



Troubleshooting

3500B Generator Set Engines

3DM1-Up (Engine)
4GM1-Up (Engine)
5XM1-Up (Engine)
6PM1-Up (Engine)
7KM1-Up (Engine)
8EM1-Up (Engine)
8RM1-Up (Engine)
6HN1-Up (Engine)
6PN1-Up (Engine)
6WN1-Up (Engine)
7RN1-Up (Engine)
9AN1-Up (Engine)
3LS1-Up (Engine)
3MS1-Up (Engine)
3NS1-Up (Engine)
3TS1-Up (Engine)
3WS1-Up (Engine)
3XS1-Up (Engine)
1NW1-Up (Engine)
1PW1-Up (Engine)
2FW1-Up (Engine)
2HW1-Up (Engine)
2JW1-Up (Engine)
3DW1-Up (Engine)
4AW1-Up (Engine)

5AW1-Up (Engine)

Prime Power, Standby and Marine Auxiliary Generator Set Engines

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Important Safety Information

Most accidents that involve product operation, maintenance and repair are caused by failure to observe basic safety rules or precautions. An accident can often be avoided by recognizing potentially hazardous situations before an accident occurs. A person must be alert to potential hazards. This person should also have the necessary training, skills and tools to perform these functions properly.

Improper operation, lubrication, maintenance or repair of this product can be dangerous and could result in injury or death.

Do not operate or perform any lubrication, maintenance or repair on this product, until you have read and understood the operation, lubrication, maintenance and repair information.

Safety precautions and warnings are provided in this manual and on the product. If these hazard warnings are not heeded, bodily injury or death could occur to you or to other persons.

The hazards are identified by the "Safety Alert Symbol" and followed by a "Signal Word" such as "DANGER", "WARNING" or "CAUTION". The Safety Alert "WARNING" label is shown below.



The meaning of this safety alert symbol is as follows:

Attention! Become Alert! Your Safety is Involved.

The message that appears under the warning explains the hazard and can be either written or pictorially presented.

Operations that may cause product damage are identified by "NOTICE" labels on the product and in this publication.

Caterpillar cannot anticipate every possible circumstance that might involve a potential hazard. The warnings in this publication and on the product are, therefore, not all inclusive. If a tool, procedure, work method or operating technique that is not specifically recommended by Caterpillar is used, you must satisfy yourself that it is safe for you and for others. You should also ensure that the product will not be damaged or be made unsafe by the operation, lubrication, maintenance or repair procedures that you choose.

The information, specifications, and illustrations in this publication are on the basis of information that was available at the time that the publication was written. The specifications, torques, pressures, measurements, adjustments, illustrations, and other items can change at any time. These changes can affect the service that is given to the product. Obtain the complete and most current information before you start any job. Caterpillar dealers have the most current information available. For a list of the most current publication form numbers available, see the Service Manual Contents Microfiche, REG1139F.



When replacement parts are required for this product Caterpillar recommends using Caterpillar replacement parts or parts with equivalent specifications including, but not limited to, physical dimensions, type, strength and material.

Failure to heed this warning can lead to premature failures, product damage, personal injury or death.

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Troubleshooting Section

Electronic Troubleshooting

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System Overview

SMCS Code: 1901-038

The engine is designed for electronic control of most engine operating functions. The electronic system consists of an Electronic Control Module (ECM), wiring harness, switches, sensors, and Electronic Unit Injectors. The ECM monitors parameters during engine operation.

Electronic Controls

Electronic Control Module

The ECM supplies signals to the Electronic Unit Injectors. The ECM signals control the engine operation. The ECM consists of two main components, the control computer (hardware) and the Personality Module (software). The control computer consists of a microprocessor and electronic circuitry. The Personality Module is the software for the control computer which contains operating maps that define power and torque curves.

The ECM governs engine speed. Desired engine rpm is determined by the throttle position sensor signal and certain sensor readings. Diagnostic codes may derate the engine. Actual engine rpm is determined by the Engine Speed/Timing signal.

Fuel Injection

The ECM controls the timing of the injectors. The ECM varies the signals to the injectors. Fuel is injected ONLY while an injector solenoid is energized by a 105 volt signal from the ECM. By controlling the timing and duration of the 105 volt signal, the ECM controls the fuel injection timing, the quantity of fuel and the desired engine rpm.

Injection timing depends on engine rpm, load, and other operational factors. The ECM detects the top center of each cylinder. The ECM sends an injection signal at the desired time. The ECM limits engine power during cold mode operation. The ECM modifies the injection timing and the ECM cuts out the cylinders. This will increase startability and this will reduce warm up time.

Cold Mode is activated whenever the engine coolant temperature falls below a predetermined value. Cold Mode remains active until the engine has warmed or a time limit is exceeded.

The ECM is programmed at the factory which limits the quantity of fuel that can be injected. The FRC Fuel Position controls the fuel limit for exhaust smoke. The FRC is based on the maximum allowable fuel to air ratio. The FRC Fuel Position is increased when the ECM senses a higher Turbocharger Compressor Outlet Pressure. This will allow more fuel into the cylinder.

The Rated Fuel Position is a limit that is based on the engine power rating. This is similar to the rack stops and the torque spring on a mechanically governed engine. The Rated Fuel Position provides power. The Rated Fuel Position provides the power curves and the torque curves for a specific engine family.

