conditioning

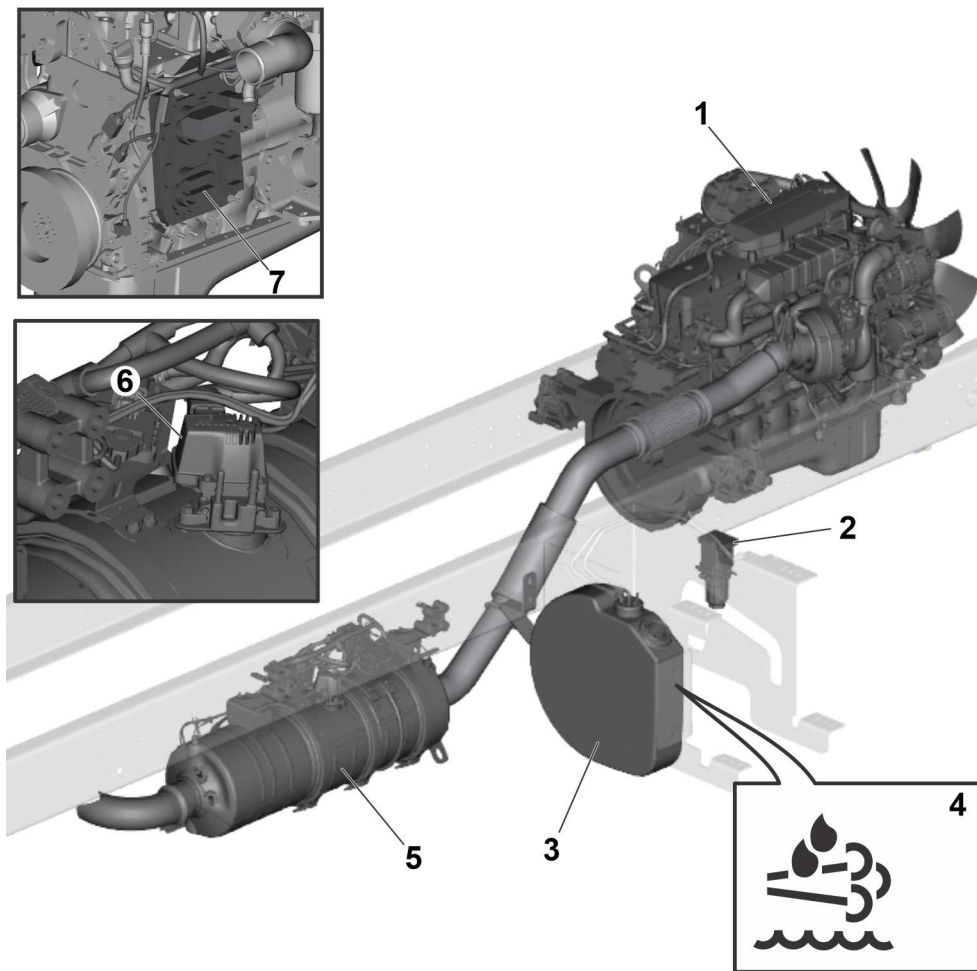
Extended idling performed on this vehicle equipped with an exhaust aftertreatment system should be carried out at a low engine idle speed. There is no benefit to using a raised engine idle speed for extended idling. The only exception is for active power take-off (power take-off). Utilizing an engine speed above 1,300 rpm is recommended for vehicles that perform extended idling with an active power take-off.

During periods of extended idling, normally greater than 8 hours, the conventional aftertreatment diesel particulate filter (DPF) system needs to perform a routine conditioning cycle. The conditioning cycle is controlled by the Cummins ECM (Engine Control Module) and will start and stop automatically as needed. The DPF conditioning is required to maintain normal exhaust aftertreatment system function and should not be stopped.

During these events the engine speed (rpm) will increase to approximately 1,050 – 1,400 rpm, for non-PTO, in order to complete the exhaust aftertreatment conditioning cycle. Exhaust gas temperatures (EGT) will also elevate slightly but remain much lower than that reached during aftertreatment DPF regeneration and present no danger.

If a compatible driver display is available a message will be displayed when the conditioning cycle is in progress. The message indicated in the driver's display will be "ATS Conditioning in Progress, No Action Required." If no driver display is available, there will be no indication of a DPF conditioning event except for the automatic increase in RPM.

Exhaust Aftertreatment System (EATS)



T2159315

- 1. Cummins B6.7 Engine
- 2. DEF (Diesel Exhaust Fluid) pump
- 3. DEF tank
- 4. DEF tank gauge
- 5. Combined aftertreatment system muffler (DOC, DPF, Mxing Chamber and SCR)
- 6. DEF dosing unit
- 7. Cummins ECM (Engine Control Module)

DEF is a reactant that's key to the exhaust aftertreatment process. It's a non-toxic, ultra-pure solution of urea and ultra-pure water. Urea is a compound of nitrogen that turns to ammonia when heated. It is used in a variety of industries, perhaps most commonly as a fertilizer in agriculture. The fluid is non-flammable, and is not dangerous when handled as recommended. However, it is highly corrosive to certain metals, especially copper and brass. Read the separate section concerning the handling of DEF solution.

