



Service Bulletin

File in Section: -

Bulletin No.: 18-NA-366

Date: December, 2018

INFORMATION

Subject: 2019 Chevrolet Silverado 4500HD 5500HD and 6500HD New Model Features

Brand:	Model:	Model Year:		VIN:		Engine:	Transmission:
		From:	To:	From:	To:		
Chevrolet	Silverado 4500HD Chassis-Cab Silverado 5500HD Chassis-Cab Silverado 6500HD Chassis-Cab	2019		—		Duramax® 6.6L V8 Diesel — RPO L5D	Allison® 6-Speed Automatic (RPO Will Vary by Vehicle and Application)

Involved Country	United States
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Overview



2019 Silverado 4500HD — Preproduction Model Shown

5122202



2019 Silverado 6500HD — Preproduction Upfitted Model Shown

Bulletin Purpose

This purpose of this bulletin is to introduce the new 2019 Chevrolet Silverado 4500HD, 5500HD and 6500HD medium duty trucks. The bulletin will help the Service Department Personnel become familiar with the vehicle's new Duramax® 6.6L V8 — RPO L5D diesel engine, the Allison® transmission with an available PTO option, brake system, chassis, and other general information. These trucks are available exclusively as chassis cab models, making them ready for up-fitters to customize for the various requirements of their customers. The trucks will be available in 2WD and 4WD. They will be very connected, with options that include OnStar®, Commercial Link, a built-in OnStar® 4G LTE™ Wi-Fi® Hotspot (requires a paid data plan), as well as wireless cell phone charging and Bluetooth®. They also support the Apple® CarPlay™ software feature and Android™ Auto™ application. They will be built in partnership with Navistar at its Springfield, Ohio plant.

Additional highlights include:



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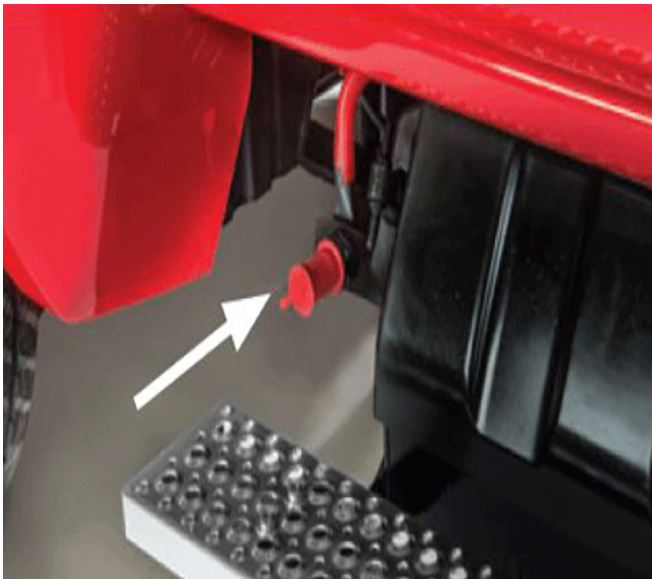
- Preproduction image shown.
Clean top of rail design with no protruding welds or brackets for smooth integrated upfits.
- Robust, single-piece frame rail for enhanced durability.
- Factory-available rear air suspension.
- Fuel tank capacity of up to 65 gallons (246 liters).
- Painted chassis provides corrosion protection.

- 40/20/40 split-bench front seat
- 60/40 rear bench seat (Crew Cab)
- Standard Grille Guard Screen for insect protection is mounted behind the grille.



5134340

- Preproduction model shown.
Tilt engine cover design. Provides service technicians with easy and comfortable access to the engine.



5181883

- Preproduction model shown.
The dual batteries are located under the cab on the driver side of the vehicle. An auxiliary jump-start 12V positive stud with a protective cover is located on the driver side of the vehicle beneath the driver door and to the left of the batteries.



5156383

- Preproduction model shown.
Dual batteries with protective cover in place.



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- Preproduction model shown.
Up to 50-degree wheel cut enhances turning radius and maneuverability and also allows for easier serviceability.



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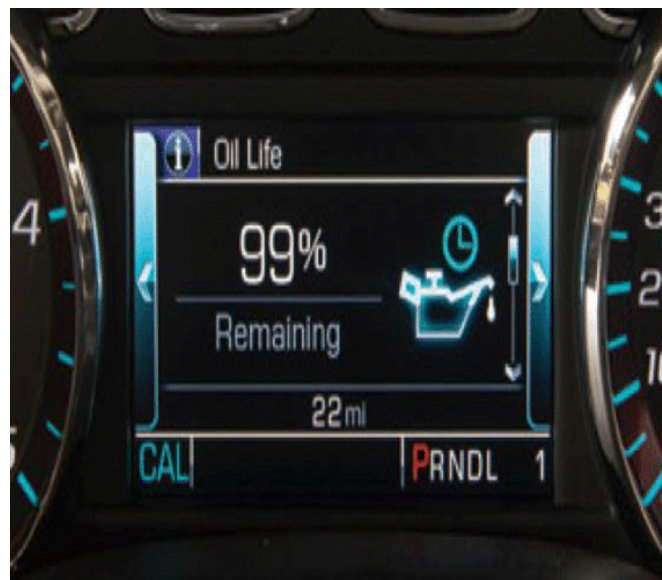
- Preproduction model shown. Easy-to-reach control buttons. Available upfitter switches, (4) provide 4-30 amp circuits to facilitate installation of aftermarket electrical accessories and are located on the instrument panel.

- Some vehicles may be equipped with a 110/120-Volt Alternating Current power outlet. It can be used to plug in electrical equipment that uses a maximum of 150 watts. If equipped with a center console, the power outlet is in front of the cupholders. If equipped with bench seats, the power outlet is on the center stack.



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- If equipped, the sunglasses storage compartment is in the overhead console. Press the button on the cover and release to access.



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- The Oil Life Monitor calculates engine oil life based on vehicle use parameters and displays the percentage of Oil Life Remaining and Change

Engine Oil Soon on the DIC when it's necessary to change the engine oil and filter. The Oil Life Monitor should be reset to 100% only following an oil and filter change.

Available Models and Trim Level

The following Regular Cab and Crew Cab Models and Trim Levels are available:

- **Crew Cab:** 2WD 1WT
- **Crew Cab:** 2WD 1LT
- **Crew Cab:** 4WD 1WT
- **Crew Cab:** 4WD 1LT
- **Regular Cab:** 2WD 1WT
- **Regular Cab:** 2WD 1LT
- **Regular Cab:** 4WD 1WT
- **Regular Cab:** 4WD 1LT

Wheelbase — Overall Length — Cab to Axle



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The following are available:

- **Regular Cab:** Wheelbase: 141—243 inches (7)
- **Regular Cab:** Length: 224.5—360 inches (12)
- **Regular Cab:** Cab to Axle: 60, 84, 108, 120, 138, 150, 162 inches
- **Crew Cab:** Wheelbase: 175, 199, 235 inches
- **Crew Cab:** Length: 258.8, 282.8, 296.6, 344.2 inches
- **Crew Cab:** Cab to Axle: 60, 84, 120 inches

Brakes

Bosch TCS8TA Brake System

This vehicle is equipped with a Bosch TCS8TA brake system which utilizes a Hydro-Max™ hydraulic brake booster and master cylinder. The system uses DOT 3 Hydraulic Brake Fluid.

The Bosch® TCS8TA brake system provides the following vehicle performance enhancement systems:

- Antilock Braking System (ABS).
- Electronic Brake Force Distribution (EBD).
- Drag Torque Control (DTC).
- Traction Control System (TCS).

Brake System Components

The following components are involved in the operation of the brake system:

- Bosch® TCS8TA Hydraulic unit with attached electronic brake control module (EBCM).
- The Body Control Module (BCM) monitors the brake pedal position sensor signal and when the brake pedal is applied it sends a high speed serial data message to the EBCM indicating the brake pedal position.
- The brake pressure sensor is used to sense the action of the driver application of the brake pedal. The sensor provides an analog voltage signal that will increase as the brake pedal is applied. The EBCM monitors the brake pressure sensor which is integral to the brake pressure modulator.
- The instrument cluster displays the vehicle speed based on the information from the engine control module (ECM). The ECM sends the vehicle speed information via a high speed serial data to the BCM. The BCM then sends the vehicle speed information via a low speed serial data to the instrument cluster in order to display the vehicle speed, either in mph or km/h based on the vehicle parameter that is selected.

ABS

When wheel slip is detected during a brake application, an ABS event occurs. During ABS braking, hydraulic pressure in the individual wheel circuits is controlled to prevent any wheel from slipping. A separate hydraulic line and specific solenoid valves are provided for each wheel. The ABS can decrease, hold, or increase hydraulic pressure to each wheel. The ABS does not increase hydraulic pressure above the amount which is transmitted by the master cylinder during braking. During an ABS braking event, a series of rapid pulsations may be felt in the brake pedal. These pulsations are caused by the rapid changes in position of the individual solenoid valves as the EBCM responds to wheel speed sensor inputs and attempts to prevent wheel slip. A ticking or popping noise may also be heard as the solenoid valves cycle rapidly. During ABS braking on dry pavement, intermittent chirping noises may be heard as the tires approach the slipping point. These noises and pedal pulsations are considered normal during ABS operation.

ABS Activation Sequence

The typical ABS activation sequence is as follows:

- **Pressure Hold:** The EBCM closes the isolation valve and keeps the dump valve closed in order to isolate the slipping wheel when wheel slip occurs. This holds the pressure steady on the brake so that the hydraulic pressure does not increase or decrease.
- **Pressure Decrease:** If a pressure hold does not correct the wheel slip condition, a pressure decrease occurs. The EBCM decreases the pressure to individual wheels as needed during deceleration when wheel slip occurs. The isolation valve is closed and the dump valve is opened. The excess fluid is stored in the accumulator until the pump can return the fluid to the master cylinder or fluid reservoir.
- **Pressure Increase:** After the wheel slip is corrected, a pressure increase occurs. The EBCM increases the pressure to individual wheels as needed during deceleration in order to reduce the speed of the wheel. The isolation valve is opened and the dump valve is closed. The increased pressure is delivered from the master cylinder.

Drag Torque Control Operation

During a slip event, the EBCM can send a message to the ECM to increase engine torque until the driven wheels are turning at a rate appropriate to the vehicle's speed.

Electronic Brake Force Distribution Operation

The slip ratio of each of the vehicle's wheels is individually monitored. If any wheel starts to slip, the brake pressure of each wheel can be modulated so that the slip ratio remains within a safe range.

Hydro-Max™ Operation

The Hydro-Max™ is a hydraulically powered brake booster which provides power assist for the hydraulic brakes. A booster combined with a master cylinder forms the hydraulic brake actuation unit. The booster which is powered by the power steering pump reduces the pedal effort required to apply the brakes as compared to a non-power system. The hydraulic booster has a backup pump which will provide hydraulic boost at a reduced rate if the normal source of fluid is interrupted. The master cylinder is a split system type with separate fluid chambers, pistons and outlet ports for the front and rear brake circuits. The master cylinder includes a differential pressure switch and a brake fluid level indicator switch.

Traction Control Operation

When drive wheel slip is noted, the EBCM will enter Traction Control (TC) mode. First the EBCM requests the ECM to reduce the amount of torque to the drive wheels via a serial data message. The ECM reduces torque to the drive wheels and reports the amount of delivered torque. If the engine torque reduction does not reduce drive wheel slip enough, the EBCM will actively apply the brakes on the slipping drive wheel. During TC braking, hydraulic pressure in each drive wheel circuit is controlled to prevent the drive wheels

from slipping. The EBCM commands the pump motor and appropriate solenoid valves ON and OFF to apply brake pressure to the slipping wheel.

Driver Information — Brake Warning Indicator

The instrument cluster turns the brake warning indicator ON when the following occurs:

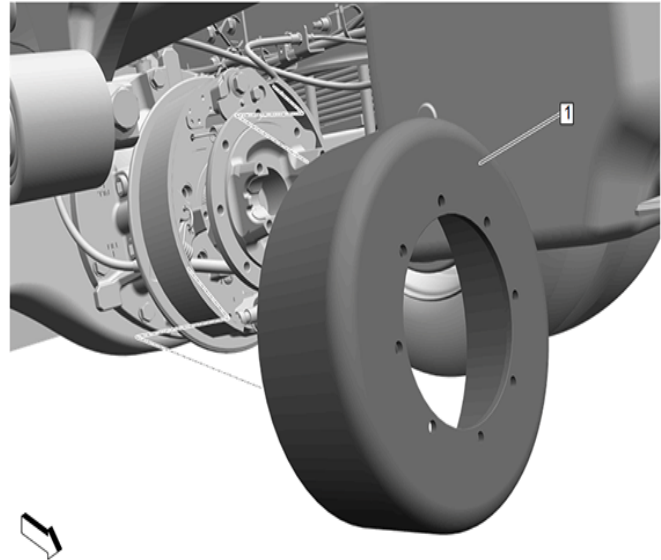
- The instrument cluster performs the bulb check.
- The BCM detects that the parking brake is engaged. The instrument cluster receives a serial data message from the BCM requesting illumination.
- The EBCM detects a faulty pump motor, solenoid valves, an internal hardware failure or a too high or too low battery voltage and sends a serial data message to the instrument cluster requesting illumination.

