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< Product: GENERATOR SET
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Configuration: 3456 Generator Set C4G00001-UP

Systems Operation

3406E and 3456 Generator Set Engines

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Electronic Control System Components

SMCS - 1900

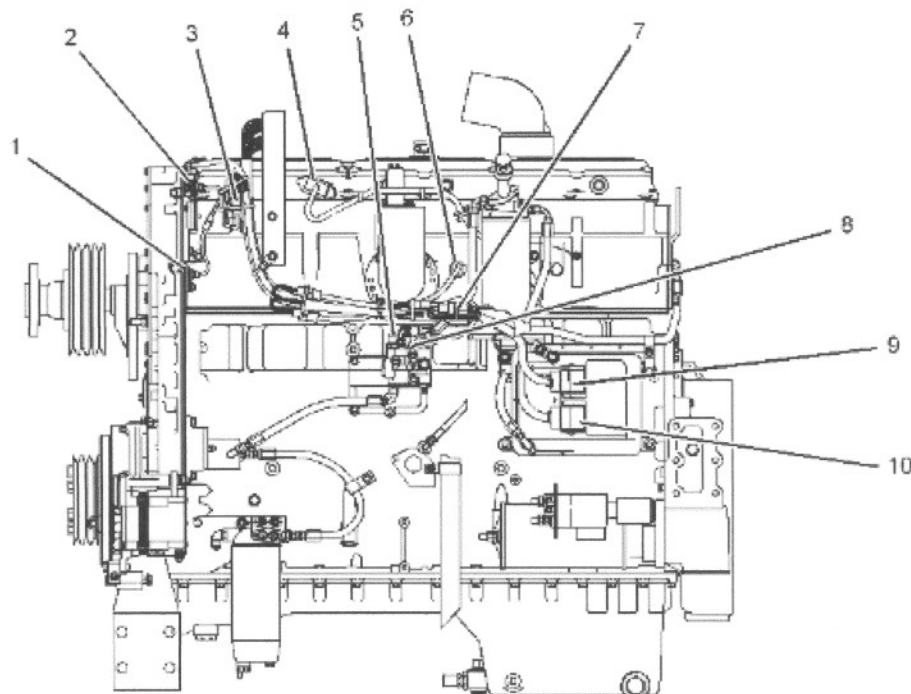


Illustration 1

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Typical example

(1) Primary engine speed/timing sensor

(2) Secondary engine speed/timing sensor

- (3) Turbocharger outlet pressure sensor
 - (4) Unit injector connector
 - (5) Fuel temperature sensor
 - (6) Inlet air temperature sensor
 - (7) Timing calibration connector
 - (8) Atmospheric pressure sensor connector
 - (9) Electronic Control Module (ECM) connector
 - (10) ECM connector
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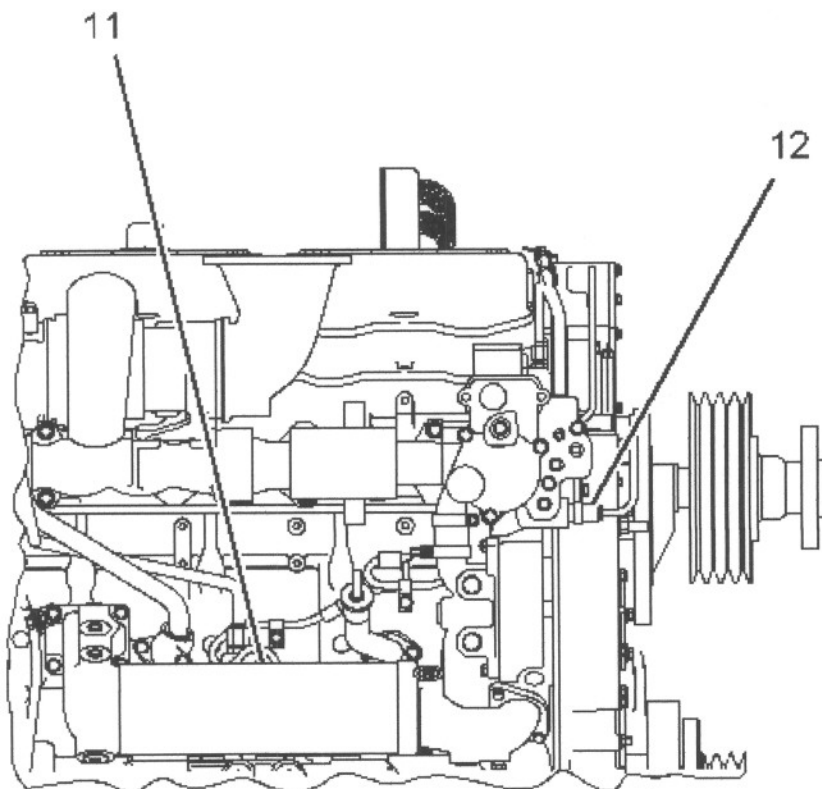


