



# Troubleshooting

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## **3500C Marine Propulsion Engines**

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TTA1-Up (Engine)  
TTB1-Up (Engine)  
M8C1-Up (Engine)  
TTC1-Up (Engine)  
M8D1-Up (Engine)  
TTD1-Up (Engine)  
TTE1-Up (Engine)  
TTF1-Up (Engine)  
TTG1-Up (Engine)  
TTH1-Up (Engine)  
TTJ1-Up (Engine)  
E3W1-Up (Engine)  
E3X1-Up (Engine)  
E3Z1-Up (Engine)

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## Location of the Engine Components

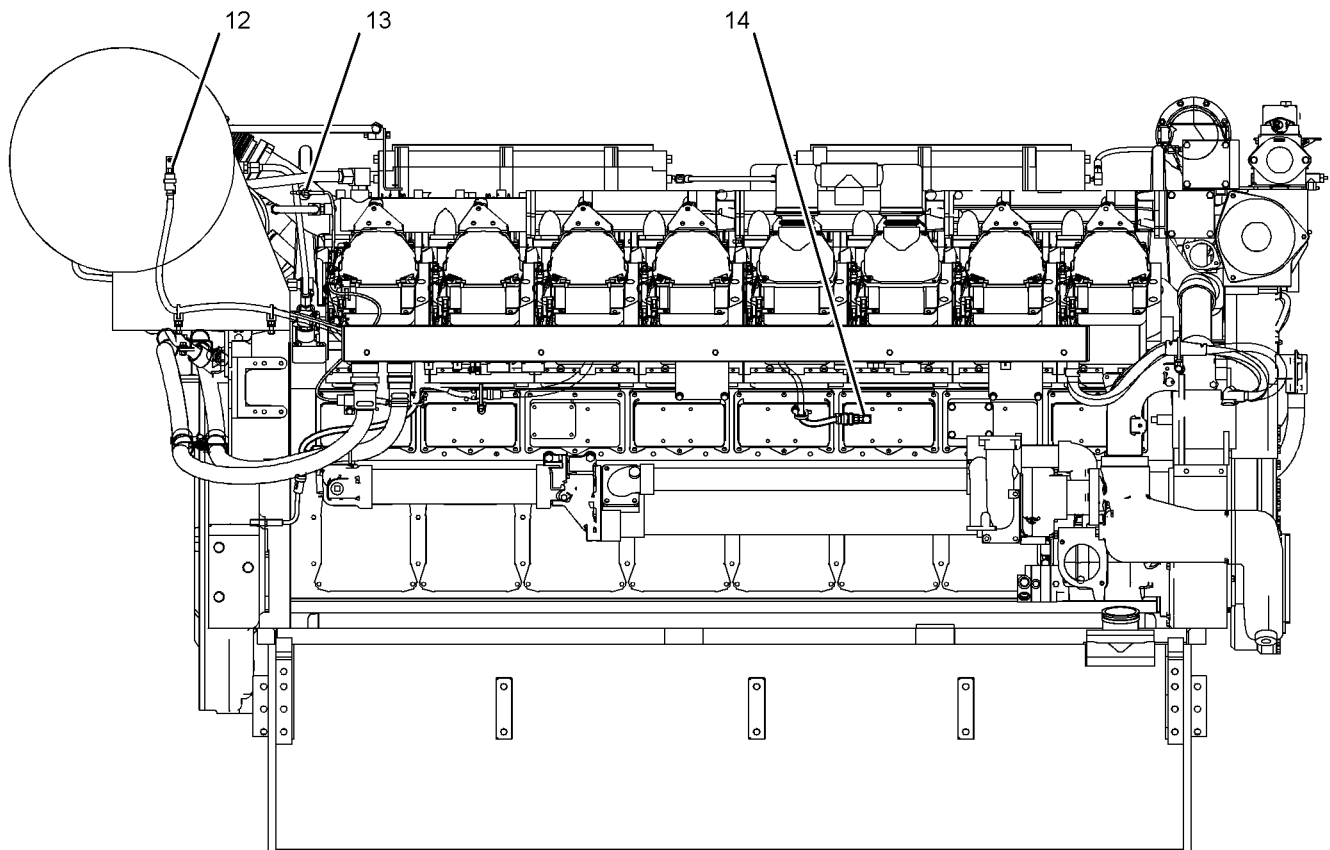


Illustration 6

g01019032

Right side view

(12) Right turbocharger compressor inlet  
pressure sensor

(13) Right exhaust temperature sensor  
(14) Crankcase pressure sensor

## Parameter Table

Table 7

System Configuration Parameters				
Parameter	ECM	Default	Range	Password
"Fuel Ratio Control Offset"	Primary	0	-25 to +25	No
"Rated Fuel Positon (mm)"	Primary	Software Dependent	Software Dependent	Yes
"Engine Cooling System Configuration"	Primary	SCAC	SCAC or JWAC	Yes
Cold Cylinder Cutout	Primary	Enabled	Enabled Disabled	No
"Cooldown Engine Speed (rpm)"	Primary	600	300 to 1600	No
"Engine Cooldown Duration (min)"	Primary	5	0 to 30	No
"Engine Prelube Duration (sec)"	Primary	0	0 to 210	No
"Crank Duration (sec)"	Primary	0	0 to 60	No
"Maximum Number of Crank Cycles"	Primary	0	0 to 10	No
"Crank Terminate Speed (rpm)"	Primary	400	100 to 500	No
"Total Tattletale"	Primary Secondary	0	0 to 255	N/A

## Customer Parameters

### "Equipment ID"

"Equipment ID" allows the customer to enter a description into the ECM in order to identify the engine. A maximum of 17 characters may be entered in the field. This parameter is only for reference by the customer. This parameter is not required.

### "Engine Serial Number"

"Engine Serial Number" must be programmed to match the engine serial number that is stamped on the engine information plate. If the ECM is replaced, the engine serial number must be programmed into the new ECM.

**Note:** When you are requesting factory passwords, always use the engine serial number that is resident in the ECM.

### "ECM Serial Number"

The "ECM Serial Number" is stored in the memory of the ECM. The "ECM Serial Number" can be accessed by the use of the service tool.

### "Personality Module Part Number"

"Personality Module Part Number" is programmed into the software.

### "Personality Module Release Date"

"Personality Module Release Date" is programmed into the software.

### "Engine Rotation"

The "Engine Rotation" can be viewed only.

### "Engine Location"

If multiple engines are installed, the parameter for the engine location identifies the locations of the engines.

### "Full Load Setting (FLS)"

"FLS" is a number that represents the adjustment to the fuel system that was made at the factory in order to fine tune the fuel system. The correct value for this parameter is stamped on the engine information plate. Factory passwords are required.

This information can be helpful for troubleshooting intermittent problems. Logged codes can also be used to review the performance of the engine.

## Clearing Event Codes

A code is cleared from memory when one of the following conditions occur:

- The code does not recur for 100 hours.
- A new code is logged and there are already ten codes in memory. In this case, the oldest code is cleared.
- The service technician manually clears the code.

Always clear logged event codes after investigating and correcting the problem which generated the code.