Driver Information — ABS / TCS Indicator

The instrument cluster turns the ABS/TCS indicator ON when the following occurs:

- The instrument cluster performs the bulb check.
- The EBCM detects a malfunction which disables the ABS and sends a serial data message to the instrument cluster requesting illumination.
- The driver manually disables the TC by pressing the traction control switch. The EBCM sends a serial data message to the instrument cluster requesting illumination.

Parking Brake System



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The parking brake is a driveline park brake system consisting of a single drum design (1), mounted around the propeller shaft and over the brake shoes, forward of the rear differential. When the parking brake pedal is depressed, the parking cable is pulled, overcoming spring pressure within the parking brake and pushing the brake shoes into contact with the inside of the parking brake drum. When the operator disengages the parking brake pedal, spring tension in the parking brake pulls the park brake shoes to their

original (disengaged) position. The parking brake self-adjusts for brake shoe wear by using a star wheel mechanism.

Commercial Link

Overview

Commercial Link enables fleet account owners a better system to manage their vehicles and improve overall fleet efficiency. Commercial Link uses the built-in OnStar® connectivity (must be active) to provide useful vehicle data, such as maintenance notifications and vehicle location, in order to better manage mileage and expenses more effectively. GM is the only auto manufacturer to offer an embedded vehicle management solution. Commercial Link is a monthly subscription with no annual contract. There is also the option of signing up for invoice payment in increments of 3 months, 6 months or 1 year.

Driver Information Center

Driver Information Center (Base Level)



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The DIC displays are shown in the center of the instrument cluster. The displays show the status of many vehicle systems. The trip odometer reset stem in the instrument cluster is used to access the DIC menu items.

Driver Information Center (Up-Level)

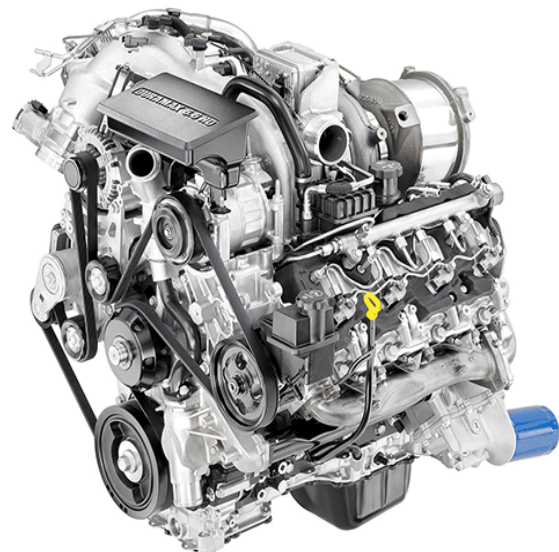


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The DIC displays are shown in the center of the instrument cluster in the Info app. The displays show the status of many vehicle systems. The controls for the DIC are on the right steering wheel control.

Engine Duramax® 6.6L V8 — RPO L5D

Overview



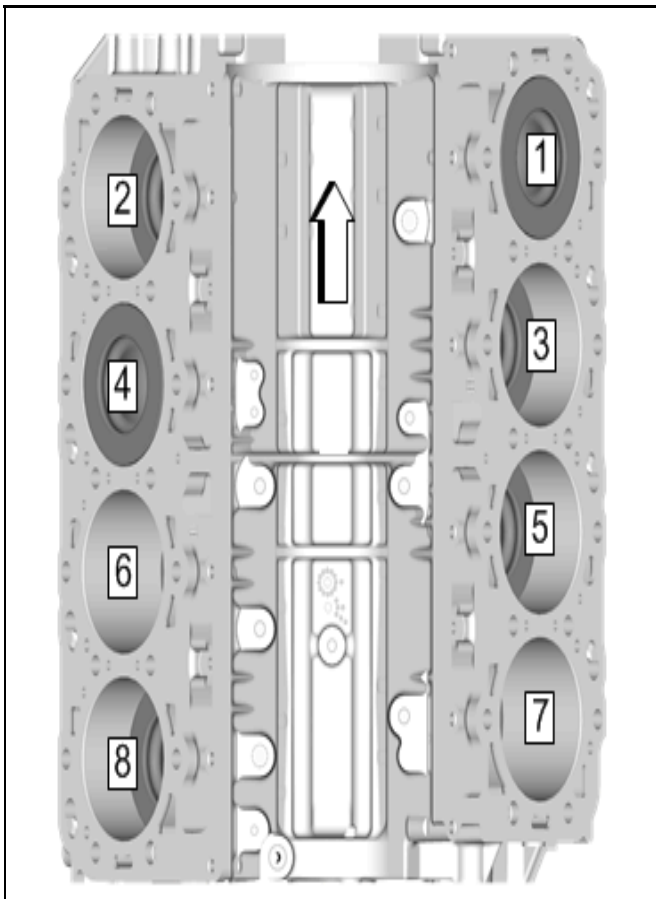
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Engine Shown is 2018 Duramax® 6.6L V8 — RPO L5P (L5D is similar)

The Duramax® 6.6L, V8 — RPO L5D is a turbocharged diesel engine produced by General Motors for use in the new 4500HD, 5500HD and 6500HD trucks. The L5D is part of a new generation of Duramax® engines. The engine is closely related to the Duramax® 6.6L, V8 — RPO L5P engine, but is equipped with a smaller turbocharger and different engine control module calibrations.

Engine Features and Specifications

- **Bore/Stroke:** 4.055 inches (103 mm) / 3.8976 inches (99 mm).
- **Compression Ratio:** 16.0:1
- **Cooling System:** Cooling system flow capacity is 270 L/min at 3,172 RPM.
- **Connecting Rods:** The connecting rods are one-piece hot forged steel. The connecting rods and caps are of a fractured split design to improve durability and reduce internal friction. The connecting rod small end is tapered cut for reduced weight and improved durability.
- **Crankshaft:** The crankshaft is a forged steel design with five main bearings. Crankshaft thrust is controlled by the number 5 bearing.



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- **Cylinder Block:** The engine block utilizes a deep skirt design for increased rigidity. The cylinders are positioned in a 90 degree "V" orientation with the number one cylinder being the right front. The block is induction hardened for increased durability. The crankshaft bearing caps are cross-bolted to enhance structural rigidity.
- **Cylinder Head:** The cylinder heads are made of aluminum for lighter weight and rapid heat dissipation. There are 4 valves per cylinder and

the ports are of a high swirl design for improved combustion. The cylinder head gaskets consist of an all steel laminated construction.

- **Emissions Controls:** Cooled Exhaust Gas Recirculation (EGR), Selective Catalytic Reduction (SCR), Diesel Particulate Filter (DPF), intake throttle.
- **Engine Covers:** There is a front engine cover and a flywheel housing, both are made of aluminum. The full bell flywheel housing is cross bolted to the upper oil pan. The flywheel housing also supplies a crossover passage for engine coolant. The front engine cover houses the gear train and provides a mounting surface for the cooling fan pulley assembly.
- **Engine Oil Capacity with Filter:** Capacity is 10 qt (9.5L).
- **Exhaust Gas Recirculation:** Exhaust gas recirculation is water cooled for improved reduction in NOx emissions.
- **Exhaust Manifold:** The exhaust manifolds are a 1-piece cast iron design. The exhaust manifolds direct exhaust gasses from the combustion chambers to the exhaust system. Each manifold has an externally mounted heat shield that is retained by bolts.
- **Firing Order:** 1-2-7-8-4-5-6-3
- **Fuel System:** Direct injection with high-pressure common rail. In the diesel engine, air alone is compressed in the cylinder. Then, after the air has been compressed, a charge of fuel is sprayed into the cylinder and ignition occurs, due to the heat of compression.

**TOP
TIER**
Diesel Fuel

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- **Fuel Type:** GM recommends the use of TOP TIER Diesel Fuel to keep the engine clean and reduce engine deposits. Use Ultra-Low Sulfur Highway Diesel Fuel and/or B20 biodiesel. Fuels

with a biodiesel content up to 20% by volume may be used (e.g., named B20). Look for the TOP TIER Diesel Fuel Logo.

- Do not use diesel fuel with more than 15 ppm Sulfur.
- Do Not Use Non-Highway Diesel Fuel.
- **Glow Plugs:** The engine utilizes eight ceramic glow plugs. Compared to conventional glow plugs, ceramic glow plugs enable greater efficiency through higher temperature capability and faster preheating time. However, ceramic glow plugs are much more sensitive to damage than conventional glow plugs. Damage can occur to the glow plug and not be visible, causing future engine failure. Therefore, ceramic glow plugs are considered one-time-use. Be sure to discard and replace with NEW whenever a ceramic glow plug is removed from the cylinder head. If the cylinder head is ever removed with the ceramic glow plugs, the ceramic glow plugs must all be replaced with new. Whenever installing a new ceramic glow plug, clean the glow plug bore with a proper tool as outlined in the service procedure. Carbon build-up in the glow plug bore can damage the ceramic glow plugs.
- **Governed Speed:** 2900 RPM
- **Horsepower:** 350 hp (257 kW) @ 2700 RPM.
Torque: 700 lb-ft (949 Nm) @ 1600 RPM.
- **Intake Airflow Valve:** The intake airflow valve is a throttle plate actuator and is used to achieve high exhaust gas recirculation rates. It increases the pressure difference between exhaust and intake so that the appropriate exhaust quantity can be mixed with the intake air.
- **Maximum Braking Speed:** 4,800 RPM.
- **Maximum Powered Speed:** 3,450 RPM.
- **Oil Cooler:** The oil cooler lowers engine temperature by cooling the oil with engine coolant. Engine coolant is directed from the water pump to the oil cooler by a coolant tube. The oil filter attaches directly to the oil cooler.
- **Oil Pump:** The oil pump is gear driven directly from the crankshaft. The oil pump drive gear is a slip fit to the crankshaft.

- **Piston:** The pistons are a full-floating design. The piston pins are a slip fit in the bronze bushed connecting rod and are retained in the piston by round wire retainers. The pistons have a piston cooling oil channel cast inside of the piston. These cooling oil channels utilize an oil jet located at the bottom of the cylinder bore to direct oil into the piston channel. There are two compression rings and one oil control ring. There is a groove machined into the pistons between the first and second compression rings. This groove reduces compression ring leakage by providing an empty space for expanding gases, reducing the combustion gas pressure on the second compression ring.
- **Turbocharger:** The turbocharger is water cooled for improved durability. It is a variable vane style. The pitch of the turbine vanes can be changed by ECM command to meet varying conditions.
- **Upper Oil Pan:** A single piece cast aluminum upper oil pan contributes to crankshaft and block rigidity while reducing overall weight.
- **Valvetrain:** The engine utilizes a mechanical roller lifter for valve operation. One rocker arm operates two valves simultaneously through a valve bridge.
- **Water Pump:** The water pump is gear driven for improved reliability.

Elevated Idle

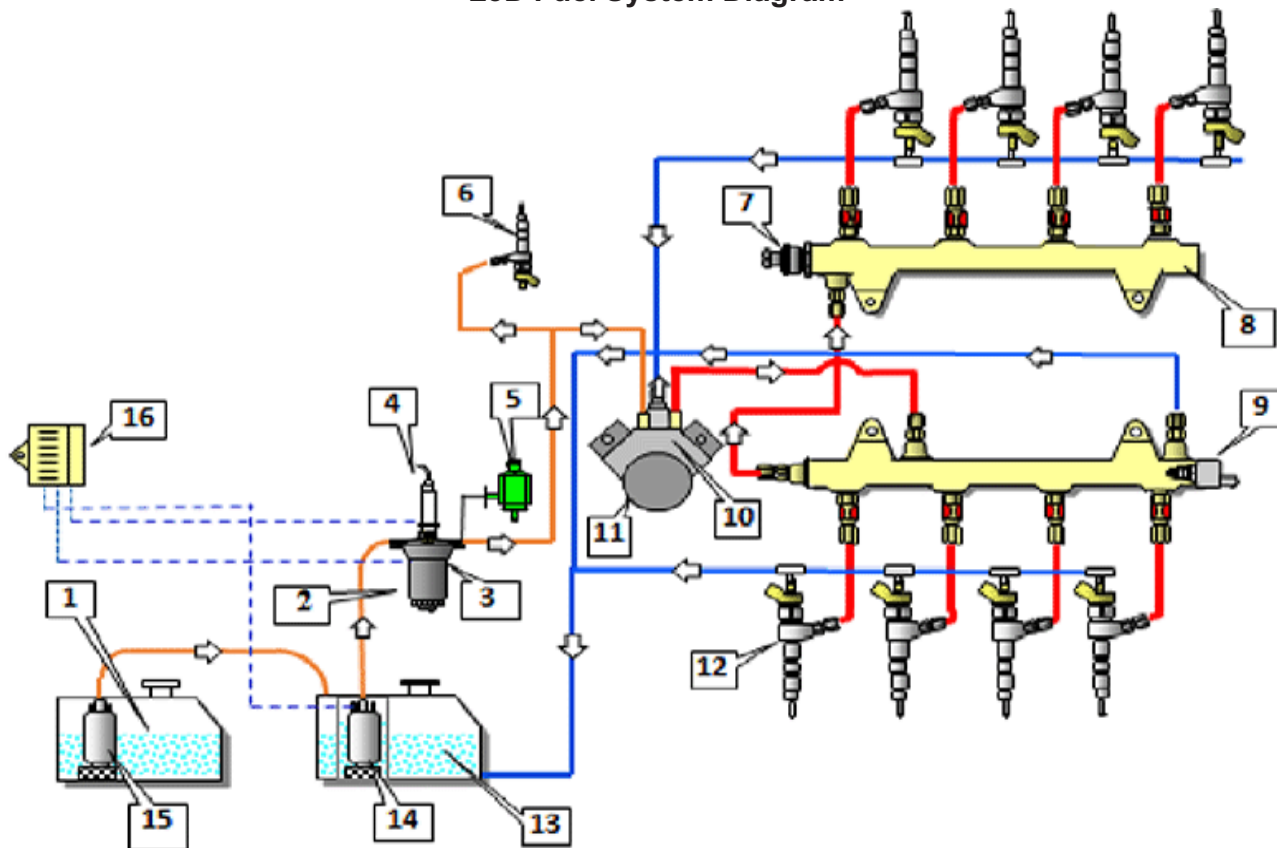
The engine has a cold temperature high idle feature which elevates the engine idle speed from base idle to 1050 to 1100 RPM when outside temperatures are colder than 32°F (0°C), and the engine coolant temperature (ECT) is colder than 150°F (65°C). This feature enhances heater performance by increasing the ECT faster.