Engine Wiring Diagram for the 3500B Engine with CMS and Without 2301A Loadshare

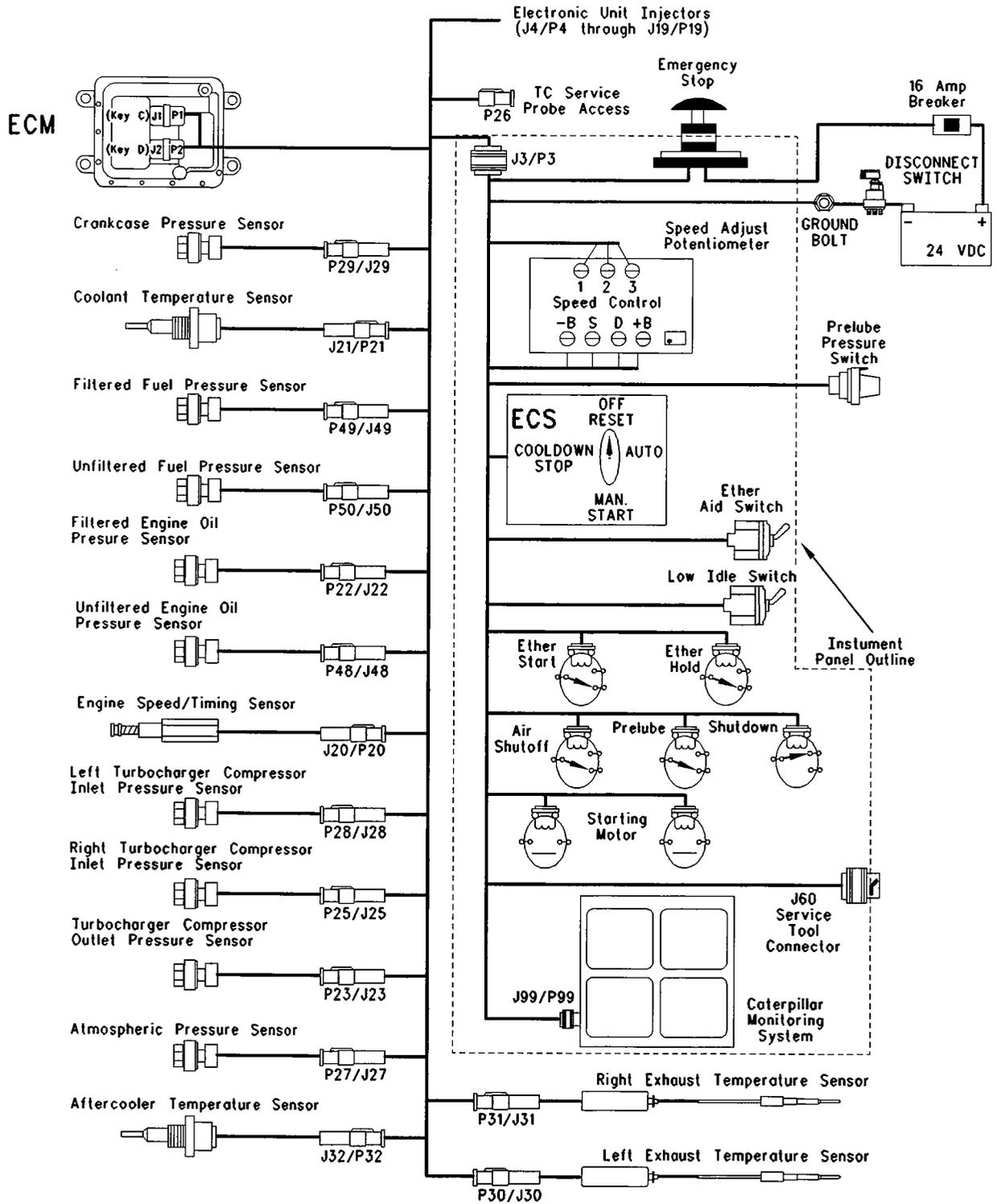


Illustration 1

**Engine Wiring Diagram for the 3500B
 Engine with EMCP II and 2301A
 Loadshare**

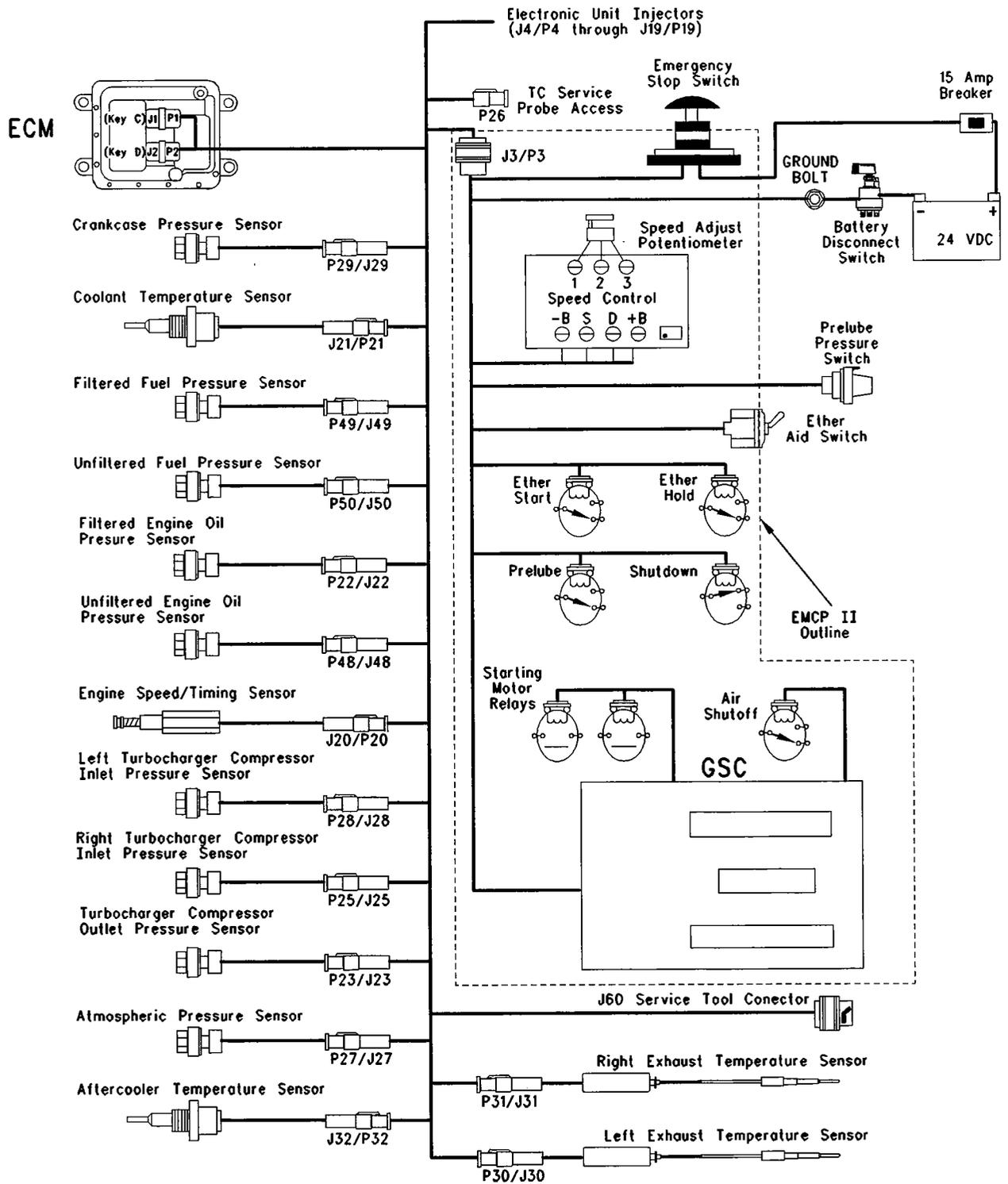


Illustration 2

Location Of The Engine Components

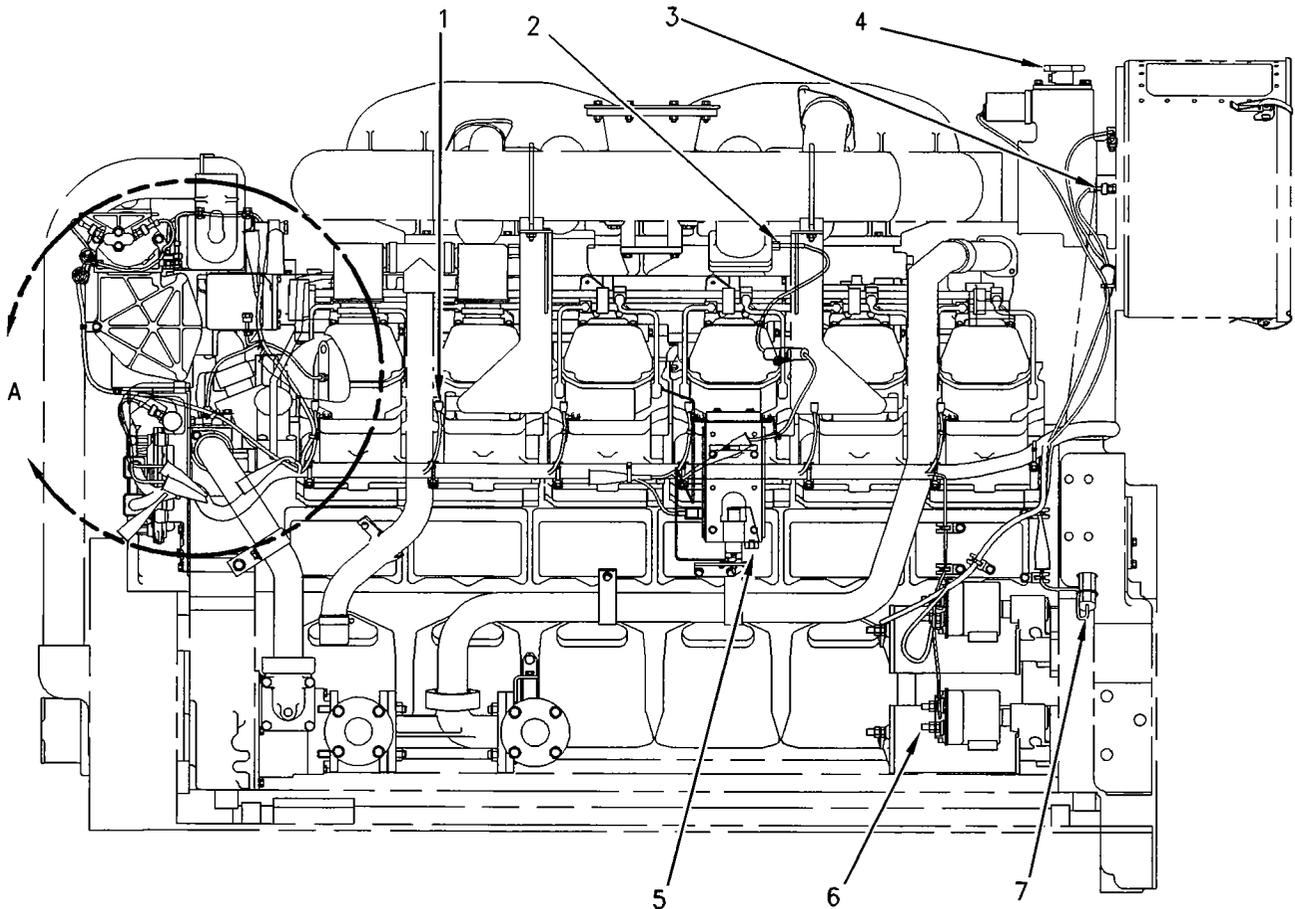


Illustration 3
Left Side View

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(1) Connector for the electronic unit injector. (2) Left exhaust temperature sensor. (3) Left turbocharger compressor inlet pressure sensor. (4) Air shutoff. (5) Ether starting aid. (6) Electric starting motor. (7) Engine speed/timing sensor.

