Service Bulletin

Bulletin No.: 19-NA-091
Date: June, 2019

INFORMATION

Subject: 2020 Chevrolet Silverado and GMC Sierra 2500HD-3500HD New Model Features

Brand:	Model:	Model Year:		VIN:		Engine:	Transmission:
		From:	To:	From:	To:		
Chevrolet GMC	Silverado 2500HD-3500HD Sierra 2500HD-3500HD	2020		—		6.6L, V8, SIDI, VVT, Cast Iron, Gasoline — RPO L8T Duramax® 6.6L V8, DI, Turbocharged Diesel, GEN 5, VAR. 1 — RPO L5P	6-Speed Automatic 6L90, HMD, — RPO MYD Allison® 10-Speed Automatic 10L1000, GRX, GEN 1, VAR 1 — RPO MGM **OR** Allison® 10-Speed Automatic 10L1000, GRX, GEN 2, VAR 2 with PTO — RPO MGU

Involved Countries and Regions	North America, South America, Israel and Middle East

Overview

Bulletin Purpose

This purpose of this bulletin is to introduce the completely new 2020 Chevrolet Silverado and GMC Sierra 2500HD-3500HD pickup trucks. This bulletin will help the Service Department Personnel become familiar with the all-new 6.6L V8 — RPO L8T gasoline engine equipped with the 6-speed 6L90 automatic transmission, and the Duramax® 6.6L V8 — RPO L5P diesel engine equipped with the all-new Allison® Branded - General Motors manufactured 10-speed automatic transmission with an available integrated PTO option, the brake system, SIR system, and other general information for these vehicles.

Available in ¾-ton 2500, 1-ton 3500 single rear wheel, and 1-ton 3500 dual rear wheel configurations with 2WD or 4WD. These trucks have at least 10 inches (25.4 cm) of ground clearance, with an improved approach angle, and a repositioned diesel exhaust fluid (DEF) tank on the diesel models enabling additional ground clearance.

The trucks are 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 Inductive Charging for capable Portable Wireless Devices and Bluetooth® capability. They also support the Apple® CarPlay™ software feature and Android™ Auto™ application.

Additional highlights include:

- A modular front on the trucks enables easier mounting of a snowplow.
- Advanced cooling system for vehicles equipped with the Duramax® 6.6L — RPO L5P. Cooling capacity is increased by use of a larger radiator, an immense cooling fan, and by improving the air induction system. A dual-path intake system draws dense, cool air through both the hood scoop and the front grille in order to optimize performance.
- Available 120 V alternating current power outlet located at the rear of the box. It can be used to plug in electrical equipment that uses a maximum of 150 watts.

- Available Autotrac Active 2-speed transfer case on 4WD models that electronically controls “4 Auto” mode.
- Available dual alternators on both engine options make it easy to power any accessories needed for commercial applications.
- Available Power Up/Down Tailgate (Silverado) that raises or lowers using the key fob, interior button or the touchpad on the tailgate.
- Silverado provides BedSteps located in front of the rear wheel openings allowing easier access from the side of the vehicle. The Sierra is equipped with the same equipment, however they are known as Bed side steps. Both complement the integrated CornerSteps in the rear bumper of the vehicles that have increased in size also to improve access to the cargo area.

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- GMC’s innovative and exclusive MultiPro Tailgate is standard on SLT, AT4, and Denali models and can be configured and used in six different ways, including as a step and a load stop for long items.

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- Other features include an easy access engine coolant block heater outlet, easy to fill diesel exhaust fluid (DEF) tank with its opening inside of the fuel door.
- Sierra has 12 corner tie-downs.
- Silverado has 12 fixed tie-down rings, with the corner rings rated at 500 pounds (227 kg) and the ability to add up to nine accessory tie downs.
- Vehicles have a Trailering Info Label placed on the driver’s door jamb which identifies the truck’s specific trailering information, including curb weight, GVWR, GCWR, maximum payload, maximum tongue weight and rear GAWR.
- Vehicles equipped with the Duramax® 6.6L V-8 Turbocharged engine and the 10-speed automatic transmission provide a 52 percent increase in maximum towing capability to 35,500 pounds (16,103 kg) on properly equipped models.

Brakes

ABS Description and Operation

The electronic brake control module (EBCM) and the brake pressure modulator are serviced separately. The brake pressure modulator uses a four circuit configuration to control hydraulic pressure to each wheel independently.

Depending on options, the following vehicle performance enhancement systems may be provided:

- ABS
- Traction Control
- Stability Control
- Dynamic Rear Proportioning
- Hill Descent Control System
- Hill Hold Start Assist
- Hydraulic Brake Assist
- Intelligent Brake Assist

- Trailer Brake Control System
- Trailer Sway Control

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 as needed. 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.

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.

Traction Control

When drive wheel slip is noted, the EBCM will enter Traction Control (TC) mode. First, the EBCM requests the engine control module (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, 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. TC can be manually disabled or enabled by pressing the TC switch.

Stability Control

Stability Control provides added stability during aggressive maneuvers. Yaw rate is the rate of rotation about the vehicle's vertical axis. The stability control is activated when the EBCM determines that the desired yaw rate does not match the actual yaw rate as measured by the yaw rate sensor. The desired yaw rate is calculated by the EBCM using the following inputs: steering wheel position, vehicle speed and lateral acceleration. The difference between the desired yaw rate and the actual yaw rate is the yaw rate error, which is a measurement of oversteer or understeer. When a yaw rate error is detected, the EBCM attempts to correct the vehicle's yaw motion by applying brake pressure to one or more of the wheels. Stability control activations generally occur in turns during aggressive driving. When braking during stability control activation, the brake pedal may pulsate.

Dynamic Rear Proportioning

The dynamic rear proportioning is a control system that replaces the mechanical proportioning valve. Under certain driving conditions the EBCM will reduce the rear wheel brake pressure by commanding the appropriate solenoid valves ON and OFF.

Hill Descent Control

The Hill Descent Control system allows a smooth and controlled hill descent in rough terrain without the driver needing to touch the brake pedal. The vehicle will automatically decelerate to a low speed and remain at that speed while activated. Some noise or vibration from the brake system may be apparent when the system is active. The descent control system may be activated, if equipped, by pressing the button on the console. To activate, press the button when traveling at speeds of less than 30 mph (50 km/h). To deactivate, press the button on the console, the brake pedal, or the accelerator. Descent control enables the vehicle to descend using the ABS to control each wheel's speed. If the vehicle accelerates without driver input, the system automatically applies the brakes to slow the vehicle down to the desired speed.

Hill Hold Start Assist

The Hill Hold Start Assist allows the driver to launch the vehicle without a roll back while moving the foot from the brake pedal to the accelerator pedal. The EBCM calculates the brake pressure, which is needed to hold the vehicle on an incline and locks that pressure for a certain time by commanding the appropriate solenoid valves ON and OFF when the brake pedal is released. Hill hold start assist is activated when the EBCM determines that the driver wishes to move the vehicle up-hill, either forward or in **R**.

Hydraulic Brake Assist

The hydraulic brake assist function is designed to support the driver in emergency braking situations. The EBCM receives inputs from the brake pressure sensor and when it senses an emergency braking situation, it will actively increase the brake pressure to a specific maximum.

Intelligent Brake Assist

Intelligent brake assist is designed to provide limited braking to help prevent front and rear low speed collisions. The EBCM receives inputs from the brake pedal position sensor, wheel speed sensors, short range radar and ultrasonic sensors in order to detect a collision. When the EBCM calculates a possible collision, it will actively increase the hydraulic brake pressure to apply the brakes.

Trailer Brake Control System

A trailer brake control system is used to control the amount of trailer braking power that is made available to trailers with brakes that require a controlled output electrical signal for actuation. The trailer brake control system determines the trailer brake type (Electric Brake or Electric Over Hydraulic Brake) automatically.

Trailer Sway Control

Trailer sway control will detect any vehicle yaw instability, caused by an attached trailer. When instability is detected, the EBCM attempts to correct the vehicle's yaw motion by applying brake pressure to one or more of the wheels as needed. The engine torque may be reduced also, if it is necessary to slow down the vehicle.

Engine 6.6L V8 — RPO L8T

Overview

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Typical views of the 2020 6.6L V8 gasoline engine

This new, more powerful engine is being produced by General Motors for use in the new 2500HD, 3500HD pickup trucks. It is equipped with spark ignited direct injection (SIDI) for greater performance and increased fuel efficiency, with 22 percent more torque and up to 18 percent more towing capability when compared to the previous 6.0L V8 — RPO L96 gasoline engine.

