CAN COMMUNICATIONS ADAPTER
Service Tool

USER'S GUIDE
22253009

INGERSOLL RAND
PORTABLE POWER
Mocksville, N.C.

Information in this document is subject to change without notice and Does not represent a commitment on the part of Ingersoll Rand Company. The software described in thei document and furnished as part of the service tool is the property of Ingersoll Rand. The software may not be copied or reproduced in any form without the expressed written consent of Ingersoll Rand.

© copyright 2004 Ingersoll Rand Company. All rights reserved.
Printed in the United States of America.

TABLE of CONTENTS

1.0 General Overview

2.0 Unpacking the CAN Adapter

3.0 Connecting The CAN Adapter to an Engine

4.0 Reading Engine Fault Codes

5.0 Engine Troubleshooting

1.0 General Overview

The ***CAN COMMUNICATIONS ADAPTER*** is a communications protocol converter that converts the J1939 protocol into a RS232 output that can be interpreted by the ***VIRTUAL TECHNICIAN*** service tool. The J1939 protocol is used on many of the tier II engines. The CAN Communications Adapter has been specifically designed to work with the following engines: Cummins QSX15 and QSL9, CAT C9 and C15 and IR 4IRD5AE and 6IRF8TE.

The engines broadcast various messages, at specific intervals, across the J1939 network. These messages include real time engine parameters such as oil pressure, intake manifold temperature and RPM. Also included, are engine fault codes that signify problems that have occurred. The ***VIRTUAL TECHNICIAN*** allows the service technician to view these parameters and fault codes. In conjunction with the appropriate service information, the ***VIRTUAL TECHNICIAN*** can be used to troubleshoot engine problems and make necessary repairs.

CAN COMMUNICATIONS ADAPTER KIT

The ***VIRTUAL TECHNICIAN*** must have software **version 2.2.2** or later for the CAN communications adapter to function.

2.0 Unpacking the CAN Adapter

The CAN COMMUNICATIONS ADAPTER kit contains the protocol adapter, Cummins, I-R engine cable, CAT engine cable, RS232 cable, CD with software and manual. If any of these items are missing, contact Ingersoll Rand Customer Support at 800-633-5206 to get the missing components. The picture below shows the contents of the kit.

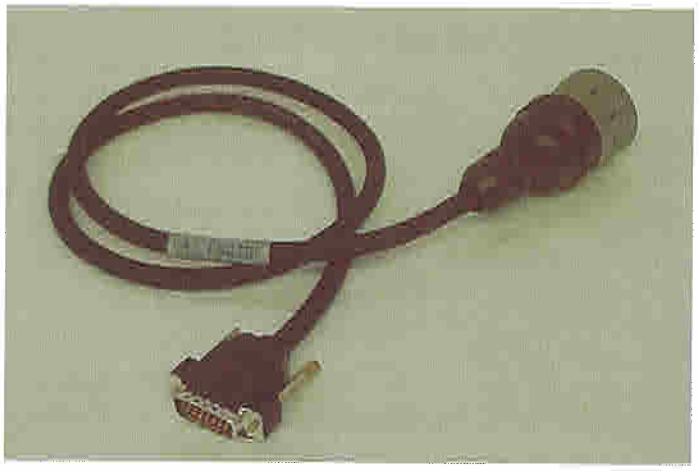
CAN COMMUNICATIONS ADAPTER KIT

The part numbers are as follows:

Item	I-R P/N
Communications adapter	22391072
Cummins/I-R engine cable	22391064
CAT engine cable	22391106
RS232 cable	22391080
Molded case	22399331
Virtual Technician software	22266761
Instruction manual	22266480

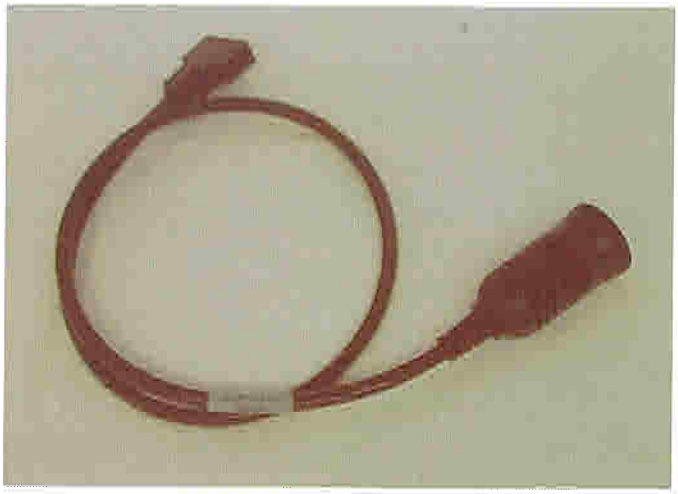
3.0 Connecting The CAN Adapter To An Engine

As describe previously, the CAN Communications Adapter Kit is designed to work with three engines: Cummins, CAT and I-R. There are two cables supplied in the kit to connect the these engines. P/N 22391106 cable connects to the CAT engine and is shown below.



CAT Engine Cable

P/N 22391064 cable connects to the Cummins and I-R engines and is shown below.



Cummins/I-R Engine Cable

P/N 22391080 cable is used to connect the CAN adapter to the ***VIRTUAL TECHNICIAN*** and is shown below.

RS232 Cable

The CAN adapter is shown below:

CAN Communications Adapter

Connect one of the 9-pin connectors on the RS232 cable to the 9-pin connector on the CAN adapter. Connect the other 9-pin connector to the 9-pin connector on the ***VIRTUAL TECHNICIAN*** as shown below.

RS 232 serial cable connected

Connect the 15-pin connector from the proper engine cable to the 15-pin connector on the CAN adapter as shown below.

Engine cable connected to CAN adapter

The service tool is now properly connected to the engine and ready to extract engine information.

4.0 Reading Engine Fault Codes

Power up the ***VIRTUAL TECHNICIAN.*** Go to the main menu and tap the Ingersoll Rand icon. This will enter the Ingersoll Rand applications. The Ingersoll Rand icon is located on the second page of the main menu. If the first page of the menu appears, tap the arrow on the left of the screen to move to the second page of the menu.
Once the Ingersoll Rand applications appear, the PDA screen below will appear.

Tap on the "Engine" icon. This will enter the program for the CAN communications. The next screen will ask if the service tool is connected to an engine. Tap "OK". The next screen to appear will be the real time parameters display. This list various parameters from the engine that are updated approximately every second. There are four pages of parameters and these can be accessed using the arrows at the right of the screen. Tap the arrow to advance to the next page or go back to the previous page(s). The "Pause" icon can be used to stop the one second update and hold the existing parameters. The "OK" icon is used to back out of the screen. It will return to the top level "Engine" icon.

Taping the "Engine Faults" icon will produce a list of active and non-active engine faults. Once the faults are displayed, select a particular fault by taping the screen over it. The fault will be highlighted. Now tap the "Troubleshooting" icon. A description of the fault will be displayed along with some troubleshooting hints to initiate the troubleshooting process.

The code number will direct you to a procedure in Troubleshooting, "Troubleshooting With A Diagnostic Code". Do not confuse diagnostic codes with diagnostic events. Events can be logged in the ECM. These events that are logged can be used in order to investigate the engine information. An example would be a low oil pressure event. An event is generated when the engine oil pressure is low but not out of range for the sensor. This does not indicate a problem with the sensor. This event indicates a problem with the engine oil pressure.

If a receiving device for a J1939 data link is used, diagnostic codes will be displayed with a SPN-FMI code. To cross reference the CID-FMI codes and the SPN-FMI codes, refer to Troubleshooting, "Flash Codes".

Active Diagnostic Codes

An ACTIVE diagnostic code represents a problem with the electronic control system. This problem should be investigated and any resulting findings should be corrected as soon as possible. When an ACTIVE diagnostic code is generated, a Diagnostic Lamp will indicate the diagnostic code. If the condition that generates the diagnostic code occurs only for a brief moment, the message will disappear and the diagnostic code will be LOGGED in the memory of the ECM.

Logged Diagnostic Codes

When the ECM generates a diagnostic code, the ECM will log the code in the permanent memory of the ECM. The ECM has a diagnostic clock that is internal. This clock records the hour of the first occurrence, the hour of the last occurrence, and the number of occurrences of the code. Knowing the timing of the code and knowing the frequency of the code can be a valuable indicator. These indicators are helpful when problems that are intermittent are being investigated.

Note: The ET can be used in order to retrieve logged codes and the ET can be used in order to erase logged codes. Logged diagnostic codes will automatically be deleted if no additional occurrences are recorded in 100 hours. Be aware of the following information when logged diagnostic codes are investigated.

- Some diagnostic codes may log occurrences that did not result in operator complaints. A diagnostic code is logged at a specific time. This time should correlate to a complaint. A repair may not be necessary if there is no correlation.
- The most likely cause of an intermittent problem is a faulty connection or damaged wiring. The next most likely cause of an intermittent failure is a component failure such as a sensor or a switch. The least likely cause of an intermittent problem is a failure of the ECM.
- Diagnostic codes that are logged repeatedly may indicate a problem that needs special investigation.
- The code number will direct you to a procedure in troubleshooting guide. If the symptoms continue, use the proper procedure for troubleshooting the symptoms that have been experienced by the operator. Refer to Troubleshooting Without A Diagnostic Code.

Note: Always clear logged diagnostic codes after investigating and correcting the problem which generated the code.

i01537183

CID 0001 FMI 11 Injector Cylinder #1 fault

SMCS Code: 1290-038

Conditions Which Generate This Code:

The ECM detects one of the following conditions after the ECM attempts to operate the injector:

- An open circuit exists in the wiring for the No. 1 cylinder injector solenoid.
- An internal open circuit exists in the No. 1 cylinder injector solenoid.
- A short circuit to ground on the injector solenoid for the No. 1 cylinder exists. The circuit is grounded to the engine.
- A short circuit in the injector solenoid for the No. 1 cylinder exists.
- A short circuit in the injector solenoid to battery voltage for the No. 1 cylinder exists.

System Response:

Electronic System Response The ECM will generate a CID 1-FMI 11 diagnostic code on the Cat Data Link. The diagnostic code will be displayed on a diagnostic screen of the Electronic Technician (ET).

The ECM will generate a SPN 651-FMI 11 diagnostic code on the J1939 Data Link. The diagnostic code may be displayed on a display module for the J1939 data link.

The ECM will generate a 72 flash code that will be displayed on the diagnostic lamp.

Engine Response The injector may not operate while the diagnostic code is active. If the problem is in the common return line the injector for the No. 1 cylinder and the injector for the No. 2 cylinder will not operate while this condition exists.

Possible Performance Effect:

- Engine misfires
- Low power

Perform the following diagnostic procedure: "Injector Solenoid Circuit - Test"

Results:

- OK – STOP.

i01537206

CID 0002 FMI 11 Injector Cylinder #2 fault

SMCS Code: 1290-038

Conditions Which Generate This Code:

The ECM detects one of the following conditions after the ECM attempts to operate the injector:

- An open circuit exists in the wiring for the No. 2 cylinder injector solenoid.
- An internal open circuit exists in the No. 2 cylinder injector solenoid.
- A short circuit to ground on the injector solenoid for the No. 2 cylinder exists. The circuit is grounded to the engine.
- A short circuit in the injector solenoid for the No. 2 cylinder exists.
- A short circuit in the injector solenoid to battery voltage for the No. 2 cylinder exists.

System Response:

Electronic System Response The ECM will generate a CID 2-FMI 11 diagnostic code on the Cat Data Link. The diagnostic code will be displayed on a diagnostic screen of the Electronic Technician (ET).

The ECM will generate a SPN 652-FMI 11 diagnostic code on the J1939 Data Link. The diagnostic code may be displayed on a display module for the J1939 data link.

The ECM will generate a 72 flash code that will be displayed on the diagnostic lamp.

Engine Response The injector may not operate while the diagnostic code is active. If the problem is in the common return line the injector for the No. 1 cylinder and the injector for the No. 2 cylinder will not operate while this condition exists.

Perform the following diagnostic procedure: "Injector Solenoid Circuit - Test"

Results:

- OK – STOP.

i01537235

CID 0003 FMI 11 Injector Cylinder #3 fault

SMCS Code: 1290-038

Conditions Which Generate This Code:

The ECM detects one of the following conditions after the ECM attempts to operate the injector:

- An open circuit exists in the wiring for the No. 3 cylinder injector solenoid.
- An internal open circuit exists in the No. 3 cylinder injector solenoid.
- A short circuit to ground (negative battery) on the injector solenoid for the No. 3 cylinder exists.
- A short circuit in the injector solenoid for the No. 3 cylinder exists.
- A short circuit to the positive battery on the injector solenoid for the No. 3 cylinder exists.

Note: If the cause of the diagnostic code is an open circuit in the injector common line, a diagnostic code for the injector on the No. 4 cylinder may be generated because of the shared injector common line inside the valve cover.

System Response:

Electronic System Response The ECM will generate a CID 3-FMI 11 diagnostic code on the Cat Data Link. The diagnostic code will be displayed on a diagnostic screen of the Electronic Technician (ET).

The ECM will generate a SPN 653-FMI 11 diagnostic code on the J1939 Data Link. The diagnostic code may be displayed on a display module for the J1939 data link.

The ECM will generate a 73 flash code that will be displayed on the diagnostic lamp.

Engine Response The injector may not operate while the diagnostic code is active. If the problem is in the common return line the injector for the No. 3 cylinder and the injector for the No. 4 cylinder will not operate while this condition exists.

Perform the following diagnostic procedure: "Injector Solenoid Circuit - Test"

Results:

- OK – STOP.

i01537238

CID 0004 FMI 11 Injector Cylinder #4 fault

SMCS Code: 1290-038

Conditions Which Generate This Code:

The ECM detects one of the following conditions after the ECM attempts to operate the injector:

- An open circuit exists in the wiring for the No. 4 cylinder injector solenoid.
- An internal open circuit exists in the No. 4 cylinder injector solenoid.
- A short circuit to ground (negative battery) on the injector solenoid for the No. 4 cylinder exists.
- A short circuit in the injector solenoid for the No. 4 cylinder exists.
- A short circuit to the positive battery on the injector solenoid for the No. 4 cylinder exists.

Note: If the cause of the diagnostic code is an open circuit in the injector common line, a diagnostic code for the injector on the No. 3 cylinder may be generated because of the shared injector common line inside the valve cover.

System Response:

Electronic System Response The ECM will generate a CID 4-FMI 11 diagnostic code on the Cat Data Link. The diagnostic code will be displayed on a diagnostic screen of the Electronic Technician (ET).

The ECM will generate a SPN 654-FMI 11 diagnostic code on the J1939 Data Link. The diagnostic code may be displayed on a display module for the J1939 data link.

The ECM will generate a 73 flash code that will be displayed on the diagnostic lamp.

Engine Response The injector may not operate while the diagnostic code is active. If the problem is in the common return line the injector for the No. 3 cylinder and the injector for the No. 4 cylinder will not operate while this condition exists.

Perform the following diagnostic procedure: "Injector Solenoid Circuit - Test"

Results:

- OK – STOP.

i01537243

CID 0005 FMI 11 Injector Cylinder #5 fault

SMCS Code: 1290-038

Conditions Which Generate This Code:

The ECM detects one of the following conditions after the ECM attempts to operate the injector:

- An open circuit exists in the wiring for the No. 5 cylinder injector solenoid.
- An internal open circuit exists in the No. 5 cylinder injector solenoid.
- A short circuit to ground (negative battery) on the injector solenoid for the No. 5 cylinder exists.
- A short circuit in the injector solenoid for the No. 5 cylinder exists.
- A short circuit to the positive battery on the injector solenoid for the No. 5 cylinder exists.

Note: If the cause of the diagnostic code is an open circuit in the injector common line, a diagnostic code for the injector on the No. 6 cylinder may be generated because of the shared injector common line inside the valve cover.

System Response:

Electronic System Response The ECM will generate a CID 5-FMI 11 diagnostic code on the Cat Data Link. The diagnostic code will be displayed on a diagnostic screen of the Electronic Technician (ET).

The ECM will generate a SPN 655-FMI 11 diagnostic code on the J1939 Data Link. The diagnostic code may be displayed on a display module for the J1939 data link.

The ECM will generate a 74 flash code that will be displayed on the diagnostic lamp.

Engine Response The injector may not operate while the diagnostic code is active. If the problem is in the common return line the injector for the No. 5 cylinder and the injector for the No. 6 cylinder will not operate while this condition exists.

Perform the following diagnostic procedure: "Injector Solenoid Circuit - Test"

Results:

- OK – STOP.

i01537248

CID 0006 FMI 11 Injector Cylinder #6 fault

SMCS Code: 1290-038

Conditions Which Generate This Code:

The ECM detects one of the following conditions after the ECM attempts to operate the injector:

- An open circuit exists in the wiring for the No. 6 cylinder injector solenoid.
- An internal open circuit exists in the No. 6 cylinder injector solenoid.
- A short circuit to ground (negative battery) on the injector solenoid for the No. 6 cylinder exists.
- A short circuit in the injector solenoid for the No. 6 cylinder exists.
- A short circuit to the positive battery on the injector solenoid for the No. 6 cylinder exists.

Note: If the cause of the diagnostic code is an open circuit in the injector common line, a diagnostic code for the injector on the No. 5 cylinder may be generated because of the shared injector common line inside the valve cover.

System Response:

Electronic System Response The ECM will generate a CID 6-FMI 11 diagnostic code on the Cat Data Link. The diagnostic code will be displayed on a diagnostic screen of the Electronic Technician (ET).

The ECM will generate a SPN 656-FMI 11 diagnostic code on the J1939 Data Link. The diagnostic code may be displayed on a display module for the J1939 data link.

The ECM will generate a 74 flash code that will be displayed on the diagnostic lamp.

Engine Response The injector may not operate while the diagnostic code is active. If the problem is in the common return line the injector for the No. 5 cylinder and the injector for the No. 6 cylinder will not operate while this condition exists.

Perform the following diagnostic procedure: "Injector Solenoid Circuit - Test"

Results:

- OK – STOP.

i01440806

CID 0091 FMI 08 Throttle Position signal abnormal

SMCS Code: 1915-ZS

Conditions Which Generate This Code:

The ECM is not receiving a correct throttle position signal.

System Response:

The ECM sets the desired engine speed to programmed low idle. The ET will indicate a throttle position of 0 percent while this diagnostic code is active.

The ECM will generate a CID 91-FMI 08 diagnostic code on the Cat Data Link. The diagnostic code will be displayed on a diagnostic screen of the Electronic Technician (ET).

The ECM will generate a SPN 91-FMI 08 diagnostic code on the J1939 Data Link. The diagnostic code may be displayed on a receiving device for the J1939 data link.

The ECM will generate a 32 flash code that will be displayed on the diagnostic lamp.

Engine Response The engine will remain in low idle while this diagnostic code is active.

Troubleshooting:

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

Results:

- OK – STOP.

i01402826

CID 0091 FMI 13 Throttle Position calibration required

SMCS Code: 1913-524

Conditions Which Generate This Code:

The duty cycle for the Throttle Position Sensor signal is less than 5 percent or more than 95 percent. This diagnostic code indicates that the stop points for the throttle are improperly set.

System Response:

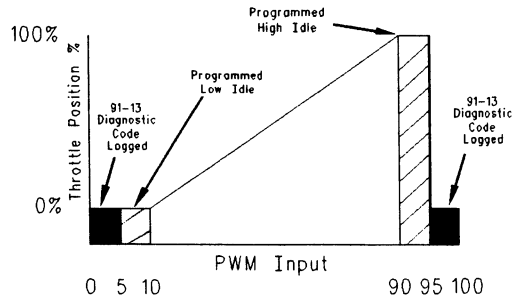


Illustration 11 g00764010

The ECM sets the desired engine speed to programmed low idle while this code is active. The ET will indicate a throttle position of 0 percent while this diagnostic code is active.

The ECM will generate a CID 91-FMI 13 diagnostic code on the Cat Data Link. The diagnostic code will be displayed on a diagnostic screen of the Electronic Technician (ET).

The ECM will generate a SPN 91-FMI 13 diagnostic code on the J1939 Data Link. The diagnostic code may be displayed on a receiving device for the J1939 data link.

The ECM will generate a 28 flash code that will be displayed on the diagnostic lamp.

Engine Response The desired engine speed will return to low idle while this diagnostic code is active.

Troubleshooting:

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

Results:

- OK – STOP.

i01440812

CID 0094 FMI 03 Fuel Pressure open/short to +batt

SMCS Code: 1408-081; 1718-038

Conditions Which Generate This Code:

The ECM detects a signal voltage from the Fuel Pressure Sensor that is greater than 4.8 volts.

System Response:

The ECM will set fuel pressure to a default value. The parameters for the fuel filter restrictions and the high fuel pressure will be disabled in the Programmable Monitoring System (PMS).

The ET will display "Open/Short High" for the Fuel Pressure on the ET status screen.

The ECM will generate a CID 94-FMI 03 diagnostic code on the Cat Data Link. The diagnostic code will be displayed on a diagnostic screen of the Electronic Technician (ET).

The ECM will generate a SPN 94-FMI 03 diagnostic code on the J1939 Data Link. The diagnostic code may be displayed on a receiving device for the J1939 data link.

The ECM will generate a 37 flash code that will be displayed on the diagnostic lamp.

Troubleshooting:

Perform the following diagnostic procedure: "Analog Sensor Open or Short Circuit - Test"

Results:

- OK – STOP.

i01440863

CID 0094 FMI 04 Fuel Pressure short to ground

SMCS Code: 1408-081; 1718-038

Conditions Which Generate This Code:

The ECM detects a signal voltage from the Fuel Pressure Sensor that is less than 0.2 volts.

System Response:

The ECM will set fuel pressure to a default value. The parameters for the fuel filter restrictions and the high fuel pressure will be disabled in the Programmable Monitoring System (PMS).

The ET will display "Short to Ground" for the Fuel Pressure on the ET status screen.

The ECM will generate a CID 94-FMI 04 diagnostic code on the Cat Data Link. The diagnostic code will be displayed on a diagnostic screen of the Electronic Technician (ET).

The ECM will generate a SPN 94-FMI 04 diagnostic code on the J1939 Data Link. The diagnostic code may be displayed on a receiving device for the J1939 data link.

The ECM will generate a 37 flash code that will be displayed on the diagnostic lamp.

Troubleshooting:

Perform the following diagnostic procedure: "Analog Sensor Open or Short Circuit - Test"

Results:

- OK – STOP.

i01440873

CID 0100 FMI 03 Engine Oil Pressure open/short to +batt

SMCS Code: 1924-038

Conditions Which Generate This Code:

The ECM detects a signal voltage from the Engine Oil Pressure Sensor that is greater than 4.8 volts.

System Response:

The ECM will set engine oil pressure to a default value. The parameters for the low oil pressure will be disabled in the Programmable Monitoring System (PMS).

The ET will display "Open/Short High" for the oil pressure on the ET status screen.

The ECM will generate a CID 100-FMI 03 diagnostic code on the Cat Data Link. The diagnostic code will be displayed on a diagnostic screen of the Electronic Technician (ET).

The ECM will generate a SPN 100-FMI 03 diagnostic code on the J1939 Data Link. The diagnostic code may be displayed on a receiving device for the J1939 data link.

The ECM will generate a 24 flash code that will be displayed on the diagnostic lamp.

Troubleshooting:

Perform the following diagnostic procedure: "Analog Sensor Open or Short Circuit - Test"

Results:

- OK – STOP.

i01440926

CID 0100 FMI 04 Engine Oil Pressure short to ground

SMCS Code: 1924-038

Conditions Which Generate This Code:

The ECM detects a signal voltage from the Engine Oil Pressure Sensor that is less than 0.2 volts.

System Response:

The ECM will set engine oil pressure to a default value. The parameters for the low oil pressure will be disabled in the Programmable Monitoring System (PMS).

The ET will display "Short to Ground" for the oil pressure on the ET status screen.

The ECM will generate a CID 100-FMI 04 diagnostic code on the Cat Data Link. The diagnostic code will be displayed on a diagnostic screen of the Electronic Technician (ET).

The ECM will generate a SPN 100-FMI 04 diagnostic code on the J1939 Data Link. The diagnostic code may be displayed on a receiving device for the J1939 data link.

The ECM will generate a 24 flash code that will be displayed on the diagnostic lamp.

Troubleshooting:

Perform the following diagnostic procedure: "Analog Sensor Open or Short Circuit - Test"

Results:

- OK – STOP.

i01440935

CID 0110 FMI 03 Engine Coolant Temperature open/short to +batt

SMCS Code: 1906-038

Conditions Which Generate This Code:

The ECM detects a signal voltage from the Engine Coolant Temperature Sensor that is greater than 4.8 volts.

System Response:

The ECM will set engine coolant temperature to a default value. The parameters for the high engine coolant temperature will be disabled in the Programmable Monitoring System (PMS).

The ET will display "Open/Short High" for the coolant temperature on the ET status screen.

The ECM will generate a CID 110-FMI 03 diagnostic code on the Cat Data Link. The diagnostic code will be displayed on a diagnostic screen of the Electronic Technician (ET).

The ECM will generate a SPN 110-FMI 03 diagnostic code on the J1939 Data Link. The diagnostic code may be displayed on a receiving device for the J1939 data link.

The ECM will generate a 27 flash code that will be displayed on the diagnostic lamp.

Troubleshooting:

Perform the following diagnostic procedure: "Analog Sensor Open or Short Circuit - Test"

Results:

- OK – STOP.

i01440957

CID 0110 FMI 04 Engine Coolant Temperature short to ground

SMCS Code: 1906-038

Conditions Which Generate This Code:

The ECM detects a signal voltage from the Engine Coolant Temperature Sensor that is less than 0.2 volts.

System Response:

The ECM will set engine coolant temperature to a default value. The parameters for the high coolant temperature will be disabled in the Programmable Monitoring System (PMS).

The ET will display "Short to Ground" for the coolant temperature on the ET status screen.

The ECM will generate a CID 110-FMI 04 diagnostic code on the Cat Data Link. The diagnostic code will be displayed on a diagnostic screen of the Electronic Technician (ET).

The ECM will generate a SPN 110-FMI 04 diagnostic code on the J1939 Data Link. The diagnostic code may be displayed on a receiving device for the J1939 data link.

The ECM will generate a 27 flash code that will be displayed on the diagnostic lamp.

Troubleshooting:

Perform the following diagnostic procedure: "Analog Sensor Open or Short Circuit - Test"

Results:

- OK – STOP.

i01451100

CID 0168 FMI 02 System Voltage intermittent

SMCS Code: 1900-038

Conditions Which Generate This Code:

The ECM detects one of the following conditions:

- The engine is running, but not cranking. Unswitched positive battery voltage drops below 9 VDC.
- The engine is running, but not cranking. Unswitched positive battery voltage drops below 9 VDC three times in the last seven seconds.

Note: Turning the keyswitch ON and OFF rapidly will cause this diagnostic code to become active.

System Response:

The ET will display the battery voltage as a single digit (8 VDC) on the ET status screen.

The ECM will generate a CID 168-FMI 02 diagnostic code on the Cat Data Link. The diagnostic code will be displayed on a diagnostic screen of the Electronic Technician (ET).

The ECM will generate a SPN 168-FMI 02 diagnostic code on the J1939 Data Link. The diagnostic code may be displayed on a receiving device for the J1939 data link.

The ECM will generate a 51 flash code that will be displayed on the diagnostic lamp.

Troubleshooting:

Perform the following diagnostic procedure: "Electrical Power Supply Circuit - Test"

Results:

- OK – STOP.

i01441027

CID 0172 FMI 03 Intake Manifold Air Temp open/short to +batt

SMCS Code: 1921-038

Conditions Which Generate This Code:

The ECM detects a signal voltage from the Intake Manifold Air Temperature Sensor that is greater than 4.8 volts.

System Response:

The ECM will set intake manifold air temperature to a default value. The parameters for the high intake manifold air temperature will be disabled in the Programmable Monitoring System (PMS).

The ET will display "Open/Short High" for the intake manifold air temperature on the ET status screen.

The ECM will generate a CID 172-FMI 03 diagnostic code on the Cat Data Link. The diagnostic code will be displayed on a diagnostic screen of the Electronic Technician (ET).

The ECM will generate a SPN 172-FMI 03 diagnostic code on the J1939 Data Link. The diagnostic code may be displayed on a receiving device for the J1939 data link.

The ECM will generate a 38 flash code that will be displayed on the diagnostic lamp.

Troubleshooting:

Perform the following diagnostic procedure: "Analog Sensor Open or Short Circuit - Test"

Results:

- OK – STOP.

i01441041

CID 0172 FMI 04 Intake Manifold Air Temp short to ground

SMCS Code: 1921-038

Conditions Which Generate This Code:

The ECM detects a signal voltage from the Intake Manifold Air Temperature Sensor that is less than 0.2 volts.

System Response:

The ECM will set intake manifold air temperature to a default value. The parameters for the high intake manifold air temperature will be disabled in the Programmable Monitoring System (PMS).

The ET will display "Short to Ground" for the intake manifold air temperature on the ET status screen.

The ECM will generate a CID 172-FMI 04 diagnostic code on the Cat Data Link. The diagnostic code will be displayed on a diagnostic screen of the Electronic Technician (ET).

The ECM will generate a SPN 172-FMI 04 diagnostic code on the J1939 Data Link. The diagnostic code may be displayed on a receiving device for the J1939 data link.

The ECM will generate a 38 flash code that will be displayed on the diagnostic lamp.

Troubleshooting:

Perform the following diagnostic procedure: "Analog Sensor Open or Short Circuit - Test"

Results:

- OK – STOP.

i01441172

CID 0174 FMI 03 Fuel Temperature open/short to +batt

SMCS Code: 1922-038

Conditions Which Generate This Code:

The ECM detects a signal voltage from the Fuel Temperature Sensor that is greater than 4.8 volts.

System Response:

The ECM will set fuel temperature to a default value. The parameters for the high fuel temperature will be disabled in the Programmable Monitoring System (PMS).

The ET will display "Open/Short High" for the fuel temperature on the ET status screen.

The ECM will generate a CID 174-FMI 03 diagnostic code on the Cat Data Link. The diagnostic code will be displayed on a diagnostic screen of the Electronic Technician (ET).

The ECM will generate a SPN 174-FMI 03 diagnostic code on the J1939 Data Link. The diagnostic code may be displayed on a receiving device for the J1939 data link.

The ECM will generate a 13 flash code that will be displayed on the diagnostic lamp.

Troubleshooting:

Perform the following diagnostic procedure: "Analog Sensor Open or Short Circuit - Test"

Results:

- OK – STOP.

i01441178

CID 0174 FMI 04 Fuel Temperature short to ground

SMCS Code: 1922-038

Conditions Which Generate This Code:

The ECM detects a signal voltage from the Fuel Temperature Sensor that is less than 0.2 volts.

System Response:

The ECM will set fuel temperature to a default value. The parameters for the high fuel temperature will be disabled in the Programmable Monitoring System (PMS).

The ET will display "Short to Ground" for the fuel temperature on the ET status screen.

The ECM will generate a CID 174-FMI 04 diagnostic code on the Cat Data Link. The diagnostic code will be displayed on a diagnostic screen of the Electronic Technician (ET).

The ECM will generate a SPN 174-FMI 04 diagnostic code on the J1939 Data Link. The diagnostic code may be displayed on a receiving device for the J1939 data link.

The ECM will generate a 13 flash code that will be displayed on the diagnostic lamp.

Troubleshooting:

Perform the following diagnostic procedure: "Analog Sensor Open or Short Circuit - Test"

Results:

- OK – STOP.

i01409650

CID 0247 FMI 09 J1939 Data Link communications

SMCS Code: 1408-081; 1900-081; 1901-038

Conditions Which Generate This Code:

The ECM has detected a loss of communications with the J1939 data link.

System Response:

The engine may operate properly.

The ECM will generate a CID 247-FMI 09 diagnostic code on the Cat Data Link. The diagnostic code will be displayed on a diagnostic screen of the Electronic Technician (ET).

The ECM will generate a 58 flash code that will be displayed on the diagnostic lamp.

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

Results:

- OK – STOP.

i01441195

CID 0253 FMI 02 Personality Module mismatch

SMCS Code: 1902-038

Conditions Which Generate This Code:

The personality module that is used for replacement is for a different engine family or a different engine application.

System Response:

The ECM will not log the diagnostic code. Fuel injection is disabled for the engine. The engine will not start.

The ECM will generate a CID 253-FMI 02 diagnostic code on the Cat Data Link. The diagnostic code will be displayed on a diagnostic screen of the Electronic Technician (ET).

The ECM will generate a SPN 234-FMI 02 diagnostic code on the J1939 Data Link. The diagnostic code may be displayed on a receiving device for the J1939 data link.

The ECM will generate a 56 flash code that will be displayed on the diagnostic lamp.

Troubleshooting:

Check the part number of ECM Personality Module. Ensure that the personality module part number agrees with the original engine arrangement.

Expected Result:

The correct personality module is installed in the ECM.

Results:

- OK – The correct personality module is installed in the ECM.

  Repair: The diagnostic code 253-02 must be cleared if the correct personality module has been installed. Clearing this diagnostic code requires factory passwords. The personality module code must also be rest to zero.

  STOP.

- Not OK – The correct personality module is not installed in the ECM.

  Repair: Reprogram the ECM with the correct personality module. Refer to Troubleshooting, "Flash Programming".

  STOP.

i01441198

CID 0254 FMI 12 Electronic Control Module Error

SMCS Code: 1901-038

Conditions Which Generate This Code:

The ECM has detected an internal fault of the ECM.

System Response:

The ECM will log the diagnostic code. Engine power and engine performance may be affected. The normal ECM functions may be affected.

The ECM will generate a CID 254-FMI 12 diagnostic code on the Cat Data Link. The diagnostic code will be displayed on a diagnostic screen of the Electronic Technician (ET).

The ECM will generate a 53 flash code that will be displayed on the diagnostic lamp.

Troubleshooting:

Replace the ECM. Ensure that the new ECM serial number ends with the same two characters as the old ECM serial number. Refer to Troubleshooting, "Replacing the ECM" before replacing the ECM.

Results:

- OK – STOP.

i01441205

CID 0261 FMI 13 Engine Timing Calibration required

SMCS Code: 1912-524

Conditions Which Generate This Code:

The timing has not been calibrated since the ECM was installed or the calibration is out of specification.

System Response:

The ECM will log the diagnostic code. The ECM uses default timing.

The engine may run rough or the engine may emit white smoke in the exhaust.

The ECM will generate a CID 261-FMI 13 diagnostic code on the Cat Data Link. The diagnostic code will be displayed on a diagnostic screen of the Electronic Technician (ET).

The ECM will generate a SPN 228-FMI 13 diagnostic code on the J1939 Data Link. The diagnostic code may be displayed on a receiving device for the J1939 data link.

The ECM will generate a 42 flash code that will be displayed on the diagnostic lamp.

Troubleshooting:

Perform the following diagnostic procedure: "Engine Speed/Timing Sensor - Calibrate"

Results:

- OK – STOP.

i01441216

CID 0262 FMI 03 5 Volt Sensor Supply short to +batt

SMCS Code: 1408-081; 1900-038

Conditions Which Generate This Code:

The ECM detects a signal voltage from the Analog Sensor Supply that is greater than 5.5 volts.

System Response:

The ECM will set all sensors that are connected to the Analog Sensor Supply to a default value. The ET will display the default value of all sensors that are connected to the Analog Sensor Supply.

The following parameters will be disabled in the Programmable Monitoring System (PMS).

- High Intake Manifold Air Temperature
- Low Engine Oil Pressure
- Low Fuel Pressure
- High Fuel Pressure

The ECM will generate a CID 262-FMI 03 diagnostic code on the Cat Data Link. The diagnostic code will be displayed on a diagnostic screen of the Electronic Technician (ET).

The ECM will generate a SPN 620-FMI 03 diagnostic code on the J1939 Data Link. The diagnostic code may be displayed on a receiving device for the J1939 data link.

The ECM will generate a 21 flash code that will be displayed on the diagnostic lamp.

Troubleshooting:

Perform the following diagnostic procedure: "Analog Sensor Open or Short Circuit - Test"

Results:

- OK – STOP.

i01441223

CID 0262 FMI 04 5 Volt Sensor Supply short to ground

SMCS Code: 1408-081; 1900-038

Conditions Which Generate This Code:

The ECM detects a signal voltage from the Analog Sensor Supply that is less than 4.5 volts.

System Response:

The ECM will set all sensors that are connected to the Analog Sensor Supply to a default value. The ET will display the default value of all sensors that are connected to the Analog Sensor Supply.

The following parameters will be disabled in the Programmable Monitoring System (PMS).

- High Intake Manifold Air Temperature
- Low Engine Oil Pressure
- Low Fuel Pressure
- High Fuel Pressure

The ECM will generate a CID 262-FMI 04 diagnostic code on the Cat Data Link. The diagnostic code will be displayed on a diagnostic screen of the Electronic Technician (ET).

The ECM will generate a SPN 620-FMI 04 diagnostic code on the J1939 Data Link. The diagnostic code may be displayed on a receiving device for the J1939 data link.

The ECM will generate a 21 flash code that will be displayed on the diagnostic lamp.

Troubleshooting:

Perform the following diagnostic procedure: "Analog Sensor Open or Short Circuit - Test"

Results:

- OK – STOP.

i01441229

CID 0263 FMI 03 Digital Sensor Supply short to +batt

SMCS Code: 1900-038

Conditions Which Generate This Code:

The ECM detects a signal voltage from the Digital Sensor Supply that is greater than 8.5 volts.

System Response:

The ECM will set all sensors that are connected to the Digital Sensor Supply to a default value. The ET will display the default value of all sensors that are connected to the Digital Sensor Supply.

The "Low Coolant Level" will be disabled in the Programmable Monitoring System (PMS).

The ECM will generate a CID 263-FMI 03 diagnostic code on the Cat Data Link. The diagnostic code will be displayed on a diagnostic screen of the Electronic Technician (ET).

The ECM will generate a SPN 678-FMI 03 diagnostic code on the J1939 Data Link. The diagnostic code may be displayed on a receiving device for the J1939 data link.

The ECM will generate a 21 flash code that will be displayed on the diagnostic lamp.

Troubleshooting:

Perform the following diagnostic procedure: "Digital Sensor Supply Circuit - Test"

Results:

- OK – STOP.

i01441238

CID 0263 FMI 04 Digital Sensor Supply short to ground

SMCS Code: 1900-038

Conditions Which Generate This Code:

The ECM detects a signal voltage from the Digital Sensor Supply that is less than 7.5 volts.

System Response:

The ECM will set all sensors that are connected to the Digital Sensor Supply to a default value. The ET will display the default value of all sensors that are connected to the Digital Sensor Supply.

The "Low Coolant Level" will be disabled in the Programmable Monitoring System (PMS).

The ECM will generate a CID263-FMI04 diagnostic code on the Cat Data Link. The diagnostic code will be displayed on a diagnostic screen of the Electronic Technician (ET).

The ECM will generate a SPN678-FMI04 diagnostic code on the J1939 Data Link. The diagnostic code may be displayed on a receiving device for the J1939 data link.

The ECM will generate a 21 flash code that will be displayed on the diagnostic lamp.

Troubleshooting:

Perform the following diagnostic procedure: "Digital Sensor Supply Circuit - Test"

Results:

- OK – STOP.

i01451109

CID 0268 FMI 02 Check Programmable Parameters

SMCS Code: 1900-038; 1901-038

Conditions Which Generate This Code:

The ECM detects that one or more of the programmable parameters have not been programmed.