Location Of The Engine Components

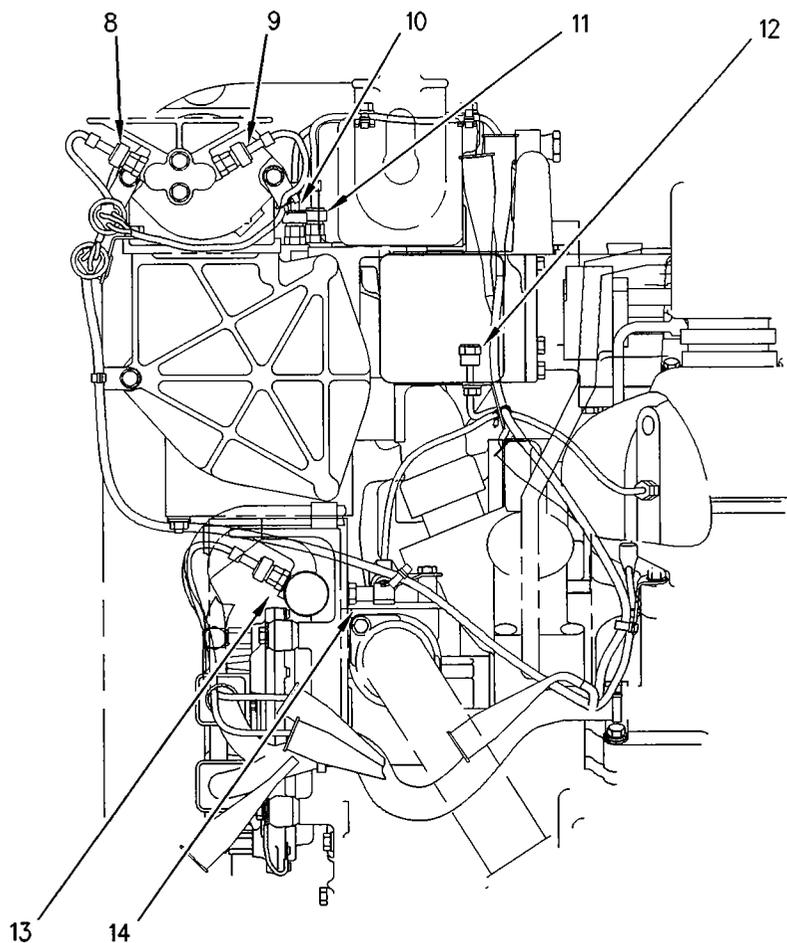


Illustration 4

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A View

(8) Unfiltered fuel pressure sensor. (9) Filtered fuel pressure sensor. (10) Unfiltered engine oil pressure sensor. (11) Filtered engine oil pressure sensor. (12) Coolant temperature sensor. (13) Atmospheric pressure sensor. (14) Aftercooler temperature sensor.

Location Of The Engine Components

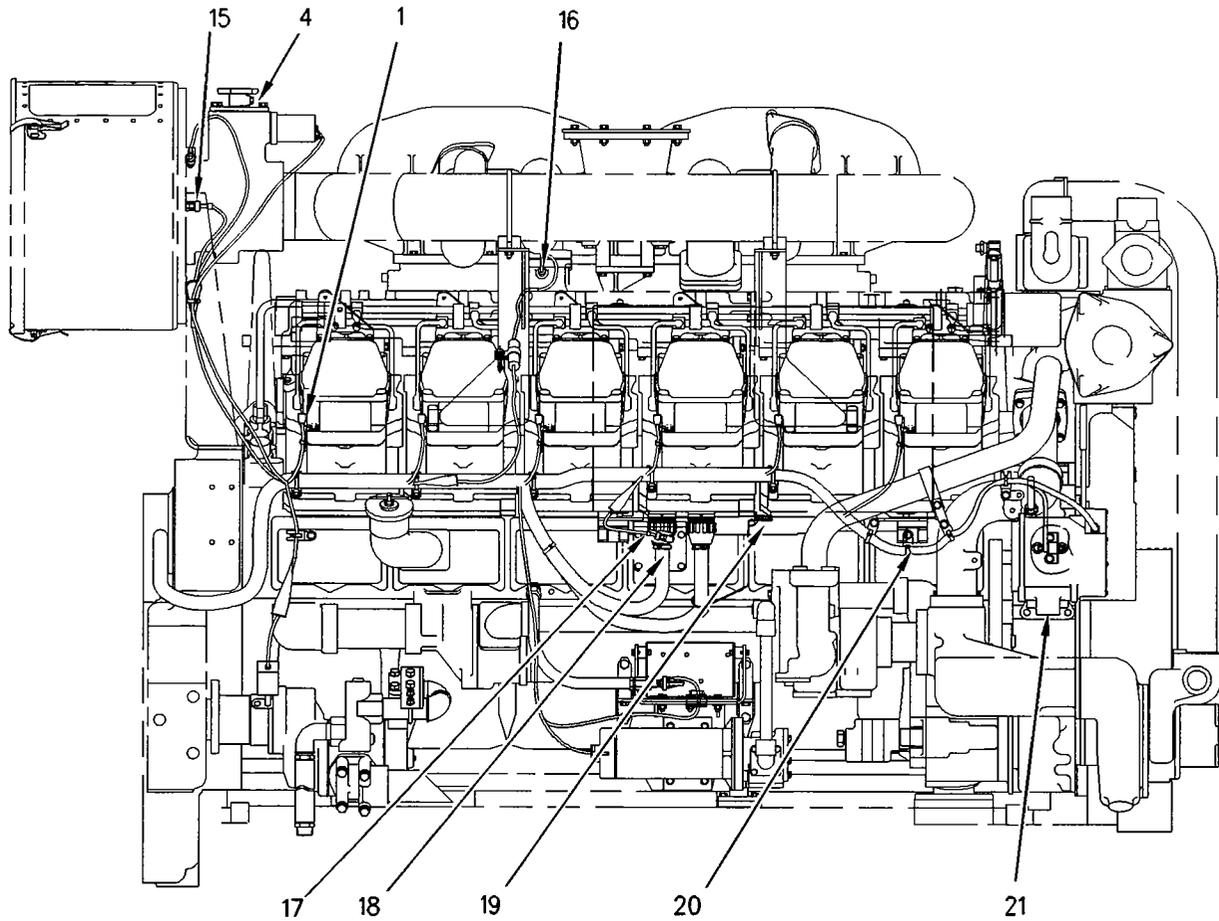


Illustration 5

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Right Side View

(15) Right turbocharger compressor inlet pressure sensor. (4) Air shutoff. (1) Connector for the electronic unit injector. (16) Right exhaust temperature sensor. (17) Crankcase pressure sensor. (18) Instrument panel connector J3A/P3A. (19) Electronic service tool connector J60/P60. (20) Customer connector J3/P3. (21) Alternator.

Location Of The Engine Components

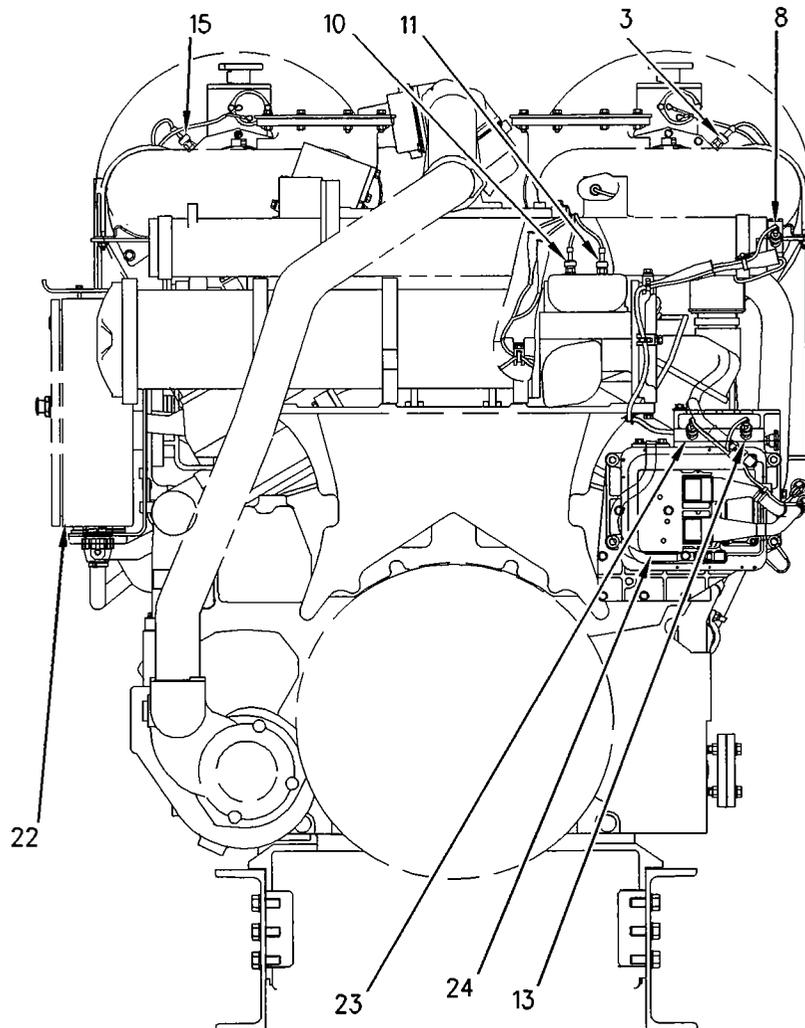


Illustration 6

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Front View

(15) Right turbocharger compressor inlet pressure sensor. (10) Unfiltered engine oil pressure sensor. (11) Filtered engine oil pressure sensor. (3) Left turbocharger compressor inlet pressure sensor. (8) Unfiltered fuel pressure sensor. (22) Instrument panel. (23) Turbocharger compressor outlet pressure sensor. (24) ECM. (13) Atmospheric pressure sensor.