Safety Information

MACK utilizes a Cummins EATS to meet US2017 emission. The EATS consists of a DOC (Diesel Oxidation Catalyst), DPF (Diesel Particulate Filter), mixing chamber and SCR (selective catalytic reduction). The system is designed to require very little driver interface to maintain correct operation. The technology utilizes an aftertreatment DPF passive regeneration, which requires no fuel to be injected to clean the DPF. The Cummins EATS does not require active regeneration to meet US2017 emission.

 **DANGER**

Exhaust gases and components can be at extremely high temperatures during aftertreatment DPF regeneration. When parking the vehicle, keep away from any flammable materials, vapors, or structures.

 **DANGER**

The temperature of the exhaust system components during the aftertreatment DPF regeneration process can exceed 350 ° C (660 ° F). The exhaust gas leaving the system can reach 505 ° C (930° F). Various factors (including ambient air temperature (AAT) and duration of the regeneration process) determine when these components will return to normal operating temperature after regeneration has completed. Be extremely careful around these hot components. Contact with these components can result in serious personal injury.

Notes

Exhaust Aftertreatment System Components

Note: It is unlawful to tamper with, modify, or remove any component of Cummins EATS system. It is also unlawful to

use DEF that does not meet the specifications provided or to operate the vehicle/equipment with no DEF.

The Cummins EATS system in MACK vehicle is simple and effective, with few components. It consists of a DEF tank, DEF pump, DEF Dosing unit, and one box muffler. The Cummins ECM (Engine Control Module) controls the EATS system. The advantage of using DEF is that it enables the engine to use less exhaust gas recirculation (EGR) gases – and higher oxygen levels – for better combustion, while meeting the EPA near-zero NOx emissions requirement of 0.2 g/hp-hr NOx. By using DEF, we avoid the disadvantages of increasing EGR to massive levels. This results in better fuel economy.

Selective Catalytic Reduction (SCR)

SCR is an emissions-reduction technology with the ability to deliver near-zero emissions of nitrogen oxides (NOx), a smog-causing pollutant and greenhouse gas. SCR's performance has been proved in millions of miles of real-world trucks in other countries, as well as in long-term field tests in the U.S. SCR reduces NOx emissions to very low levels, while at the same time delivering excellent fuel economy and reliability. The system doesn't change the design or of the basic engine. Rather, SCR is an aftertreatment system that converts NOx in the exhaust stream into harmless gases. Modern diesels already use exhaust aftertreatment systems, called diesel particulate filters (DPFs), to control emissions of another pollutant, soot (also known as particulate matter). SCR works by injecting diesel exhaust fluid (DEF) into the exhaust. DEF is a solution of ultra-pure water and urea. DEF works with the heat of the exhaust and a SCR catalyst to convert NOx into nitrogen and water vapor - two harmless and natural components of the air we breathe. The end result is cleaner air, excellent fuel efficiency and a reliable emissions control system for today's modern diesel engine.

Notes



WARNING

Do not spray diesel fuel in the aftertreatment DEF tank. Diesel fuel, if sprayed into the hot exhaust along with the DEF, could ignite explosively causing a fire resulting in personal injury or damage to the exhaust system.



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Diesel Exhaust Fluid (DEF)

DEF is a reactant that's key to the EATS process. It's a non-toxic, ultra-pure solution of urea and ultra-pure water. Urea is a compound of nitrogen that turns to ammonia when heated. The fluid is non-flammable, and is not dangerous when handled as recommended. However, it is highly corrosive to certain metals, especially copper and brass. Read the separate section concerning the handling of DEF solution. Use only **DEF** that is **clearly labeled as meeting ISO-22241** standards, and **certified by the American Petroleum Institute (API)**. The container **must display the API certification seal**. **Never use agricultural or industrial grade urea**. Use of fluids other than API certified DEF will compromise aftertreatment system performance, increase emissions, and may impact your product warranties. **Never dilute DEF with water or any other fluid**. It is recommended that DEF not be stored in extreme hot or cold conditions, or for prolonged periods. Follow the instructions for proper storage and handling as indicated on the container or provided with the purchase.

Note: Agriculture mixtures are not pure enough for use in the SCR system. Impurities in the solution affects the SCR system.

Notes

Diesel Exhaust Fluid (DEF) Handling

When handling DEF solution, it is important to prevent contact with electrical connections. There is a risk that the DEF causes oxidation that cannot be removed. Water or compressed air do not help, since DEF quickly oxidizes certain metal. If a disconnected connector comes into contact with the DEF solution, it must be replaced immediately to prevent the DEF solution from creeping further into the copper wiring.



CAUTION

When detaching hoses and components, do not spill DEF on disconnected or unsealed connectors. If DEF is spilled on a disconnected or unsealed connector, the connector must be replaced immediately.