Illustration 2
Electronic control system components (right side view)

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- (11) Oil pressure sensor connector
- (12) Coolant temperature sensor connector

Engine Monitoring

An engine monitoring function is included in the electronic control system. The engine monitoring function monitors the following items:

- Engine oil pressure
- Coolant temperature
- Inlet manifold air temperature
- Coolant level

All engines are shipped with the following sensors:

- Oil pressure sensor
- Coolant temperature sensor
- Inlet air temperature sensor
- Coolant level sensor

The coolant level sensor is the only sensor that can be individually selected for engine monitoring. The Electronic Control Module (ECM) programmable parameter enables the coolant level sensor. The default factory setting is "NO". The programmable parameters for the ECM have four levels that are for engine monitoring:

- Off
- Warning (Factory Default)
- Derate
- Shutdown

Engine Monitoring is Programmed to "Off"

The ECM will ignore the oil pressure sensor and the coolant level sensor. Coolant Temperature is still used for Cold Mode. Inlet Manifold Air Temperature is used for operation in cold air regardless of the engine monitoring mode.

Engine Monitoring is Programmed to "Warning "

Warning mode uses the following sensors: Oil Pressure, Coolant Temperature, Inlet Manifold Temperature and Coolant Level Sensor.

Electronic Control System Operation

The fuel delivery and injection timing are electronically controlled. In comparison to engines that are controlled mechanically, the electronic control system provides increased control of timing and increased control to the fuel to air ratio. Injection timing is achieved by precise control of injector firing time, and engine power is controlled by adjusting the firing duration. The ECM energizes the fuel injection solenoid in order to start the injection of fuel. The ECM will de-energize the fuel injection solenoid in order to stop the injection of fuel. Refer to the Systems Operation, "Fuel System" for a complete explanation of the fuel injection process.

The engine uses the following types of electronic components: input, control and output.

An input component is one that sends an electrical signal to the ECM. The signal that is sent varies in either voltage or in frequency when there is a change in some specific system. An example would be the engine speed/timing sensor or the coolant temperature sensor. The electronic control module interprets the input sensor signal as information about the condition, environment, or operation of the engine.

An electronic control system component receives the input signals. Electronic circuits that are inside the ECM evaluate the signals. The ECM then supplies electrical energy to the output components of the system, which are in response to predetermined combinations of input signal values.

An output component is one that is operated by the ECM. An output component receives electrical energy from the ECM. The electrical energy is used to perform one of the following functions:

- Perform work. An example would be moving a solenoid plunger. An output component takes an active part in regulating or operating the engine.
- An output component can give information or a warning. An example would be a light or an alarm to the operator of the engine or other person.

Output components provide the ability to electronically control the engine operation in order to improve the following items: performance, fuel consumption rate and reduced emissions levels.

Check Engine Lamp (Diagnostic Lamp)

The Check Engine Lamp is sometimes referred to as the Diagnostic Lamp. The Check Engine Lamp can be used as a diagnostic lamp in order to communicate any problems with the operation of the electronic control system.

Note: The Check Engine Lamp and the Warning Lamp are different.

