Perkins 1104 Series

WORKSHOP MANUAL

Troubleshooting

4 cylinder, naturally aspirated, and turbocharged diesel engines for agricultural and industrial use

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Electronic Service Tools

Electronic Service Tools are designed to help the service technician with the diagnosis and repair of electronic engines. Several tools are available to assist the service technician.

Some of the included Diagnostic Functional Tests in this manual require two short jumper wires. The jumper wires are used to check the continuity of some wiring harness circuits by shorting two adjacent terminals together in a connector.

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

Electronic Service Tool

The electronic service tool can display the following information:

- Parameters
- Event codes
- Diagnostic codes
- Engine configuration

The electronic service tool can be used by the technician to perform the following functions:

- Diagnostic tests
- Sensor calibrations
- Flash programming
- Set parameters

The following components are required to use the electronic service tool to service the engine.

Table 1

Required Electronic Service Tools for the Use of the Electronic Service Tool	
Part Number	**Description**
N/A	**Required** IBM compatible PC with 266 MHz Pentium processor 64 MB of RAM 400 MB of available hard drive space CD-ROM drive 3.5" 1.44 MB floppy disk drive VGA monitor or display (800 x 600) Microsoft® Windows 2000, XP, ME, NT 4.0, 98, or 95 RS232 port with 16550AF UART
N/A	**Recommended** IBM compatible PC with 450 MHz Pentium III processor 128 MB of RAM 1 GB of available hard drive space 40X speed CD-ROM drive or 8X speed DVD drive 3.5" 1.44 MB floppy disk drive Super VGA monitor or display (800 x 600) Microsoft® Windows 2000, XP, ME, NT 4.0, or 98 RS232 port with 16550AF UART

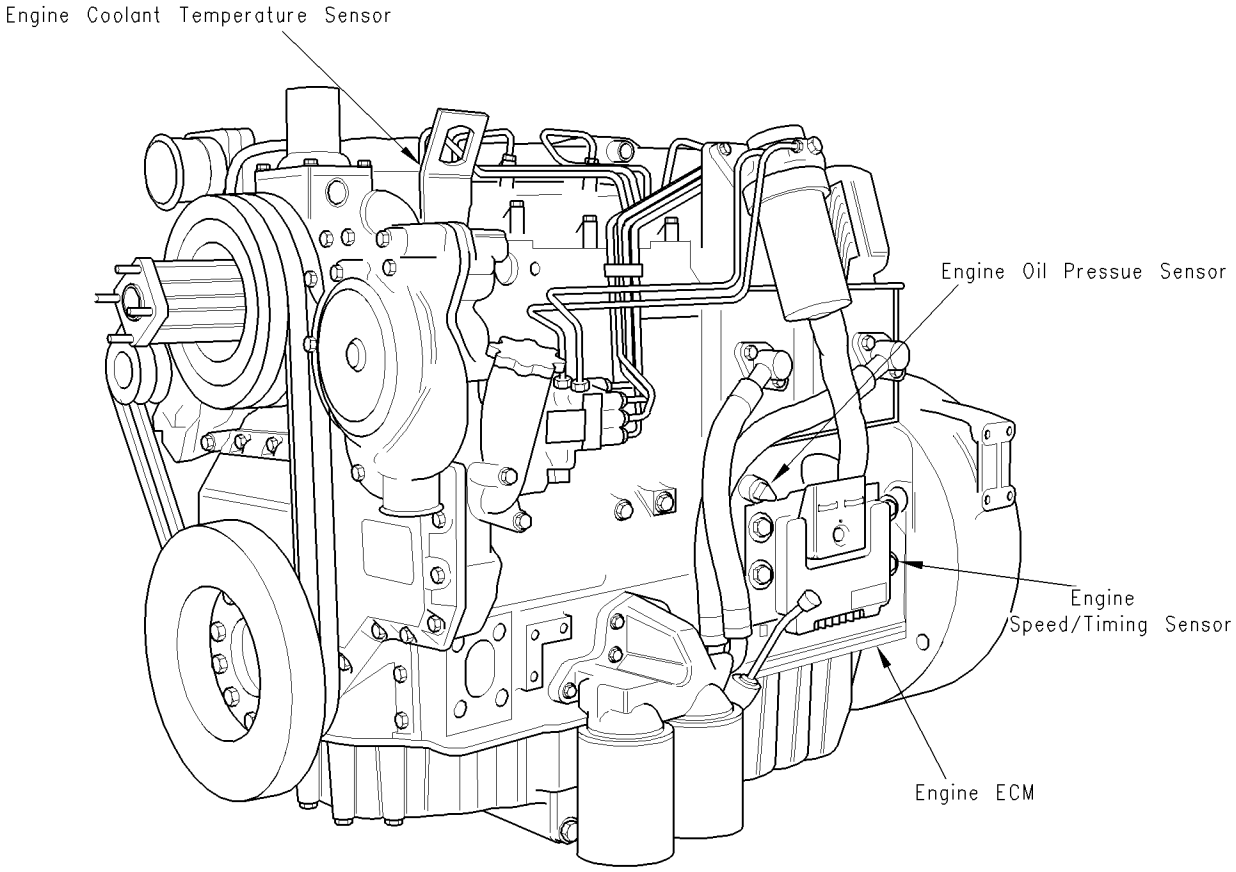

Illustration 8 g00884570

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Typical example of left side sensor locations

System Configuration Parameters

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System Configuration Parameters

System Configuration Parameters affect the emissions of the engine or the power of the engine. System configuration parameters are programmed at the factory. Normally, system configuration parameters would never need to be changed through the life of the engine. System configuration parameters must be reprogrammed if an ECM is replaced. Unless the engine rating has changed, system configuration parameters do not need to be reprogrammed when the Personality Module is replaced. The correct values for these parameters are stamped on the engine information ratings plate. The engine information ratings plate is located on the valve cover or on the air intake manifold. Factory passwords are required to change these parameters. The following information is a description of the system configuration parameters.

“Full Load Setting”

“Full Load Setting” 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 ratings plate. If the ECM is replaced, the “full load setting” must be reprogrammed in order to prevent a 253-02 diagnostic code from becoming active.

“Full Torque Setting”

“Full Torque Setting” is similar to “Full Load Setting”. If the ECM is replaced, the full torque setting must be reprogrammed in order to prevent a 253-02 diagnostic code from becoming active.

Rating Interlock

The Rating Interlock is a code that prevents the use of an incorrect power rating and/or emission rating for a specific engine. Each horsepower rating and each emission certification has a different code to all other horsepower ratings and emission certifications.

