

Tuesday, August 20, 2013

## 3126E Truck Engines / Air Inlet Heater

### Air Inlet Heater

The engines are equipped with an electric heater that is located behind the air inlet elbow. The electric heater has two functions:

- Aid in starting
- Aid in white smoke cleanup during start-up

Under the proper conditions, the ECM turns on the electric heater. The following conditions are evaluated prior to activating the electric heater:

- Jacket water coolant temperature
- Inlet manifold air temperature
- Ignition switch position
- Duration of time

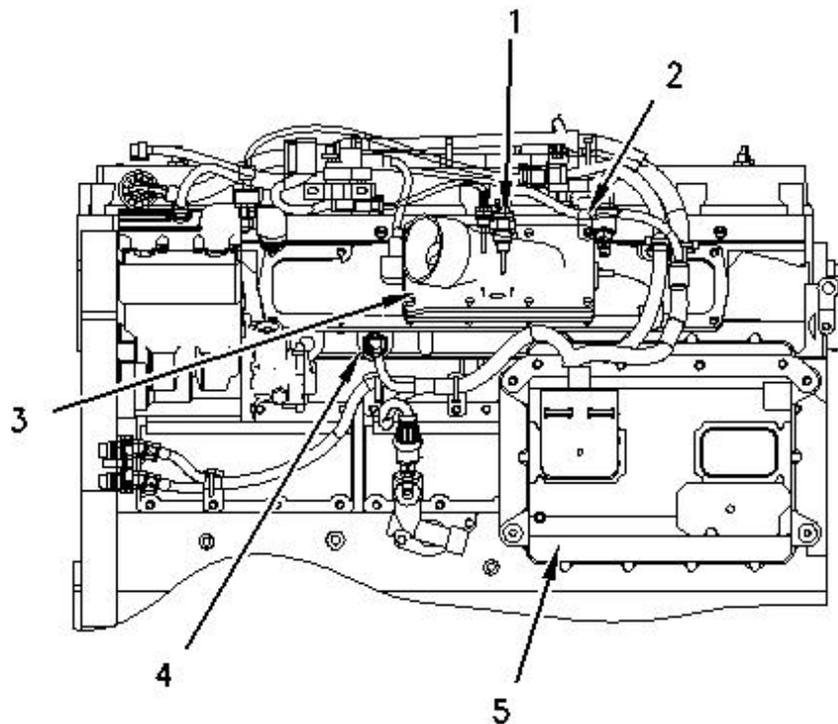
The system is capable of delivering heat for 30 seconds prior to start-up and during cranking of the engine. After the engine has started, the system is capable of delivering heat constantly for 7 minutes, or the system can cycle the heat for 13 minutes. During the heating cycle, the heat is on for ten seconds and the heat is off for ten seconds.

If the air inlet heater malfunctions, the engine will still start and the engine will still run. There may be a concern regarding the amount of white smoke that is present. Also, there may be a concern regarding the need for an alternative starting aid.

### System Components

The system of the air inlet heater consists of the following basic components:

- Relay of the air inlet heater
- Heater element
- Coolant temperature sensor
- Inlet air temperature sensor
- ECM
- Indicator lamp



### Location of components

- (1) Inlet air temperature sensor
- (2) Ground strap (heater to engine)
- (3) Air inlet heater
- (4) Coolant temperature sensor
- (5) ECM

The air inlet heater relay turns the 12 V heater ON and OFF in response to signals from the ECM (5) .

The air inlet heater (3) is a component of the air inlet cover. The heater element has a ground strap (2) that must be connected to the engine.

There are three conditions that would cause the air inlet heater to be activated:

- Powerup and Mode of Preheat

Regardless of temperature, the heater and the lamp of the heater should come on for two seconds when the ECM is first powered (lamp check). When the sum of the coolant temperature plus the inlet manifold air temperature is less than 25°C (109°F), the ECM will turn on the heater and the lamp for 30 seconds. This is a cycle of preheat.

The ECM will then turn off the heater and the lamp. When the operator attempts to start the engine prior to the completion of preheat, the ECM proceeds into the mode of cranking for heater control.

- Mode of cranking

During engine cranking, when the sum of the coolant temperature plus the inlet manifold air temperature is less than 25°C (109°F), the ECM will turn on the heater. The heater will remain on during engine cranking. If the engine fails to start, the ECM reverts to preheat. Reverting to preheat will activate the heater for another 30 seconds.

- Running of the engine

After the engine has started, the same combination of inlet manifold air temperature and coolant temperature will determine the state of the heater. The cycle has two strategies.