System Response:

The diagnostic code is not logged. Any unprogrammed parameters are set to the default value. Engine performance may be affected. This is dependent on the unprogrammed parameters.

The ECM will generate a CID 268-FMI 02 diagnostic code on the Cat Data Link. The diagnostic code will be displayed on a diagnostic screen of the Electronic Technician (ET).

The ECM will generate a SPN 1111-FMI 02 diagnostic code on the J1939 Data Link. The diagnostic code may be displayed on a receiving device for the J1939 data link.

The ECM will generate a 56 flash code that will be displayed on the diagnostic lamp.

Troubleshooting:

Reprogram the system configuration parameters. Refer to Troubleshooting, "System Configuration Parameters" for additional information.

Results:

- OK – STOP.

i01441313

CID 0273 FMI 03 Turbo Outlet Pressure open/short to +batt

SMCS Code: 1917-038

Conditions Which Generate This Code:

The ECM detects a signal voltage from the Turbocharger Outlet Pressure Sensor that is greater than 4.8 volts.

System Response:

The ECM will set the turbocharger outlet pressure to a default value.

The ET will display "Open/Short High" for the Turbocharger Outlet Pressure on the ET status screen.

The ECM will generate a CID 273-FMI 03 diagnostic code on the Cat Data Link. The diagnostic code will be displayed on a diagnostic screen of the Electronic Technician (ET).

The ECM will generate a SPN 102-FMI 03 diagnostic code on the J1939 Data Link. The diagnostic code may be displayed on a receiving device for the J1939 data link.

The ECM will generate a 25 flash code that will be displayed on the diagnostic lamp.

Troubleshooting:

Perform the following diagnostic procedure: "Analog Sensor Open or Short Circuit - Test"

Results:

- OK – STOP.

i01441320

CID 0273 FMI 04 Turbo Outlet Pressure short to ground

SMCS Code: 1917-038

Conditions Which Generate This Code:

The ECM detects a signal voltage from the Turbocharger Outlet Pressure Sensor that is less than 0.2 volts.

System Response:

The ECM will set turbocharger outlet pressure to a default value.

The ET will display "Short to Ground" for the turbocharger outlet pressure on the ET status screen.

The ECM will generate a CID 273-FMI 04 diagnostic code on the Cat Data Link. The diagnostic code will be displayed on a diagnostic screen of the Electronic Technician (ET).

The ECM will generate a SPN 102-FMI 04 diagnostic code on the J1939 Data Link. The diagnostic code may be displayed on a receiving device for the J1939 data link.

The ECM will generate a 25 flash code that will be displayed on the diagnostic lamp.

Troubleshooting:

Perform the following diagnostic procedure: "Analog Sensor Open or Short Circuit - Test"

Results:

- OK – STOP.

i01441400

CID 0274 FMI 03 Atmospheric Pressure open/short to +batt

SMCS Code: 1923-038

Conditions Which Generate This Code:

The ECM detects a signal voltage from the Atmospheric Pressure Sensor that is greater than 4.8 volts.

System Response:

The ECM will set atmospheric pressure to a default value. The parameters for the atmospheric pressure will be disabled in the Programmable Monitoring System (PMS).

The ET will display "Open/Short High" for the atmospheric pressure on the ET status screen.

The ECM will generate a CID 274-FMI 03 diagnostic code on the Cat Data Link. The diagnostic code will be displayed on a diagnostic screen of the Electronic Technician (ET).

The ECM will generate a SPN 108-FMI 03 diagnostic code on the J1939 Data Link. The diagnostic code may be displayed on a receiving device for the J1939 data link.

The ECM will generate a 26 flash code that will be displayed on the diagnostic lamp.

Troubleshooting:

Perform the following diagnostic procedure: "Analog Sensor Open or Short Circuit - Test"

Results:

- OK – STOP.

i01441437

CID 0274 FMI 04 Atmospheric Pressure short to ground

SMCS Code: 1923-038

Conditions Which Generate This Code:

The ECM detects a signal voltage from the Atmospheric Pressure Sensor that is less than 0.2 volts.

System Response:

The ECM will set atmospheric pressure to a default value. The parameters for the atmospheric pressure will be disabled in the Programmable Monitoring System (PMS).

The ET will display "Short to Ground" for the oil pressure on the ET status screen.

The ECM will generate a CID 274-FMI 04 diagnostic code on the Cat Data Link. The diagnostic code will be displayed on a diagnostic screen of the Electronic Technician (ET).

The ECM will generate a SPN 108-FMI 04 diagnostic code on the J1939 Data Link. The diagnostic code may be displayed on a receiving device for the J1939 data link.

The ECM will generate a 26 flash code that will be displayed on the diagnostic lamp.

Troubleshooting:

Perform the following diagnostic procedure: "Analog Sensor Open or Short Circuit - Test"

Results:

- OK – STOP.

i01410420

CID 0320 FMI 02 Speed/Timing Sensor Loss of Signal

SMCS Code: 1408-081; 1912-038

Conditions Which Generate This Code:

The signal for the primary engine speed/timing sensor (crankshaft) is intermittent or lost for less than one second.

System Response:

The engine may misfire or the engine may run rough during starting. The ECM will log the diagnostic code.

The ECM will generate a CID 320-FMI 02 diagnostic code on the Cat Data Link. The diagnostic code will be displayed on a diagnostic screen of the Electronic Technician (ET).

The ECM will generate a SPN 190-FMI 02 diagnostic code on the J1939 Data Link. The diagnostic code may be displayed on a receiving device for the J1939 data link.

The ECM will generate a 34 flash code that will be displayed on the diagnostic lamp.

Troubleshooting:

Perform the following diagnostic procedure: "Engine Speed/Timing Sensor Circuit - Test"

Results:

- OK – STOP.

i01410461

CID 0320 FMI 11 Speed/Timing Sensor mechanical failure

SMCS Code: 1912-038

Conditions Which Generate This Code:

The signal for the primary engine speed/timing sensor (crankshaft) is lost for more than one second.

System Response:

The engine may misfire or the engine may run rough during starting. The ECM will log the diagnostic code.

There should not be a noticeable change in engine response unless the signal for the primary engine speed/timing sensor (crankshaft) is lost. This loss will shut down the engine.

The ECM will generate a CID 320-FMI 11 diagnostic code on the Cat Data Link. The diagnostic code will be displayed on a diagnostic screen of the Electronic Technician (ET).

The ECM will generate a SPN 190-FMI 11 diagnostic code on the J1939 Data Link. The diagnostic code may be displayed on a receiving device for the J1939 data link.

The ECM will generate a 34 flash code that will be displayed on the diagnostic lamp.

Perform the following diagnostic procedure: "Engine Speed/Timing Sensor Circuit - Test"

Results:

- OK – STOP.

i01441492

CID 0342 FMI 02 Loss of Secondary Engine Speed signal

SMCS Code: 1907-038

Conditions Which Generate This Code:

The signal for the secondary engine speed/timing sensor (camshaft) is intermittent or lost for less than one second.

System Response:

The engine may misfire or the engine may run rough during starting. The ECM will log the diagnostic code.

There should not be a noticeable change in engine response unless the signal for the engine speed/timing sensor (camshaft) is lost. This loss will shut down the engine.

The ECM will generate a CID 342-FMI 02 diagnostic code on the Cat Data Link. The diagnostic code will be displayed on a diagnostic screen of the Electronic Technician (ET).

The ECM will generate a SPN 723-FMI 02 diagnostic code on the J1939 Data Link. The diagnostic code may be displayed on a receiving device for the J1939 data link.

The ECM will generate a 34 flash code that will be displayed on the diagnostic lamp.

Troubleshooting:

Perform the following diagnostic procedure: "Engine Speed/Timing Sensor Circuit - Test"

Results:

- OK – STOP.

i01441502

CID 0342 FMI 11 Secondary Engine Speed Sensor mechanical failure

SMCS Code: 1907-038

Conditions Which Generate This Code:

The signal for the secondary engine speed/timing sensor (camshaft) is lost for more than one second.

System Response:

The engine may misfire or the engine may run rough during starting. The ECM will log the diagnostic code.

There should not be a noticeable change in engine response unless the signal for the engine speed/timing sensor (camshaft) is lost. This loss will shut down the engine.

The ECM will generate a CID 342-FMI 11 diagnostic code on the Cat Data Link. The diagnostic code will be displayed on a diagnostic screen of the Electronic Technician (ET).

The ECM will generate a SPN 723-FMI 11 diagnostic code on the J1939 Data Link. The diagnostic code may be displayed on a receiving device for the J1939 data link.

The ECM will generate a 34 flash code that will be displayed on the diagnostic lamp.

Troubleshooting:

Perform the following diagnostic procedure: "Engine Speed/Timing Sensor Circuit - Test"

Results:

- OK – STOP.

i01442238

CID 0545 FMI 05 Ether Start Relay open/short to +batt

SMCS Code: 1456-038-R7

Conditions Which Generate This Code:

The ECM detects all of the following conditions:

- The driver output is off.
- An open circuit or a short to + battery condition is detected at the ether relay output for at least 2 seconds.
- The ECM has been powered for at least three seconds.
- Battery voltage is greater than 9 VDC for the last 2 seconds.

System Response:

The ECM will log the diagnostic code. The diagnostic code may be viewed on a display module or on ET. Ether injection is disabled.

Possible Performance Effect:

- Hard starting

Troubleshooting:

Perform the following diagnostic procedure: "Ether Injection System - Test"

Results:

- OK – STOP.

i01442243

CID 0545 FMI 06 Ether Start Relay short to ground

SMCS Code: 1456-038-R7

Conditions Which Generate This Code:

The ECM detects all of the following conditions:

- The driver output is on.
- The ECM has detected an open or a short to ground at the output for the ether relay for at least 2 seconds.
- The ECM has been powered for at least three seconds.
- Battery voltage is greater than 9 VDC for the last 2 seconds.

System Response:

The ECM will log the diagnostic code. The diagnostic code may be viewed on a display module or on ET. Ether injection is disabled.

Possible Performance Effect:

- Hard starting

Troubleshooting:

Perform the following diagnostic procedure: "Ether Injection System - Test"

Results:

- OK – STOP.

Parameters for Programmable Monitoring System

The following features are able to be selected in the Programmable Monitoring System (PMS) for Industrial engines.

- Warning
- Derate
- Shutdown

The electronic technician (ET) can be used in order to select the monitoring features. These features can be turned ON or OFF. When an event is active, the ECM will generate an event code.

The ECM will generate a EID diagnostic code on the Cat Data Link. The diagnostic code will be displayed on a diagnostic screen of the Electronic Technician (ET).

The ECM will generate a SPN-FMI diagnostic code on the J1939 Data Link. The diagnostic code may be displayed on a receiving device for the J1939 data link.

The ECM will generate a flash code that will be displayed on the diagnostic lamp.

The Warning Lamp will display the following conditions.

- Remain ON for a "Warning".
- Flash for a "Derate".

When a selected level is turned OFF, the ECM will log the event code but the ECM will not take any action on the event. For example, the ECM will not give a warning, a derate, or a shutdown.

If multiple derates are active, the derate that limits the most power will be the derate that is shown.

i01452638

E004 Engine Overspeed Shutdown

SMCS Code: 1900

Conditions Which Generate This Code:

Table 20

Trip Level	Set Point (sec)	Reset Level	Reset Time
1800 to 2800 rpm	1 sec	0 rpm	0 sec

System Response:

The engine will shut down after all of the conditions for "shutdown" are met.

The ET will display "No Engine Speed" in the first engine status box on any ET status screen.

The ET will display "Injection Disabled" in the third engine status box on any ET status screen.

The ECM will generate a EID 004 event code on the Cat Data Link. The event code will be displayed on a diagnostic screen of the Electronic Technician (ET).

The ECM will generate a SPN 190-FMI 16 event code on the J1939 Data Link. The event code may be displayed on a receiving device for the J1939 data link.

The ECM will generate a 35 flash code that will be displayed on the diagnostic lamp.

Troubleshooting:

The operator may be operating the machine incorrectly.

Interview the Operator

Determine the events that caused the overspeed of the engine.

Results:

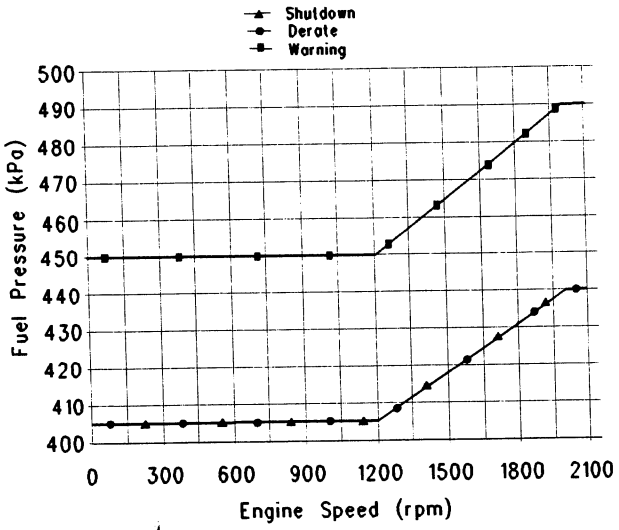
- OK – STOP.

i01453971

E005 Fuel Filter Restriction Derate

SMCS Code: 1900

Conditions Which Generate This Code:



g00760381

Illustration 13

Map for Plugged Fuel Filter (Low Fuel Pressure)

Table 21

Trip Level	Set Point (sec)	Reset Level	Reset Time
Refer to illustration 13 for additional information.	4 sec	10 kPa (1 psi)	4 sec

Table 22

Derate Ramp Rate	Maximum Derate
17.5% per sec	35%

System Response:

The warning lamp will flash while the "Derate" is active.

The ET will display "Engine Derate" in the first engine status box on any ET status screen.

The ECM will generate a EID 005 event code on the Cat Data Link. The event code will be displayed on a diagnostic screen of the Electronic Technician (ET).

The ECM will generate a SPN 094-FMI 15 event code on the J1939 Data Link. The event code may be displayed on a receiving device for the J1939 data link.

The ECM will generate a 63 flash code that will be displayed on the diagnostic lamp.

Troubleshooting:

This event code indicates a restriction in the fuel filter. This does not represent a problem with the ECM.

Replace the plugged fuel filter.

Results:

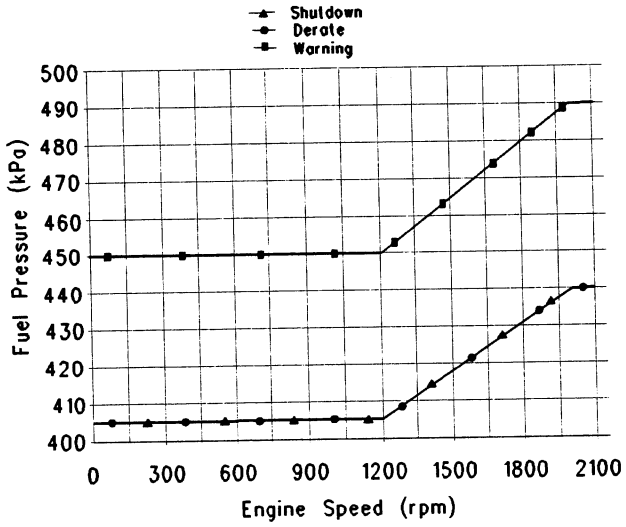
- OK – STOP.

i01453979

E006 Fuel Filter Restriction Shutdown

SMCS Code: 1900

Conditions Which Generate This Code:



g00760381

Illustration 14

Map for Plugged Fuel Filter (Low Fuel Pressure)

Table 23

Trip Level	Set Point (sec)	Reset Level	Reset Time
Refer to illustration 14 for additional information.	10 sec	0 rpm	5 sec

System Response:

The engine will shut down 4 seconds past the derate set point.

The ET will display "No Engine Speed" in the first engine status box on any ET status screen.

The ECM will generate a EID 006 event code on the Cat Data Link. The event code will be displayed on a diagnostic screen of the Electronic Technician (ET).

The ECM will generate a SPN 094-FMI 16 event code on the J1939 Data Link. The event code may be displayed on a receiving device for the J1939 data link.

The ECM will generate a 63 flash code that will be displayed on the diagnostic lamp.

Troubleshooting:

This event code indicates a restriction in the fuel filter. This does not represent a problem with the ECM.

Replace the plugged fuel filter.

Results:

- OK – STOP.

i01452135

E015 High Engine Coolant Temperature Derate

SMCS Code: 1900

Conditions Which Generate This Code:

Table 24

Trip Level	Set Point (sec)	Reset Level	Reset Time
86 °C (187 °F) to 106 °C (223 °F)	0 to 120	Trip Level minus 2 °C (4 °F)	20 sec

Table 25

Temperature	Derate Ramp Rate	Maximum Derate
<107 °C (225 °F)	1.0 % per sec	12.5%
>108 °C (226 °F)		25%

System Response:

The warning lamp will flash while the "Derate" is active.

The ET will display "Engine Derate" in the first engine status box on any ET status screen.

The ECM will generate a EID 015 event code on the Cat Data Link. The event code will be displayed on a diagnostic screen of the Electronic Technician (ET).

The ECM will generate a SPN 110-FMI 16 event code on the J1939 Data Link. The event code may be displayed on a receiving device for the J1939 data link.

The ECM will generate a 61 flash code that will be displayed on the diagnostic lamp.

Troubleshooting:

Refer to Troubleshooting, "Troubleshooting without a Diagnostic Code" for additional information.

Perform the following diagnostic procedure: "Coolant Temperature Is Too High"

Results:

- OK – STOP.

i01452532

E016 High Engine Coolant Temperature Shutdown

SMCS Code: 1900

Conditions Which Generate This Code:

Table 26

Trip Level	Set Point (sec)	Reset Level	Reset Time
87 °C (189 °F) to 107 °C (225 °F)	0 to 120 sec	0 rpm	5 sec

System Response:

The engine will shut down after all of the conditions for "shutdown" are met.

The ET will display "No Engine Speed" in the first engine status box on any ET status screen.

The ET will display "High Coolant Temp" in the second engine status box on any ET status screen.

The ECM will generate a EID 016 event code on the Cat Data Link. The event code will be displayed on a diagnostic screen of the Electronic Technician (ET).

The ECM will generate a SPN 110-FMI 00 event code on the J1939 Data Link. The event code may be displayed on a receiving device for the J1939 data link.

The ECM will generate a 61 flash code that will be displayed on the diagnostic lamp.

Troubleshooting:

Refer to Troubleshooting, "Troubleshooting without a Diagnostic Code" for additional information.

Perform the following diagnostic procedure: "Coolant Temperature Is Too High"

Results:

- OK – STOP.

i01441556

E017 High Engine Coolant Temperature Warning

SMCS Code: 1900

Conditions Which Generate This Code:

Table 27

Trip Level	Set Point (sec)	Reset Level	Reset Time
85 °C (185 °F) to 105 °C (221 °F)	4 sec	Trip Level minus 2 °C (4 °F)	4 sec

The ECM will not act until the engine speed is greater than 0 rpm for 3 minutes.

System Response:

The warning lamp will turn ON while the "Warning" is active.

The ET will display "High Coolant Temp" in the second engine status box on any ET status screen.

The ECM will generate a EID 017 event code on the Cat Data Link. The event code will be displayed on a diagnostic screen of the Electronic Technician (ET).

The ECM will generate a SPN 110-FMI 15 event code on the J1939 Data Link. The event code may be displayed on a receiving device for the J1939 data link.

The ECM will generate a 61 flash code that will be displayed on the diagnostic lamp.

Troubleshooting:

Refer to Troubleshooting, "Troubleshooting without a Diagnostic Code" for additional information.

Perform the following diagnostic procedure: "Coolant Temperature Is Too High"

Results:

- OK – STOP.

i01502521

E025 High Inlet Air Temperature Derate

SMCS Code: 1900

Conditions Which Generate This Code:

Table 28

Trip Level	Set Point (sec)	Reset Level	Reset Time
79 °C (174 °F)	0 to 120 sec	77 °C (171 °F)	20 sec

Table 29

Temperature	Derate Ramp Rate	Maximum Derate
< 80 °C (176 °F)	1.0 % per sec	3.0%
81 °C (178 °F)		6.0%
82 °C (180 °F)		9.0%
83 °C (181 °F)		12.0%
84 °C (183 °F)		15.0%
85 °C (185 °F)		18.0%
> 86 °C (187 °F)		20.0%

System Response:

The warning lamp will flash while the "Derate" is active.

The ECM will generate a EID 025 event code on the Cat Data Link. The event code will be displayed on a diagnostic screen of the Electronic Technician (ET).

The ECM will generate a SPN 172-FMI 16 event code on the J1939 Data Link. The event code may be displayed on a receiving device for the J1939 data link.

The ECM will generate a 64 flash code that will be displayed on the diagnostic lamp.

Troubleshooting:

- There may be a problem with the aftercooler.

Test Step 1. Check for Diagnostic Codes.

A. Connect ET to the service tool connector.

B. Turn the keyswitch to the ON position. The engine should be off.

C. Check for any active diagnostic codes or logged diagnostic codes.

Expected Result:

There should be no diagnostic codes that are present.

Results:

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

  Repair: Repair the diagnostic codes that are present. Refer to the appropriate topic in the "Troubleshooting With a Diagnostic Code" section of this manual.

  Ensure that the repair eliminates the problem.

  STOP.

Test Step 2. Perform a Check of the Aftercooler.

A. Perform a check of the aftercooler. Refer to the appropriate topic in Testing and Adjusting for possible causes.

Expected Result:

There are no problems with the aftercooler.

Results:

- OK – There may be an intermittent problem.

  Repair: Monitor the operation of the engine.

  Repair the problem.

  Ensure that the repair eliminates the problem.

  STOP.

- Not OK

  Repair: Repair the problem.

  Ensure that the repair eliminates the problem.

  STOP.

i01502550

E027 High Inlet Air Temperature Warning

SMCS Code: 1900

Conditions Which Generate This Code:

Table 30

Trip Level	Set Point (sec)	Reset Level	Reset Time
75 °C (167 °F)	4 sec	73 °C (163 °F)	4 sec

The ECM will not act until the engine speed is greater than 0 rpm for 3 minutes.

System Response:

The warning lamp will turn ON while the "Warning" is active.

The ECM will generate a EID 027 event code on the Cat Data Link. The event code will be displayed on a diagnostic screen of the Electronic Technician (ET).

The ECM will generate a SPN 172-FMI 15 event code on the J1939 Data Link. The event code may be displayed on a receiving device for the J1939 data link.

The ECM will generate a 64 flash code that will be displayed on the diagnostic lamp.

Troubleshooting:

- There may be a problem with the aftercooler.

Test Step 1. Check for Diagnostic Codes.

A. Connect ET to the service tool connector.

B. Turn the keyswitch to the ON position. The engine should be off.

C. Check for any active diagnostic codes or logged diagnostic codes.

Expected Result:

There should be no diagnostic codes that are present.

Results:

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

  Repair: Repair the diagnostic codes that are present. Refer to the appropriate topic in the "Troubleshooting With a Diagnostic Code" section of this manual.

  Ensure that the repair eliminates the problem.

  STOP.

Test Step 2. Perform a Check of the Aftercooler.

A. Perform a check of the aftercooler. Refer to the appropriate topic in Testing and Adjusting for possible causes.

Expected Result:

There are no problems with the aftercooler.

Results:

- OK – There may be an intermittent problem.

  Repair: Monitor the operation of the engine.

  Repair the problem.

  Ensure that the repair eliminates the problem.

  STOP.

- Not OK

  Repair: Repair the problem.

  Ensure that the repair eliminates the problem.

  STOP.

i01554227

E039 Low Engine Oil Pressure Derate

SMCS Code: 1900

Conditions Which Generate This Code:

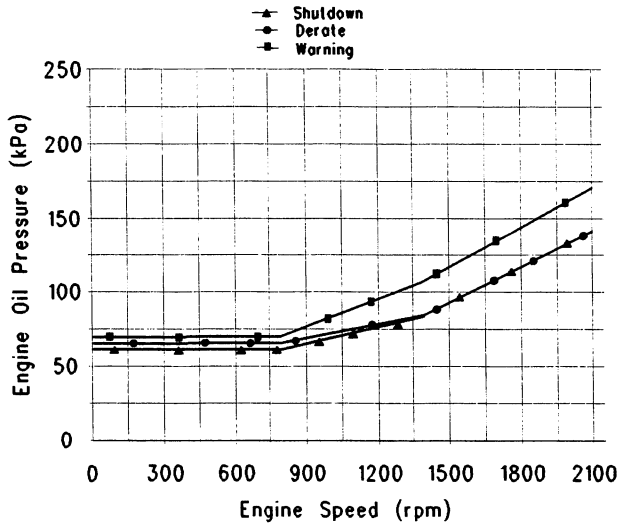


Illustration 15 g00760014

Oil pressure map for C-10 and C-12 Industrial Engines

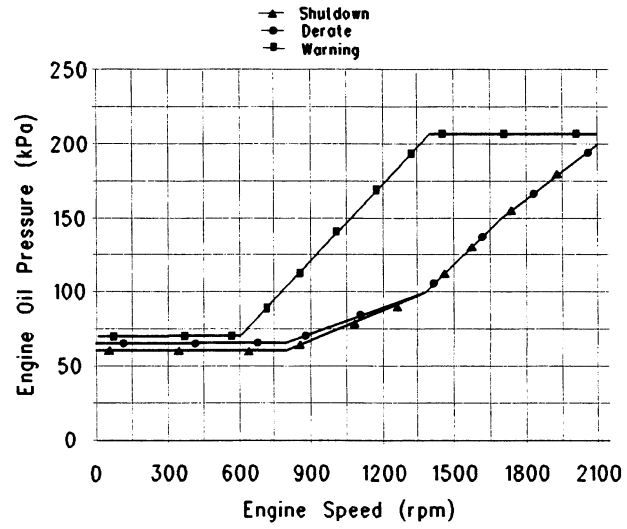


Illustration 16 g00760031

Oil pressure map for C-15 and C-16 Industrial Engines

Table 31

Trip Level	Set Point (sec)	Reset Level	Reset Time
Refer to illustrations 15 and 16 for additional information.	2 sec	70 kPa (10 psi)	2 sec

Table 32

Derate Ramp Rate	Maximum Derate
17.5% per sec	35%

System Response:

The warning lamp will flash while the "Derate" is active.

The ET will display "Engine Derate" in the first engine status box on any ET screen.

The ECM will generate a EID 039 event code on the Cat Data Link. The event code will be displayed on a diagnostic screen of the Electronic Technician (ET).

The ECM will generate a SPN 100-FMI 18 event code on the J1939 Data Link. The event code may be displayed on a receiving device for the J1939 data link.

The ECM will generate a 46 flash code that will be displayed on the diagnostic lamp.

Troubleshooting:

- There may be a problem with the engine lubrication system.
- There may be a problem with the engine oil pressure sensor.

Test Step 1. Check for Diagnostic Codes.

A. Connect ET to the service tool connector.

B. Turn the keyswitch to the ON position. The engine should be off.

C. Check for any active diagnostic codes or logged diagnostic codes.

Expected Result:

There should be no diagnostic codes that are present.

Results:

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

  Repair: Repair the diagnostic codes that are present. Refer to the appropriate topic in the "Troubleshooting With a Diagnostic Code" section of this manual.

  Ensure that the repair eliminates the problem.

  STOP.

Test Step 2. Perform a Check of the Engine Lubrication System.

A. Perform a check of the engine lubrication system. Refer to Troubleshooting, "Low Engine Oil Pressure".

Expected Result:

There are no problems with engine oil pressure.

Results:

- OK – There may be an intermittent problem.

  Repair: Monitor the operation of the engine.

  Repair the problem.

  Ensure that the repair eliminates the problem.

  STOP.

- Not OK

  Repair: Repair the problem.

  Ensure that the repair eliminates the problem.

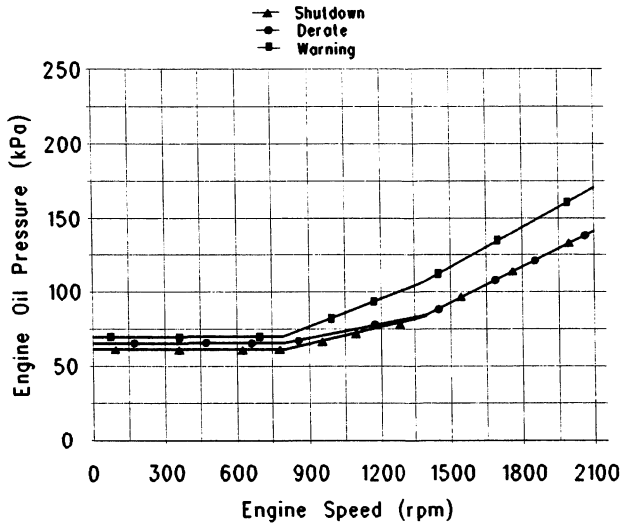
  STOP.

i01554326

E040 Low Engine Oil Pressure Shutdown

SMCS Code: 1900

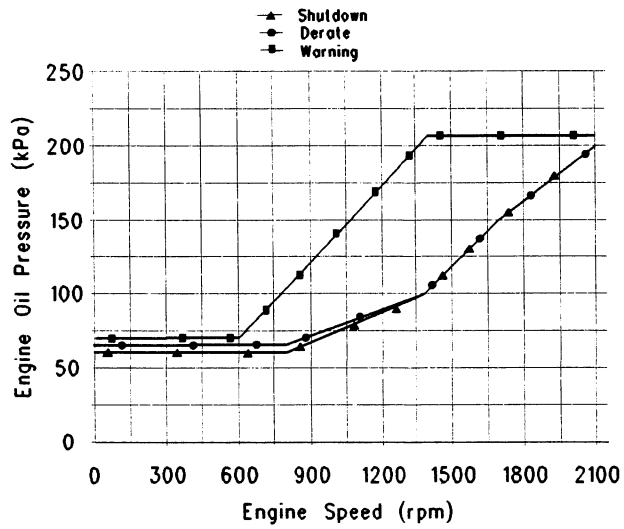
Conditions Which Generate This Code:



g00760014

Illustration 17

Oil pressure map for C-10 and C-12 Industrial Engines



g00760031

Illustration 18

Oil pressure map for C-15 and C-16 Industrial Engines

Table 33

Trip Level	Set Point (sec)	Reset Level	Reset Time
Refer to illustrations 17 and 18 for additional information.	10 sec	0 rpm	5 sec

System Response:

The engine will shut down after all of the conditions for "shutdown" are met.

The ET will display "No Engine Speed" in the first engine status box on any ET screen.

The ECM will generate a EID 040 event code on the Cat Data Link. The event code will be displayed on a diagnostic screen of the Electronic Technician (ET).

The ECM will generate a SPN 100-FMI 01 event code on the J1939 Data Link. The event code may be displayed on a receiving device for the J1939 data link.

The ECM will generate a 46 flash code that will be displayed on the diagnostic lamp.

Troubleshooting:

- There may be a problem with the engine lubrication system.
- There may be a problem with the engine oil pressure sensor.

Test Step 1. Check for Diagnostic Codes.

A. Connect ET to the service tool connector.

B. Turn the keyswitch to the ON position. The engine should be off.

C. Check for any active diagnostic codes or logged diagnostic codes.

Expected Result:

There should be no diagnostic codes that are present.

Results:

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

Repair: Repair the diagnostic codes that are present. Refer to the appropriate topic in the "Troubleshooting With a Diagnostic Code" section of this manual.

Ensure that the repair eliminates the problem.

STOP.

Test Step 2. Perform a Check of the Engine Lubrication System.

A. Perform a check of the engine lubrication system. Refer to Troubleshooting, "Low Engine Oil Pressure".

Expected Result:

There are no problems with engine oil pressure.

Results:

- OK – There may be an intermittent problem.

  Repair: Monitor the operation of the engine.

  Repair the problem.

  Ensure that the repair eliminates the problem.

  STOP.

- Not OK

  Repair: Repair the problem.

  Ensure that the repair eliminates the problem.

  STOP.

i01453377

E054 High Fuel Temperature Derate

SMCS Code: 1900

Conditions Which Generate This Code:

Table 34

Trip Level	Set Point (sec)	Reset Level	Reset Time
81 °C (178 °F) to 91 °C (196 °F)	0 to 120 sec	Trip Level minus 2%	4 sec

Table 35

Derate Ramp Rate	Maximum Derate
1.5% per sec	30%

System Response:

The warning lamp will flash while the "Derate" is active.

The ET will display "Engine Derate" in the first engine status box on any ET status screen.

The ECM will generate a EID 054 event code on the Cat Data Link. The event code will be displayed on a diagnostic screen of the Electronic Technician (ET).

The ECM will generate a SPN 174-FMI 16 event code on the J1939 Data Link. The event code may be displayed on a receiving device for the J1939 data link.

The ECM will generate a 65 flash code that will be displayed on the diagnostic lamp.

Troubleshooting:

- There may be a problem with the fuel system.
- There may be a problem with the fuel temperature sensor.

Test Step 1. Check for Diagnostic Codes.

A. Connect ET to the service tool connector.

B. Turn the keyswitch to the ON position. The engine should be off.

C. Check for any active diagnostic codes or logged diagnostic codes.

Expected Result:

There should be no diagnostic codes that are present.

Results:

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

  Repair: Repair the diagnostic codes that are present. Refer to the appropriate topic in the "Troubleshooting With a Diagnostic Code" section of this manual.

Ensure that the repair eliminates the problem.

STOP.

Test Step 2. Perform a Check of the Fuel System.

A. Perform a check of the fuel system. Refer to the appropriate topic in Testing and Adjusting for possible causes.

Expected Result:

There are no problems with the fuel system.

Results:

- OK – There may be an intermittent problem.

  Repair: Monitor the operation of the engine.

  Repair the problem.

  Ensure that the repair eliminates the problem.

  STOP.

- Not OK

  Repair: Repair the problem.

  Ensure that the repair eliminates the problem.

  STOP.

Test Step 3. Check the Fuel Temperature Sensor

Perform the following diagnostic procedure. Troubleshooting, "Engine Temperature Sensor Open or Short Circuit - Test"

Results:

- OK – STOP.

i01453407

E055 High Fuel Temperature Shutdown

SMCS Code: 1900

Conditions Which Generate This Code:

Table 36

Trip Level	Set Point (sec)	Reset Level	Reset Time
81 °C (178 °F) to 91 °C (196 °F)	0 to 120 sec	0 rpm	5 sec

System Response:

The engine will shut down after all of the conditions for "shutdown" are met.

The ET will display "No Engine Speed" in the first engine status box on any ET status screen.

The ECM will generate a EID 055 event code on the Cat Data Link. The event code will be displayed on a diagnostic screen of the Electronic Technician (ET).

The ECM will generate a SPN 174-FMI 00 event code on the J1939 Data Link. The event code may be displayed on a receiving device for the J1939 data link.

The ECM will generate a 65 flash code that will be displayed on the diagnostic lamp.

Troubleshooting:

- There may be a problem with the fuel system.
- There may be a problem with the fuel temperature sensor.

Test Step 1. Check for Diagnostic Codes.

A. Connect ET to the service tool connector.

B. Turn the keyswitch to the ON position. The engine should be off.

C. Check for any active diagnostic codes or logged diagnostic codes.

Expected Result:

There should be no diagnostic codes that are present.

Results:

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

  Repair: Repair the diagnostic codes that are present. Refer to the appropriate topic in the "Troubleshooting With a Diagnostic Code" section of this manual.

  Ensure that the repair eliminates the problem.

  STOP.

Test Step 2. Perform a Check of the Fuel System.

A. Perform a check of the fuel system. Refer to the appropriate topic in Testing and Adjusting for possible causes.

Expected Result:

There are no problems with the fuel system.

Results:

- OK – There may be an intermittent problem.

  Repair: Monitor the operation of the engine.

  Repair the problem.

  Ensure that the repair eliminates the problem.

  STOP.

- Not OK

  Repair: Repair the problem.

  Ensure that the repair eliminates the problem.

  STOP.

Test Step 3. Check the Fuel Temperature Sensor

Perform the following diagnostic procedure. Troubleshooting, "Engine Temperature Sensor Open or Short Circuit - Test"

Results:

- OK – STOP.

i01453298

E056 High Fuel Temperature Warning

SMCS Code: 1900

Conditions Which Generate This Code:

Table 37

Trip Level	Set Point (sec)	Reset Level	Reset Time
70 °C (158 °F) to 80 °C (176 °F)	0 to 120 sec	Trip Level minus 2%	4 sec

The ECM will not act until the engine speed is greater than 0 rpm for 3 minutes.

System Response:

The warning lamp will turn ON while the "Warning" is active.

The ECM will generate a EID 056 event code on the Cat Data Link. The event code will be displayed on a diagnostic screen of the Electronic Technician (ET).

The ECM will generate a SPN 174-FMI 15 event code on the J1939 Data Link. The event code may be displayed on a receiving device for the J1939 data link.

The ECM will generate a 65 flash code that will be displayed on the diagnostic lamp.

Troubleshooting:

- There may be a problem with the fuel system.
- There may be a problem with the fuel temperature sensor.

Test Step 1. Check for Diagnostic Codes.

A. Connect ET to the service tool connector.

B. Turn the keyswitch to the ON position. The engine should be off.

C. Check for any active diagnostic codes or logged diagnostic codes.

Expected Result:

There should be no diagnostic codes that are present.

Results:

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

  Repair: Repair the diagnostic codes that are present. Refer to the appropriate topic in the "Troubleshooting With a Diagnostic Code" section of this manual.

  Ensure that the repair eliminates the problem.

  STOP.

Test Step 2. Perform a Check of the Fuel System.

A. Perform a check of the fuel system. Refer to the appropriate topic in Testing and Adjusting for possible causes.

Expected Result:

There are no problems with the fuel system.

Results:

- OK – There may be an intermittent problem.

  Repair: Monitor the operation of the engine.

  Repair the problem.

  Ensure that the repair eliminates the problem.

  STOP.

- Not OK

  Repair: Repair the problem.

  Ensure that the repair eliminates the problem.

  STOP.

Test Step 3. Check the Fuel Temperature Sensor

Perform the following diagnostic procedure. Troubleshooting, "Engine Temperature Sensor Open or Short Circuit - Test"

Results:

- OK – STOP.

i01563333

E057 Low Engine Coolant Level Derate

SMCS Code: 1900; 7422

Conditions Which Generate This Code:

Table 38

Trip Level	Set Point (sec)	Reset Level	Reset Time
Low	10 sec	OK	5 sec

Table 39

Derate Ramp Rate	Maximum Derate
1.0% per sec	35%

System Response:

The warning lamp will flash while the "Derate" is active.

The ET will display "Engine Derate" in the first engine status box on any ET status screen.

The ECM will generate a EID 057 event code on the Cat Data Link. The event code will be displayed on a diagnostic screen of the Electronic Technician (ET).

The ECM will generate a SPN 111-FMI 18 event code on the J1939 Data Link. The event code may be displayed on a receiving device for the J1939 data link.

The ECM will generate a 62 flash code that will be displayed on the diagnostic lamp.

Troubleshooting:

- There may be a problem with the cooling system.

Test Step 1. Check the Level of the Engine Coolant

⚠ WARNING

Pressurized System: Hot coolant can cause serious burns. To open the cooling system filler cap, stop the engine and wait until the cooling system components are cool. Loosen the cooling system pressure cap slowly in order to relieve the pressure.

A. Check the level of the engine coolant. The coolant must completely cover the coolant level switch. Refer to the appropriate topic in Testing and Adjusting for information about problems with the cooling system.

Expected Result:

There are no problems with the cooling system.

Results:

- OK – There may be an intermittent problem.

  Repair: Monitor the operation of the engine.

  Repair the problem.