Engine Features and Specifications

- **Bore/Stroke:** 4.064-inches (103.25 mm) / 3.858-inches (98 mm).
- **Compression Ratio:** 10.75:1
- **Cylinder Block:** Cast iron with nodular iron main caps.
- **Cylinder Head:** The cylinder heads are made of cast aluminum for lighter weight and rapid heat dissipation, with overhead-valve, two valves per cylinder and variable valve timing.
- **Electronic Ignition System:** The electronic ignition system produces and controls the high energy secondary spark. This spark ignites the compressed air/fuel mixture at precisely the correct time, providing optimal performance, fuel economy, and control of exhaust emissions. The ECM collects information from the crankshaft position sensor and camshaft position sensor to control the sequence, dwell, and timing of the spark.
- **Engine Oil Capacity with Filter:** 8 Quarts (7.6 L)
  Engine Oil Capacity without Filter: 7.5 Quarts (7.1 L)
- **Firing Order:** 1-8-7-2-6-5-4-3
- **Fuel System:** The fuel system is an electronic returnless on-demand design, which reduces the internal temperature of the fuel tank by not returning hot fuel from the engine to the fuel tank.

- **Fuel:** GM recommends the use of TOP TIER Gasoline to keep the engine clean and reduce deposits.
- **Horsepower:** 401 hp (299 kW) @ 5200 RPM (SAE certified).

  Torque: 464 lb-ft (629 Nm) @ 4000 RPM (SAE certified).

Engine Controls — Components

Some of the engine controls components and their operation are as follows:

Camshaft Position Actuator System

The camshaft position actuator system is used for a variety of engine performance enhancements. These enhancements include lower emission output through exhaust gas recirculation (EGR) control, a wider engine torque range, improved fuel efficiency, and improved engine idle stability. The CMP actuator system which is controlled by the ECM, accomplishes these enhancements by controlling the valve timing relative to piston position.

Camshaft Position Actuator System Operation

The ECM sends a pulse width modulated signal to a CMP actuator solenoid in order to control the amount of engine oil flow to a camshaft actuator passage. There are 2 different passages for oil to flow through, a passage for CAM advance and a passage for CAM retard. The camshaft actuator is attached to the front of the camshaft, and is hydraulically operated in order to change the angle of the camshaft relative to the crankshaft position.

Camshaft Position Sensor

The camshaft position sensor (CMP) detects magnetic flux changes between the four narrow and wide tooth slots on the reluctor wheel. The camshaft position sensor provides a digital ON/OFF DC voltage of varying frequency per each camshaft revolution. The ECM will recognize the narrow and wide tooth patterns to identify camshaft position, or which cylinder is in compression and which is in exhaust. The information is then used to determine the correct time and sequence for fuel injection and ignition spark events.

Crankshaft Position Sensor

The crankshaft position sensor (CKP) is an internally magnetic biased digital output integrated circuit sensing device. The sensor detects magnetic flux changes of the teeth and slots of the reluctor wheel on the crankshaft. The reluctor wheel is spaced at 60-tooth spacing, with two missing teeth for the reference gap. The reference gap is used to identify the crankshaft position at each start-up. The ECM uses each crankshaft position signal pulse to determine crankshaft speed position, to determine the camshaft relative position to the crankshaft, to control camshaft phasing, and to detect cylinder misfire.

Electronic Ignition System

The electronic ignition (EI) system produces and controls the high energy secondary spark. This spark ignites the compressed air/fuel mixture at precisely the correct time, providing optimal performance, fuel economy, and control of exhaust emissions. The ECM utilizes information from the CKP, CMP and knock sensor (KS) to control the sequence, dwell, and timing of the spark.

Engine Misfire Detection

The crankshaft position sensor is used to determine when an engine misfire is occurring. The camshaft position sensor is used to determine which cylinder is misfiring. By monitoring variations in the crankshaft rotation speed for each cylinder, the ECM is able to detect individual misfire events. For accurate detection of engine misfire, the ECM must distinguish between crankshaft deceleration caused by actual misfire and deceleration caused by rough road conditions.

EVAP System

The EVAP system limits fuel vapors from escaping into the atmosphere. Fuel tank vapors are allowed to move from the fuel tank, due to pressure in the tank, through the EVAP vapor tube, into the EVAP canister. Carbon in the canister absorbs and stores the fuel vapors. Excess pressure is vented through the vent hose and EVAP vent solenoid valve to the atmosphere. The EVAP canister stores the fuel vapors until the engine is able to use them. At an appropriate time, the ECM will command the EVAP purge solenoid valve ON, allowing engine vacuum to be applied to the EVAP canister. With the normally open EVAP vent solenoid valve OFF, fresh air is drawn through the vent solenoid valve and the vent hose to the EVAP canister. Fresh air is drawn through the canister, pulling fuel vapors from the carbon. The air/fuel vapor mixture continues through the EVAP purge tube and EVAP purge solenoid valve into the intake manifold to be consumed during normal combustion. The ECM uses several tests to determine if the EVAP system is leaking or restricted.

Heated Oxygen Sensor

The ECM controls a closed loop air/fuel metering system in order to provide the best possible combination of driveability, fuel economy, and emission control. The ECM monitors the heated oxygen sensor (HO2S) signal voltage and adjusts the fuel delivery based on the signal voltage while in closed loop. The short term fuel trim values change rapidly in response to the HO2S signal voltages. These changes fine tune the engine fueling. The long term fuel trim values change in response to trends in the short term fuel trim. The long term fuel trim makes coarse adjustments to fueling in order to re-center and restore control to short term fuel trim.

Ignition Coils

Each ignition coil has an ignition 1 voltage circuit and a ground circuit. The ECM supplies a low reference and an ignition control circuit. Each ignition coil contains a solid state driver module. The ECM will command the ignition control circuit ON, which allows the current to flow through the primary coil windings. When the ECM commands the ignition control circuit OFF, this will interrupt current flow through the primary coil windings. The magnetic field created by the primary coil windings will collapse across the secondary coil windings, which induces a high voltage across the spark plug electrodes.

Knock Sensor

The Knock Sensor (KS) system is used by the ECM to control the ignition timing for the best possible performance while protecting the engine from potentially damaging levels of detonation, also known as spark knock. The KS system uses one or two flat response 2-wire sensors. The sensor(s) use piezo-electric crystal technology that produces an AC voltage signal of varying amplitude and frequency based on the engine vibration or noise level and provides that signal to the ECM.

Fuel System

Overview

The fuel system is an electronic returnless on-demand design which reduces the internal temperature of the fuel tank by not returning hot fuel from the engine to the fuel tank. Reducing the internal temperature of the fuel tank results in lower evaporative emissions. An electric turbine style fuel pump attaches to the fuel tank fuel pump module inside the fuel tank. The fuel pump supplies fuel through the fuel feed pipe to the high pressure fuel pump. The high pressure fuel pump supplies fuel to a variable-pressure fuel rail. Fuel enters the combustion chamber through precision multi-hole fuel injectors. The high pressure fuel pump, fuel rail pressure, fuel injection timing, and injection duration are controlled by the ECM.

Electronic Returnless Fuel System Operation

The electronic returnless fuel system controls fuel delivery using a microprocessor. It functions as an electronic replacement for a traditional, mechanical fuel pressure regulator. The pressure relief regulator valve within the fuel tank provides an added measure of over pressure protection. Desired fuel pressure is commanded by the ECM, and transmitted to the K111 fuel pump driver control module via a GMLAN serial data message. A fuel pressure sensor located on the fuel feed pipe provides the signal used by the ECM for Closed Loop fuel pressure control.

Fuel Pressure Sensor

The fuel pressure sensor is a serviceable 5 V, 3-pin device. It is located on the fuel feed line forward of the fuel tank. The ECM provides a 5 V circuit and a low reference circuit. The sensor provides the fuel pressure signal to the ECM, which is used for Closed Loop fuel pressure control.

Fuel Pump Driver Control Module

The K111 fuel pump driver control module is a serviceable GMLAN module. The fuel pump driver control module receives the desired fuel pressure signal from the ECM and controls the fuel pump located within the fuel tank to achieve the desired fuel pressure. The fuel pump driver control module controls the in-tank fuel pump by providing varying AC voltage to the 3 phase motor inside the fuel pump.