Engine Block Heater

If equipped, the engine block heater can provide easier starting and better fuel economy during the engine warm-up period in weather conditions that are colder than 0°F (-18°C). Vehicles with an engine block heater should be plugged in at least four hours before starting. An internal thermostat in the plug-end of the cord may exist, which will prevent engine block heater operation at temperatures warmer than 0°F (-18°C).

Fuel System Overview

L5D Fuel System Diagram



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Legend

- | | |
|---|---|
| (1) Secondary Fuel Tank (if equipped) | (9) Fuel Rail Pressure Regulator 2 |
| (2) Fuel Filter with Water in Fuel Sensor | (10) Fuel Pressure Regulator 1 (Located in Fuel Injection Pump) |
| (3) Fuel Heater | (11) Fuel Injection Pump |
| (4) Fuel Temperature Sensor | (12) Fuel Injectors |
| (5) Fuel Pressure Sensor | (13) Primary Fuel Tank |
| (6) Exhaust Aftertreatment Fuel Injector (not equipped on the L5D) | (14) Electric 3-Phase Fuel Pump |
| (7) Dual Fuel Rail Pressure Sensor (Contains Fuel Rail Pressure Sensor 1 and Fuel Rail Pressure Sensor 2) | (15) Fuel Transfer Pump (if equipped with secondary tank) |
| (8) Fuel Rail Assembly | (16) Fuel Pump Driver Control Module |

The primary fuel tank and secondary fuel tank (if equipped) stores the fuel supply. A fuel transfer pump is located in the secondary fuel tank to transfer fuel to the primary tank. The primary fuel tank contains a 3-phase electric fuel pump that is controlled by the fuel pump driver control module and ECM. Fuel is pumped from the primary fuel tank through the fuel feed line to the fuel filter assembly. The fuel filter assembly consists of a fuel filter/water separator, fuel heater, fuel temperature sensor, and a water in fuel sensor. Fuel flows out of the fuel filter assembly through the rear fuel feed pipe and past the fuel pressure sensor to the fuel injection pump. High pressure fuel is supplied through the high pressure fuel line to the fuel rails and then

through the fuel injector lines to the fuel injectors. High pressure fuel is controlled by the ECM, Fuel Pressure Regulator 1 and Fuel Pressure Regulator 2. Excess fuel returns to the fuel tank through the fuel return pipes.

Exhaust Aftertreatment Uses Post Injection

The engine uses post combustion injection through the engine fuel injectors to increase the exhaust gas temperature as needed for regeneration. It does not use an HC Injector.

Engine Oil

Specification

Engine oil with the letters CJ-4 or CK-4 are required for the Duramax® 6.6L diesel engine. The CJ-4 or CK-4 designation can appear either alone or in combination with other American Petroleum Institute (API) designations, such as API CJ-4/SL. These letters show API levels of quality.

American Petroleum Institute (API) Symbol



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This doughnut-shaped logo (symbol) is used on most oil containers to help you select the correct oil. It means that the oil has been certified by the American Petroleum Institute. Look for this on the oil container, and use only those oils that display this logo.

Caution: Use only engine oils that have the designation CJ-4 or CK-4 for the diesel engine. Failure to use the recommended oil can damage the DPF and result in engine damage not covered by the vehicle warranty.

Viscosity Grade

Use SAE 15W-40 viscosity grade engine oil. When it is very cold, below 0°F (-18°C), use SAE 5W-40 to improve cold starting. These numbers on the oil container show its viscosity, or thickness.

Exhaust Brake

Operation

The exhaust brake can be used to enhance the vehicle brake system and reduce brake lining wear. Downshifts may be automatically selected to increase engine speed, which increases the effectiveness of the exhaust brake. The number of downshifts selected is determined by the length of time the brakes are applied and the rate the vehicle is slowing. The system delivers the correct amount of braking to assist in vehicle control. The heavier the vehicle load, the more active the engine exhaust brake will be. Automatic downshifts will not occur if the vehicle is in Range Selection Mode.

Activation

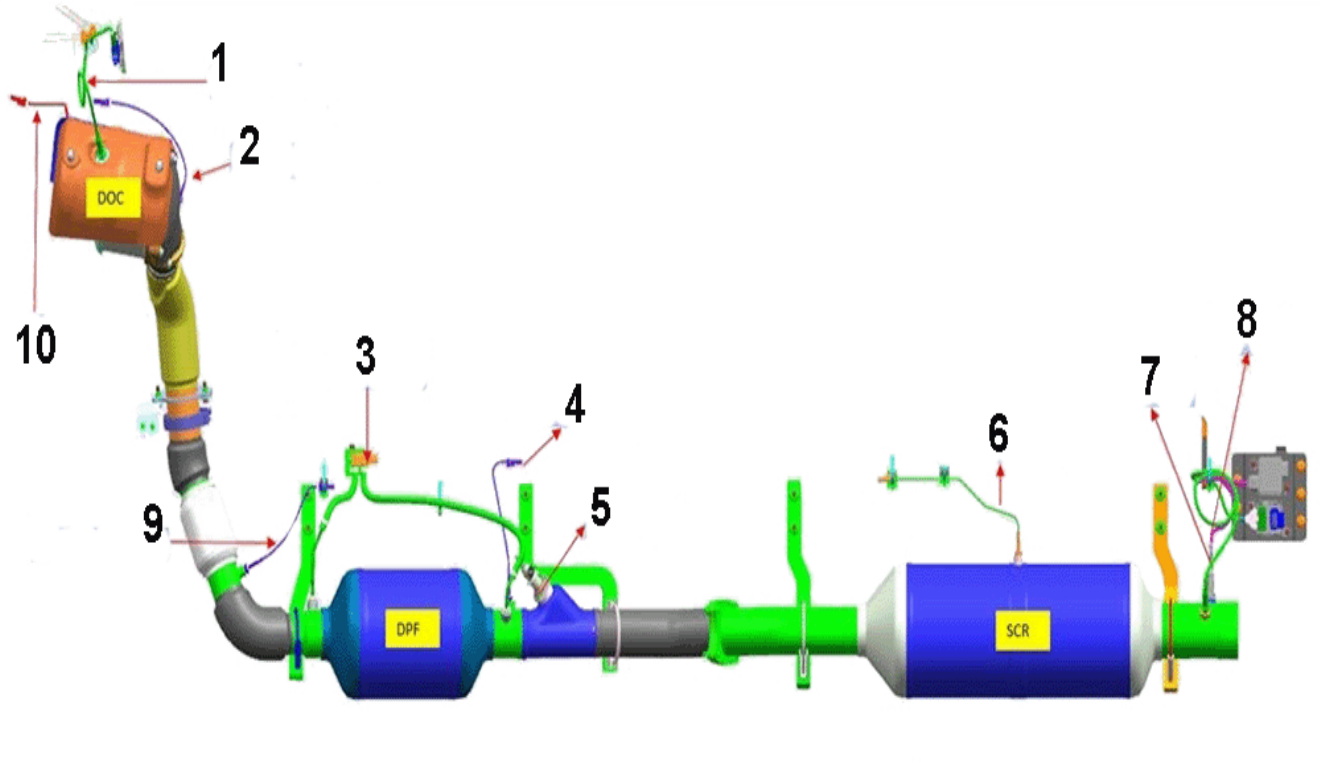


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The exhaust brake only activates when the transmission torque converter is locked. This can vary based on vehicle speed, gear, and load. To activate the system, press the exhaust brake switch in the control panel. A light in the switch will turn ON when the exhaust brake is activated. The DIC displays the message EXHAUST BRAKE ON for approximately three seconds, then clears. To turn the brake OFF, press the exhaust brake switch a second time. The DIC displays the message EXHAUST BRAKE OFF for approximately three seconds, then clears. The switch must be pressed at each vehicle start for the system to be active.

Exhaust Aftertreatment System

L5D Emission Control System Architecture



5138795

Legend

(1)	NOx Sensor 1	(6)	EGT Sensor 5
(2)	EGT Sensor 2	(7)	NOx Sensor 2
(3)	Differential Pressure Sensor	(8)	Particulate Matter Sensor
(4)	EGT Sensor 4	(9)	EGT Sensor 3
(5)	DEF Injector	(10)	EGT Sensor 1

Exhaust Aftertreatment System

Fuel Requirements

Notice:

- **Use Ultra Low Sulfur Diesel Fuel (ULSD) only. Do Not use a diesel blend containing more than 20% biodiesel by volume.**
- **Do Not Use Non-Highway Fuel. Fuel labeled as off road or non-highway is typically very high in sulfur content and will damage the emission control system. Non-highway fuel is not intended for use in on-highway vehicles and does not have the fuel properties needed by the Duramax® Exhaust Aftertreatment System to properly function.**

Overview

The diesel exhaust aftertreatment system is designed to reduce the levels of hydrocarbons (HC), carbon monoxide (CO), oxides of nitrogen (NOx), and particulate matter remaining in the vehicle's exhaust gases. Reducing these pollutants to acceptable levels is achieved through a 3 stage process as follows:

1. The close coupled Diesel Oxidation Catalyst (DOC) stage
2. The Diesel Particulate Filter (DPF) stage
3. The Selective Catalyst Reduction (SCR) stage

Component Function

The main components function as follows:

- The Close Coupled Diesel Oxidation Catalyst (DOC) removes exhaust HC and CO through an oxidation process.
- Particulate Matter (PM) consisting of extremely small particles of carbon remaining after combustion are removed from the exhaust gas by the porous barrier in the Diesel Particulate Filter (DPF) which lets the gases pass through and retains the particulates.
- Diesel Exhaust Fluid (DEF), is injected into the exhaust gases prior to entering the SCR. Within the SCR, NO_x is converted to nitrogen (N₂) and water vapor (H₂O) through a catalytic reduction fueled by the injected DEF. The SCR is a single assembly canister, consisting of two separate SCR bricks which are separated by a small space in which EGT Sensor 5 resides.

Close Coupled Diesel Oxidation Catalyst

DOC Overview

The close coupled DOC functions much like the catalytic converter used with gasoline fueled engines. As with all catalytic converters, the DOC must be hot in order to effectively convert the exhaust HC and CO into CO₂ and H₂O. On cold starts, the exhaust gases are not hot enough to create temperatures within the DOC high enough to support full HC and CO conversion. The temperature at which conversion starts to occur is known as light-off. Proper DOC function requires the use of ultra-low sulfur diesel (ULSD) fuel containing less than 15 parts-per-million (ppm) sulfur. Levels above 15 ppm will reduce catalyst efficiency and eventually result in poor driveability and one or more DTCs being set.

DOC Operation

In addition to reducing emissions, the DOC also generates the exhaust heat needed by the SCR stage to perform its function. Exhaust gas temperature sensors are located upstream and downstream of the DOC. By monitoring the temperature differential between these two sensors, the ECM is able to confirm DOC light-off. Light-off is confirmed by a DOC output temperature that is greater than its input temperature. In order to generate the high exhaust temperatures needed for regeneration, the aftertreatment system increases exhaust temperatures by injecting additional diesel fuel into the post combustion process.

Diesel Particulate Filter

DPF Overview

The DPF captures diesel exhaust gas particulates, also known as soot, preventing their release into the atmosphere. This is accomplished by forcing particulate-laden exhaust through a filter substrate consisting of thousands of porous cells. Half of the cells are open at the filter inlet but are capped at the filter outlet. The other half of the cells are capped at the filter

inlet and open at the filter outlet. This forces the particulate-laden exhaust gases through the porous walls of the inlet cells into the adjacent outlet cells trapping the particulate matter. The DPF is capable of removing more than 90% of particulate matter, or soot carried in the exhaust gases.

Differential Pressure Sensor

Pressure connections at the DPF inlet and outlet allow the Differential Pressure Sensor (DPS) to measure the pressure drop across the DPF. The pressure drop increases as trapped soot collects in the cells of the DPF during vehicle operation. The rate at which soot collects varies with the power demands placed on the engine. If left unchecked, the increasing backpressure will eventually result in a driveability problem. There are two sensing elements in the Differential Pressure Sensor (DPS), one for the upstream side of the DPF, and the other for the downstream side. Pressure from each side of the DPF is applied to the bottom side of a silicon diaphragm in each sensing element; atmospheric pressure is applied to the top side of each diaphragm. Relative pressure differences in each sensing element is converted to a voltage (V1 & V2). The difference in these voltages is sent to the ECM. As the DPF becomes clogged, the pressure on the upstream side increases because of back pressure due to the restriction of the exhaust gas flow through the DPF.