When an ECM is replaced this rating interlock code must match the code that is stored in the ECM. If the rating interlock code does not match the code that is stored in the ECM, both of the following situations will exist:

- The engine will not run.
- The diagnostic code 253-02 (Incorrect ECM Software) will be active.

Note: The flash programming of a new rating interlock replaces the old rating interlock.

This code does not need to be programmed when the replacement ECM is from the same engine rating.

If the ECM is from a different engine rating, then the following components may need to be changed: pistons, fuel injectors, and other components. The engine information ratings plate must also be changed in order to reflect the new rating.

Some vehicle systems such as the cooling system or the transmission may also require changes when the engine is rerated. Please contact the local OEM dealer for further information.

“Engine Serial Number”

When a new ECM is delivered, the engine serial number in the ECM is not programmed. The “Engine Serial Number” should be programmed to match the engine serial number that is stamped on the engine information plate.

“ECM Software Release Date”

This parameter is defined by the rating interlock and this parameter is not programmable. The “ECM Software Release Date” is used to provide the version of the software. The Customer parameters and the software change levels can be monitored by this date. The date is provided in the month and the year (NOV99). NOV is the month (November). 99 is the year (1999).

- Individual malfunctioning cylinder
- Valve lash
- Low compression (cylinder pressure)
- Fuel injection nozzles
- Air inlet heater starting aid
- Engine speed/timing sensors
- Throttle position sensor
- Fuel injection pump

Recommended Actions

Logged Codes

Check for active diagnostic codes on the electronic service tool. Troubleshoot any active codes before continuing with this procedure.

Fuel Supply

1. Check the fuel pressure. Refer to Systems Operation, Testing and Adjusting, “Fuel System Pressure - Test”.
2. Ensure that the fuel system has been primed. Refer to Systems Operation, Testing and Adjusting, “Fuel System - Prime”.
3. Check the diesel fuel for contamination. Refer to Systems Operation, Testing and Adjusting, “Fuel Quality - Test”.
4. Check for air in the fuel system. Refer to Systems Operation, Testing and Adjusting, “Air in Fuel - Test”.
5. Check that the fuel lines are tight and secured properly.
6. Check for fuel supply lines that are restricted.
7. Check the fuel filters.
8. Visually check the fuel tank for fuel. The fuel gauge may be faulty.
9. If the engine has a water separator, check for water in the fuel.
10. Ensure that the fuel supply valve (if equipped) is in the full OPEN position.
11. If the temperature is below 0 °C (32 °F), check for solidified fuel (wax).
12. If the repairs do not eliminate the problem proceed to “Air Intake and Exhaust System”.

Air Intake and Exhaust System

1. Check the air filter restriction indicator, if equipped.
2. Ensure that the air filter is clean and serviceable.
3. Check the air intake and exhaust systems for the following defects:
   - Blockages
   - Restrictions
   - Damage to lines or hoses
4. If the repairs do not eliminate the problem proceed to “Individual Malfunctioning Cylinders”.

Individual Malfunctioning Cylinders

1. With the engine speed at a fast idle, loosen the high pressure fuel line to the fuel injection nozzle of number 1 cylinder. Note if there is any reduction in engine speed. Tighten the high pressure fuel line to the fuel injection nozzle.
2. Individually repeat this procedure for each fuel injection nozzle. If there is not a reduction in the engine speed proceed to “Check the Air Inlet Heater Starting Aid”.
3. If there is a reduction in engine speed proceed to “Valve Lash”.

Valve lash

1. Check the valve lash and reset the valve lash if it is necessary. Refer to Systems Operation, Testing and Adjusting, “Engine Valve Lash - Inspect and Adjust”.
2. If the repair does not eliminate the fault proceed to “Check for Low Compression”.

Check for Low Compression

Examples of low compression are shown on the following list:

- Mechanical problems
- Faulty piston rings
- Worn cylinder bores
- Worn valves

Low Compression (cylinder pressure)

1. Remove the fuel injection nozzles and perform a compression test. Refer to Systems Operation, Testing and Adjusting, “Compression - Test ”data.
2. Make all necessary repairs to the engine.
3. Ensure that the repairs have eliminated the faults.

   Examples of low compression are shown in the following list:

   - Mechanical problem
   - Faulty piston rings
   - Worn cylinder bores
   - Worn valves
   - Faulty cylinder head gasket
   - Damaged cylinder head

4. If the repair does not eliminate the fault proceed to “Air Inlet Heater Starting Aid”.

Air Inlet Heater Starting Aid

1. Verify that the air inlet heater is operating correctly. Refer to Testing and Adjusting, “Air Inlet Heater - Test”.
2. If the repair does not eliminate the fault proceed to “Fuel Injection Nozzles”.

Fuel Injection Nozzles

1. Remove the fuel injection nozzles from the cylinder head. Refer to Disassembly and Assembly, “Fuel Injection Nozzle - Remove”.
2. Check the fuel injection nozzles. Refer to Testing and Adjusting, “Fuel Injection Nozzle - Test”.
3. Ensure that the repairs have eliminated the problems.
4. If the problem has not been eliminated, proceed to “Coolant Temperature Sensor Circuit”.

Coolant Temperature Sensor Circuit

1. Connect the electronic service tool to the diagnostic connector.
2. Monitor the display screen on the electronic service tool in order to verify the presence of active diagnostic codes for the coolant temperature. Refer to Troubleshooting, “Engine Temperature Sensor Open or Short Circuit - Test”.

Engine Pressure Sensors

1. Connect the electronic service tool to the diagnostic connector.
2. Monitor the display screen on the electronic service tool in order to verify the presence of active diagnostic codes for the engine pressure sensors. Refer to Troubleshooting, “5 Volt Engine Pressure Sensor Supply Circuit - Test”.

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Intake Air Temperature Is Too High

Probable Causes

- High ambient air temperature
- High coolant temperature
- High intake air restriction and/or high altitude
- Faulty intake manifold air temperature sensor and/or circuit
- Insufficient flow of cooling water through the aftercooler (if equipped)
- Insufficient flow of air through the aftercooler (if equipped)

Recommended Repairs

High Ambient Air Temperature

Determine if the ambient air temperature is within the design specifications for the cooling system.

Determine the cause of the high air temperature. Make corrections, when possible.

Coolant Temperature

Refer to Troubleshooting, “Coolant Temperature Is Too High”.

Troubleshooting with a Diagnostic Code

i01798139

CID 0041 FMI 03 8v Sensor Power Supply, Voltage More Than Normal

Conditions Which Generate This Code:

The ECM detects all of the following conditions:

- The ECM has been powered for at least three seconds.
- The ECM reads signal voltage that is above normal.