  Ensure that the repair eliminates the problem.

  STOP.

- Not OK

  Repair: Repair the problem.

  Ensure that the repair eliminates the problem.

  STOP.

Test Step 2. Check the Coolant Level Switch

A. Check the coolant level switch. Refer to Troubleshooting, "Coolant Level Sensor Circuit - Test".

Expected Result:

There are no problems with the coolant level switch.

Results:

- OK – There may be an intermittent problem.

  Repair: Monitor the operation of the engine.

  Repair the problem.

  Ensure that the repair eliminates the problem.

  STOP.

- Not OK

  Repair: Repair the problem.

  Ensure that the repair eliminates the problem.

  STOP.

i01563344

E058 Low Engine Coolant Level Shutdown

SMCS Code: 1900

Conditions Which Generate This Code:

Table 40

Trip Level	Set Point (sec)	Reset Level	Reset Time
Low	5 sec	0 rpm	5 sec

The engine will shut down after all of the conditions for "shutdown" are met.

The ET will display "No Engine Speed" in the first engine status box on any ET status screen.

The ECM will generate a EID 058 event code on the Cat Data Link. The event code will be displayed on a diagnostic screen of the Electronic Technician (ET).

The ECM will generate a SPN 111-FMI 01 event code on the J1939 Data Link. The event code may be displayed on a receiving device for the J1939 data link.

The ECM will generate a 62 flash code that will be displayed on the diagnostic lamp.

Troubleshooting:

- There may be a problem with the cooling system.

Test Step 1. Check the Level of the Engine Coolant

⚠ WARNING

Pressurized System: Hot coolant can cause serious burns. To open the cooling system filler cap, stop the engine and wait until the cooling system components are cool. Loosen the cooling system pressure cap slowly in order to relieve the pressure.

A. Check the level of the engine coolant. The coolant must completely cover the coolant level switch. Refer to the appropriate topic in Testing and Adjusting for information about problems with the cooling system.

Expected Result:

There are no problems with the cooling system.

Results:

- OK – There may be an intermittent problem.

  Repair: Monitor the operation of the engine.

  Repair the problem.

  Ensure that the repair eliminates the problem.

  STOP.

- Not OK

  Repair: Repair the problem.

  Ensure that the repair eliminates the problem.

  STOP.

Test Step 2. Check the Coolant Level Switch

A. Check the coolant level switch. Refer to Troubleshooting, "Coolant Level Sensor Circuit - Test".

Expected Result:

There are no problems with the coolant level switch.

Results:

- OK – There may be an intermittent problem.

  Repair: Monitor the operation of the engine.

  Repair the problem.

  Ensure that the repair eliminates the problem.

  STOP.

- Not OK

  Repair: Repair the problem.

  Ensure that the repair eliminates the problem.

  STOP.

i01563493

E059 Low Engine Coolant Level Warning

SMCS Code: 1900

Conditions Which Generate This Code:

Table 41

Trip Level	Set Point (sec)	Reset Level	Reset Time
Low	10 sec	OK	5 sec

The ECM will not act until engine speed is greater than 0 rpm for 60 seconds.

System Response:

The warning lamp will come on while the "Warning" is active.

The ECM will generate a EID 059 event code on the Cat Data Link. The event code will be displayed on a diagnostic screen of the Electronic Technician (ET).

The ECM will generate a SPN 111-FMI 17 event code on the J1939 Data Link. The event code may be displayed on a receiving device for the J1939 data link.

The ECM will generate a 62 flash code that will be displayed on the diagnostic lamp.

Troubleshooting:

- There may be a problem with the cooling system.

Test Step 1. Check the Level of the Engine Coolant

⚠ WARNING

Pressurized System: Hot coolant can cause serious burns. To open the cooling system filler cap, stop the engine and wait until the cooling system components are cool. Loosen the cooling system pressure cap slowly in order to relieve the pressure.

A. Check the level of the engine coolant. The coolant must completely cover the coolant level switch. Refer to the appropriate topic in Testing and Adjusting for information about problems with the cooling system.

Expected Result:

There are no problems with the cooling system.

Results:

- OK – There may be an intermittent problem.

  Repair: Monitor the operation of the engine.

  Repair the problem.

  Ensure that the repair eliminates the problem.

  STOP.

- Not OK

  Repair: Repair the problem.

  Ensure that the repair eliminates the problem.

  STOP.

Test Step 2. Check the Coolant Level Switch

A. Check the coolant level switch. Refer to Troubleshooting, "Coolant Level Sensor Circuit - Test".

Expected Result:

There are no problems with the coolant level switch.

Results:

- OK – There may be an intermittent problem.

  Repair: Monitor the operation of the engine.

  Repair the problem.

  Ensure that the repair eliminates the problem.

  STOP.

- Not OK

  Repair: Repair the problem.

  Ensure that the repair eliminates the problem.

  STOP.

i01410495

E095 Fuel Filter Restriction Warning

SMCS Code: 1261; 1900

Conditions Which Generate This Code:

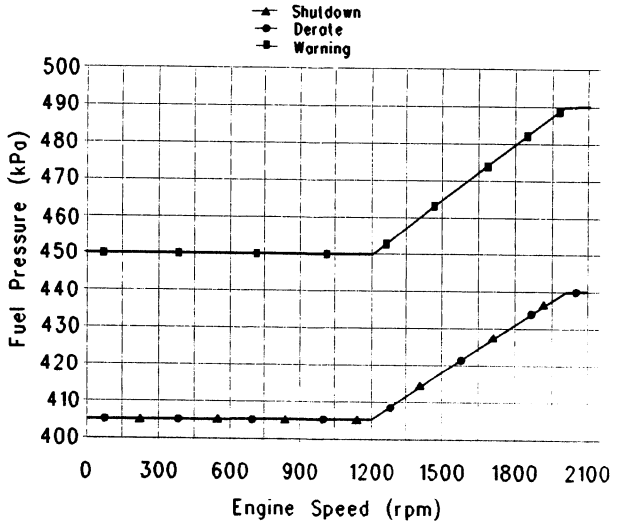


Illustration 19 g00760381

Map for Plugged Fuel Filter (Low Fuel Pressure)

Table 42

Trip Level	Set Point (sec)	Reset Level	Reset Time
Refer to illustration 19 for additional information.	10 sec	10 kPa (1 psi)	4 sec

System Response:

The warning lamp will turn ON while the "Warning" is active.

The ECM will generate a EID 095 event code on the Cat Data Link. The event code will be displayed on a diagnostic screen of the Electronic Technician (ET).

The ECM will generate a SPN 094-FMI 00 event code on the J1939 Data Link. The event code may be displayed on a receiving device for the J1939 data link.

The ECM will generate a 63 flash code that will be displayed on the diagnostic lamp.

Troubleshooting:

This event code indicates a restriction in the fuel filter. This does not represent a problem with the ECM.

Replace the plugged fuel filter.

Results:

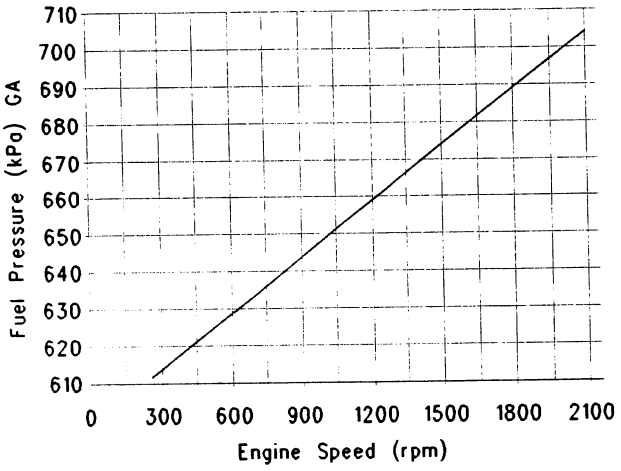
- OK – STOP.

i01453998

E096 High Fuel Pressure

SMCS Code: 1900

Conditions Which Generate This Code:



g00760491

Illustration 20

Map for high fuel pressure

Table 43

Trip Level	Set Point (sec)	Reset Level	Reset Time
Refer to illustration 20 for additional information.	2 sec	70 kPa (10 psi)	20 sec

The ECM will not act until the engine speed is greater than 0 rpm for 60 seconds.

System Response:

The warning lamp will turn ON while the "Warning" is active.

The ECM will generate a EID 096 event code on the Cat Data Link. The event code will be displayed on a diagnostic screen of the Electronic Technician (ET).

The ECM will generate a SPN 094-FMI 00 event code on the J1939 Data Link. The event code may be displayed on a receiving device for the J1939 data link.

The ECM will generate a 63 flash code that will be displayed on the diagnostic lamp.

Troubleshooting:

- There may be a problem with the fuel system.
- There may be a problem with the fuel pressure sensor.

Test Step 1. Check for Diagnostic Codes.

A. Connect ET to the service tool connector.

B. Turn the keyswitch to the ON position. The engine should be off.

C. Check for any active diagnostic codes or logged diagnostic codes.

Expected Result:

There should be no diagnostic codes that are present.

Results:

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

  Repair: Repair the diagnostic codes that are present. Refer to the appropriate topic in the "Troubleshooting With a Diagnostic Code" section of this manual.

  Ensure that the repair eliminates the problem.

  STOP.

Test Step 2. Perform a Check of the Fuel System.

A. Perform a check of the fuel system. Refer to the appropriate topic in Testing and Adjusting for possible causes.

Expected Result:

There are no problems with the fuel system.

Results:

- OK – There may be an intermittent problem.

  Repair: Monitor the operation of the engine.

  Repair the problem.

  Ensure that the repair eliminates the problem.

  STOP.

- Not OK

  Repair: Repair the problem.

  Ensure that the repair eliminates the problem.

  STOP.

Test Step 3. Check the Fuel Pressure Sensor

Perform the following diagnostic procedure. Troubleshooting, "Analog Sensor Supply Circuit - Test"

Results:

- OK – STOP.

i01554333

E100 Low Engine Oil Pressure Warning

SMCS Code: 1900

Conditions Which Generate This Code:

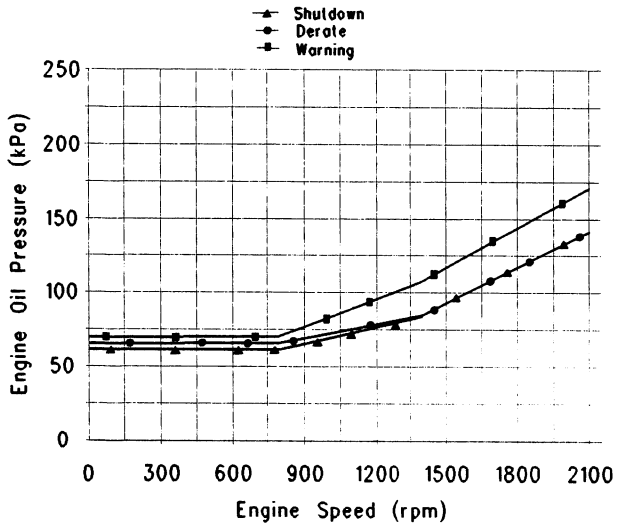


Illustration 21 g00760014

Oil pressure map for the C-10 and the C-12 Industrial Engines

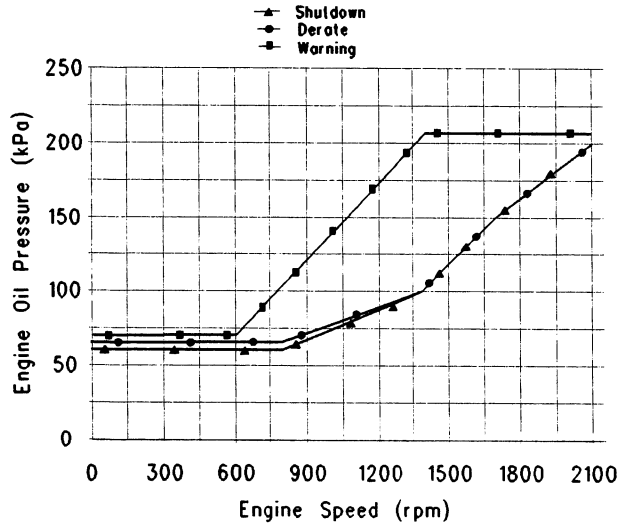


Illustration 22 g00760031

Oil Pressure Map for the C-15 and the C-16 Industrial Engines

Table 44

Trip Level	Set Point (sec)	Reset Level	Reset Time
Refer to illustrations 21 and 22 for additional information.	2 sec	70 kPa (10 psi)	20 sec

The ECM will not act until the engine speed has been greater than 0 rpm for 30 seconds.

System Response:

The warning lamp will turn ON while the "Warning" is active.

The ECM will generate a EID 100 diagnostic code on the Cat Data Link. The diagnostic code will be displayed on a diagnostic screen of the Electronic Technician (ET).

The ECM will generate a SPN 100-FMI 01 diagnostic code on the J1939 Data Link. The diagnostic code may be displayed on a receiving device for the J1939 data link.

The ECM will generate a 46 flash code that will be displayed on the diagnostic lamp.

Troubleshooting:

- There may be a problem with the engine lubrication system.
- There may be a problem with the engine oil pressure sensor.

Test Step 1. Check for Diagnostic Codes.

A. Connect ET to the service tool connector.

B. Turn the keyswitch to the ON position. The engine should be off.

C. Check for any active diagnostic codes or logged diagnostic codes.

Expected Result:

There should be no diagnostic codes that are present.

Results:

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

Repair: Repair the diagnostic codes that are present. Refer to the appropriate topic in the "Troubleshooting With a Diagnostic Code" section of this manual.

Ensure that the repair eliminates the problem.

STOP.

Test Step 2. Perform a Check of the Engine Lubrication System.

A. Perform a check of the engine lubrication system. Refer to Troubleshooting, "Low Engine Oil Pressure".

Expected Result:

There are no problems with engine oil pressure.

Results:

- OK – There may be an intermittent problem.

  Repair: Monitor the operation of the engine.

  Repair the problem.

  Ensure that the repair eliminates the problem.

  STOP.

- Not OK

  Repair: Repair the problem.

  Ensure that the repair eliminates the problem.

  STOP.

i01452572

E190 Engine Overspeed Warning

SMCS Code: 1900

Conditions Which Generate This Code:

Table 45

Trip Level	Set Point (sec)	Reset Level	Reset Time
1800 to 2800 rpm	0.6 sec	Trip Level minus 200 rpm	0.6 sec

The ECM will act when the engine speed is greater than 0.

System Response:

The warning lamp will turn ON while the "Warning" is active.

The ET will display "Engine Overspeed Shutdown" in the fourth engine status box on any ET status screen.

The ET will display "Injection Disabled" in the third engine status box on any ET status screen.

The ECM will generate a EID 190 diagnostic code on the Cat Data Link. The diagnostic code will be displayed on a diagnostic screen of the Electronic Technician (ET).

The ECM will generate a SPN 190-FMI 00 diagnostic code on the J1939 Data Link. The diagnostic code may be displayed on a receiving device for the J1939 data link.

The ECM will generate a 35 flash code that will be displayed on the diagnostic lamp.

Troubleshooting:

The operator may be operating the machine incorrectly.

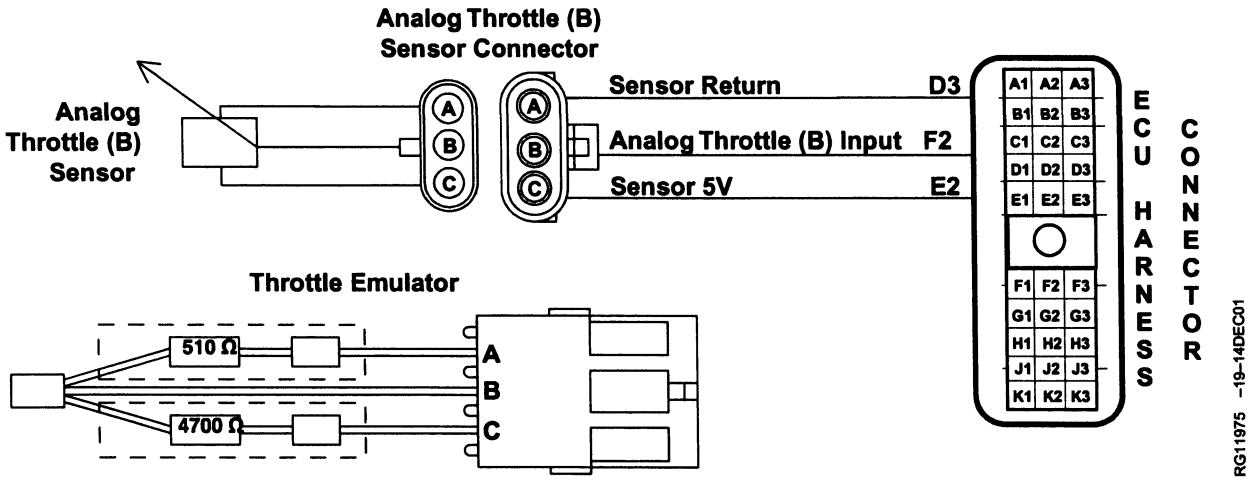
Interview the Operator

Determine the events that caused the overspeed of the engine.

Results:

- OK – STOP.

T5 - Analog Throttle (B) Input High



NOTE: Wiring schematic shows OEM engine applications only. For non-OEM engine wiring information, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

Analog Throttle Position Sensor

- The analog throttle position sensor is a variable resistor (potentiometer) used to measure the position of the throttle. The throttle input voltage normally varies between 1.0 and 4.0 volts depending on throttle position. Analog throttle voltage at low idle will be approximately 1.0 volt and 4.0 volts at high idle. The ECU has the ability to learn different voltages for low and high idle, so the voltage range may change per application.

This code will set if:

- The analog throttle (B) input voltage exceeds the sensor's high voltage specification. The voltage is higher than what is physically possible for the throttle lever to achieve.
  - For OEM applications, the high analog throttle (B) input voltage specification is 4.7 volts.
  - For non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual for the high analog throttle (B) input voltage specification.

If this code sets, the following will occur:

- If more than one throttle is available, the ECU will ignore the input from the analog throttle, and will use the input values from another throttle.
- If the analog throttle is the only throttle or all additional throttles are also faulted, the ECU will use a default "limp-home" throttle value that will only allow idle engine speed.

RG40854,00000BA -19-07DEC01-1/1

T5 - Analog Throttle (B) Input High

RG40854,00000A6 -19-13DEC01-1/1

T5 - Analog Throttle (B) Input High Diagnostic Procedure

---1/1

❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see T5 - ANALOG THROTTLE (B) INPUT HIGH supporting information.* Perform a preliminary inspection of the ECU connector, the analog (B) throttle connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s) ---1/1
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see T5 - ANALOG THROTTLE (B) INPUT HIGH supporting information.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Analog Throttle (B) in the idle position. 5. Using the DST or SERVICE ADVISOR™: • For OEM applications, read Analog Throttle (B) Input Voltage (OEM) • For non-OEM applications, read Analog Throttle (B) Input Voltage *NOTE: For OEM applications, the high analog throttle (B) input voltage specification is 4.7V. For the high voltage specification on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**4.7 V or greater:** GO TO ❹ **Below 4.7 V:** GO TO ❸

SERVICE ADVISOR is a trademark of Deere & Company

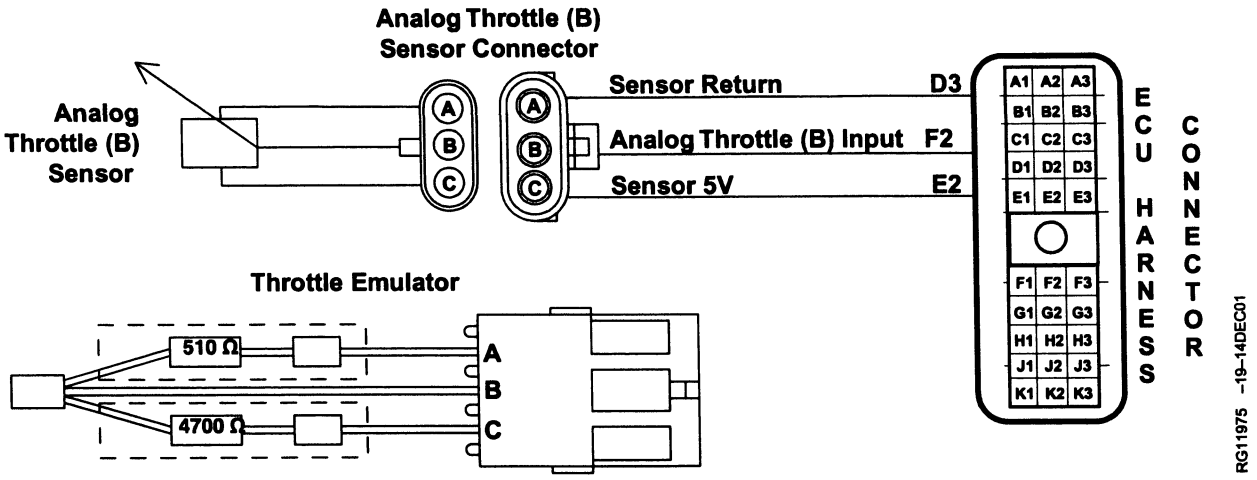
---1/1

❸ **Throttle Travel Voltage Test**	*NOTE: For wiring and theory of operation, see T5 - ANALOG THROTTLE (B) INPUT HIGH supporting information.* While slowly operating analog throttle (B) through its full travel, use the DST or SERVICE ADVISOR for the following: • For OEM applications, read Analog Throttle (B) Input Voltage (OEM) • For non-OEM applications, read Analog Throttle (B) Input Voltage *NOTE: For OEM applications, the high analog throttle (B) input voltage specification is 4.7V. For the high voltage specification on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**Goes above 4.7 V:** Faulty analog throttle (B) sensor connector OR Open in analog throttle (B) sensor ground circuit OR Faulty analog throttle (B) sensor **Never goes above 4.7 V:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group ---1/1

❹ **Throttle Position Input Shorted Test**	*NOTE: For wiring and theory of operation, see T5 - ANALOG THROTTLE (B) INPUT HIGH supporting information.* 1. Ignition OFF 2. Disconnect analog throttle (B) sensor connector behind instrument panel. 3. Ignition ON, Engine OFF 4. Using the DST or SERVICE ADVISOR: • For OEM applications, read Analog Throttle (B) Input Voltage (OEM) • For non-OEM applications, read Analog Throttle (B) Input Voltage *NOTE: For OEM applications, the low analog throttle (B) input voltage specification is 0.3V. For the low voltage specification on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**0.3 V or less:** GO TO ❺ **Above 0.3 V:** Short to voltage in analog throttle (B) input circuit OR Faulty ECU ---1/1

❺ **Throttle Position Ground Circuit Open Test**	*NOTE: For wiring and theory of operation, see T5 - ANALOG THROTTLE (B) INPUT HIGH supporting information.* 1. Ignition OFF 2. Analog throttle (B) sensor connector disconnected. 3. Using a test light connected to battery (+), probe the ground terminal in throttle (B) sensor harness connector.	**Light ON:** Faulty analog throttle (B) sensor connector OR Faulty analog throttle (B) sensor **Light OFF:** Open in analog throttle (B) ground circuit ---1/1

T6 - Analog Throttle (B) Input Low



NOTE: Wiring schematic shows OEM engine applications only. For non-OEM engine wiring information, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

Analog Throttle Position Sensor

- The analog throttle position sensor is a variable resistor (potentiometer) used to measure the position of the throttle. The throttle input voltage normally varies between 1.0 and 4.0 volts depending on throttle position. Analog throttle voltage at low idle will be approximately 1.0 volt and 4.0 volts at high idle. The ECU has the ability to learn different voltages for low and high idle, so the voltage range may change per application.

This code will set if:

- The analog throttle (B) input voltage goes below the sensor's low voltage specification. The voltage is lower than what is physically possible for the throttle lever to achieve.
  - For OEM applications, the low analog throttle (B) input voltage specification is 0.3 volts.
  - For non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual for the low analog throttle (B) input voltage specification.

If this code sets, the following will occur:

- If more than one throttle is available, the ECU will ignore the input from the analog throttle, and will use the input values from another throttle.
- If the analog throttle is the only throttle or all additional throttles are also faulted, the ECU will use a default "limp-home" throttle value that will only allow idle engine speed.

RG40854,0000098 -19-07DEC01-1/1

T6 - Analog Throttle (B) Input Low

RG40854,00000A7 -19-13DEC01-1/1

T6 - Analog Throttle (B) Input Low Diagnostic Procedure

---1/1

❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see T6 - ANALOG THROTTLE (B) INPUT LOW supporting information.* Perform a preliminary inspection of the ECU connector, the analog (B) throttle connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s) ---1/1
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see T6 - ANALOG THROTTLE (B) INPUT LOW supporting information.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Analog Throttle (B) in the idle position. 5. Using the DST or SERVICE ADVISOR™: • For OEM applications, read Analog Throttle (B) Input Voltage (OEM) • For non-OEM applications, read Analog Throttle (B) Input Voltage *NOTE: For OEM applications, the low analog throttle (B) input voltage specification is 0.3V. For the low voltage specification on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**0.3 V or less:** GO TO ❹ **Above 0.3 V:** GO TO ❸

SERVICE ADVISOR is a trademark of Deere & Company ---1/1

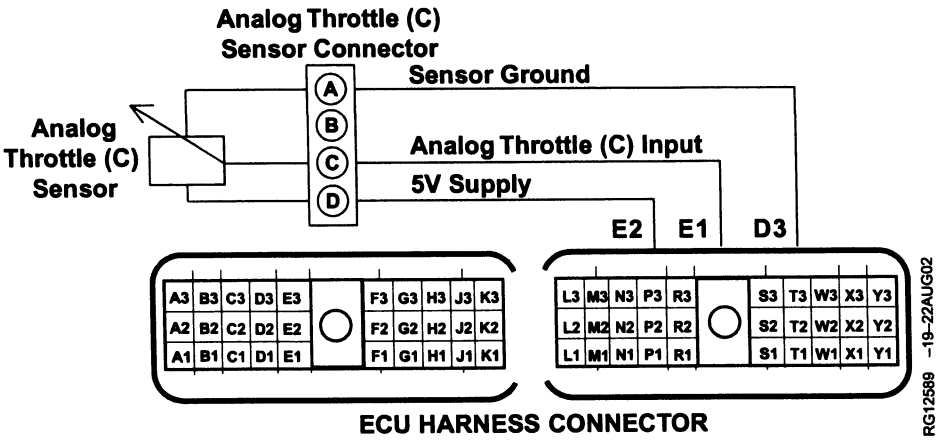
04 160 75

❸ **Throttle Travel Voltage Test**	*NOTE: For wiring and theory of operation, see T6 - ANALOG THROTTLE (B) INPUT LOW supporting information.* While slowly operating analog throttle (B) through its full travel, use the DST or SERVICE ADVISOR for the following: • For OEM applications, read Analog Throttle (B) Input Voltage (OEM) • For non-OEM applications, read Analog Throttle (B) Input Voltage	**Goes below 0.3 V:** Faulty analog throttle (B) sensor connector OR Open in analog throttle (B) sensor ground circuit OR Faulty analog throttle (B) sensor **Never goes above 0.3 V:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group ---1/1

❹ **Throttle Position Wiring Test**	*NOTE: For wiring and theory of operation, see T6 - ANALOG THROTTLE (B) INPUT LOW supporting information.* 1. Ignition OFF 2. Disconnect analog throttle (B) sensor connector. 3. Install a jumper wire between the 5 V Supply terminal and the input terminal in the harness side of the sensor connector. 4. Ignition ON, engine OFF 5. Using the DST or SERVICE ADVISOR: • For OEM applications, read Analog Throttle (B) Input Voltage (OEM) • For non-OEM applications, read Analog Throttle (B) Input Voltage *NOTE: For OEM applications, the high analog throttle (B) input voltage specification is 4.7V. For the high voltage specification on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**Below 4.7 V:** GO TO ❺ **4.7 V or greater:** Faulty analog throttle (B) sensor connector OR Faulty analog throttle (B) sensor ---1/1

5 Throttle Position 5 V Supply Test	*NOTE: For wiring and theory of operation, see T6 - ANALOG THROTTLE (B) INPUT LOW supporting information.* 1. Ignition OFF 2. Remove jumper wire. 3. Ignition ON, engine OFF 4. Using a multimeter, measure the voltage between the analog throttle (B) ground terminal and the 5 V Supply terminal in the sensor harness connector.	**Between 4.0 V and 6.0 V:** Open in analog throttle (B) input circuit OR Short to ground in analog throttle (B) input circuit OR Faulty ECU connector OR Faulty ECU **Below 4.0 V:** Open in analog throttle (B) 5 V Supply circuit OR Short to ground in analog throttle (B) 5 V Supply circuit OR Faulty ECU connector OR Faulty ECU ---1/1

T17 - Analog Throttle (C) Input High



04
160
106

Analog Throttle (C) Position Sensor

- The analog throttle (C) position sensor is a variable resistor (potentiometer) used to measure the position of the cruise throttle for Tractor applications. The throttle input voltage normally varies between 0.75 and 4.25 volts depending on throttle position.

This code will set if:

- The analog throttle (C) input voltage exceeds the 4.7 volts. The voltage is higher than what is physically possible for the cruise analog throttle to achieve.

If this code sets, the following will occur:

- If more than one throttle is available, the ECU will ignore the input from the analog throttle, and will use the input values from another throttle.
- If the analog throttle is the only throttle or all additional throttles are also faulted, the ECU will use a default "limp-home" throttle value that will only allow idle engine speed.

RG40854,0000110 –19–12AUG02–1/1

T17 - Analog Throttle (C) Input High

RG40854,0000111 –19–12AUG02–1/1

T17 - Analog Throttle (C) Input High Diagnostic Procedure

---1/1

❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see T17 - ANALOG THROTTLE (C) INPUT HIGH supporting information.* Perform a preliminary inspection of ECU connectors and the analog throttle (C) sensor connector looking for dirty, damaged, or poorly positioned terminals.	**No faulty connections:** GO TO ❷ **Faulty connections:** Repair faulty connection(s).

---1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see T17 - ANALOG THROTTLE (C) INPUT HIGH supporting information.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Throttle (C) in the idle position 5. Read the analog throttle (C) voltage parameter on DST or SERVICE ADVISOR™.	**4.7 V or greater:** GO TO ❹ **Below 4.7 V:** GO TO ❸

SERVICE ADVISOR is a trademark of Deere & Company

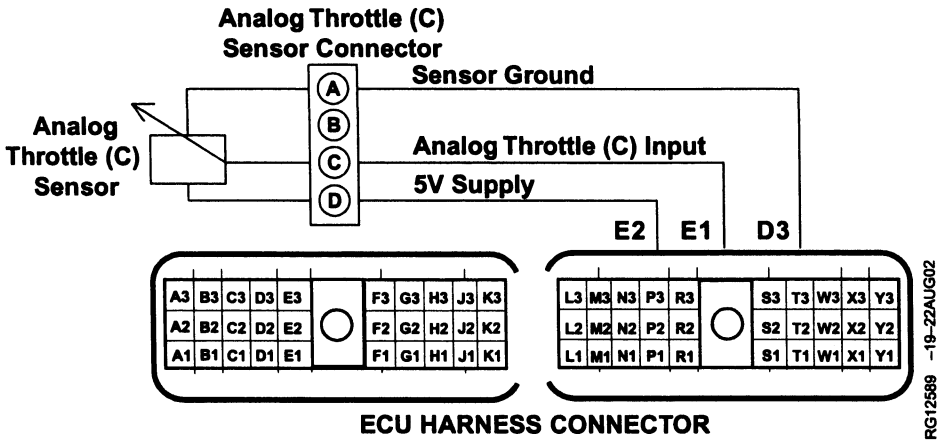
---1/1

❸ **Throttle Travel Voltage Test**	*NOTE: For wiring and theory of operation, see T17 - ANALOG THROTTLE (C) INPUT HIGH supporting information.* Read the analog throttle (C) voltage parameter while slowly operating the analog throttle (C) through full travel	**Goes above 4.7 V:** Faulty analog throttle (C) sensor connector OR Open in analog throttle (C) sensor ground circuit OR Faulty analog throttle (C) sensor **Never goes above 4.7 V:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group ---1/1

❹ **Throttle Position Input Shorted Test**	*NOTE: For wiring and theory of operation, see T17 - ANALOG THROTTLE (C) INPUT HIGH supporting information.* 1. Ignition OFF 2. Disconnect analog throttle sensor connector 3. Ignition ON, engine OFF 4. Read the analog throttle (C) voltage parameter	**0.3 V or less:** GO TO ❺ **Above 0.3 V:** Short to voltage in analog throttle input circuit OR Faulty ECU ---1/1

❺ **Throttle Position Ground Circuit Open Test**	*NOTE: For wiring and theory of operation, see T17 - ANALOG THROTTLE (C) INPUT HIGH supporting information.* 1. Ignition OFF 2. Analog throttle (C) sensor connector disconnected 3. Using a test light connected to battery (+), probe the ground terminal in analog throttle (C) sensor harness connector	**Light ON:** Faulty analog throttle (C) sensor connector OR Faulty analog throttle (C) sensor **Light OFF:** Open in analog throttle (C) ground circuit ---1/1

T18 - Analog Throttle (C) Input Low



04
160
110

Analog Throttle (C) Position Sensor

- The analog throttle (C) position sensor is a variable resistor (potentiometer) used to measure the position of the cruise throttle for Tractor applications. The throttle input voltage normally varies between 0.75 and 4.25 volts depending on throttle position.

This code will set if:

- The analog throttle (C) input voltage exceeds the 4.7 volts. The voltage is higher than what is physically possible for the cruise analog throttle to achieve.

If this code sets, the following will occur:

- If more than one throttle is available, the ECU will ignore the input from the analog throttle, and will use the input values from another throttle.
- If the analog throttle is the only throttle or all additional throttles are also faulted, the ECU will use a default "limp-home" throttle value that will only allow idle engine speed.

RG40854,0000112 –19–12AUG02–1/1

T18 - Analog Throttle (C) Input Low

RG40854,0000113 -19-12AUG02-1/1

T18 - Analog Throttle (C) Input Low Diagnostic Procedure

---1/1

❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see T18 - ANALOG THROTTLE (C) INPUT LOW supporting information.* Perform a preliminary inspection of ECU connectors and the analog throttle (C) sensor connector looking for dirty, damaged, or poorly positioned terminals.	**No faulty connections:** GO TO ❷ **Faulty connections:** Repair faulty connection(s).

---1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see T18 - ANALOG THROTTLE (C) INPUT LOW supporting information.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Throttle (C) in the idle position 5. Read the analog throttle (C) voltage parameter	**0.3 V or less:** GO TO ❹ **Above 0.3 V:** GO TO ❸

SERVICE ADVISOR is a trademark of Deere & Company

---1/1

❸ **Throttle Travel Voltage Test**	*NOTE: For wiring and theory of operation, see T18 - ANALOG THROTTLE (C) INPUT LOW supporting information.* Read the analog throttle (C) voltage parameter while slowly operating the analog throttle (C) through full travel	**Goes below 0.3 V:** Faulty analog throttle (C) sensor connector OR Open in analog throttle (C) sensor ground circuit OR Faulty analog throttle (C) sensor **Never goes below 0.3 V:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group ---1/1

❹ **Throttle Position Wiring Test**	*NOTE: For wiring and theory of operation, see T18 - ANALOG THROTTLE (C) INPUT LOW supporting information.* 1. Ignition OFF 2. Disconnect analog throttle (C) sensor connector 3. Install a jumper wire between the 5 V supply terminal and the input terminal in the harness side of the sensor connector 4. Ignition ON, engine OFF 5. Read the analog throttle (C) voltage parameter	**Below 4.7 V:** GO TO ❺ **4.7 V or greater:** Faulty analog throttle (C) sensor connector OR Faulty analog throttle sensor ---1/1

❻ **Throttle Position 5 V Supply Test**	*NOTE: For wiring and theory of operation, see T18 - ANALOG THROTTLE (C) INPUT LOW supporting information.* 1. Ignition OFF 2. Remove jumper wire between the two terminals 3. Ignition ON, engine OFF 4. Using a multimeter, measure the voltage between the throttle ground terminal and the 5 V supply terminal in the sensor harness connector	**4.0 - 6.0 V:** Open in analog throttle (C) input circuit OR Short to ground in analog throttle (C) input circuit OR Faulty ECU connection OR Faulty ECU **Below 4.0 V:** Open in analog throttle (C) 5 V supply circuit OR Short to ground in analog throttle (C) 5 V supply circuit OR Faulty ECU connection OR Faulty ECU ---1/1

T19 - Throttle Not Calibrated Properly

Throttle Calibration

Throttle calibration is necessary to allow the ECU to learn the range of the throttle. It is done when a new ECU or a new throttle has been installed.

This code will set if:

- The ECU detects an improper throttle calibration range.

If this code sets, the following will occur:

- Throttle position will not match percent throttle.

If this code sets:

- Diagnose other DTCs first.
- If no other DTCs are found, perform throttle sensor diagnostics.
  - **For 310G Backhoe Loaders**, see THROTTLE POSITION SENSOR TEST (S.N. XXXXXX—) in Section 9015, Group 120 of TM1885.
  - **For 310SG/315SG Backhoe Loaders**, see THROTTLE POSITION SENSOR TEST (S.N. XXXXXX—) in Section 9015, Group 120 of TM1883.

04
160
113

RG40854,0000118 –19–28JAN02–1/1

T20 - Throttle Input Voltage Below Lower Calibration Limit

Throttle Calibration

Throttle calibration is necessary to allow the ECU to learn the range of the throttle. It is performed when a new ECU or a new throttle has been installed.

This code will set if:

- The ECU detects a throttle input voltage lower than the defined low calibration limit.

If this code sets, the following will occur:

- Throttle position will not match percent throttle.

If this code sets:

- Diagnose other DTCs first.
- If no other DTCs are found, perform throttle sensor diagnostics.
  - **For 310G Backhoe Loaders**, see THROTTLE POSITION SENSOR TEST (S.N. XXXXXX—) in Section 9015, Group 120 of TM1885.
  - **For 310SG/315SG Backhoe Loaders**, see THROTTLE POSITION SENSOR TEST (S.N. XXXXXX—) in Section 9015, Group 120 of TM1883.

RG40854,000011F –19–28JAN02–1/1

T21 - Throttle Calibration Aborted

Throttle Calibration

Throttle calibration is necessary to allow the ECU to learn the range of the throttle. It is done when a new ECU or a new throttle has been installed.

This code will set if:

- Throttle calibration mode was enabled but was aborted before it was completed.

If this code sets, the following will occur:

- Throttle position will not match percent throttle.

If this code sets:

- Diagnose other DTCs first.
- If no other DTCs are found, perform throttle sensor diagnostics.
  - **For 310G Backhoe Loaders**, see THROTTLE POSITION SENSOR TEST (S.N. XXXXXX—) in Section 9015, Group 120 of TM1885.
  - **For 310SG/315SG Backhoe Loaders**, see THROTTLE POSITION SENSOR TEST (S.N. XXXXXX—) in Section 9015, Group 120 of TM1883.

RG40854,000011E –19–28JAN02–1/1

T22 - Analog Throttle (A) Input Voltage Out of Range

Analog Throttle Sensor

The analog throttle position sensor is a variable resistor (potentiometer) used to measure the position of the throttle. The throttle input voltage normally varies between 1.0 and 4.0 volts depending on throttle position. Analog throttle voltage at low idle will be approximately 1.0 volt and 4.0 volts at high idle. The ECU has the ability to learn different voltages for low and high idle, so the voltage range may change per application.