DPF Regeneration

Over time, the soot trapped on the cell walls acts to restrict exhaust flow through the DPF reducing engine efficiency. This restriction in exhaust flow produces a pressure drop across the DPF that increases as the once porous cell walls become saturated with trapped soot. The DPS monitors the pressure drop across the DPF and provides the ECM with a voltage signal proportional to soot buildup. Once soot buildup reaches a specified limit (100%), as signaled by the increased pressure drop across the DPF, the ECM commands a regeneration event to burn-off the collected soot during normal vehicle operation. Regeneration events occurring during vehicle operation are known as normal regenerations as they occur automatically and without driver knowledge. In general, the vehicle will need to be driven safely at a steady speed, preferably without stopping for approximately 20–30 minutes for a full and effective regeneration to complete.

Selective Catalyst Reduction

SCR Overview

While diesel engines are more fuel efficient and produce less HC and CO than gasoline engines, they generate higher levels of Nitrous Oxide (NO_x). In order to meet today's tighter NO_x limits, an SCR catalyst, using the injected DEF, is used to convert NO_x into N₂ and H₂O.

NO_x Sensors

The ECM uses two smart NO_x sensors to control exhaust NO_x levels. The first NO_x sensor is located in the DOC inlet and monitors the engine out NO_x. The second NO_x sensor is located in the exhaust tailpipe

downstream of the SCR and monitors NOx levels exiting the aftertreatment system. The smart NOx sensors communicate with the ECM over the serial data line.

The smart NOx sensors consist of two components, the NOx module and the NOx sensor element that are serviced as a unit. The NOx sensors incorporate an electric heater that is controlled by the NOx module to quickly bring the sensors to operating temperature. As moisture remaining in the exhaust pipe could interfere with sensor operation, there is a delay turning on the heaters until the exhaust temperature exceeds a calibrated value. This allows any moisture remaining in the exhaust pipe to boil off before it can effect NOx sensor operation. Depending on engine temperature at start up, the delay can be less than a minute or as long as two minutes. Typically, NOx sensor 1 will reach operating temperature faster than NOx sensor 2 as it's closer to the engine's hot exhaust. At idle or low engine speeds, NOx sensor 2 may require up to 5 minutes to reach operating temperature. The sensors must be hot before accurate exhaust NOx readings are available to the ECM.

Diesel Exhaust Fluid

DEF is a mixture of carefully blended aqueous urea solution of 32.5% high purity urea (Pharmaceutical Grade Urea) and 67.5% deionized water. Within the SCR, exhaust heat converts the urea into ammonia (NH₃) that reacts with NOx to form nitrogen, CO₂, and water vapor. Optimum NOx reduction occurs at SCR temperatures of more than 480°F (250°C). At lower temperatures, NH₃ and NOx may react to form Ammonium Nitrate (NH₄NO₃) which can lead to temporary deactivation of the SCR catalyst. To prevent this, the ECM will suspend DEF injection when the exhaust temperature is less than a calibrated minimum.

Exhaust Gas Temperature Sensors

The engine uses Exhaust Gas Temperature (EGT) management to maintain the SCR catalyst within the optimum NOx conversion temperature range of 390–750°F (200–400°C). The ECM monitors the EGT sensors located upstream and within the SCR in order to determine if the SCR catalyst is within the temperature range where maximum NOx conversion occurs.

Particulate Matter Sensor

PM Sensor Overview

The Particulate Matter (PM) sensor determines the amount of particulates (soot) in the diesel exhaust gas exiting the tailpipe by monitoring the collection efficiency of the DPF and this also assists in emission diagnostics. The PM sensor is similar to the heated oxygen sensor with a ceramic element but also includes an individually calibrated control unit. The PM sensor sensing element includes two comb-shaped inter-digital electrodes, a heater and a positive temperature coefficient (PTC) resistor for temperature measurement.

PM Sensor Operation

The operation of the PM sensor is based on the electrical conductivity characteristic of the soot. As the exhaust gas flows over the sensing element, soot is absorbed in the combs between the electrodes, eventually creating a conductive path. When the path is formed, it generates a current based on the voltage being applied to the element. The measurement process continues until a preset current value is reached. To avoid misleading readings, the sensor operates on a “regenerative” principle, which means the soot is removed by heating up the element to burn off the carbon, before the measurement phase begins. The amount of regenerations is based on vehicle strategy; when the amount of regeneration is reached, the cumulative current readings are used to determine the amount of soot concentration in the exhaust gas, and thus the collection efficiency of the DPF.

The PM sensor is operated in 3 successive modes:

1. Standby mode after power-up to ensure protective heating. On power-up, the control unit starts the heating process to avoid condensation of liquids on the sensing element. Presence of liquid can cause thermal shock during the heating process, resulting in damage to the ceramic element. Regeneration is not initiated until the dew point temperature has been exceeded.
2. Regeneration mode is conducted before each measurement to ensure a soot free sensing element. Before starting measurements, absorbed soot is burned off the sensing element by heating it up; this ensures each measurement starts off at the same condition. Regeneration is conducted for a pre-determined period of time based on soot level.
3. Measurement mode is when soot is actively collected on the sensing element. The sensor heater is deactivated during measurement, so the temperature on the element is equivalent to that of the exhaust gas. Voltage is applied until a preset 12 micro-amp current threshold is achieved due to increasing current as the soot builds up on the element. The time from the end of the regeneration to reach the threshold is used to calculate the concentration of soot in the exhaust gas.

Diesel Exhaust Fluid System

Overview

The DEF system consists of the following components located at the DEF reservoir:

- An electrically-operated DEF pump.
- A integrated DEF level sensor and DEF temperature sensor.
- A DEF control module.
- A DEF quality sensor.
- DEF system heaters.

The remaining DEF system component is an electrically-controlled DEF injector which is external to the reservoir.

The on-board reservoir holds approximately 7 gallons (26 liters) of DEF. A pump within the reservoir supplies pressurized DEF to the DEF injector located upstream of the SCR. A DEF level sensor within the DEF reservoir provides the DEF control module a signal indicating DEF level. The DEF pressure sensor provides the DEF control module with a voltage signal proportional to the DEF pressure generated by the DEF pump. The DEF control module varies the duty-cycle of the pump voltage to maintain DEF pressure within a calibrated range.

When the ignition is turned OFF, the DEF pump will run in reverse for about 45 seconds in order to purge the supply line of DEF. There is a one minute delay between ignition OFF and the start of purge to allow the exhaust system to cool in order to prevent hot exhaust gas from being drawn into the DEF line. The ECM also commands the DEF injector open during the purge process. Purging prevents the DEF from freezing in the pump or supply line to the DEF injector.

The ECM energizes the DEF injector to dispense a precise amount of DEF upstream of the SCR in response to changes in exhaust NOx levels. Feedback from NOx sensor 1 and NOx sensor 2 allow the ECM to accurately control the amount of DEF supplied to the SCR. If more DEF is supplied to the SCR than is needed for a given NOx level, the excess DEF results in what is called ammonia slip where significant levels of ammonia exit the SCR. Since the NOx sensors are unable to differentiate between NOx and ammonia, ammonia slip will cause NOx sensor 2 to detect higher NOx levels than actually exist.

Cold Weather Operation

A 32.5% solution of urea with 67.5% deionized water will begin to crystallize and freeze at 12°F (-11°C). At this ratio, both the urea and water will freeze at the same rate, ensuring that as it thaws, the fluid does not become diluted, or over concentrated. The freezing and thawing of DEF will not cause degradation of the product. There are 2 DEF heaters in the system. DEF Heater 1 is in the DEF reservoir and DEF Heater 2 is in the supply line to the DEF injector. The DEF control module monitors the DEF temperature sensor located within the reservoir in order to determine if the DEF temperature is below its freeze point. If the module determines that the DEF may be frozen, it energizes the DEF heaters. DEF pump operation is disabled for a calibrated amount of time to allow the heaters an adequate amount of time to thaw the frozen DEF. Once the thaw time period expires, the module energizes the DEF pump to circulate warm DEF back to the reservoir to speed thawing. The ECM looks for an increase in the DEF temperature to verify that the DEF reservoir heater is working.

DEF Level Gauge



5182514

The DEF level must be maintained for the vehicle to run properly. As the DEF level becomes low, warnings are displayed on the DIC. These warnings will increase in intensity as the DEF level is reduced. As the tank nears empty, vehicle speed will be limited in a series of steps. At least 2 gallons (7.57L) of DEF must be added to release the speed limitation.

Recommended DEF — Storage and Transfer — DEF Reservoir

Recommended DEF



5138259

API Certified Diesel Exhaust Fluid Mark

- GM DEF is an aldehyde free, NOx reducing treatment. It is a mixture of 32.5% high purity synthetic urea and 67.5% deionized water. GM DEF meets the stringent ISO 22241 standard for purity and concentration. GM DEF is a stable, colorless, non-flammable, non-toxic primary component used to help convert NOx, an environmental pollutant, into harmless nitrogen and water. Use Diesel Exhaust Fluid GM PN 19286291 or DEF that meets the International Organization for Standardization ISO 22241 specification or displays the API Certified Diesel Exhaust Fluid Mark (meets API certification requirements). Classified as minimum risk for transportation.
- ACDelco® DEF is an aldehyde free, NOx reducing treatment. It is a mixture of 32.5% high purity synthetic urea and 67.5% deionized water. ACDelco® DEF meets the stringent ISO 22241 standard for purity and concentration. ACDelco® DEF is a stable, colorless, non-flammable, non-toxic primary component used to help convert NOx, an environmental pollutant, into harmless nitrogen and water. It meets API regulations, and meets or exceeds GM OE specifications. Classified as minimum risk for transportation.

Storage and Transfer of DEF

DEF has a shelf life of approximately 24 months, but when exposed to sunlight or prolonged exposure to temperatures warmer than 75°F (23.8°C), the nitrogen in DEF begins to volatilize into ammonia gas and can reduce shelf life. Once volatilized, it will not go back into suspension and the percentage of urea in the product decreases to less than the optimum 32.5%. Fresh DEF has a slightly pungent smell of ammonia. After extended exposure to temperatures warmer than 75°F (23.8°C), the ammonia scent grows stronger, indicating nitrogen has vaporized, changing the urea-to-water ratio of the product. Because DEF is highly reactive to many metals, it must be stored in stainless steel, polypropylene or high-density polyethylene (HDPE) storage tanks. All pumps, valves and fittings must be DEF compatible and used only to transfer DEF.

DEF Reservoir



5124361

The DEF reservoir cap is blue and is positioned on the right fender behind the front wheel for easy reservoir fluid refills. It is recommended to fill the DEF tank on level ground and when the engine is not running.

DEF Warning Light



5152580

When there is an issue with the DEF such as a low fluid level or fluid contamination, the DEF Warning Light will illuminate, a DIC message will display and a chime will sound. To avoid vehicle speed limitations, fill the DEF tank at the first opportunity after a Low Fluid Level warning message displays.

DEF Website

For more information, click on:

Regeneration

Normal Regeneration

Over time, the soot trapped on the cell walls acts to restrict exhaust flow through the DPF reducing its effectiveness as well as reducing engine efficiency. This restriction in exhaust flow produces a pressure drop across the DPF that increases as the once porous cell walls become saturated with trapped soot. A DPS monitors the pressure drop across the DPF and provides the ECM with a voltage signal proportional to soot buildup. Once soot buildup reaches a specified limit (100%), as signaled by the increased pressure drop across the DPF, the ECM commands a regeneration event to burn-off the collected soot during normal vehicle operation. Regeneration events occurring during vehicle operation are known as normal regenerations as they occur automatically and without driver knowledge. In general, the vehicle will need to be driven safely at a steady speed, preferably without stopping for approximately 20–30 minutes for a full and effective regeneration to complete.

The frequency of normal DPF regeneration in this system is determined by soot accumulation using the pressure drop across the DPF and engine run time which is approximately 18 hours. The L5D does not utilize a Hydrocarbon (HC) Injector, so in order to initiate a normal DPF regeneration event, the ECM commands additional post injection diesel fuel in order to create the additional exhaust heat in the **DOC** necessary to promote regeneration and burn-off the collected soot in the **DPF**.

During regeneration exhaust temperatures may exceed 1,184°F (640°C) due to the rapid catalytic combustion of soot **within** the DPF. Conversely, under low engine speed or light loads, exhaust temperatures may be too low to promote proper regeneration. To protect the DPF catalyst from thermal damage due to excessive soot combustion, the ECM monitors the EGT sensors upstream and downstream of the DPF during regeneration. If the vehicle is slowed to idle speed during a normal DPF regeneration, the engine may maintain an elevated idle of 900 RPM until the DPF is cooled to a calibrated temperature.

Should the EGT sensors indicate that regeneration temperatures have exceeded a calibrated threshold, regeneration will be temporarily suspended until the sensors return to a normal temperature. If regeneration temperatures fall below a calibrated threshold, regeneration is terminated and a corresponding DTC is set in the ECM.