Location Of The Engine Components

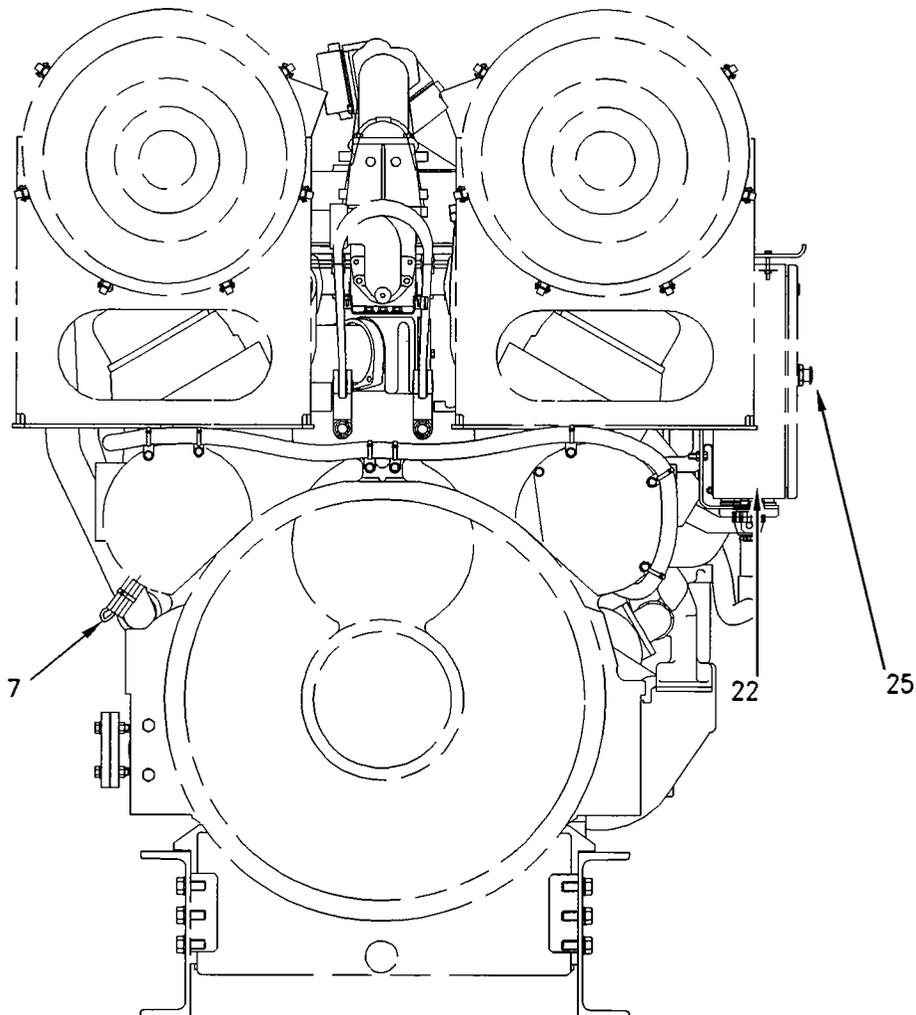


Illustration 7

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Rear View

(7) Engine speed/timing sensor. (22) Instrument panel. (25) Emergency stop push button.

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Self-Diagnostics

SMCS Code: 1901-038

The ECM has the ability to detect problems with the electronic system and with engine operation. When a problem is detected, a code is generated. An alarm may also be generated. There are two types of codes:

- Diagnostic
- Event

Diagnostic Code – When a problem with the electronic system is detected, the ECM generates a diagnostic code. This indicates the specific problem with the ECM circuitry.

Event Code – An event code is generated by the detection of an abnormal engine operating condition. For example, an event code will be generated if the oil pressure is too low. In this case, the event code indicates the symptom of a problem.

The codes can have two different states:

- Active
- Logged

Active Code – An active diagnostic code or an active event code indicates that an active problem has been detected. Active codes require immediate attention. Always service active codes prior to servicing logged codes.

Logged Code – Every generated code is stored in the permanent memory of the ECM. The codes are logged.

Logged codes may not indicate that a repair is needed. The problem may have been temporary. The problem may have been resolved since the logging of the code. If the system is powered, it is possible to generate an active diagnostic code whenever a component is disconnected. When the component is reconnected, the code is no longer active. Logged codes may be useful to help troubleshoot intermittent problems. Logged codes can also be used to review the performance of the engine and the electronic system.

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Electronic Service Tools

SMCS Code: 1901-038

The Caterpillar Electronic Service Tools are designed to perform the following functions:

- Obtain data from the engine.
- Display the diagnostic codes or display the event codes on the Electronic Technician (ET).
- Perform sensor calibrations.
- Read the programmable parameters.
- Change the programmable parameters.

The ET requires a communication adapter to communicate with the ECM.

There are several service tools that are required in order to allow a service technician to perform the procedures. These tools are listed in the following tables.

Table 1

Required Service Tools	
Part Number	Description
N/A	4 mm Allen Wrench
N/A	Vacuum Pump Test Unit
1U-5805	Wire Removal Tool (14 AWG)
151-6320	Wire Removal Tool (16/18 AWG)
9U-7330	Digital Multimeter
7X-1710	Multimeter Probes
175-3700	Connector Repair Kit
1U-5804	Crimp Tool

Optional Service Tools

Two short jumper wires are needed to check continuity of some wiring harness circuits. The jumper wires are used to short two adjacent pins or sockets together in a connector.

A long extension wire may be needed to check continuity of some wiring harness circuits.

The following list contains service tools that are not required. These tools may be helpful to service the engine. The following optional tools are used to measure voltage, pressures and/or temperatures.

Table 2

Optional Service Tools	
Part Number	Description
1U-5470	Engine Pressure Group
4C-4071	Contact Removal Tool
4C-4072	Contact Removal Tool
4C-4073	Contact Removal Tool
4C-4074	Contact Removal Tool
4C-4075	Crimp Tool
146-4080	Digital Multimeter
4C-4911 ⁽¹⁾	Battery Load Tester
6V-9130 ⁽²⁾	Temperature Adapter
7X-6370	Adapter Cable
151-6320	Wire Removal Tool
8T-5319	Connector Tool Group
8T-8726	Adapter Cable
9S-9082	Engine Turning Tool
9S-9150	Clip
5P-7277	Voltage Tester

⁽¹⁾ Refer to Special Instruction, SEHS9249, "Use of the 4C-4911 Battery Load Tester for 6, 8, and 12 Volt Lead". Also, refer to Special Instruction, SEHS7633, "Battery Test Procedure".

⁽²⁾ Refer to Special Instructions, SEHS8382, "Use of 6V-9130 Temperature Adapter Group".

Electronic Technician

The Caterpillar Electronic Technician (ET) is designed to run on a personal computer. The ET can display the status of a group of parameters. The ET can display the following information:

- Sensor Values
- Diagnostic codes
- Engine configuration

The ET can perform the following functions:

- Diagnostic tests
- Sensor calibration
- Flash downloading
- Set programmable parameters

The following components are required to use the ET to service the engine.

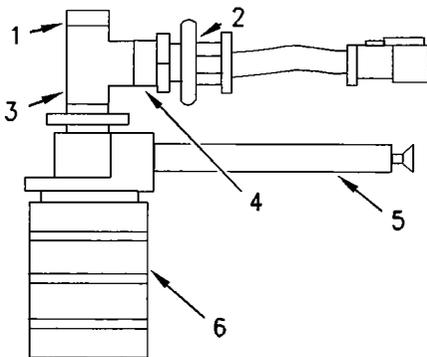


Illustration 8

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Vacuum Pump Test Unit

- (1) 4C-3973 Connector
- (2) Pressure sensor
- (3) Tee
- (4) 9X-0263 Adapter
- (5) 1U-5718 Vacuum Pump
- (6) 169-7372 Fluid Sampling Bottle

Note: Similar parts may be used to build the vacuum pump test unit. The vacuum pump test unit can be used with the 1U-5470 Engine Pressure Group.

