A NAVISTAR COMPANY

# MaxxForce™ 7 Overview

## Study Guide
## TMT-120707

INTERNATIONAL®

Study Guide
MaxxForce™ 7 Overview
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# Introduction

Welcome to the International® 2007 MaxxForce™ 7 Overview Web Based Training Course. This program is designed to provide an overview of the International® MaxxForce™ 7 engine.

To receive credit for completing this training course, you must take a post test on ISIS®/Education/Service/Online Testing.

**Objectives**

**Upon Completion of this program, you will be able to identify the following:**

- **General engine specification**
- **Component and system locations**
- **Key design features**

## NOTES

# General Information

# Module 1

## V8 Comparison 6.0L vs. 6.4L

The 2007 MaxxForce™ 7 engine has been substantially upgraded from the VT 365™. This engine has a new high pressure common rail fuel system, an increased bore size, high cylinder pressure engine block, a single box Engine Control Module (ECM), a Diesel Particulate Filter (DPF), and a Can-Operated Variable Geometry Turbocharger (VGT).

***"The 2007 MaxxForce™ 7 engine has been substantially upgraded from the VT 365™."***

## MaxxForce™ 7 Engine Specifications

Engine Configuration…4-cycle, Diesel V8, Valve Configuration…4 Valves Per Cylinder, Displacement…6.4L (389 cu. In.), Bore…98.2 mm (3.87 in), Stroke…105 mm (4.134 in.), Aspiration… VGT Turbocharged and Charge Air Cooled, Engine Rotation… Counterclockwise when Facing the Flywheel, Fuel System… Common Rail High Pressure Fuel System, Engine Weight (Dry) …482 kg (1063 lbs. est.), Firing Order…1-2-7-3-4-5-6-8.

## Engine Horsepower and Torque

***"There are three different horsepower and torque configurations available for the MaxxForce™ 7."***

There are three different horsepower and torque configurations available for the MaxxForce™ 7. The base MaxxForce™ 7 engine has an output of 200 brake horsepower and 560 foot pounds of torque.

The second horsepower and torque configuration has 215 brake horsepower and 516 foot pounds of torque.

Finally the third horsepower and torque configuration boasts a substantial 230 brake horsepower and 620 foot pounds of torque.

## Engine Serial Number (ESN) Location

The Engine Serial Number (ESN) is located on the left rear corner of the crankcase, just below the cylinder head. The ESN identifies the engine family, build location, and the sequential build number. For the MaxxForce™ 7 the ESN numbers are as follows; 6.4 is the engine family, HM2Y indicates the build location, and 0342752 designates the sequential build number.

# Components

Module 2

## Water Pump

The water pump is mounted to the front cover. The water pump impeller pulls coolant from the center of the housing to improve distribution of coolant throughout the engine.

## Dual Thermostats

The dual thermostats control the amount of coolant that flows to the radiator for optimal engine cooling. Dual thermostats are necessary because of the additional load on the coolant system.

## Secondary Fuel Filter

The secondary fuel filter provides a 4 micron filtration rating for the fuel supplied by the low pressure fuel pump and fuel cooler. The secondary fuel filter supplies fuel directly to the high pressure fuel pump. The Engine Fuel Temperature (EFT) sensor and optional Engine Fuel Pressure (EFP) sensor are installed in the secondary fuel filter housing.

***"The secondary fuel filter provides a 4 micron filtration rating for the fuel supplied by the low pressure fuel pump and fuel cooler. "***

## Glow Plugs

The glow plugs are located inside the cylinder head under the valve cover. The glow plugs can be serviced without removing the valve cover.

## Engine Coolant Temperature (ECT) Sensor

***"The Engine Coolant Temperature (ECT) sensor is a thermistor mounted on the Engines Front Cover Module."***

The Engine Coolant Temperature (ECT) sensor is a thermistor mounted on the Engines Front Cover Module. The ECT transmits coolant temperature data from the engine to the ECM.

## Intake Throttle Valve (ITV)

The Intake Throttle Valve (ITV) is controlled by the Engine Control Module (ECM). The ITV is used to increase the efficiency of the Aftertreatment system soot reduction process. The soot reduction process is called Regeneration.

## Electronic Control Module (ECM)

The Injector Harness, Engine Sensor Harness and Chassis Harness are connected to the ECM.

## Camshaft Position (CMP) Sensor

The Camshaft Position (CMP) sensor is a magnetic pickup-type sensor mounted in the left front side of the crankcase.

## Barometric Pressure (BAP) Sensor

The BAP sensor measures barometric pressure and sends its signal information to the ECM to help calculate fuel delivery and timing for the engine. The BAP is integrated into the ECM and is not serviceable.

