NAVISTAR®

2015 PSI 8.8L LPG Engine Overview

Study Guide

Course Code: 8777

Contents

Introduction

Welcome to the Navistar® training course: 2015 PSI 8.8L LPG Engine Overview. After completing this course, the viewer will be able to:

- Identify the PSI 8.8 liter LPG engine.
- Perform a basic visual inspection of a vehicle equipped with the PSI 8.8 liter LPG engine.

If you have questions or concerns regarding the playback of this program, please contact Navistar Service Education by submitting a case file (Dealer Personnel); or by calling 1-800-365-0088.

The information provided within this course is for training purposes only. Always consult the latest service, diagnostic, and tool information, located on Navistar's Service Portal, prior to performing service on Navistar engines, vehicles, and equipment.

Course Navigation

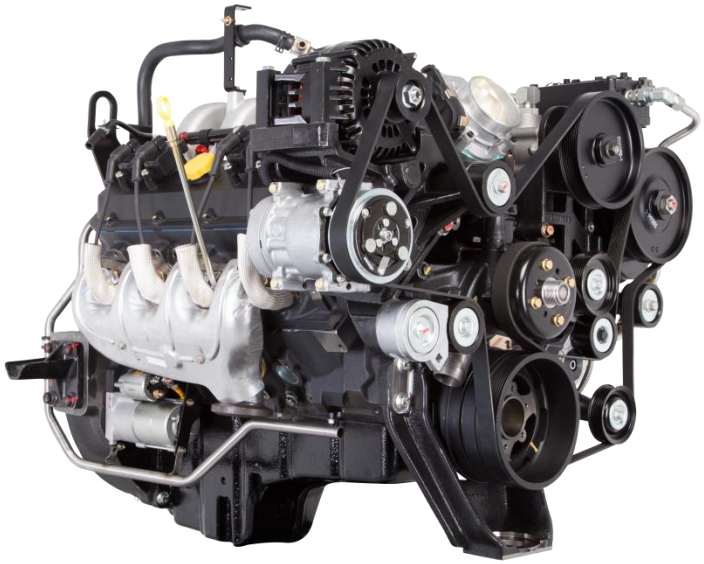
Navigation of this course may be performed in several ways. At the bottom of the screen are the "NEXT," "PREVIOUS," and "REPLAY" buttons. Clicking either the "NEXT" or "PREVIOUS" buttons will take you to the next or previously viewed course topic. After all information on a topic has been covered, the arrow on the "NEXT" button will pulse red to indicate you are ready to continue.

Clicking the "REPLAY" button will replay the topic you are currently viewing.

Near the bottom right-hand corner of the screen are the "PAUSE/PLAY" and "NOTES" buttons. Clicking the "PAUSE/PLAY" button allows you to pause the course and resume when you're ready to continue.

Clicking the "NOTES" button will bring up a small window containing the narrated text for the currently viewed topic. Click the "NOTES" button again to hide this window. That's all for course navigation.

Engine Overview



The Power Solutions International (PSI) 8.8 liter Liquefied Petroleum Gas (LPG) engine is a purpose built naturally-aspirated V8. The LPG fueled engine provides a cleaner alternative to gasoline or diesel fueled engines.

LPG is also known as Liquefied Propane (or LP), LP-Gas, and when powering a vehicle, propane autogas. It is also referred to as 'propane'.

The engine serial number is stamped on the left rear of the engine block. A serial number label ls located on the valve cover.

The PSI 8.8 liter LPG engine uses dual catalytic converters to reduce emissions produced by the engine. The single butterfly-type throttle body is mounted to the front of the intake manifold and controls air flow into the engine. Throttle body position is actuated by an electric motor that receives commands from the ECM.

The single piece crankcase is designed to withstand high-pressure engine loads, and utilizes parent bore cylinders. The engine utilizes heavy duty high-flow cylinder heads that promote a faster burn which improves efficiency and reduces emissions.