Things to know about spilled DEF

If DEF solution comes into contact with the skin: rinse with plenty of water and remove contaminated clothing.

If DEF solution comes into contact with the eyes: rinse for several minutes and call for medical help if necessary.

If inhaled: breathe fresh air and call for medical help if necessary.

Do not allow the DEF solution to come into contact with other chemicals.

The DEF solution is not flammable. If the DEF solution is exposed to high temperatures, it breaks down into ammonia and carbon dioxide.

The DEF solution is highly corrosive to certain metals, including copper and brass.

If the DEF solution is spilled onto the vehicle, wipe off the excess and rinse with water. Spilled DEF solution can form concentrated white crystals on the vehicle. Rinse off these crystals with water.

Note: Do not flush DEF spillage into the normal drain system.

Notes

Aftertreatment Diesel Particulate Filter (DPF)



CAUTION

Use of diesel fuel other than ultra low sulfur diesel (ULSD) and engine oils other than EO-N (or VDS-3), will adversely affect performance, efficiency and durability of the aftertreatment DPF system and the engine, to the point where the engine may not run at all. Manufacturer's warranties can also be rendered void due to usage of improper fuel. Unapproved fuel additives (including engine oil) are NOT permitted. Blends of No. 1D and No. 2D grades of ULSD are recommended and allowable for cold weather.

The exhaust aftertreatment system virtually eliminates exhaust smoke. Exhaust vapor (water condensation) may be visible during a cold start. If exhaust smoke is visible during engine startup, this indicates a problem with the exhaust aftertreatment system. Take the vehicle to an authorized MACK Truck dealer immediately.

Vehicles equipped with a US2017 emission-compliant engine have an exhaust aftertreatment system, which includes a DOC (Diesel Oxidation Catalyst), SCR (selective catalytic reduction) and diesel particulate filter (DPF). The aftertreatment DPF reduces soot and particulate emissions into the atmosphere. Soot and other particulate matter are collected by a filter where it is eventually oxidized using an aftertreatment DPF regeneration process. Vehicles equipped with an aftertreatment DPF require the use of EO-N (or VDS-3) specification high-performance diesel engine oil and ULSD fuel.

Notes

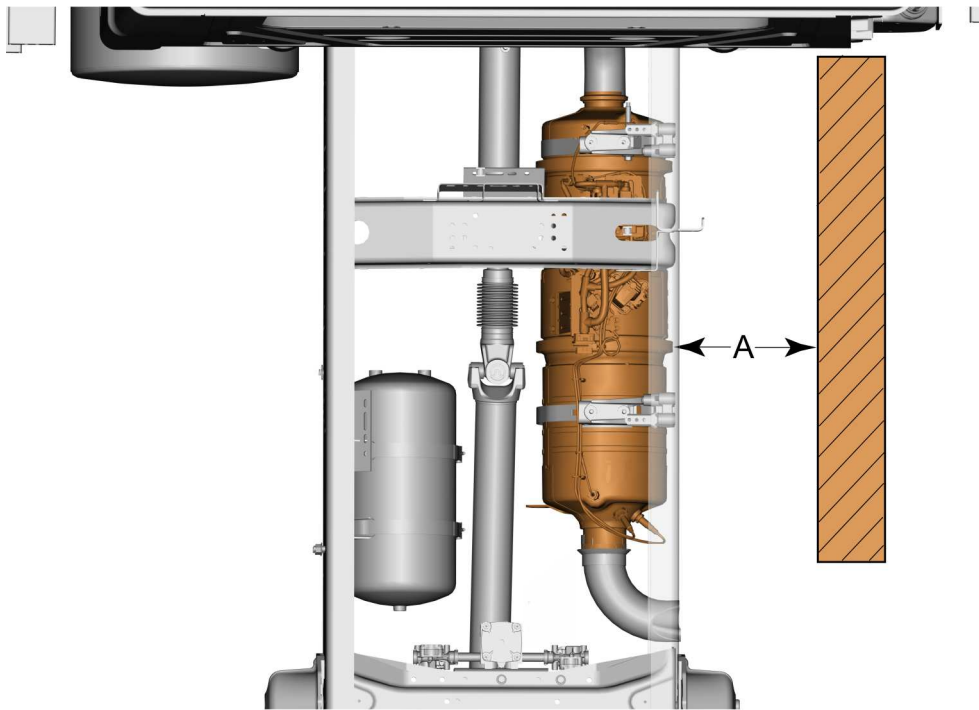
For emission compliance, all MACK chassis are equipped with a one box unit, which is designed to reduce soot-related emissions, particularly on vehicles used in metropolitan areas. The one box unit replaces the standard muffler.

The outer skin of the one box unit reaches a temperature of approximately 300 °C (572 °F), and exhaust outlet temperatures can reach approximately 620 °C (1,148 °F), during regeneration cycles. Outlet temperatures may be lowered as much as 250 °C (480 °F), measured 152.4 mm (6 in) from the outlet, by the installation of an exhaust gas diffuser. Vehicle upfitters must evaluate the effect these elevated temperatures can have on the equipment being installed, as well as the impact of any exhaust system modifications that may be performed.