Fuel Pump

The fuel pump is mounted in the fuel tank fuel pump module reservoir. The fuel pump is a 3 phase electric pump. Fuel is pumped to the high pressure fuel pump at a pressure that is based on feedback from the fuel pressure sensor. The fuel pump delivers a constant flow of fuel even during low fuel conditions and aggressive vehicle maneuvers. The fuel pump flex pipe acts to dampen the fuel pulses and noise generated by the fuel pump.

Fuel Pump — High Pressure

The high fuel pressure necessary for direct injection (DI) is supplied by the high pressure fuel pump. The high pressure fuel pump is mounted on the rear of the engine under the intake manifold and is driven by a tri-lobe cam on the camshaft. The high pressure fuel pump also regulates the fuel pressure using an actuator in the form of an internal solenoid-controlled valve.

Fuel Tank Fuel Pump Module

The electric turbine style fuel pump attaches to the fuel tank fuel pump module inside the fuel tank and supplies fuel through the fuel feed pipe to the high pressure fuel pump. The fuel tank fuel pump module contains a reverse flow check valve. The check valve maintains fuel pressure in the fuel feed pipe in order to prevent long cranking times. The fuel tank fuel pump module consists of the following major components:

- **Fuel Level Sensor:** The fuel level sensor consists of a float, a wire float arm, and a ceramic resistor card. The position of the float arm indicates the fuel level. The fuel level sensor contains a variable resistor which changes resistance in correspondence with the position of the float arm. The ECM monitors the signal circuit of the fuel level sensor in order to determine the fuel level and sends the information to the instrument panel cluster to control the fuel gauge.
- **Fuel Pump and Reservoir Assembly**
- **Pressure Relief Regulator Valve:** The pressure relief regulator valve replaces the typical fuel pressure regulator used on a mechanical returnless fuel system. The valve is closed during normal vehicle operation. The pressure relief regulator valve is used to vent pressure during hot soaks and also functions as a fuel pressure regulator in the event of the fuel pump driver control module defaulting to 100% commanded output of the fuel pump.
- **Fuel Strainer**
- **Primary Jet Pump:** The primary jet pump is located in the fuel tank fuel pump module. Fuel pump flow loss, caused by vapor expansion in the pump inlet chamber, is diverted to the primary jet pump through a restrictive orifice located on the pump cover. The primary jet pump fills the reservoir of the fuel tank fuel pump module.

Fuel Rail Assembly

The fuel rail assembly attaches to each cylinder head. The fuel rail distributes high pressure fuel to the fuel injectors. The fuel rail assembly consists of the direct fuel injectors and the fuel rail pressure sensor. The fuel rail pressure sensor transmits fuel pressure and temperature information by serial data using the Society of Automotive Engineers (SAE) J2716 Single Edge Nibble Transmission (SENT) protocol.

Fuel Injectors

The fuel injector assembly is an inside opening electrical magnetic injector. The injector has six precision machined holes that generate a cone shaped oval spray pattern. The fuel injector has a slim extended tip in order to allow a sufficient cooling jacket in the cylinder head. The fuel injectors are mounted in the cylinder head beneath the intake ports and spray fuel directly into the combustion chamber. Direct injection requires very high fuel pressure due to the fuel injector's location in the combustion chamber.

Engine Oil — 6.6L Gasoline

Specification

5108021

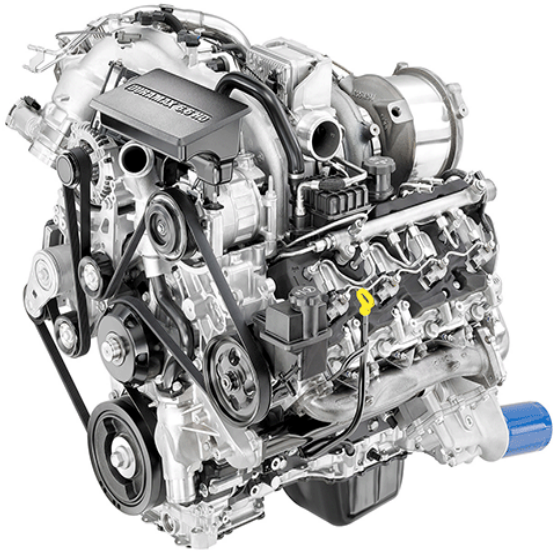
Use full synthetic engine oils that meet the dexos®1 APPROVED - GEN 2 specification. Engine oils that have been approved by GM as meeting the dexos®1 specification are marked with the dexos®1 APPROVED - GEN 2 logo.

Viscosity Grade

Use SAE 5W-30 viscosity grade engine oil for the 6.6L V8 gasoline engine. In an area of extreme cold, where the temperature is colder than −20°F (−29°C), use SAE 0W-30 oil. An oil of this viscosity grade will provide easier cold starting for the engine at extremely cold temperatures.

Engine 6.6L V8 — RPO L5P

Overview



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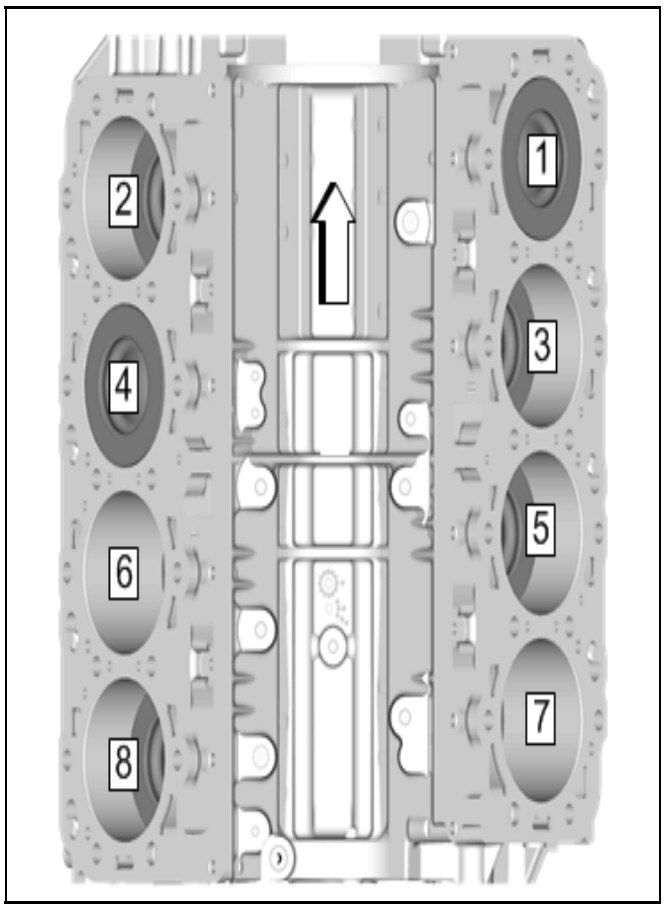
Typical view of the Duramax® 6.6L V8 — RPO L5P

This is a turbocharged diesel engine produced by DMAX which is a joint venture between GM and Isuzu in Moraine, Ohio for use in the new 2500HD, 3500HD pickup trucks and other GM vehicles.

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 capacity is 30.8 qt (29.15 L).
- **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.
- **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 provides 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 (9.5 L).
- **EGR System:** The EGR system is used to reduce the amount of nitrogen oxide (NOx) emission levels caused by high combustion temperatures. At temperatures more than 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. Exhaust gas recirculation is water cooled for improved reduction in NOx emissions.
- **Exhaust Manifold:** Cast nodular iron with steel pipe extension.
- **Firing Order:** 1-2-7-8-4-5-6-3
- **Fuel System:** Direct injection (DI) 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). Always look for the TOP TIER Diesel Fuel Logo at the fuel dispenser.
  - – **DO NOT** use diesel fuel with more than 15 ppm sulfur.
  - – **DO NOT** use off-highway diesel fuel, also known as off-road 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.

- **Horsepower:** SAE-certified 445 horsepower (332 kW).

  Torque: SAE-certified 910 lb-ft (1,234 Nm).
- **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. 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.

Duramax® After-Run Feature

A new after-run feature, specifically engineered for use following a demanding towing situation is an additional new technology for the Duramax engine. The after-run allows the engine to keep running for up to 15 minutes to allow it to cool down using the fan and circulating the engine coolant. If the driver puts the truck in **P** when an after-run situation is needed, an alert will appear on the DIC directing them to keep the engine running for cool down. Should the driver choose to ignore the message and exit the vehicle, the truck will restart on its own via remote start mode for cool-down. At that point the customer can walk away and the truck will turn itself OFF when the engine reaches an acceptable temperature.