The engine is also equipped with a tuned, long-runner intake manifold to increase torque. The intake manifold provides an air gap which keeps intake air cooler and improves efficiency.

Fuel System Overview

The PSI 8.8 liter LPG Engine's fuel system is composed of the fuel tank, Liquid Propane Delivery Module, fuel lines, fuel rails, and fuel injectors.

The PSI 8.8 liter LPG engine utilizes a dual-cylinder liquid propane fuel tank.

NOTE

Propane autogas tanks are considered full when they are filled to 80% of their capacity. This allows the propane autogas to safely expand when external temperatures rise.

The primary cylinder contains the Liquid Propane Delivery Module's components. A certification label mounted to the primary cylinder contains the tank's serial number and size specifications.

The fueling port is a threaded fitting with a port cover.

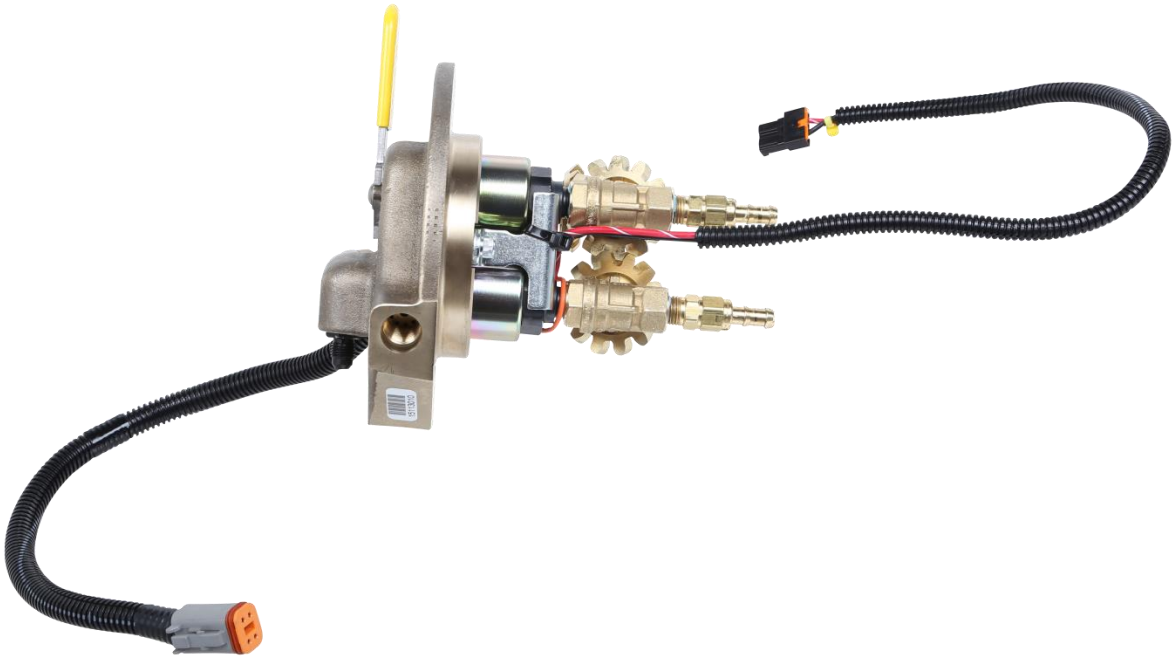
The 80% stop fill valve only allows the tank to be filled to 80 percent. A float connected to an arm closes the valve; effectively stopping the tank from filling once the liquid propane autogas reaches a certain level.

The pressure relief valve is a hydrostatic valve which will open if the internal tank pressure exceeds a certain pressure. A hose is connected to the valve to divert propane autogas vapor away from the tank.

The tank level gauge displays the amount of liquid propane autogas in the tank. The level shown on the gauge is determined by an internal float.

The liquid service valve is a manually operated hand wheel type valve that is also equipped with an overflow protection device. The overflow protection device will trip when flow exceeds a pre-determined gallon per minute specification.