System Response:

The ECM will log the diagnostic code. The diagnostic code may be viewed on the electronic service tool.

The ECM will return the engine to low idle or a safe speed. The engine will remain at low idle or safe speed while the diagnostic code remains active.

Possible Performance Effect:

- Low power

Troubleshooting:

Perform the following diagnostic procedure: “Throttle Position Sensor Circuit - Test”

Results:

- OK – STOP.

i01798140

CID 0041 FMI 04 8v Sensor Power Supply, Voltage Less Than Normal

Conditions Which Generate This Code:

The ECM detects all of the following conditions:

- The ECM has been powered for at least three seconds.
- The ECM reads signal voltage that is below normal.

System Response:

The ECM will log the diagnostic code. The diagnostic code may be viewed on the electronic service tool.

The ECM will return the engine to idle or a safe speed. The engine will remain at idle or safe speed while the diagnostic codes remain active.

Possible Performance Effect:

- Low power

Troubleshooting:

Perform the following diagnostic procedure: “Throttle Position Sensor Circuit - Test”

Results:

- OK – STOP.

i01798141

CID 0091 FMI 02 Throttle Demand Sensor Erratic Or Intermittent

Conditions Which Generate This Code:

If the engine is equipped with a throttle switch then the signal from this switch is invalid.

If the engine is equipped with a throttle position sensor then the signal from the throttle idle validation switch is invalid.

System Response:

The ECM will log the diagnostic code. The diagnostic code may be viewed on the electronic service tool.

Possible Performance Effect:

The engine speed defaults to low idle or a predetermined safe speed.

The engine will remain at this speed while the diagnostic code remains active.

i01798161

CID 0342 FMI 02 Speed And Timing Sensor No.2 Intermittent Signal

Conditions Which Generate This Code:

Note: If both of the following diagnostic codes are active, then the fuel injection pump has suffered a complete failure of the electrical supply:

- 0174-02
- 0342-02

Both of the diagnostic codes will be active if there has been a communication fault between the Electronic Control Module (ECM) and the CAN data link for the fuel injection pump. If only the 0342-02 is active there is not a fault with the electrical supply for the fuel injection pump.

The signal for the speed/timing sensor in the fuel injection pump is intermittent or lost for less than one second.

System Response:

The Electronic Control Module (ECM) will log the diagnostic code. The ECM will force the engine to a default value or a safe speed. The diagnostic code may be viewed on the electronic service tool.

Possible Performance Effect:

The engine will shut down.

Test Step 1.

Perform the following diagnostic procedure: “Fuel Injection Pump Circuit - Test”

Results:

- OK – STOP.

Test Step 2.

Perform the following diagnostic procedure: “CAN Data Link Circuit - Test”

Results:

- OK – STOP.
- REPAIRED, OK – STOP.

i01798162

CID 0774 FMI 02 Throttle Demand Sensor No.2 Erratic Or Intermittent

Conditions Which Generate This Code:

The ECM detects one of the following conditions:

- Erratic data
- Intermittent data
- Incorrect data

System Response:

The ECM will log the diagnostic code. The diagnostic code may be viewed on the electronic service tool.

The ECM will return the engine to low idle or to a safe speed while the diagnostic code is active.

Possible Performance Effect:

The engine speed defaults to low idle or a predetermined safe speed.

The engine will remain at this speed while the diagnostic code remains active.

The reduction of speed is determined by the current speed of the engine.

When a fault is detected and the engine is above the predetermined safe speed, the engine will reduce speed to the safe speed.

When a fault is detected and the engine is below the predetermined safe speed, the engine will match the correct speed.

The throttle is ignored by the ECM until the fault is repaired.

The throttle switch will also be ignored by the ECM until the keyswitch has been turned to the OFF position and then back to the ON position.

- Low power
- Reduced engine speed

Perform the following diagnostic procedure: “Throttle Switch Circuit - Test”

System Response:

The engine speed fails to disengage from the set speed.

The ECM will log the diagnostic code. The diagnostic code may be viewed on the electronic service tool.

The ECM will have no response to this active code. There is no loss of engine performance.

Troubleshooting:

Further troubleshooting is required.

Refer to Troubleshooting, “Throttle Switch Circuit - Test”.

Results:

- OK – STOP.

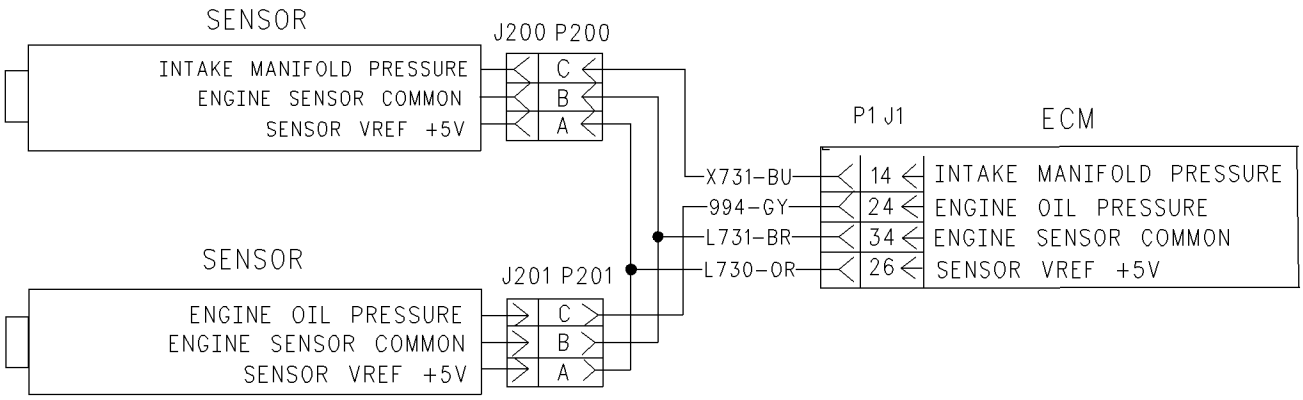

Illustration 17 g00954290

Schematic of the +5 V supply for the engine pressure sensors

Test Step 1. Inspect Electrical Connectors And Wiring.

A. Thoroughly inspect the following connections:

- P1/J1 ECM Engine harness connector
- P20/J20 MIC Machine harness connector
- P201/J201 Engine oil pressure sensor
- P200/J200 Intake manifold pressure sensor

Refer to Troubleshooting, “Electrical Connectors - Inspect” for details.