Under most conditions, the soot collected within the DPF burns off during normal regeneration cycles. Periodic regeneration prevents the buildup of soot from reaching a level where its burn-off could produce damaging high temperatures within the DPF. Vehicles operated for short distances or extended idle where normal regeneration does not occur will eventually reach a high soot load condition. When the increased pressure drop across the DPF is detected by the DPS,

the ECM illuminates the DPF lamp in the instrument cluster and sends a Clean Exhaust Filter message to the DIC.

Service Regeneration

Exhaust temperatures at the **tailpipe** may exceed 572°F (300°C) during service regeneration. Observe the following precautions:

- Service regeneration **must** be performed outdoors. Most exhaust removal hoses cannot withstand the high exhaust temperatures generated during regeneration.
- Park the vehicle outdoors and keep people, other vehicles, and combustible material away during service regeneration.
- Park the vehicle in an area that provides a clearance area of at least 10 feet on all sides of the vehicle and open the hood.
- Ensure the tailpipe is not obstructed by mud or debris.
- Do not leave the vehicle unattended during service regeneration.

The ECM uses two EGT sensors to measure the temperature of the exhaust gases at the inlet and outlet of the DPF. Optimum DPF temperature is critical for emission reduction and for ensuring complete regeneration. Excessive DPF temperatures could damage the ceramic substrate. The ECM monitors the inlet and outlet EGT sensors in order to maintain the DPF at its optimum temperature.

Service Regeneration Precautions

Warning: Tailpipe outlet exhaust temperature will be greater than 572°F (300°C) during this procedure. To help prevent personal injury or property damage from fire or burns, perform the following:

1. Do not connect any shop exhaust removal hoses to the vehicle tailpipe.
2. Park the vehicle outdoors and keep people, other vehicles, and combustible material away during this procedure.
3. Do not leave the vehicle unattended.

Should the vehicle operator fail to drive the vehicle within the conditions necessary to initiate a normal regeneration cycle, the ECM illuminates the Service Engine Soon lamp and displays a REDUCED ENGINE POWER message on the DIC once the soot buildup exceeds a calibrated value. The vehicle will remain in the REDUCED ENGINE POWER mode until service regeneration is performed.

Service regeneration is required because the amount of soot collected in the DPF, known as soot load, is too high to be burned off without possible thermal damage to the DPF's ceramic substrate. Service regeneration is one of several output control functions available on the scan tool. When service regeneration is commanded, the ECM takes control of engine operation until the service regeneration is completed in approximately 35 minutes or until the service regeneration is either cancelled by the technician or is aborted by the ECM

when it detects unexpected conditions. The ECM commands additional post injection diesel fuel in order to create the additional exhaust heat in the **DOC** necessary to promote regeneration and burn-off the collected soot in the **DPF**. The service regeneration can be terminated by applying the brake pedal, commanding service regeneration OFF using the scan tool, or disconnecting the scan tool from the vehicle.

Intake Air Valve

The Intake Air (IA) Valve is located upstream of the intake air heater, and is normally in the open position. The ECM commands the valve to close in order to precisely control combustion temperature during DPF regeneration. The IA valve will ensure the temperature of the exhaust gas remains in an efficient range under all operating conditions. The IA valve system uses a position sensor located within the valve assembly to monitor the position of the valve. The IA valve uses a motor to move the valve to a closed position and spring tension returns it to the open position. The motor is operated through Motor Control 1 and Motor Control 2 circuits.

Ash Loading

Ash is a non-combustible by-product from normal oil consumption. Low ash content engine oil (CJ-4 or CK-4) is required for these vehicles with the exhaust aftertreatment system. Ash accumulation will eventually cause a restriction in the DPF. Being non-combustible, ash is not burned off during regeneration. A DPF that is ash loaded will need to be removed from the vehicle and replaced.

Manual Regeneration

Manual Regeneration Overview

Important: This feature is available as an option.

To verify if the vehicle has this feature, refer to Build Information in Investigate Vehicle History (IVH) or click on: to contact the GM Upfitter Integration Group for assistance.

If equipped, this feature allows for manual regeneration of the DPF when it is unable to clean itself. It may be necessary to perform a manual regeneration if driving conditions, such as extended slow speed, stop-and-go traffic, extended idle times, short drive cycles, or stationary PTO operation, prevent DPF self-cleaning.

Starting Manual Regeneration

Manual regeneration can only be used when the DPF has become at least 90% full. At 100% full, it will attempt to automatically self-clean if proper driving conditions are met. The DPF will clean itself if the vehicle can be driven more than 30 mph (50 km/h) for about 30 minutes. A DIC message displays when manual regeneration is possible. Scroll through the DIC pages to find the Exhaust Cleaning menu. Depending on whether the vehicle has a base or up-level cluster, it may be under the Settings menu. If the vehicle cannot be stopped when the DIC message first indicates cleaning is available, automatic self-cleaning may have begun. If conditions cannot be met for self-cleaning to complete, and manual regeneration is selected, it may

take up to four minutes for the system to switch to manual regeneration. When the switch occurs, a DIC message prompts to start the cleaning process. After making sure all of the safety conditions have been met, press the trip odometer reset stem or the check-mark symbol on the steering wheel control for at least one second to select Start on the infotainment display. Follow the instructions in the DIC messages. Touch ACCEPT to acknowledge that all of these safety conditions have been met and to activate regeneration.

Continue to follow the instructions in the DIC messages. Hold the Exhaust Brake switch on the instrument panel below the climate controls for more than three seconds, and then release it, to begin the regeneration process.

If the EXHAUST BRAKE ON message displays, then the switch was released too soon. Press it again to turn OFF the exhaust brake, then try again when the DIC message prompts.

When manual regeneration begins, the engine speed increases, the engine cooling fan sound increases, and a DIC message indicates that cleaning is in progress.

A DIC message will display when cleaning has completed. The message will remain as long as cleaning is not necessary. Cleaning could take up to 30 minutes. Upon completion, the engine will return to normal idle, but exhaust components will remain hot for several minutes. Do not move the vehicle until the exhaust has had time to cool. Manual regeneration can be canceled at any time by pressing the brake pedal or turning the engine off. Unusual noises may be heard if regeneration is interrupted.

Exhaust Gas Recirculation

EGR Purpose

The Exhaust Gas Recirculation (EGR) system is used to reduce the amount of nitrogen oxide (NOx) emission levels caused by high combustion temperatures. At temperatures above 1,371° C (2,500° F) oxygen and nitrogen combine to form NOx. Introducing small amounts of exhaust gas back into the combustion chamber displaces the amount of oxygen entering the engine. With less oxygen in the air/fuel mixture, the combustion pressures are reduced, and as a result, combustion temperatures are decreased, restricting the formation of NOx.

EGR Operation

Air coming from the intake air filter housing is compressed by the turbocharger, cooled by the charge air cooler and mixed with cooled exhaust gas coming from the exhaust gas recirculation EGR valve. The exhaust gas mixes with the intake air to satisfy emissions, performance, fuel economy and cool the combustion process. The Mass Air Flow (MAF) sensor signal is used by the ECM to detect the proper amount of EGR flow. The ECM will close the EGR valve, then open the EGR valve to 100%. The ECM will then calculate the MAF difference and determine if the proper EGR flow has been detected. The recirculated gas also prevents the formation of NOx related gases, refer to as NOx emissions, which are a common cause

for failing emissions testing. When a failure occurs both the air intake system and exhaust system should be checked in order to isolate the root cause.

Marketplace, GM's In-Vehicle Commerce Platform

Tap, Tap and Away — Pay for Fuel Directly From Your Dashboard

Through Marketplace, GM's in-vehicle commerce platform, drivers can pay for fuel through their infotainment touchscreens at more than 22,000 different Shell, Exxon and Mobil stations across the U.S. The process is simple. First, the owner needs to download Marketplace from the vehicle's app shop (on the infotainment touchscreen) and link either an ExxonMobil Speedpass+™ account or a Shell Fuel Rewards® account. If they don't have an existing account, Marketplace will send an email to create a free account and start collecting rewards points.

Once a rewards account is linked, the driver can pull into the nearest eligible fuel station, select the pump number and activate the fuel pump with a few simple clicks on the infotainment touchscreen. The fuel cost is charged to the payment method on file and drivers can earn ExxonMobil Speedpass+™ or Shell Fuel Rewards® points with each transaction. All of this can be done without swiping a card or paying with cash, providing security and convenience to GM vehicle owners.

This technology requires no mobile phone and takes fewer steps than other fuel payment features on the market. The service is powered by Marketplace, the automotive industry's first commerce platform for on-demand reservations and purchases of goods and services.

Power Take-Off

Overview

If equipped, the Power Take-Off (PTO) is used to create an auxiliary power source for running add-on equipment, such as salt spreaders, snow plows, winches, and lift buckets. The PTO system controls engine speed to values higher than normal base idle, PTO load relay engagement, and remote starting and shutdown of the engine. When installing PTO aftermarket equipment, the PTO wiring and operation recommendations provided by the service manual and GM Upfitter documentation must be followed.

Refer to the bulletins in the GM Upfitter Integration Group website for the Power Take-Off operating description and application guide. Click on:

Primary PTO Operating Modes

Refer to the Owner Manual for the Preset Enable Conditions for each Mode **before** operating. PTO modes of operation are:

- **Preset:** Stationary operation only: In-cab control is standard, remote control is available.
Remote Operation requires programming with the GM Service Tool and remote switch panel provided by GM Upfitter Group.
- **Variable:** Stationary operation only: In-cab control is standard, remote control is available.
Remote Operation requires programming with the GM Service Tool and remote switch panel provided by GM Upfitter Group.
- **Mobile:** In-cab control only.
This requires programming with the GM Service Tool.
- **Operator Selectable In-Cab Mode (OSIM):** OSIM is for in-cab operation only. OSIM is for vehicles that require both stationary and mobile modes.
OSIM is available via the GM Service Tool only. During the configuration of OSIM, two modes must be paired. The options for pairing are: stationary preset and mobile, or stationary variable and mobile.

Refrigerant R-1234yf

Air Conditioning Service Fittings

Service fittings meeting SAE J639 are used on these vehicles for R-1234yf refrigerant. GM has chosen gray caps to designate systems with R-1234yf.

A/C Compressor (Manual)

The A/C compressor uses a conventional belt driven magnetic clutch to engage and mechanically turn the compressor. When the A/C switch is pressed, the HVAC control module sends an A/C request message to the ECM via serial data. If specific criteria is met, the ECM then grounds the A/C compressor clutch relay control circuit, which will switch the A/C compressor clutch relay. With the relay contacts closed, battery voltage is supplied to the permanently grounded A/C compressor clutch. The A/C compressor clutch will then be activated.

This A/C system utilizes a variable displacement solenoid valve to alter the amount of displacement created by the turning of the compressor. The HVAC control module provides both battery voltage and a pulse width modulated ground to the variable displacement solenoid valve. When the A/C switch is pressed, the HVAC control module grounds the variable displacement solenoid using a pulse width modulation (PWM) signal in order to determine the amount of compressor displacement. The performance of the A/C compressor is regulated based on cooling load.

A/C Evaporator Temperature Sensor

The evaporator temperature sensor is a 2-wire negative temperature co-efficient thermistor. The sensor operates within a temperature range of -40 to +185°F (-40 to +85°C). The sensor is installed at the evaporator and measures its temperature. If the temperature drops below 38°F (3°C), the compressor will be switched OFF in order to prevent evaporator icing.

A/C Refrigerant Pressure Sensor

The A/C refrigerant pressure sensor is a 3-wire piezoelectric pressure transducer. The sensor has a 5 V reference voltage, low reference, and signal circuit. The A/C pressure signal can be between 0.2–4.8 V. When the A/C refrigerant pressure is low, the signal value is near 0 V. When the A/C refrigerant pressure is high, the signal value is near 5 V. The ECM converts the voltage signal to a pressure value. When pressure is too high or too low, the ECM will not allow the A/C compressor clutch to engage.

Actuators

Doors in the HVAC case assembly are used to control air flow. The HVAC control module operates the doors through the use of actuators, with one actuator being used for each door. The system has the following air control doors and associated actuators: mode, temperature, and recirculation.

Blower Motor

The blower motor speed control signal from the HVAC Control Module, battery positive and ground circuits enable the blower motor to operate. The blower motor control circuitry is integrated within the blower motor assembly. The HVAC control module provides a low side PWM signal to the blower motor to request a specific motor speed. The blower motor translates the PWM signal and drives the motor accordingly.

Rear Vision Camera

Important: The RVC camera is shipped loose in the cab for upfitter installation.

If equipped, the Rear Vision Camera (RVC) may help the driver park or avoid objects. Always check around the vehicle when parking or backing. When the vehicle is shifted into **R** (Reverse), the RVC displays an image of the area behind the vehicle in the infotainment display. The previous screen displays when the vehicle is shifted out of **R** after a short delay. To return to the previous screen sooner, press any button on the infotainment system, shift into **P**, or reach a vehicle speed of approximately 8 mph (12 km/h).

Refer to the GM Upfitter Integration Group website for mounting locations.

Refueling the Vehicle

The fuel fill port(s) is located on the driver side of the vehicle. If equipped with dual fuel tanks, each tank must be filled through its own fill port.