## Troubleshooting

For basic troubleshooting of the engine, perform the following steps in order to diagnose a malfunction:

1. Obtain the following information about the complaint:
  - The event and the time of the event
  - Determine the conditions for the event. The conditions will include the engine rpm and the load.
  - Determine if there are any systems that were installed by the dealer or by the customer that could cause the event.
  - Determine whether any additional events occurred.
2. Verify that the complaint is not due to normal engine operation. Verify that the complaint is not due to error of the operator.
3. Narrow the probable cause. Consider the operator information, the conditions of operation, and the history of the engine.
4. Perform a visual inspection. Inspect the following items:
  - Fuel supply
  - Oil level
  - Oil supply
  - Wiring
  - Connectors

Be sure to check the connectors. This is very important for problems that are intermittent. Refer to Troubleshooting, “Inspecting Electrical Connectors”.

If these steps do not resolve the problem, refer to Table 10 for the procedure to troubleshoot the event code.

## Trip Points for the “Caterpillar Monitoring System”

The monitoring system determines the level of action that is taken by the ECM in response to a condition that can damage the engine. When any of these conditions occur, the appropriate event code will be generated.

Table 11 contains the parameters that are monitored and the appropriate event code(s) that can be generated for that parameter. Table 11 also contains the minimum and maximum ranges for the parameter and the default trip points for each parameter. The actual settings for each parameter can be viewed with Caterpillar Electronic Technician (ET). The trip points for some of the parameters may be adjustable with Cat ET.

Table 13

Event Code		
Code and Description	Conditions which Generate this Code	System Response
E038(1) Low Engine Coolant Temperature Warning	The coolant temperature is below the trip point temperature.	The code is logged.

## Probable Causes

- Faulty water temperature regulator
- Very light loads

## Recommended Actions

### Water Temperature Regulator

A regulator that is stuck open can cause overcooling. Overcooling also occurs when the water temperature regulator is stuck between the following positions: open position and closed position. Coolant leaks that are around the water temperature regulator can cause overcooling. An example would be a leak in the vent line.

### Very Light Loads

Very light loads or a very slow engine speed can cause overcooling. This overcooling is caused by the low heat input of the engine.

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## Crankcase Pressure Is High

**SMCS Code:** 1201-035-PX

Use this procedure in order to troubleshoot a high crankcase pressure or use this procedure if one of the following event codes is active. Refer to Troubleshooting, "Event Codes" for information about event codes and the default trip points for these codes. You must access the monitoring system on Caterpillar Electronic Technician (ET) in order to view the current trip points for these codes.

Table 14

Event Code		
Code and Description	Conditions which Generate this Code	System Response
E012(2) High Crankcase Pressure Derate	Engine crankcase pressure is above the trip point pressure for the delay time.	The code is logged. The engine will be derated.
E013(3) High Crankcase Pressure Shutdown		The code is logged. The engine will shut down.
E101(1) High Crankcase Pressure Warning		The code is logged.

## Accessory Equipment

Check all accessory equipment for problems that may create excessive load on the engine. Repair any damaged components or replace any damaged components.

## Electronic Unit Injectors

1. Perform the "Injector Solenoid Test" on Cat ET in order to determine if all of the injector solenoids are being energized by the ECM.
2. Perform the "Cylinder Cutout Test" on Cat ET in order to identify any injectors that might be misfiring.
3. If Cat ET indicates a problem, remove the electronic unit injector from the suspect cylinder and install a new electronic unit injector. Refer to Disassembly and Assembly.
4. Ensure that the repairs have eliminated the problem. If there is still a problem, refer to the circuit test Troubleshooting, "Injector Solenoid - Test".

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## Engine Top Speed Is Not Obtained

**SMCS Code:** 1915-035

**Note:** If this fault occurs only under load, refer to Troubleshooting, "Acceleration Is Poor or Throttle Response Is Poor".

## Probable Causes

- Diagnostic codes
- Event codes
- Derates
- Engine parameters
- Throttle signal
- Air inlet and exhaust system
- Fuel supply
- Cylinder performance
- Electrical connectors

## Recommended Actions

### Diagnostic Codes, Event Codes and Derates

Certain diagnostic codes, event codes and/or derates may cause poor performance. Connect Caterpillar Electronic Technician (ET) and check for active codes and/or for logged codes. Troubleshoot any codes that are present before continuing with this procedure.

If this application supports engine derates, use Cat ET to check for logged derates. Refer to Troubleshooting, "Event Codes" for the specific events that are applicable to this application. A status screen on Cat ET will display a derate if a derate is active.

### Engine Parameters

Verify that the correct engine parameters are being used.

### Throttle Signal

Monitor the status for "Throttle Position" on Cat ET. Verify that the status for "Throttle Position" is stable and that the engine is able to reach high idle speed.

### Air Inlet and Exhaust System

1. Check the air filter restriction indicator, if equipped. Clean plugged air filters or replace plugged air filters. Refer to the Operation and Maintenance Manual.
2. Check the air inlet and exhaust system for restrictions and/or leaks. Refer to Systems Operation/Testing and Adjusting.

### Fuel Supply

1. Visually check the fuel level. Do not rely on the fuel gauge only. If necessary, add fuel. If the engine has been run out of fuel, it will be necessary to purge the air from the fuel system. Refer to Operation and Maintenance Manual.
2. Ensure that the fuel supply valve (if equipped) is in the full OPEN position.
3. Check the fuel lines for the following problems: restrictions, collapsed lines, pinched lines, and loose connections. If problems are found with the fuel lines, repair the lines and/or replace the lines.
4. Prime the fuel system if any of the following procedures have been performed:
  - Replacement of the fuel filters

- Leaking seals on the fuel line adapter for the cylinder head
- Excessive leakage from the unit injector tip or breakage of the unit injector tip
- Cracked fuel supply manifold
- Leaking seal on the fuel transfer pump

**Note:** For additional information, refer to , REHS3007, "Determining the Cause of Fuel Dilution of Engine Oil".

## Recommended Actions

### **WARNING**

Contact with high pressure fuel may cause fluid penetration and burn hazards. High pressure fuel spray may cause a fire hazard. Failure to follow these inspection, maintenance and service instructions may cause personal injury or death.

### **WARNING**

Do not loosen any high pressure fuel lines when the engine is running. The high pressure in the fuel lines can cause personal injury or death. Wait 60 seconds after the engine has stopped to allow pressure to purge before any service or repair is performed on the engine fuel lines.

## Leaking Seals on the Case of the Unit Injector or on the Barrel of the Unit Injector

Look for signs of damage to the seals for the unit injectors. Replace any seals that are leaking.

## Leaking Seals on the Fuel Line Adapter for the Cylinder Head

Look for signs of damage to the seals on the fuel line adapter for the cylinder head. Repair any leaking fuel lines or components and/or replace any leaking fuel lines or components.

## Excessive Leakage from the Unit Injector Tip or Breakage of the Unit Injector Tip

Look for signs of damage to the unit injectors. If necessary, repair the unit injectors or replace the unit injectors.

## Cracked Fuel Supply Manifold

Look for signs of damage to the fuel supply manifold.

## Leaking Fuel Transfer Pump Seal

Ensure that the weep hole is not plugged. If necessary, repair the fuel transfer pump or replace the fuel transfer pump.

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## Oil Filter Differential Pressure Problem

**SMCS Code:** 1308-035-PX

Use this procedure if the following event code is active. Refer to Troubleshooting, "Event Codes" for the default conditions for this code.

