

## SECTION 4 – ENGINE OPERATION

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### Operation

#### SUGGESTED WARM UP TIME

**NOTE:** Before applying a load or increasing speed above 1000 rpm, warm up engine for a minimum of 5 minutes at or below 1000 rpm. The warm up period allows lubricating oil to establish a film between moving parts.

After allowing the vehicle to warm up for 5 minutes, begin operating the vehicle at reduced engine speeds and load until it reaches operating temperature. Once operating temperature is reached, begin normal operation. The Cold Ambient Protection (CAP) system aids in engine warm up and maintains engine heat during extended idling periods. See Cold Ambient Protection (CAP) (page 59) in this section.

#### IDLE SPEED

 **WARNING:** To prevent personal injury or death, provide ventilation when operating an engine in a closed area. Inhalation of exhaust gas can be fatal.

Low idle speed for the MaxxForce® DT, 9, and 10 Diesel Engines is 700 rpm (nonadjustable). If the engine coolant temperature is below 70 °C (158 °F), the Electronic Control Module (ECM) will adjust the low idle speed from 700 rpm to a maximum of 875 rpm. High idle speed is a nonadjustable factory setting.

High idle speed is a nonadjustable factory setting. The high idle setting depends on the application of the vehicle and has the following ranges:

MaxxForce® DT: 2600 rpm through 2770 rpm

MaxxForce® 9 and 10: 2325 rpm through 2425 rpm

#### EXTENDED IDLING PERIODS

**CAUTION:** To prevent engine damage, do not extend low idle periods.

Idling periods over 15 minutes should be avoided. Diesel engine efficiency is improved when the cylinder temperature remains high. Low temperature in cylinders may cause the following:

- Unburned fuel may seep from exhaust manifold gaskets and vehicle exhaust system connections. This seepage has the dark colored appearance of lubricating oil.
- Incomplete combustion and unburned fuel washes lubricating oil from cylinder sleeves. Unburned fuel will be carried into the lubricating oil, dilute the oil, and change oil viscosity.
- Carbon forms on internal components of turbochargers and EGR, reducing engine efficiency.
- Carbon clogs and damages the Diesel Particulate Filter (DPF).

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### Operation (cont.)

#### AFTERTREATMENT SYSTEM

The engine and vehicle exhaust piping includes an Aftertreatment System to capture soot and other particulates before they exit the exhaust pipe. The soot is captured by the Diesel Particulate Filter (DPF) and is periodically converted to carbon dioxide (CO<sub>2</sub>) by a Regeneration (Regen) process.

The Regen process may take place during vehicle operation (Active Regen). The Active Regen process will be triggered by either a time-based soot or a soot mass buildup-based strategy.

A Parked Regen process is required when insufficient thermal energy has not been present to initiate the process for Diesel Oxidation Catalyst (DOC) light off. The vehicle is required to be parked (stationary).

- A Parked Regeneration will be requested if the Passive Regeneration cannot be completed during driving.
- In this case, a dash-mounted lamp will be lit to alert the driver to perform a Parked Regeneration.
- The driver must park the vehicle and then perform the Regen as required.
- Follow the Parked Regeneration process listed in the *Vehicle Operator Manual*.
- If the Parked Regeneration process is ignored, the engine may stop running.

- See the “SAFETY INFORMATION” (page 3) section for safety precautions.

A Preliminary Diesel Oxidation Catalyst (PDOC) and a DOC operate together to oxidize the injected fuel to increase the exhaust gas temperature as needed for DPF Regen.

#### ENGINE IDLE SHUTDOWN TIMER (FEDERAL-OPTIONAL)



**GOVERNMENT REGULATION: State and local regulations may limit engine idle time. The vehicle owner or operator is responsible for compliance with these regulations.**

The optional Idle Shutdown Timer (IST) allows the Engine Control Module (ECM) to shutdown the engine during extended idle. Idle time can be programmed from 5 to 120 minutes. The ECM can be programmed to deactivate the IST when the Power Takeoff (PTO) is active.

Thirty seconds before engine shutdown, the amber IDLE SHUTDOWN indicator in the instrument panel gauge cluster illuminates. This continues until the engine shuts down or the low idle shutdown timer is reset. The engine must be out of

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### Operation (cont.)

#### ENGINE IDLE SHUTDOWN TIMER (CALIFORNIA-STANDARD) (cont.)


the idle time can be programmed up to 60 minutes. The ECM will deactivate the IST when the PTO is active.

Thirty seconds before engine shutdown, the amber IDLE SHUTDOWN indicator in the instrument panel gauge cluster illuminates. This continues until the engine shuts down or the low idle shutdown timer is reset. The engine must be out of gear for the IST to work. Engine shutdown timer will deactivate for one or more of the following conditions:

- Engine speed is not at idle speed (700 rpm).
- Vehicle movement or a Vehicle Speed Sensor (VSS) fault is detected.
- Manual DPF Regeneration is enabled (Parked Regen).
- Accelerator pedal movement or an Accelerator Pedal Sensor (APS) fault is detected.
- Engine coolant operating temperature is below 16 °C (60 °F).
- Brake pedal movement or a brake switch fault is detected.
- Parking brake transition is detected.
- Clutch pedal is pressed or clutch pedal switch fault is detected (manual transmissions, if equipped with a clutch switch).

- Shift selector is moved from neutral (automatic transmissions).
- If the IST is enabled, the Cold Ambient Protection (CAP) will not function.

#### COLD WEATHER OPERATION

 **WARNING: To prevent personal injury or death, do not use ether, propane, gasoline or gasohol as starting aids.**

**NOTE:** If operating in temperatures below -12 °C (10 °F), contact an International® dealer for information about special cold weather equipment and precautions.

At temperatures below -12 °C (10 °F) a 1250 watt coolant heater and a 300 watt oil pan heater is required for cold starting.

1. Before operating the engine at 0 °C (32 °F) or lower, check or service the following:
  - Correct battery size
  - Correct amount of electrolyte, if not a maintenance free battery.
  - Full battery charge
  - Condition of other electrical equipment

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### Operation (cont.)

#### COLD WEATHER OPERATION (cont.)

- Cooling system leaks
  - Correct coolant and cooling system level
  - Recommended oil grade
2. At the end of each daily operation do the following:
- Fill the fuel tank with correct fuel.
  - Drain water from the fuel filter housing.
  - Check oil level
  - Clean external surfaces of the engine and accessories to prevent dirt or snow build up.
  - Clean outside and in between radiators to prevent dirt or snow build up.

#### COLD AMBIENT PROTECTION (CAP)

CAP is a standard feature on all vehicles. It safeguards the engine from damage caused by prolonged idle at no load during cold weather. CAP also improves cab warm-up.

CAP maintains engine coolant temperature by increasing engine rpm to a programmed value when ambient air temperature is below 0 °C (32 °F), coolant temperature is below 65 °C (149 °F), and engine has been idling at no load for over five minutes.

Engine speed will ramp up to 1400 rpm and will maintain at 1400 rpm until coolant temperature has reached 75 °C (167 °F).