Supplemental Inflatable Restraint System

SIR System Overview

The Supplemental Inflatable Restraint (SIR) system supplements the protection offered by the seat belts. The SIR system contains an inflatable restraint sensing and diagnostic module (SDM), the airbags, seat belt pretensioners (retractor), and impact sensor. When the SDM detects a collision, it will process the information provided by the sensors to further support airbag or pretensioner deployment. The SDM will deploy the airbags and pretensioners if it detects a collision of sufficient force. If the force of the impact is not sufficient to warrant airbag deployment, the SDM may still deploy the seat belt pretensioners. The SDM contains a sensing device that converts vehicle velocity changes to an electrical signal. The SDM compares these signals to values stored in memory. If the signals exceed a stored value, the SDM will determine the severity of the impact and either cause current to flow through the frontal deployment loops deploying the frontal airbags and pretensioners, or it will deploy the pretensioners only. The SDM continuously monitors the deployment loops for malfunctions and illuminates the AIRBAG indicator if a fault is detected. The SDM performs continuous diagnostic monitoring of the SIR system electrical components. Upon detection of a circuit malfunction, the SDM will set a DTC and inform the driver by illuminating the AIRBAG indicator. The steering column and knee bolsters are designed to absorb energy and compress during frontal collisions in order to limit leg movement and decrease the chance of injury to the driver and passenger.

Inflatable Restraint Sensing and Diagnostic Module

The SDM is a microprocessor and the control center for the SIR system. The SDM contains internal sensors along with an external impact sensor mounted at a strategic location on the front of the vehicle. In the event of a collision, the SDM compares the signals from the internal and external impact sensors to a value stored in memory. When the generated signals exceed the stored value, the SDM will cause current to flow through the appropriate deployment loops to deploy the airbags. The SDM records the SIR system status when a deployment occurs and illuminates the AIRBAG indicator located in the instrument cluster.

Airbags

This vehicle contains 2 airbags. The 2 airbags are located in the steering wheel (single inflator) and instrument panel on the passenger side (single inflator). Airbags contain a housing, inflatable airbag, initiating device, canister of gas generating material and in some cases, stored compressed gas. The deployment loops supply current through the inflator modules to deploy the airbags. For moderate frontal collisions the airbags deploy at less than full deployment which consists of stage 1. The current passing through the airbag, ignites the material in the canister producing a rapid generation of gas and in some cases, the release of compressed gas. The gas produced from this reaction rapidly inflates the airbag. Once the airbag is inflated it

quickly deflates through the airbag vent holes and/or the airbag fabric. Each airbag is equipped with a shorting bar located in the connectors of the module. The shorting bar shorts the airbag deployment loop circuitry to prevent unwanted deployment of the airbag when it is disconnected.

Impact Sensor

There is one impact sensor which is located in the front of the vehicle. The impact sensor contains a sensing device which monitors vehicle acceleration to detect collisions that are severe enough to warrant airbag deployment. The impact sensor is not part of the deployment loop, but instead provides input to the SDM. The SDM contains a microprocessor that performs calculations using the measured inputs from acceleration and pressure sensors. When the generated calculations exceed the stored value, the SDM will cause current to flow through the deployment loops deploying the appropriate airbags.

Seat Belt Pretensioners

Important: Once a pyrotechnic pretensioner is activated it must be replaced.

The pyrotechnic pretensioner is the most sophisticated type of pretensioning device. The seat belt pretensioners for the driver and passenger consist of a housing, the seat belt retractor which is located in the B-pillar, seat belt webbing, an initiator and a canister of gas generating materials. The initiator is part of the seat belt pretensioner deployment loop. When the vehicle is involved in a collision of sufficient force, the SDM causes current to flow through the seat belt deployment loops to the initiator. Current passing through the initiator ignites the material in the canister producing a rapid generation of gas. The gas produced from this reaction deploys the seat belt pretensioners which removes all of the slack in the seat belts. Depending on the severity of the collision, the seat belt pretensioners may deploy without the frontal airbags deploying, or they will deploy immediately before the frontal airbags deploy. Each seat belt pretensioner is equipped with a shorting bar that is located in the connector of the seat belt pretensioner. The shorting bar shorts the seat belt pretensioner circuitry to prevent unwanted deployment of the seat belt pretensioner when the connector is disconnected.

Snow Plow

If a snow plow is added to the vehicle, the airbags should still work properly. The airbag systems were designed to work properly under a wide range of conditions, including snow plowing with vehicles that have the optional snow plow prep package — RPO VYU

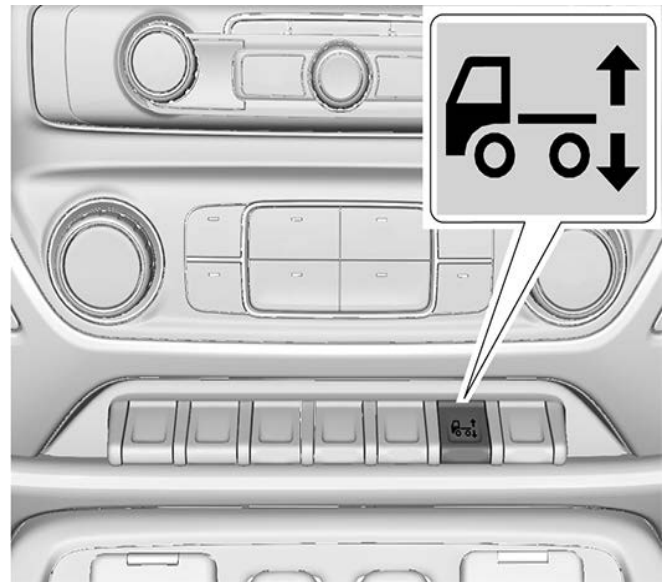
Do not change or defeat the snow plow's "tripping mechanism." If you do, it can damage the snow plow and the vehicle, and may cause an airbag deployment.

Suspension — Air Ride

Operation

If equipped, the Air Ride Suspension provides a smooth, shock and vibration free ride with a preset constant frame height. The air springs on the air ride suspension take the place of steel springs, which eliminates the need to overcome inter-leaf friction resulting in a minimum amount of road shock being transferred to the frame, cargo and suspension. The air ride suspension adjusts to load changes automatically, providing a low rate suspension with a light or no load condition, and a higher rate suspension with heavier loads.

Air Ride Suspension Dump Switch



5124391

Control button positioning may vary depending on equipment and options.

The air ride suspension system allows the rear suspension to be temporarily lowered by approximately 6 inches. The system is controlled by the Air Suspension Dump (ASD) switch in the center stack. This switch controls solenoids, which direct air to the suspension dump and height valve. Pressing the ASD switch when the vehicle is in **P** and the ignition is in the ON/RUN position releases air supplied to the rear suspension, lowering (dumping) the rear air suspension for loading. The indicator on the ASD switch illuminates. When the vehicle is shifted out of **P**, air is filled into the system and the indicator on the switch will turn OFF. Vehicles with air suspension have an AUX warning lamp immediately to the left of the ASD switch. The suspension may refill slowly if this lamp is ON.

Suspension — Front

Non-Driving Axle

The non-driving axle is a solid I-Beam type with knuckles attached by kingpins. By matching steering geometry with specific wheelbase lengths, tire scrub and premature tire wear are reduced.

The front axle has two primary functions:

- Support the front of the truck including the load.
- Provide good maneuverability through steering control.

Leaf Springs

Tapered leaf springs are used at the front axle. Parabolic tapered leaf springs are thicker in the middle than at the ends. Because of this design, these suspensions are able to use fewer spring leaves, which helps to reduce leaf-to-leaf friction and produces a smoother ride than flat multi-leaf springs.

Stabilizer Bar

The stabilizer bar reduces body roll while turning, keeping weight more evenly distributed above all wheels, improving traction and reducing tire wear.

Suspension — Rear

Multileaf Variable Rate Springs

This leaf spring design offers a variable deflection rate by changing the effective length of the spring with the use of a cam-type frame mounting bracket. As the spring deflects, due to increased load, the point of spring contact on the bracket moves toward the center of the spring, making it stiffer as the load increases. This type of rear suspension provides good stability and control.

Tires and Wheels

Tire/Certification Label

The Tire/Certification Label is typically located on the driver side door frame of the vehicle and indicates the size of the original equipment tires installed on each axle of the vehicle. The load rating of the tires installed on the vehicle at the time of production is at or in excess of the Gross Axle Weight Rating (GAWR) on the Tire/Certification Label. When replacing the tires be sure the replacement tire load rating (listed separately in pounds and kilograms on the tire sidewall for single or dual applications) multiplied by the number of tires on that axle is equal to or higher than the specified listed Steer Axle or Drive Axle GAWR. Failure to do so will adversely affect maximum load-carrying capacity. Tires with the same size specifications do not always have the same load specification. Dual tires should be matched using tires of equivalent size. Tires which differ more than 1/4 in (6 mm) in diameter or 3/4 in (19 mm) in circumference should not be mounted on the same dual wheel assembly.

Tire/Certification Label Legend

MFG. BY	DATE: MM-YYYY		GVWR: ____KG	
ASSEMBLED IN			____LB	
AXLE	GAWR	SUITABLE TIRE & RIM	TIRE PRESSURE (COLD)	
	KG	TIRE	RIM	SINGLE DUAL
	LB			KPA PSI KPA PSI
FRT	----	----	----	----
2ND	----	----	----	----
3RD	----	----	----	----
4TH	----	----	----	----
THIS VEHICLE CONFORMS TO ALL APPLICABLE FEDERAL MOTOR VEHICLE SAFETY STANDARDS IN EFFECT ON THE DATE OF MANUFACTURE SHOWN ABOVE.				
VIN	TYPE			

5152209

1. Gross Weight Rating of the Front Axle
2. Tire Size for Front Axle
3. Tire Size for Rear Axle
4. Gross Weight Rating of the Rear Axle

Tires — Lug and Rib Patterns

While a truck's application plays the primary role in selecting a tire tread pattern, there are really only two options, lug and rib. Lug patterns can be closed or open shoulder design, and are typically used on drive axles. Rib patterns can be straight or zigzagged and typically are used on steer and trailer axles. A straight rib pattern is designed for high mileage, good fuel economy and resistance to irregular wear. The zigzagged pattern offers additional biting edges for improved traction on wet road surfaces. Use tires of the same type on the same axle.

Tires

The vehicle can be equipped with the following:

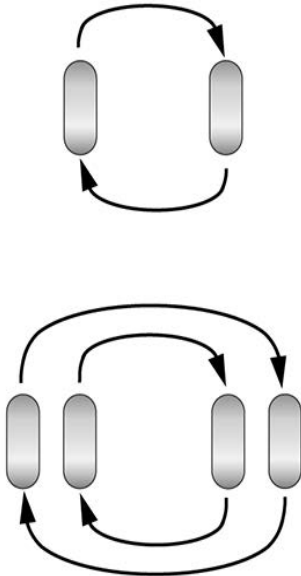
- **Tires:** Front, 225/70R19.5G Highway, Blackwall, Continental (Standard)
- **Tires:** Rear, 225/70R19.5G Highway, Blackwall, Continental (Standard)
- **Tires:** Front, 225/70R19.5G Highway, Blackwall, Goodyear (Available)
- **Tires:** Rear, 225/70R19.5G Highway, Blackwall, Goodyear (Available)
- **Tires:** Rear, 225/70R19.5G Traction, Blackwall, Continental (Available)
- **Tires:** Rear, 225/70R19.5G Traction, Blackwall, Goodyear (Available)
- **Tire:** Spare, Match Tire to Vehicle Equipment

Tire Rotation

Tires should be rotated every 7,500 mi (12,000 km). Tires are rotated to achieve a uniform wear for all tires. The first rotation is the most important. The outer tire on a dual wheel setup generally wears faster than the inner tire. Adjust the front and rear tires to the

recommended inflation pressure on the Tire and Loading Information label after the tires have been rotated.

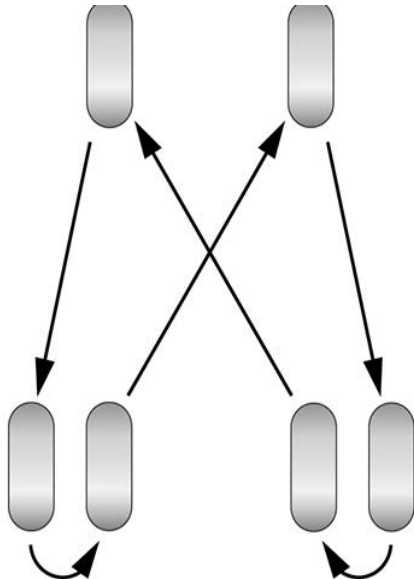
Tire Rotation Pattern — Aluminum Wheels



5152010

Vehicles with aluminum wheels have two unique wheels. They are aluminum front and rear outer wheels, and steel rear inner wheels. The aluminum wheels can only be rotated using the front and rear outer positions. The steel wheels can only be rotated on the rear inner positions. Use this rotation pattern when rotating tires that are mounted on aluminum wheels.

Tire Rotation Pattern — Steel Wheels



5151982

Use this rotation pattern when rotating tires that are mounted on steel wheels. **DO NOT** use this rotation pattern for tires mounted on aluminum wheels.

If equipped, the steel spare wheel can be used in any position in the event of a flat tire.