Table 28

Synchronization Status		No Synchronization	Synchronization
Port	Engine Synchronization Input 1	Open	Low
	Engine Synchronization Input 2	Open	Open
	Active Throttle	Primary	Secondary
Starboard	Engine Synchronization Input 1	Open	Open
	Engine Synchronization Input 2	Open	Low
	Active Throttle	Primary	Primary
Center	Engine Synchronization Input 1	Open	Open
	Engine Synchronization Input 2	Open	Low
	Active Throttle	Primary	Secondary

Illustration 21 shows the wiring for an installation of three engines. Illustration 21 shows the starboard engine as the master throttle control.

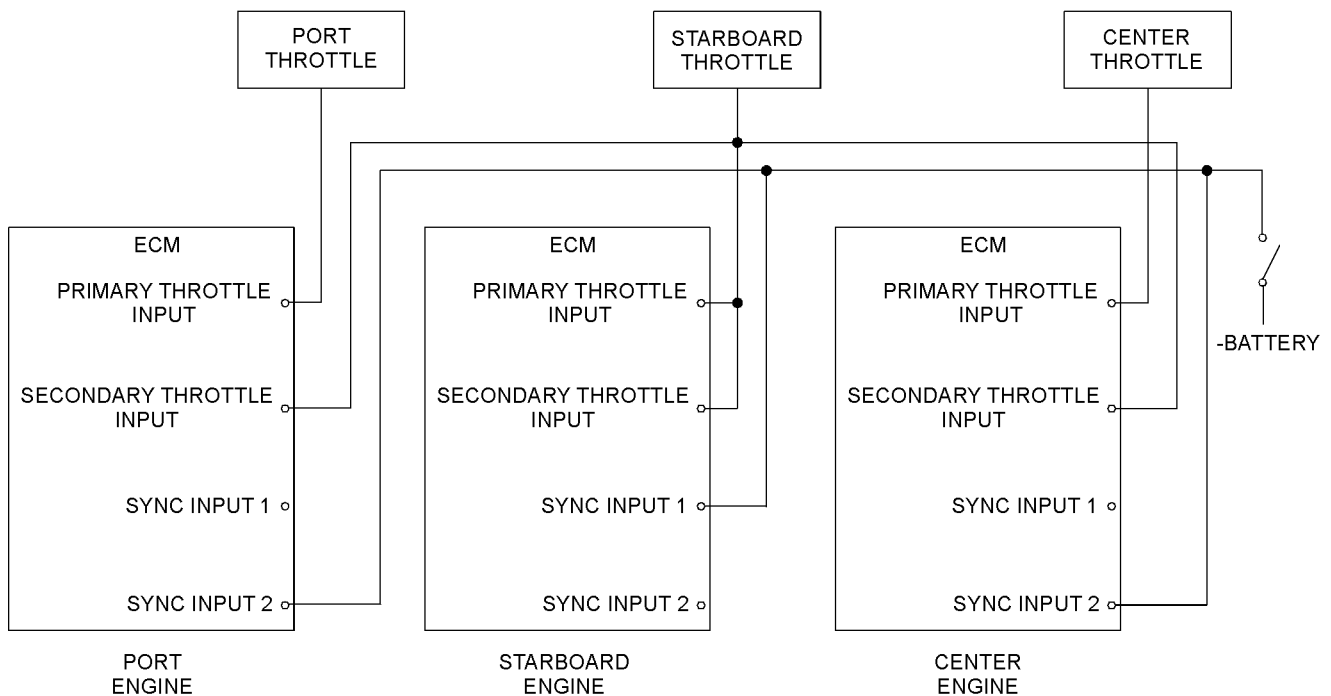


Illustration 21

Wiring for the throttle in a triple engine installation (starboard as master throttle)

**B.** The input to the coil of the “ASOS” is wire T708-BK from the diode assembly. Remove wire T708 from the coil of the “ASOS”. Connect a voltmeter between wire T708-BK and the engine ground.

**Note:** The “ASOS” is turned on for one second by the ECM. The timer keeps the “ASOS” energized for approximately 2.5 seconds.

**C.** Turn the ECS to the STOP position.

**D.** Activate the customer's emergency stop switch.

**E.** Monitor the voltage on the voltmeter.

**F.** Deactivate the customer's emergency stop switch.

**G.** Return all wiring to the original configuration.

**Expected Result:**

The voltage measures  $24 \pm 3$  VDC for approximately 2.5 seconds.

**Results:**

- OK – The voltage measures  $24 \pm 3$  VDC for approximately 2.5 seconds. The circuit is operating correctly to this point. Proceed to Test Step 6.
- Not OK – No voltage was measured. Proceed to Test Step 10.
- Not OK – The voltage did not measure  $24 \pm 3$  VDC for 2.5 seconds. Proceed to Test Step 8.

**Test Step 6. Check for Voltage from the “ASOS” to the Air Shutoff Solenoids**

**A.** Turn the ECS to the OFF/RESET position.

**B.** Disconnect wire G708-BK from the “ASOS”.

**C.** Connect a voltmeter to the empty terminal on the “ASOS”. Connect the other lead of the voltmeter to engine ground.

**D.** Turn the ECS to the STOP position.

**E.** Activate the customer's emergency stop switch.

**F.** Monitor the voltage on the voltmeter.

**G.** Deactivate the customer's emergency stop switch.

**H.** Reconnect wire G708-BK to the “ASOS”.

**Expected Result:**

The voltage measures  $24 \pm 3$  VDC for approximately 2.5 seconds.

**Results:**

- OK – The voltage measures  $24 \pm 3$  VDC for approximately 2.5 seconds. The circuit is operating correctly to this point.

**Repair:** Repair the wire G708-BK between the “ASOS” and terminal I at connector P-C1 of the power distribution panel.

STOP.

- Not OK – The voltage did not measure  $24 \pm 3$  VDC for approximately 2.5 seconds.

**Repair:** Verify that  $24 \pm 3$  VDC is present on wire K708-BK at the normally open contacts of the “ASOS”. If voltage is not present on wire K708-BK, check the wiring and the circuit breaker for the air shutoff for problems.

Check wire 220-BK on the coil of the “ASOS” for continuity to the –Battery. If necessary, repair the wire or replace the wire.

If wire 220-BK is OK and voltage is present on wire K708-BK, replace the “ASOS”.

STOP.

**Test Step 7. Check the Voltage at the Connector for the Air Shutoff Solenoids**

**A.** Turn the ECS to the OFF/RESET position.

**B.** Disconnect the connector for the air shutoff solenoids. Disconnect the connector for the right and left sides of the engine.

**C.** Connect a voltmeter between wire G708-BK on the connector for the air shutoff solenoid and the engine ground.

**D.** Turn the ECS to the STOP position.

**E.** Activate the customer's emergency stop switch.

**F.** Monitor the voltage on the voltmeter.

**G.** Deactivate the customer's emergency stop switch.

**H.** Reconnect the connectors for the air shutoff solenoids.

**Expected Result:**

The voltage measures  $24 \pm 3$  VDC for approximately 2.5 seconds.