The 80% liquid level valve, also referred as the 'spit valve', contains a small orifice that can be manually opened or closed. During filling, the valve can be opened to indicate when the propane tank has reached 80% of the tanks capacity.



The Liquid Propane Delivery Module, or LPDM, is located at the end of the primary fuel cylinder. A combination pressure/temperature sensor threads into the LPDM.

The schrader valve is used for service and diagnostics of the fuel system. The failsafe electric valves are the: excess flow valves, supply lock-off valve, and the return lock-off valve.

The booster pump is an electric pump that maintains the supply pressure of liquid propane autogas. A filter surrounds the booster pump, which is held in place by a steel sleeve within the primary cylinder.

The lock-off valves are normally closed. Once energized, a solenoid will partially open the valve. When fuel pressure is equalized on both sides, the valve will completely open. The excess flow valves prevent excessive flow of propane autogas in the event of fuel line failure.

Always consult the owner's manual and company policies prior to operating a propane-autogas-fueled vehicle to determine what steps to take in the event of an emergency

To prevent personal property damage, personal injury, and/or death, DO NOT attempt to close the manual shutoff valve if there is immediate danger.

The quarter turn shutoff valve quickly stops the flow of propane autogas in the system. It's used by first responders in the event of an emergency, or any other time the flow of propane needs to be turned off.

The Scavenge pump, located in the primary fuel cylinder, is mounted near the LPDM. The scavenge pump is designed to constantly supply liquid propane autogas to the front of the baffle plate where the booster pump is located.

The baffle plate ensures there is always liquid propane autogas at the booster pump, even when the vehicle is on a grade. With the ignition key on, the scavenge pump will continuously pull liquid propane autogas from the rear of the tank through a pickup tube to the front of the baffle plate.

Magnets are placed in various locations of the tank. These magnets attract any metallic debris that may enter the tank.

The fuel lines consist of two flexible hoses. The supply line is contained within the return line. This is known as a concentric design. This design cuts the number of possible leak points in half and uses the return line as insulation for the supply line. The inner fuel line is made of nylon and supplies liquid propane autogas to the injectors. The outer line is made of rubber and returns propane autogas to the tank in a vapor state.

A fuel rail is located on the top of each row of fuel injectors. These fuel rails have have the same concentric design as the fuel lines.

The fuel injectors are designed specifically for propane autogas systems. A screen located in the fuel inlet port of the injector filters out contaminants in the fuel. A small orifice within the injector, called a Cooling Bushing, allows propane autogas to continuously flow through the injector.

Fuel System Flow

Liquid propane autogas is drawn from the primary tank by the booster pump.

Tank pressure will change depending on fuel level and temperature, however, the booster pump ensures the fuel supply pressure remains constant. Due to the consistent pressure, propane autogas will remain a liquid throughout the supply portion of the system.

From the LPDM, liquid propane autogas then flows to the fuel rails through the fuel lines running along the frame. The fuel rail supplies the injectors with liquid propane autogas.

The injectors deliver liquid propane autogas into the intake port / runner. Since propane has a very low boiling point, it vaporizes immediately as it exits the injector.Any liquid propane autogas not injected into the intake port / runner flows through the cooling bushing. Since the cooling bushing causes a pressure reduction to take place, the propane autogas vaporizes.

This is called a refrigeration cycle. It allows the vaporized propane autogas returning to the tank to act as an insulator for the inner supply line. Due to this fuel system design, propane autogas is constantly circulated through the system.

ENGINE ELECTRICAL OVERVIEW

An **Engine Control Module, or ECM**, will monitor and control performance of the PSI 8.8 liter LPG engine in order to ensure maximum performance and compliance with EPA emissions requirements.

Spark Plugs receive voltage from ignition coils mounted to the valve covers. This voltage is used to ignite the air/fuel mixture in the combustion chamber.