The two strategies are continuous and intermittent. During the continuous strategy, the heater will remain on for a maximum

of 7 minutes after starting. If the same conditions exist, the ECM will activate the intermittent strategy. During the intermittent strategy, the heater is cycled for a maximum of 13 minutes. During this cycle, the heater is turned on for 10 seconds and the heater is turned off for 10 seconds. After the 13 minute time limit, the heater is shut off. When one of the temperature sensors fails, the system will operate in the following manner:

- Coolant temperature sensor

When the coolant temperature sensor has an open circuit or a short circuit, the coolant temperature sensor has failed. During this condition, the heater will be activated when the inlet manifold air temperature is less than 10°C (50°F).

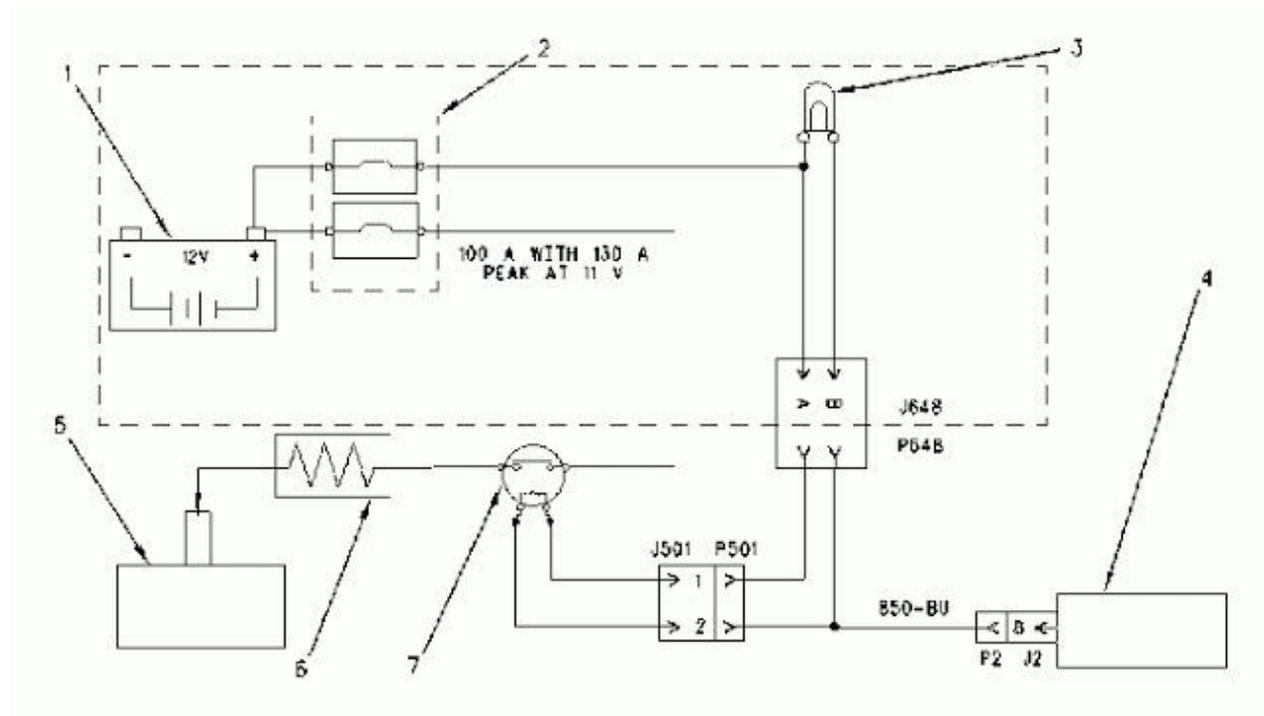
- Inlet air temperature sensor

When the inlet air temperature sensor has an open circuit or a short circuit, the inlet air temperature sensor has failed. During this condition, the heater will be activated when the coolant temperature is less than 40°C (104°F).

Under the proper condition, the heater will be reactivated. When the sum of the coolant temperature and the inlet manifold air temperature has dropped below 25°C (109°F), the heater will be reactivated. This condition could exist after a warm engine has cooled and the operator attempts to start the engine.