Sufficient clearance (approximately 152.4 mm [6 in] minimum) away from the one box unit must be maintained for any temperature-sensitive components such as hydraulic lines, air lines, wire harnesses, electronic control units (ECUs), etc. If sufficient clearance cannot be maintained, shields must be installed to prevent heat-related damage to any temperature-sensitive components. On the one box unit, the areas around the clamps are the hottest. Shields should be installed around the clamps to provide protection for any heat-sensitive components that may be located in close proximity to the one box clamps.

Exhaust system modifications, including modification or removal of an exhaust gas diffuser, can result in heat-related damage to vehicle equipment or other property. Vehicle upfitters are responsible for any damage due to exhaust system modification or removal.

In addition to maintaining proper clearances for any heat-sensitive components, the exhaust stack outlet must be positioned in such a way to prevent rain ingestion.



T2162327

Fig. 2 Allow Sufficient Clearance (A) Between Body Installation and one box unit.

A. 152.4 mm (6 in) Minimum

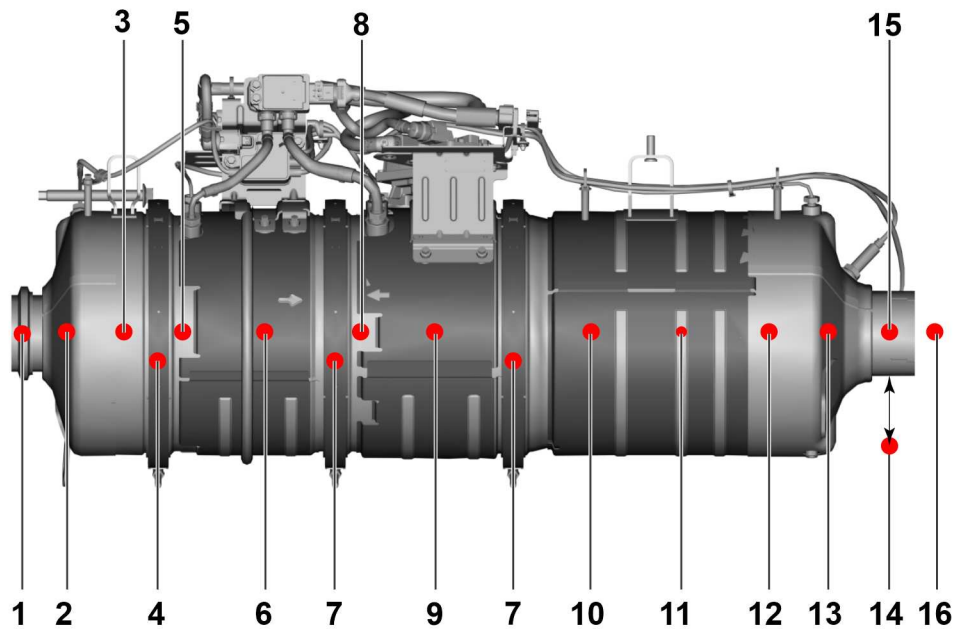
One Box Unit Surface Temperatures

The one box unit is equipped with heat insulation that covers most areas of the one box unit. Uninsulated areas of the one box unit are at the clamp areas, body connections, inlet pipe and outlet pipe. The following surface temperatures have been measured with the one box unit freely positioned in a room temperature environment with no forced cooling or wind; only self-convection.

Note: The temperatures provided are not maximum temperatures. The surface temperature in certain vehicle applications is dependent on the degree of encapsulation and the airflow around the one box unit.

During aftertreatment regeneration, exhaust gases exiting the one box outlet can reach temperatures as high as 700°C (1,290°F). In cases where a heated dump body is being installed on a platform truck, or modifications are being made to the vehicle exhaust system to accommodate a heated dump trailer, vehicle upfitters must evaluate the effect these elevated temperatures can have on the body, as well as the impact that modifications to the exhaust system can have on the vehicle.