Table 3

Required Electronic Service Tools for the Use of ET	
Part Number	Description
N/A	Requirements IBM PC compatible 100 mHz processor 32 megabyte of RAM 10 megabyte of available hard drive space CD-ROM drive 3.5" 1.44-MB floppy disk drive Windows NT or Windows 95 RS232 port with "16550AF UART" VGA monitor or display
N/A	Recommended Intel Pentium II 333 mHz processor 64 megabyte of RAM 4.3 gigabyte hard drive CD-ROM drive 14X speed
JERD2124	License for ET
JERD2129 or JERD2142	Data Subscription for all engines and machines Data Subscription for machines only
NEHS0758 ⁽¹⁾	Service Program Module for the 171-4401 Communication Adapter II
160-0141 ⁽²⁾	Data Link Cable
160-0133 ⁽²⁾	Data Link Cable
171-4401 ⁽²⁾	Communication Adapter II for use between ET and the ECM

⁽¹⁾ The subscription will be updated at regular intervals.
⁽²⁾ This part number is part of the 171-4400 Communication Adapter II Group. The 7X-1701 Communication Adapter and wiring will also work.

Connecting ET and the Communication Adapter II

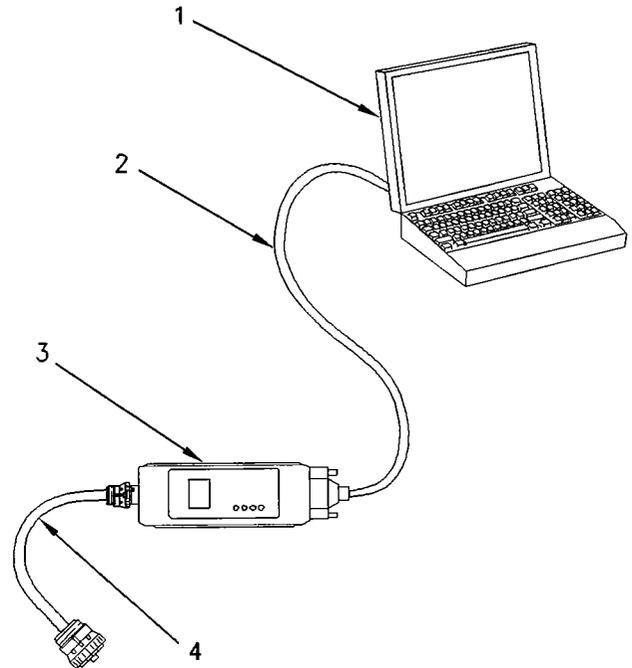


Illustration 9

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- (1) Personal computer
- (2) 160-0141 Data Link Cable
- (3) 171-4401 Communication Adapter II
- (4) 160-0133 Data Link Cable

Note: The 7X-1701 Communication Adapter will also work.

The power supply provides the Communication Adapter II with 24 VDC. Use the following procedure to connect the ET and the Communication Adapter II to the engine.

1. Remove the power from the battery terminal block.
2. Connect the 160-0133 Data Link Cable. The cable connects to the J42 service tool connector and the control connector on the Communication Adapter II.
3. Connect the 160-0141 Data Link Cable. The cable connects to the laptop computer's RS232 serial port and the service tool connector on the Communication Adapter II.

4. Connect the battery power to the battery terminal block. Check the Emergency Stop and the Start/Run/Stop circuit. Verify that the circuit is disconnected. If the ET and the Communication Adapter II do not communicate with the Electronic Control Module (ECM), refer to Troubleshooting, "Electronic Service Tool Will Not Communicate With ECM".

Table 4

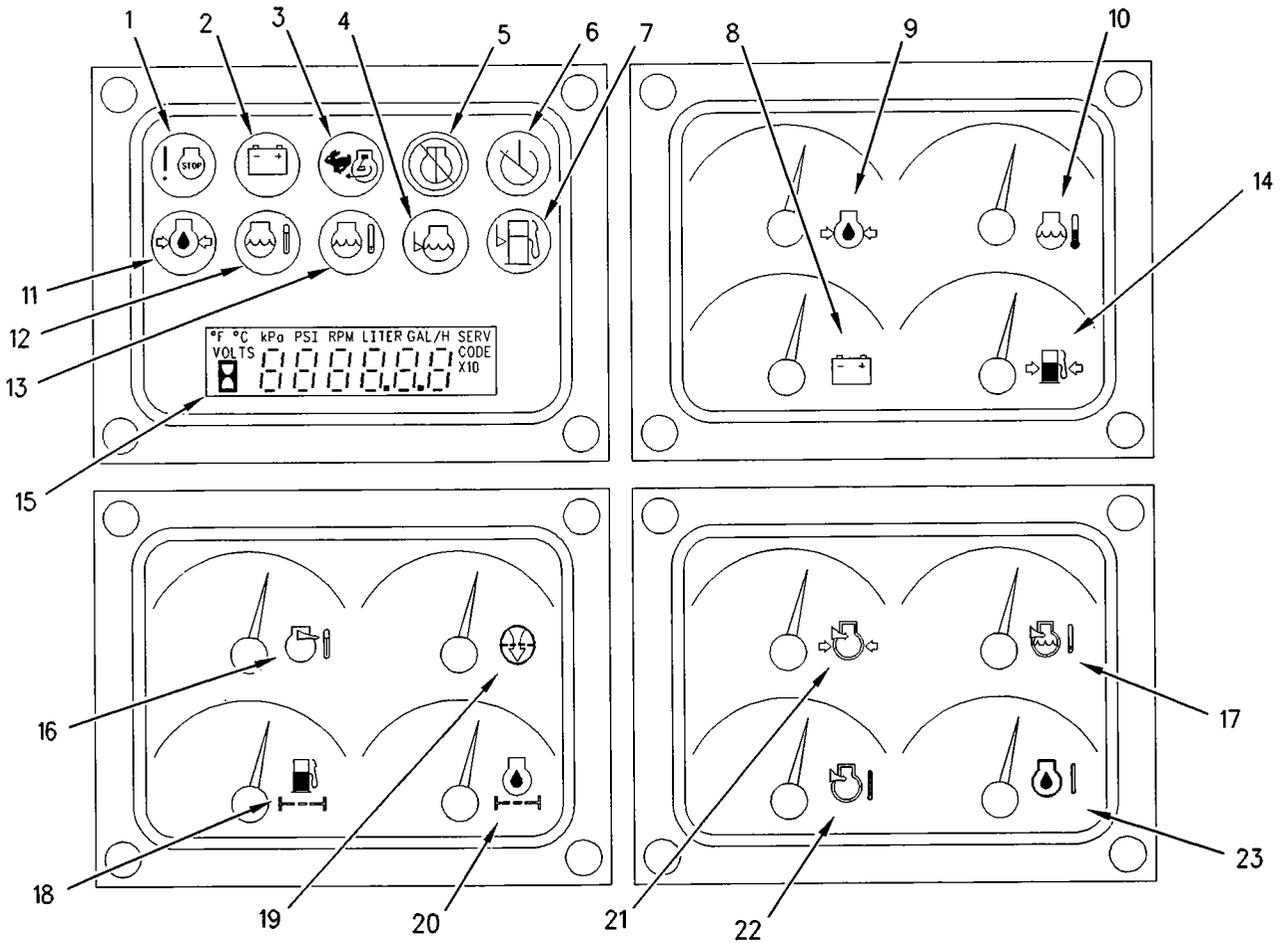
Communication Adapter II Specifications	
Operating Voltage	7 VDC to 40 VDC at 1.0 amp
Operating Temperature	-18 °C to +65 °C (0 °F to 149 °F)
Storage Temperature	-40 °C to +80 °C (-40 °F to 176 °F)
Dimensions	180 mm X 85 mm X 44.5 mm (7.085 inch X 3.343 inch X 1.75 inch)
Weight	454 g (1 lb)

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Electronic Display Module

SMCS Code: 1901-038

The electronic display module can display a CID-FMI from the engine control system. Three switches are used to select various operating modes and display modes. Refer to the Service Manual for more information.