When a diagnostic fault is detected by the ECM, the Check Engine Lamp will turn ON. When a diagnostic fault is detected by the ECM, the Check Engine Lamp will flash at five second intervals. The Check Engine Lamp should be ON and the Check Engine Lamp should be flashing Diagnostic Code 55 whenever the START switch is turned ON but the engine is not running. This condition will test whether the lamp is operating correctly.

If the Check Engine Lamp comes on and the Check Engine Lamp stays on after the initial start-up, the system has detected a fault. The Check Engine Lamp or Caterpillar Electronic Technician (ET) can be used to identify the diagnostic code.

The Check Engine Lamp will begin to flash in order to indicate a two digit diagnostic code while the

SET/RESUME switch is held in the RESUME position. The sequence of flashes represents the system diagnostic message. The first sequence of flashes adds up to the first digit of the diagnostic code. After a one second pause, a second sequence of flashes will occur. The second sequence of flashes represent the second digit of the diagnostic code. If necessary, additional diagnostic codes will follow after a three second pause. Additional diagnostic codes will be displayed in the same manner.

Electronic Control Module

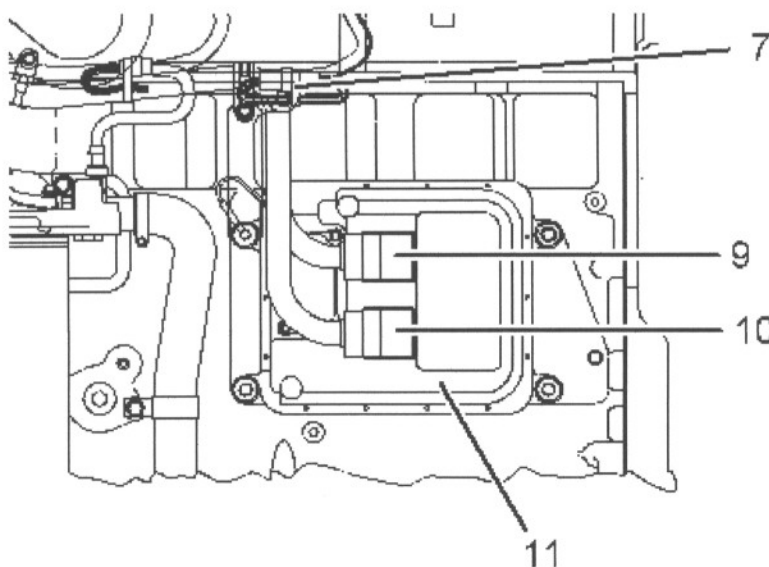


Illustration 3

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(7) TC Probe connector "J26/P26"

(9) ECM connector "J2/P2"

(10) ECM connector "J1/P1"

(11) Electronic Control Module

The 3406E and 3456 Engines use an ECM microprocessor. The ECM is mounted on the rear left side of the engine.

The ECM power supply provides electrical power to all engine mounted sensors and actuators. Reverse voltage polarity protection and resistance to voltage swings or surges have been designed into the ECM. The ECM also monitors all input from the sensors. The ECM also provides the correct outputs in order to ensure desired engine operation.

The electronic engine control system has the following features that are designed into the system.

- Resistance to radio frequency

- Resistance to electromagnetic interference

The ECM contains memory in order to store customer specified parameters. The ECM also identifies a selected factory engine rating. The memory also contains a personality module identification code in order to prevent unauthorized tampering. The memory also contains an identification code in order to prevent switching of engine ratings and other pertinent manufacturing information.

The wiring harness provides communications to the following areas:

- Various sensors
- Data link connector
- Engine connectors

The ECM is programmed to perform the following functions:

- Diagnostic tests on all inputs
- Diagnostic tests on all outputs
- Separate faults to a specific circuit

Once a fault is detected, the fault can be displayed on a diagnostic lamp. The diagnostic code can be read by using Cat ET. A multimeter can be used to check most problems. Also, a multimeter can be used to troubleshoot most problems. The ECM will record most of the diagnostic codes that are generated during operation of the engine. These logged codes or intermittent codes can be read by Cat ET.