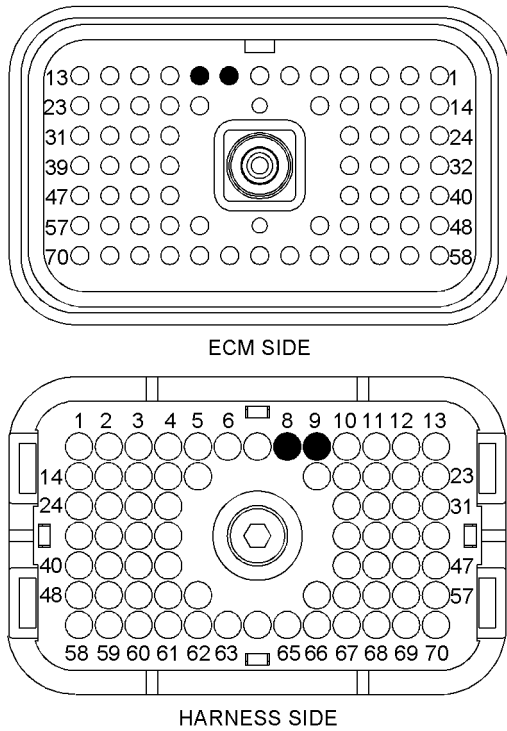


Illustration 31 g01156133  
P1 ECM connector  
(P1-8) Cat Data Link +  
(P1-9) Cat Data Link -

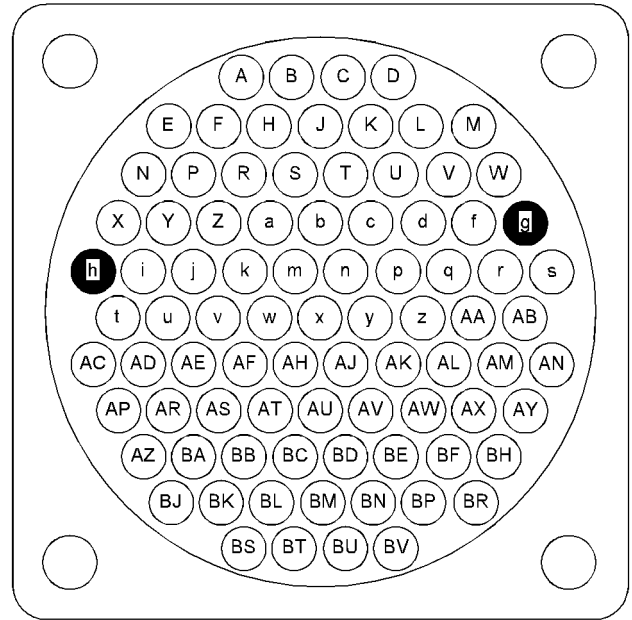


Illustration 32 g01161996  
Customer connector  
(Terminal g) Cat Data Link +  
(Terminal h) Cat Data Link -

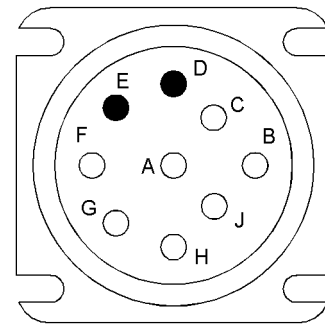


Illustration 33 g01161999  
Service tool connector  
(Terminal D) Cat Data Link +  
(Terminal E) Cat Data Link -

### Test Step 1. Inspect Electrical Connectors and Wiring

- A. Remove power from the ECM.
- B. Thoroughly inspect the J1/P1 ECM connector and the J2/P2 ECM connector. Inspect all of the connectors that are associated with the circuit.

Refer to Troubleshooting, "Electrical Connectors - Inspect" for details.

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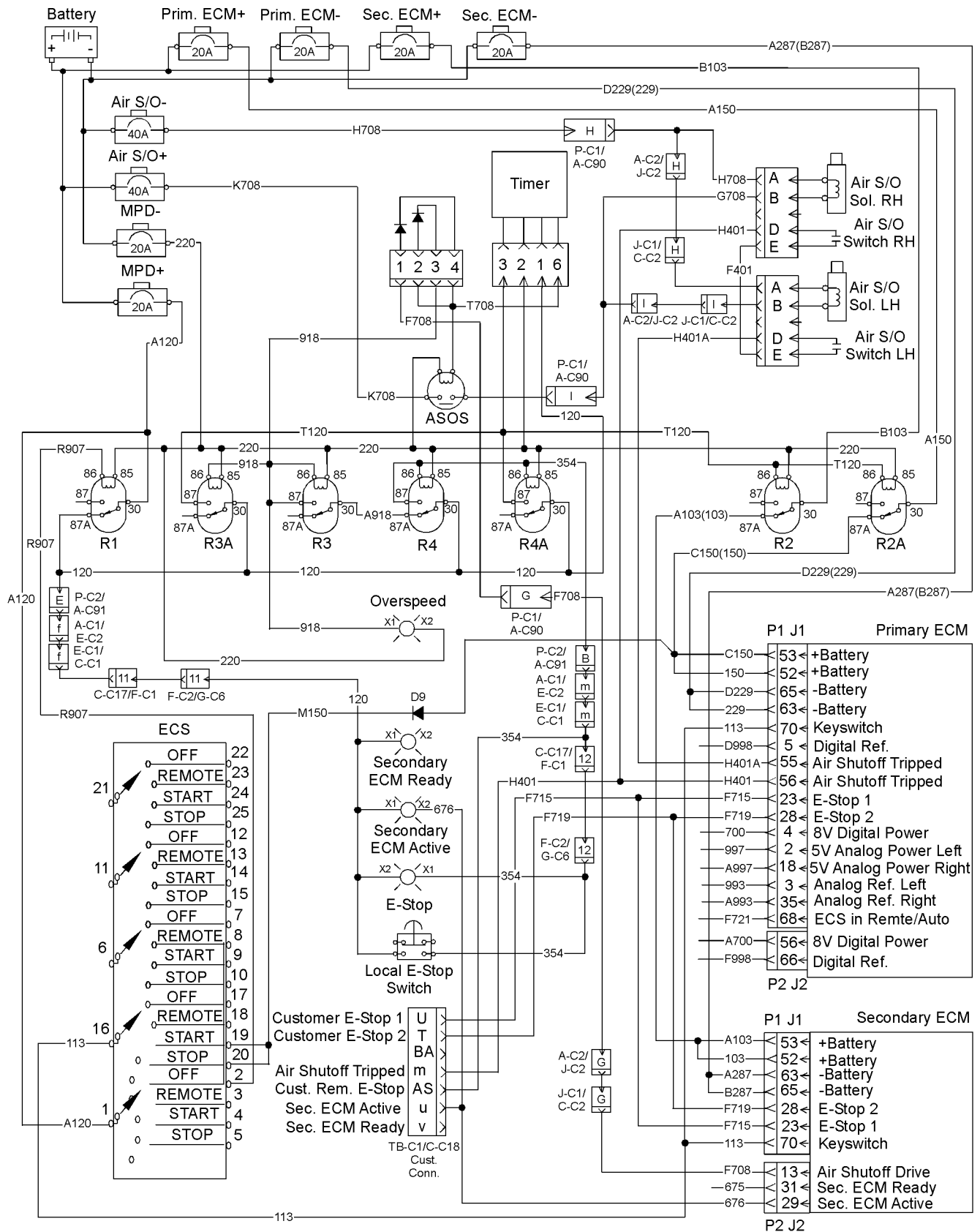
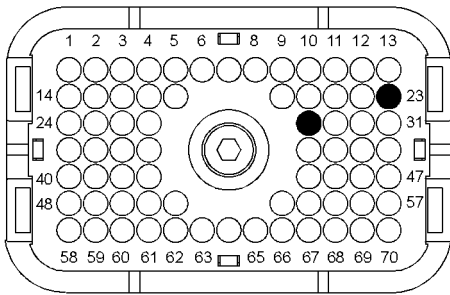