One Box Unit Surface Temperatures

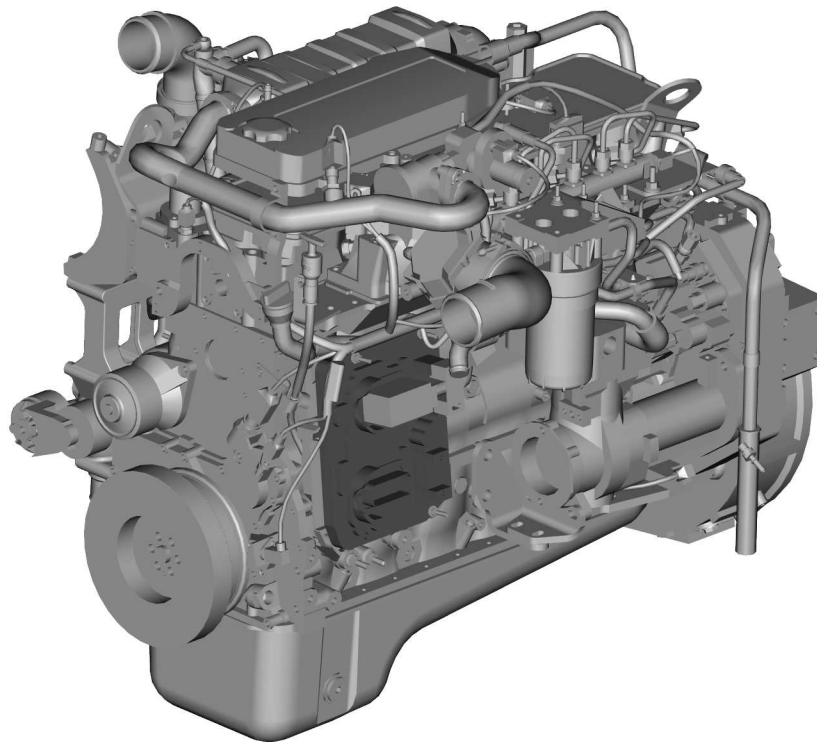


T2162422

	Position	Heat During Active Regeneration
1	Inlet flange	500°C (932°F)
2	Inlet body	233 °C (451°F)
3	Inlet/Diesel Oxidation Catalyst (DOC)/Mounting zone	500°C (932°F)
4	V-band (DOC inlet)	315°C (599°F)
5	DOC outlet (uninsulated area)	455°C (851°F)
6	DOC outer insulated area	247 °C (476.6°F)
7	V-band (DOC/Mixer outlet)	327°C (620.6°F)
8	V-band (DOC outlet, uninsulated area)	475°C (887°F)
9	Mixer outer insulation	298°C (568°F)
10	AMOX outer insulation	284°C (543°F)
11	SCR surface	350°C (662°F)
12	Outer body uninsulated area	402°C (755.6°F)
13	Outlet body	276 °C (529°F)
14	76.2 mm away from body surface	150 °C (302°F)
15	Outlet flange	517°C (962.6°F)
16	Exhaust gas at outlet	620 °C (1148°F)

Notes

Cummins ECM (Engine Control Module)



T2159317

The Cummins Engine control unit controls the following components in the exhaust aftertreatment system:

- Aftertreatment Diesel Exhaust Fluid (DEF) Dosing Unit
- Aftertreatment DEF Tank Heater Valve
- Aftertreatment DEF Line Heaters
- Aftertreatment DEF Pump
- Aftertreatment DEF Return Valve

The Cummins Engine control unit also monitors the following values in the exhaust aftertreatment system:

- Aftertreatment DEF Dosing Pressure
- Aftertreatment DEF Tank Temperature
- Aftertreatment DEF Tank Level
- Aftertreatment DPF Intake/Outlet Temperature
- Aftertreatment DPF Differential Pressure
- NOx Sensors

Notes

Heated Dump Bodies



CAUTION

Due to the higher exhaust temperatures created during the regeneration process of Diesel Particulate Filter equipped vehicles, it is strongly recommended to consult your heated dump body supplier to verify that these temperatures will not adversely affect their product. Failure to do so may result in component damage.

The exhaust aftertreatment system virtually eliminates exhaust smoke. Exhaust vapor (water condensation) may be visible during a cold start. If exhaust smoke is visible during engine operation, this indicates a problem with the exhaust aftertreatment system. Take the vehicle to an authorized MACK Truck dealer immediately.

Vehicles equipped with a US2017 emission-compliant engine have an exhaust aftertreatment system, which includes a DOC (Diesel Oxidation Catalyst), SCR (selective catalytic reduction) and diesel particulate filter (DPF). The aftertreatment one box unit reduces soot and particulate emissions into the atmosphere. Soot and other particulate matter are collected by a filter where it is eventually oxidized using an aftertreatment DPF regeneration process. Vehicles equipped with an aftertreatment DPF require the use of EO-N (or VDS-3) specification high-performance diesel engine oil and ULSD fuel.

The following are important items to consider when installing a heated dump body:

- Due to the presence of the aftertreatment system, exhaust gas temperatures can reach up to 620 °C (1148 °F) on US2017 vehicles at the one box outlet during a normal regeneration cycle. These temperatures should be taken into consideration while installing equipment, in the vicinity of the exhaust system. It may be necessary or prudent to affix warning labels on the equipment to warn people about these temperatures.
- In the case of a heated dump installation; only use materials that can withstand the high temperatures as mentioned above, for body and other related parts.
- The use of a diverter valve to divert the exhaust to the atmosphere and away from the body during a regeneration.
- The lack of soot coating may mean increased corrosion for the body, diverter valve, pipes and other related parts. Always use suitable corrosion resistant materials for these parts.
- Heater lines to urea pump.

Notes

One Box Requirements

Exhaust Back Pressure for US2017 Emission-Compliant Engines

If modifications are made to the exhaust system after the SCR, the back pressure must be measured to ensure that the changes do not exceed the back pressure limits.