Duramax® Cooling System

Helping cool the Duramax® engine is a massive 28-inch (71 cm) diameter fan with variable fan speed, which is 2.5-inches (6.35 cm) larger than the current fan. The ECM controls the fan speed by sending a pulse width modulated (PWM) signal to the cooling fan control module. The cooling fan control module varies the voltage drop across the cooling fan motor in relation to the PWM signal, which allows the cooling fan to operate at variable speeds.

Elevated Idle

The engine has a cold temperature high idle feature which elevates the engine idle speed from base idle to approximately 1,050 to 1,100 RPM when outside ambient 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 Coolant Heater

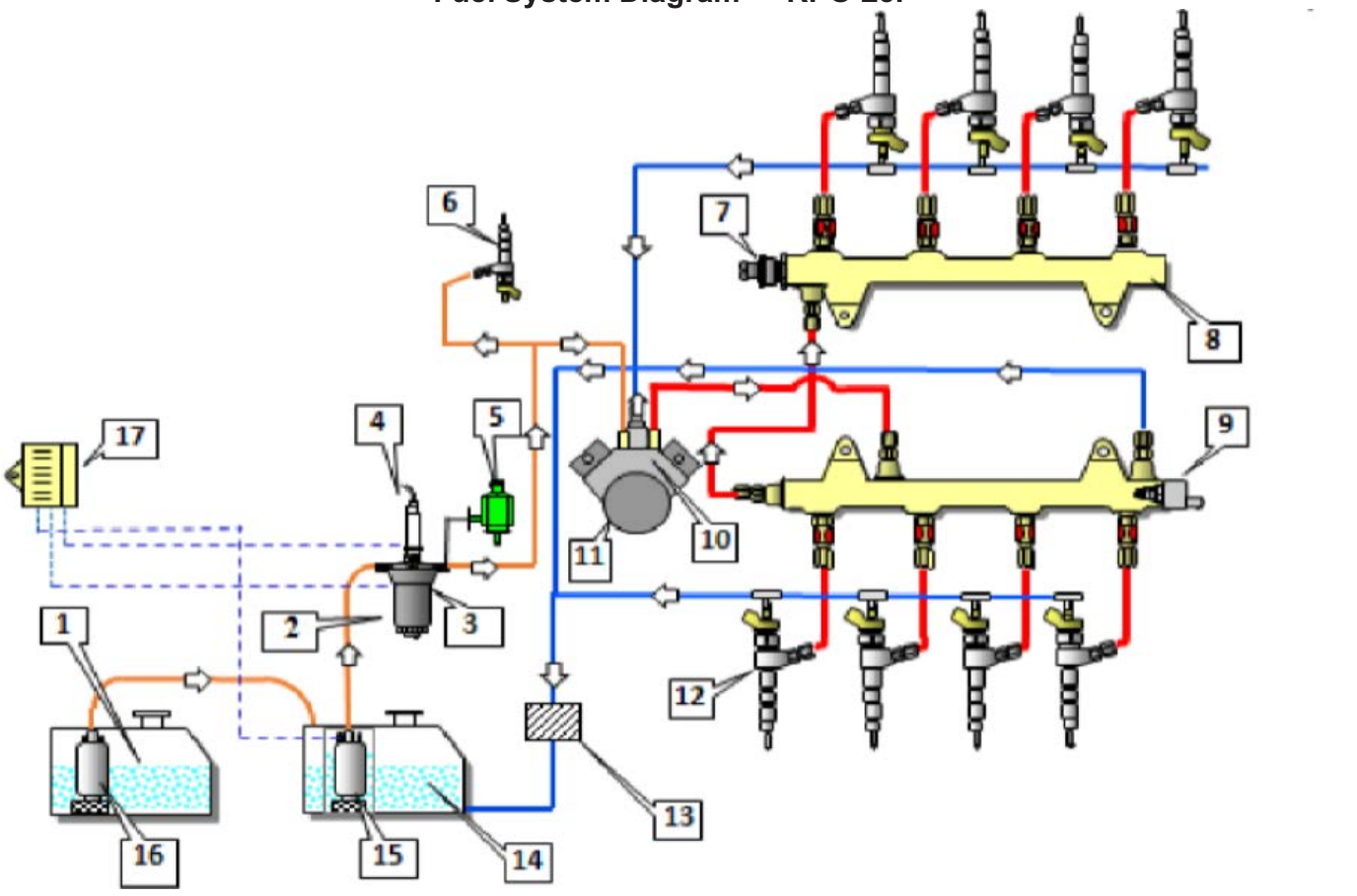
The coolant heater operates using 110 V alternating current from an external power source and is designed to warm the coolant in the engine block area for improved starting in weather conditions that are colder than 0°F (−18°C). Vehicles with an engine block heater should be plugged in at least four hours before starting. An internal thermostat in the plug-end of the cord may exist, which will prevent engine coolant heater operation at temperatures warmer than 0°F (−18°C). The coolant heater also helps reduce fuel consumption when a cold engine is warming up. The unit is equipped with a detachable AC power cord. A weather shield on the cord is provided to protect the plug when not in use.

Exhaust Brake

The Duramax® / Allison® combination incorporates an integrated engine exhaust brake, which leverages the engine's backpressure and the Heavy Duty's driveline components to help control the speed of the truck and trailer while descending, reducing the need to use service brakes on long, steep grades. The exhaust brake is also tied to the cruise control system, allowing a set speed to easily be maintained, even over hilly terrain.

Fuel System Diagram

Fuel System Diagram — RPO L5P



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Legend

(1) Auxiliary Fuel Tank (Equipped with RPO N2N)
(2) Fuel Filter Assembly with Water in Fuel Sensor
(3) E11A Fuel Heater/Water in Fuel Sensor
(4) B48 Fuel Temperature Sensor
(5) B47 Fuel Pressure Sensor
(6) Q67 Exhaust Aftertreatment Fuel Injector
(7) B47B Fuel Rail Pressure Sensor
(8) Fuel Injection Fuel Rail Assembly
(9) Q18B Fuel Rail Pressure Regulator 2
(10) Q18A Fuel Pressure Regulator 1 (Located in Fuel Injection Pump)
(11) G18 High Pressure Fuel Pump
(12) Q17 Fuel Injector(s)
(13) Fuel Cooler
(14) Fuel Tank — Primary
(15) G12A Fuel Pump — Primary
(16) G12B Fuel Pump — Secondary (Equipped with RPO N2N)
(17) K111 Fuel Pump Driver Control Module

Fuel Tank — Auxiliary

For vehicles equipped with dual fuel tanks, the auxiliary fuel tank is located in the rear of the vehicle. The fuel tank is held in place by 2 metal straps that attach to the frame. The fuel tank is molded from high density polyethylene.

Fuel Filter Assembly

The fuel filter assembly is located near the left frame rail and contains the following components: fuel filter/water separator, fuel heater, fuel temperature sensor, water in fuel sensor.

Fuel Heater

The fuel heater is controlled by the ECM. When the temperature of the fuel is less than a calibrated value, the ECM will command the fuel heater relay ON. When the relay is ON, battery voltage is supplied to the fuel heater to assist in cold weather operation.

Fuel Temperature Sensor

The fuel temperature sensor is a thermistor that is located in the fuel filter assembly. The ECM monitors the fuel temperature sensor through the fuel pump driver control module in order to calculate the temperature of the fuel entering the fuel injection pump.

Fuel Pressure Sensor

The fuel pressure sensor is located in the fuel feed pipe. The fuel pressure sensor monitors the fuel pressure in the fuel line. The ECM monitors the voltage signal from the fuel pressure sensor. The sensor provides a fuel pressure signal to the ECM, which is used to provide fuel pressure control.

Exhaust Aftertreatment Fuel Injector

The exhaust aftertreatment fuel injector, also known as an indirect fuel injector is located on the passenger side frame rail. The exhaust aftertreatment fuel injector is used to inject fuel into the exhaust system to generate the required heat needed by the diesel oxidation catalyst to function properly.