Illustration 39  
Typical example

WIRE SIDE



ECM SIDE

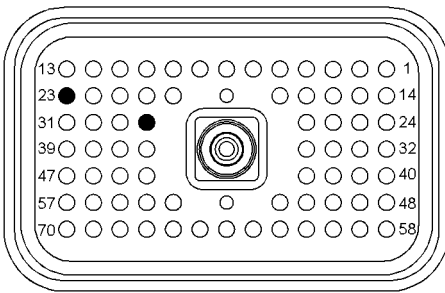
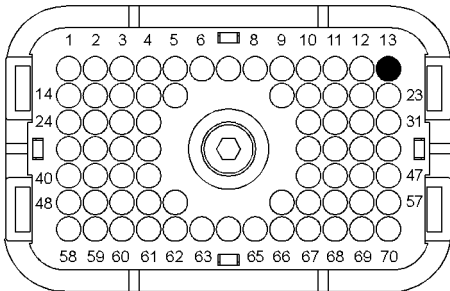


Illustration 45  
P1 ECM connector  
(P1-23) "E-Stop 1"  
(P1-28) "E-Stop 2"

g01323905

WIRE SIDE



ECM SIDE

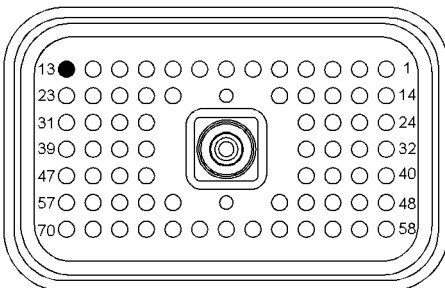


Illustration 46  
P2 ECM connector  
(P2-13) Drive for the air shutoff

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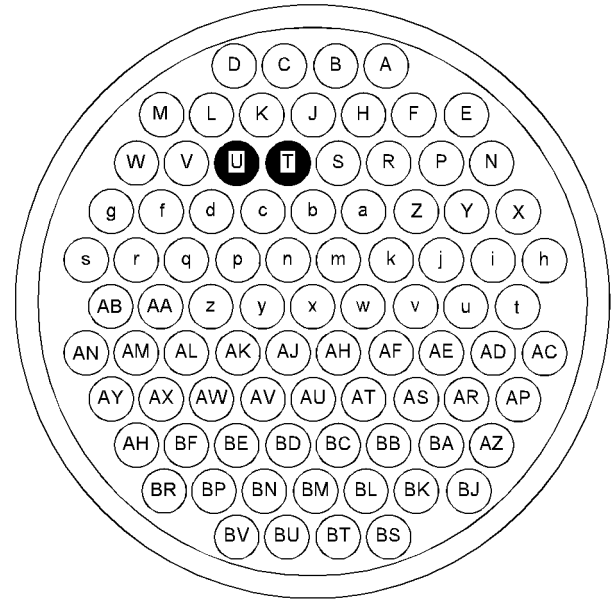
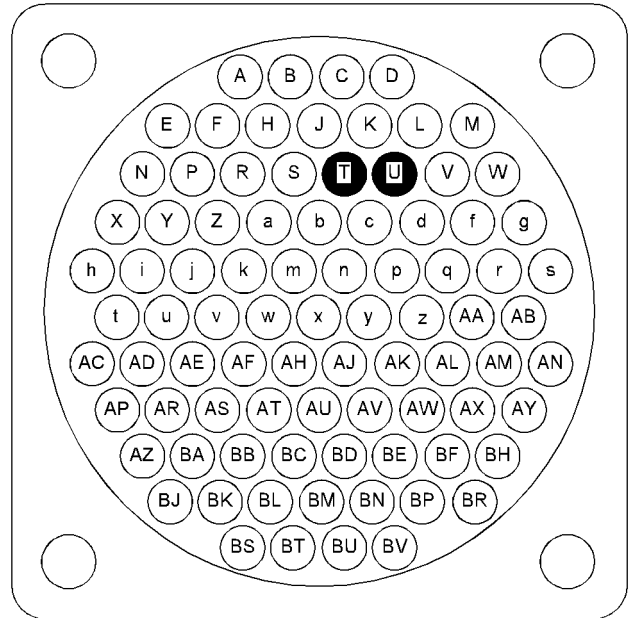


Illustration 47

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Terminal locations for the TB-C1/C-C18 customer connector  
(Terminal U) "E-Stop 1"  
(Terminal T) "E-Stop 2"

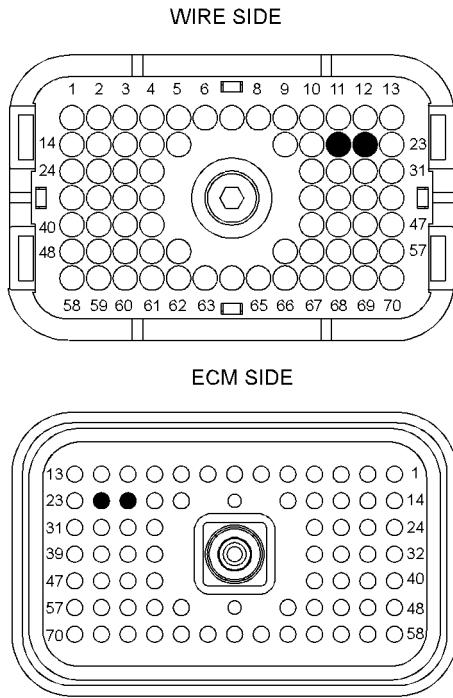


Illustration 51  
P1 Primary ECM connector  
(P1-21) "Start/Run/Stop 1"  
(P1-22) "Start/Run/Stop 2"

g01324452

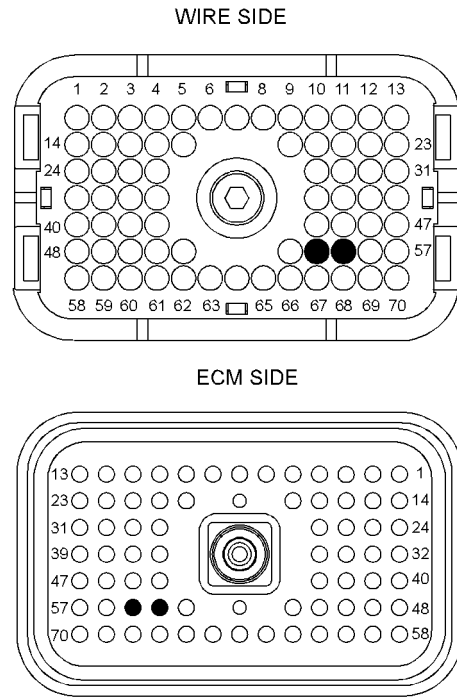


Illustration 52  
P2 Primary ECM connector  
(P2-54) "Digital return"  
(P2-55) "Digital return"

g01324924

(Table 38, contd)