Note: If the pressure in the exhaust is too high, engine damage can result.

Requirement:

Allowed pressure in the exhaust piping after the SCR is:

Maximum Exhaust Restriction		
Horsepower Rating	Maximum Exhaust Back Pressure	
	kPa	in-Hg
220 hp	29	8.5
240 hp	31	9.1
250 hp	32	9.5
260 hp	33	9.7
280 hp	32	9.5
300 hp	35	10.3

Exhaust pipe size (normally acceptable inside diameter)	102 mm (4 in)
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Refer to Cummins service manual for back pressure testing procedure.

Notes

Exhaust Aftertreatment System Regeneration

CAUTION

If the vehicle is in a location that may be hazardous when aftertreatment DPF regeneration begins (i.e., in close proximity to flammable materials or gases, inside tunnels, parked under flammable objects, etc.), the DPF regeneration should be stopped (if equipped). If DPF regeneration is stopped by the vehicle operator, it must be initiated at a later time when the vehicle is in a safer location. DPF regenerations that are stopped and never restarted at a later time, however, will require that the vehicle be taken to an authorized MACK Truck dealer to have the aftertreatment DPF regeneration manually started with special service tools.

Note: During vehicle operation, idle speed may increase when the vehicle is stopped at a traffic light to maintain heat in the DPF for passive regeneration and diesel exhaust fluid (DEF) dosing.









There are two types of aftertreatment DPF regeneration: passive regeneration and parked/active regeneration.

Passive regeneration occurs when the exhaust gas within the aftertreatment system is hot enough to remove soot without injecting additional fuel into the DPF system.

An active regeneration, that included injection of fuel. With the addition of the selective catalytic reduction (SCR) system active regenerations are no longer needed for US2017.

Refer to the Exhaust Aftertreatment System Information sun visor label or the Operators Manual for additional aftertreatment DPF information.

ENGINE EXHAUST AFTERTREATMENT SYSTEMS (EATS)

DEF Indicators:	 (solid)	 (flashing)	 (flashing) + Message
Diesel Exhaust Fluid (DEF) Condition:	The DEF tank is low.	The DEF tank is empty. Engine is in derate mode.	The DEF tank is empty. The vehicle is limited to 5 mph.
DEF Action:	Refill the DEF tank.	Refill the DEF tank now (before adding diesel).	Refill the DEF tank now (before operating vehicle).
DEF Indicators:	 (flashing)	 (flashing) 	 (flashing) 
Diesel Particulate Filter (DPF) Condition:	The DPF filter is full.	The DPF filter is overfull. Engine is in derate mode.	The DPF filter may be clogged with soot. Engine is in shutdown mode.
DPF Action:	Initiate a parked manual regeneration at next available stop.	IMMEDIATELY stop and initiate a parked regeneration.	Service EATS system immediately.
See Operator's Manual for Further Detail			

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Driver Warnings and On Board Diagnostics (OBD)

On Board Diagnostics (OBD)

Beginning with US2013 Emission-compliant vehicle, OBD is introduced. This is very similar to the OBD system that has been required on passenger cars for many years. OBD is a system that monitors the functions of emissions-related components and alerts the vehicle operator to any detected need for an emission related repair. When the system detects a malfunction with an emissions-related component it activates the malfunction indicator lamp (MIL).

Instrument Cluster Icons Overview

Instrument Cluster Icons

Aftertreatment icons are displayed on the instrument cluster. There are 3 aftertreatment icons:

- Aftertreatment DPF Regeneration Required
- High Exhaust System Temperature (HEST)
- Aftertreatment DEF Tank Low-Level Indicator

The Aftertreatment DPF Regeneration Required icon flashes when the Diesel Particulate Filter (DPF) is full/overfull and regeneration is needed.



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Aftertreatment DPF Regeneration Required Icon

The HEST icon illuminates when a parked Aftertreatment DPF Regeneration Required is initiated. It also indicates high exhaust gas temperature during a passive regeneration. When the HEST icon is illuminated, do not park or operate the vehicle near people, or any flammable materials, vapors, or structures.



W3007444

HEST Icon

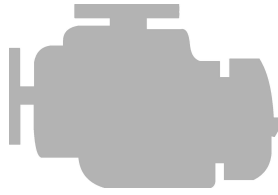
The aftertreatment DEF tank low-level indicator icon illuminates when the fluid level is low. It also flashes when the level becomes critically low.



W2029416

Aftertreatment DEF Tank Low-Level Indicator

Malfunction Indicator Lamp (MIL)



W3031200




MIL Lamp

- MIL indicates government regulation on board diagnostics (OBD) faults
- Lamp may remain active after repair until system confirms repair

Aftertreatment Diesel Exhaust Fluid (DEF) Tank Level - Driver Warning & Inducement





Aftertreatment DEF tanks are sized to have no less than 2 times the diesel fuel tank mileage or hour range.

The vehicle instrument cluster has an Aftertreatment DEF Tank Level Gage.