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Analog Throttle Position Sensor Circuit - Test

System Operation Description:

Use this procedure if another procedure has directed you here. Use this procedure if any of the following diagnostic codes are active:

- 91-02 Throttle Demand Sensor erratic or intermittent
- 91-03 Throttle Demand Sensor open circuit or shorted high
- 91-04 Throttle Demand Sensor shorted low
- 774-02 Throttle Demand Sensor No.2 erratic or intermittent
- 774-03 Throttle Demand Sensor No.2 open circuit or shorted high
- 774-04 Throttle Demand Sensor No.2 shorted low
- 262-03 5V Sensor Supply Voltage more than normal
- 262-04 5V Sensor Supply Voltage less than normal

The throttle demand sensor is an Analog sensor and this sensor is mounted on the throttle pedal. The throttle demand sensor provides an output voltage to the ECM. This sensor output voltage will vary with the position of the throttle from 0.5 volts to 4.5 volts. The throttle demand sensor is attached directly to the throttle assembly. Foot or hand operated versions of the throttle assembly are also available.

The sensor receives +5 volt power from the ECM. The sensor will produce a voltage that will alter between low idle and high idle. The voltage is changed into a throttle position within the range 0 to 100 percent by the ECM.

The throttle demand sensor senses the speed requirement from the throttle position. A second throttle demand sensor may override this speed requirement from the first throttle demand sensor. This override will be subject to an input from either the SAE J1939 (CAN), or from the Set Speed Control. The input status can be checked on the electronic service tool Status Display Screen.

The system will check the switch position in relation to the throttle position signal when the idle validation has been set for use. If the switch position and the signal from the throttle demand sensor are valid then the throttle will operate as normal.

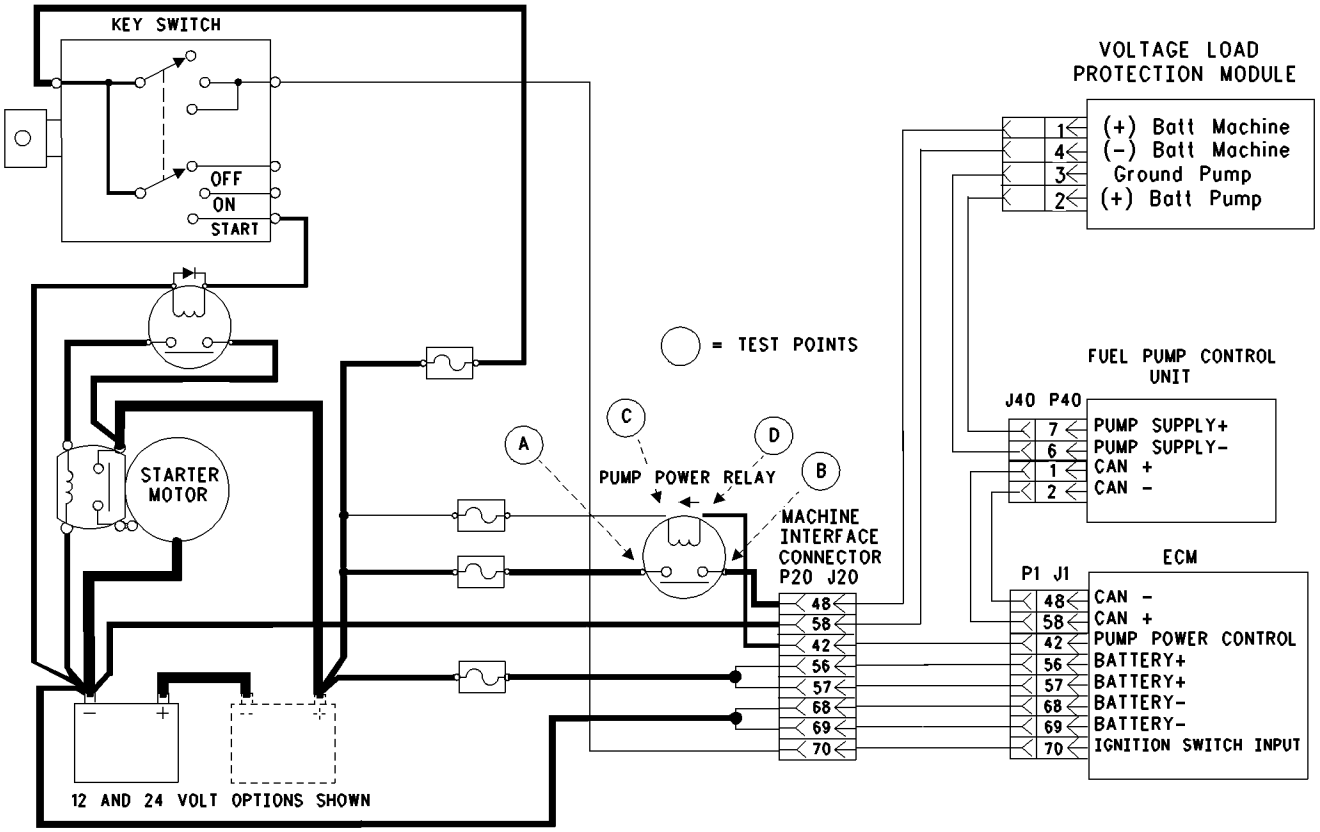

Illustration 30 g00910876

Schematic for the CAN Data Link and the fuel injection pump

Test Step 5. Connect the Electronic Service Tool directly to the ECM.