<b>Diagnostic Codes Table</b>		
<b>Code and Description</b>	<b>Conditions which Generate this Code</b>	<b>System Response</b>
7-5 Cylinder #7 Injector current below normal	The ECM detects an open circuit.	The code is logged. The ECM continues to fire the injector solenoid.
7-6 Cylinder #7 Injector current above normal	The ECM detects a short circuit.	The code is logged. The ECM will disable the solenoid circuit. The ECM will periodically try to fire the injector. If the short circuit remains, this sequence of events will be repeated until the problem is corrected.
8-5 Cylinder #8 Injector current below normal	The ECM detects an open circuit.	The code is logged. The ECM continues to fire the injector solenoid.
8-6 Cylinder #8 Injector current above normal	The ECM detects a short circuit.	The code is logged. The ECM will disable the solenoid circuit. The ECM will periodically try to fire the injector. If the short circuit remains, this sequence of events will be repeated until the problem is corrected.
9-5 Cylinder #9 Injector current below normal	The ECM detects an open circuit.	The code is logged. The ECM continues to fire the injector solenoid.
9-6 Cylinder #9 Injector current above normal	The ECM detects a short circuit.	The code is logged. The ECM will disable the solenoid circuit. The ECM will periodically try to fire the injector. If the short circuit remains, this sequence of events will be repeated until the problem is corrected.
10-5 Cylinder #10 Injector current below normal	The ECM detects an open circuit.	The code is logged. The ECM continues to fire the injector solenoid.
10-6 Cylinder #10 Injector current above normal	The ECM detects a short circuit.	The code is logged. The ECM will disable the solenoid circuit. The ECM will periodically try to fire the injector. If the short circuit remains, this sequence of events will be repeated until the problem is corrected.
11-5 Cylinder #11 Injector current below normal	The ECM detects an open circuit.	The code is logged. The ECM continues to fire the injector solenoid.
11-6 Cylinder #11 Injector current above normal	The ECM detects a short circuit.	The code is logged. The ECM will disable the solenoid circuit. The ECM will periodically try to fire the injector. If the short circuit remains, this sequence of events will be repeated until the problem is corrected.
12-5 Cylinder #12 Injector current below normal	The ECM detects an open circuit.	The code is logged. The ECM continues to fire the injector solenoid.
12-6 Cylinder #12 Injector current above normal	The ECM detects a short circuit.	The code is logged. The ECM will disable the solenoid circuit. The ECM will periodically try to fire the injector. If the short circuit remains, this sequence of events will be repeated until the problem is corrected.

(continued)

Table 39

Diagnostic Codes Table		
Code and Description	Conditions which Generate this Code	System Response
338-5 Engine Pre-Lube Pump Relay current below normal	The engine's Electronic Control Module (ECM) detects an open circuit at the prelube relay. The ECM detects a short to battery voltage at the prelube relay.	The code is logged.
338-6 Engine Pre-Lube Pump Relay current above normal	The engine's ECM detects a short circuit at the prelube relay.	

The ECM has the ability to automatically prelube the engine before cranking. This prelubrication may increase the life of certain engine parts. The ECM will prelube the engine, when the Engine Control Switch (ECS) is placed in the START position. The ECM will prelube the engine, when the ECS is placed in the AUTO position and the remote start/run/stop switch is closed. The length of time for the prelube cycle can be programmed by the customer. The prelube cycle will end when the "prelube pressure switch" closes or when the customer programmed time ends. The engine speed must equal zero rpm before the prelube will begin.

The prelube cycle has the following status codes: "OFF", "ON", "COMPLETED", and "DISABLED".

The "OFF" status is entered when the engine control is first powered up with the ECS in the STOP position.

The "ON" status is entered when the ECM is on with the ECS in the START position.

The "COMPLETED" status is entered when the engine prelube duration is reached or when the engine prelube's pressure switch is activated.

The "DISABLED" status is entered when the engine prelube duration is programmed to 0.

The prelube function will be aborted when one of the following conditions occur:

- The "prelube pressure switch" is activated.
- The user defined engine prelube duration has been reached.
- The operator activates the prelube override switch.

When the ECM is in the START position, the ECM will activate the output driver for the "PPR1" relay. When the "PPR1" relay energizes, the normally open contacts of the "PPR1" relay close. This allows current to flow to the prelube motor. The prelube motor activates the prelube pump. The prelube pump builds pressure in the engine's lubrication system. When the "prelube pressure switch" closes as a result of the increased pressure, the ECM input for the "prelube pressure switch" is taken low. The ECM then knows that the pressure in the prelube system is adequate. The ECM will begin the starting sequence.

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1. Remove the wire G705-BK from terminal 2 of the "PPR1" relay. Activate the prelube override and measure the voltage between terminal 2 and engine ground. If voltage is present on terminal 2, repair the wire G705-BK between the "PPR1" relay and the prelube motor.
2. If voltage is not present on terminal 2, verify that 24 VDC is present on terminal 1 of the "PPR1" relay. If voltage is not present on terminal 1 of the "PPR1" relay, repair the wire K708-BK between the "Prelube Air S/O" breaker and the "PPR1" relay.
3. Verify that the wire 229-BK on terminal 4 of the "PPR1" relay has continuity to the -Battery.
4. Verify that the coil of the "PPR1" relay does not have an open circuit.

STOP.

### Test Step 9. Check the Operation of the Prelube Motor

- A. Fabricate a wire jumper out of a piece of 10 AWG wire and a 30A in-line fuse. Ensure that the wire jumper is long enough to reach between the +Battery terminal of the prelube motor and the battery.
- B. Connect one side of the wire jumper to the +Battery.
- C. For one second, connect the other end of the wire to the positive terminal of the prelube motor.

#### Expected Result:

The prelube motor starts while the wire is connected to the positive terminal of the prelube motor.

#### Results:

- OK – The prelube motor starts. There is a problem in the wiring harness at the prelube motor.

**Repair:** Repair the connectors or wiring and/or replace the connectors or wiring.

STOP.

- Not OK – The prelube motor did not start.

**Repair:** Verify that the wire to the -Battery at the prelube motor has continuity to the -Battery. If the wire to the -Battery is OK, the problem is in the prelube motor. Install a new prelube motor. Verify that the problem is no longer present.

STOP.

## Sensor Signal (Analog, Active) - Test

**SMCS Code:** 1439-038

#### System Operation Description:

Use this procedure to troubleshoot the electrical system if a problem is suspected with the sensors or if any one of the diagnostic codes in Table 40 is active or easily repeated.

Table 41

Diagnostic Codes Table		
Description	Conditions which Generate this Code	System Response
105-3 Inlet Manifold Temperature Sensor voltage above normal	The engine's Electronic Control Module (ECM) detects signal voltage that is more than 4.8 VDC for one second. The ECM has been powered for at least three seconds.	The code is logged. The value of the parameter is set to zero.
105-4 Inlet Manifold Temperature Sensor voltage below normal	The ECM detects signal voltage that is less than 0.2 VDC for one second. The ECM has been powered for at least three seconds.	
175-3 Engine Oil Temperature Sensor voltage above normal	The ECM detects signal voltage that is more than 4.8 VDC for one second. The ECM has been powered for at least three seconds.	The code is logged. The value of the parameter is set to zero.
175-4 Engine Oil Temperature Sensor voltage below normal	The ECM detects signal voltage that is less than 0.2 VDC for one second. The ECM has been powered for at least three seconds.	

