

Fuel System - Overview

NOTICE: Repairs of the fuel system are to be achieved only by replacement of the failed component(s). Repair of a fuel system component should not be attempted.

NOTICE: If directed during assembly of fuel system components, lubricate any seal(s) only with specified material. Failure to follow this instruction may result in seal failure and fuel leakage.

The diesel fuel system consists of the following:

- Fuel tubes
- Fuel filters (located on the engine and on the fuel tank)
- Fuel level sensor
- Fuel tank filler pipe assembly
- Fuel tanks
- In tank diesel delivery module
- Externally mounted fuel filter and water separator

The fuel system for the high-pressure common rail direct injection turbocharged diesel engine:

- is controlled by the PCM.

The electric FP (located in the diesel delivery module in the tank):

- draws fuel from the fuel tank through a screen covered fuel pickup, then through an externally mounted fuel filter.
- circulates fuel at low vacuum through the 10 micron externally mounted fuel filter to the engine mounted secondary fuel filter and fuel injectors to initially fill the hydraulic couplers. The fuel is filtered through a 4 micron engine mounted secondary fuel filter, and then supplied to the high-pressure fuel injection pump. Fuel is returned from the injectors through the fuel injector return hose and combines with fuel being supplied to the inlet of the engine mounted secondary fuel filter. Fuel that is returned from the fuel rail combines with fuel being returned from the high-pressure fuel injection pump and passes through the frame mounted fuel cooler to the diesel fuel conditioning module.
- The externally mounted fuel tank filter contains a thermal recirculating valve that, based on fuel temperature, allows the returning fuel to be sent back to the fuel tank.

Fuel

When equipped with a single fuel tank, the IPC receives the fuel level data from a single fuel level sender. The IPC sends a reference voltage to the fuel level sender. As the fuel level changes, a float actuates the variable resistor fuel level sender, converts sender voltage to Fuel Level Percent Status (FLPS) value, and sends FLPS to the PCM. PCM calculates the fuel gauge pointer position, PCM sends the fuel gauge pointer position to the IPC, and IPC displays fuel gauge pointer position.

When equipped with dual fuel tanks, the IPC receives fuel level data from both primary and auxiliary fuel level senders. The fuel pump operates a jet pump in tank diesel delivery module that transfers fuel from the auxiliary fuel tank to the primary fuel tank. This functions similar to the saddle-type fuel tank design except that there are 2 separate fuel tanks that need to be refueled independent of one another. The primary fuel tank maintains a higher level of fuel due to the transfer function of the jet pump. For further information, refer to the vehicles owner manual. The IPC sends a reference voltage to the fuel level senders. As the fuel level changes, a float actuates the variable resistor fuel level senders, raising or lowering the fuel level signal voltages. The IPC monitors the changes in voltage from both senders, converts each sender voltage to two different Fuel Level Percent Status (FLPS) values, and sends the two FLPS values to the PCM. PCM calculates the main fuel gauge pointer position and individual gauge pointer positions, PCM sends the fuel gauge pointer positions to the IPC, and IPC displays fuel gauge pointer positions. . In addition to the main fuel gauge, the message center provides virtual fuel gauges for each individual tank on all Instrument Panel Clusters (IPCs).

After a fuel fill up, the time for the fuel gauge to move from empty (E) to full (F) ranges from 2 seconds to 55 minutes depending on which operating mode the fuel gauge is in.

The IPC uses 4 different operating modes to calculate the fuel level:

- Anti-slosh (default mode)
- Key OFF fueling
- Key ON fueling
- Recovery

Anti-Slosh Mode

The default fuel gauge mode is called the anti-slosh mode. To prevent fuel gauge changes from fuel slosh (gauge instability due to changes in fuel

sensor readings caused by fuel moving around in the tank), the fuel gauge takes approximately 40 minutes to go from empty (E) to full (F).

Key OFF Fueling Mode

The key OFF fueling mode (2 seconds to read empty [E] to full [F]) requires 3 conditions to be met:

- The ignition must be in the OFF mode when refueling the vehicle.
- At least 6% of the vehicle's fuel capacity must be added to the fuel tank.
- The IPC must receive a valid ignition ON fuel sensor reading within one second of the ignition being put into the RUN mode. The key ON sample readings are considered valid if the fuel sensor reading is between 10 ohms $\hat{\pm}$ 2 ohms and 180 ohms $\hat{\pm}$ 4 ohms.

If these conditions are not met, the fuel gauge stays in the anti-slosh mode, which results in a slow to read full (F) event.

Key ON Fueling Mode

In key ON fueling mode, a 30-second timer activates after the transmission is put into the PARK (P) or NEUTRAL (N) position. When the 30-second time has elapsed and at least 9% of the vehicle's fuel capacity has been added, the fuel gauge response time is 60 seconds to read from empty (E) to full (F). When the transmission is shifted out of PARK (P) or NEUTRAL (N), the fuel gauge strategy reverts to the anti-slosh mode. The key ON fueling mode prevents slow to read full events from happening if the customer refuels the vehicle with the ignition in the RUN mode.

The key ON fueling mode (approximately 60 seconds to read empty [E] to full [F]) requires the following conditions be met:

- The transmission is in PARK (P) or NEUTRAL (N).
- The ignition is in the RUN mode.
- At least 6% of the vehicle's fuel capacity must be added to the fuel tank.

Recovery Mode

Recovery mode is incorporated into the IPC strategy to recover from a missing fuel level input after a refueling event. Missing fuel level inputs result from intermittent opens in the fuel sensor or its circuits. Recovery mode (empty [E] to full [F] approximately 17 minutes) is initiated when the following 2 conditions are met:

- The IPC is in the anti-slosh (default) mode.
- The actual fuel level in the tank is 5% different from what is being displayed by the fuel gauge.

Externally Mounted Fuel Filter/Water Separator

The vehicle is equipped with an externally mounted fuel filter/water separator. The externally mounted fuel filter/water separator contains a fuel filter and water separator. Drain the water from the externally mounted fuel filter/water separator at the recommended maintenance intervals. Refer to the Owner's Literature for the maintenance intervals.

While the engine is running a water in fuel indicator on the instrument panel or a "Water in Fuel, Drain Filter" message on the instrument panel message center will alert the operator. When this occurs drain the water from the externally mounted fuel filter/water separator as soon as possible to prevent damage to the fuel injection system.

Fuel Pump Shut-off Feature

If your vehicle has a key system:

- Switch off the ignition.
- Switch to start position.
- Switch off the ignition.
- Switch on the ignition to re-enable the fuel pump.
- If the vehicle does not start, repeat steps 1 through 4.

If your vehicle has a push button start system:

- Press to switch off your vehicle.
- Press the brake pedal and to switch on your vehicle.
- Remove your foot from the brake pedal and press to switch off your vehicle.
- You can attempt to start the vehicle by pressing the brake pedal and , or press without pressing the brake pedal.
- If the vehicle does not start, repeat steps 1 through 4.

In the event of a moderate to severe collision, the vehicle is equipped with a Fuel Pump and Sender Unit Shut-off Feature that is initiated by the event notification signal.

The event notification signal is a signal provided by the RCM to the Fuel Pump Control Module. Signal communication between the RCM and the Fuel Pump Control Module allows the PCM to shut-off the Fuel Pump.

Should the vehicle shut off after a collision due to this feature, the vehicle may be restarted by first turning the ignition to the OFF position and then turn the ignition to the ON position. In some instances the vehicle may not start the first time and may take one additional ignition cycle.

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