Triggers	Aftertreatment DEF Tank Low-Level Indicator	Amber Warning Lamp	Inducement
>12% Aftertreatment DEF Tank Level Gauge	None	None	None
<=12% Aftertreatment DEF Tank Level Gauge	 W2029-416	None	None
0% Aftertreatment DEF Tank Level Gauge (~4% DEF Remaining)	 W2029415	None	25% torque reduction
0% Aftertreatment DEF Tank Gauge Insufficient DEF Pump Pressure Diesel Fuel Refueling >15%	 W2029415	None	8 km/h (5 mph) Road Speed Limit (RSL)

Note: Vehicle has to be stationary before 5 mph road speed limit (RLS) becomes active.

Aftertreatment Diesel Exhaust Fluid (DEF) Quality - Driver Warning & Inducement

Triggers	Aftertreatment DEF Tank Low-Level Indicator	Amber Warning Lamp	Inducement
Good DEF Quality	None	None	None
Poor DEF Quality DTC Initial Detected	None	 W303-1623	None
Poor DEF Quality DTC Initial Detected + 10 hours	None	 W303-1623	25% torque reduction
Poor DEF Quality DTC Initial Detected + 20 hours Diesel Fuel Refueling >15%	None	 W303-1623	8 km/h (5 mph) Road Speed Limit (RSL)
Temporary Exit from 8 km/h (5 mph) Inducement	None	 W303-1623	25% torque reduction

Note: Vehicle has to be stationary before 8 km/h (5 mph) RSL becomes active.

Exit conditions for DEF Quality "5 mph road speed limit (RSL)" Inducement:

First Restart: Return to 25% torque reduction until proper DEF quality evaluation. If poor DEF quality is detected during the next monitoring cycle, then the 5 mph limit is resumed after vehicle is stationary for 20 minutes. After the second restart a scan tool is required to exit the 8 km/h (5 mph) RSL.

Misfilling Diesel or Aftertreatment Diesel Exhaust Fluid (DEF) Tanks

Although diesel fuel and aftertreatment DEF caps are clearly labeled and filler necks and nozzles are different accidents can happen.

Contamination of fluids by misfilling of diesel or DEF in the wrong tank may result in vehicle malfunction.

Results of misfilling DEF in diesel tank

- Engine may run poorly or not at all
- Injectors may be damaged
- On board diagnostic (OBD) diagnostic trouble codes (DTCs)
- Exhaust system corrosion may occur between turbocharger and aftertreatment DPF
- Costly repairs

Results of misfilling diesel in aftertreatment DEF tank





- Aftertreatment selective catalytic reduction (SCR) system may be damaged by Diesel
- SCR catalyst may be damaged by diesel (chemical damage)
- Emissions may be non-compliant
- OBD DTCs
- Costly repairs

Note: DEF tank has a magnetic interlock and fuel station DEF fluid dispensing nozzle with a magnetic valve, have to meet to prevent from dispensing into anything other than the DEF tanks.

Notes

Selective Catalytic Reduction (SCR) Tampering - Driver Warning & Inducement

1. Disconnected aftertreatment DEF tank level sensor	4. Disconnected aftertreatment DEF pump
2. Blocked aftertreatment DEF line or dosage valve	5. Disconnected SCR wiring harness
3. Disconnected aftertreatment DEF dosage valve	6. Disconnected NOx sensor

Triggers	Aftertreatment DEF Tank Low-Level Indicator	Warning Lamp	Inducement
No Tampering	None	None	None
Tampering Diagnostic Trouble Code (DTC) Pending	None	 W303-1623	None
Tampering DTC Confirmed	None	 W303-1623	None
Tampering DTC Initial Detected + 10 hours	None	 W303-1623	25% torque reduction
Tampering DTC Initial Detected + 40 hours Diesel Fuel Refueling >15%	None	 W303-1623	8 km/h (5 mph) road speed limit

Note: Operator cannot override the 8 km/h (5 mph) road speed limit (RSL).

Note: Vehicle has to be stationary before 8 km/h (5 mph) RSL becomes active.

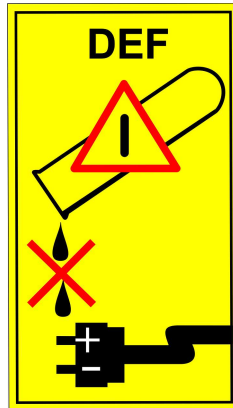
DEF Components and Piping

DEF Precautions

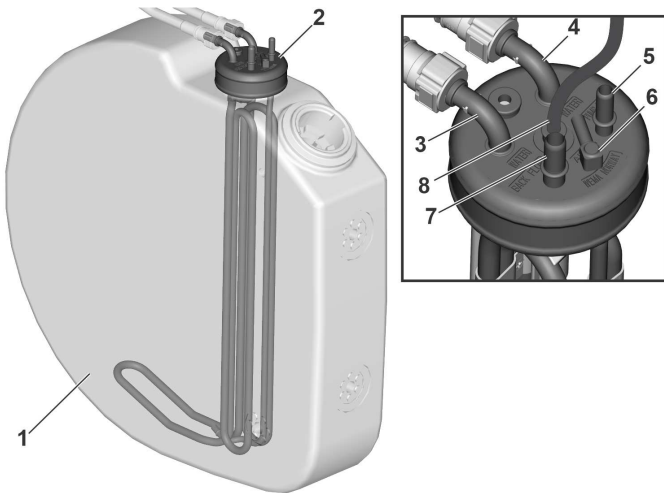
If the DEF tank needs to be repositioned, refer to the following illustrations for coolant flow. Due to its corrosive nature, diesel exhaust fluid requires special considerations around electrical systems.