This code will set if:

- The ECU detects a high or low out of range analog throttle (A) input voltage.

If this code sets, the following will occur:

- For engines with only one throttle, the ECU will not read the input of the throttle and run the engine at low idle.
- For engine with multiple throttles, the ECU will not read the input of the faulty throttle, so the ECU run entirely off of the other throttle.

If this code sets:

- Diagnose other DTCs first.
- If no other DTCs are found, perform throttle sensor diagnostics.
  - **For 310G Backhoe Loaders**, see THROTTLE POSITION SENSOR TEST (S.N. XXXXXX—) in Section 9015, Group 120 of TM1885.
  - **For 310SG/315SG Backhoe Loaders**, see THROTTLE POSITION SENSOR TEST (S.N. XXXXXX—) in Section 9015, Group 120 of TM1883.
- Check for other throttle DTCs. Diagnose those first.
- Return throttle to 0% throttle position
- Some applications require key OFF/restart cycle to clear the code.

RG40854,000011D -19-28JAN02-1/1

T23 - Multi-state Throttle Input Voltage Out of Range

Multi-state Throttle Switch

- Multi-state throttle is composed of an idle switch that allows engine speed to be at high or low idle. On some applications, there is a bump up and a bump down feature. This allows for high and low idle to be controlled.
- On certain applications, an additional throttle is used in addition to the multi-state throttle. If the desired engine speed of the additional throttle is greater than the multi-state throttle, the multi-state throttle will be overridden. When the desired engine speed of the multi-state throttle is greater than the additional throttle, the multi-state throttle will be in total control.

This code will set if:

- The ECU detects a high or low out of range multi-state throttle input voltage.

If this code sets, the following will occur:

- The engine will not run if this code is active.

If this code sets:

- Check to see if DTC 000091.03 or 4 is active. Diagnose those first.
- Return throttle to 0% throttle position

RG40854,000011C –19–28JAN02–1/1

000028.03 — Throttle Voltage High

Throttle voltage is above the specification.

Diagnostic Trouble Codes (DTCs) assigned to throttles change per application. Choose the application from the list below and go to the corresponding diagnostic procedure.

Application	Diagnostic Procedure
Excavator	T11 - Excavator Throttle Reference Voltage High
OEM	T5 - Analog Throttle (B) Input High
Tractors	T17 - Analog Throttle (C) Input High

RG41221,00000CE –19–22JAN03–1/1

000028.04 — Throttle Voltage Low

Throttle voltage is below the specification.

Diagnostic Trouble Codes (DTCs) assigned to throttles change per application. Choose the application from the list below and go to the corresponding diagnostic procedure.

Application	Diagnostic Procedure
Excavator	T12 - Excavator Throttle Reference Voltage Low
Tractor	T18 - Analog Throttle (C) Input Low

RG41221,00000CF –19–22JAN03–1/1

000029.03 — Throttle Voltage High

Throttle voltage is above the specification.

Diagnostic Trouble Codes (DTCs) assigned to throttles change per application. Choose the application from the list below and go to the corresponding diagnostic procedure.

Application	Diagnostic Procedure
Excavator	T13 - Excavator Throttle Ground Voltage High
Forwarder	T5 - Analog Throttle (B) Input High
OEM	T3 - Analog Throttle (A) Input High
Skidder	T1 - Multi-state Throttle Input High
Tractor	T5 - Analog Throttle (B) Input High

RG41221,0000DD0 –19–22JAN03–1/1

000029.04 — Throttle Voltage Low

Throttle voltage is below the specification.

Diagnostic Trouble Codes (DTCs) assigned to throttles change per application. Choose the application from the list below and go to the corresponding diagnostic procedure.

Application	Diagnostic Procedure
Excavator	T14 - Excavator Throttle Ground Voltage Low
Forwarder	T6 - Analog Throttle (B) Input Low
OEM	T4 - Analog Throttle (A) Input Low
Skidder	T2 - Multi-state Throttle Input Low
Tractor	T6 - Analog Throttle (B) Input Low

RG41221,00000D1 –19–22JAN03–1/1

000029.14 — Throttle Voltage Out of Range

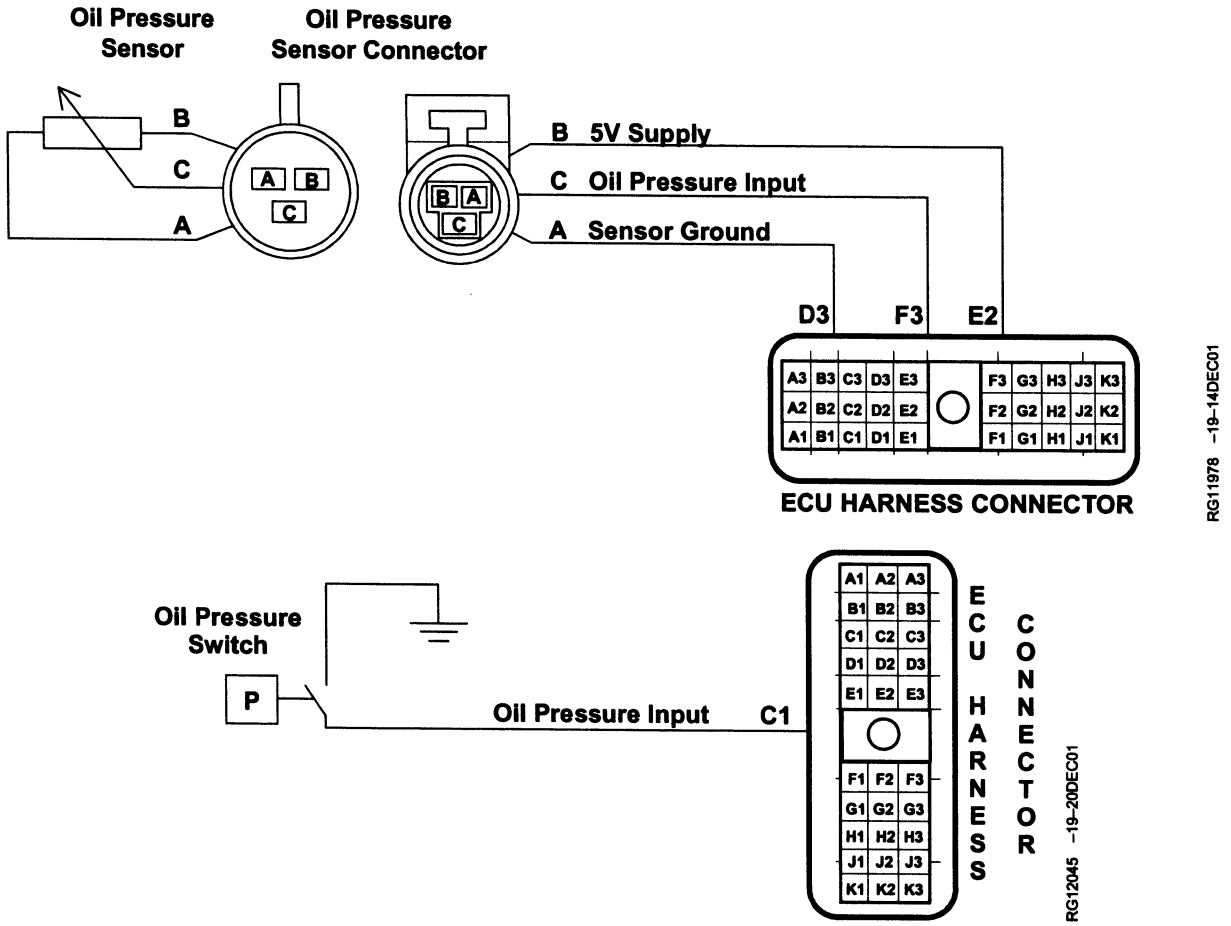
Throttle voltage is out of range.

Diagnostic Trouble Codes (DTCs) assigned to throttles change per application. Choose the application from the list below and go to the corresponding diagnostic procedure.

Application	Diagnostic Procedure
Skidder	T23 - Multi-state Throttle Input Voltage Out of Range

RG41221,00000D2 –19–22JAN03–1/1

000100.01 — Engine Oil Pressure Extremely Low



NOTE: Wiring schematics show OEM engine applications for the oil pressure sensor and Telehandler applications for the oil pressure switch. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

Oil Pressure Sensor or Switch

- The oil pressure sensor is a pressure transducer connected to the main oil galley. As engine oil pressure increases, the oil pressure sensor input voltage increases. The ECU monitors oil pressure in order to protect the engine in case of a low oil pressure condition. For further oil pressure sensor information, see MEASURING PRESSURE in Section 03, Group 140 earlier in this manual.
- The oil pressure switch is used to detect a loss of oil pressure. Oil pressure causes the contacts in the switch close when oil pressure drops below the minimum oil pressure threshold. The switch is open when the engine is not running and engine is running with sufficient oil pressure.

DTC 000100.01 will set if:

- For engines with an oil pressure sensor, the ECU senses an extremely low oil pressure.
- For engines with an oil pressure switch, the ECU senses the oil pressure switch is open after the engine is above cranking RPM for several seconds.

If DTC 000100.01 sets, the following will occur:

Continued on next page

- Engine protection is enabled. See ENGINE PROTECTION in Section 03, Group 140 of this manual.
  - With Shutdown Feature: The derate feature will go into effect when the code is set, and the engine will shut down after 30 seconds.
  - With Derate Feature: On OEM applications, the engine derates 60% per minute until the engine is running at 40% of full power. For non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

RG40854,0000088 –19–07DEC01–2/2

000100.01 — Engine Oil Pressure Extremely Low

For engines with an oil pressure sensor, the ECU senses an extremely low oil pressure.
For engines with an oil pressure switch, the ECU senses the oil pressure switch is open after the engine is above cranking RPM for several seconds.

RG40854,00000B2 –19–13DEC01–1/1

000100.01 Engine Oil Pressure Extremely Low Diagnostic Procedure

---1/1

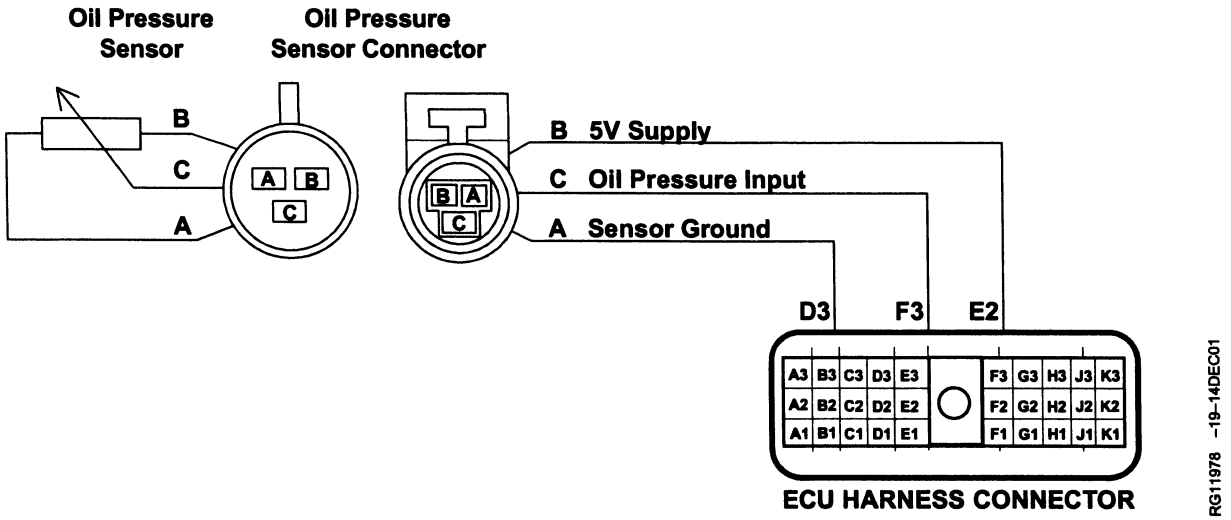
❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 000100.01 ENGINE OIL PRESSURE EXTREMELY LOW supporting information* Perform a preliminary inspection of the ECU connector, the oil pressure sensor, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

---1/1

❷ **Oil Pressure Check**	*NOTE: For wiring and theory of operation information, see DTC 000100.01 ENGINE OIL PRESSURE EXTREMELY LOW supporting information* Under the conditions where DTC 000100.01 occurs, measure engine oil pressure. See CHECK ENGINE OIL PRESSURE in Section 04, Group 150 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM 104).	**Oil pressure within specification:** Verify that oil pressure sensor or switch circuits is OK. If oil pressure sensor or switch circuits are OK, replace oil pressure sensor or switch and retest. **Oil pressure below specification:** Low oil pressure problem. See 4.5L/6.8L - L2 - ENGINE OIL PRESSURE LOW in Section 04, Group 150 of 4.5 L and 6.8 L Diesel Engines Base Engine Manual (CTM 104).

---1/1

000100.03 — Engine Oil Pressure Input Voltage High



NOTE: Wiring schematic shows OEM engine applications only. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

Oil Pressure Sensor

- The oil pressure sensor is a pressure transducer connected to the main oil galley. As engine oil pressure increases, the oil pressure sensor input voltage increases. The ECU monitors oil pressure in order to protect the engine in case of a low oil pressure condition. For further oil pressure sensor information, see MEASURING PRESSURE in Section 03, Group 140 earlier in this manual.

DTC 000100.03 will set if:

- The oil pressure input voltage exceeds the sensor's high voltage specification. The voltage is higher than what is physically possible for oil pressure.
  - For OEM applications, the high oil pressure input voltage specification is 4.5 volts.
  - For other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual for the high oil pressure input voltage specification.

If DTC 000100.03 sets, the following will occur:

- ECU uses a default oil pressure of 260 kPa (2.6 bar) (37.5 psi).
- ECU's low oil pressure engine protection feature disabled.

RG40854,0000086 –19–07DEC01–1/1

000100.03 — Engine Oil Pressure Input Voltage High

The oil pressure input voltage exceeds the sensor's high voltage specification. The voltage is higher than what is physically possible for oil pressure.

RG40854,00000B3 –19–14DEC01–1/1

000100.03 Engine Oil Pressure Input Voltage High Diagnostic Procedure

04
160
147

---1/1

❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 000100.03 ENGINE OIL PRESSURE INPUT VOLTAGE HIGH supporting information* Perform a preliminary inspection of the ECU connector, the oil pressure sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s) ---1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000100.03 ENGINE OIL PRESSURE INPUT VOLTAGE HIGH supporting information* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™. 5. Make note of any DTCs, then clear all DTCs 6. Ignition ON, engine running 7. Read Oil Pressure Input Voltage using the DST or SERVICE ADVISOR™. *NOTE: For OEM applications, the high oil pressure input voltage specification is 4.5V. For the high voltage specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**4.5 V or greater:** GO TO ❸ **Below 4.5 V:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

SERVICE ADVISOR is a trademark of Deere & Company

---1/1

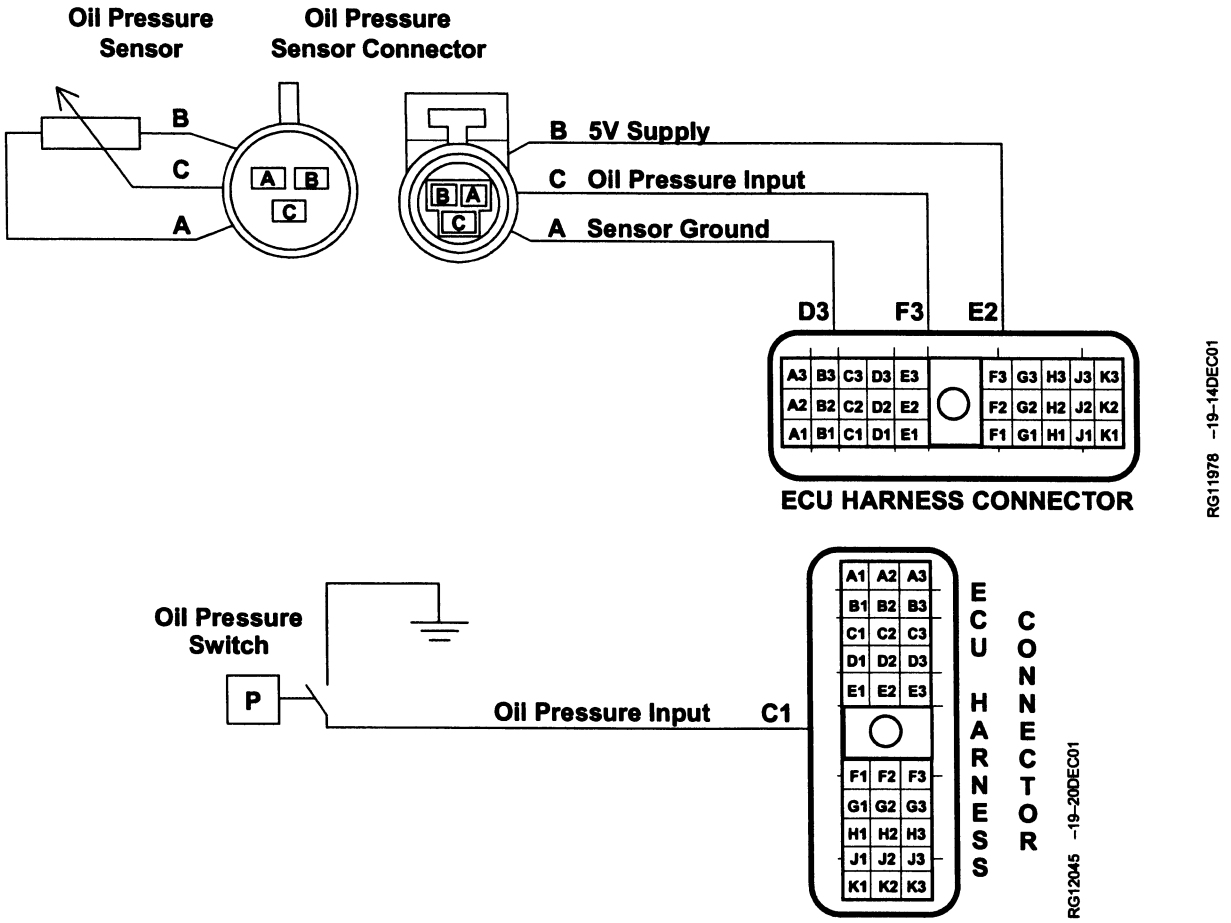
❸ **Oil Pressure Input Shorted Test**	*NOTE: For wiring and theory of operation information, see DTC 000100.03 ENGINE OIL PRESSURE INPUT VOLTAGE HIGH supporting information* 1. Ignition OFF 2. Disconnect oil pressure sensor connector 3. Ignition ON, engine OFF 4. Read Oil Pressure Input Voltage using the DST or SERVICE ADVISOR. *NOTE: For OEM applications, the low oil pressure input voltage specification is 0.3V. For the low voltage specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**0.3 V or below:** GO TO ❹ **Above 0.3 V:** Short to voltage in oil pressure sensor input circuit OR Faulty ECU

---1/1

❹ **Oil Pressure Ground Circuit Open Test**	*NOTE: For wiring and theory of operation information, see DTC 000100.03 ENGINE OIL PRESSURE INPUT VOLTAGE HIGH supporting information* Probe oil pressure sensor ground (Terminal A) in sensor harness connector with a test light connected to battery voltage.	**Light ON:** Faulty oil pressure sensor OR Faulty ECU connection OR Faulty ECU **Light OFF:** Open in oil pressure sensor ground circuit OR Faulty ECU connection OR Faulty ECU

---1/1

000100.04 — Engine Oil Pressure Input Voltage Low



NOTE: Wiring schematics show OEM engine applications for the oil pressure sensor and Telehandler applications for the oil pressure switch. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

Oil Pressure Sensor or Switch

- The oil pressure sensor is a pressure transducer connected to the main oil galley. As engine oil pressure increases, the oil pressure sensor input voltage increases. The ECU monitors oil pressure in order to protect the engine in case of a low oil pressure condition. For further oil pressure sensor information, see MEASURING PRESSURE in Section 03, Group 140 earlier in this manual.
- The oil pressure switch is used to detect a loss of oil pressure. A lack of oil pressure causes the contacts in the switch close when oil pressure drops below the minimum oil pressure threshold. The switch is open when the engine is not running and engine is running with sufficient oil pressure.

DTC 000100.04 will set if:

- For oil pressure sensors, the oil pressure input voltage drops below the sensor's low voltage specification. The voltage is lower than what is physically possible for oil pressure.
  - For OEM applications, the low oil pressure input voltage specification is 0.3 volts.

Continued on next page

– For other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual for the low oil pressure input voltage specification.
- For oil pressure switches, the oil pressure switch is closed when key is on and there is no engine speed.

If DTC 000100.04 sets, the following will occur:

- ECU uses a default oil pressure of 260 kPa (2.6 bar) (37.5 psi).
- ECU's low oil pressure engine protection feature disabled.

RG40854,0000084 –19–07DEC01–2/2

000100.04 — Engine Oil Pressure Input Voltage Low

For oil pressure sensors, the oil pressure input voltage drops below the sensor's low voltage specification.

For oil pressure switches, the oil pressure switch is closed when key is on and there is no engine speed.

RG40854,00000B4 –19–14DEC01–1/1

000100.04 Engine Oil Pressure Input Voltage Low Diagnostic Procedure

04 160 152

---1/1

❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 000100.04 ENGINE OIL PRESSURE INPUT VOLTAGE LOW supporting information* Perform a preliminary inspection of the ECU connector, the oil pressure sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

---1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000100.04 ENGINE OIL PRESSURE INPUT VOLTAGE LOW supporting information* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™. 5. Make note of any DTCs, then clear all DTCs 6. Ignition ON, engine running 7. Read DTCs using the DST or SERVICE ADVISOR™.	**000100.04 reoccurs:** GO TO ❸ **000100.04 doesn't reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

SERVICE ADVISOR is a trademark of Deere & Company

---1/1

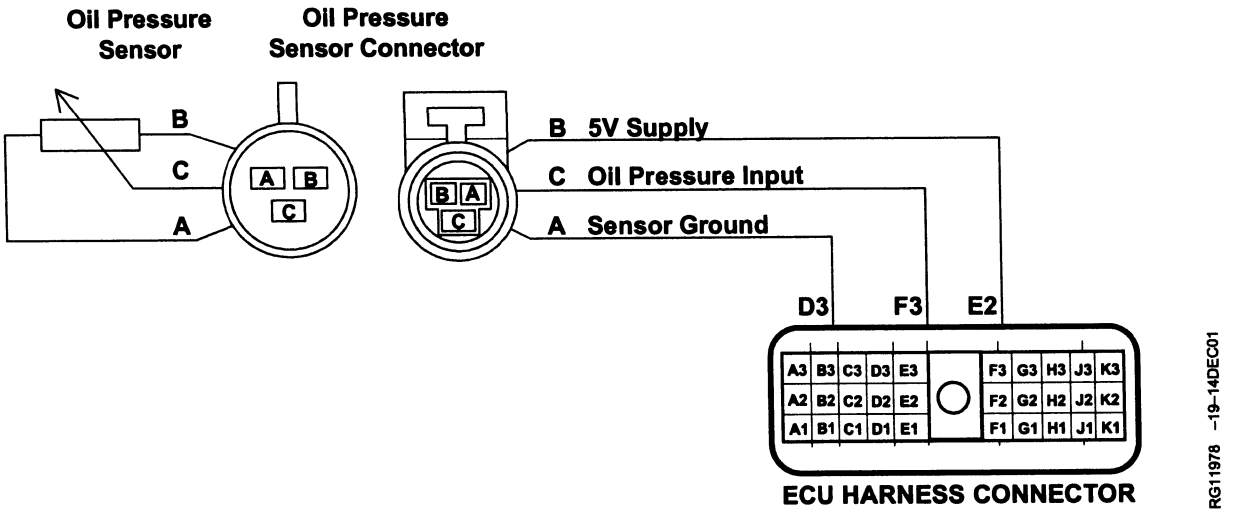
❸ **Oil Pressure Sensor Check**	*NOTE: For wiring and theory of operation information, see DTC 000100.04 ENGINE OIL PRESSURE INPUT VOLTAGE LOW supporting information.* Determine whether an oil pressure sensor or an oil pressure switch is being used.	**Oil pressure sensor being used:** GO TO ❹ **Oil pressure switch being used:** GO TO ❻ ---1/1

❹ **Oil Pressure Sensor Wiring Test**	*NOTE: For wiring and theory of operation information, see DTC 000100.04 ENGINE OIL PRESSURE INPUT VOLTAGE LOW supporting information.* 1. Ignition OFF 2. Disconnect oil pressure sensor connector 3. Install a jumper wire between oil pressure 5 V supply and oil pressure input in harness sensor connector 4. Read the Oil Pressure Input Voltage parameter using the DST or SERVICE ADVISOR. *NOTE: For OEM applications, the high oil pressure input voltage specification is 4.5V. For the high voltage specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**Below 4.5 V:** GO TO ❺ **4.5 V or greater:** Faulty oil pressure sensor connector OR Faulty oil pressure sensor ---1/1

❺ **Oil Pressure Sensor 5 V Supply Test**	*NOTE: For wiring and theory of operation information, see DTC 000100.04 ENGINE OIL PRESSURE INPUT VOLTAGE LOW supporting information.* 1. Ignition OFF 2. Remove jumper wire 3. Ignition ON, engine OFF 4. Using a multimeter, measure voltage between oil pressure 5 V supply terminal and a good chassis ground	**Between 4.0 V and 6.0 V:** Open in oil pressure input circuit OR Short to ground in oil pressure input circuit OR Faulty ECU connector OR Faulty ECU **Below 4.0 V:** Open in oil pressure 5 V supply circuit OR Short to ground in oil pressure 5 V supply circuit OR Faulty ECU connector OR Faulty ECU ---1/1

⑥ **Oil Pressure Switch Short in Wire Check**	*NOTE: For wiring and theory of operation information, see DTC 000100.04 ENGINE OIL PRESSURE INPUT VOLTAGE LOW supporting information.* 1. Ignition OFF 2. Disconnect oil pressure switch connector and ECU connector 3. Using a multimeter, measure the resistance between terminal C1 in the ECU and: • All other terminals in the ECU connector • A good ground	**All measurements greater than 2000 ohms:** Faulty oil pressure switch OR Faulty ECU **Any measurement less than 2000 ohms:** Short in oil pressure input circuit ---1/1

000100.18 — Engine Oil Pressure Moderately Low



NOTE: Wiring schematic shows OEM engine applications only. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

Oil Pressure Sensor

- The oil pressure sensor is a pressure transducer connected to the main oil galley. As engine oil pressure increases, the oil pressure sensor input voltage increases. The ECU monitors oil pressure in order to protect the engine in case of a low oil pressure condition. For further oil pressure sensor information, see MEASURING PRESSURE in Section 03, Group 140 earlier in this manual.

DTC 000100.18 will set if:

- For engines with an oil pressure sensor, the ECU senses a moderately low oil pressure.

If DTC 000100.18 sets, the following will occur:

- Engine protection is enabled. See ENGINE PROTECTION in Section 03, Group 140 of this manual.
  - With Shutdown Feature: No shutdown available for this code.
  - With Derate Feature: On OEM applications, the engine derates 40% per minute until the engine is running at 60% of full power. For non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

RG40854,0000082 –19–07DEC01–1/1

000100.18 — Engine Oil Pressure Moderately Low

For engines with an oil pressure sensor, the ECU senses a moderately low oil pressure.

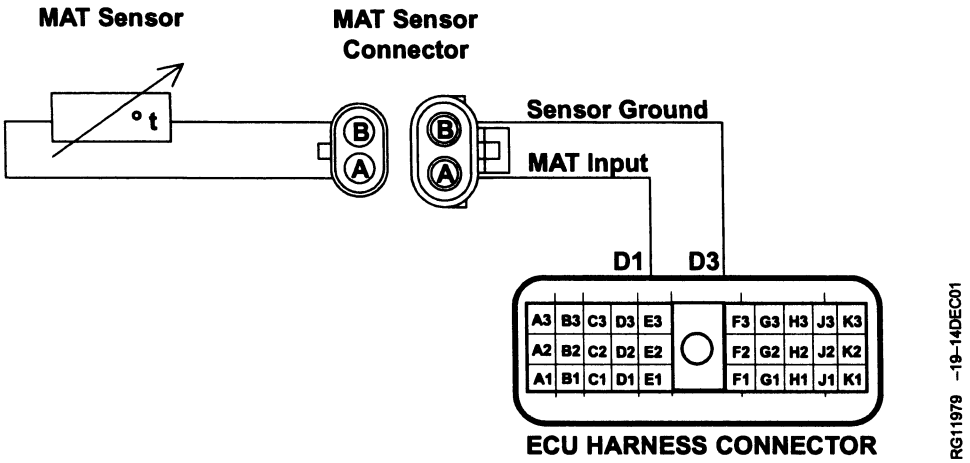
RG40854,00000B5 –19–14DEC01–1/1

000100.18 Engine Oil Pressure Moderately Low Diagnostic Procedure

–––1/1

❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 000100.18 ENGINE OIL PRESSURE MODERATELY LOW supporting information* Perform a preliminary inspection of the ECU connector, the oil pressure sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s) –––1/1
❷ **Oil Pressure Check**	*NOTE: For wiring and theory of operation information, see DTC 000100.18 ENGINE OIL PRESSURE MODERATELY LOW supporting information* Under the conditions where DTC 000100.18 occurs, measure engine oil pressure. CHECK ENGINE OIL PRESSURE in Section 04, Group 150 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM 104).	**Oil pressure within specification:** Low oil pressure problem. See 4.5L/6.8L - L2 - ENGINE OIL PRESSURE LOW in Section 04, Group 150 of 4.5 L and 6.8 L Diesel Engines Base Engine Manual (CTM 104). **Oil pressure below specification:** Verify that oil pressure sensor 5 V supply, input, and ground circuits are OK. If oil pressure sensor circuits are OK, replace oil pressure sensor and retest. –––1/1

000105.03 — Manifold Air Temperature Input Voltage High



NOTE: Wiring schematic shows OEM engine applications only. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

MAT (Manifold Air Temperature) Sensor

- The MAT sensor is a thermistor (temperature sensitive resistor) mounted in the intake manifold. The MAT sensor is used to measure the temperature of the intake air. The MAT sensor's variable resistance causes the input voltage to the ECU to vary. Higher intake air temperatures result in lower MAT input voltages to the ECU; lower temperatures result in higher voltages. For further MAT sensor information, see MEASURING TEMPERATURE in Section 03, Group 140.

DTC 000105.03 will set if:

- The manifold air temperature input voltage exceeds the sensor's high voltage specification. The voltage is higher than what is physically possible for manifold air.
  - For OEM applications, the high manifold air temperature input voltage specification is 4.9 volts.
  - For other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual for the high manifold air temperature specification.

If DTC 000105.03 sets, the following will occur:

- ECU uses a default MAT value of 60°C (140°F).
- ECU's high manifold air temperature engine protection feature disabled.

RG40854,0000080 -19-07DEC01-1/1

000105.03 — Manifold Air Temperature Input Voltage High

The manifold air temperature input voltage exceeds the sensor's high voltage specification.

RG40854,0000086 -19-18DEC01-1/1

000105.03 Manifold Air Temperature Input Voltage High Diagnostic Procedure

---1/1

❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 000105.03 MANIFOLD AIR TEMPERATURE INPUT VOLTAGE HIGH supporting information.* Perform a preliminary inspection of the ECU connector, the manifold air temperature sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

---1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000105.03 MANIFOLD AIR TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Ignition ON, engine OFF 5. Read the Manifold Air Temperature Input Voltage parameter using the DST or SERVICE ADVISOR™. *NOTE: For OEM applications, the high manifold air temperature input voltage specification is 4.9V. For the high voltage specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**4.9 V or greater:** GO TO ❸ **Below 4.9 V:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

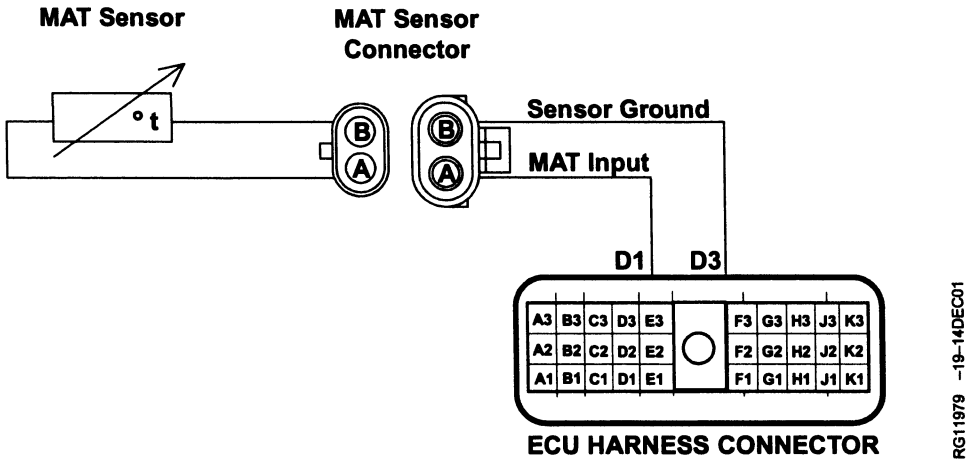
SERVICE ADVISOR is a trademark of Deere & Company

---1/1

❸ **MAT Sensor and Connector Test**	*NOTE: For wiring and theory of operation information, see DTC 000105.03 MANIFOLD AIR TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. Ignition OFF 2. Disconnect MAT sensor connector 3. Install a jumper wire between both terminals in the MAT sensor harness connector 4. Ignition ON, engine OFF 5. Read the Manifold Air Temperature Input Voltage parameter using the DST or SERVICE ADVISOR. *NOTE: For OEM applications, the low manifold air temperature input voltage specification is 0.1V. For the low voltage specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**Above 0.1 V:** GO TO ❹ **0.1 V or below:** Faulty MAT sensor connector OR Faulty MAT sensor ---1/1

❹ **MAT Sensor Open Ground Circuit Test**	*NOTE: For wiring and theory of operation information, see DTC 000105.03 MANIFOLD AIR TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. Ignition OFF 2. Remove jumper wire between both terminals. 3. Install jumper wire between MAT sensor harness connector input terminal and a good chassis ground. 4. Ignition ON, engine OFF 5. Read the Manifold Air Temperature Input Voltage parameter using the DST or SERVICE ADVISOR. *NOTE: For OEM applications, the low manifold air temperature input voltage specification is 0.1V. For the low voltage specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**Above 0.1 V:** Open in MAT sensor input circuit OR Faulty ECU connection OR Faulty ECU **0.1 V or below:** Open in MAT sensor ground circuit OR Faulty ECU connection OR Faulty ECU ---1/1

000105.04 — Manifold Air Temperature Input Voltage Low



NOTE: Wiring schematic shows OEM engine applications only. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

MAT (Manifold Air Temperature) Sensor

- The MAT sensor is a thermistor (temperature sensitive resistor) mounted in the intake manifold. The MAT sensor is used to measure the temperature of the intake air. The MAT sensor's variable resistance causes the input voltage to the ECU to vary. Higher intake air temperatures result in lower MAT input voltages to the ECU; lower temperatures result in higher voltages. For further MAT sensor information, see MEASURING TEMPERATURE in Section 03, Group 140.

DTC 000105.04 will set if:

- The manifold air temperature input voltage goes below the sensor's low voltage specification. The voltage is lower than what is physically possible manifold air temperature to achieve.
  - For OEM engine applications, the low manifold air temperature input voltage specification is 0.1 volts.
  - For other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual for the low manifold temperature input voltage specification.

If DTC 000105.04 sets, the following will occur:

- ECU uses a default MAT value of 60°C (140°F) to run engine.
- ECU's high manifold air temperature engine protection feature disabled.

RG40854,00000D7D –19–07DEC01–1/1

000105.04 — Manifold Air Temperature Input Voltage Low

The manifold air temperature input voltage goes below the sensor's low voltage specification.

RG40854,0000037 -19-18DEC01-1/1

000105.04 Manifold Air Temperature Input Voltage Low Diagnostic Procedure

---1/1

❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 000105.04 MANIFOLD AIR TEMPERATURE INPUT VOLTAGE LOW supporting information.* Perform a preliminary inspection of the ECU connector, the manifold air temperature sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

---1/1

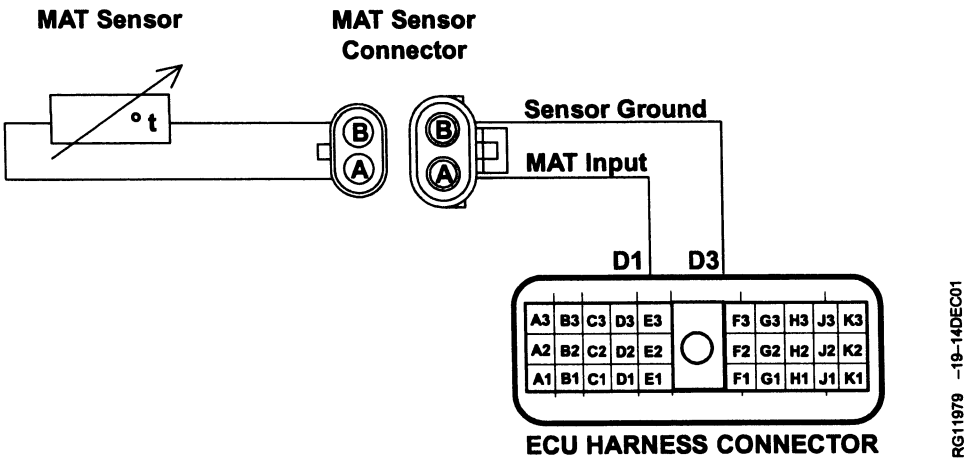
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000105.04 MANIFOLD AIR TEMPERATURE INPUT VOLTAGE LOW supporting information.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Ignition ON, engine OFF 5. Read the Manifold Air Temperature Input Voltage parameter using the DST or SERVICE ADVISOR™. *NOTE: For OEM engine applications, the low manifold air temperature input voltage specification is 0.1V. For the low voltage specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**0.1 V or below:** GO TO ❸ **Above 0.1 V:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

SERVICE ADVISOR is a trademark of Deere & Company

---1/1

❸ **MAT Sensor Test**	*NOTE: For wiring and theory of operation information, see DTC 000105.04 MANIFOLD AIR TEMPERATURE INPUT VOLTAGE LOW supporting information.* 1. Ignition OFF 2. Disconnect MAT sensor connector. 3. Ignition ON, engine OFF 4. Read the Manifold Air Temperature Input Voltage parameter using the DST or SERVICE ADVISOR. *NOTE: For OEM engine applications, the high manifold air temperature input voltage specification is 4.9V. For the high voltage specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**Below 4.9 V:** Short to ground in MAT sensor input circuit OR Faulty ECU connector OR Faulty ECU **4.9 V or greater:** Faulty MAT sensor connector OR Faulty MAT sensor ---1/1

000105.16 — Manifold Air Temperature Moderately High



NOTE: Wiring schematic shows OEM engine applications only. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

MAT (Manifold Air Temperature) Sensor

- The MAT sensor is a thermistor (temperature sensitive resistor) mounted in the intake manifold. The MAT sensor is used to measure the temperature of the intake air. The MAT sensor's variable resistance causes the input voltage to the ECU to vary. Higher intake air temperatures result in lower MAT input voltages to the ECU; lower temperatures result in higher voltages. For further MAT sensor information, see MEASURING TEMPERATURE in Section 03, Group 140.