Dual Fuel Rail Pressure Sensor

The fuel rail pressure sensor is a dual analog sensor that provides two fuel rail pressure signals to the ECM and is located in the end of the fuel rail assembly. The ECM provides a 5 V reference voltage on the 5 V reference circuit and ground on the low reference circuit. The ECM receives a varying signal voltage on both the fuel rail pressure sensor and fuel rail pressure sensor 2 signal circuits. The ECM monitors the voltage on both of the fuel rail pressure sensor circuits and compares the values to determine if the sensors are accurate. When the fuel pressure is high, the fuel rail pressure sensor signal voltage is high and the fuel rail pressure sensor 2 signal voltage is low. When the fuel pressure is low, the fuel rail pressure sensor signal voltage is low and the fuel rail pressure sensor 2 signal voltage is high.

Fuel Rail Assembly

The left and right fuel rails are attached to the cylinder heads. The fuel rails distribute pressurized fuel to the fuel injectors through the fuel lines.

Fuel Pressure Regulator 1

The ECM controls the fuel rail pressure using two pulse width modulated fuel rail pressure regulators. Fuel pressure regulator 1 is located in the fuel injection pump and meters the amount of fuel that enters the high pressure side of the pump. From the high pressure pump, the fuel moves to the fuel rail through a high pressure steel line. The fuel rail distributes high pressure fuel to all 8 fuel injectors.

Fuel Pressure Regulator 2

The ECM controls the fuel rail pressure using two pulse width modulated fuel rail pressure regulators. Fuel pressure regulator 2 is located on the rear of the driver side fuel rail and meters the amount of fuel being returned to the fuel tank. The ECM varies the pulse width modulated voltage to the fuel pressure regulator 2 to relieve excessive fuel pressure which returns to the fuel tank. When the ignition is OFF, fuel pressure regulator 2 opens to bleed off the pressure in the fuel rail.

High Pressure Fuel Pump

The high pressure fuel pump is a mechanical pump. The high pressure fuel pump is located at the front of the engine below the intake manifold. The high pressure fuel pumps provides high pressure fuel to the fuel rail at a specified pressure regulated by the fuel pressure regulators.

Fuel Injectors

A fuel injector is a solenoid device, controlled by the ECM, that meters pressurized fuel to a single engine cylinder. Fuel from the fuel injector tip is sprayed directly into the combustion chamber on the compression stroke of the engine. The fuel injectors are located above each cylinder and deliver fuel directly into the cylinder. Each injector has a high pressure fuel pipe from the fuel rail and a return line.

Fuel Cooler

The fuel cooler is located under the vehicle. The returning fuel flows through the cooler in order to reduce the fuel temperature before returning it to the vehicle's fuel tank.

Fuel Tank — Primary

The primary fuel tank is located on the left side of the vehicle. The fuel tank is held in place by 2 metal straps that attach to the frame. The fuel tank is molded from high density polyethylene.

Fuel Pump — Primary

The primary fuel pump is mounted in the primary fuel tank module reservoir.

Fuel Pump — Secondary

The fuel transfer pump is located in the auxiliary (rear) fuel tank, (if equipped with N2N).

Fuel Pump Driver Control Module

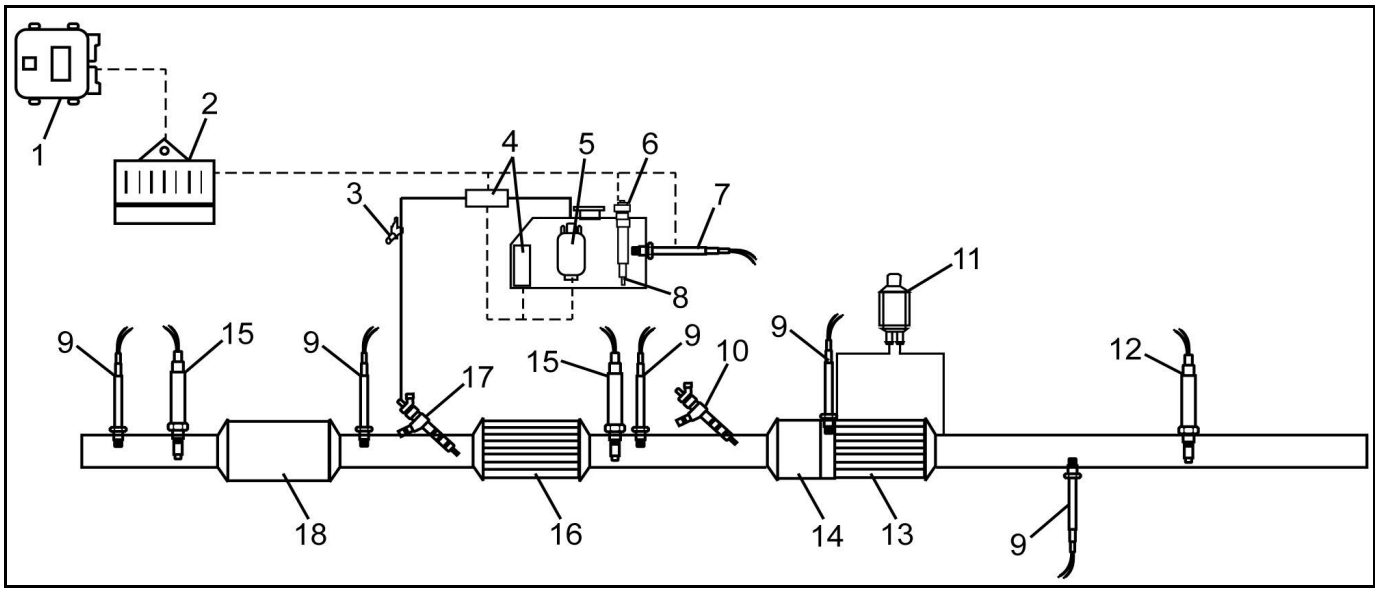
The fuel pump driver control module is located under the vehicle, mounted to the bracket above the spare tire. If this component is replaced, the Fuel Pump Driver Control Module Configuration must be performed.

Water in Fuel Sensor

The water in fuel sensor monitors for the presence of water in the diesel fuel. When water is present, the fuel pump driver control module detects low voltage on the signal circuit and sends a message to the ECM. The ECM sends a serial data message to the instrument panel cluster to display the WATER IN FUEL SERVICE REQUIRED message.

Exhaust Aftreatment System

Emission Control System Architecture — RPO L5P



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Legend

(1) E41 ECM w/Baro Sensor
(2) Reductant Control Module, CAN Interface
(3) DEF Pressure Sensor
(4) DEF Heaters — to Reductant Control Module
(5) DEF Pump — to Reductant Control Module
(6) DEF Continuous Level Sensor — to Reductant Control Module
(7) DEF Temperature Sensor — to Reductant Control Module
(8) DEF Quality Sensor — to Reductant Control Module
(9) Exhaust Gas Temperature Sensor [5x]
(10) HC Injector
(11) DPF Differential Pressure Sensor
(12) PM Sensor, CAN Interface
(13) DPF
(14) DOC
(15) NOx Sensor [2x] — CAN Interface
(16) SCR
(17) DEF Injector
(18) Close Coupled DOC

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 (PM) in the engine exhaust gases. Reducing these pollutants to acceptable levels is achieved using the following components:

1. **Close Coupled Diesel Oxidation Catalyst (DOC):** The close coupled DOC functions similar to the catalytic converter used with gasoline 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. Proper DOC function requires the use of ultra-low sulfur diesel (ULSD) fuel containing less than 15 ppm sulfur.
2. **Selective Catalyst Reduction (SCR):** Diesel engines are more fuel efficient and produce less HC and CO than gasoline engines, however they generate much higher levels of NOx. In order to meet the current NOx limits, an SCR catalyst, along with reductant, is used to convert NOx into N2, CO2, and H2O.
3. **Diesel Oxidation Catalyst (DOC):** In addition to reducing emissions, the DOC also generates the exhaust heat needed by the SCR to properly function. Exhaust gas temperature sensors are located upstream and downstream of the DOC. By monitoring the temperature differential between these 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 diesel fuel into the exhaust gases entering the DOC. This is accomplished by means of a hydrocarbon injector (HCI) upstream of the DOC in the exhaust system.

4. **Diesel Particulate Filter (DPF):** 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 (PM). The DPF is capable of removing more than 90% of particulate matter, or soot carried in the exhaust gases.

DEF

Depending on the information being referenced, reductant is also identified as diesel exhaust fluid (DEF) which is a mixture of ***specifically 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.