**System Operation**

Use this procedure to troubleshoot any suspect problems with the following sensors:

- Inlet manifold temperature sensor
- Engine oil temperature sensor

The sensor signal for the passive sensors is routed to terminal C of each sensor connector. The sensor return for the passive sensors is routed to terminal B of each sensor connector.

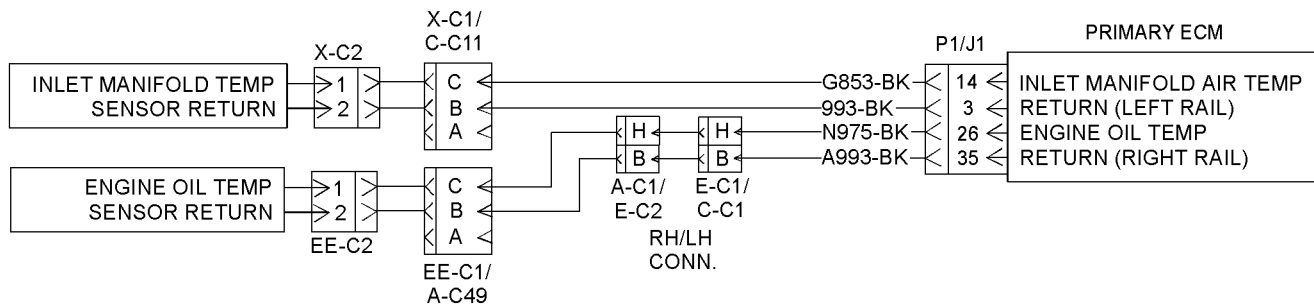


Illustration 77  
Typical schematic

Table 43

Diagnostic Codes Table		
Description	Conditions which Generate this Code	System Response
262-3 5 Volt Sensor DC Power Supply voltage above normal	The analog sensor supply voltage is above normal for two seconds.	The code is logged. All sensors are set to default values.
262-4 5 Volt Sensor DC Power Supply voltage below normal	The analog sensor supply voltage is below normal for two seconds.	
263-3 Digital Sensor Power Supply (8V Or 12V) voltage above normal	The digital sensor supply voltage is above normal for two seconds.	
263-4 Digital Sensor Power Supply (8V Or 12V) voltage below normal	The digital sensor supply voltage is below normal for two seconds.	

**System Operation**

The Electronic Control Module (ECM) supplies a regulated voltage of  $5.0 \pm 0.2$  VDC to the following sensors:

- Aftercooler temperature sensor
- Atmospheric pressure sensor
- Coolant temperature sensor
- Crankcase pressure sensor
- Filtered engine oil pressure sensor
- Filtered fuel pressure sensor
- Turbocharger outlet pressure sensor
- Left turbocharger inlet pressure sensor
- Right turbocharger inlet pressure sensor
- Unfiltered engine oil pressure sensor
- Unfiltered fuel pressure sensor

The ECM supplies a regulated voltage of  $8.0 \pm 0.4$  VDC to the following sensors:

- Left exhaust temperature sensor
- Right exhaust temperature sensor

The supply voltage for the sensors is routed from the ECM to terminal A of each sensor connector. The sensor return for the sensors is routed from the ECM to terminal B of each sensor connector. The ECM provides short circuit protection for the internal power supply. A short circuit to the battery will not damage the internal power supply.

**Note:** The sensors are not protected from overvoltage. A short from the supply line to the +Battery may damage the sensors. If the diagnostic code 262-3 or the diagnostic code 263-3 is logged, it is possible that all of the sensors have been damaged. Repair the sensor supply and check for any active sensor diagnostic codes in order to determine if a sensor has failed.

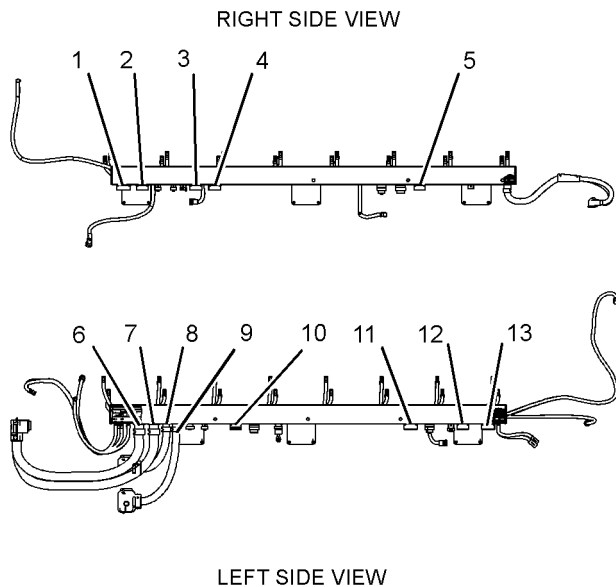


Illustration 102

g01320528

## Connector locations

- (1) A-C1/E-C2 RH rigid harness connectors
- (2) A-C2/J-C2 RH rigid harness connectors
- (3) P-C1/A-C90 Connectors for the power distribution panel
- (4) P-C2/A-C91 Connectors for the power distribution panel
- (5) G-C6/F-C2/F-C1/A-C92 Connectors for a RH Control panel
- (6) C-C22 Primary ECM connector P2
- (7) C-C15 Primary ECM connector P1
- (8) C-C28 Secondary ECM connector P2
- (9) C-C29 Secondary ECM connector P1
- (10) G-C6/F-C2/F-C1/C-C17 Connectors for a LH Control panel
- (11) C-C18/TB-C1 Customer connectors
- (12) C-C2/J-C1 LH rigid harness connectors
- (13) C-C1/E-C1 LH rigid harness connectors

### Test Step 1. Inspect the Electrical Connectors and the Wiring

- A. Turn the Engine Control Switch (ECS) to the OFF/RESET position.
- B. Thoroughly inspect the ECM connectors J1/P1 and J2/P2. Inspect the wiring and the connectors that are associated with the circuit. Refer to Troubleshooting, "Electrical Connectors - Inspect" for details.
- C. Perform a 45 N (10 lb) pull test on each of the wires in the ECM connectors that are associated with the circuit.
- D. Check the ECM connector (allen head screw) for the proper torque. Refer to Troubleshooting, "Electrical Connectors - Inspect" for details.

- E. Check the harness and wiring for abrasion and for pinch points from the sensors back to the ECM.

#### Expected Result:

All connectors, pins, and sockets are completely coupled and/or inserted, and the harness and wiring are free of corrosion, of abrasion or of pinch points.

#### Results:

- OK – The connectors and wiring are OK. Proceed to Test Step 2.
- Not OK – The connectors and/or wiring need repair.

**Repair:** Repair the connectors or wiring and/or replace the connectors or wiring.

STOP.