Wheels — Overview

While some steel wheels look similar and some aluminum alloy wheels look very similar, there is more of a difference in them than can normally be seen by the naked eye, when they are **already mounted on a vehicle**. The two basic types of commercial wheels are determined by how the wheel is centered on the hub. **Stud Piloted** wheels have tapered stud holes and the lug nuts have a matching taper. The centering of each lug nut in the stud hole of the wheel will cause the wheel to be centered on the hub. The hub hole in the wheel only serves to allow hub clearance. **Hub Piloted** wheels use the center hole of the wheel (hub bore) to fit over the matching size ridge on the hub. The wheel is centered on the hub by the hub bore. The lug nuts will have a flush face in contact with the wheel. The lug nuts only secure the wheel to the hub. Interchanging lug nuts between the two different style of wheels is NOT recommended and could cause damage to the wheel or more. To avoid surface damage on wheels and wheel trim, do not use strong soaps, chemicals, abrasive polishes, cleaners, or brushes. Use only GM approved cleaners. Do not drive the vehicle through an automatic car wash that uses silicone carbide tire/wheel cleaning brushes.

Wheel Size — Material — Color

Notice: On a vehicle that is equipped with aluminum wheels, the two front and two outside rear wheels are aluminum. The two rear inner wheels are steel.

The wheel selections are:

- **Wheels:** 19.5" x 6.75", Steel, Black Painted, 8-holes, Hub Piloted (Standard)
- **Wheels:** 19.5" x 6.75", Steel, Grey Painted, 8-holes, Hub Piloted (Available)
- **Wheels:** 19.5" x 6.75", Steel, White Painted, 8-holes, Hub Piloted (Available)
- **Wheels:** 19.5" x 6.75", Aluminum, 8-holes, Hub Piloted (Available)
- **Wheel:** 19.5" x 6.75", Spare, Steel, Black, 8-holes, Temporarily Mounted on Frame, Hub Piloted (Available)

Traction Control System

System Operation

The vehicle has a Traction Control System (TCS). This system helps limit wheel spin and assist the driver in maintaining control, especially on slippery road conditions. TCS activates if it senses any of the drive wheels are spinning or beginning to lose traction. When this happens, TCS applies the brakes to the spinning wheel(s) and reduces engine power to assist in limiting wheel spin.

If the cruise control is being used and traction control begins to limit wheel spin, the cruise control will disengage. Cruise control may be turned back ON when road conditions allow. The TCS turns ON automatically when the vehicle is started and begins to move. The system may be heard or felt while operating or while it is performing diagnostic checks. This is

normal and does not mean there is a problem with the vehicle. It is recommended to leave TCS ON for normal driving conditions, but it may be necessary to turn TCS OFF if the vehicle gets stuck in sand, mud, ice, or snow.

Turning the System OFF and ON



5181620

The control button for the TCS (shown) is on the center stack control panel.

- To turn TCS OFF, press and release the button. The Traction OFF light displays in the instrument cluster. The appropriate message will display in the DIC.
- To turn TCS ON, press and release the button. The Traction OFF light displayed in the instrument cluster will turn OFF.

Transmission Allison® 6-Speed

Notice: The Allison® Transmission and TCM will be warrantied by Allison® and will have to be taken to an Allison® Authorized Distributor and Dealer Location for repair or replacement.

Transmission Component and System Description

The Allison® 6-speed fully automatic transmission delivers solid fuel efficiency, superior performance and outstanding vehicle safety. If equipped, Allison's Power Take-Off (PTO) provision, which draws energy from the truck's running engine, enables the operator to power attachments and accessories with ease.

Depending on the vehicle, the following transmissions are used on the 2WD and 4WD applications:

- Allison® 1700 with double overdrive
- Allison® 1750 with double overdrive
- Allison® 2700 with double overdrive

For additional transmission application information, refer to the section titled: **Gross Combined Weight Rating Table**

Emergency Vehicle Series™

Allison Emergency Vehicle Series™ offers a complete family of automatic transmissions to meet the special needs of fire and emergency vehicles.

Highway Series™

Allison Highway Series™ automatic transmission are designed to meet all the horsepower needs of strictly on-highway vehicles that do not require a PTO operation.

Motorhome Series™

Allison Motorhome Series™ automatic transmissions are designed to provide enhanced performance and exceptional value to the motorhome market.

Rugged Duty Series™

Allison Rugged Duty Series™ automatic transmissions are suited for any vehicle that operates on/off highway and requires PTO operation.

Automatic Transmission Shift Lock Control

The Automatic Transmission Shift Lock Control System is a safety device that prevents an inadvertent shift out of **P** when the engine is running. The driver must press the brake pedal before moving the shift lever out of the **P** position. The shift lock control solenoid is permanently grounded. The BCM supplies voltage to the automatic transmission shift lock control solenoid, releasing the mechanical lock on the shift lever as the solenoid energizes. The energized solenoid allows the driver to move the shift lever out of the **P** position. When the brake pedal is not applied, the BCM turns the control voltage output of the shift lock control solenoid OFF, de-energizing the shift lock control solenoid. When the transmission is in **P**, the de-energized shift lock control solenoid will prevent shifting as the lever is mechanically locked in **P**.

The system consists of the following components:

- The Automatic Transmission Shift Lock Solenoid (serviced as the Automatic Transmission Shift Lock Actuator)
- The ECM
- The Body Control Module (BCM)

Transfer Case — Four-Wheel Drive

When equipped with four-wheel drive, the engine's driving power can be sent to all four wheels for extra traction.

Manual Locking Hubs



5141552

The locking hubs are on each end of the front axle and must be manually turned to LOCK **before** the four-wheel drive modes can be used. The hubs may remain in the LOCK position when road surface traction conditions are variable or it is temporarily unsafe to exit the vehicle and unlock them. When four-wheel drive is no longer needed, turn the locking hubs to FREE. If the hubs are locked when in two-wheel drive, driveline vibration may be experienced.

Electronic Transfer Case Switch



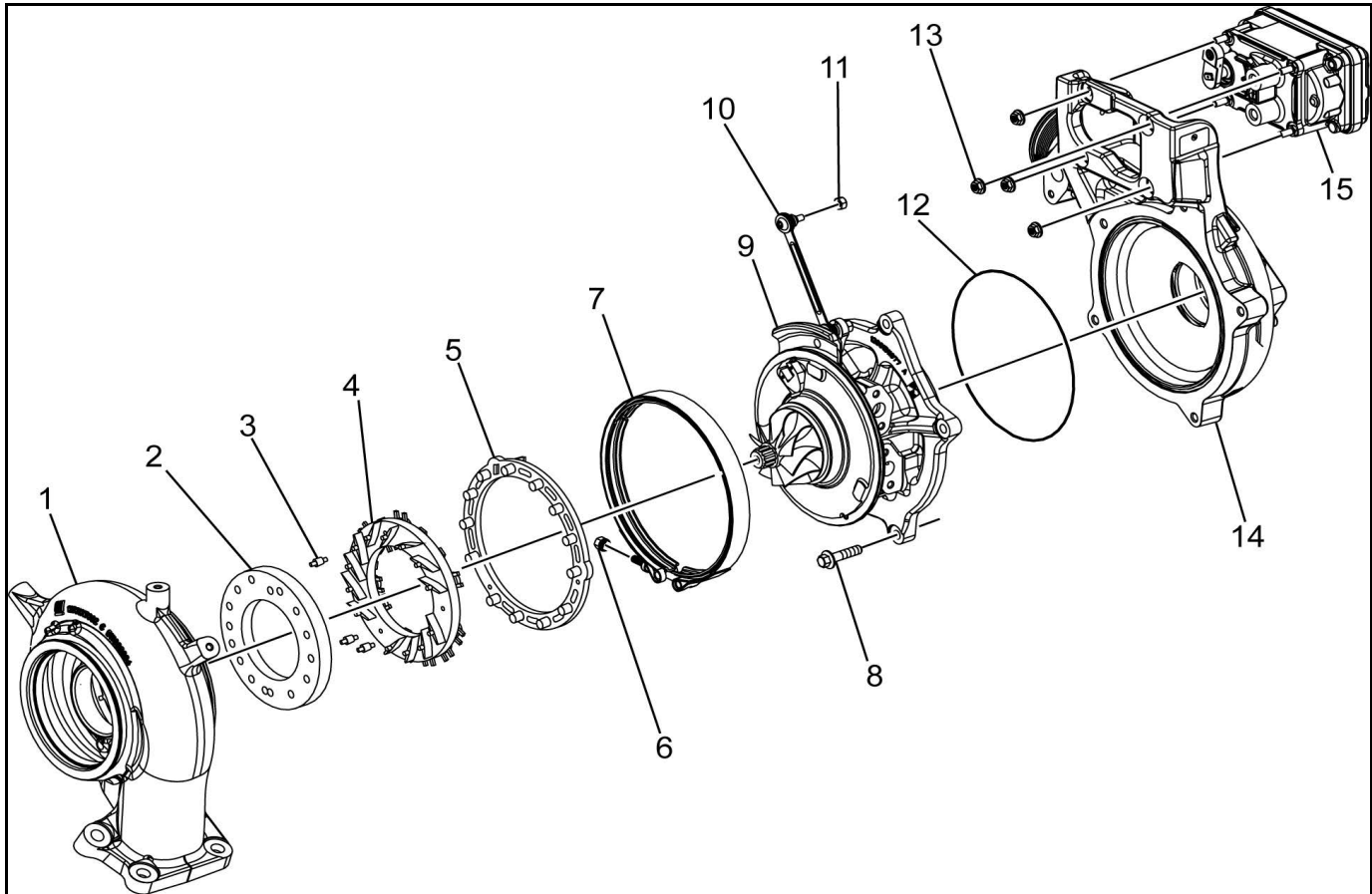
5141562

Caution: Shifting the transmission into gear before the requested mode indicator light has stopped flashing could damage the transfer case.

All of the lights on the transfer case switch will flash ON then OFF momentarily when the ignition is turned ON. The light that remains ON indicates the current state of the transfer case. The indicator mark on the switch must line up with the indicator light before a shift can be commanded. With the ignition ON, rotate the switch located to the left of the steering wheel, to shift into and out of four-wheel drive for extra traction. The light will flash indicating that the shift is in progress. When the shift is completed the new position will be illuminated. If the transfer case cannot complete a shift command, it will go back to its last chosen setting.

Turbocharger System Description

Variable Vane Turbocharger Overview



4584300

Legend

- | | |
|-------------------------------|--------------------------------|
| (1) Turbine Housing | (9) Core Assembly |
| (2) Lower Vane Ring | (10) Linkage Assembly |
| (3) Vane Ring Assembly Spacer | (11) Linkage Assembly Nut |
| (4) Upper Vane Ring Assembly | (12) Compressor Housing O-Ring |
| (5) Adjusting Ring Assembly | (13) Actuator Nut |
| (6) V-Band Nut | (14) Compressor Housing |
| (7) V-Band | (15) Actuator |
| (8) Compressor Housing Bolt | |

The turbocharger increases engine power by pumping compressed air into the combustion chambers, allowing a greater quantity of fuel to combust at the optimal air/fuel ratio. The turbine spins as exhaust gas flows out of the engine and over the turbine blades, and turns the compressor wheel at the other end of the turbine shaft, pumping more air into the intake system. This is a BorgWarner single stage, water cooled, variable geometry turbocharger (VGT) capable of producing 220 kPa (31.9 psi) boost pressure.

The ECM communicates with the turbocharger vane position actuator via the controller area network (CAN) bus to control the turbocharger vanes. The smart actuator incorporates a brushless motor and is mounted on top of the turbocharger. It is connected to the vanes by a linkage rod. The vanes are used to vary the amount of boost pressure and can control the boost pressure independent of engine speed. The vanes mount to a unison ring which is rotated to change the vane angle. The ECM will vary the vane angle which adjusts the boost dependent upon the load requirements of the engine.

When the actuator arm is in the vertical top rest position the turbocharger vanes are fully open. When the actuator arm is in the horizontal bottom of travel position the turbocharger vanes are fully closed.

The turbocharger vanes are normally open when the engine is not under load. However, the ECM will often close the turbocharger vanes to create back pressure to drive exhaust gas through the Exhaust Gas Recirculation (EGR) valve as required. At extreme cold temperatures, the ECM may close the vanes at low load conditions in order to accelerate engine coolant heating.

The turbocharger is also utilized as a component of the exhaust brake system. Under certain conditions, the ECM will automatically close the turbocharger vanes to build back pressure in the exhaust, which reduces engine speed and slows the vehicle without applying the brakes.

During regeneration, the ECM will vary the turbocharger vanes to assist with the exhaust system warm-up, and to maintain proper engine exhaust temperatures needed to properly regenerate the Diesel Exhaust Particulate Filter (DPF).

Each time the ignition is turned OFF, the turbocharger vane position actuator performs a learn procedure. The actuator arm sweeps the turbocharger vanes from fully open to fully closed to obtain a count value. This value is compared to the previous value to ensure proper vane position. Following the learn sweep the actuator sweeps the vanes two more times to clean off combustion soot.

Vehicle Hoisting/Lifting

The Service Department will need a 25,000 pound Hoist/Lift to raise the vehicle. For safety reasons, DO NOT use jackstands or floor jacks.

Vehicle Personalization



5186413

Some vehicle features can be customized using the Settings menus on the infotainment system. The Settings menus may include Time and Date, Language, Radio, Vehicle, Bluetooth, Apple CarPlay, Android Auto, Voice, Display, Return to Factory Settings, Software Information, Wi-Fi, and more.