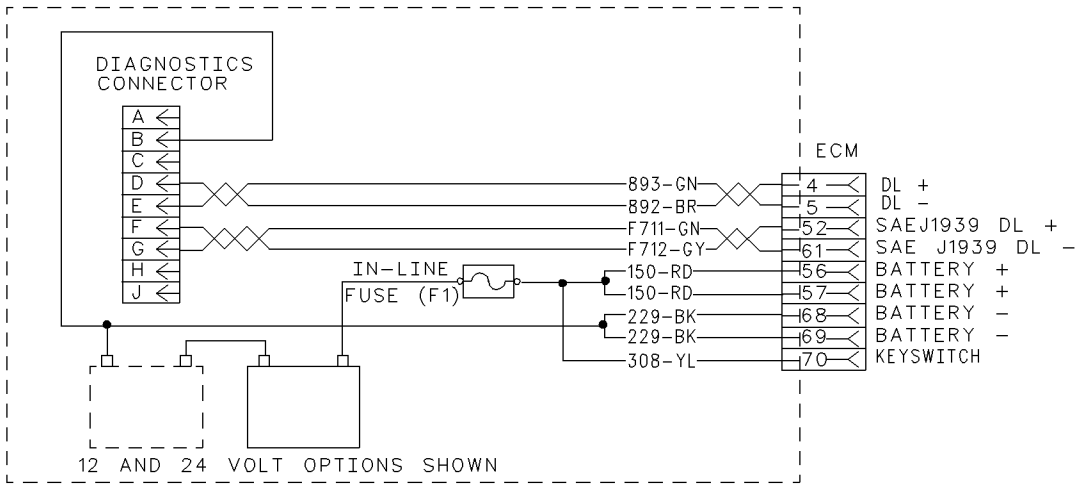

Illustration 39 g00954776

Typical bypass harness

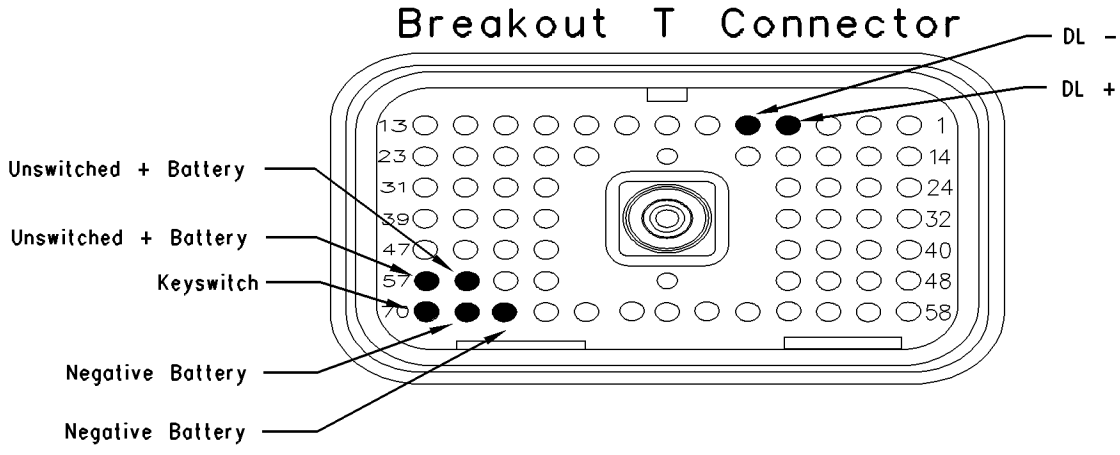

Illustration 40 g00954771

Pin locations for the Breakout T

Test Step 10. Remove the Throttle Position Sensor from the Engine Speed Control Assembly.

A Mate sensor to accelerator pedal assembly. Key must match up with the sensor slot. Check the sensor housing for a flush fit to the pedal assembly mounting surface (This ensures slot on sensor has mated correctly with the pedal assembly key.)

B Ensure the sensor is oriented the same as it was prior to removal to ensure sensor harness pigtail is routed correctly.

C Line up screw holes and install mounting screws.

NOTE: Procedure is identical for the suspended accelerator pedal assembly.

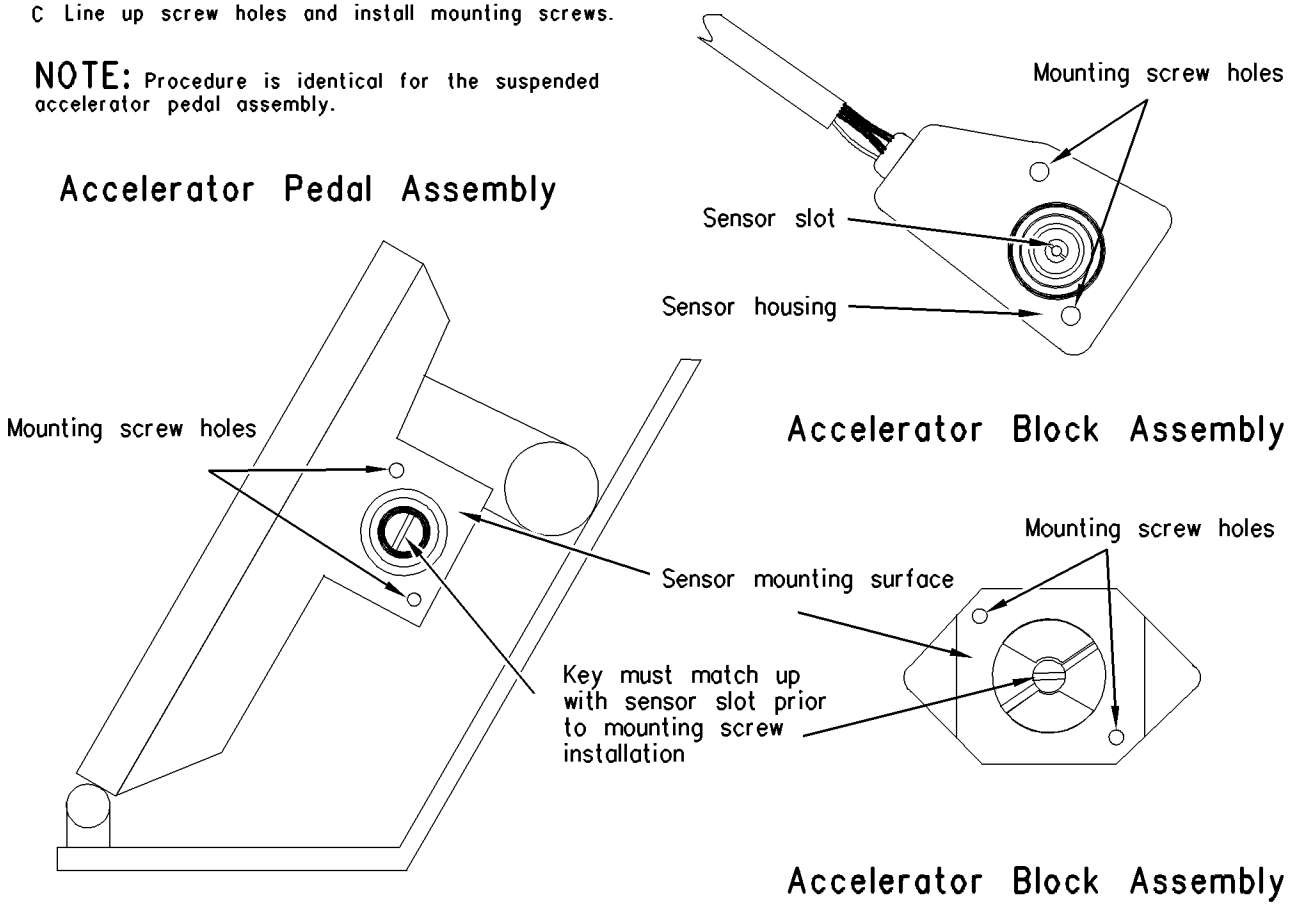

Illustration 46 g00706977

Accelerator pedal assembly

A. Turn the keyswitch to the OFF position.

B. Record the position of the sensor before removing the throttle position sensor.

C. Remove the throttle position sensor from the housing and inspect the cables for signs of wear.

D. Connect a multimeter to terminal C of the Breakout T.

E. Turn the keyswitch to the ON position.

F. Record the output signal of the throttle position sensor with the sensor slot in the released position.

G. Record the output signal of the throttle position sensor with the sensor slot in the advanced position.

Expected Result:

The throttle position sensor output is 10 percent or less.