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Illustration 10
 Caterpillar Monitoring System

- | | | |
|-----------------------|-------------------------------|------------------------------|
| (1) Shutdown | (9) Oil Pressure | (17) Aftercooler Temperature |
| (2) System Voltage | (10) Coolant Temperature | (18) Fuel Filter Restriction |
| (3) Overspeed | (11) Low Oil Pressure | (19) Air Inlet Restriction |
| (4) Low Coolant Level | (12) High Coolant Temperature | (20) Oil Filter Restriction |
| (5) Overcrank | (13) Low Coolant Temperature | (21) Inlet Air Pressure |
| (6) Not in AUTO | (14) Fuel Pressure | (22) Inlet Air Temperature |
| (7) Low Fuel Level | (15) LED Display | (23) Oil Temperature |
| (8) System Voltage | (16) Exhaust Temperature | |

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Engine Monitoring System

SMCS Code: 1901-038

The ECM monitors parameters. If a parameter extends outside an acceptable range, the ECM will initiate action. The ECM can cause a warning to occur. The ECM can derate engine power. The ECM can cause an engine shutdown to occur. Not all of the actions are available for certain parameters.

The ET can select the ECM response. The ET can be used to program the level of engine monitoring and the delay times.

Note: The following tables are examples. The values may have changed. Use the ET to determine the actual defaults and the specific configuration.

Table 5

Engine Monitoring System						
Parameter	ECM Response	Default Trip Point	Default Delay Time	Limits		
				Range for Trip Point		Delay Time
				Low	High	
Low System Voltage	Off					
	Warning	20 VDC	10 Seconds	20 VDC	22 VDC	1 to 30 seconds
Low Oil Pressure	Off					
	Warning	(1)	4 Seconds	N/A		1 to 15 seconds
	Shutdown	(1)	9 Seconds	N/A		1 to 15 seconds
High Coolant Temperature	Off					
	Warning	102 °C (216 °F)	5 Seconds	90 °C (194 °F)	102 °C (216 °F)	1 to 60 Seconds
	Derate	107 °C (225 °F)	30 Seconds	90 °C (194 °F)	107 °C (225 °F)	1 to 60 Seconds
	Shutdown	107 °C (225 °F)	5 Seconds	90 °C (194 °F)	107 °C (225 °F)	1 to 60 Seconds
Low Coolant Temperature	Off					
	Warning	80 °C (176 °F)	5 Seconds	63 °C (145 °F)	85 °C (185 °F)	1 to 60 Seconds
Engine Overspeed	Off					
	Warning	1.18 × Rated Speed	0 Seconds	1200 rpm	2400 rpm	0 to 5 Seconds
	Shutdown (50 Hz)	1.18 × Rated Speed	0 Seconds	1200 rpm	2400 rpm	0 to 5 Seconds
	Shutdown (60 Hz)	1.18 × Rated Speed	0 Seconds	1200 rpm	2400 rpm	0 to 5 Seconds
Air Filter Restriction Pressure	Off					
	Warning	7 kPa (1 psi)	5 Seconds	3 kPa (0.4 psi)	7 kPa (1 psi)	1 to 60 Seconds
	Derate	7 kPa (1 psi)	5 Seconds	1 kPa (0.14 psi)	7 kPa (1 psi)	1 to 60 Seconds
Altitude	Off					
	Derate	(2)	N/A	250 m (820 ft)	3658 m (12001 ft)	N/A
High Exhaust Temperature	Off					
	Warning	(2)	5 Seconds	500 °C (932 °F)	800 °C (1472 °F)	1 to 60 Seconds
	Derate	(2)	5 Seconds			1 to 60 Seconds
Oil Filter Differential Pressure	Off					
	Warning	105 kPa (15 psi)	5 Seconds	70 kPa (10 psi)	105 kPa (15 psi)	1 to 60 Seconds

(continued)

(Table 5, contd)

Fuel Filter Differential Pressure	Off					
	Warning	105 kPa (15 psi)	5 Seconds	70 kPa (10 psi)	105 kPa (15 psi)	1 to 60 Seconds
Crankcase Pressure	Off					
	Warning	2 kPa (0.3 psi)	3 Seconds	0.5 kPa (0.1 psi)	6 kPa (0.9 psi)	1 to 30 Seconds
	Derate	6 kPa (0.9 psi)	10 Seconds	0.5 kPa (0.1 psi)	6 kPa (0.9 psi)	1 to 60 Seconds
	Shutdown	3.5 kPa (0.5 psi)	3 Seconds	0.5 kPa (0.1 psi)	6 kPa (0.9 psi)	1 to 60 Seconds
Aftercooler Water Temperature	Off					
	Warning	102 °C (216 °F)	5 Seconds	40 °C (104 °F)	102 °C (216 °F)	1 to 60 Seconds
	Derate	107 °C (225 °F)	5 Seconds	40 °C (104 °F)	107 °C (225 °F)	1 to 60 Seconds
	Shutdown	107 °C (225 °F)	5 Seconds	40 °C (104 °F)	107 °C (225 °F)	1 to 60 Seconds

(1) Refer to the oil pressure map.

(2) Refer to the Performance and Ratings Specifications in the TMI (Technical Marketing Information).

Oil Pressure Map

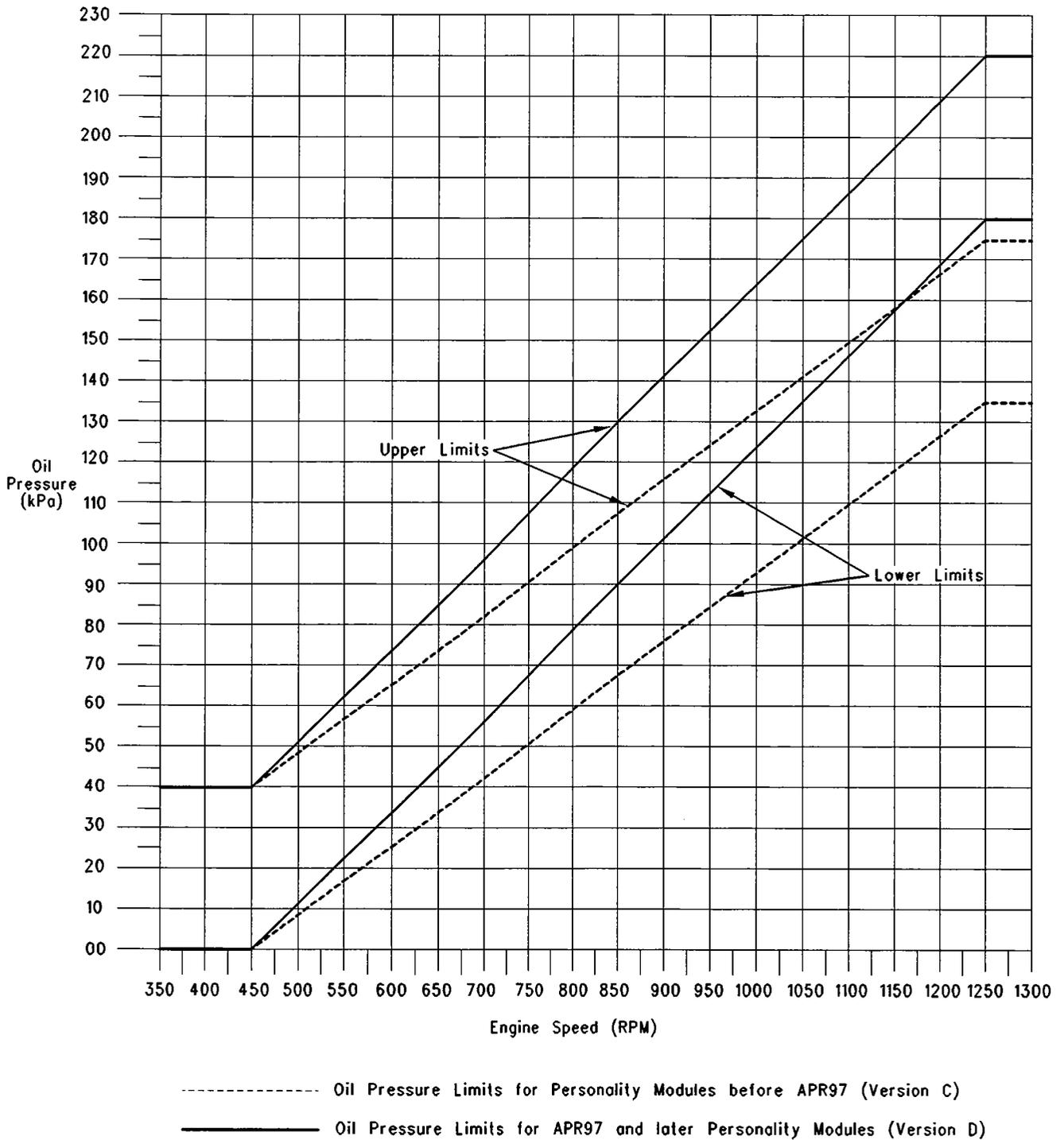


Illustration 11
 Oil Pressure Map

Separate timers are used in the ECM for each response that is associated with a parameter. Once the trip point is exceeded for an action, the timer for that action is started. For example, if the high Coolant Temperature Warning is set to 102 °C (216 °F) with a five second delay, the delay timer starts counting once the coolant temperature exceeds 102 °C (216 °F). If the coolant remained above 102 °C (216 °F) for five seconds, a warning would be issued.