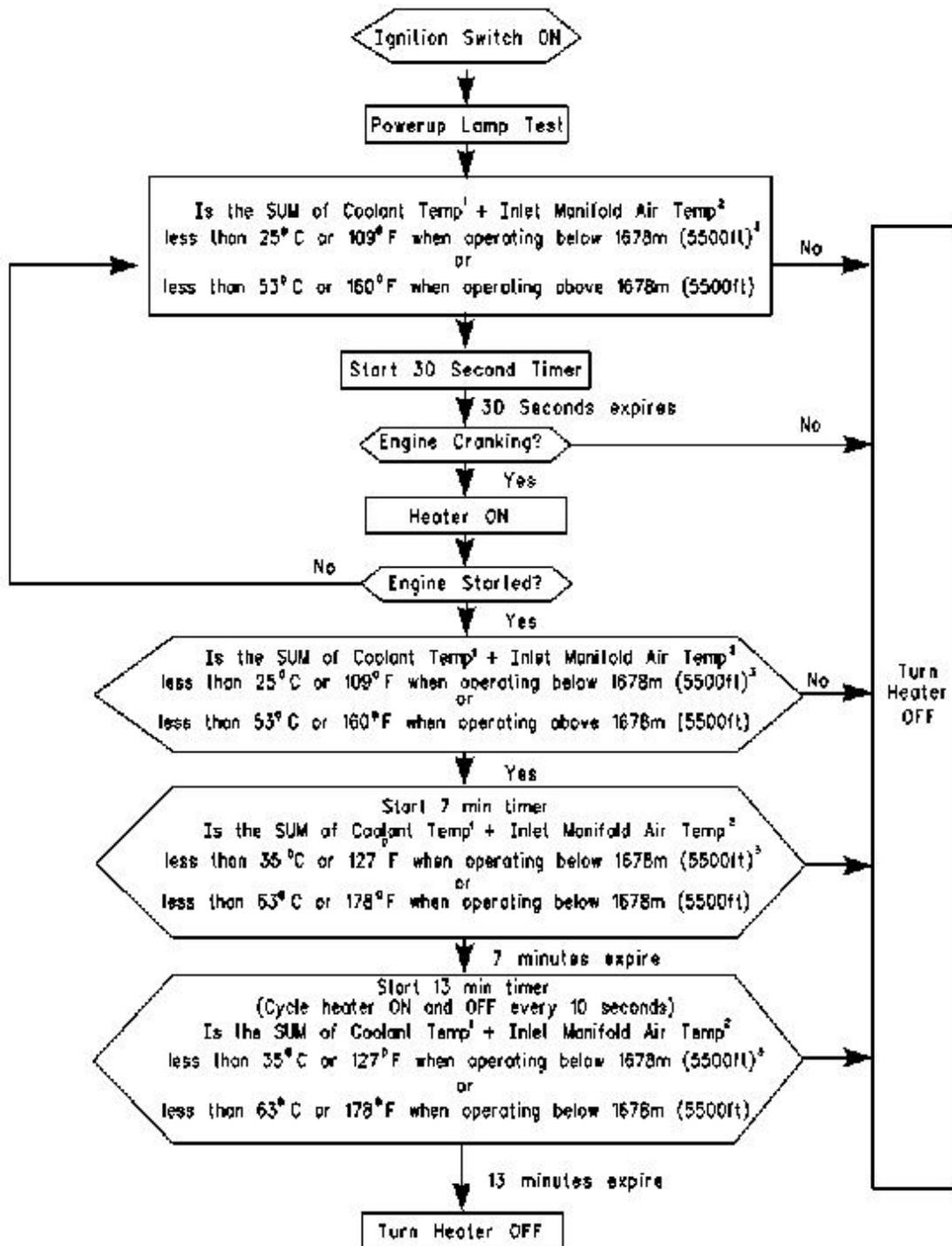
When the sum of the coolant temperature and the inlet manifold air temperature does not attain 35°C (127°F), the heater will be activated. The heater can be activated no longer than 20 minutes (maximum). The ECM will turn off the heater after the 20 minute time limit.

For additional information on the air inlet heater, refer to Troubleshooting, "Air Inlet Heater Circuit - Test".



Schematic of air inlet heater (typical example)

- (1) Battery
- (2) Fuse panel
- (3) Inlet heater lamp
- (4) ECM
- (5) Engine ground
- (6) Air inlet heater
- (7) Air inlet heater relay



- <sup>1</sup> If a coolant temperature sensor open circuit or short circuit diagnostic code is active, the heater will come ON if Inlet Manifold air temperature <math>10^{\circ}\text{C}</math> (<math>50^{\circ}\text{F}</math>)
- <sup>2</sup> If an Inlet Manifold air temperature sensor open circuit or short circuit diagnostic code is active, the heater will come ON if coolant temperature <math>40^{\circ}\text{C}</math> (<math>140^{\circ}\text{F}</math>)
- <sup>3</sup> With APR99 and Newer Personality Modules, the Boost Pressure reading is used to determine Atmospheric Pressure. This indicates if the engine is operating above 1678m (5500ft). If so, the temperature calculations used to determine Inlet Air Heater operation are adjusted to compensate for the extreme altitude operation.

## Flow Chart Of Controller Of Air Inlet Heater