DEF Heaters for 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 two 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 K115 Reductant Control Module monitors the B214 Reductant 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 Injector

The ECM energizes the DEF injector in order to dispense a precise amount of reductant upstream of the SCR in response to changes in exhaust NOx levels. The signal from NOx Sensors 1 and 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, the ammonia slip will cause NOx Sensor 2 to detect higher NOx levels than actually exist.

DEF Level

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 (7.57 L) of DEF must be added to release the speed limitation.

DEF Reservoir Components

The DEF system reservoir components consist of the following: :

- An electrically-operated DEF pump
- An integrated B213A Reductant Level Sensor 1 and B214 Reductant Temperature Sensor
- K115 Reductant Control Module
- B295 Reductant Quality Sensor
- Reductant system heaters
- An electrically controlled DEF injector which is external to the reservoir.

Exhaust Gas Temperature (EGT) Sensor

The engine uses exhaust gas temperature 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 downstream of the SCR in order to determine if the SCR catalyst is within the temperature range where maximum NOx conversion occurs.

NOx Sensor

The ECM uses two smart NOx sensors to monitor the exhaust NOx levels. The first NOx sensor is located at the turbocharger outlet and monitors the engine out NOx. The second NOx sensor is located in the exhaust pipe 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.

Particulate Matter Sensor

The 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 to aid in OBD-II 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.

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, where the soot is cleaned off by heating up the element to burn off the carbon, before the measurement phase begins. The amount of regenerations is based on vehicle strategy. The cumulative PM sensor current readings are used to determine the amount of soot concentration in the exhaust gas, and determine the collection efficiency of the DPF and if a regeneration is needed.

Regeneration Process

A number of engine and exhaust aftertreatment components are required to function together to perform the regeneration process. The engine components are the fuel injectors, turbocharger, Intake Air (IA) valve, fuel pressure control, and the intake air heater (IAH).

DEF Recommendation — Storage and Transfer

DEF Recommendation

5138259

API Certified Diesel Exhaust Fluid Logo

- General Motors 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, in Canada 88862660 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

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.

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.

Engine Oil — 6.6L Diesel

Ash Loading

Ash is a non-combustible by-product occurring from normal oil consumption. Low ash content engine oil (CJ-4 or CK-4) is ***required*** for these diesel engine equipped vehicles because of 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 replaced.

Specification

5123610

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.

Viscosity Grade

Use SAE 15W-40 viscosity grade engine oil. In an area of extreme cold, where the temperature is colder than 0°F (−18°C), use SAE 5W-40. An oil of this viscosity grade will provide easier cold starting for the engine at extremely cold temperatures.

Head-Up Display

5323981

Both vehicles offer an available multicolor 15-inch (381 mm) diagonal Head-Up Display (HUD) to help keep the driver's eyes on the road by conveniently

projecting key information directly onto the windshield such as speed, active safety information, available Navigation and an inclinometer that measures grade.

Supplemental Inflatable Restraint 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), air bags, seat belt pretensioner (anchor and retractor), and impact sensors. The SDM is a microprocessor and the control center for the SIR system. The SDM determines the severity of a collision with the assistance of impact sensors located at strategic points on the vehicle. When the SDM detects a collision, it will process the information provided by the sensors to further support air bag or pretensioner deployment. The SDM will deploy the air bags and pretensioners if it detects a collision of sufficient force. If the force of the impact is not sufficient to warrant air bag 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 calibrated values stored in its memory. If the signals exceed a calibrated value, the SDM will determine the severity of the impact and either cause current to flow through the frontal deployment loops deploying the frontal air bags and pretensioners, or it will deploy the pretensioners only. The SDM continuously monitors the deployment loops and the SIR system electrical components for malfunctions and illuminates the SIR system AIR BAG indicator if a fault is detected.

Air Bags

These vehicles contain 7 air bags. The 7 air bags are located in the steering wheel (dual air bags), instrument panel (passenger side) (dual air bags), driver side seat inboard side, driver side seat outboard side, passenger side (seat), left roof rail, right roof rail. Air bags contain a housing, inflatable air bag, two initiating devices (if dual air bags), a canister of gas generating material and, in some cases, stored compressed gas. The deployment loops supply current to deploy the air bags. The steering wheel and passenger instrument panel air bags have two stages of deployment, which varies the amount of restraint to the occupant according to the collision severity. For moderate frontal collisions the air bags deploy at less than full deployment which consists of stage 1. For more severe frontal collisions a full deployment is initiated which consists of stage 1 and stage 2. The current passing through the air bags ignite the material in the canister producing a rapid generation of gas and is some cases, the release of compressed gas. The gas produced from this reaction rapidly inflates the air bag. Once the air bag is inflated it quickly deflates through the air bag vent holes and/or the bag fabric. A shorting bar (if equipped) is located in the air bag connector.

Impact Sensors

There are multiple impact sensors which may be located in the front of the vehicle, in the front doors or on the B-pillar, and on the C-pillar depending on the vehicle configuration. The front of vehicle, B-pillar, and C-pillar impact sensors contain a sensing device which monitors vehicle acceleration to detect collisions that are severe enough to warrant air bag deployment. The front door impact sensors contain a sensing device which monitors the door cavity air pressure change to detect side collisions that are severe enough to warrant air bag deployment. It is important when working on components in the door to make sure any items which have a sealing impact on the door (water deflector, exterior door handle, speaker, door harness grommet, or sealing strip) are securely fastened when reinstalled. The impact sensors are not part of the deployment loop, but instead provide input to the SDM.

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 pretensioner (driver and passenger) consist of a housing, seat belt retractor (located in the B-pillar), seat belt anchor (located in the seat), 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 air bags deploying, or they will deploy immediately before the frontal air bags deploy. A shorting bar (if equipped) is located in the connector.

Snow Plow

The air bag system was 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" because it can damage the snow plow and the vehicle, and may cause an air bag deployment.

Suspension — Front

Short long arms independent front suspension with torsion bars.

Suspension — Rear

Semi-elliptic three-stage multi-leaf spring.

Tire Rotation — Tire and Loading Information Label

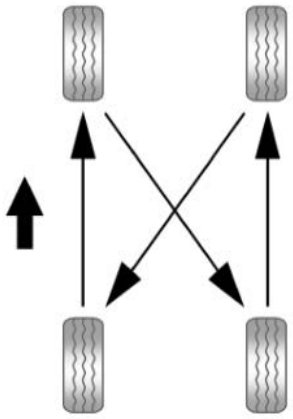
Tire and Loading Information Label

A vehicle-specific Tire and Loading Information label is attached to the center pillar (B-pillar). The Tire and Loading Information label shows the number of occupant seating positions, and the maximum vehicle capacity weight in pounds and kilograms. The Tire and Loading Information label also shows the size of the original equipment tires and the recommended cold tire inflation pressures. There is also important loading information on the vehicle Certification/Tire label. It may show the Gross Vehicle Weight Rating (GVWR) and the Gross Axle Weight Rating (GAWR) for the front and rear axles.

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 — Single Rear Wheels



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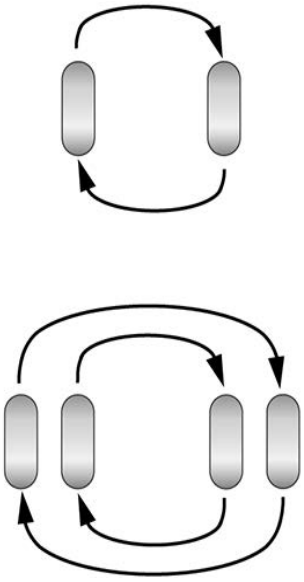
Use this rotation pattern when rotating the tires if the vehicle has single rear wheels.

Tire Rotation Pattern — Polished Forged Dual Aluminum Wheels



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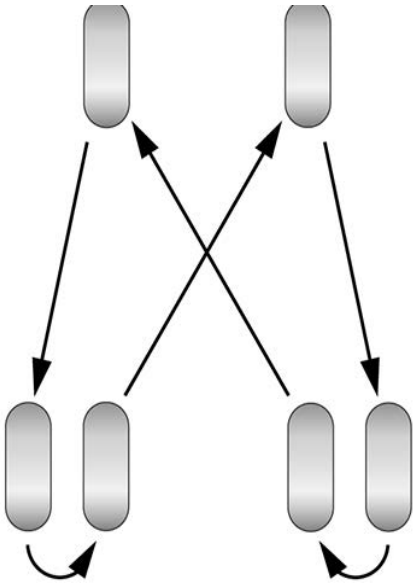
Vehicles with polished forged aluminum dual wheels have three unique wheels; a front, a rear outer and a rear inner. These wheels cannot be rotated to another position, however, they can be rotated from left to right to the same position.