The engine monitoring system is enabled after the engine is started. When the engine is within 50 rpm of low idle, the ECM will check the parameters. The ECM will not check the parameter for low oil pressure. Low oil pressure has an additional 10 second delay after the engine is started. The delay is designed to eliminate false low oil pressure warnings.

Use care when you program the trip point and the delay time. Check that the ECM response is correct for your application. If the legal range is not exceeded, the engine monitoring system will accept any setting.

The engine will shut down if the trip point for a shutdown is lower than the trip point for a warning. The warning will not be activated.

Once a parameter has exceeded the trip point, the parameter must drop a certain amount below the trip point before the ECM response will end.

If a High Coolant Temperature warning is programmed to 102 °C (216 °F), the temperature must exceed the range in order for the warning to activate. The temperature must decrease below 99 °C (210 °F) for the warning to stop. The variance is the hysteresis. The following table gives the hysteresis for each parameter.

Table 6

Parameter	Hysteresis
ECM Voltage	3 VDC
Oil Pressure	50 kPa (7 psi)
High Coolant Temperature	3 °C (7 °F)
Low Coolant Temperature	3 °C (7 °F)
Overspeed	100 rpm
Air Inlet Restriction	N/A
Altitude	N/A
High Exhaust Temperature	102 °C (216 °F)
Oil Filter Differential Pressure	10 kPa (1.5 psi)
Fuel Filter Differential Pressure	10 kPa (1.5 psi)
Crankcase Pressure	N/A
Aftercooler Water Temperature	3 °C (7 °F)

Most active engine derates that occur are activated when the associated parameter is out of range.

When the parameter returns to normal operation, the active engine derate is disengaged.

There are a few exceptions:

- High exhaust temperature
- High air filter restriction
- Crankcase pressure

The active engine derate is latched until the ECM is powered down.

Programming Parameters

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Programming Parameters

SMCS Code: 1901-038

The ET can view certain parameters that can affect the operation of the engine. The ET can change certain parameters that can affect the operation of the engine. The parameters are stored in the ECM. The parameters are NOT stored in the Personality Module. Some of the parameters are protected from unauthorized changes by passwords. Parameters that can be changed have a tattletale number. The tattletale number shows if a parameter has been changed.

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Factory Passwords

SMCS Code: 1901-038

Factory Level Passwords are required to clear certain logged events. Factory Level Passwords are required to change certain parameters such as Full Load Setting. The passwords restrict changes to authorized personnel. When the correct passwords have been entered, the changes will be programmed in the ECM.

Factory Level Passwords are required to clear all events.

The Electronic Service Tool Factory Level Password screen will display the following parameters:

- ECM serial number
- Engine serial number
- Electronic Service Tool
- Electronic Service Tool serial number
- Reason Code
- Total Tattletale number

In order to obtain the proper passwords, the information must be given to an authorized Caterpillar dealer. The old interlock code is required to change the interlock code on a used ECM. The new interlock code is also required to change the interlock code on a used ECM. The passwords are controlled by Caterpillar. The passwords may only be obtained by an authorized Caterpillar dealer. The passwords may only be used for one programming session. A new set of passwords will be required to perform the following functions:

- Clear all events.
- Program the parameters.

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Flash Programming

SMCS Code: 1901-038

Flash Programming – This is a method of programming or updating the personality module in an ECM.

The ET can be utilized to flash a new personality module into the ECM. This eliminates the need to physically remove the personality module from the ECM. This is the preferred method for updating the software. There is no risk of moisture entry into the ECM due to improper seal installation. The flash is accomplished by transferring the data from the PC to the ECM.

Note: If the appropriate computer (PC) and software (ET) are not available, the personality module can be physically removed and replaced.

Flash Programming a Personality Module

1. Connect the ET to the service tool connector.
2. Select "WinFlash" from the "Utilities" menu on the ET.

"WinFlash" will try to detect an ECM.
3. When an ECM has been detected, the "ECM Selector" window will appear. Select the appropriate ECM and then select "OK".

The "Flash File Selection" window will appear.
4. The flash files are located on a disk drive and in a directory. Select the correct disk drive and the directory from "Drives" and "Directories" on the ET.

A list of flash files will appear.
5. Select the correct file from the list of flash files. Read the "Description" and the "File Info" in order to verify that the correct file is selected. Select "OK".
6. Select the "Begin Flash" button in order to program the personality module.

When the flash is completed, this message will appear: "Flash Completed Successfully".
7. Start the engine and check for proper operation.

- a. If a diagnostic code of 268-02 "Check Programmable Parameters" is generated, program any parameters that were not in the old personality module.
- b. Access the "Configuration" screen under the "Service" menu in order to determine the parameters that require programming. Look under the "Tattletale" column. All of the parameters should have a tattletale of 1 or more. If a parameter has a tattletale of 0, program that parameter.

"WinFlash" Error Messages

If you receive any error messages during flash programming, click on the "Cancel" button in order to stop the process. Access the information about the "ECM Summary" under the "Information" menu. Make sure that you are flashing the correct file for your engine.

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System Configuration Parameters

SMCS Code: 1901-038

System Configuration Parameters are parameters that affect emissions, power of the engine, and other features. The parameters are programmed at the factory. In most cases, the parameters do not need to be changed. You must reprogram the System Configuration Parameters if the ECM is replaced and/or you reprogram the engine rating. You do not need to reprogram the System Configuration Parameters if you replace the Personality Module. Proper values for these parameters are available on an Electronic Service Tool. Certain Configuration Parameters are also stamped on the Engine Information Plate.

Note: If the parameters that are protected with the factory passwords are changed, the Caterpillar warranty may be voided.

The following functions will be performed with an engine that has EMCP II:

- Automatic Start/Stop
- Air Shutoff
- Cooldown

Note: Changing the parameters that are protected by factory passwords may cause your Caterpillar warranty to be voided.

Engine Serial Number

The engine serial number should be programmed to match the engine information plate. The serial number is not programmed on a new ECM.

Rated Fuel Position

This parameter is used to set engine power. A Factory Password is required to change this setting.

Table 7

Minimum	Default	Maximum
Minimum Rack	Engine Dependent	Engine Dependent

Acceleration Delay

When the engine is started the ECM will limit the engine to low idle. The ECM will no longer limit the engine rpm when the following conditions exist:

- The engine oil pressure is above 70 kPa (10 psi).
- The acceleration delay is reached.

Programming this parameter to 0 will disable this function.

Note: If the engine is configured to operate in Direct Fuel Control Mode, this parameter is disabled.

Table 8

Minimum	Default	Maximum
0 seconds	0 seconds	60 seconds

Acceleration Ramp Rate

The acceleration ramp rate is the maximum ramp rate of the desired engine rpm. The desired engine rpm will be set to low idle until the engine rpm reaches 400. When the engine rpm becomes greater than 400 rpm, desired engine rpm will start increasing until the required desired engine rpm is reached.

Note: If the engine is configured to operate in Direct Fuel Control Mode, this parameter is disabled.

Table 9

Minimum RPM per second	Default RPM per second	Maximum RPM per second
1 rpm/sec	250 rpm/sec	750 rpm/sec

Low Idle

The parameter defines the lowest rpm level.

Note: If the engine is configured to operate in Direct Fuel Control Mode, this parameter is disabled.

Table 10

Minimum	Default	Maximum
810 rpm	1000 rpm	1000 rpm

Cooldown Speed

This parameter defines the engine rpm level when the ECS is placed in the STOP position.

Table 11

Minimum	Default	Maximum
810 rpm	1000 rpm	1800 rpm

Cooldown Time

This parameter defines engine operation at the cooldown speed. Programming this parameter to 0 will disable this function.

Note: This parameter should be programmed to 0 if EMCP II is connected to this system. Problems may result if both controls try to perform this function.

Table 12

Minimum	Default	Maximum
0 minutes	0 minutes	30 minutes

Prelube Time

The parameter sets the amount of time for prelubrication. Programming this parameter to 0 will disable this function.

Table 13

Minimum	Default	Maximum
0 seconds	0 seconds	210 seconds

Crank Duration

The crank duration determines when the starting motors will be energized. The crank duration determines when the starting motors will be disengaged. Programming this parameter to 0 will prevent the ECM from engaging the starting motors.

Note: This parameter should be programmed to 0 if EMCP II is connected to this system. Problems may result if both controls try to perform this function.

Table 14

Minimum	Default	Maximum
0 seconds	0 seconds	60 seconds

Cranking Cycles

This parameter is the total number of crank cycles that can be performed.

Table 15

Minimum	Default	Maximum
0	0	10

Crank Terminate Speed

This parameter determines when the starting motor will disengage.