### Test Step 2. Check the Throttle Position on Caterpillar Electronic Technician (ET)

- A. Connect Cat ET to the service tool connector.
- B. Turn the ECS to the STOP position.
- C. Observe the position of the throttle on Cat ET.
- D. Adjust the speed control to the lowest setting.
- E. Start at the lowest position. Slowly adjust the speed control to the highest setting. Monitor the position of the throttle on Cat ET.

#### Expected Result:

The throttle position on Cat ET is 0 percent at the lowest setting and 0 to 100 percent as the speed control is adjusted to the highest setting.

#### Results:

- OK – The speed control is operating correctly.

**Repair:** There may be an intermittent problem. If the problem is intermittent, refer to Troubleshooting, "Electrical Connectors - Inspect" for details on inspecting wiring and connectors.

STOP.

- Not OK – The throttle position on Cat ET does not change correctly. If you are troubleshooting either the primary speed control or the secondary speed control from the customer, proceed to Test Step 3. If you are troubleshooting the local speed control on the instrument panel, proceed to Test Step 5.

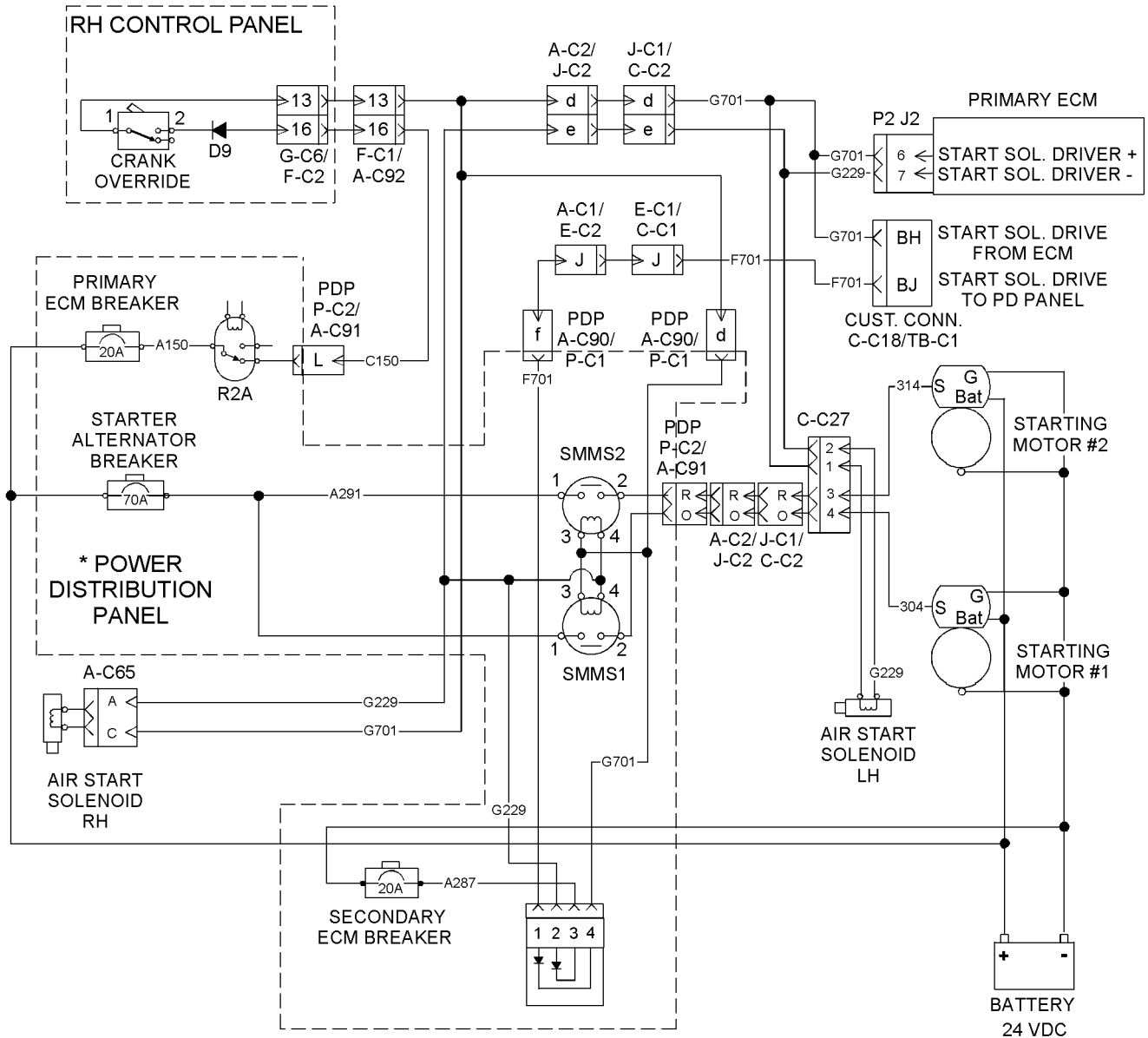


Illustration 106  
Typical example

# Service

i02826488

## Factory Passwords

i02584369

**SMCS Code:** 0785; 1900

### NOTICE

Operating the engine with a flash file not designed for that engine will damage the engine. Be sure the flash file is correct for your engine.

**Note:** Factory passwords are provided only to Caterpillar dealers.

Factory passwords are required to perform each of the following functions:

- Program a new Electronic Control Module (ECM).

When an ECM is replaced, the system configuration parameters must be programmed into the new ECM. A new ECM will allow these parameters to be programmed once without factory passwords. After the initial programming, some parameters are protected by factory passwords.

- Rerate the engine.

This may require changing the interlock code, which is protected by factory passwords.

- Unlock parameters.

Factory passwords are required in order to unlock certain system configuration parameters. Refer to Troubleshooting, "Configuration Parameters".

- Clear engine events and certain diagnostic codes.

Most engine events require factory passwords in order to clear the code from ECM memory. Clear these codes only when you are certain that the problem has been corrected. For example, the Engine Overspeed code requires the use of factory passwords in order to clear the code from ECM memory.

Since factory passwords contain alphabetic characters, the Caterpillar Electronic Technician (ET) must be used to perform these functions. In order to obtain factory passwords, proceed as if you already have the password. If factory passwords are needed, Cat ET will request the factory passwords and Cat ET will display the information that is required to obtain the passwords. For the worksheet that is used for acquiring factory passwords, refer to Service Troubleshooting, "Factory Passwords Worksheet".

## ECM Will Not Accept Factory Passwords

**SMCS Code:** 0785; 1901

### Probable Causes

One of the following items may not be recorded correctly on the Caterpillar Electronic Technician (ET):

- Passwords
- Serial numbers
- Total tattletale
- Reason code

### Recommended Actions

1. Verify that the correct passwords were entered. Check every character in each password. Remove the electrical power from the engine for 30 seconds and then retry.
2. Verify that Cat ET is displaying the "Enter Factory Passwords" dialog box.
3. Use Cat ET to verify that the following information has been entered correctly:
  - Engine serial number
  - Serial number for the electronic control module
  - Serial number for Cat ET
  - Total tattletale
  - Reason code

For additional information, refer to Troubleshooting, "Factory Passwords".

i02909404

## Electronic Service Tool Does Not Communicate

**SMCS Code:** 0785; 1900

### System Operation Description:

Use this procedure to solve communication problems between Caterpillar Electronic Technician (ET) and the Electronic Control Module (ECM). Cat ET must communicate with the ECM in order to fully service the engine.

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