Use this rotation pattern when rotating the tires if the vehicle has polished forged aluminum dual rear wheels. The spare wheel can be used in any position in the event of a flat tire, and can be rotated with the rear inner wheels. After the flat tire is repaired, if the spare is not on one of the inner rear positions, it must be replaced by the correct wheel in the front or rear outer positions.

Tire Rotation Pattern — Dual Rear Wheels



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Use this rotation pattern when rotating the tires if the vehicle has dual rear wheels (except polished forged aluminum wheels).

Trailer Detection

With RPO U1D

The K68 Trailer Lighting Control Module is supplied with battery voltage as well as ignition voltage and is permanently grounded. The trailer lighting control module constantly monitors for trailer connection status, this is accomplished through the lighting circuits of the trailer to determine if a trailer is connected. With the key OFF, the K68 Trailer Lighting Control Module will periodically pulse the lighting circuits of the trailer to verify it is still connected. Depending on the configuration of the trailer lights, the trailer lights may periodically flash as part of the trailer theft deterrent function. These flashes correspond to when the K68 Trailer Lighting Control Module pulses the lighting circuits to ensure the trailer is still connected and is considered normal. When a trailer is connected, the K68 Trailer Lighting Control Module senses the trailer connection and alerts the driver by requesting a trailer profile setup through the Trailering App, which is displayed on infotainment screen (P17 Info Display Module). If a trailer is disconnected with the ignition ON, the vehicle will display multiple trailer lighting message faults until a trailer is reconnected or the ignition is cycled.

Trailering Mirrors

Overview

The trailering mirrors have been redesigned with improved perimeter lighting. New, larger and more functional door-mounted trailering mirrors are standard on all 2500HD and 3500HD models. The mirrors extend and retract using a four-bar-link system that makes for smooth operation, whether done with power or manually. The surface area of the mirrors is larger, for a greater field of view compared to the current model, and an available power extension feature makes it easier to adjust the view from the driving position. New for 2020 is the forward-facing spot lamp on each mirror that shines light at about a 45-degree angle, providing illumination on the job site or camp site. There also are side-view cameras mounted within the mirror housings, and when equipped, mirror-mounted puddle lamps and two rearward-facing spot lamps are also available.

Extending

5326383

If equipped, grasp the mirror housing firmly and pull back in one motion, arching slightly toward the rear of the vehicle.

Retracting

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To return the mirror to its original position, reverse the motion.

Power Extending Mirrors

If equipped, press the power extend button to fully extend the mirror. Press it again to retract.

Trailering Systems

The available Advanced Trailering System (Silverado) and ProGrade Trailering System (Sierra) offer additional and new technologies. The in-vehicle trailering system features an available total of 15 camera views (requires an installed accessory camera), such as HD Surround Vision and other unique views including a transparent trailer view feature to help provide added confidence when towing and a hitch view camera used when connecting the trailer to the vehicle.

5303297

Transparent trailer camera view.

5303357

Trailer hitch camera view.

5324568

Sierra bed-view camera.

5324544

Silverado High Country with 5th wheel.

Trailering — Vehicle Weight Ratings

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 Gross Axle Weight Rating (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 GAWR. 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). 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 Gross Combined Weight Rating (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.

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

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 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 Gross Vehicle Weight Rating (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.

Transmission — 6-Speed 6L90 Automatic

Overview

5324137

The Hydra-Matic™ 6L90 6-speed — RPO MYD is a fully automatic, rear-wheel drive, electronic-controlled transmission. It consists primarily of a 4-element torque converter, an integral fluid pump and converter housing, a single and double planetary gear set, friction and mechanical clutch assemblies, and a hydraulic pressurization and control system. There are four

variants of the transmission, all based on torque capacity. Architecture is common between the variants, and component differences are primarily related to size.

Transmission General Description

The 6-speed 6L90 has a 4-element torque converter that contains a pump, a turbine, a pressure plate splined to the turbine, and a stator assembly. The torque converter acts as a fluid coupling to smoothly transmit power from the engine to the transmission. It also hydraulically provides additional torque multiplication when required. The pressure plate, when applied, provides a mechanical direct drive coupling of the engine to the transmission.

The planetary gear sets provide the 6 forward gear ratios and reverse. Changing gear ratios is fully automatic and is accomplished through the use of a transmission control module (TCM) located inside the transmission. The TCM receives and monitors various electronic sensor inputs and uses this information to shift the transmission at the optimum time.

The TCM commands shift solenoids and variable bleed pressure control solenoids to control shift timing and feel. The TCM also controls the apply and release of the torque converter clutch which allows the engine to deliver the maximum fuel efficiency without sacrificing vehicle performance. All the solenoids, including the TCM, are packaged into a self-contained control solenoid valve assembly.

The hydraulic system primarily consists of a vane-type pump, 2 control valve body assemblies, converter housing and case. The pump maintains the working pressures needed to stroke the clutch pistons that apply or release the friction components. These friction components, when applied or released, support the automatic shifting qualities of the transmission.

The friction components used in this transmission consist of 5 multiple disc clutches. The multiple disc clutches combine with one mechanical sprag clutch to deliver 7 different gear ratios, 6 forward and one reverse, through the gear sets. The gear sets then transfer torque through the output shaft.

Transmission — 10-Speed 10L1000 Automatic

Notice: **The all-new Allison® / General Motors 10-Speed Transmission can be Serviced at Authorized Chevrolet and GMC Dealers.**

Overview

5343851

Right Side

5343900

Left Side

The Allison® Branded 10-speed 10L1000 automatic transmission — RPO MGM or MGU, manufactured by General Motors, combines enhanced performance, fuel economy, greater operational flexibility, and improved driver comfort and control, with an industry-leading reputation for uptime and reliability. Designed for high-performance and low-maintenance, the 10-speed coupled with the Duramax® 6.6L diesel engine provides superior power delivery and productivity. The

new transmission is tested and validated in partnership with Allison® Transmission. Each transmission will deliver its legendary quality and durability. The Duramax® / Allison® powertrain standard axle ratio has been reduced to 3.42:1, reducing engine speed, enhancing refinement and efficiency. Duramax® equipped vehicles with the 10-speed transmission are available as 2WD or 4WD.

Transmission General Description

The transmission is a fully automatic, 10-speed, rear-wheel drive electronically controlled transmission. The ten speed ratios are generated using four simple planetary gearsets, two brake clutches, and four rotating clutches. The resultant on-axis transmission architecture utilizes a squashed torque converter, an off-axis pump and four close coupled gearsets. The four rotating clutches have been located forward of the gearsets to minimize the length of oil feeds which provides for enhanced shift response. There are different variants of the transmission, all based on torque capacity. Architecture is common between the variants, and component differences are primarily related to size.

The transmission architecture features a case with an integral bell housing for enhanced powertrain stiffness. A unique pump drive design allows for off-axis packaging very low in the transmission. The pump is a variable vane type which effectively allows for two pumps in the packaging size of one. This design and packaging strategy not only enables low parasitic losses and optimum priming capability but also provides for ideal oil routing to the controls system, with the pump located in the valve body itself. The transmission control module (TCM) is externally mounted, enabling packaging and powertrain integration flexibility. The TCM utilizes three speed sensor signals providing enhanced shift response and accuracy. The transmission enables solid fuel efficiency, superior performance and outstanding vehicle safety.

The 4-element torque converter contains a pump, a turbine, a pressure plate splined to the turbine, and a stator assembly. The torque converter acts as a fluid coupling to smoothly transmit power from the engine to the transmission. It also hydraulically provides additional torque multiplication when required. The pressure plate, when applied, provides a mechanical direct drive coupling of the engine to the transmission.

The planetary gear sets provide the 10 forward gear ratios and reverse. The TCM receives and monitors various electronic sensor inputs and uses this information to shift the transmission at the optimum time.

The hydraulic system primarily consists of an off-axis gear-driven variable vane-type pump next to the valve body, and 2 control valve body assemblies. The pump maintains the working pressures needed to stroke the clutch pistons that apply or release the friction components. These friction components, when applied or released, support the automatic shifting qualities of the transmission.

The friction components used in this transmission consist of 6 multiple disc clutches. The multiple disc clutches deliver 11 different gear ratios, 10 forward and one reverse, through the gear sets. The gear sets then transfer torque through the output shaft.