DTC 000105.16 will set if:

- The ECU senses MAT on OEM applications above 100°C (212°F) for "H engines" and 120°C (248°F) for "T engines". For MAT specifications on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

If DTC 000105.16 sets, the following will occur:

- Engine protection is enabled. See ENGINE PROTECTION in Section 03, Group 140 of this manual.
  - With Shutdown Feature: The ECU does not use shutdown feature with this code.
  - With Derate Feature: On OEM applications, the engine derates 2% per minute until the engine is running at 80% of full power. For non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

RG40854,000007B -19-07DEC01-1/1

000105.16 — Manifold Air Temperature Moderately High

The ECU senses MAT on OEM applications above specifications.

RG40854,0000088 -19-18DEC01-1/1

000105.16 Manifold Air Temperature Moderately High Diagnostic Procedure

---1/1

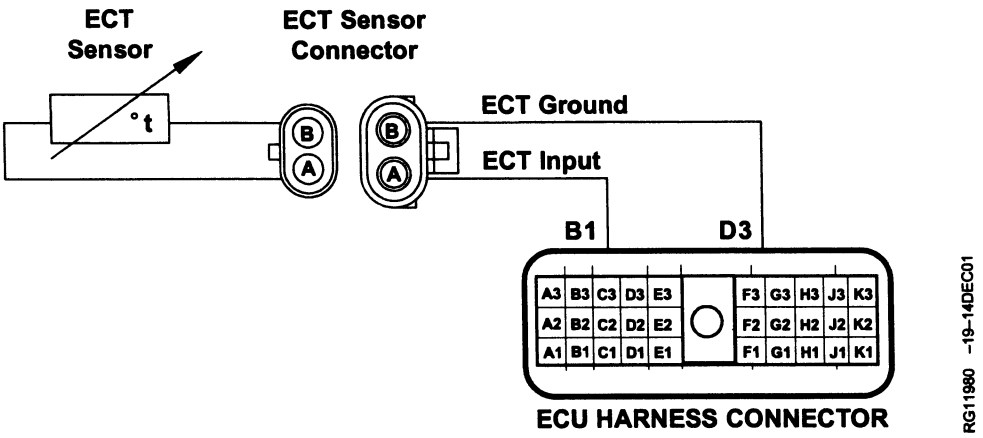
❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 000105.16 MANIFOLD AIR TEMPERATURE MODERATELY HIGH supporting information.* Perform a preliminary inspection of the ECU connector, the manifold air temperature sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

---1/1

❷ **Failures Causing High MAT Check**	*NOTE: For wiring and theory of operation information, see DTC 000105.16 MANIFOLD AIR TEMPERATURE MODERATELY HIGH supporting information.* Check the following items that can cause high intake air temperatures: • Excessively high ambient air temperature. • Restricted, dirty, or damaged charge air cooler. • Loose cooling fan belt. • Malfunctioning cooling fan. • Restricted or damaged intake air piping. • Damaged cooling fan shroud.	**Cause of high MAT located:** Repair problem and retest. **No cause of high MAT located:** Verify that MAT sensor input and ground circuits are OK. If MAT sensor circuits are OK, replace MAT sensor and retest.

---1/1

000110.00 — Engine Coolant Temperature Extremely High



NOTE: Wiring schematic shows OEM engine applications only. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

Engine Coolant Temperature (ECT) Sensor

- The ECT sensor is a thermistor (temperature sensitive resistor) mounted on the thermostat housing or in the rear of the cylinder head. It is used to measure the coolant temperature. The ECT's variable resistance causes the input voltage to the ECU to vary. Higher coolant temperatures result in lower ECT input voltages to the Engine Control Unit (ECU); lower temperatures result in higher voltages. For further ECT sensor information, see MEASURING TEMPERATURE in Section 03, Group 140 earlier in this manual.

DTC 000110.00 will set if:

- The ECU senses ECT on OEM applications above 118°C (244°F). For the most severe ECT specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

If DTC 000110.00 sets, the following will occur:

- Engine protection is enabled. See ENGINE PROTECTION in Section 03, Group 140 of this manual.
  - With Shutdown Feature: The derate feature will go into effect when the code is set, and the engine will shut down after 30 seconds.
  - With Derate Feature: On OEM applications, the engine derates 60% per minute until the engine is running at 40% of full power. For non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

RG40854,0000071 -19-06DEC01-1/1

000110.00 — Engine Coolant Temperature Extremely High

The ECU senses ECT above specification.

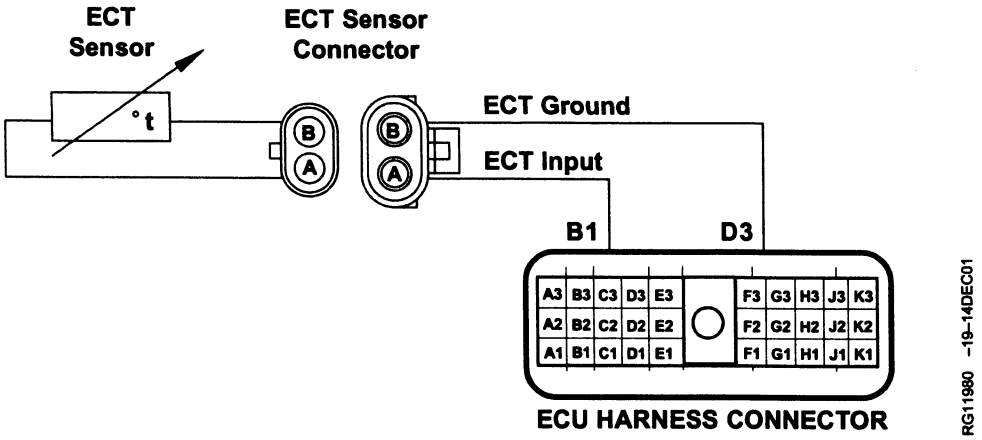
RG40854,00000B9 -19-18DEC01-1/1

000110.00 Engine Coolant Temperature Extremely High Diagnostic Procedure

---1/1

❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 000110.00 ENGINE COOLANT TEMPERATURE EXTREMELY HIGH supporting information* Perform a preliminary inspection of the ECU connector, the Engine Coolant Temperature (ECT) connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s) ---1/1
❷ **ECT Sensor and Circuit Test**	*NOTE: For wiring and theory of operation information, see DTC 000110.00 ENGINE COOLANT TEMPERATURE EXTREMELY HIGH supporting information* Under the conditions where DTC 000110.00 occurs, use a temperature gauge and verify that engine coolant temperature is above the most severe ECT specification. *NOTE: On OEM applications, the most severe ECT specification is 118°C (244°F). For the most severe ECT specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**ECT 118°C (244°F) or above:** Engine overheating problem. See 4.5L/6.8L - C1 - ENGINE COOLANT TEMPERATURE ABOVE NORMAL in Section 04, Group 150 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM 104). **ECT significantly less than 118°C (244°F):** Verify that ECT input and ground circuits are OK If both circuits are OK, replace ECT sensor and retest ---1/1

000110.03 — Engine Coolant Temperature Input Voltage High



04
160
170

NOTE: Wiring schematic shows OEM engine applications only. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

Engine Coolant Temperature (ECT) Sensor

- The ECT sensor is a thermistor (temperature sensitive resistor) mounted on the thermostat housing or in the rear of the cylinder head. It is used to measure the coolant temperature. The ECT's variable resistance causes the input voltage to the ECU to vary. Higher coolant temperatures result in lower ECT input voltages to the Engine Control Unit (ECU); lower temperatures result in higher voltages. For further ECT sensor information, see MEASURING TEMPERATURE in Section 03, Group 140 earlier in this manual.

DTC 000110.03 will set if:

- The ECT input voltage goes above the sensor's high voltage specification. This voltage corresponds to a temperature that is lower than what is physically possible for engine coolant.
  - For OEM engine applications, the high ECT input voltage specification is 4.9 volts.
  - For other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual for the high ECT input voltage specification.

If DTC 000110.03 sets, the following will occur:

- When in start mode, the ECU will default the ECT to -30°C (-22°F).
- When in running mode, the ECU will default the ECT to 90°C (194°F).
- ECU's high ECT engine protection feature disabled.

RG40854,0000072 -19-07DEC01-1/1

000110.03 — Engine Coolant Temperature Input Voltage High

The ECT input voltage goes above the sensor's high voltage specification.

RG40854,00000BA -19-19DEC01-1/1

000110.03 Engine Coolant Temperature Input Voltage High Diagnostic Procedure

---1/1

❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 000110.03 ENGINE COOLANT TEMPERATURE INPUT VOLTAGE HIGH supporting information* Perform a preliminary inspection of the ECU connector, the Engine Coolant Temperature (ECT) connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000110.03 ENGINE COOLANT TEMPERATURE INPUT VOLTAGE HIGH supporting information* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Ignition ON, engine running 5. Read the Engine Coolant Temperature Input Voltage parameter using DST or SERVICE ADVISOR™. *NOTE: On OEM applications, the high ECT input voltage specification is 4.9V. For high input voltage specifications on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**At or above 4.9 V:** GO TO ❸ **Below 4.9 V:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

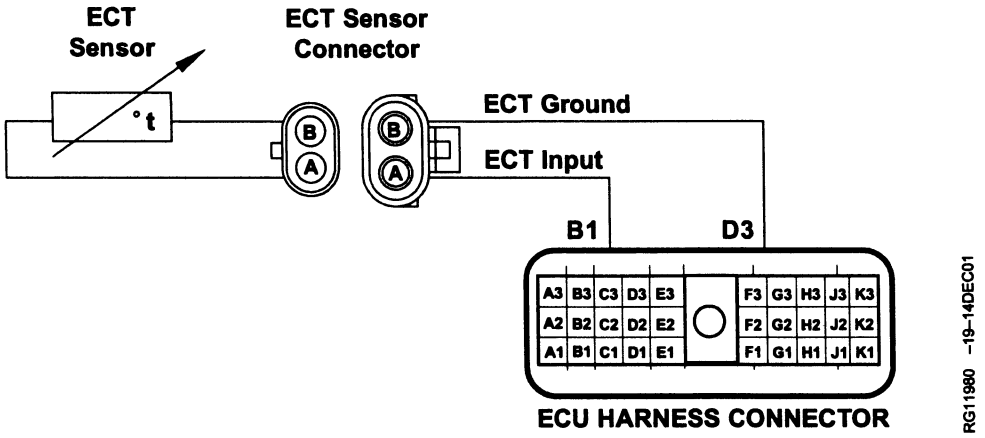
SERVICE ADVISOR is a trademark of Deere & Company

---1/1

❸ **Engine Coolant Temperature (ECT) Sensor and Connector Test**	*NOTE: For wiring and theory of operation information, see DTC 000110.03 ENGINE COOLANT TEMPERATURE INPUT VOLTAGE HIGH supporting information* 1. Ignition OFF 2. Disconnect ECT sensor connector 3. Install a jumper wire between both terminals in the ECT sensor harness connector 4. Ignition ON, engine OFF 5. Read the Engine Coolant Temperature Input Voltage parameter using the DST or SERVICE ADVISOR. *NOTE: On OEM applications, the low ECT input voltage specification is 0.1 volts and below. For ECT input voltage specifications on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**Above 0.1 V:** GO TO ❹ **At or below 0.1 V:** Faulty ECT sensor connector OR Faulty ECT sensor ---1/1

❹ **Engine Coolant Temperature (ECT) Open Ground Test**	*NOTE: For wiring and theory of operation information, see DTC 000110.03 ENGINE COOLANT TEMPERATURE INPUT VOLTAGE HIGH supporting information* 1. Ignition OFF 2. Remove jumper wire between both terminals 3. Install jumper wire between ECT sensor harness connector input terminal and a good chassis ground 4. Ignition ON, engine OFF 5. Read the Engine Coolant Temperature Input Voltage parameter using the DST or SERVICE ADVISOR. *NOTE: On OEM applications, the low ECT input voltage specification is 0.1 volts and below. For ECT input voltage specifications on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**Above 0.1 V:** Open in ECT input sensor circuit OR Faulty ECU connection OR Faulty ECU **0.1 V or below:** Open in ECT sensor ground circuit OR Faulty ECU connection OR Faulty ECU ---1/1

000110.04 — Engine Coolant Temperature Input Voltage Low



04
160
174

NOTE: Wiring schematic shows OEM engine applications only. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

Engine Coolant Temperature (ECT) Sensor

- The ECT sensor is a thermistor (temperature sensitive resistor) mounted on the thermostat housing. It is used to measure the coolant temperature. The ECT's variable resistance causes the input voltage to the ECU to vary. Higher coolant temperatures result in lower ECT input voltages to the ECU; lower temperatures result in higher voltages. For further ECT sensor information, see MEASURING TEMPERATURE in Section 03, Group 140 earlier in this manual.

DTC 000110.04 will set if:

- The ECT input voltage goes below the sensor's low voltage specification. This voltage corresponds to a temperature that is higher than what is physically possible for engine coolant.
  - For OEM engine applications, the low ECT input voltage specification is 0.1 volts.
  - For other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual for the high ECT input voltage specification.

If DTC 000110.04 sets, the following will occur:

- When in start mode, the ECU will default the ECT to -30°C (-22°F).
- When in running mode, the ECU will default the ECT to 90°C (194°F).
- ECU's high ECT engine protection feature disabled.

RG40854,0000074 –19–07DEC01–1/1

000110.04 — Engine Coolant Temperature Input Voltage Low

The ECT input voltage goes below the sensor's low voltage specification.

RG40854,0000088 -19-19DEC01-1/1

000110.04 Engine Coolant Temperature Input Voltage Low Diagnostic Procedure

---1/1

❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 000110.04 ENGINE COOLANT TEMPERATURE INPUT VOLTAGE LOW supporting information* Perform a preliminary inspection of the ECU connector, the Engine Coolant Temperature (ECT) sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

---1/1

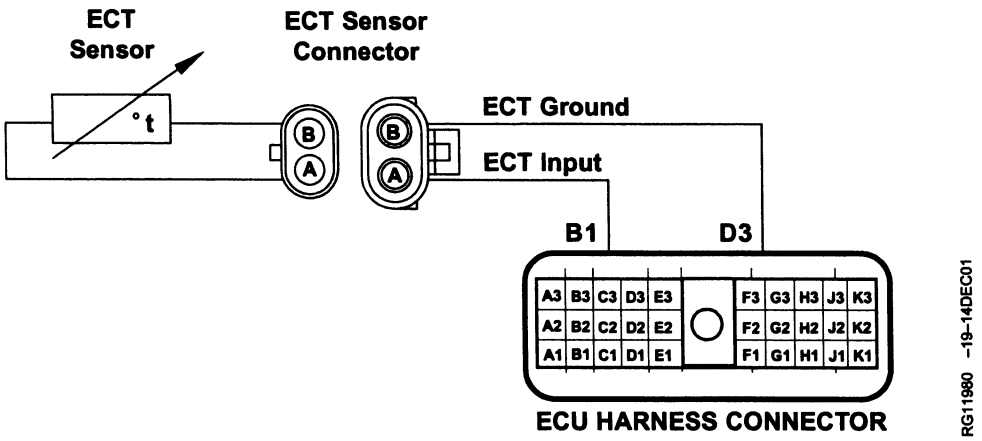
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000110.04 ENGINE COOLANT TEMPERATURE INPUT VOLTAGE LOW supporting information* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Ignition ON, engine OFF 5. Read the Engine Coolant Temperature Input Voltage parameter using DST or SERVICE ADVISOR™. *NOTE: For OEM engine applications, the low ECT input voltage specification is 0.1V. For the low voltage specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**0.1 V or below:** GO TO ❸ **Above 0.1 V:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

SERVICE ADVISOR is a trademark of Deere & Company

---1/1

❷ **Engine Coolant Temperature (ECT) Sensor Test**	*NOTE: For wiring and theory of operation information, see DTC 000110.04 ENGINE COOLANT TEMPERATURE INPUT VOLTAGE LOW supporting information* 1. Ignition OFF 2. Disconnect ECT sensor connector 3. Ignition ON 4. Read the Engine Coolant Temperature Input Voltage parameter using the DST or SERVICE ADVISOR. *NOTE: For OEM engine applications, the high ECT input voltage specification is 4.9V. For the high voltage specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**Below 4.9 V:** Short to ground in ECT sensor input circuit OR Faulty ECU **4.9 V or greater:** Faulty ECT sensor ---1/1

000110.15 — Engine Coolant Temperature High Least Severe



04
160
178

NOTE: Wiring schematic shows OEM engine applications only. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

Engine Coolant Temperature (ECT) Sensor

- The ECT sensor is a thermistor (temperature sensitive resistor) mounted on the thermostat housing or at the rear of the cylinder head. It is used to measure the coolant temperature. The ECT's variable resistance causes the input voltage to the ECU to vary. Higher coolant temperatures result in lower ECT input voltages to the ECU; lower temperatures result in higher voltages. For further ECT sensor information, see MEASURING TEMPERATURE in Section 03, Group 140 earlier in this manual.

DTC 000110.15 will set if:

- The ECU senses ECT on OEM applications above 108°C (226°F). For the least severe ECT specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

If DTC 000110.15 sets, the following will occur:

- Engine protection is enabled. See ENGINE PROTECTION in Section 03, Group 140 of this manual.
  - With Shutdown Feature: No shutdown available for this code.
  - With Derate Feature: On OEM applications, the engine derates 2% per minute until the engine is running at 95% of full power. For non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

RG40854,0000076 –19–07DEC01–1/1

000110.15 — Engine Coolant Temperature High Least Severe

The ECU senses ECT above specification.

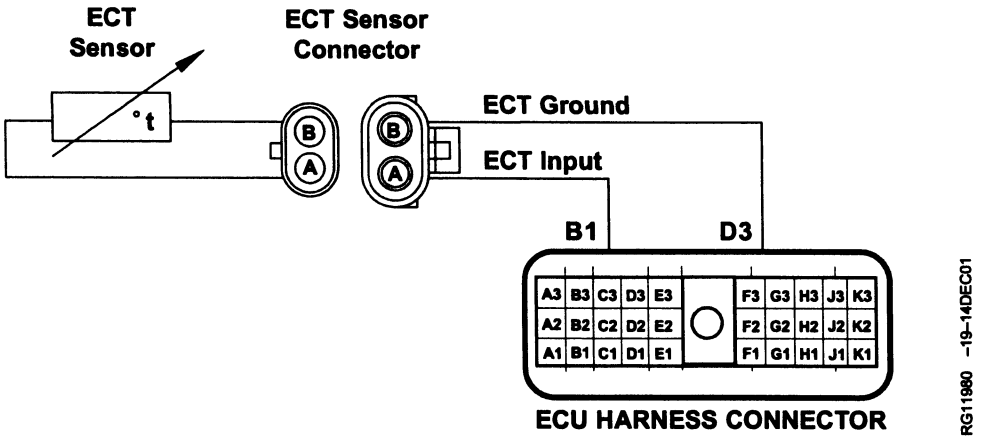
RG40854,00000BC –19–19DEC01–1/1

000110.15 Engine Coolant Temperature High Least Severe Diagnostic Procedure

–––1/1

❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 000110.15 ENGINE COOLANT TEMPERATURE HIGH LEAST SEVERE supporting information* Perform a preliminary inspection of the ECU connector, the Engine Coolant Temperature (ECT) sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)
		–––1/1
❷ **Engine Coolant Temperature (ECT) Sensor and Circuit Test**	*NOTE: For wiring and theory of operation information, see DTC 000110.15 ENGINE COOLANT TEMPERATURE HIGH LEAST SEVERE supporting information* Under the conditions where DTC 000110.15 occurs, using a temperature gauge, verify that engine coolant temperature is above the least severe ECT specification. *NOTE: On OEM applications, the least severe ECT specification is 108°C (226°F). For the least severe ECT specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**ECT above 108°C (226°F):** Engine overheating problem. See 4.5L/6.8L - C1 - ENGINE COOLANT TEMPERATURE ABOVE NORMAL in Section 04, Group 150 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM 104). **ECT significantly less than 108°C (226°F):** Verify that ECT sensor input and ground circuits are OK. If ECT sensor circuits are OK, replace ECT sensor and retest
		–––1/1

000110.16 — Engine Coolant Temperature Moderately High



NOTE: Wiring schematic shows OEM engine applications only. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

Engine Coolant Temperature (ECT) Sensor

- The ECT sensor is a thermistor (temperature sensitive resistor) mounted on the thermostat housing or at the rear of the cylinder head. It is used to measure the coolant temperature. The ECT's variable resistance causes the input voltage to the ECU to vary. Higher coolant temperatures result in lower ECT input voltages to the ECU; lower temperatures result in higher voltages. For further ECT sensor information, see MEASURING TEMPERATURE in Section 03, Group 140 earlier in this manual.

DTC 000110.16 will set if:

- The ECU senses ECT on OEM applications above 113°C (235°F). For the moderately ECT specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

If DTC 000110.16 sets, the following will occur:

- Engine protection is enabled. See ENGINE PROTECTION in Section 03, Group 140 of this manual.
  - With Shutdown Feature: No shutdown available for this code.
  - With Derate Feature: On OEM applications, the engine derates 40% per minute until the engine is running at 60% of full power. For non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

RG40854,0000079 –19–07DEC01–1/1

000110.16 — Engine Coolant Temperature Moderately High

The ECU senses ECT above specification.

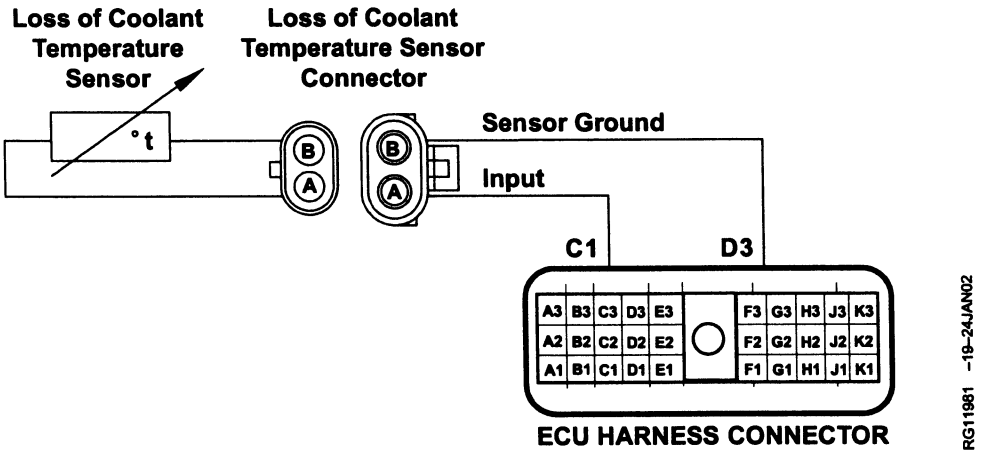
RG40854,00000BD –19–19DEC01–1/1

000110.16 Engine Coolant Temperature Moderately High Diagnostic Procedure

---1/1

❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 000110.16 ENGINE COOLANT TEMPERATURE MODERATELY HIGH supporting information* Perform a preliminary inspection of the ECU connector, the Engine Coolant Temperature (ECT) sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s) ---1/1
❷ **Engine Coolant Temperature (ECT) Sensor and Circuit Test**	*NOTE: For wiring and theory of operation information, see DTC 000110.16 ENGINE COOLANT TEMPERATURE MODERATELY HIGH supporting information* Under the conditions where DTC 000110.16 occurs, using a temperature gauge, verify that engine coolant temperature is above 113°C (235°F). *NOTE: On OEM applications, the moderately high ECT specification is 113°C (235°F). For the moderately high ECT specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**ECT above 113°C (235°F):** Engine overheating problem. See 4.5L/6.8L - C1 - ENGINE COOLANT TEMPERATURE ABOVE NORMAL in Section 04, Group 150 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM 104). **ECT significantly less than 113°C (235°F):** Verify that ECT sensor input and ground circuits are OK. If ECT sensor circuits are OK, replace ECT sensor and retest ---1/1

000111.00 — Loss of Coolant Temperature Extremely High



Loss of Coolant Temperature Sensor

- The loss of coolant temperature sensor is a thermistor (temperature sensitive resistor) mounted in the rear of the cylinder head. It is used to measure the coolant temperature to detect whether there is a loss of coolant. The sensor's variable resistance causes the input voltage to the ECU to vary. Higher coolant temperatures result in lower loss of coolant temperature input voltages to the ECU; lower temperatures result in higher voltages. For further loss of coolant temperature sensor information, see MEASURING TEMPERATURE in Section 03, Group 140 earlier in this manual.

DTC 000111.00 will set if:

- The ECU senses a coolant temperature above 124°C (255°F).

If DTC 000111.00 sets, the following will occur:

- The engine derates 20% per minute until the engine is running at 60% of full power. If the temperature goes below 124°C (255°F), the engine will regain power at 20% per minute.

RG40854,00000BF -19-06DEC01-1/1

000111.00 — Loss of Coolant Temperature Extremely High

The ECU senses a coolant temperature above specification.

RG40854,00000BE –19–19DEC01–1/1

000111.00 Loss of Coolant Temperature Extremely High Diagnostic Procedure

---1/1

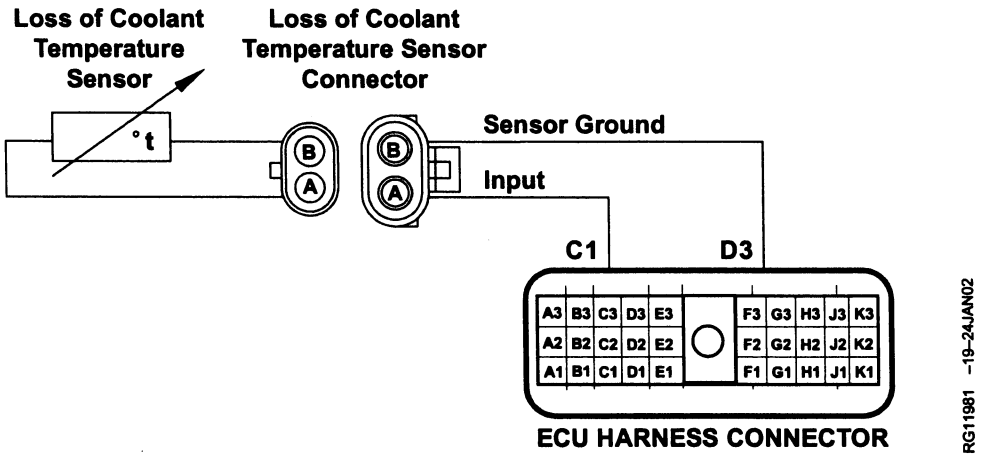
❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 000111.00 LOSS OF COOLANT TEMPERATURE EXTREMELY HIGH supporting information* Perform a preliminary inspection of the ECU connector, the loss of coolant temperature sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

---1/1

❷ **Loss of Coolant Temperature Sensor and Circuit Test**	*NOTE: For wiring and theory of operation information, see DTC 000111.00 LOSS OF COOLANT TEMPERATURE EXTREMELY HIGH supporting information* Under the conditions where DTC 000111.00 occurs, using a temperature gauge, verify that loss of coolant temperature is above 124°C (255°F).	**Significantly less than 124°C (255°F):** Verify that loss of coolant temperature sensor input and ground circuits are OK. If loss of coolant temperature sensor circuits are OK, replace loss of coolant temperature sensor and retest **Temperature above 124°C (255°F):** Engine overheating problem. See 4.5L/6.8L - C1 - ENGINE COOLANT TEMPERATURE ABOVE NORMAL in Section 04, Group 150 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM 104).

---1/1

000111.03 — Loss of Coolant Temperature Input Voltage High



Loss of Coolant Temperature Sensor

- The loss of coolant temperature sensor is a thermistor (temperature sensitive resistor) mounted in the rear of the cylinder head. It is used to measure the coolant temperature to detect whether there is a loss of coolant. The sensor's variable resistance causes the input voltage to the ECU to vary. Higher coolant temperatures result in lower loss of coolant temperature input voltages to the ECU; lower temperatures result in higher voltages. For further loss of coolant temperature sensor information, see MEASURING TEMPERATURE in Section 03, Group 140 earlier in this manual.

DTC 000111.03 will set if:

- The loss of coolant temperature input voltage exceeds 4.9 volts. This voltage corresponds to a temperature that is lower than what is physically possible for engine coolant.

If DTC 000111.03 sets, the following will occur:

- ECU's high loss of coolant temperature engine protection feature disabled.

RG40854,00000C0 –19–19DEC01–1/1

000111.03 — Loss of Coolant Temperature Input Voltage High

The loss of coolant temperature input voltage exceeds 4.9 volts. This voltage corresponds to a temperature that is lower than what is physically possible for engine coolant.

RG40854,00000C1 –19–19DEC01–1/1

000111.03 Loss of Coolant Temperature Input Voltage High Diagnostic Procedure

---1/1

❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 000111.03 LOSS OF COOLANT TEMPERATURE INPUT VOLTAGE HIGH supporting information* Perform a preliminary inspection of the ECU connector, the loss of coolant temperature sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

---1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000111.03 LOSS OF COOLANT TEMPERATURE INPUT VOLTAGE HIGH supporting information* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™. 5. Make note of any DTCs, then clear all DTCs 6. Ignition ON, engine running 7. Read DTCs using the DST or SERVICE ADVISOR™.	**000111.03 reoccurs:** GO TO ❸ **000111.03 does not reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

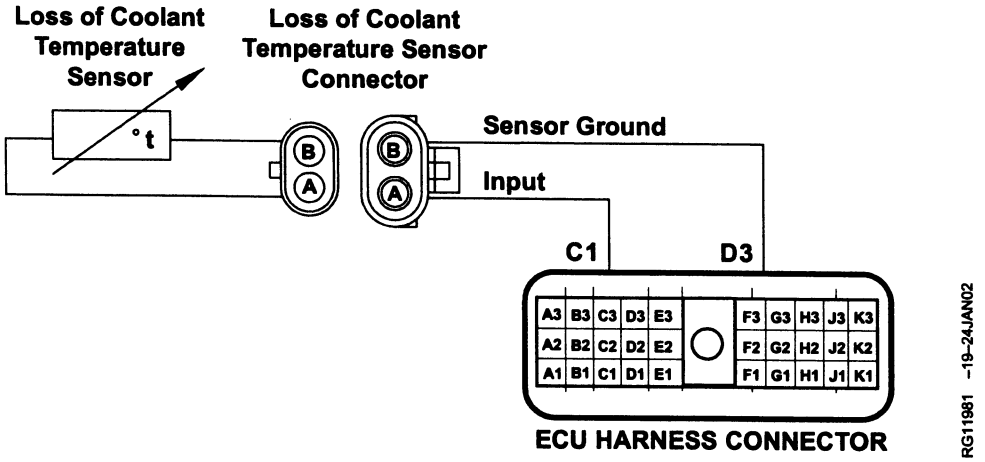
SERVICE ADVISOR is a trademark of Deere & Company

---1/1

❸ **Loss of Coolant Temperature Sensor and Connector Test**	*NOTE: For wiring and theory of operation information, see DTC 000111.03 LOSS OF COOLANT TEMPERATURE INPUT VOLTAGE HIGH supporting information* 1. Ignition OFF 2. Disconnect loss of coolant temperature sensor connector 3. Install a jumper wire between both terminals in the loss of coolant temperature sensor harness connector 4. Ignition ON, engine OFF 5. Read DTCs using the DST or SERVICE ADVISOR.	**000111.03 reoccurs:** GO TO ❹ **000111.04 occurs:** Faulty loss of coolant temperature sensor connector OR Faulty loss of coolant temperature sensor ---1/1

❹ **Loss of Coolant Temperature Open Ground Test**	*NOTE: For wiring and theory of operation information, see DTC 000111.03 LOSS OF COOLANT TEMPERATURE INPUT VOLTAGE HIGH supporting information* 1. Ignition OFF 2. Remove jumper wire between both terminals 3. Install jumper wire between loss of coolant temperature sensor harness connector input terminal and a good chassis ground 4. Ignition ON, engine OFF 5. Using a multimeter, measure voltage between loss of coolant temperature input (5V supply) terminal and a good chassis ground.	**Between 4.0 V and 6.0 V:** Open in loss of coolant temperature input sensor circuit OR Faulty ECU connection OR Faulty ECU **Below 4.0 V:** Open in loss of coolant temperature sensor ground circuit OR Faulty ECU connection OR Faulty ECU ---1/1

000111.04 — Loss of Coolant Temperature Input Voltage Low



Loss of Coolant Temperature Sensor

- The loss of coolant temperature sensor is a thermistor (temperature sensitive resistor) mounted in the rear of the cylinder head. It is used to measure the coolant temperature to detect whether there is a loss of coolant. The sensor's variable resistance causes the input voltage to the ECU to vary. Higher coolant temperatures result in lower loss of coolant temperature input voltages to the ECU; lower temperatures result in higher voltages. For further loss of coolant temperature sensor information, see MEASURING TEMPERATURE in Section 03, Group 140 earlier in this manual.

DTC 000111.04 will set if:

- The loss of coolant temperature input voltage drops below 0.1 volts. This voltage corresponds to a temperature that is higher than what is physically possible for engine coolant.

If DTC 000111.04 sets, the following will occur:

- ECU's high loss of coolant temperature engine protection feature disabled.

RG40854,0000089 -19-06DEC01-1/1

000111.04 — Loss of Coolant Temperature Input Voltage Low

The loss of coolant temperature input voltage drops below 0.1 volts. This voltage corresponds to a temperature that is higher than what is physically possible for engine coolant.

RG40854,00000C2 –19–19DEC01–1/1

000111.04 Loss of Coolant Temperature Input Voltage Low Diagnostic Procedure

04
160
191

---1/1

❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 000111.04 LOSS OF COOLANT TEMPERATURE INPUT VOLTAGE LOW supporting information* Perform a preliminary inspection of the ECU connector, the loss of coolant temperature sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

---1/1

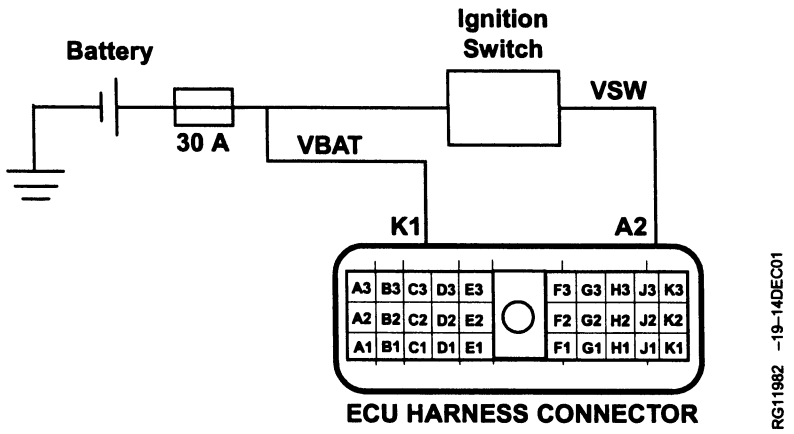
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000111.04 LOSS OF COOLANT TEMPERATURE INPUT VOLTAGE LOW supporting information* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™. 5. Make note of any DTCs, then clear all DTCs 6. Ignition ON, engine OFF 7. Read DTCs using DST or SERVICE ADVISOR™.	**000111.04 reoccurs:** GO TO ❸ **000111.04 does not reoccur:** Problem is intermittent. If no other codes are present, INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

SERVICE ADVISOR is a trademark of Deere & Company

---1/1

❷ **Loss of Coolant Temperature Sensor Test**	*NOTE: For wiring and theory of operation information, DTC 000111.04 LOSS OF COOLANT TEMPERATURE INPUT VOLTAGE LOW supporting information* 1. Ignition OFF 2. Disconnect loss of coolant temperature sensor connector 3. Ignition ON 4. Read DTCs using DST or SERVICE ADVISOR.	**000111.04 reoccurs:** Short to ground in loss of coolant temperature sensor input circuit OR Faulty ECU **000111.03 occurs:** Faulty loss of coolant temperature sensor ---1/1

000158.17 — ECU Power Down Error



04
160
194

NOTE: Wiring schematic shows OEM engine applications only. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

DTC 000158.17 will set if:

- ECU detects voltage is on the switched voltage input wire to the ECU.

If DTC 000158.17 sets, the following will occur:

- Vehicle battery may be drained because ECU will not power down.

RG40854,0000056 –19–06DEC01–1/1

000158.17 — ECU Power Down Error

ECU detects voltage is on the switched voltage input wire to the ECU.

RG40854,0000109 –19–15JAN02–1/1

000158.17 ECU Power Down Error Diagnostic Procedure

04
160
195

---1/1

❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 000158.17 ECU POWER DOWN ERROR supporting information.* Perform a preliminary inspection of the ECU connector, ignition power circuit, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

---1/1

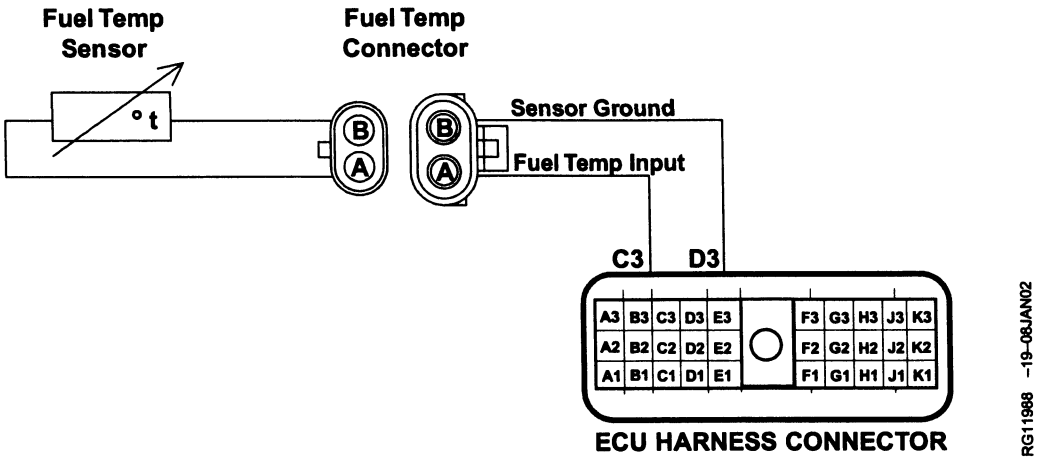
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000158.17 ECU POWER DOWN ERROR supporting information.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™. 5. Make note of any DTCs, then clear all DTCs 6. Cycle ignition OFF for 10 seconds, then back ON 7. Read DTCs using the DST or SERVICE ADVISOR™.	**000158.17 reoccurs:** GO TO ❸ **000158.17 does not reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

SERVICE ADVISOR is a trademark of Deere & Company

---1/1

❸ **Wiring Test**	*NOTE: For wiring and theory of operation information, see DTC 000158.17 ECU POWER DOWN ERROR supporting information.* 1. Ignition OFF 2. Disconnect the ECU connector 3. Ignition ON, engine OFF 4. Using a multimeter, measure voltage between terminal A2 the ECU wiring harness connector and a good chassis ground.	**Measurement above 3.0 V:** Faulty ignition switch circuit OR ECU key-on power supply shorted to voltage OR Faulty ignition switch **Measurement below 3.0 V:** Faulty ECU connection OR Faulty ECU ---1/1

000174.03 — Fuel Temperature Input Voltage High



NOTE: Wiring schematic shows OEM engine applications only. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

Fuel Temperature Sensor

- The fuel temperature sensor is a thermistor (temperature sensitive resistor) located on the injection pump fuel outlet housing. The fuel temperature sensor's variable resistance causes the input voltage to the ECU to vary. Higher fuel temperatures result in lower fuel temperature input voltages to the ECU; lower temperatures result in higher voltages. The ECU uses the fuel temperature sensor input to adjust the fuel delivery for the variations in fuel density caused by varying fuel temperatures. For more fuel temperature sensor information, see MEASURING TEMPERATURE in Section 03, Group 140 of this manual.