## Fuel Cooler

The purpose of the Fuel Cooler is to maintain fuel operating temperature at or below 158°f (70°c). The high pressure fuel pump requires cooled fuel to maintain proper lubrication.

***"The purpose of the Fuel Cooler is to maintain fuel operating temperature at or below 158°f (70°c)."***

## Variable Geometry Turbocharger (VGT)

The Variable Geometry Turbocharger (VGT) is designed to provide adequate boost pressure at all engine speeds.

## 42-Way Connector

The 42-Way connector is an interface that allows communication between the ECM and the CAN Data Bus.

## VGT Actuator

The VGT Actuator is a variable position actuator that controls the VGT vane position.

## Fuel Primer Pump

The Fuel Primer Pump allows the Low Pressure Fuel system to be primed if the engine has run out of fuel or if the fuel system has been serviced.

## Primary Fuel Filter

The Primary Fuel Filter has a 10 micron rating and is serviced from under the engine.

## Low Pressure Fuel/ Power Steering Pump

***"The Low Pressure Fuel/Power Steering Pump is mounted on the right rear of the engine and is driven from the idler gear."***

The Low Pressure Fuel/Power Steering Pump is mounted on the right rear of the engine and is driven from the idler gear. The pump is a vane type mechanical pump. Attached to the pump is the fuel strainer, which serves

as the location to measure fuel inlet restriction.

## Coolant Heater

The Coolant Heater warms the engine coolant to prevent hard starts in cold ambient temperatures.

***"The Coolant Heater warms the engine coolant to prevent hard starts in cold ambient temperatures."***

## Engine Diesel Oxidation Catalyst (EDOC)

The EDOC is located in the Exhaust System between the right Exhaust Manifold and the EGR cooler.

The main function of the EDOC is to reduce EGR cooler fouling and soot buildup.

## EGR Cooler

The EGR cooler is mounted above the right cylinder head. The coolant connections for the truck are on top of the EGR cooler.

## Crankshaft Position Sensor (CKP)

The CKP is a magnetic pickup sensor mounted on the right front side of the crankcase.

## Fuel Heater / Water In Fuel (WIF) Sensor

The Fuel Heater is mounted to the bottom of the Primary Fuel Filter. It is controlled by a thermostatic switch.

The Water In Fuel (WIF) sensor that detects water in the Primary Fuel Filter.

## Glow Plug Relay

***"The Glow Plug Relay is mounted on a bracket above the right cylinder head."***

The Glow Plug Relay is mounted on a bracket above the right cylinder head. This Glow Plug Relay uses two separate glow plug harnesses. They are two very different harnesses located on each of the cylinder heads.

## Exhaust Backpressure (EBP) Sensor

The EBP sensor relays exhaust pressure information to the ECM for proper control of the VGT and the Exhaust Gas Recirculation (EGR) valve.

## EGR Cooler Coolant Return Line

The EGR coolant return line returns coolant from the EGR cooler to the front cover.

## EGR Cooler Coolant Supply Line

EGR Cooler Coolant Supply Line supplies coolant from the front cover to the EGR cooler.

## Exhaust Gas Recirculation (EGR) Valve

The EGR valve circulates exhaust gases to help reduce the oxides of nitrogen emissions from the engine.

After exhaust gases are cooled by the EGR cooler, the gases are routed to the valve. When the valve opens, the exhaust gases are mixed into the stream of fresh air delivered to the intake manifold.

***"The EGR valve circulates exhaust gases to help reduce the oxides of nitrogen emissions from the engine."***

## Engine Fuel Pressure (EFP) Sensor

The EFP sensor is a variable capacitance sensor mounted in the bottom of the Secondary Fuel Filter housing. The EFP is optional.

## Engine Fuel Temperature (EFT) Sensor

The EFT sensor is a thermistor mounted in the base of the Secondary Fuel Filter housing.

## NOTES

# Design Features

# Module 3

## Rear Gear Train

The Primary and Secondary Flange Gears are bolted to the Crankshaft. The Secondary Flange Gear is used to drive the Camshaft Gear which in turn, drives the High Pressure Fuel Pump Gear. The Secondary Flange Gear is also used to drive an Idler Gear that in turn, drives the Low Pressure Fuel Pump. Only the Primary Flange Gear and the Camshaft Gear are timed together.

***"The Primary and Secondary Flange Gears are bolted to the Crankshaft."***

## High Pressure Common Rail Fuel

The High-Pressure Common Rail Fuel system has three main components: a High Pressure Pump, a Common Rail for each cylinder bank, and the injectors.

In a Common Rail system, the High Pressure pump takes fuel under low pressure from the Fuel Supply system and raises the pressure to meet the Fuel Injector pressure requirement for the current engine Accelerator Position Sensor (APS) input, engine load and engine temperatures.

