

SECTION 4 – ENGINE OPERATION


Operation

SUGGESTED WARM UP TIME

NOTE: The warm up period allows lubricating oil to establish a film between moving parts. Keep the engine at or below 1000 rpms and less than half throttle for a minimum of 5 minutes before moving the vehicle.

Cold ambient engine warm up time can be reduced by operating the vehicle under load at reduced engine speed. Begin normal operation when engine systems reach operating temperature. The Cold Ambient Protection (CAP) system aids in engine warm up and maintains engine heat during extended idling periods. See Extended Idling Periods, 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 MaxxF[®] 7 Diesel Engines is 700 rpm (nonadjustable). If the engine coolant temperature is below 70 °C (158 °F) and Cold Ambient Protection (CAP) is enabled, the Electronic Control Module (ECM) adjusts the low idle speed from 700 rpm to a maximum of 1000 rpm. High idle speed is a non adjustable factory setting.

EXTENDED IDLING PERIODS

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

Extended idling periods 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 will wash lubricating oil from cylinder sleeves. Unburned fuel will be carried into the lubricating oil, dilute the oil, and change oil viscosity.
- Carbon will form on internal components of turbocharger and EGR, reducing engine efficiency.
- Carbon will clog and damage the Diesel Particulate Filter (DPF)

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 (CO₂) by a Regeneration (Regen) process.

SECTION 4 – ENGINE OPERATION

Operation (cont.)

AFTERTREATMENT SYSTEM (cont.)

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 “Safety Information” (page 3) in this manual 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 2 to 120 minutes. The ECM can be programmed to 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.

SECTION 4 – ENGINE OPERATION

Operation (cont.)

ENGINE IDLE SHUTDOWN TIMER (FEDERAL-OPTIONAL) (cont.)

- Manual DPF Regeneration is enabled (Parked Regen).
- Accelerator pedal movement or an Accelerator Position sensor (APS) fault is detected.
- Engine coolant operating temperature is below 60 °C (140 °F).
- Ambient temperature below 16 °C (60 °F) or above or above 44 °C (110 °F).
- Brake pedal movement is detected 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.

ENGINE IDLE SHUTDOWN TIMER (CALIFORNIA-STANDARD)



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

Your light heavy duty diesel engine conforms to applicable California Air Resources Board (CARB) Engine Shutdown System (ESS) regulations. This vehicle is registered and certified for sale in California.

The CARB Idle Shutdown Timer (IST) allows the Engine Control Module (ECM) to shutdown the engine during extended idle. When parking brake is set, the idle time can be programmed up to 5 minutes. When parking brake is released, the idle time can be programmed up to 15 minutes. No parking brake, the idle time can be programmed up to 15 minutes. During service, the idle time can be programmed up to 60 minutes. The ECM will deactivate the IST when the PTO is active.

SECTION 4 – ENGINE OPERATION

Operation (cont.)

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

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

NOTE: If operating in temperatures below -29 °C (-20 °F), contact an International® dealer for information about special cold weather equipment and precautions.

NOTE: At temperatures below -20 °C (-4 °F), a crankcase mounted cup plug coolant heater is recommended to improve 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
 - Cooling system hoses for leaks
 - Correct coolant and cooling system level
 - Recommended oil grade

SECTION 4 – ENGINE OPERATION

Operation (cont.)

COLD WEATHER OPERATION (cont.)

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 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 20 °C (68 °F), coolant temperature is below 70 °C (158 °F), and engine has been idling at no load for over five minutes.

CAP is standard on all trucks without an Idle Shutdown Timer (IST), with a clutch switch (manual transmissions) or a neutral safety switch (automatic transmission).

The engine speed continues to increase or decrease to maintain a coolant temperature of 80 °C (176 °F) until the following occurs:

- Engine load is greater than 45%.
- Brake pedal is applied or brake switch fault 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). Shift selector must be in neutral for CAP to work.
- Power Takeoff (PTO) switch, also used for electronic hand throttle, is turned on and actively controls engine speed.
- Accelerator pedal is pressed or Accelerator Pedal Position (APP) fault is detected.
- IST is enabled.
- Engine Coolant Temperature (ECT) sensor fault is detected.
- Intake Air Temperature (IAT) ambient temperature sensor fault is detected.