DTC 000174.03 will set if:

- The fuel temperature input voltage goes above the sensor's high voltage specification. This voltage corresponds to a temperature that is lower than what is physically possible for fuel temperature.
  - For OEM engine applications, the high fuel temperature input voltage specification is 4.9 volts.
  - For other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual for the high fuel temperature input voltage specification.

If DTC 000174.03 sets, the following will occur:

- The ECU will use a "limp-home" fuel temperature value of -20°C (-4°F) during cranking, and 40°C (104°F) during running.
- Engine power will be slightly derated.

RG40854,0000062 –19–06DEC01–1/1

000174.03 — Fuel Temperature Input Voltage High

The fuel temperature input voltage goes above the sensor's high voltage specification.

RG40854,00000F3 –19–07JAN02–1/1

000174.03 Fuel Temperature Input Voltage High Diagnostic Procedure

---1/1

❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring, theory of operation, and sensor location information, see DTC 000174.03 FUEL TEMPERATURE INPUT VOLTAGE HIGH supporting information.* Perform a preliminary inspection of the ECU connector, the fuel temperature sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

---1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring, theory of operation, and sensor location information, see DTC 000174.03 FUEL TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Ignition ON, engine running 5. Read the Fuel Temperature Input Voltage parameter using the DST or SERVICE ADVISOR™. *NOTE: On OEM applications, the high fuel temperature input voltage specification is 4.9 volts and above. For fuel temperature input voltage specifications on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**4.9 V or greater:** GO TO ❸ **Below 4.9 V:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

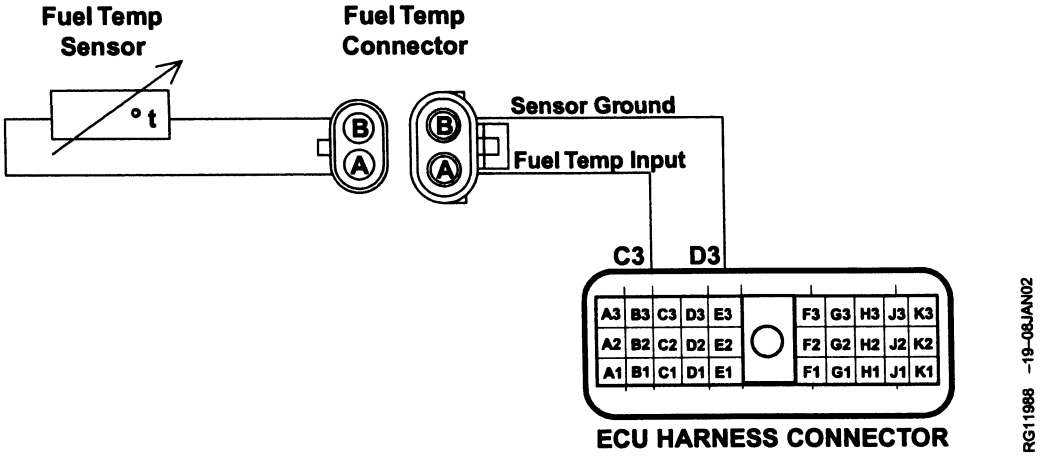
SERVICE ADVISOR is a trademark of Deere & Company

---1/1

❸ **Fuel Temperature Sensor and Connector Test**	*NOTE: For wiring, theory of operation, and sensor location information, see DTC 000174.03 FUEL TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. Ignition OFF 2. Disconnect fuel temperature sensor connector 3. Install a jumper wire between both terminals in the fuel temperature sensor harness connector 4. Ignition ON, engine OFF 5. Read the Fuel Temperature Input Voltage parameter using the DST or SERVICE ADVISOR. *NOTE: On OEM applications, the low fuel temperature input voltage specification is 0.1 volts and below. For fuel temperature input voltage specifications on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**Above 0.1 V:** GO TO ❹ **At or below 0.1 V:** Faulty fuel temperature sensor connector OR Faulty fuel temperature sensor ---1/1

❹ **Fuel Temperature Open Ground Test**	*NOTE: For wiring, theory of operation, and sensor location information, see DTC 000174.03 FUEL TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. Ignition OFF 2. Remove jumper wire between both terminals 3. Install jumper wire between fuel temperature sensor harness connector input terminal and a good chassis ground 4. Ignition ON, engine OFF 5. Read the Fuel Temperature Input Voltage parameter using the DST or SERVICE ADVISOR. *NOTE: On OEM applications, the low fuel temperature input voltage specification is 0.1 volts and below. For fuel temperature input voltage specifications on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**Above 0.1 V:** Open in fuel temperature input sensor circuit OR Faulty ECU connection OR Faulty ECU **0.1 V or below:** Open in fuel temperature sensor ground circuit OR Faulty ECU connection OR Faulty ECU ---1/1

000174.04 — Fuel Temperature Input Voltage Low



NOTE: Wiring schematic shows OEM engine applications only. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

Fuel Temperature Sensor

- The fuel temperature sensor is a thermistor (temperature sensitive resistor) located on the injection pump fuel outlet housing. The fuel temperature sensor's variable resistance causes the input voltage to the ECU to vary. Higher fuel temperatures result in lower fuel temperature input voltages to the ECU; lower temperatures result in higher voltages. The ECU uses the fuel temperature sensor input to adjust the fuel delivery for the variations in fuel density caused by varying fuel temperatures. For more fuel temperature sensor information, see MEASURING TEMPERATURE in Section 03, Group 140 of this manual.

DTC 000174.04 will set if:

- The fuel temperature input voltage goes above the sensor's low voltage specification. This voltage corresponds to a temperature that is higher than what is physically possible for fuel temperature.
  - For OEM engine applications, the low fuel temperature input voltage specification is 0.1 volts.
  - For other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual for the low fuel temperature input voltage specification.

If DTC 000174.04 sets, the following will occur:

- The ECU will use a "limp-home" fuel temperature value of -20°C (-4°F) during cranking, and 40°C (104°F) during running.
- Engine power will be slightly derated.

RG40854,0000054 -19-06DEC01-1/1

000174.04 — Fuel Temperature Input Voltage Low

The fuel temperature input voltage goes above the sensor's low voltage specification.

RG40854,00000F2 –19–07JAN02–1/1

000174.04 Fuel Temperature Input Voltage Low Diagnostic Procedure

---1/1

❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring, theory of operation, and sensor location information, see DTC 000174.04 FUEL TEMPERATURE INPUT VOLTAGE LOW supporting information.* Perform a preliminary inspection of the ECU connector, the fuel temperature sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

---1/1

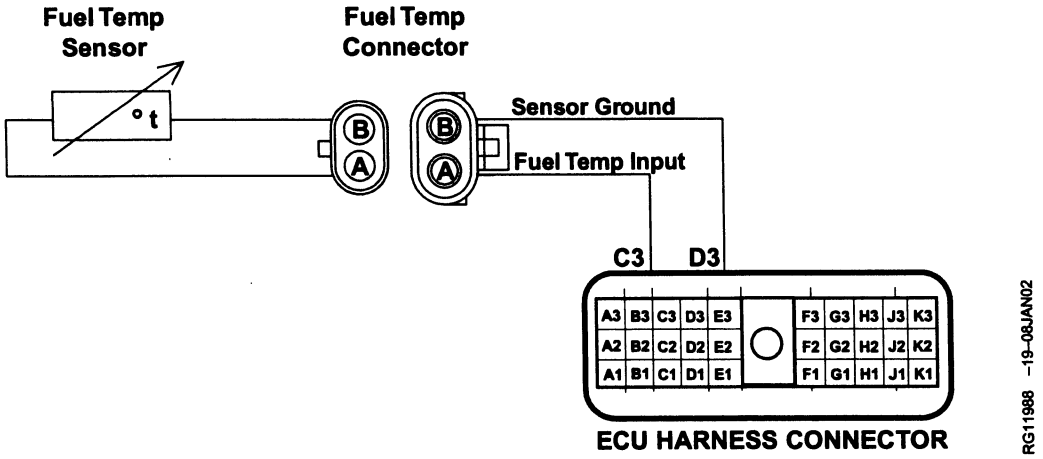
❷ **Intermittent Fault Test**	*NOTE: For wiring, theory of operation, and sensor location information, see DTC 000174.04 FUEL TEMPERATURE INPUT VOLTAGE LOW supporting information.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Ignition ON, engine OFF 5. Read the Fuel Temperature Input Voltage parameter using the DST or SERVICE ADVISOR™ *NOTE: For OEM engine applications, the low fuel temperature input voltage specification is 0.1V. For the low voltage specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**0.1 V or below:** GO TO ❸ **Above 0.1 V:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

SERVICE ADVISOR is a trademark of Deere & Company

---1/1

❸ **Fuel Temperature Sensor Test**	*NOTE: For wiring, theory of operation, and sensor location information, seeDTC 000174.04 FUEL TEMPERATURE INPUT VOLTAGE LOW supporting information.* 1. Ignition OFF 2. Disconnect fuel temperature sensor connector 3. Ignition ON 4. Read the Fuel Temperature Input Voltage parameter using the DST or SERVICE ADVISOR. *NOTE: For OEM engine applications, the high fuel temperature input voltage specification is 4.9V. For the high voltage specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**Below 4.9 V:** Short to ground in fuel temperature sensor input circuit OR Faulty ECU **4.9 V or greater:** Faulty fuel temperature sensor ---1/1

000174.16 — Fuel Temperature High Moderately Severe



NOTE: Wiring schematic shows OEM engine applications only. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

Fuel Temperature Sensor

- The fuel temperature sensor is a thermistor (temperature sensitive resistor) located on the injection pump fuel outlet housing. The fuel temperature sensor's variable resistance causes the input voltage to the ECU to vary. Higher fuel temperatures result in lower fuel temperature input voltages to the ECU; lower temperatures result in higher voltages. The ECU uses the fuel temperature sensor input to adjust the fuel delivery for the variations in fuel density caused by varying fuel temperatures. For more fuel temperature sensor information, see MEASURING TEMPERATURE in Section 03, Group 140 of this manual.

DTC 000174.16 will set if:

- The ECU senses fuel temperature on OEM applications above 120°C (248°F). For fuel temperature specifications on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

If DTC 000174.16 sets, the following will occur:

- Engine protection is enabled. See ENGINE PROTECTION in Section 03, Group 140 of this manual.
  - With Shutdown Feature: No shutdown available for this code.
  - With Derate Feature: On OEM applications, the engine derates 2% per minute until the engine is running at 80% of full power. For non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

RG40854,0000061 –19–06DEC01–1/1

000174.16 — Fuel Temperature High Moderately Severe

The ECU senses fuel temperature above specifications.

RG40854,00000F5 –19–08JAN02–1/1

000174.16 Fuel Temperature High Moderately Severe Diagnostic Procedure

---1/1

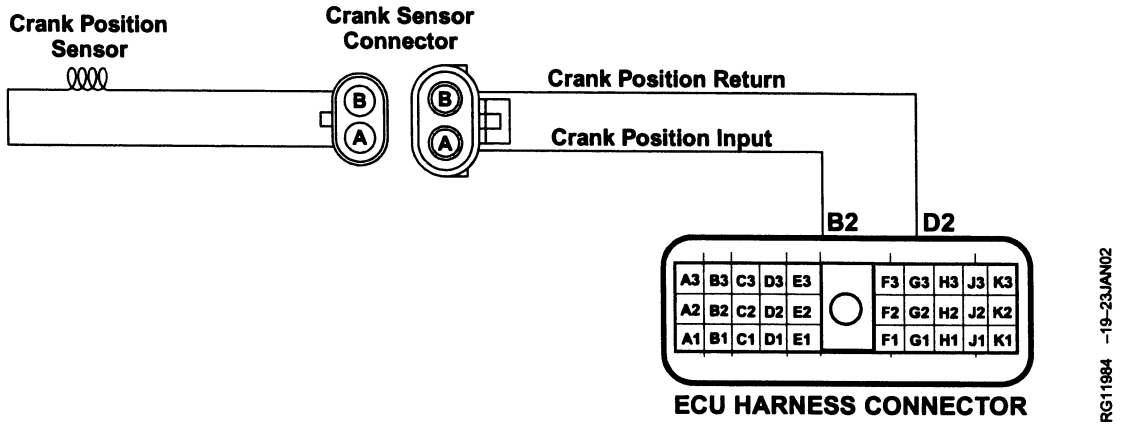
❶ **DTC 000174.16 Preliminary Check**	Before using this diagnostic procedure: 1. Ensure that the fuel level in the fuel tank is not extremely low 2. Ensure that fuel cooler is clean	**No problems found:** GO TO ❷ **Problem found:** Repair and retest ---1/1
❷ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 000174.16 FUEL TEMPERATURE HIGH MODERATELY SEVERE supporting information* Perform a preliminary inspection of the ECU connector, the fuel temperature sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❸ **Faulty connection(s):** Repair faulty connection(s) ---1/1

❸ **Fuel Supply Pressure Check**	*NOTE: For wiring and theory of operation information, see DTC 000174.16 FUEL TEMPERATURE HIGH MODERATELY SEVERE supporting information* Determine fuel supply pressure. See CHECK FUEL SUPPLY PRESSURE in Section 04, Group 150 of this manual.	**Fuel pressure within specification:** GO TO ❹ **Fuel pressure below specification:** Determine cause of low fuel supply pressure. See F1 - FUEL SUPPLY SYSTEM CHECK DIAGNOSTIC PROCEDURE in Section 04, Group 150 of this manual. Repair and retest. ---1/1

04
160
212

❹ **Fuel Return Lines Restriction Check**	*NOTE: For wiring and theory of operation information, see DTC 000174.16 FUEL TEMPERATURE HIGH MODERATELY SEVERE supporting information* Check return fuel lines for restriction between fuel tank and: • Overflow valve on injection pump • Fuel leak off line at injection nozzles	**Fuel return lines NOT restricted:** Faulty fuel cooler OR Faulty injection pump **Restriction found in either fuel return line:** Determine the cause of restriction Repair and retest ---1/1

000190.00 — Engine Overspeed Extreme



04 160 214

The ECU detects that engine speed exceeds 3400 rpm.

NOTE: Wiring schematic shows OEM engine applications only. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

Crank Position Sensor

- The crank position sensor is located on the front of the crankshaft, behind the pressed-on crank gear. It is an inductive type pickup sensor that detects teeth on the crank timing wheel. The ECU uses the crank position input to determine engine speed and precise piston position in relation to the firing order. The crank timing wheel is composed of 46 evenly spaced teeth and 2 missing teeth. The missing teeth help the ECU to determine Top-Dead-Center (TDC).

DTC 000190.00 will set if:

- The ECU detects that engine speed exceeds 3400 rpm.

If DTC 000190.00 sets, the following will occur:

- The ECU shuts fuel off until engine speed is below 2800 rpm.

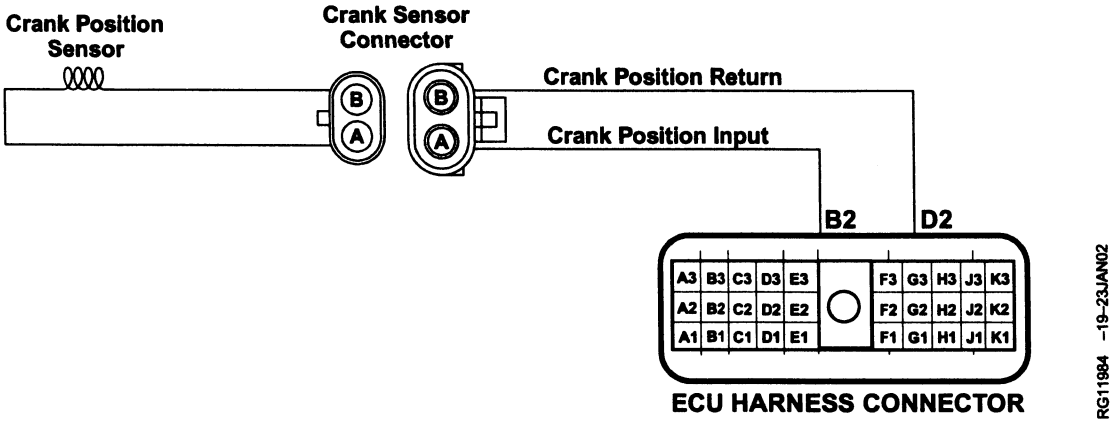
If DTC 000190.00 sets:

- With DTC 000190.00, there may or not be a problem with the electronic control system. Using the DST or SERVICE ADVISOR™, monitor DTCs on the active code display parameter. To find DTC list, see LISTING OF DIAGNOSTIC TROUBLE CODES (DTCS) ON ECU earlier in this Group. If there are other codes, go to the appropriate diagnostic procedure.
- If there are no other stored or active DTCs, clear DTC 000190.00 and monitor codes to see if DTC 000190.00 reoccurs.

SERVICE ADVISOR is a trademark of Deere & Company

RG40854,0000148 –19–11FEB02–1/1

000190.16 — Engine Overspeed Moderate



The ECU detects that engine speed is higher than 3000 rpm.

NOTE: Wiring schematic shows OEM engine applications only. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

Crank Position Sensor

- The crank position sensor is located on the front of the crankshaft, behind the pressed-on crank gear. It is an inductive type pickup sensor that detects teeth on the crank timing wheel. The ECU uses the crank position input to determine engine speed and precise piston position in relation to the firing order. The crank timing wheel is composed of 46 evenly spaced teeth and 2 missing teeth. The missing teeth help the ECU to determine Top-Dead-Center (TDC).

DTC 000190.16 will set if:

- The ECU detects that engine speed is higher than 3000 rpm.

If DTC 000190.16 sets, the following will occur:

- The ECU shuts fuel off until engine speed is below 2800 rpm.

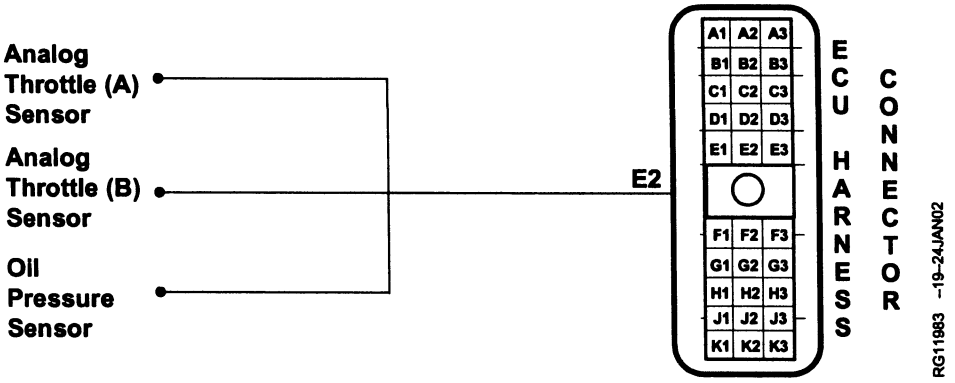
If DTC 000190.16 sets:

- With DTC 000190.16, there may or not be a problem with the electronic control system. Using the DST or SERVICE ADVISOR™, monitor DTCs on the active code display parameter. To find DTC list, see LISTING OF DIAGNOSTIC TROUBLE CODES (DTCS) ON ECU earlier in this Group. If there are other codes, go to the appropriate diagnostic procedure.
- If there are no other stored or active DTCs, clear DTC 000190.16 and monitor codes to see if DTC 000190.16 reoccurs.

SERVICE ADVISOR is a trademark of Deere & Company

RG40854,0000149 -19-11FEB02-1/1

000620.03 — Sensor Supply Voltage High



NOTE: Wiring schematic shows OEM engine applications only. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

Sensor Supply Voltage

- The ECU supplies voltage to a few different sensors depending on the application. The ECU monitors the drop in voltage that the sensor causes and compares that drop to preprogrammed values in the ECU's memory to determine the value of the parameter the sensor was measuring. In addition, the ECU monitors the exact voltage on the 5 volt supply circuit in order to ensure accurate readings.

DTC 000620.03 will set if:

- The ECU detects a voltage that is higher than 5.5 volts on the ECU 5 volt sensor supply circuit.

If DTC 000620.03 sets, the following will occur:

- The ECU will use default values for the sensors that use sensor supply input voltage.

RG40854,000005C –19–06DEC01–1/1

000620.03 — Sensor Supply Voltage High

The ECU detects a voltage that is higher than 5.5 volts on the ECU 5 volt sensor supply circuit.

RG40854,00000F6 –19–08JAN02–1/1

000620.03 Sensor Supply Voltage High Diagnostic Procedure

04 160 217

---1/1

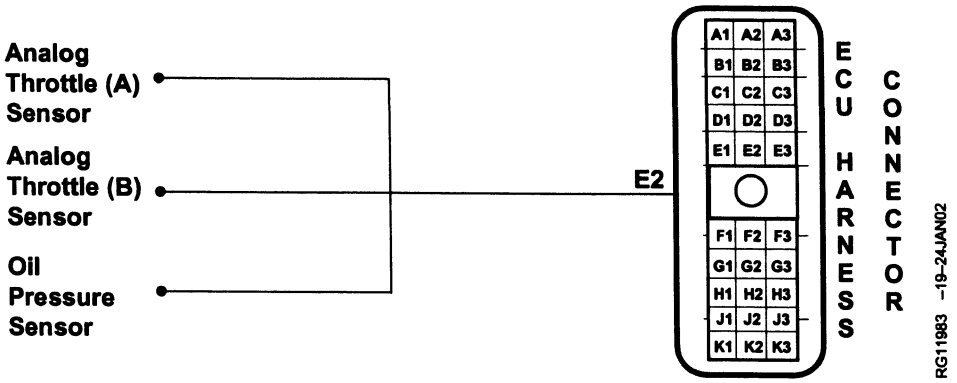
❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 000620.03 SENSOR SUPPLY VOLTAGE HIGH supporting information.* Perform a preliminary inspection of the ECU connector. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000620.03 SENSOR SUPPLY VOLTAGE HIGH supporting information.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™. 5. Make note of any DTCs, then clear all DTCs 6. Ignition ON, engine OFF 7. Read DTCs using the DST or SERVICE ADVISOR™.	**000620.03 reoccurs:** GO TO ❸ **000620.03 does not reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

SERVICE ADVISOR is a trademark of Deere & Company

---1/1

❷ **Sensor Supply Wire Check for Short**	*NOTE: For wiring and theory of operation information, see DTC 000620.03 SENSOR SUPPLY VOLTAGE HIGH supporting information.* 1. Ignition OFF 2. Disconnect ECU connector 3. Using multimeter, measure resistance between terminal E2 in the harness end of the ECU connector and all other terminals in the harness end of the ECU connector.	**Greater than 20,000 ohms:** Faulty ECU connector OR Faulty ECU **Less than 20,000 ohms:** Short to voltage in sensor supply wire ---1/1

000620.04 — Sensor Supply Voltage Low



04 160 220

NOTE: Wiring schematic shows OEM engine applications only. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

Sensor Supply Voltage

- The ECU supplies voltage to a few different sensors depending on the application. The ECU monitors the drop in voltage that the sensor causes and compares that drop to preprogrammed values in the ECU's memory to determine the value of the parameter the sensor was measuring. In addition, the ECU monitors the exact voltage on the 5 volt supply circuit in order to ensure accurate readings.

DTC 000620.04 will set if:

- The ECU detects a voltage that is lower than 4.44 volts on the ECU 5 volt sensor supply circuit.

If DTC 000620.04 sets, the following will occur:

- The ECU will use default values for the sensors that use sensor supply input voltage.

RG40854,000005E –19–06DEC01–1/1

000620.04 — Sensor Supply Voltage Low

The ECU detects a voltage that is lower than 4.44 volts on the ECU 5 volt sensor supply circuit.

RG40854,00000F7 –19–08JAN02–1/1

000620.04 Sensor Supply Voltage Low Diagnostic Procedure

---1/1

❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 000620.04 SENSOR SUPPLY VOLTAGE LOW supporting information.* Perform a preliminary inspection of the ECU connector. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

---1/1

❷ **Sensor Check**	*NOTE: For wiring and theory of operation information, see DTC 000620.04 SENSOR SUPPLY VOLTAGE LOW supporting information.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™. 5. Make note of any DTCs, then clear all DTCs 6. Ignition OFF 7. Disconnect all sensors that receive their 5V supply from terminal E2 of the ECU 8. Ignition ON, engine running 9. Read DTCs using the DST or SERVICE ADVISOR™.	**000620.04 reoccurs:** GO TO ❹ **000620.04 does not reoccur:** GO TO ❸

SERVICE ADVISOR is a trademark of Deere & Company

---1/1

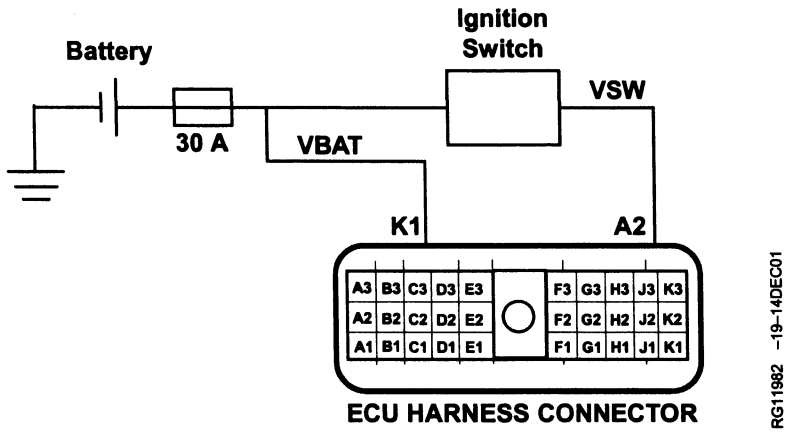
❸ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000620.04 SENSOR SUPPLY VOLTAGE LOW supporting information.* 1. Ignition ON, engine OFF 2. While reconnecting each sensor one at a time, monitor DTCs using the DST or SERVICE ADVISOR.	**000620.04 reoccurs:** Faulty sensor Replace and retest **000620.04 does not reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

---1/1

❹ **Sensor Supply Short to Ground Check**	*NOTE: For wiring and theory of operation information, see DTC 000620.04 SENSOR SUPPLY VOLTAGE LOW supporting information.* 1. Ignition OFF 2. Disconnect the ECU connector 3. Using a multimeter, measure resistance between terminal D3 in the harness end of the ECU connector and: • A good chassis ground • Terminal J2 in the harness end of the ECU connector	**Greater than 20,000 ohms:** Faulty ECU connector OR Faulty ECU **Less than 20,000 ohms:** Sensor 5 volt supply circuit shorted to ground

---1/1

000627.04 — ECU Unswitched Power Missing



04 160 224

DTC 000627.04 will set if:

- The ECU does not detect battery voltage.

If DTC 000627.04 sets, the following will occur:

- The engine will not start or run.

RG40854,000014B –19–13FEB02–1/1

000627.04 — ECU Unswitched Power Missing

The ECU does not detect battery voltage.

RG40854,000014C –19–13FEB02–1/1

000627.04 ECU Unswitched Power Missing Diagnostic Procedure

04 160 225

---1/1

❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 000620.04 SENSOR SUPPLY VOLTAGE LOW supporting information.* Perform a preliminary inspection of the ECU connector. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s) ---1/1
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000627.04 ECU UNSWITCHED POWER MISSING supporting information.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™. 5. Make notes of any DTCs, then clear all DTCs 6. Ignition ON, engine running 7. Read DTCs using the DST or SERVICE ADVISOR™.	**000627.04 reoccurs:** GO TO ❸ **000627.04 does not reoccur:** Problem is intermittent. If no other codes are present, seeINTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

SERVICE ADVISOR is a trademark of Deere & Company

---1/1

❸ **ECU and ECU Connector Test**	*NOTE: For wiring and theory of operation information, see DTC 000627.04 ECU UNSWITCHED POWER MISSING supporting information.* 1. Ignition OFF 2. Disconnect ECU connector 3. Using a multimeter, measure voltage between a good chassis ground and terminal K1	**Voltage is substantially less than battery voltage:** GO TO ❹ **Voltages are at or near battery voltage on both terminals:** Faulty ECU connection OR Faulty ECU ---1/1

❹ **Battery Voltage Check**	*NOTE: For wiring and theory of operation information, see DTC 000627.04 ECU UNSWITCHED POWER MISSING supporting information.* Using a multimeter, measure battery voltage at the battery terminals.	**Voltage within specification for battery:** Faulty ECU power supply fuse OR Faulty ECU connection OR Open or short in ECU power circuit **Voltage substantially less than battery voltage:** Faulty battery or charging system ---1/1

000629.13 — ECU Error

The ECU detects an internal problem.

DTC 000629.13 will set if:

- The ECU detects an internal problem.

If DTC 000629.13 sets, the following will occur:

- The engine will not start or run.

RG40854,000003C –19–06DEC01–1/1

000629.13 ECU Error Diagnostic Procedure

04
160
228

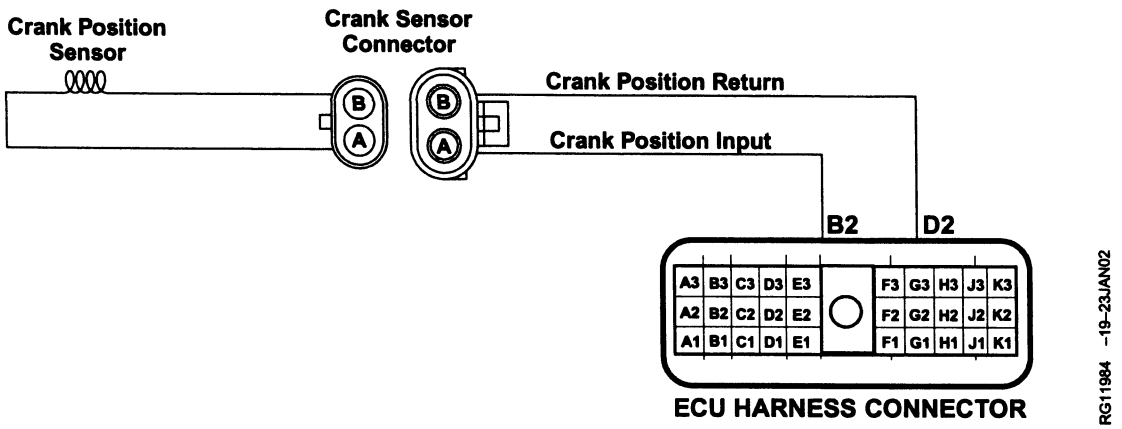
---1/1

❶ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000629.13 ECU ERROR supporting information.* 1. Verify that controllers on vehicle are in correct location and connected to the correct wiring harness 2. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group. 3. Ignition ON, engine OFF 4. Start the ECU communication software 5. Read DTCs using DST or SERVICE ADVISOR™. 6. Make note of any DTCs, then clear all DTCs 7. Ignition ON, engine running or cranking for 15 seconds 8. Read DTCs using DST or SERVICE ADVISOR™.	**000629.13 reoccurs:** Faulty ECU **000629.13 does not reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

SERVICE ADVISOR is a trademark of Deere & Company

---1/1

000637.02 — Crank Position Input Noise



04 160 230

NOTE: Wiring schematic shows OEM engine applications only. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

Crank Position Sensor

- The crank position sensor is located on the front of the crankshaft, behind the pressed-on crank gear. It is an inductive type pickup sensor that detects teeth on the crank timing wheel. The ECU uses the crank position input to determine engine speed and precise piston position in relation to the firing order. The crank timing wheel is composed of 46 evenly spaced teeth and 2 missing teeth. The missing teeth help the ECU to determine Top-Dead-Center (TDC).

DTC 000637.02 will set if:

- The ECU detects excessive noise (extra pulses) on the crank position input.

If DTC 000637.02 sets, the following will occur:

- Engine probably will not run

RG40854,0000038 –19–06DEC01–1/1

000637.02 — Crank Position Input Noise

The ECU detects excessive noise (extra pulses) on the crank position input.

RG40854,00000F8 –19–08JAN02–1/1

000637.02 Crank Position Input Noise Diagnostic Procedure

---1/1

❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 000637.02 CRANK POSITION INPUT NOISE supporting information.* Perform a preliminary inspection of the ECU connector, the crank position sensor connector, and any other connector. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

---1/1

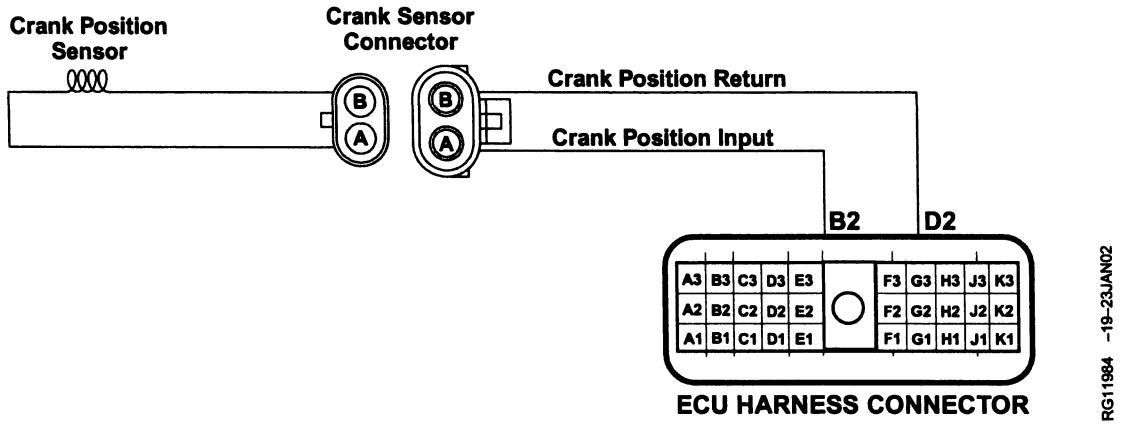
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000637.02 CRANK POSITION INPUT NOISE supporting information.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™. 5. Make note of all DTCs, then clear all DTCs 6. Warm engine 7. Ignition ON, engine running 8. Read DTCs using DST or SERVICE ADVISOR™.	**000637.02 reoccurs:** GO TO ❸ **000637.02 does not reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

SERVICE ADVISOR is a trademark of Deere & Company

---1/1

❷ **Crank Signal Noise Test**	*NOTE: For wiring and theory of operation information, see DTC 000637.02 CRANK POSITION INPUT NOISE supporting information.* 1. 000637.02 is most likely caused by radiated or conducted electrical "noise" from some part of the machine. This problem may be caused by loose electrical ground or power connections anywhere on the machine. Things to check: • All harness connectors • Alternator connections • Chassis ground connections, battery ground connection • Corrosion, dirt, or paint can cause intermittent and "noisy" connections • Check the wiring for intermittent open and short circuits; particularly the crank sensor wiring • Check wiring for proper pin location in the crank sensor and ECU connectors 2. Other possible causes of 000637.02: • Electromagnetic interference (EMI) from an incorrectly installed 2-way radio • Interference from some radar source • Possible broken teeth on the crankshaft timing ring	---1/1

000637.10 — Crank Position Input Pattern Error



04
160
234

NOTE: Wiring schematic shows OEM engine applications only. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

Crank Position Sensor

- The crank position sensor is located on the front of the crankshaft, behind the pressed-on crank gear. It is an inductive type pickup sensor that detects teeth on the crank timing wheel. The ECU uses the crank position input to determine engine speed and precise piston position in relation to the firing order. The crank timing wheel is composed of 46 evenly spaced teeth and 2 missing teeth. The missing teeth help the ECU to determine Top-Dead-Center (TDC).

DTC 000637.10 will set if:

- The ECU detects an improper pattern on the crank position input.

If DTC 000637.10 sets, the following will occur:

- Engine probably will not run.

RG40854,00000BA –19–06DEC01–1/1

000637.10 — Crank Position Input Pattern Error

The ECU detects an improper pattern on the crank position input.