CAUTION

Urea solution is hazardous for open electrical connectors and spreads rapidly in cables. If urea is spilled on a connector, the part of the cable that has been exposed to urea solution must be exchanged immediately.



W2105885



T2159314

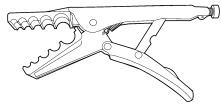
- | | |
|-----------------------------------|--|
| 1 DEF tank | 6 Breather |
| 2 Combined tank unit | 7 Backflow connection from the DEF pump unit |
| 3 Coolant inlet | 8 Electrical connection to level, temperature, and urea quality sensor |
| 4 Coolant outlet | |
| 5 DEF outlet to the DEF pump unit | |

Fittings, Fuel Line, Replacement

This information covers the proper procedure for replacing the Voss fuel line fittings.

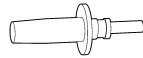
Note: Information is subject to change without notice. Illustrations are used for reference only, and may differ slightly from the actual engine version. However, key components addressed in this information are represented as accurately as possible.

Special Tools



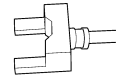
W2006113

85111500
Voss Pliers



W2006115

85111501
Voss Straight Drift



W2006116

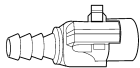
85111502
Voss Elbow Drift



W2006114

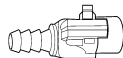
85111503
Voss Handle

Fittings



W2006109

20395030
Straight 16 mm Fitting



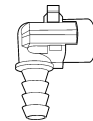
W2006110

20395028
Straight 12.5 mm Fitting



W2006111

20395034
90 12.5 mm Fitting



W2006112

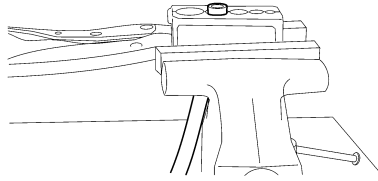
20395036
90 16 mm Fitting

Notes

Replacement

1. After determining which molded Nylon end needs to be replaced, cut the nylon tubing off just behind the barb.

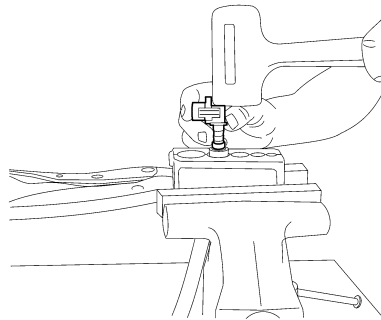
Note: Make a nice clean, square cut.



W2006149

2. Clamp the tubing in the jaws, special tool number 85111500, and carefully insert the Nylon end in by using a soft tipped hammer or a small arbor or drill press.

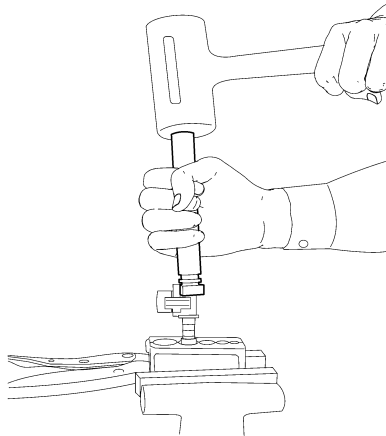
Note: To press in the new end, the Nylon tubing must be held in the special serrated jaws.



W2006150

3. The Nylon end can be pressed in with a small arbor press or a small hammer if used carefully. The Nylon tubing should stick out of the pliers about 1/4 inch.

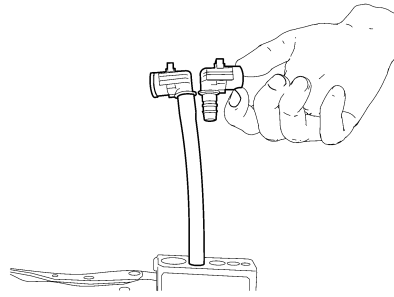
Note: For ease of assembly, small hand tools as shown are available.



W2006151

4. The Nylon should be pressed down into the Nylon tubing so that all barbs are fully inserted. Care should be taken to keep all parts clean.
5. The Nylon tube need not be heated for assembly.

- The tube end should be free of grease or lubricants.



W2006152

- Care should be taken to not damage the tubing by excessive clamp force.
- Make sure that the proper sized end is used for the selected Nylon tubing.

Notes