Test Step 6. Check Connectors for Moisture or Corrosion.

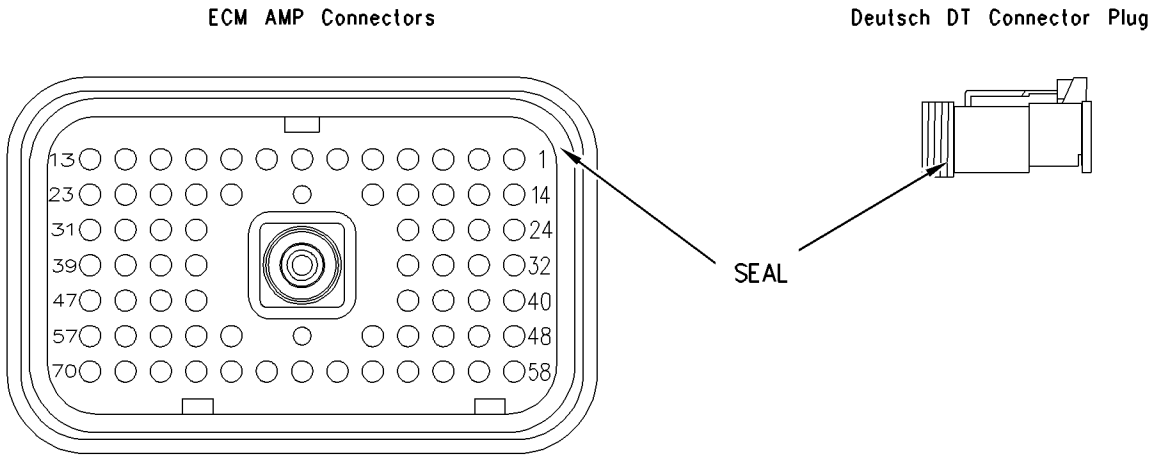

Illustration 57 g00705443

Connector seals

A. Ensure that the connector seals and the white sealing plugs are in place. If any of the seals or plugs are missing, replace the seal or plug. If necessary, replace the connector.

B. Check all of the wiring harnesses in order to verify that the harness does not make a sharp bend out of a connector. This will deform the connector seal and this will create a path for the entrance of moisture.

Thoroughly inspect ECM connectors J1/P1 and J20/P20 for evidence of moisture entry.

Note: It is normal to see some minor seal abrasion on the ECM connector seals. Minor seal abrasion will not allow the entry of moisture.

C. If moisture or corrosion is evident in the connector, the source of the moisture entry must be found and the source of the moisture entry must be repaired. If the source of the moisture entry is not repaired, the problem will reoccur. Simply drying the connector will not fix the problem. Likely paths for the entrance of moisture are in the following list:

- Missing seals
- Improperly installed seals
- Nicks in exposed insulation
- Improperly mated connectors

Moisture can also travel from one connector through the inside of a wire to the ECM connector. If moisture is found in the ECM connector, thoroughly check all connectors and wires on the harness that connect to the ECM. The ECM is not the source of the moisture. Do not replace an ECM if moisture is found in either ECM connector.

Note: If corrosion is evident on the pins, sockets,or the connectors, use only denatured alcohol to remove the corrosion. Use a cotton swab or a soft brush to remove the corrosion. Do not use any cleaners that contain trichloro-ethylene because trichloro-ethylene may damage the connector.

Expected Result:

All of the connectors should be completely coupled and all of the seals should be completely inserted. The harness and the wiring should be free of corrosion, abrasion or pinch points.

Results:

- OK – Proceed to Test Step 7.
- Not OK

Repair: Repair the connectors and/or wiring, or replace the connectors and/or wiring. Ensure that all of the seals are properly in place and ensure that the connectors are completely coupled.

Results:

- OK – The resistance is greater than 20,000 ohms. Proceed to test step 6.
- Not OK – The resistance is less than 20,000 ohms. There is a short in the wiring harness.

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

  STOP.

Test Step 6. Check the Resistance through the Harness.

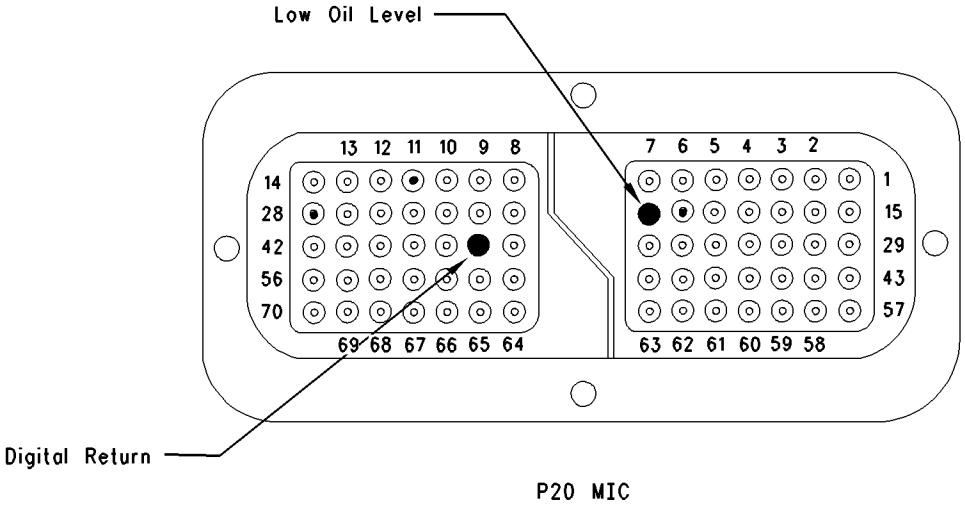

Illustration 65 g00955140

A. Measure the resistance between P20:21 and P20:37 at the MIC.

Expected Result:

The resistance should be less than 10 ohms.