## Exhaust Gas Recirculation Valve

The EGR valve circulates exhaust gases to help reduce the oxides of nitrogen emissions from the engine.

After exhaust gases are cooled by the EGR, cooler the gases are routed to the valve. When the valve opens, the exhaust gases are mixed into the stream of fresh air delivered to the intake manifold.

## Closed Crankcase Breather

***"The Crankcase Breather removes the residual oil in the crankcase gases."***

The Crankcase Breather removes the residual oil in the crankcase gases. The gases pass through the Crankcase Breather and the liquid is separated from the vapor. The vapor is returned to the inlet side of the Turbocharger and the liquid is returned to the crankcase.

## Exhaust Gas Recirculation Valve

The MaxxForce™7 uses an Engine Diesel Oxidation Catalyst (EDOC) between the right exhaust manifold and the EGR cooler. The purpose of the EDOC is to keep the EGR cooler clean by removing heavy chain hydrocarbons or soluble organic fraction from the

exhaust gas stream.

Exhaust gases pass through the EGR cooler to dissipate heat before being mixed into the fresh air intake via the EGR valve. The coolant entering the EGR cooler flows from the back exiting in the front making it a parallel flow cooler.

***"Exhaust gases pass through the EGR cooler to dissipate heat before being mixed into the fresh air intake via the EGR valve."***

## Variable Geometry Turbocharger (VGT)

The MaxxForce™7 has a Variable Geometry Turbocharger (VGT) to provide boost pressure. The VGT operates with an Actuator and linkage that change the pitch of the vanes depending on engine load.

The VGT actuator is directly controlled by the ECM over the CAN Data bus.

## Intake Throttle Valve (ITV)

The Intake Throttle valve is mounted on the inlet mixer duct on the front of the engine.

The Intake Throttle valve has a variable position throttle plate that the ECM can close to restrict intake air flow. The restricted air flow in combination with additional fuel injected into the cylinders reacts in the Diesel

Oxidation Catalyst (DOC) to raise the temperature in the Diesel Particulate Filter (DPF) in order to burn the collected soot into the ash.

## Fuel Supply Features

***"The fuel supply system has four main components: Primary Fuel Filter, Low Pressure Fuel Pump, Secondary Fuel Filter, and Fuel Cooler."***

The fuel supply system has four main components: Primary Fuel Filter, Low Pressure Fuel Pump, Secondary Fuel Filter, and Fuel Cooler.

The Low Pressure Fuel Pump draws fuel from the fuel tank(s) through the Primary Fuel Filter.

The Low Pressure Fuel Pump raises the pressure of the fuel from the Primary Fuel Filter and supplies fuel to the Secondary Fuel Filter.

The fuel filtered by the Secondary Fuel Filter is supplied directly to the High Pressure Fuel pump.

The High Pressure Fuel Pump and cylinder head returns any unused fuel to the Fuel Cooler to be cooled.

The cooled fuel from the Fuel Cooler is supplied to the Secondary Fuel Filter housing. The cooled fuel is mixed with the fuel supplied by the Low Pressure Fuel Pump.

## Electronic Control Module (ECM) Features

The MaxxForce™7 ECM uses various sensor inputs to calculate the commands sent to the Injectors, Actuators, Glow Plug System, and the After Treatment System. The ECM houses the Barometric Pressure (BAP) sensor and has three connectors compared to the seven on the previous model.

***"The MaxxForce™7 ECM uses various sensor inputs to calculate the commands sent to the Injectors, Actuators, Glow Plug System, and the After Treatment System.."***

## Aftertreatment Features

The Aftertreatment portion of the exhaust system is mounted downstream of the turbocharger. The Diesel Oxidation Catalyst (DOC) and a Diesel Particulate Filter (DPF) reduce the amount of particulate matter allowed into the engine exhaust to comply with the 2007 emission standards. The ECM monitors the DOC's and DPF's soot levels, pressure sensor and temperature sensors.

Aftertreatment uses two methods to regenerate: Passive regeneration and active regeneration. Passive regeneration occurs as the engines exhaust temperature burns the soot under medium to heavy loads. Active regeneration occurs periodically when the soot levels are too high. During

this process, a small mist of diesel fuel is injected into the exhaust stream, the mist travels through the exhaust pipe to wet the DOC's pre-catalyst. This causes a chemical reaction which raises DPF temperatures to the level required to convert the soot into ash.

## Conclusion

This concludes the International® MaxxForce™ 7 Overview WBT. The information and techniques presented here are pivotal when becoming a certified International® technician. You are now required to take a post-test via ISIS®/Education/Service/Online Testing.

## NOTES

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