Table 16

Minimum	Default	Maximum
100 rpm	400 rpm	500 rpm

Air Shutoff

Programming the parameter to "OFF" will disable the air shutoff. This parameter should be programmed to "OFF" if the function is not being used or installed on this engine. This will prevent diagnostics from being logged.

Table 17

Minimum	Default	Maximum
OFF	OFF	ON

Ether Control

Programming this parameter to "OFF" will disable the function. This parameter should be programmed to "OFF" if the function is not being used or installed on this engine. This will prevent diagnostics from being logged.

Table 18

Minimum	Default	Maximum
OFF	OFF	ON

Engine Cooling System

This parameter determines the cooling system. The parameter requires a factory password to change.

Table 19

Minimum	Default	Maximum
SCAC	SCAC	JWAC

Fuel Correction Factor

The parameter is programmed to a numerical value. The calculations will be adjusted in accordance with the numerical value. The parameter requires a factory password to change.

CAT Data Link

This parameter determines the engine identification for the secondary CAT Data Link.

Table 20

Minimum	Default	Maximum
Engine Control 1	Engine Control 1	Engine Control 8

Cold Mode Cylinder Cutout

This parameter provides the strategy for the cold mode cylinder cutout.

Table 21

Minimum	Default	Maximum
Disabled	Disabled	Enabled

Direct Fuel Control Mode

If you program the parameter to "ON", you will enable the Direct Fuel Control Mode. The parameter requires a factory password to change. This feature requires special hardware in order to operate properly.

Table 22

Minimum	Default	Maximum
OFF	OFF	ON

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Factory Passwords Worksheet

SMCS Code: 1901-038

Factory passwords are required to perform the following functions:

- Program the Rated Fuel Position.
- Program the cooling system.
- Program the Total Fuel.
- Program the Total Hours.
- Program the Direct Fuel Control Mode.

The following information is required to obtain Caterpillar Factory Passwords:

Table 23

Caterpillar Dealer Code	
Name	
Address	
Phone Number	

Note: Record logged events before you remove the ECM.

The following information is required to obtain factory passwords.

Table 24

Engine hours	
--------------	--

Note: Engine hours do not include service meter hours.

View the factory password screen on the Electronic Service Tool. Record the following information:

Table 25

Electronic Service Tool Serial Number	
Engine Serial Number	
ECM Serial Number	
Total Tattletale	
Reason Code	
Other parameters	

- Clear logged events
- Program the engine monitoring system.

Injector Codes

Table 26

Injector 1	
Injector 2	
Injector 3	
Injector 4	
Injector 5	
Injector 6	
Injector 7	
Injector 8	
Injector 9	
Injector 10	
Injector 11	
Injector 12	
Injector 13	
Injector 14	
Injector 15	
Injector 16	

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Customer Parameters Worksheet

SMCS Code: 1901-038

Record the following information before you change any programmable parameter:

Table 27

Engine Serial Number	
ECM Serial Number	
Rated Fuel Position	
Low Idle Speed	
Acceleration Delay Time	
Acceleration Ramp Rate	
Cooldown Time	
Cooldown Speed	
Prelube Time	
Crank Duration	
Total Number of Crank Cycles	
Air Shutoff	
Fuel Control	
Direct Fuel Control Mode	

Record the following information from the engine information plate.

- Engine serial number

Record the following information from the engine monitoring system.

ECM Voltage

Table 28

Warning Trip Point	
Warning Delay Time	

Engine Oil Pressure

Table 29

Warning Trip Point	
Warning Delay Time	
Shutdown Trip Point	
Shutdown Delay Time	

High Coolant Temperature

Table 30

Warning Trip Point	
Warning Delay Time	
Derate Trip Point	
Derate Delay Time	
Shutdown Trip Point	
Shutdown Delay Time	

Low Coolant Temperature

Table 31

Warning Trip Point	
Warning Delay Time	

Engine Overspeed

Table 32

Warning Trip Point	
Warning Delay Time	
Shutdown Trip Point	
Shutdown Delay Time	

Air Inlet Restriction

Table 33

Warning Trip Point	
Warning Delay Time	
Derate Trip Point	
Derate Delay Time	

Altitude

Table 34

Derate Trip Point	
-------------------	--

High Exhaust Temperature

Table 35

Warning Trip Point	
Warning Delay Time	
Derate Trip Point	
Delay Time	

Engine Oil Filter Differential Pressure

Table 36

Warning Trip Point	
Warning Delay Time	

Fuel Filter Differential Pressure

Table 37

Warning Trip Point	
Warning Delay Time	

Crankcase Pressure

Table 38

Warning Trip Point	
Warning Delay Time	
Shutdown Trip Point	
Shutdown Delay Time	

Aftercooler Temperature

Table 39

Warning Trip Point	
Warning Delay Time	
Derate Trip Point	
Derate Delay Time	
Shutdown Trip Point	
Shutdown Delay Time	

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Replacing the ECM

SMCS Code: 1901-038

NOTICE

Care must be taken to ensure that fluids are contained during performance of inspection, maintenance, testing, adjusting and repair of the product. Be prepared to collect the fluid with suitable containers before opening any compartment or disassembling any component containing fluids.

Refer to Special Publication, NENG2500, "Caterpillar Tools and Shop Products Guide" for tools and supplies suitable to collect and contain fluids on Caterpillar products.

Dispose of all fluids according to local regulations and mandates.

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

The Electronic Control Module (ECM) contains no moving parts. Replacement of the ECM can take a long time. Follow the troubleshooting procedures in this manual in order to be sure that replacing the ECM will correct the problem. Verify that the suspect ECM is the cause of the problem.

Note: Ensure that the ECM is receiving power and that the ECM is properly grounded before a replacement of the ECM is attempted. Refer to Troubleshooting, "Electrical Power Supply".

A test ECM can be used to determine if the ECM is faulty. Install a test ECM in place of the suspect ECM. Transfer the personality module from the suspect ECM to the test ECM. Program the parameters for normal operation. The parameters must match the parameters in the suspect ECM. Refer to the following test steps for details. If the test ECM resolves the problem, reconnect the suspect ECM. Verify that the problem returns. If the problem returns, replace the ECM.

Note: When a new ECM is not available, you may need to remove an ECM from an engine that is not in service. The ECM must have the same serial number suffix. Ensure that the replacement ECM and the Personality Module Interlock Code match the suspect ECM. Be sure to record the parameters from the replacement ECM. Use the "Copy Configuration/ECM Replacement" feature that is found under the "Service" menu on ET.

NOTICE

If the personality module and engine application are not matched, engine damage may result.

Perform the following procedure in order to replace the ECM.

1. Connect ET to the service tool connector.
2. Print the parameters from the "Configuration" screen on ET. If a printer is unavailable, record all of the parameters. Record any logged diagnostic codes and logged event codes for your records.
3. Use the "Copy Configuration/ECM Replacement" feature that is found under the "Service" menu on ET. Select "Load from ECM" in order to copy the configuration from the suspect ECM.

Note: If the "Copy Configuration" process fails and the parameters were not obtained in Step 2, the parameters must be obtained elsewhere. Some parameters are stamped on the engine information plate, but most parameters must be obtained from the factory.

4. Remove the ECM.
 - a. Turn the keyswitch to the OFF/RESET position.
 - b. Disconnect the ECM connectors J1/P1 and J2/P2.

NOTICE

Use a suitable container to catch any fuel that might spill. Clean up any spilled fuel immediately.

NOTICE

Do not allow dirt to enter the fuel system. Thoroughly clean the area around a fuel system component that will be disconnected. Fit a suitable cover over disconnected fuel system component.

- c. Remove the fuel lines from the ECM.
- d. Remove the mounting bolts from the ECM.
- e. Disconnect the ECM ground strap from the engine.
- f. If you are flash programming, go to Step 7. If you are physically replacing the personality module, proceed to Step 5.

Note: Flash programming is the preferred method for replacing the personality module. The personality module can be physically removed, if flash programming is unsuccessful.

NOTICE

Moisture entry into the ECM from improper servicing can result in ECM failure.

5. Remove the personality module from the old ECM.
 - a. Remove the tag wire from the back cover of the ECM.
 - b. Remove the bolts from the back cover of the ECM.
 - c. Remove the O-ring seal from the cover.
 - d. Remove the personality module by squeezing the tabs on the ends of the blue plastic case. Pull the module straight out of the ECM.

NOTICE

Improper O-ring placement could result in moisture damage from improper sealing. Do not over tighten bolts! This could result in damaged threads and moisture damage from improper sealing.

6. Install the personality module into the replacement ECM.
 - a. Carefully seat the personality module in the EPROM carrier socket.

Note: Do not use excessive force to insert the module into the socket. The socket will accept the personality module in only one position. A click is audible when the personality module is inserted correctly.