RG40854,000010A –19–15JAN02–1/1

000637.10 Crank Position Input Pattern Error Diagnostic Procedure

04 160 235

---1/1

❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 000637.10 CRANK POSITION INPUT PATTERN ERROR supporting information.* Perform a preliminary inspection of the ECU connector, the crank position sensor connector, and any other connector. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000637.10 CRANK POSITION INPUT PATTERN ERROR supporting information.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™. 5. Make note of any DTCs, then clear all DTCs 6. Ignition ON, engine running 7. Read DTCs using DST or SERVICE ADVISOR™.	**000637.10 reoccurs:** GO TO ❸ **000637.10 does not reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

SERVICE ADVISOR is a trademark of Deere & Company

---1/1

❸ **Crank Position Sensor Test**	*NOTE: For wiring and theory of operation information, see DTC 000637.10 CRANK POSITION INPUT PATTERN ERROR supporting information.* 1. Ignition OFF 2. Disconnect crank position sensor connector 3. Using a multimeter, measure resistance between both terminals of the crank position sensor.	**Between 2500 and 3500 ohms:** GO TO ❹ **Below 2500 ohms or above 3500 ohms:** Faulty crank position sensor ---1/1

❹ **Open in Crank Sensor Input and Return Check**	*NOTE: For wiring and theory of operation information, see DTC 000637.10 CRANK POSITION INPUT PATTERN ERROR supporting information.* 1. Ignition OFF 2. Disconnect crank position sensor connector 3. Disconnect ECU connector 4. Using a multimeter, measure resistance between: • Terminal A of the crank position sensor harness connector and terminal B2 in the harness end of the ECU connector • Terminal B of the crank position sensor harness connector and terminal D2 in the harness end of the ECU connector	**Both measurements 5 ohms or less:** GO TO ❺ **Either measurement greater than 5 ohms:** Open in crank position sensor input wire OR Open in crank position sensor return wire OR Terminals A and B in the crank position sensor harness connector possibly inverted ---1/1

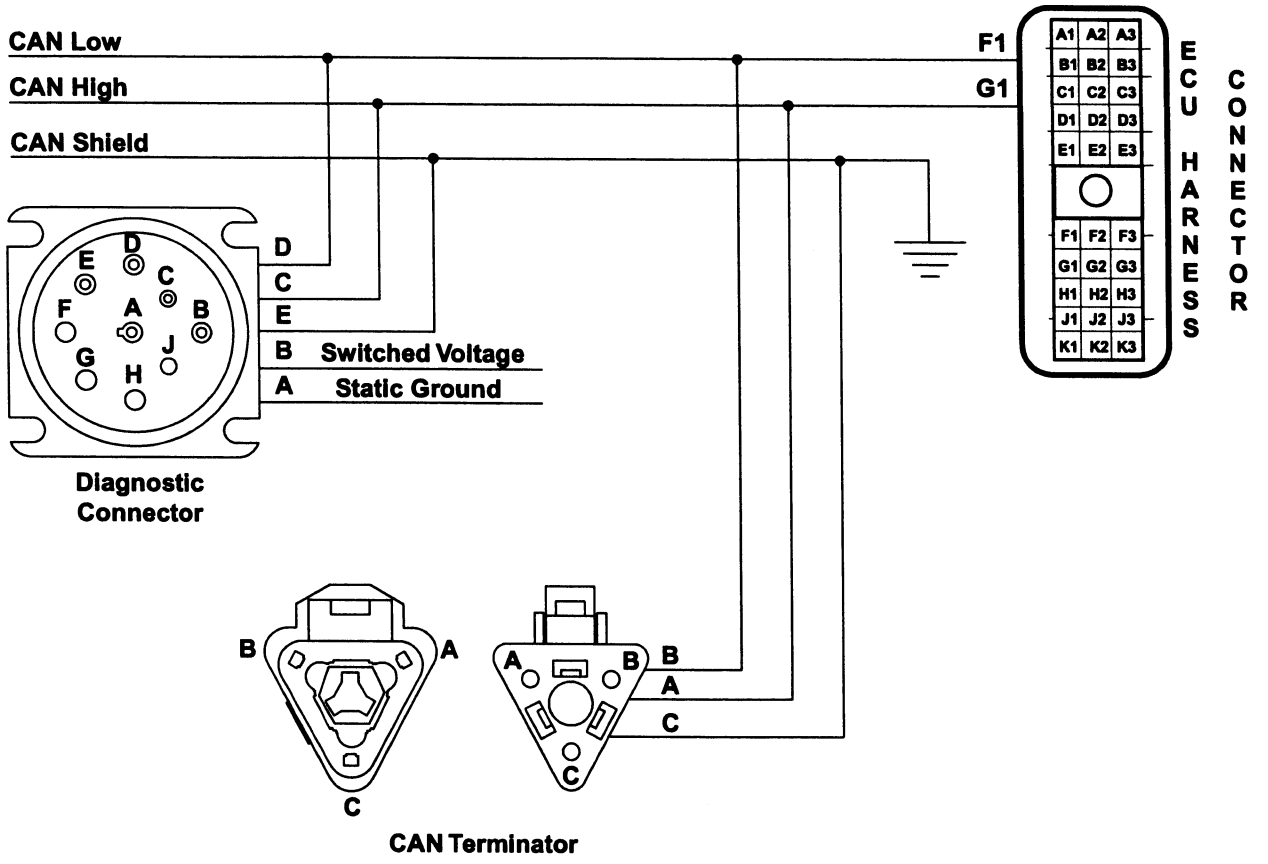
❺ **Crank Sensor Input Wiring Check**	*NOTE: For wiring and theory of operation information, see DTC 000637.10 CRANK POSITION INPUT PATTERN ERROR supporting information.* 1. Ignition OFF 2. Crank position sensor connector and ECU connector still disconnected 3. Using a multimeter measure resistance between terminal B2 in the harness end of the ECU connector and the following: • A good ground • All other terminals in both ECU connectors	**All measurements greater than 2000 ohms:** GO TO ❻ **Any measurement less than 2000 ohms:** Faulty crank position sensor input wiring harness ---1/1

❻ Crank Sensor Return Wiring Check	*NOTE: For wiring and theory of operation information, see DTC 000637.10 CRANK POSITION INPUT PATTERN ERROR supporting information.* 1. Ignition OFF 2. Crank position sensor connector and ECU connector still disconnected 3. Using a multimeter measure resistance between terminal D2 in the harness end of the ECU connector and the following: • A good ground • All other terminals in both ECU connectors	**All measurements greater than 2000 ohms:** GO TO ❼ **Any measurement less than 2000 ohms:** Faulty crank position sensor return wiring harness ---1/1

❼ Crank Sensor and Timing Wheel Check	*NOTE: For wiring and theory of operation information, see DTC 000637.10 CRANK POSITION INPUT PATTERN ERROR supporting information.* 1. Remove crank position sensor from injection pump 2. Remove crank position sensor 3. Inspect sensor for cracks, corrosion, or any foreign material on the end of the sensor 4. Inspect the crank timing wheel notches for burrs or chips	**All components OK:** GO TO ❽ **Fault found in a component:** Repair or replace component as needed ---1/1

❽ Gear Timing Check	*NOTE: For wiring and theory of operation information, see DTC 000637.10 CRANK POSITION INPUT PATTERN ERROR supporting information.* 1. Ignition OFF 2. Remove timing cover 3. Check timing between camshaft, crankshaft, and injection pump gears. See INSTALL CAMSHAFT in Group 050 of 4.5 & 6.8 L Diesel Engines Base Engine Manual (CTM 104).	**All gears in time:** Faulty crank position sensor connector OR Faulty ECU connector OR Faulty ECU **One or more gears out of time:** Make necessary adjustments to ensure correct timing. See INSTALL CAMSHAFT in Section 02, Group 050 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM 104). ---1/1

000639.13 — CAN Bus Error



NOTE: Wiring schematic shows OEM engine applications only. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

Controller Area Network (CAN)

- CAN is the network in which the individual controllers on a machine communicate with each other. The number of controllers communicating on CAN depends on the application. On some applications, the ECU is the only controller on CAN; on other applications, there are many controllers on CAN.

DTC 000639.13 will set if:

- The ECU detects a problem communicating on CAN.

If DTC 000639.13 sets, the following will occur:

- Depending on the application, engine operation may or may not be affected.

RG40854,0000036 -19-06DEC01-1/1

000639.13 — CAN Bus Error

The ECU detects a problem communicating on CAN.

RG40854,000010F –19–16JAN02–1/1

000639.13 CAN Bus Error Diagnostic Procedure

---1/1

❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 000639.13 CAN BUS ERROR supporting information* Perform a preliminary inspection of the ECU connector, the CAN connections, and any other connector. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

---1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000639.13 CAN BUS ERROR supporting information* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™. 5. Make note of all DTCs, then clear all DTCs 6. Ignition ON 7. Read DTCs using the DST or SERVICE ADVISOR.	**DTC 000639.13 reoccurs:** GO TO ❸ **DTC 000639.13 does not reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

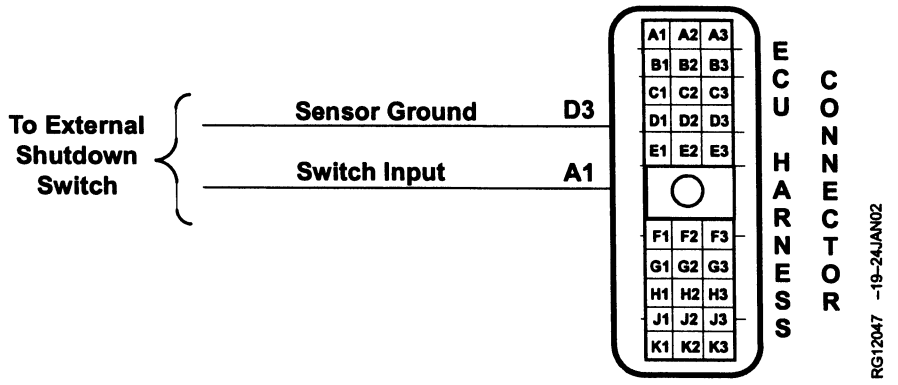
SERVICE ADVISOR is a trademark of Deere & Company

---1/1

❸ **Check Other Controllers For CAN Related DTCs**	*NOTE: For wiring and theory of operation information, see DTC 000639.13 CAN BUS ERROR supporting information* If application has other machine controllers communicating on the CAN bus, check those controllers for CAN related DTCs	**No CAN related DTCs found on other controllers:** GO TO ❹ **Found CAN related DTCs on other controllers:** Refer to machine manual to diagnose and repair the cause of DTC, then determine if DTC 000639.13 reoccurs ---1/1

❹ **CAN Resistance Test**	*NOTE: For wiring and theory of operation information, see DTC 000639.13 CAN BUS ERROR supporting information* 1. Ignition OFF 2. Disconnect ECU connector 3. Using a multimeter, measure resistance between terminals F1 and G1 in the harness end of the ECU connector	**Between 55 ohms and 65 ohms:** Faulty ECU connector OR Faulty ECU **Less than 55 ohms or greater than 65 ohms:** Open or short in CAN communication circuit ---1/1

000970.31 — Auxiliary Engine Shutdown Switch Active



04 160 250

The ECU does not read an input voltage on the auxiliary engine shutdown input wire.

IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

NOTE: Wiring schematic shows OEM engine applications only. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

Auxiliary Engine Shutdown Switch

- On OEM applications, the engine shutdown switch is a normally open switch. When the property being measured exceeds a certain value, the switch will close. When the switch is closed, the voltage is grounded, which will cause the ECU to shutdown the engine.

DTC 000970.31 will set if:

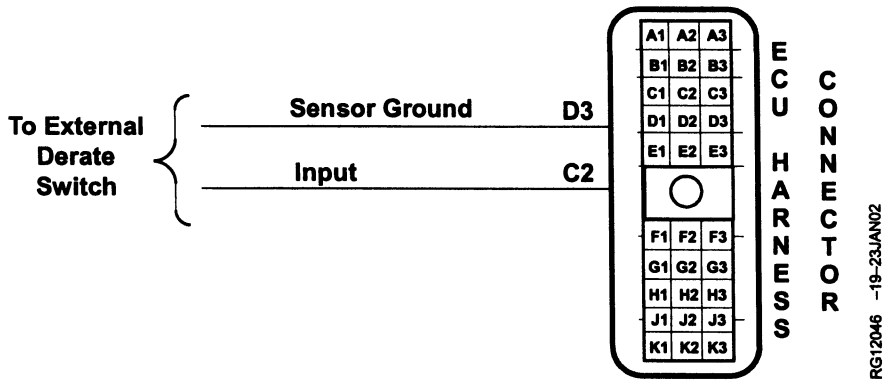
- The ECU does not read an input voltage on the auxiliary engine shutdown input wire.

If DTC 000970.31 sets, the following will occur:

- The ECU will shut the engine down immediately.

RG40854,00000BE –19–06DEC01–1/1

000971.31 — External Engine Derate Switch Active



The ECU does not read an input voltage.

IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

NOTE: Wiring schematic shows OEM engine applications only. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

External Fuel Derate Switch

- On OEM applications, the external derate switch is a normally open switch. When property being measured exceeds a certain value, the switch will close. When the switch is closed, the voltage is grounded, which will cause the ECU to derate the engine.

DTC 000971.31 will set if:

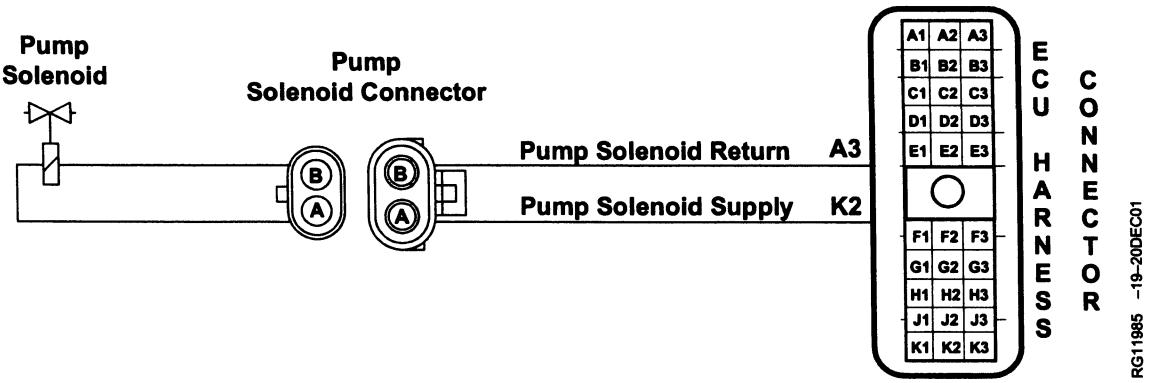
- The ECU does not read an input voltage.

If DTC 000971.31 sets, the following will occur:

- On OEM applications, the ECU will derate the engine 2% per minute until the engine is running at 80% of full power. For derates on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

RG40854,00000BF –19–06DEC01–1/1

001076.00 — Pump Control Valve Closure Too Long



04 160 258

Stanadyne DE10 Injection Pump

- The Stanadyne DE10 injection pump has an fuel control solenoid that is controlled by the Engine Control Unit (ECU). The ECU switches current on and off in order to charge the solenoid. When the current to the solenoid is increased, it moves a pump control valve into a position that allows for injection pressure to be developed. When the current to the solenoid is decreased, the pump control valve will return to a position that ends injection pressure. By controlling current to the solenoid, the ECU has the ability to manage the quantity and timing of fuel delivery to the engine. For more operation information, see FUEL INJECTION PUMP OPERATION in Section 03, Group 130 of this manual.

DTC 001076.00 will set if:

- The ECU determines that the pump control valve takes too long to close.

If DTC 001076.00 sets, the following will occur:

- Engine performance may be erratic.

RG40854,0000040 –19–06DEC01–1/1

001076.00 — Pump Control Valve Closure Too Long

The ECU determines that the pump control valve takes too long to close.

RG40854,0000124 -19-29JAN02-1/1

001076.00 Pump Control Valve Closure Too Long Diagnostic Procedure

---1/1

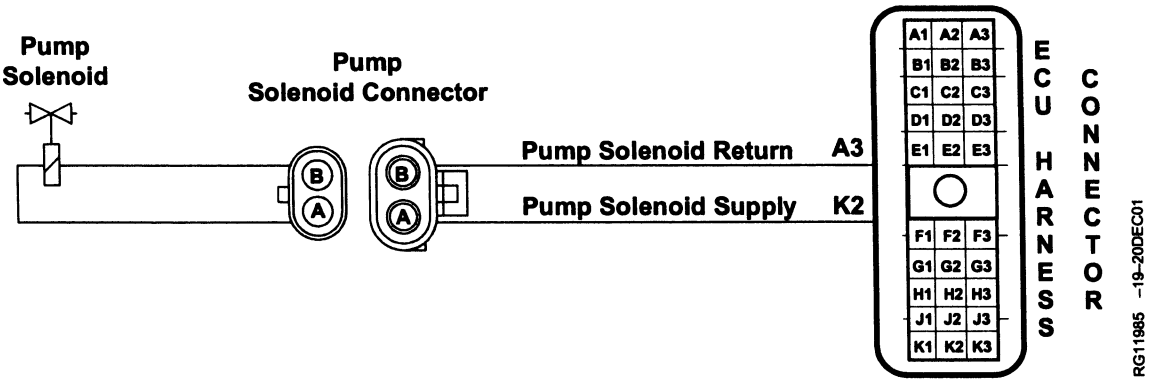
❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 001076.00 PUMP CONTROL VALVE CLOSURE TOO LONG supporting information.* Perform a preliminary inspection of the ECU connector, the pump connector, and any other connector. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 001076.00 PUMP CONTROL VALVE CLOSURE TOO LONG supporting information.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Make note of any DTCs, then clear all DTCs 5. Ignition ON, engine cranking or running 6. Read DTCs using DST or SERVICE ADVISOR™.	**001076.00 reoccurs:** GO TO ❸ **001076.00 does not reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

SERVICE ADVISOR is a trademark of Deere & Company

---1/1

❸ **Injection Pump Check**	*NOTE: For wiring and theory of operation information, see DTC 001076.00 PUMP CONTROL VALVE CLOSURE TOO LONG supporting information.* 1. Remove and install new injection pump. See REMOVE INJECTION PUMP and INSTALL INJECTION PUMP in Section 02, Group 090 of this manual. 2. Ignition ON, engine running. 3. Read DTCs using DST or SERVICE ADVISOR.	**001076.00 reoccurs:** Faulty ECU **001076.00 does not reoccur:** Problem repaired ---1/1

001076.01 — Pump Control Valve Closure Too Short



04 160 262

Stanadyne DE10 Injection Pump

- The Stanadyne DE10 injection pump has an fuel control solenoid that is controlled by the Engine Control Unit (ECU). The ECU switches current on and off in order to charge the solenoid. When the current to the solenoid is increased, it moves a pump control valve into a position that allows for injection pressure to be developed. When the current to the solenoid is decreased, the pump control valve will return to a position that ends injection pressure. By controlling current to the solenoid, the ECU has the ability to manage the quantity and timing of fuel delivery to the engine. For more operation information, see FUEL INJECTION PUMP OPERATION in Section 03, Group 130 of this manual.

DTC 001076.01 will set if:

- The ECU determines that the control valve closes too quickly.

If DTC 001076.01 sets, the following will occur:

- Engine performance may be erratic.

RG40854,0000044 –19–06DEC01–1/1

001076.01 — Pump Control Valve Closure Too Short

The ECU determines that the control valve closes too quickly.

RG40854,0000125 –19–29JAN02–1/1

001076.01 Pump Control Valve Closure Too Short Diagnostic Procedure

---1/1

❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 001076.01 PUMP CONTROL VALVE CLOSURE TOO SHORT supporting information.* Perform a preliminary inspection of the ECU connector, the pump connector, and any other connector. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

---1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 001076.01 PUMP CONTROL VALVE CLOSURE TOO SHORT supporting information.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Make note of any DTCs, then clear all DTCs 5. Ignition ON, engine cranking or running 6. Read DTCs using DST or SERVICE ADVISOR™.	**001076.01 reoccurs:** GO TO ❸ **001076.01 does not reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

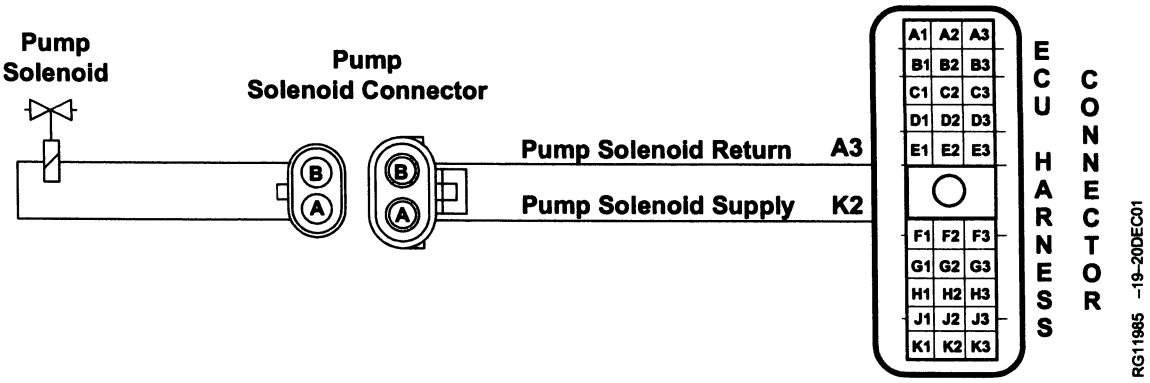
SERVICE ADVISOR is a trademark of Deere & Company

---1/1

❸ **Checking Battery Voltage**	*NOTE: For wiring and theory of operation information, see DTC 001076.01 PUMP CONTROL VALVE CLOSURE TOO SHORT supporting information.* 1. Ignition ON, engine OFF 2. Read the Battery Voltage parameter using the DST or SERVICE ADVISOR.	**At or near battery voltage:** GO TO ❹ **Significantly above or below battery voltage:** Faulty power supply ---1/1

❹ **Injection Pump Check**	*NOTE: For wiring and theory of operation information, see DTC 001076.01 PUMP CONTROL VALVE CLOSURE TOO SHORT supporting information.* 1. Remove and install new injection pump. See REMOVE INJECTION PUMP and INSTALL INJECTION PUMP in Section 02, Group 090 of this manual. 2. Ignition ON, engine running. 3. Read DTCs using the DST or SERVICE ADVISOR.	**001076.01 reoccurs:** Faulty ECU **001076.01 does not reoccur:** Problem repaired ---1/1

001076.03 — Pump Solenoid Current High



04 160 266

Stanadyne DE10 Injection Pump

- The Stanadyne DE10 injection pump has an internal solenoid that is controlled by the Engine Control Unit (ECU). The ECU switches current on and off in order to charge the solenoid. When the current to the solenoid is increased, it moves a pump control valve into a position that allows for injection pressure to be developed. When the current to the solenoid is decreased, the pump control valve will return to a position that ends injection pressure. By controlling current to the solenoid, the ECU has the ability to manage the quantity and timing of fuel delivery to the engine. For more operation information, see FUEL INJECTION PUMP OPERATION in Section 03, Group 130 of this manual.

DTC 001076.03 will set if:

- The ECU determines that pump solenoid current is higher than normal.

If DTC 001076.03 sets, the following will occur:

- Engine performance may be erratic.

RG40854,0000046 –19–06DEC01–1/1

001076.03 — Pump Solenoid Current High

The ECU determines that pump solenoid current is higher than normal.

RG40854,0000126 -19-29JAN02-1/1

001076.03 Pump Solenoid Current High Diagnostic Procedure

---1/1

❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 001076.03 PUMP SOLENOID CURRENT HIGH supporting information.* Perform a preliminary inspection of the ECU connector, the pump connector, and any other connector. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

---1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 001076.03 PUMP SOLENOID CURRENT HIGH supporting information.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Make note of any DTCs, then clear all DTCs 5. Ignition ON, engine cranking or running 6. Read DTCs using DST or SERVICE ADVISOR™.	**001076.03 reoccurs:** GO TO ❸ **001076.03 does not reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

SERVICE ADVISOR is a trademark of Deere & Company

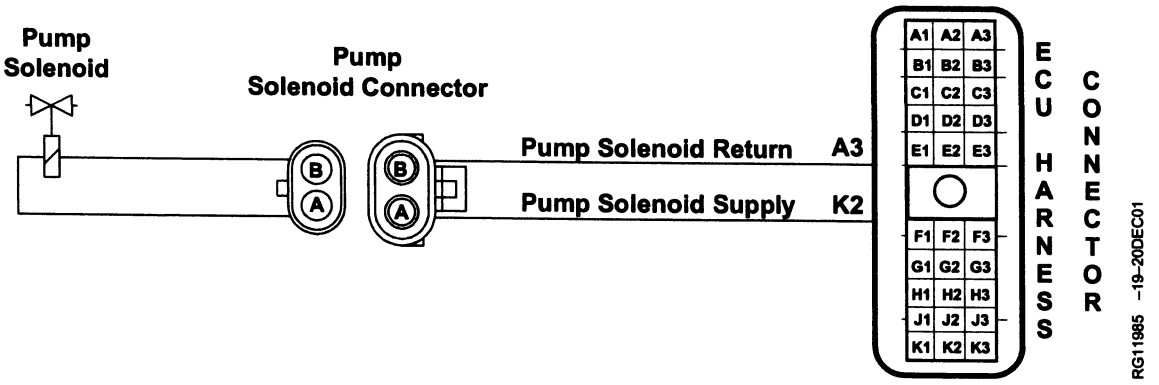
---1/1

❸ **Pump Solenoid Return Wire Check**	*NOTE: For wiring and theory of operation information, see DTC 001076.03 PUMP SOLENOID CURRENT HIGH supporting information.* 1. Ignition OFF 2. Disconnect pump solenoid connector and ECU connector 3. Using a multimeter, measure resistance between Terminal A3 and all other terminals in the ECU connector	**Measurement greater than 20,000 ohms:** GO TO ❹ **Measurement less than 20,000 ohms:** Short to power in pump solenoid return wire ---1/1

❹ **Pump Solenoid Supply Wire Check**	*NOTE: For wiring and theory of operation information, see DTC 001076.03 PUMP SOLENOID CURRENT HIGH supporting information.* 1. Ignition OFF 2. Disconnect pump solenoid connector and ECU connector 3. Using a multimeter, measure resistance between Terminal K2 and all other terminals in the ECU connector	**Measurement greater than 20,000 ohms:** GO TO ❺ **Measurement less than 20,000 ohms:** Short to power in pump solenoid supply wire ---1/1

❺ **Injection Pump Check**	*NOTE: For wiring and theory of operation information, see DTC 001076.03 PUMP SOLENOID CURRENT HIGH supporting information.* 1. Remove and install new injection pump. See REMOVE INJECTION PUMP and INSTALL INJECTION PUMP in Section 02, Group 090 of this manual. 2. Ignition ON, engine running. 3. Read DTCs using the DST or SERVICE ADVISOR.	**001076.03 reoccurs:** Faulty ECU **001076.03 does not reoccur:** Problem repaired ---1/1

001076.05 — Pump Solenoid Circuit Open



04 160 270

Stanadyne DE10 Injection Pump

- The Stanadyne DE10 injection pump has an internal solenoid that is controlled by the Engine Control Unit (ECU). The ECU switches current on and off in order to charge the solenoid. When the current to the solenoid is increased, it moves a pump control valve into a position that allows for injection pressure to be developed. When the current to the solenoid is decreased, the pump control valve will return to a position that ends injection pressure. By controlling current to the solenoid, the ECU has the ability to manage the quantity and timing of fuel delivery to the engine. For more operation information, see FUEL INJECTION PUMP OPERATION in Section 03, Group 130 of this manual.

DTC 001076.05 will set if:

- The ECU determines that pump solenoid circuit is open.

If DTC 001076.05 sets, the following will occur:

- Engine will not run.

RG40854,0000049 –19–06DEC01–1/1

001076.05 — Pump Solenoid Circuit Open

The ECU determines that pump solenoid circuit is open.

RG40854,00000C -19-06DEC01-1/1

001076.05 Pump Solenoid Circuit Open Diagnostic Procedure

---1/1

❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 001076.05 PUMP SOLENOID CIRCUIT OPEN supporting information.* Perform a preliminary inspection of the ECU connector, the pump connector, and any other connector. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

---1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 001076.05 PUMP SOLENOID CIRCUIT OPEN supporting information.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Make note of any DTCs, then clear all DTCs 5. Ignition ON, engine cranking or running 6. Read DTCs using DST or SERVICE ADVISOR™.	**001076.05 reoccurs:** GO TO ❸ **001076.05 does not reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

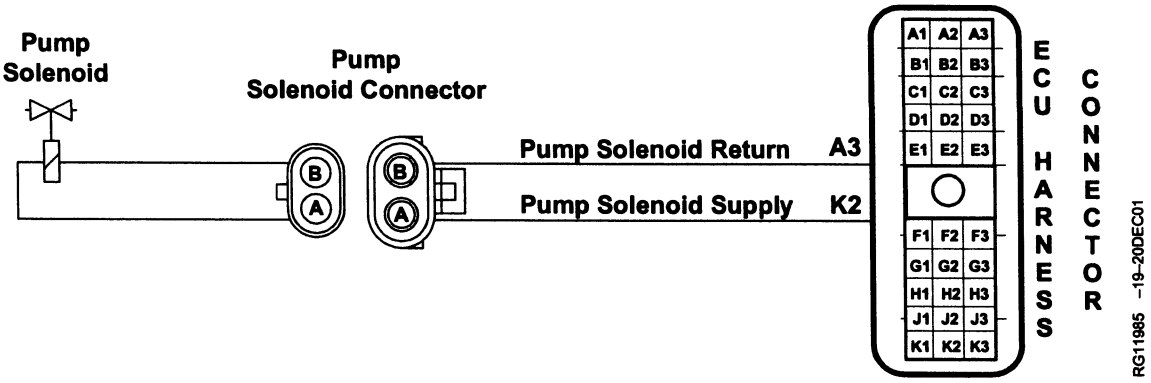
SERVICE ADVISOR is a trademark of Deere & Company

---1/1

❸ **ECU Check**	*NOTE: For wiring and theory of operation information, see DTC 001076.05 PUMP SOLENOID CIRCUIT OPEN supporting information.* 1. Ignition OFF, engine OFF 2. Disconnect ECU connector 3. Using a multimeter, measure resistance between terminal K2 and terminal A3 of the harness side of the ECU connector.	**Measurement less than 5 ohms:** GO TO ❹ **Measurement 5 ohms or greater:** Faulty ECU connector OR Faulty ECU ---1/1

❹ **Injection Pump Wiring Check**	*NOTE: For wiring and theory of operation information, see DTC 001076.05 PUMP SOLENOID CIRCUIT OPEN supporting information.* 1. Ignition OFF 2. Disconnect pump solenoid connector and ECU connector 3. Using a multimeter, measure resistance between: • Terminal K2 in the ECU connector and terminal A in the pump solenoid connector • Terminal A3 in the ECU connector and terminal B in the pump solenoid connector	**Both measurements less than 5 ohms:** Faulty pump connector OR Faulty injection pump **Either measurement greater than 5 ohms:** Faulty pump connector OR Faulty ECU connector OR Open in pump solenoid supply wire OR Open in pump solenoid return wire ---1/1

001076.06 — Pump Solenoid Circuit Severely Shorted



Stanadyne DE10 Injection Pump

- The Stanadyne DE10 injection pump has an internal solenoid that is controlled by the Engine Control Unit (ECU). The ECU switches current on and off in order to charge the solenoid. When the current to the solenoid is increased, it moves a pump control valve into a position that allows for injection pressure to be developed. When the current to the solenoid is decreased, the pump control valve will return to a position that ends injection pressure. By controlling current to the solenoid, the ECU has the ability to manage the quantity and timing of fuel delivery to the engine. For more operation information, see FUEL INJECTION PUMP OPERATION in Section 03, Group 130 of this manual.

DTC 001076.06 will set if:

- The ECU determines that pump solenoid circuit is shorted.

If DTC 001076.06 sets, the following will occur:

- ECU will shut engine down immediately.

RG40854,000004D –19–06DEC01–1/1

001076.06 — Pump Solenoid Circuit Severely Shorted

The ECU determines that pump solenoid circuit is shorted.

RG40854,0000127 –19–29JAN02–1/1

001076.06 Pump Solenoid Circuit Severely Shorted Diagnostic Procedure

---1/1

❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 001076.06 PUMP SOLENOID CIRCUIT SEVERELY SHORTED supporting information.* Perform a preliminary inspection of the ECU connector, the pump connector, and any other connector. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

---1/1

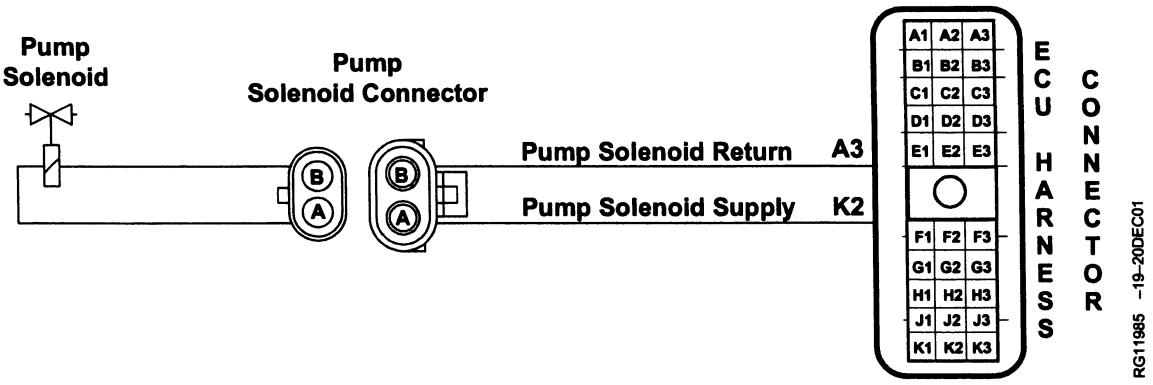
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 001076.06 PUMP SOLENOID CIRCUIT SEVERELY SHORTED supporting information.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISORearlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Make note of any DTCs, then clear all DTCs 5. Ignition ON, engine cranking or running 6. Read DTCs using DST or SERVICE ADVISOR™.	**001076.06 reoccurs:** GO TO ❸ **001076.06 does not reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

SERVICE ADVISOR is a trademark of Deere & Company

---1/1

❸ **Pump Solenoid Supply Circuit Check**	*NOTE: For wiring and theory of operation information, see DTC 001076.06 PUMP SOLENOID CIRCUIT SEVERELY SHORTED supporting information.* 1. Ignition OFF 2. Disconnect pump solenoid connector and ECU connector 3. Using a multimeter, measure resistance between terminal K2 of the harness side of the ECU connector and: • A good ground • All other terminals in the ECU connector	**Measurement greater than 20,000 ohms:** GO TO ❹ **Measurement less than 20,000 ohms:** Pump solenoid supply wire shorted ---1/1
❹ **Pump Solenoid Return Circuit Check**	*NOTE: For wiring and theory of operation information, see DTC 001076.06 PUMP SOLENOID CIRCUIT SEVERELY SHORTED supporting information.* 1. Ignition OFF 2. Disconnect pump solenoid connector and ECU connector 3. Using a multimeter, measure resistance between terminal A3 of the harness side of the ECU connector and: • A good ground • All other terminals in the ECU connector	**Measurement greater than 20,000 ohms:** GO TO ❺ **Measurement less than 20,000 ohms:** Pump solenoid return wire shorted ---1/1
❻ **Injection Pump Check**	*NOTE: For wiring and theory of operation information, see DTC 001076.06 PUMP SOLENOID CIRCUIT SEVERELY SHORTED supporting information.* 1. Remove and install new injection pump. See REMOVE INJECTION PUMP and INSTALL INJECTION PUMP in Section 02, Group 090 of this manual. 2. Ignition ON, engine running. 3. Read DTCs using DST or SERVICE ADVISOR.	**001076.06 reoccurs:** Faulty ECU **001076.06 does not reoccur:** Problem repaired ---1/1

001076.07 — Pump Control Valve Closure Not Detected



Stanadyne DE10 Injection Pump

- The Stanadyne DE10 injection pump has an internal solenoid that is controlled by the Engine Control Unit (ECU). The ECU switches current on and off in order to charge the solenoid. When the current to the solenoid is increased, it moves a pump control valve into a position that allows for injection pressure to be developed. When the current to the solenoid is decreased, the pump control valve will return to a position that ends injection pressure. By controlling current to the solenoid, the ECU has the ability to manage the quantity and timing of fuel delivery to the engine. For more operation information, see FUEL INJECTION PUMP OPERATION in Section 03, Group 130 of this manual.

DTC 001076.07 will set if:

- The ECU determines that it can not detect the closure of the pump control valve.

If DTC 001076.07 sets, the following will occur:

- Engine performance may be erratic.

RG40854,000004F –19–06DEC01–1/1

001076.07 — Pump Control Valve Closure Not Detected

The ECU determines that it can not detect the closure of the pump control valve.

RG40854,0000050 –19–06DEC01–1/1

001076.07 Pump Control Valve Closure Not Detected Diagnostic Procedure

---1/1

❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 001076.07 PUMP CONTROL VALVE CLOSURE NOT DETECTED supporting information.* Perform a preliminary inspection of the ECU connector, the pump connector, and any other connector. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

---1/1

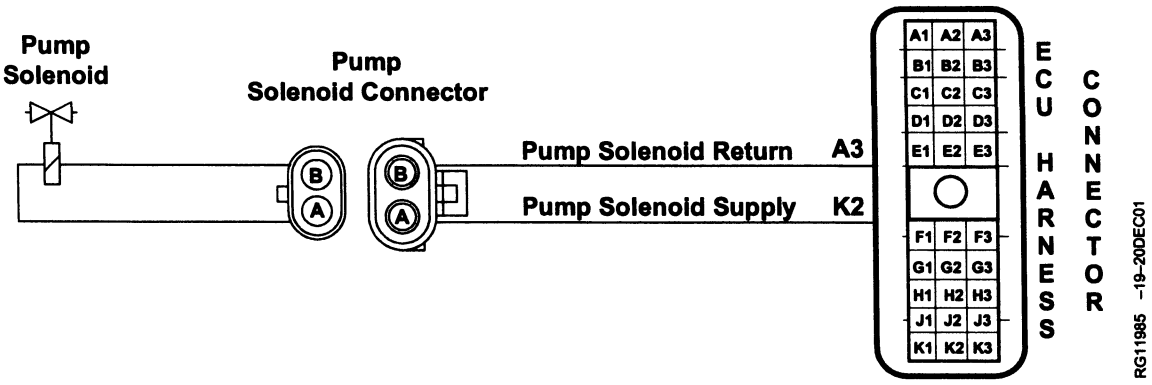
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 001076.07 PUMP CONTROL VALVE CLOSURE NOT DETECTED supporting information.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Make note of any DTCs, then clear all DTCs 5. Ignition ON, engine cranking or running 6. Read DTCs using the DST or SERVICE ADVISOR™.	**001076.07 reoccurs:** GO TO ❸ **001076.07 does not reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

SERVICE ADVISOR is a trademark of Deere & Company

---1/1

❸ **Injection Pump Check**	*NOTE: For wiring and theory of operation information, see DTC 001076.07 PUMP CONTROL VALVE CLOSURE NOT DETECTED supporting information.* 1. Remove and install new injection pump. See REMOVE INJECTION PUMP and INSTALL INJECTION PUMP in Section 02, Group 090 of this manual. 2. Ignition ON, engine running. 3. Read DTCs using the DST or SERVICE ADVISOR.	**001076.07 reoccurs:** Faulty ECU **001076.07 does not reoccur:** Problem repaired ---1/1

001076.10 — Pump Solenoid Circuit Moderately Shorted



Stanadyne DE10 Injection Pump

- The Stanadyne DE10 injection pump has an internal solenoid that is controlled by the Engine Control Unit (ECU). The ECU switches current on and off in order to charge the solenoid. When the current to the solenoid is increased, it moves a pump control valve into a position that allows for injection pressure to be developed. When the current to the solenoid is decreased, the pump control valve will return to a position that ends injection pressure. By controlling current to the solenoid, the ECU has the ability to manage the quantity and timing of fuel delivery to the engine. For more operation information, see FUEL INJECTION PUMP OPERATION in Section 03, Group 130 of this manual.

DTC 001076.10 will set if:

- Pump solenoid circuit is moderately shorted to power.

If DTC 001076.10 sets, the following will occur:

- ECU will derate engine to 50% of full power immediately.

RG40854,0000051 –19–06DEC01–1/1

001076.10 — Pump Solenoid Circuit Moderately Shorted

Pump solenoid circuit is moderately shorted to power.