Power Take-Off

An all new factory integrated, engine-driven Power Take-Off (PTO) is available and eliminates the need for an aftermarket unit. Exclusively offered with the 10-speed transmission on select diesel models, it's the first fully integrated PTO system in the HD truck segment, with the PTO's drive gear operated via chain to direct engine power. And because it is engine-driven rather than turbine-driven, the PTO can be used while the vehicle is idling. A button inside the cab enables the PTO, and a mode selector allows adjustment of load and torque output.

Transfer Case — Autotrac 2-Speed

Overview

If equipped, the Autotrac 2-speed transfer case on 4WD models electronically controls "4 Auto" mode, allowing the truck to seamlessly shift between 2WD and 4WD based on road conditions.

Autotrac helps the driver to select the ideal 4WD mode, depending on road conditions, using electronic controls to make the process seamless. The Autotrac 2-speed transfer case offers four transfer case modes, allowing the driver to select the ideal mode for specific on-road or off-road conditions. To select a mode, the driver will either push a button or use a rotary knob (depending on equipment) located on the instrument panel to the left of the steering wheel.

Operation

The Magna Powertrain (MP) model 3025 — RPO NQH is a 2-speed automatic, active transfer case (ATC). The MP 3025 ATC provides 5 modes, Auto 4WD, 4HI, 4LO, 2HI and NEUTRAL (**N**). The Auto 4WD position allows the capability of an active transfer case, which provides the benefits of on-demand torque biasing wet clutch and easy vehicle tuning through software calibrations. The software calibrations allow more features such as flexible adapt ready position and clutch preload torque levels. The technology allows for vehicle speed dependent clutch torque levels to enhance the performance of the system. For example, the system is calibrated to provide 0–5 lb-ft (0–6.78 Nm) of clutch torque during low speed, low engine torque operation, and predetermined higher torque for 25 mph (40 km/h) and greater. This prevents crow-hop and binding at low speeds and provides higher torque biases at higher vehicle speeds, in order to enhance stability.

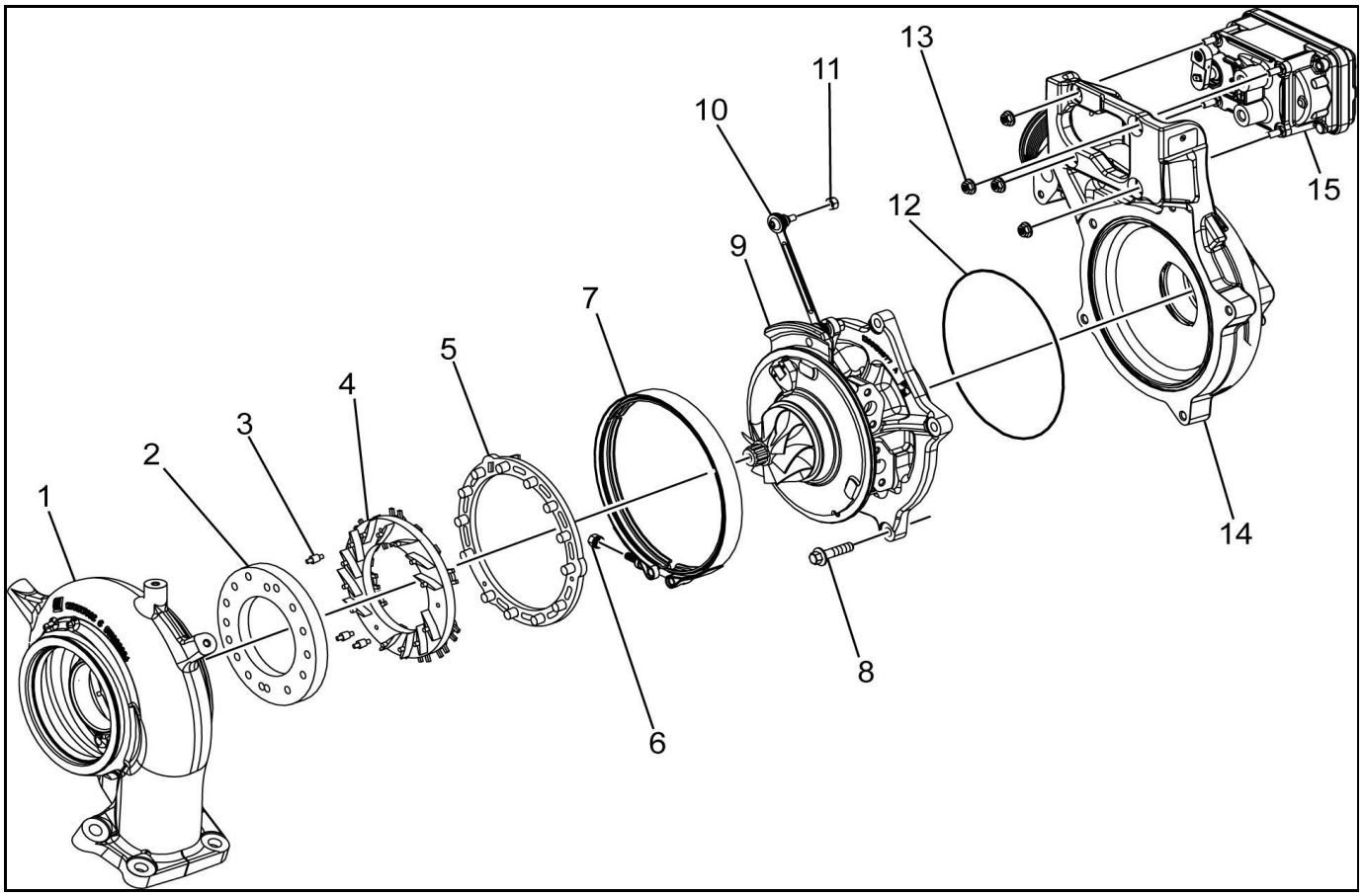
5326341

Typical view of Sierra AT4 Autotrac 2 controls.

- **2 Hi:** For normal operation on paved roads where there is no loss of traction, this mode allows the vehicle to operate as 2WD to help save wear on 4WD components. When this mode is selected, the front axle is disengaged and power is distributed only to the rear axle.
- **4 Auto:** If road conditions frequently vary between high and low-traction areas, 4 Auto can help automatically distribute torque to the front axle by anticipating the need for additional traction, helping to improve handling and control. In this mode, the front axle is engaged but the transfer case uses an electronically controlled clutch to manage torque sent to each axle. The transfer case automatically adjusts the clutch to help provide improved traction, stability and control.
- **4 Hi:** High-range 4WD is designed to help increase traction when driving over loose, slippery or demanding terrain, such as off-road conditions, deep sand or snow. This mode is NOT designed for use on dry surfaces or roads with good traction, so it is important to shift out of 4 Hi as soon as road conditions improve.
- **4 Low:** Low-range 4WD engages gearing within the transfer case to provide more torque to the wheels for off-road driving, such as in deep sand, mud or snow. In severe off-road scenarios, 4 Low is designed to help give the driver more control of the vehicle's speed when crossing obstacles or rocks, or climbing and descending steep grades. This mode should NOT be utilized at speeds over 45 mph (72 km/h) and is NOT designed for use on dry surfaces or roads with good traction.
- **Neutral:** Additionally, the vehicle may include **N**, which disengages the driveline to allow the truck to be towed behind another vehicle (also known as dinghy towing). ***Use this range ONLY when the vehicle needs to be towed.***

Turbocharger System Description

Variable Vane Turbocharger Overview



4584300

Legend

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

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 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.

Upfitter Integration Group

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

1. To visit the GM Upfitter Integration Group Home Page, Go to: http://www.gmupfitter.com/
   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.

Special Tools

The following new tools were released for the 2020 Silverado / Sierra 2500HD and 3500HD pickup trucks:

Special Tools — Tool Number and Description

Tool Number	Description
EN-52793	Front Crankshaft Seal Installer (6.6L L8T)
EN-52794	Rear Crankshaft Seal Installer (6.6L L8T)

Training Courses

Training Courses — Description — Number and Course Name

Description	Number and Course Name
New Model Launch	#10320.18H — 2020 Chevrolet Silverado and GMC Sierra 2500HD/3500HD New Model Launch (T1CXH Truck)
Automatic Transmission	#17041.85V — 10L1000 Allison Branded® HydraMatic™ Transmission

Version Information

Version	1
Modified	**Released June 10, 2019**

Trademark Footnotes

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