Results:

- OK – The resistance is less than 10 ohms. Proceed to test step 7.
- Not OK – The resistance is greater than 10 ohms. There is an open circuit or excessive resistance in the wiring harness.

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

  STOP.

The second speed/timing sensor is located in the fuel injection pump. This speed/timing sensor measures the speed and the position of the fuel injection pump.

The ECM uses both sensor signals to calculate the engine speed and the correct engine timing.

The engine will start and the engine will run when only one sensor signal is present from either of the sensors. The loss of the signal from both of the sensors during engine operation will result in the termination of injection and the shutting down of the engine by the ECM. The loss of the signal from both of the sensors during start-up will prevent the engine from starting.

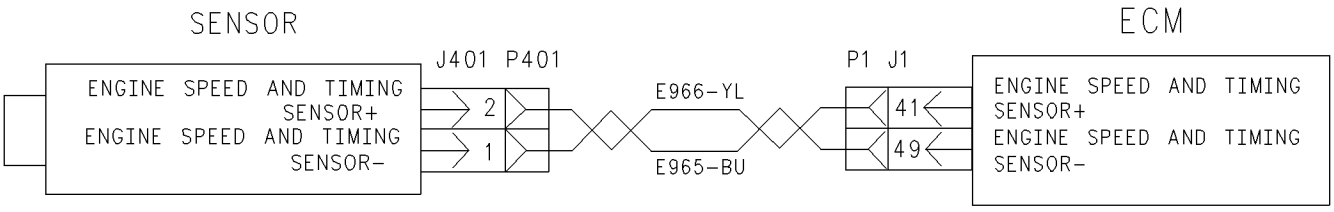

Illustration 72 g00835107

The schematic for the speed/timing sensor

Test Step 1. Inspect the Electrical Connectors and Cables

A. Turn the keyswitch to the OFF position.

B. Inspect the electrical connectors for damage. Refer to Troubleshooting, “Electrical Connectors - Inspect”.

Expected Result:

The electrical system is free from damage and faults.

Results:

- OK – There is no damage or faults. Proceed to Test Step 2.
- Not OK – There is damage to the electrical system components.

  Repair: Repair the cables and/or the connectors or replace the cables and/or the connectors.

  Ensure that all seals are in place and ensure that the connectors are correctly installed.

  Verify that the repair has eliminated the fault.

  STOP.

- Fault not eliminated – Proceed to Test Step 2.

Test Step 4. Disconnect The Sensor In Order To Create An Open Circuit.

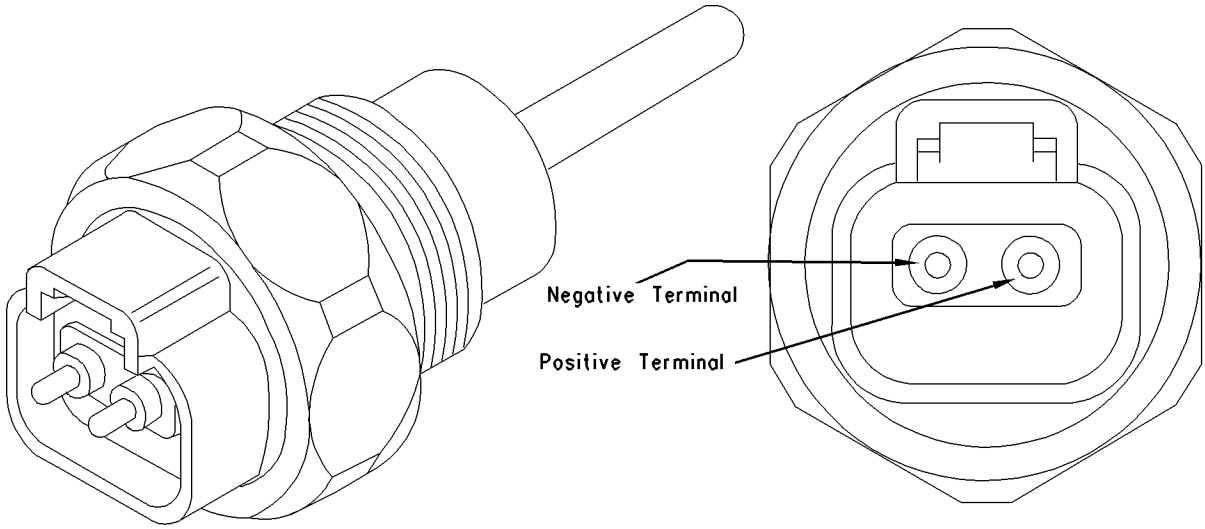

Illustration 83 g00835142

Engine coolant temperature sensor

A. Turn the keyswitch to the OFF position.

B. Disconnect the sensor connector of the sensor with the short circuit diagnostic code.

C. Turn the keyswitch to the ON position.

Note: Wait at least 15 seconds for activation of the diagnostic codes.

D. Access the “Active Diagnostic Code” screen of the electronic service tool. Check for an active open circuit diagnostic code.

Expected Result:

An open circuit diagnostic code for the disconnected sensor is now active.

Results:

- OK – A short circuit diagnostic code was active before disconnecting the sensor. An open circuit diagnostic code became active after disconnecting the sensor.

  Repair: Refer to Troubleshooting, “Electrical Connectors - Inspect”.

  Inspect the seals of the connectors for damage.

  Connect the sensor and verify that the fault returns. If the fault returns, the sensor is faulty.

  Replace the sensor.

  Remove all inactive diagnostic fault codes.

  STOP.

- Not OK – There is a short circuit between the sensor harness connector and the ECM. Leave the sensor disconnected. Proceed to Test Step 6.

Test Step 5. Create A Short Circuit Between The Signal And The Common Terminals At The Sensor Harness Connector.

A. Turn the keyswitch to the ON position.

Note: Wait at least 15 seconds for the activation of any diagnostic fault codes.

B. Fabricate a jumper wire 150 mm (6 inch) long. Crimp a Deutsch terminal to both ends of the wire.

C. Monitor the “Active Diagnostic Code” screen on the electronic service tool before installing the jumper wire and after installing the jumper wire.

D. Install the jumper on the engine harness connector. Install one end of the jumper at the sensor signal (positive terminal). Install the other end of the jumper at the common connection for the engine temperature sensor (terminal 2).