The combination Engine Oil Pressure/Engine Oil Temperature Sensor threads into a port on the main oil galley. This sensor measures both the pressure and temperature of the engine oil.

The ECM uses a Knock Sensor at the rear of each cylinder head to detect knocking caused by detonation of the Air/Fuel mixture.

The engine coolant temperature sensor is located at the front of the engine on the coolant crossover. The Manifold Absolute Pressure (MAP) sensor, located on top of the intake manifold, measures the pressure within the intake manifold.

The Mass Air Flow (MAF) sensor is located in-line with the air inlet system after the air filter. The MAF sensor measures the amount of air entering the engine.

Four Heated Oxygen (O2) sensors are used to measure the amount of oxygen present in the exhaust stream. Each exhaust bank has two O2 sensors: A Pre-Catalyst and a Post-Catalyst.

The Camshaft Position Sensor located in the front cover determines the speed and position of the camshaft. The Crankshaft Position sensor located at the rear of the engine measures crankshaft speed and position.

All of these sensors work together to monitor and verify proper operation of engine components and systems.

ENGINE OPERATION

The PSI 8.8 liter LPG engine's ECM utilizes a propane specific fuel strategy. Gasoline engines need a very rich fuel mixture to start the engine. Propane autogas on the other hand requires much less fuel enrichment at start up, reducing the amount of emissions released.

If the 'Wait to Start' lamp on the dashboard is illuminated, the fuel systems purge cycle is active. The purge cycle pushes liquid propane autogas to the engine by running the booster pump in the tank.

The purge cycle aides in hot starting or restarting, and can last between 5 and 30 seconds. PowerLink, which was developed by Power Solutions International, is the recommended diagnostic and service software for this engine.

PowerLink software is compatible with the EZ-Tech laptops and tablets using USB Link cables.

The PSI 8.8 liter LPG Engine also utilizes a Positive Crankcase Ventilation, or PCV, system. The PCV system circulates fresh air through the crankcase to remove blow-by gasses that are built up. Air is drawn in from the air inlet piping…past a mesh filter into the crankcase where the air is circulated. This circulated crankcase air then passes through an additional mesh filter before it enters the intake manifold.

VISUAL INSPECTION

WARNING

To prevent property damage, injury, or death, beware of liquid propane autogas leaks. Because of the large expansion rate, a liquid propane autogas leak can be more hazardous than a vapor autogas leak.

Before entering a vehicle powered by the PSI 8.8 liter LPG engine, a visual inspection should be performed. Let's cover some inspection points that may be recommended.

NOTE

Always consult the vehicles Operation and Maintenance Manual before performing a visual inspection.

WARNING

To prevent personal injury and/or death, always respond in accordance with local AHJ guidelines to even a faint odor of propane.

Look and listen for leaks and puddles as you walk around the vehicle. Check for vandalism and loose items.

Check that the fuel door and fueling port are free of damage. Verify the fuel door securely closes, as the vehicle may not start if the fuel door is open.

Check for signs of fluid leaks in the engine compartment. Also check for signs of drips on the ground under the engine.

Inspect the fuel tanks for any punctures, gouges, or signs of damage. Ensure all fuel tank mounting brackets and supports are free of corrosion and damage.

Inspect the fuel lines and connections for any leaks, kinking, or any other signs of damage. Inspect the quarter turn safety shut off valve for any damage or leaks.

WARNING

To prevent property damage, personal injury and/or death, beware of liquid propane autogas leaks. Because of the large expansion rate, a liquid propane autogas vapor leak can be more hazardous than a vapor propane autogas leak.

If there are any leaks or signs of damage, immediately leave the area and call the proper authorities.

The PSI PowerLink software contains a vehicle inspection form that can be used to report all issues. Refer to the PowerLink user manual for more information.

Conclusion

This concludes the Navistar® training course: 2015 PSI 8.8 Liter LPG Engine Overview. Thank you for your participation.

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