1. Select Settings on the Home page.
2. Select the desired menu item.
3. Select the desired feature and setting. Settings are saved automatically.
4. . Select BACK to exit each menu.

Bluetooth®

The Bluetooth® system allows users with a Bluetooth® enabled cell phone to make and receive hands-free calls using the vehicle audio system and controls. Before using a Bluetooth® enabled device in the vehicle, it must be paired with the in-vehicle Bluetooth® system. The pairing process is disabled when the vehicle is moving. When using the Bluetooth system, sound comes through the vehicle's front audio system speakers and overrides the audio system. Use the volume control knob during a call to change the volume level. The system maintains a minimum volume level. Not all devices will support all functions.

Accessory Power Outlets — 110 Volt Power Outlet — USB Ports

Depending on the type of seat



5186598

- Vehicles with bench seats have an accessory power outlet and 110 volt power outlet that are located on the lower-center of the instrument panel. USB ports and an accessory power outlet are located in the center seat storage compartment.



5186733

- Vehicles with bucket seats have USB ports, accessory power outlets and a 110 volt power outlet that are located on the center console. USB ports and an accessory power outlet also are located in the center console storage compartment.

Vehicle Label — Incomplete

A vehicle-specific Incomplete Vehicle Label is attached to the driver-side door frame. The upfitter will add an additional Label upon completion of the work to the vehicle, directly above the Incomplete Vehicle Label.

Curb Weight

Curb Weight is the weight of a vehicle without the driver, passengers or cargo but including the maximum capacity of fuel, oil, coolant and other items of standard equipment.

Gross Axle Weight Rating

Note: It is important to remember that a vehicle's GAWR is not a measurement of how much weight each axle is actually carrying at any given time. The actual amount of weight each axle is carrying is the gross axle weight or GAW.

A vehicle's GAWR is the specific weight determined by the manufacturer to be the maximum allowable weight that can be placed on an individual axle. Front and rear axles have individual gross axle weight ratings. The GAWR is a weight limit for each of the vehicle's axles which is determined by the manufacturer. A vehicle's axles should never be loaded beyond the manufacturer's listed GAWR. The GAWR includes the

weight of the vehicle, passengers, cargo and trailer tongue weight (if equipped). Of course, all of this weight is distributed between two axles.

Gross Combined Weight Rating

Note: It is important to remember that the GCWR is not an actual measurement of the weight of a tow vehicle and a trailer, but rather the combined maximum weight limit that the manufacturer has set for the two vehicles once attached.

A specific vehicle's GCWR is based on parameters established by chassis manufacturers. The manufacturer makes an assessment in accordance with SAE International test protocols, determining maximum GCWR. Additionally, the OEM runs stringent tests based on internal requirements which may include testing total GCWR braking capability using only the towing vehicle chassis braking system. GCWR is the total weight of the truck pulling the trailer and the trailer itself. The truck chassis dictates proper GCWR for safe operation of the combination truck and trailer. GCWR is the total allowable weight of the completely loaded vehicle and trailer including fuel, passengers, cargo, equipment, and accessories. Do not exceed the GCWR for the vehicle.

- **4500HD Regular/Crew Cab:** GCWR 26,000–30,000 lbs.
- **5500HD Regular/Crew Cab:** GCWR 26,000–30,000 lbs.
- **6500HD Regular/Crew Cab:** GCWR 26,000–30,000 lbs.

Gross Combined Weight Rating — Calculating

To check that the weight of the vehicle and trailer are within the GCWR for the vehicle, follow these steps:

- Start with the "curb weight" from the trailering information label.
- Add the weight of the trailer loaded with cargo and ready for the trip.
- Add the weight of all passengers.
- Add the weight of all cargo in the vehicle.
- Add the weight of hitch hardware such as a draw bar, ball, load equalizer bars and sway bars.
- Add the weight of any accessories or aftermarket equipment added to the vehicle.

The resulting weight cannot exceed the GCWR of the vehicle.

The gross combined weight can also be confirmed by weighing the truck and trailer on a public scale. The truck and trailer should be loaded for the trip with passengers and cargo.

Gross Vehicle Weight Rating

Note: It is important to remember that the GVWR is not a measurement of how much a vehicle actually weighs. A vehicle's actual weight is the gross vehicle weight, or GVW.

A truck's GVWR is the maximum weight rating established by the chassis manufacturer. The OEM will determine the GVWR based on test results and vehicle dynamic performance to ensure a safe, reliable truck. Safety standards that apply to braking, vehicle stability,

and chassis manufacturer internal standards for durability, dynamic stability and handling can restrict GVWR to less than the sum of the gross axle weight ratings (GAWR) for that vehicle. The GVWR is calculated by adding the vehicle's listed curb weight, the weight of any optional accessories, cargo, the trailer tongue weight (if equipped) and passengers.

- **4500HD Regular/Crew Cab:** GVWR 15,000–16,500 lbs.
- **5500HD Regular/Crew Cab:** GVWR 17,500–19,500 lbs.
- **6500HD Regular/Crew Cab:** GVWR 21,000–22,900 lbs.

Gross Vehicle Weight

Gross Vehicle Weight (GVW) is the total weight of the truck and payload at a point in time and will vary. The GVW includes the vehicle's listed curb weight, cargo, equipment, trailer tongue weight (if equipped) and passengers. Vehicle options, passengers, cargo, and equipment reduce the maximum allowable tongue weight the vehicle can carry, which also reduces the maximum allowable trailer weight.

Gross Combined Weight Rating Table

Use this table to determine the Gross Combined Weight Rating (GCWR) based on the model and equipment.

Vehicle	Transmission	Axle Ratio	Maximum Trailer Weight (2)	GCWR*
4500/5500/ 6500HD 2WD	Allison® 1700	4:10/4:30/4:56/4.88	(1)	26,000 lbs (11,818 kg)
4500/5500/ 6500HD 2WD	Allison® 1750	4:10/4:30/4:56/4.88	(1)	30,000 lbs (16,636 kg)
6500HD 2WD	Allison® 2700	4:10/4:30/4:56/4.88	(1)	26,000 lbs (11,818 kg)
4500/5500/ 6500HD 4WD	Allison® 1700	4:30	(1)	26,000 lbs (11,818 kg)
4500/5500/ 6500HD 4WD	Allison® 1750	4:30	(1)	30,000 lbs (16,636 kg)
6500HD 4WD	Allison® 2700	4:30	(1)	26,000 lbs (11,818 kg)

*The GCWR is the total allowable weight of the completely loaded vehicle and trailer including passengers, cargo equipment and conversions. The GCWR for the vehicle **must not** be exceeded.

(1) Maximum Trailer Weight cannot be provided because total vehicle weight is unknown.

(2) Choose an appropriate hitch and load the truck and trailer within the limits of GCWR, GVWR, and GAWR (of the Rear Axle).

Integrated Trailer Brake Control

The Integrated Trailer Brake Control (ITBC) system can be used to adjust the amount of power output, or Trailer Gain, available to the trailer brakes. The control panel is located on the left side of the instrument panel. ITBC information is displayed on the DIC.

Operation



5182686

To operate the system:

- Squeeze the levers together on the control panel (the left lever does not move) to manually apply the trailer brakes.
- Adjust the Trailer Gain by pressing the +/- adjustment buttons on the control panel.

Roadside Assistance

Overview

Owners of the new 2019 Chevrolet Silverado Chassis Cab Medium Duty vehicles are automatically enrolled in the Chevrolet Roadside Assistance program for up to 5 years/100,000 miles, whichever occurs first, at no expense to you. Chevrolet's Roadside Assistance toll-free number is staffed by a team of trained advisors who are available 24 hours a day, 365 days a year, to contact a service provider for light services such as fuel delivery, jump-starts, flat tire and lock-outs or to make arrangements to have the vehicle towed to the nearest Chevrolet Dealer for any repairs. Services are provided for the duration of the vehicle's powertrain warranty. For U.S.-purchased vehicles, call 1-888-899-1327. (Text Telephone (TTY): 1-888-889-2438).

OnStar® Roadside Assistance

If you have a current OnStar® Safety & Security plan, push the blue OnStar® button or red Emergency button to get the help you need. An OnStar® advisor will use GPS technology to pinpoint the vehicle location and contact the nearest service provider. To learn more about OnStar® services, push the blue OnStar® button or click on: or call 1-888-4-ONSTAR (1-888-466-7827).

GM Upfitter Integration Group

Important: *When adding non OE content to a vehicle, contact the GM Upfitter Integration Group for assistance if needed.*

1. Click on: to visit the GM Upfitter Integration Group Home Page. Scroll to the bottom of the page and click on: **Contact Us / Request Data**
2. A request form will appear in a new window. To request technical assistance from the GM Upfitter Integration Group, complete and submit the form.

Warranty Coverage at a Glance

- **Bumper-to-Bumper:** (Includes Tires) Coverage is for the first 3 years or 36,000 miles, whichever comes first.
- **Powertrain:** 6.6 Duramax® Turbo-Diesel Engine coverage is provided for 5 years or 100,000 miles, whichever comes first.
- **Powertrain:** The General Motors Powertrain warranty on the Silverado chassis-cab 4500HD, 5500HD and 6500HD trucks **excludes** the Allison® transmission and Transmission Control Module (TCM). Investigate Vehicle History (IVH) will display this as: Powertrain Ltd. Wty. (Excludes Trans). The Allison® Transmission and TCM will be warrantied by Allison® and will have to be taken to an Allison® Authorized Distributor and Dealer Location for repair or replacement.
Find an Allison® Authorized Service Facility near you by searching the Sales + Service Locator. Click on:
 - **Sheet Metal:** Corrosion coverage is for the first 3 years or 36,000 miles, whichever comes first.
 - **Sheet Metal:** Rust-through coverage is for the first 6 years or 100,000 miles, whichever comes first.

Wireless Charging



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The Wireless Charging system for mobile devices is located on the storage tray on top of the center console (Crew Cab bucket seat equipped models only).

1. The vehicle must be ON or Retained Accessory Power (RAP) must be active.
2. Remove all objects from the charging pad.
3. Place the device, face up, against the rear alignment rib on the charge pad.
4. The charging symbol will appear on the infotainment screen when charging. If the device is not charging, remove it for 3 seconds and rotate it 180 degrees.

Special Tools

The following new tools were released for the 2019 Silverado 4500HD, 5500HD and 6500HD chassis cab medium duty trucks:

Special Tools — Tool Number and Description

Tool Number	Description
EN-52539	Holder, Fan Clutch Pulley — Engine L5D and L5P
EN-52538	Compressor, Tensioner Strut — Engine L5D
J-39197-21	T&B Flex Connector (incl. J-39197-1 x3) — Electrical for Allison Transmission
J-39197-22	0.062 AMP Male Connector (incl. J-39197-2 x3) — Electrical for Allison Transmission
J-39197-23	280 Series Flex Connector (incl. J-39197-3 x3) — Electrical for Allison Transmission
J-47277	4th Gen TCM Terminal Test Probe (Orange) — Electrical for Allison Transmission
GE-52582	Drain Hose (w/ Quick Connect and Valve) — Engine Cooling
DT-52713	Transfer Case 7-way Breakout Harness — Driveline
DT-52709	Pinion Seal Installer (Front) — Driveline Dana
DT-52710	Pinion Seal Installer (Rear) — Driveline Dana
PN 20-2977-2 (8-Lug, 19.5 inch Stud Kit)	Wheel Balancer Adapter — Will Ship Essential
Special Tool Loan Program	
CH-52708	Parking Brake Adjustment Tool — Brakes
CH-52707	Installer / Remover, Bushing (1.35" O.D.) — Chassis
CH-52706	Installer, 1.39" I.D. x 1.76" O.D. — Chassis
CH-52705	King Pin Bushing Service Kit — Chassis
DT-52739	Transfer Case Support Adapter — Transfer Case (Meritor)

Training Course

Training Courses — Description — Number and Course Name

Description	Number and Course Name
New Model Features	#90319.50W: 2019 Medium Duty Silverado 4500HD, 5500HD, & 6500HD New Model Features

Version Information

Version	1
Modified	Released December 18, 2018

Trademark Footnotes

ACDelco® is a registered trademark of General Motors LLC

Allison® is a registered trademark of Allison Transmission

– Emergency Vehicle Series™ is a trademark of Allison Transmission

– Highway Series™ is a trademark of Allison Transmission

– Motorhome Series™ is a trademark of Allison Transmission

– Rugged Duty Series™ is a trademark of Allison Transmission

Android™ is a trademark of Google LLC .

Android Auto™ is a trademark of Google LLC

Apple® is a registered trademark of Apple Inc.

Bluetooth® is a registered trademark Owned by Bluetooth SIG, Inc.

Bosch® is a registered trademark of Robert Bosch GmbH, Germany

CarPlay™ Software Feature is a trademark of Apple Inc.

Duramax® is a registered trademark of General Motors LLC (United States)

Duramax™ is a trademark of General Motors LLC

Goodyear® is a registered trademark of The Goodyear Tire & Rubber Company

Hydro-Max™ is a trademark of Robert Bosch GmbH, Germany

LTE™ is a trademark of the European Telecommunications Standards Institute (ETSI)

OnStar® is a registered trademark of OnStar, LLC

Speedpass+™ is a trademark of Exxon Mobil Corporation

Wi-Fi® is the registered trademark of the Wi-Fi Alliance