Repair: The wiring harness and the voltage supply to the fuel injection pump are correct. The problem is in the fuel injection pump or there is a communication problem between the ECM and the fuel injection pump. Refer to Troubleshooting, “CAN Data Link Circuit - Test”. If the CAN Data Link is correct the problem is in the fuel injection pump. Contact the Perkins Technical Support Centre in order to check if the software version is correct. Also check that there have been no software updates. If the problem still exists contact the Perkins Technical Support Centre in order to change the fuel injection pump. The warranty of the fuel injection pump will be affected if the pump is replaced without prior consultation. Replace the fuel injection pump. Refer to Disassembly and Assembly, “Fuel Injection Pump Remove and Install”. Check for active diagnostic codes.

STOP.

- Intermittent voltage or the voltage is out of range

Repair: There is a problem in the wiring between J20 connector and J40 connector. Repair the wiring or replace the wiring. Verify that the repair has eliminated the problem.

STOP.

The voltage load protection module should also be replaced when the fuel injection pump is replaced.

STOP.

i01798195

Indicator Lamp Circuit - Test

System Operation Description:

Use this procedure under the following circumstances:

- The lamps are not receiving battery voltage.
- The lamps are not operating properly.

Also, use this procedure if another procedure has directed you here.

The following diagnostic lamps are available with the 12 V system:

- Set speed lamp
- Warning lamp
- Engine shutdown lamp

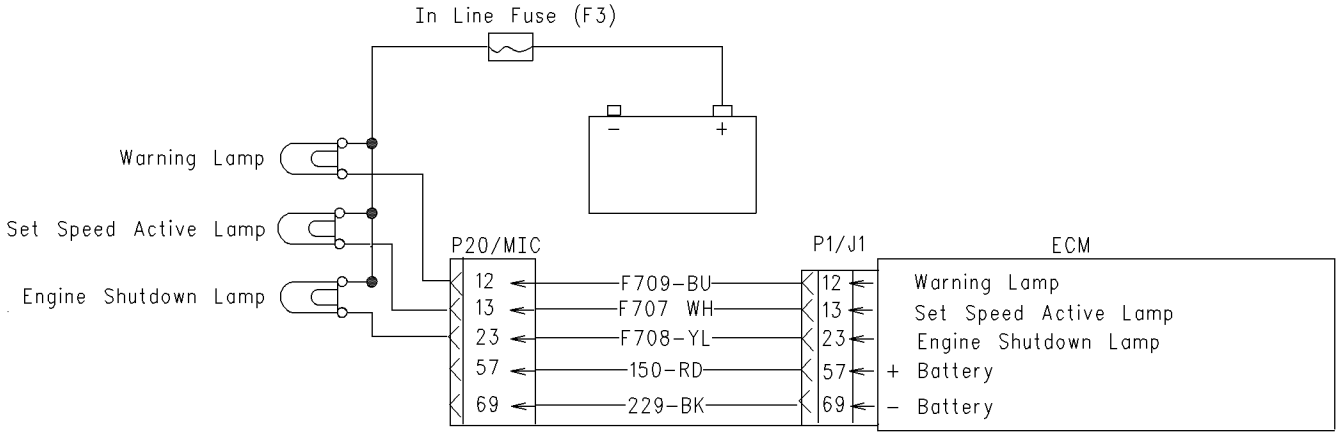

Illustration 102 g00954720

Circuit for the indicator lamps

E. Turn the keyswitch to the ON position. Monitor the status screen on the electronic service tool. Slowly connect and disconnect the jumper wire from the 70 pin Breakout T.

Expected Result:

With the switch in the OFF position, the switch will have an open condition.

With the switch in the ON position, the switch will have a closed condition.

Results:

- OK – The ECM is operating correctly. STOP.
- Not OK

  Repair: If the problem has not been eliminated temporarily connect a test ECM. Remove all jumpers and replace all connectors. The test ECM should be programmed with the correct software. All parameters should be set to the same value of the suspect ECM.

  If the problem is eliminated with the test ECM, reconnect the suspect ECM. If the problem returns with the suspect ECM, replace the suspect ECM.

  Verify that the repair has eliminated the problem.

  STOP.

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Set Speed Circuit - Test

System Operation Description:

Use this procedure under the following circumstances:

- Verify that the set speed switch receives the proper supply voltage.
- Check that the set speed switches operate correctly.

Also, use this procedure if another procedure has directed you here.

The set speed switch provides the operator with the ability to select the desired engine speed. Engine speed will decrease with increasing load. The set speed control can be used to control the engine speed. Also for certain engine applications, the set speed control can be used to control the vehicle speed.

The 1104 and 1106 engines have the following options of set speed control:

- Single speed
- Dual Speed
- No speed (no set speed control)

The set speed switches are listed below:

- P1:28 Set Speed Control ON or OFF
- P1:11 Set Speed Continue or Accelerate
- P1:19 Set Speed 1 or Set Speed 2
- P1:20 Set Speed Set or Decelerate
- P1:29 Clutch or Brake Automatic Disengage

Warning lamps are used to indicate the status of the set speed control.

Results:

- OK – Proceed to Test Step 2.
- Not OK

  Repair: Repair the circuit.

  Verify that the repair eliminates the problem.

  STOP.

Test Step 2. Check "Throttle Switch Position" on the Electronic Service Tool

A. Turn the keyswitch to the OFF position.

B. Connect the electronic service tool to the diagnostic connector.

C. Turn the keyswitch to the ON position.

D. Observe the status of the throttle switch and the throttle inputs on the electronic service tool while you operate the throttle switch in each position.

Expected Result:

The status on the electronic service tool should correspond with the information in Table 16.

Results:

- OK – The throttle switch is functioning properly at this time.

  Repair: Refer to Troubleshooting, "Electrical Connectors - Inspect" if the problem is intermittent.

  STOP.

- Not OK – Record the suspect input. Proceed to Test Step 3.

Test Step 3. Jumper the Switch Input at the Suspect Throttle Position Switch

A. Turn the keyswitch to the OFF position.

B. Observe the status of the suspect throttle input on the electronic service tool.

C. Use a suitable piece of wire to short P/20:37 Switch Return to the terminal for the suspect throttle input.

D. Observe the status of the suspect throttle input on the electronic service tool.

E. Remove the wire short.

Expected Result:

The status of the suspect throttle input should be "OFF" when the jumper wire is disconnected. The status should be "ON" when the jumper wire is connected.

Results:

- OK – The harness and the ECM are OK.

  Repair: Replace the throttle switch.

  Verify that the repair eliminates the problem.

  STOP.

- Not OK – Proceed to Test Step 4.