RG41221,0000137 –19–29APR03–1/1

001076.10 Pump Solenoid Circuit Moderately Shorted Diagnostic Procedure

---1/1

❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 001076.10 PUMP SOLENOID CIRCUIT MODERATELY SHORTED supporting information.* Perform a preliminary inspection of the ECU connector, the pump connector, and any other connector. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

---1/1

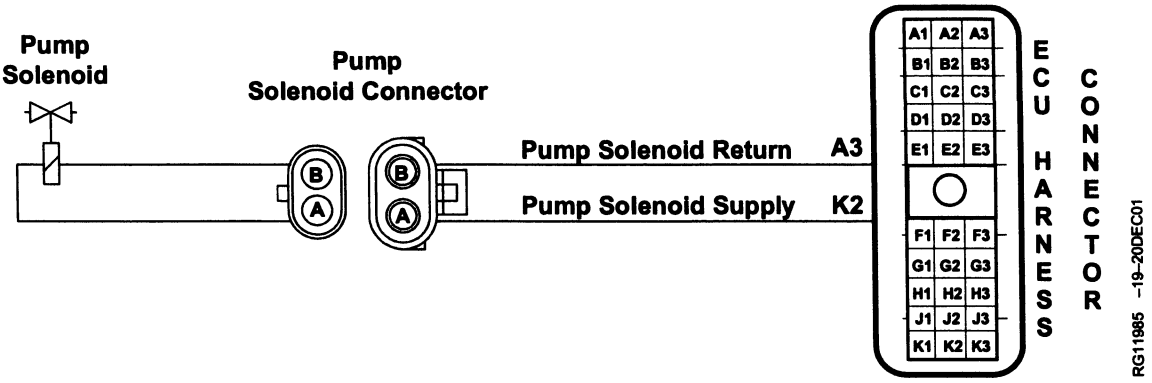
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 001076.10 PUMP SOLENOID CIRCUIT MODERATELY SHORTED supporting information.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Make note of any DTCs, then clear all DTCs 5. Ignition ON, engine cranking or running 6. Read DTCs using DST or SERVICE ADVISOR™.	**001076.10 reoccurs:** GO TO ❸ **001076.10 does not reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

SERVICE ADVISOR is a trademark of Deere & Company

---1/1

❸ **Pump Solenoid Supply Circuit Check**	*NOTE: For wiring and theory of operation information, see DTC 001076.10 PUMP SOLENOID CIRCUIT MODERATELY SHORTED supporting information.* 1. Ignition OFF 2. Disconnect pump solenoid connector and ECU connector 3. Using a multimeter, measure resistance between terminal K2 of the harness side of the ECU connector and: • A good ground • All other terminals in the ECU connector	**Measurement greater than 20,000 ohms:** GO TO ❹ **Measurement less than 20,000 ohms:** Pump solenoid supply wire shorted ---1/1
❹ **Pump Solenoid Return Circuit Check**	*NOTE: For wiring and theory of operation information, see DTC 001076.10 PUMP SOLENOID CIRCUIT MODERATELY SHORTED supporting information.* 1. Ignition OFF 2. Disconnect pump solenoid connector and ECU connector 3. Using a multimeter, measure resistance between terminal A3 of the harness side of the ECU connector and: • A good ground • All other terminals in the ECU connector	**Measurement greater than 20,000 ohms:** GO TO ❺ **Measurement less than 20,000 ohms:** Pump solenoid return wire shorted ---1/1
❺ **Injection Pump Check**	*NOTE: For wiring and theory of operation information, see DTC 001076.10 PUMP SOLENOID CIRCUIT MODERATELY SHORTED supporting information.* 1. Remove and install new injection pump. See REMOVE INJECTION PUMP and INSTALL INJECTION PUMP in Section 02, Group 090 of this manual. 2. Ignition ON, engine running. 3. Read DTCs using the DST or SERVICE ADVISOR.	**001076.10 reoccurs:** Faulty ECU **001076.10 does not reoccur:** Problem repaired ---1/1

001076.13 — Pump Current Decay Time Invalid



04 160 286

Stanadyne DE10 Injection Pump

- The Stanadyne DE10 injection pump has an internal solenoid that is controlled by the Engine Control Unit (ECU). The ECU switches current on and off in order to charge the solenoid. When the current to the solenoid is increased, it moves a pump control valve into a position that allows for injection pressure to be developed. When the current to the solenoid is decreased, the pump control valve will return to a position that ends injection pressure. By controlling current to the solenoid, the ECU has the ability to manage the quantity and timing of fuel delivery to the engine. For more operation information, see FUEL INJECTION PUMP OPERATION in Section 03, Group 130 of this manual.

DTC 001076.13 will set if:

- ECU detects high resistance in the pump solenoid.

If DTC 001076.13 sets, the following will occur:

- ECU will derate engine to 50% of full power immediately.

RG41221,0000CEE -19-24JAN03-1/1

001076.13 — Pump Current Decay Time Invalid

ECU detects high resistance in the pump solenoid.

RG41221,0000EF –19–24JAN03–1/1

001076.13 Pump Current Decay Time Invalid Diagnostic Procedure

---1/1

❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 001076.13 PUMP CURRENT DECAY TIME INVALID supporting information.*	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 001076.13 PUMP CURRENT DECAY TIME INVALID supporting information.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Make note of any DTCs, then clear all DTCs 5. Ignition ON, engine cranking or running 6. Read DTCs using DST or SERVICE ADVISOR™.	**001076.13 reoccurs:** GO TO ❸ **001076.13 does not reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

SERVICE ADVISOR is a trademark of Deere & Company

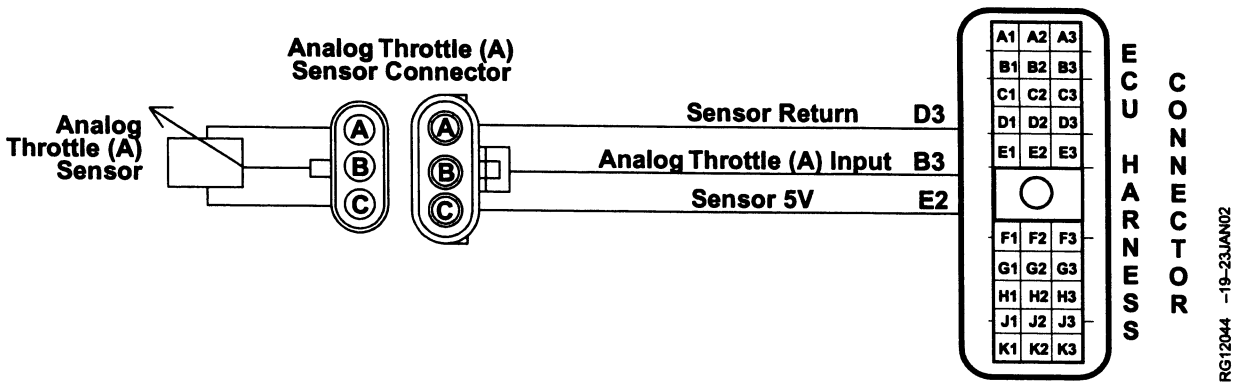
---1/1

❸ **Pump Solenoid Supply Circuit Check**	*NOTE: For wiring and theory of operation information, see DTC 001076.13 PUMP CURRENT DECAY TIME INVALID supporting information.* 1. Ignition OFF 2. Disconnect pump solenoid connector and ECU connector 3. Using a multimeter, measure resistance between terminal K2 of the harness side of the ECU connector and: • A good ground • All other terminals in the ECU connector	**Measurement greater than 20,000 ohms:** GO TO ❹ **Measurement less than 20,000 ohms:** Pump solenoid supply wire shorted ---1/1

❹ **Pump Solenoid Return Circuit Check**	*NOTE: For wiring and theory of operation information, see DTC 001076.13 PUMP CURRENT DECAY TIME INVALID supporting information.* 1. Ignition OFF 2. Disconnect pump solenoid connector and ECU connector 3. Using a multimeter, measure resistance between terminal A3 of the harness side of the ECU connector and: • A good ground • All other terminals in the ECU connector	**Measurement greater than 20,000 ohms:** GO TO ❺ **Measurement less than 20,000 ohms:** Pump solenoid return wire shorted ---1/1

❺ **Injection Pump Check**	*NOTE: For wiring and theory of operation information, see DTC 001076.13 PUMP CURRENT DECAY TIME INVALID supporting information.* 1. Remove and install new injection pump. See REMOVE INJECTION PUMP and INSTALL INJECTION PUMP in Section 02, Group 090 of this manual. 2. Ignition ON, engine running. 3. Read DTCs using the DST or SERVICE ADVISOR.	**001076.10 reoccurs:** Faulty ECU **001076.10 does not reoccur:** Problem repaired ---1/1

001079.03 — Sensor Supply Voltage High



04 160 290

Sensor Supply Voltage

- The ECU supplies voltage to a few different sensors depending on the application. The ECU monitors the drop in voltage that the sensor causes and compares that drop to preprogrammed values in the ECU's memory to determine the value of the parameter the sensor was measuring. In addition, the ECU monitors the exact voltage on the 5 volt supply circuit in order to ensure accurate readings.

DTC 001079.03 will set if:

- The ECU detects a voltage that is higher than 5.5 volts on the ECU 5 volt sensor supply circuit.

If DTC 001079.03 sets, the following will occur:

- The ECU will use default values for the sensors that use sensor supply input voltage.

RG40854,0000052 –19–06DEC01–1/1

001079.03 — Sensor Supply Voltage High

The ECU detects a voltage that is higher than 5.5 volts on the ECU 5 volt sensor supply circuit.

RG40854,000010E –19–16JAN02–1/1

001079.03 Sensor Supply Voltage High Diagnostic Procedure

–––1/1

❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 001079.03 SENSOR SUPPLY VOLTAGE HIGH supporting information.* Perform a preliminary inspection of the ECU connector, the analog throttle (A) connector, and any connectors in between. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

–––1/1

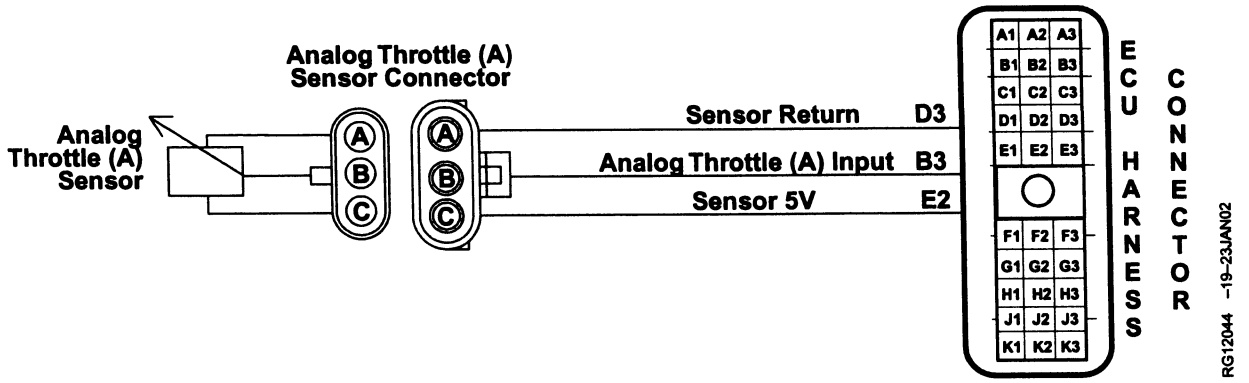
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 001079.03 SENSOR SUPPLY VOLTAGE HIGH supporting information.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Make notes of any DTCs, then clear all DTCs 5. Ignition ON, engine OFF 6. Read DTCs using DST or SERVICE ADVISOR™.	**001079.03 reoccur:** GO TO ❸ **001079.03 does not reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

SERVICE ADVISOR is a trademark of Deere & Company

–––1/1

❸ **Sensor Supply Wire Check for Short**	*NOTE: For wiring and theory of operation information, DTC 001079.03 SENSOR SUPPLY VOLTAGE HIGH supporting information.* 1. Ignition OFF 2. Disconnect ECU connector 3. Using a multimeter, measure resistance between terminal E2 the harness end of the ECU connector and all other terminals in the harness end of the ECU connector	**Greater than 20,000 ohms:** Faulty ECU connector OR Faulty ECU **Less than 20,000 ohms:** Short to voltage in sensor supply wire ---1/1

001079.04 — Sensor Supply Voltage Low



04 160 294

Sensor Supply Voltage

- The ECU supplies voltage to a few different sensors depending on the application. The ECU monitors the drop in voltage that the sensor causes and compares that drop to preprogrammed values in the ECU's memory to determine the value of the parameter the sensor was measuring. In addition, the ECU monitors the exact voltage on the 5 volt supply circuit in order to ensure accurate readings.

DTC 001079.04 will set if:

- The ECU detects a voltage that is lower than 4.44 volts on the ECU 5 volt sensor supply circuit.

If DTC 001079.04 sets, the following will occur:

- The ECU will use default values for the sensors that use sensor supply input voltage.

RG40854,0000054 –19–06DEC01–1/1

001079.04 — Sensor Supply Voltage Low

The ECU detects a voltage that is lower than 4.44 volts on the ECU 5 volt sensor supply circuit.

RG40854,000010D –19–16JAN02–1/1

001079.04 Sensor Supply Voltage Low Diagnostic Procedure

---1/1

❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 001079.04 SENSOR SUPPLY VOLTAGE LOW supporting information.* Perform a preliminary inspection of the ECU connector, the analog throttle (A) connector, and any connectors in between. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

---1/1

❷ **Sensor Check**	*NOTE: For wiring and theory of operation information, see DTC 001079.04 SENSOR SUPPLY VOLTAGE LOW supporting information.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Make note of any DTCs, then clear all DTCs 5. Ignition OFF 6. Disconnect all of the sensors that receive their 5 V supply from terminal E2 in the ECU connector. 7. Ignition ON, engine running 8. Read DTCs using DST or SERVICE ADVISOR™.	**001079.04 reoccurs:** GO TO ❹ **001079.04 does not reoccur:** GO TO ❸

SERVICE ADVISOR is a trademark of Deere & Company

---1/1

❸ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 001079.04 SENSOR SUPPLY VOLTAGE LOW supporting information.* 1. Ignition ON 2. While reconnecting each of the sensors one at a time, read DTCs using the DST or SERVICE ADVISOR.	**001079.04 reoccurs:** Sensor that reset the DTC is faulty Replace and retest **001079.04 does not reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group. ---1/1

❹ **Sensor Supply Short to Ground Check**	*NOTE: For wiring and theory of operation information, see DTC 001079.04 SENSOR SUPPLY VOLTAGE LOW supporting information.* 1. Ignition OFF 2. Disconnect ECU connector 3. Using a multimeter, measure resistance individually between terminal E2 in the harness end of the ECU connector and: • A good chassis ground • Terminal J2 in the harness end of the ECU connector • Terminal D3 in the harness end of the ECU connector	**Greater than 20,000 ohms:** Faulty ECU connector OR Faulty ECU **Less than 20,000 ohms:** Sensor 5 volt supply circuit shorted to a ground ---1/1

001109.31 — Engine Protection Shutdown Warning

The ECU detects low oil pressure, high engine coolant temperature, high loss of coolant temperature, or high fuel temperature.

Engine Shutdown Warning:

- This code informs the operator that the ECU will shut the engine down because it has detected a condition such as low oil pressure, high engine coolant temperature, high loss of coolant temperature, low coolant level, high fuel temperature, or a faulty injection pump. If the ECU is programmed with engine protection with shutdown, the ECU has shut the engine down within 30 seconds. Prior to shutdown, the engine will be derated.

DTC 001109.31 will set if:

- The ECU detects low oil pressure.
- The ECU detects a high engine coolant temperature.
- The ECU detects a high loss of coolant temperature.
- The ECU detects a high fuel temperature.

If DTC 001109.31 sets, the following will occur:

- If the ECU has engine protection with shutdown, it will derate (according to relating DTC) the engine for 30 seconds and will shut the engine down.

If DTC 001109.31 sets:

- If DTC 000100.01 is active, see DTC 000100.01 ENGINE OIL PRESSURE EXTREMELY LOW DIAGNOSTIC PROCEDURE earlier in this Group of the manual.
- If DTC 000110.00 is active, see DTC 000110.00 ENGINE COOLANT TEMPERATURE EXTREMELY HIGH DIAGNOSTIC PROCEDURE earlier in this Group of the manual.
- If DTC 000111.00 is active, see DTC 000111.00 LOSS OF COOLANT TEMPERATURE EXTREMELY HIGH DIAGNOSTIC PROCEDURE earlier in this Group of the manual.
- If DTC 000174.16 is active, see DTC 000174.16 FUEL TEMPERATURE HIGH MODERATELY SEVERE DIAGNOSTIC PROCEDURE earlier in this Group of the manual.

RG40854,0000056 –19–06DEC01–1/1

001110.31 — Engine Protection Shutdown

The ECU detects low oil pressure, high engine coolant temperature, high loss of coolant temperature, or high fuel temperature.

Engine Protection Shutdown:

- This code informs the operator that the ECU shut the engine down because it has detected a condition such low oil pressure, high engine coolant temperature, high loss of coolant temperature, or low coolant level. If the ECU is programmed with engine protection with shutdown, the ECU has shut the engine down.

DTC 001110.31 will set if:

- The ECU detects low oil pressure.
- The ECU detects a high engine coolant temperature.
- The ECU detects a high loss of coolant temperature.
- The ECU detects a high fuel temperature.

If DTC 001110.31 sets, the following will occur:

- The ECU will have shut the engine down.

If DTC 001110.31 sets:

- If DTC 000100.01 is active, see DTC 000100.01 ENGINE OIL PRESSURE EXTREMELY LOW DIAGNOSTIC PROCEDURE earlier in this Group of the manual.
- If DTC 000110.00 is active, see DTC 000110.00 ENGINE COOLANT TEMPERATURE EXTREMELY HIGH DIAGNOSTIC PROCEDURE earlier in this Group of the manual.
- If DTC 000111.00 is active, see DTC 000111.00 LOSS OF COOLANT TEMPERATURE EXTREMELY HIGH DIAGNOSTIC PROCEDURE earlier in this Group of the manual.
- If DTC 000174.16 is active, see DTC 000174.16 FUEL TEMPERATURE HIGH MODERATELY SEVERE DIAGNOSTIC PROCEDURE earlier in this Group of the manual.

RG40854,0000057 -19-06DEC01-1/1

001569.31 — Fuel Derate

The ECU detects low oil pressure, high manifold air temperature, high engine coolant temperature, high loss of coolant temperature, or high fuel temperature.

Fuel Derate

- The fuel derate trouble code is set to indicate that the ECU has detected a condition such as low oil pressure, high manifold air temperature, high coolant temperature, high loss of coolant temperature, or high fuel temperature. If the ECU detects one of these conditions, it will begin to derate the amount of fuel delivered to the engine.

DTC 001569.31 will set if:

- The ECU detects low oil pressure.
- The ECU detects high manifold air temperature.
- The ECU detects a high engine coolant temperature.
- The ECU detects a high loss of coolant temperature.
- The ECU detects a high fuel temperature.

If DTC 001569.31 sets, the following will occur:

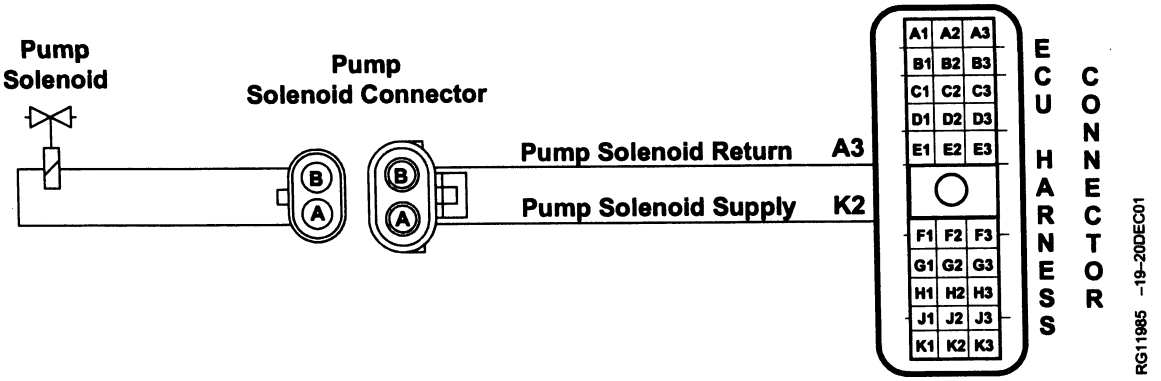
- The ECU will limit the amount of fuel available to the engine in an attempt to protect the engine.

If DTC 001569.31 sets:

- If DTC 000100.01 or DTC 000100.18 is active, see one of the following procedures earlier in this Group of the manual:
  - DTC 000100.01 ENGINE OIL PRESSURE EXTREMELY LOW DIAGNOSTIC PROCEDURE
  - DTC 000100.18 ENGINE OIL PRESSURE MODERATELY LOW DIAGNOSTIC PROCEDURE
- If DTC 000105.16 is active, see DTC 000105.16 MANIFOLD AIR TEMPERATURE MODERATELY HIGH DIAGNOSTIC PROCEDURE earlier in this Group of the manual.
- If DTC 000110.00, DTC 000110.15, or DTC 000110.16 is active, see one of the following procedures earlier in this Group of the manual:
  - DTC 000110.00 ENGINE COOLANT TEMPERATURE EXTREMELY HIGH DIAGNOSTIC PROCEDURE
  - DTC 000110.15 ENGINE COOLANT TEMPERATURE HIGH LEAST SEVERE DIAGNOSTIC PROCEDURE
  - DTC 000110.16 ENGINE COOLANT TEMPERATURE MODERATELY HIGH DIAGNOSTIC PROCEDURE
- If DTC 000111.00 is active, see DTC 000111.00 LOSS OF COOLANT TEMPERATURE EXTREMELY HIGH DIAGNOSTIC PROCEDURE earlier in this Group of the manual.
- If DTC 000174.16 is active, see DTC 000174.16 FUEL TEMPERATURE HIGH MODERATELY SEVERE DIAGNOSTIC PROCEDURE earlier in this Group of the manual.

RG40854,0000058 -19-06DEC01-1/1

002000.06 — Internal ECU Failure



ECU has detected a short in the ECU that causes an extremely high current at the injection pump.

Stanadyne DE10 Injection Pump

- The Stanadyne DE10 injection pump has an internal solenoid that is controlled by the Engine Control Unit (ECU). The ECU switches current on and off in order to charge the solenoid. When the current to the solenoid is increased, it moves a pump control valve into a position that allows for injection pressure to be developed. When the current to the solenoid is decreased, the pump control valve will return to a position that ends injection pressure. By controlling current to the solenoid, the ECU has the ability to manage the quantity and timing of fuel delivery to the engine. For more operation information, see FUEL INJECTION PUMP OPERATION in Section 03, Group 130 of this manual.

DTC 002000.06 will set if:

- ECU has detected a short in the ECU that causes an extremely high current at the injection pump.

If DTC 002000.06 sets, the following will occur:

- Engine shuts down immediately

If DTC 002000.06 sets:

- Replace the ECU and retest.

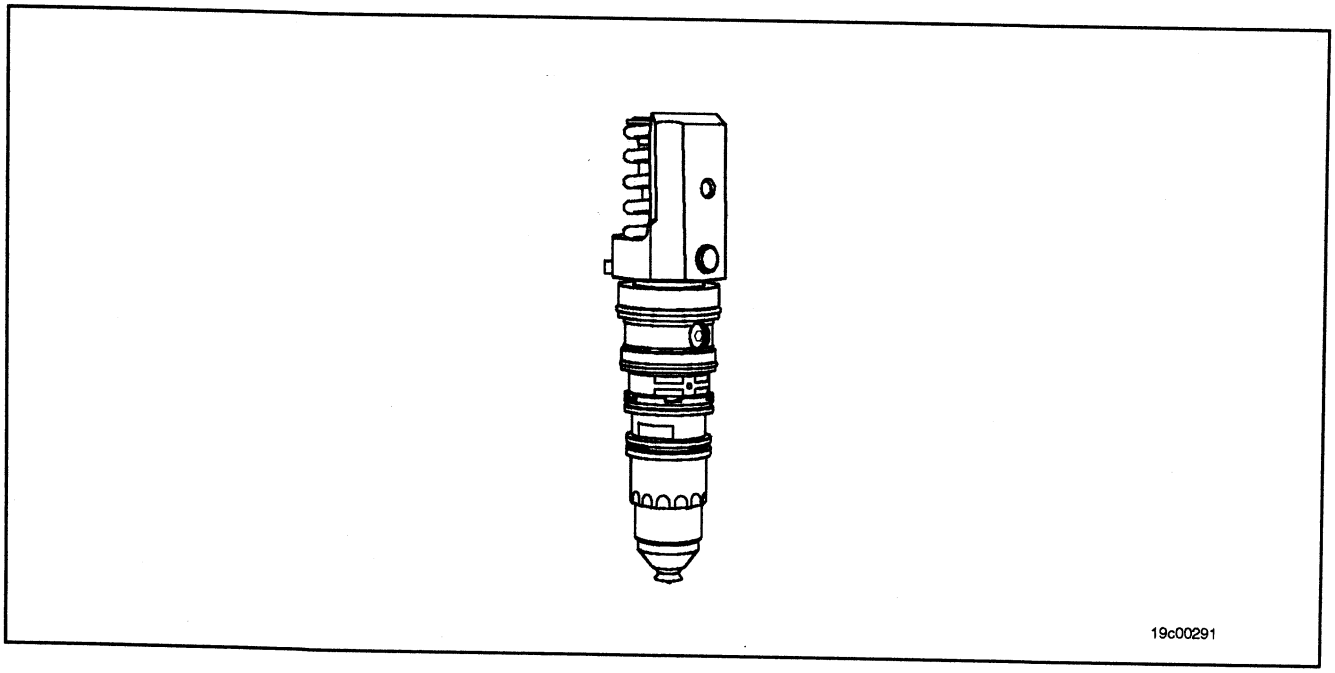
RG40854,000005A -19-06DEC01-1/1

Fault Code 758

Fuel Injector

CODES	REASON	EFFECT
Fault Code: 758 PID(P), SID(S): P129 SPN: 1349 FMI: 7/7 Lamp: Yellow	Incorrect fueling was detected on the rear three cylinders.	Engine will misfire.

Fuel Injector



Circuit Description:

The electronic control module (ECM) supplies voltage to open the fueling actuators for a short length of time. This allows a short pulse of fuel to flow to the injector. The injector then injects this fuel into the cylinder for combustion.

Component Location:

The injectors are located in the cylinder head under the valve cover.

Shop Talk:

The ECM measures the amount of fuel metered into each injector by using the rear fuel rail pressure sensor. If the ECM detects that no fuel is entering an injector, the fault code is activated.

TROUBLESHOOTING SUMMARY

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the fuel system.		
STEP 1A: Measure the drain line restriction.	Less than 4.0 in Hg	
STEP 1B: Check for air in the pressure-side fuel.	No air in fuel	
STEP 2: Perform the cylinder performance test.		
STEP 2A: Inspect for rear cylinder performance.	Cylinder contribution above 70%	
STEP 3: Check the rear fuel injectors.		
STEP 3A: Inspect the rear fuel injectors.	Fault Code 758 goes inactive	
STEP 4: Clear the fault codes.		
STEP 4A: Disable the fault code.	Fault Code 758 inactive	
STEP 4B: Clear the inactive fault codes.	All fault codes cleared	

TROUBLESHOOTING STEP

STEP 1: Check the fuel system.

STEP 1A: Measure the drain line restriction.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Measure the drain line restriction.	**OK** **Less than 4.0 in Hg**	1B
	NOT OK **More than 4.0 in Hg** Refer to Procedure 006-012 in the Signature, ISX and QSX15 Troubleshooting and Repair Manual, Bulletin No. 3666239.	4A

STEP 1B: Check for air in the pressure-side fuel.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Check for air in the pressure-side fuel.	**OK** **No air in fuel**	2A
	NOT OK **Air in fuel** Refer to Procedure 006-003 in the Signature, ISX and QSX15 Troubleshooting and Repair Manual, Bulletin No. 3666239.	4A

STEP 2: Perform the cylinder performance test.

STEP 2A: Inspect for rear cylinder performance.

Condition:
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Perform cylinder performance test on rear cylinders. • Use INSITE™ to determine cylinder with lowest power. • It is normal for next cylinder in firing order of the rear bank of three cylinders to have high power; above 125% is acceptable.	**OK** **Cylinder contribution above 70%**	4A
	NOT OK	3A

STEP 3: Check the rear fuel injectors.

STEP 3A: Inspect the rear fuel injectors.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Replace the appropriate fuel injector in the rear bank. • Replace the fuel injector at the cylinder with the lowest power output.	**OK** **Fault Code 758 goes inactive**	4A
	NOT OK **Replace the appropriate fuel injector** Refer to Procedure 006-026 in the Signature, ISX and QSX15 Troubleshooting and Repair Manual, Bulletin No. 3666239.	4A

STEP 4: Clear the fault codes.

STEP 4A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and run it above 1000 rpm for at least 1 minute. • Using INSITE™, verify Fault Code 758 is inactive.	**OK** **Fault Code 758 inactive**	4B
	NOT OK Return to the troubleshooting steps or contact your local Cummins Authorized Repair Location if all the steps have been completed and checked again.	1A

STEP 4B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

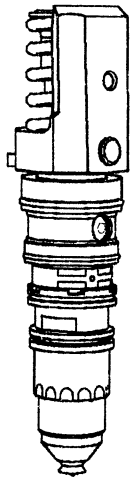
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes	Appropriate troubleshooting charts

Fault Code 755

Fuel Injector

CODES	REASON	EFFECT
Fault Code: 755 PID(P), SID(S): P157 SPN: 157 FMI: 7/7 Lamp: Yellow	Incorrect fueling was detected on the front three cylinders.	Engine will misfire.

Fuel Injector



19c00291

Circuit Description:

The electronic control module (ECM) supplies voltage to open the fueling actuators for a short length of time. This allows a short pulse of fuel to flow to the injector. The injector then injects this fuel into the cylinder for combustion.

Component Location:

The injectors are located in the cylinder head under the valve cover.

Shop Talk:

The ECM measures the amount of fuel metered into each injector by using the front fuel rail pressure sensor. If the ECM detects that no fuel is entering an injector, the fault code is activated.
This fault can be caused by air in the fuel.

TROUBLESHOOTING SUMMARY

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the fuel system.		
STEP 1A: Measure the drain line restriction.	Less than 4.0 in Hg	
STEP 1B: Check for air in the pressure-side fuel.	No air in fuel	
STEP 2: Perform the cylinder performance test.		
STEP 2A: Inspect for front cylinder performance.	Cylinder contribution above 70%	
STEP 3: Check the front fuel injectors.		
STEP 3A: Inspect the front fuel injectors.	Fault Code 755 goes inactive	
STEP 4: Clear the fault codes.		
STEP 4A: Disable the fault code.	Fault Code 755 inactive	
STEP 4B: Clear the inactive fault codes.	All fault codes cleared	

TROUBLESHOOTING STEP

STEP 1: Check the fuel system.

STEP 1A: Measure the drain line restriction.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Measure the drain line restriction.	**OK** **Less than 4.0 in Hg**	1B
	NOT OK **More than 4.0 in Hg** Refer to Procedure 006-012 in the Signature, ISX and QSX15 Troubleshooting and Repair Manual, Bulletin No. 3666239.	4A

STEP 1B: Check for air in the pressure-side fuel.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Check for air in the pressure-side fuel.	**OK** **No air in fuel**	2A
	NOT OK **Air in fuel** Refer to Procedure 006-003 in the Signature, ISX and QSX15 Troubleshooting and Repair Manual, Bulletin No. 3666239.	4A

STEP 2: Perform the cylinder performance test.

STEP 2A: Inspect for front cylinder performance.

Condition:
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Perform cylinder performance test on front cylinders. • Use INSITE™ to determine cylinder with lowest power. • It is normal for next cylinder in firing order of the front bank of three cylinders to have high power; above 125% is acceptable.	**OK** **Cylinder contribution above 70%**	4A
	NOT OK	3A

STEP 3: Check the front fuel injectors.

STEP 3A: Inspect the front fuel injectors.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Replace the appropriate fuel injector in the front bank. • Replace the fuel injector at the cylinder with the lowest power output.	**OK** **Fault Code 755 goes inactive**	4A
	NOT OK **Replace the appropriate fuel injector** Refer to Procedure 006-026 in the Signature, ISX and QSX15 Troubleshooting and Repair Manual, Bulletin No. 3666239.	4A

STEP 4: Clear the fault codes.

STEP 4A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and run it above 1000 rpm for at least 1 minute. • Using INSITE™, verify Fault Code 755 is inactive.	**OK** **Fault Code 755 inactive**	4B
	NOT OK Return to the troubleshooting steps or contact your local Cummins Authorized Repair Location if all the steps have been completed and checked again.	1A

STEP 4B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

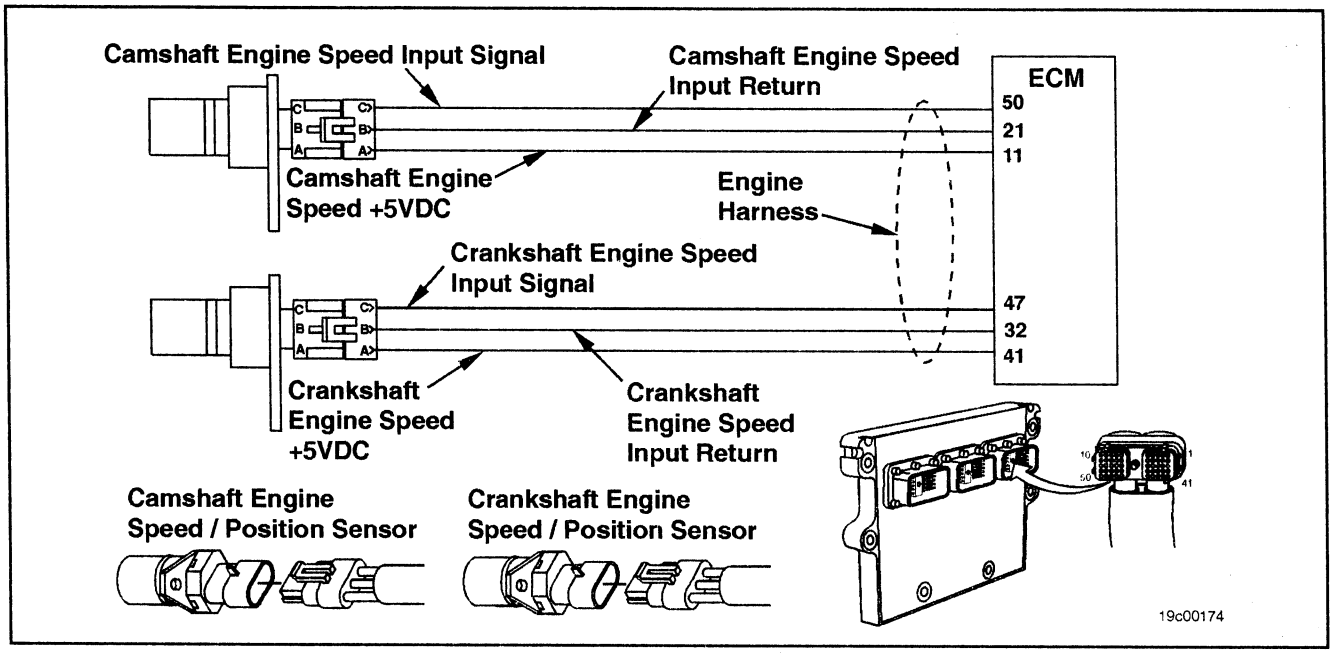
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 753

Engine Speed Sensor Circuit

CODES	REASON	EFFECT
Fault Code: 753 PID(P), SID(S): S064 SPN: 723 FMI: 2/2 Lamp: Yellow	Engine position signal from the camshaft and crankshaft engine position sensors do **not** match up.	Low power, rough idle, or possible white smoke.

Engine Speed Sensor Circuit



Circuit Description:

The engine speed sensor is a solid-state sensor that provides the engine speed signal to the electronic control module (ECM) through the engine harness.

Component Location:

The crankshaft engine speed sensor is located on the front cover of the gear housing. This is on the intake side of the vibration damper. The camshaft engine speed sensor is located in the cylinder head above the ECM.

Shop Talk:

If the problem occurs **only** at a certain engine temperature, be sure to check the engine speed sensor circuit while the engine is at that particular temperature.

TROUBLESHOOTING SUMMARY

⚠ CAUTION ⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead
Part No. 3824775 - breakout cable.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the camshaft engine speed sensor.		
STEP 1A: Inspect the camshaft engine speed sensor and engine harness connector pins.	No damaged pins	
STEP 1B: Inspect the camshaft engine speed sensor.	No damaged engine speed sensor	
STEP 1C: Check the camshaft engine speed sensor operation.	Positive ([+] 4.0 to 5.0 VDC to (+) 0.5 to 2.3 VDC) and back about every 360° of rotation	
STEP 1C-1: Check the engine speed sensor supply voltage.	(+) 4.75 to 5.25 VDC	
STEP 2: Check the crankshaft engine speed sensor.		
STEP 2A: Inspect the crankshaft engine speed sensor and engine harness connector pins.	No damaged pins	
STEP 2B: Inspect the crankshaft engine speed sensor.	No damaged engine speed sensor	
STEP 2C: Check the crankshaft engine speed sensor operation.	Positive ([+] 4.0 to 5.0 VDC to (+) 0.5 to 2.3 VDC) and back about every 60° of rotation	
STEP 2C-1: Check the engine speed sensor supply voltage.	(+) 4.75 to 5.25 VDC	
STEP 3: Check the engine harness for both circuits.		
STEP 3A: Inspect the engine harness and ECM connector pins.	No damaged pins	
STEP 3B: Check for an open circuit.	Less than 10 ohms	
STEP 3C: Check for a short circuit to engine block ground.	More than 100k ohms	
STEP 3D: Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 4: Clear the fault codes.		
STEP 4A: Disable the fault code.	Fault Code 753 inactive	

STEP 4B: Clear the inactive fault codes.	**All fault codes cleared**
STEP 4C: Should the fault code return.	**All fault codes cleared and timing checked**

TROUBLESHOOTING STEP

STEP 1: Check the camshaft engine speed sensor.

STEP 1A: Inspect the camshaft engine speed sensor and engine harness connector pins.

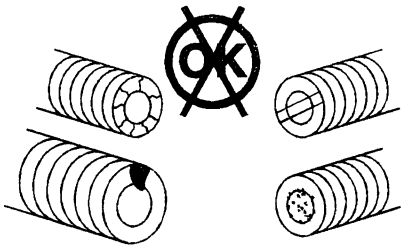
Condition:
- Turn keyswitch OFF.
- Disconnect the engine harness from the engine speed sensor.

Action	Specifications/Repair	Next Step
Inspect the engine speed sensor and engine harness connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	1B
	NOT OK **Repair damaged pins** Repair or replace the engine harness or the engine speed sensor, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-204. • Replace the engine harness. Refer to Procedure 019-043. • Replace the engine speed sensor. Refer to Procedure 019-038.	4A

STEP 1B: Inspect the camshaft engine speed sensor.

Condition:
- Turn keyswitch OFF.
- Disconnect the engine harness from the engine speed sensor.
- Remove the engine speed sensor.

Action	Specifications/Repair	Next Step
Inspect the engine speed sensor for the following: • Metal debris on end of sensor • Damage to end of sensor caused by camshaft gear • Oil leakage or insulation problems such as swelling • Damaged electrical potting in sensing end of sensor.	**OK** **No damaged engine speed sensor**	1C
	NOT OK **Replace the engine speed sensor** Refer to Procedure 019-038.	4A



19400003

STEP 1C: Check the camshaft engine speed sensor operation.

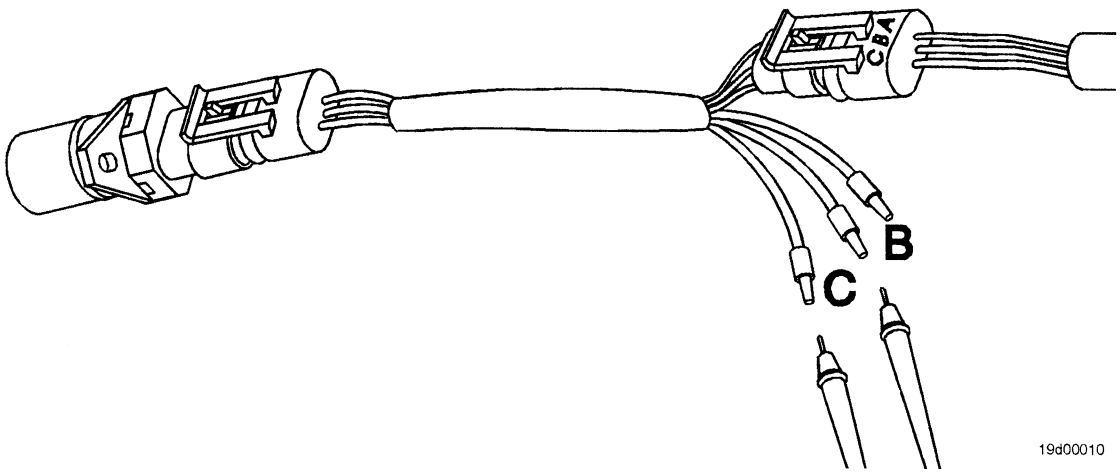
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3824775 - breakout cable.

Condition:

- Install wiring breakout cable.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check for a signal from engine speed sensor. • Measure the voltage from pin B (or BLACK) to pin C (or YELLOW) at the breakout cable, while barring the engine over.	**OK** **Positive ([+] 4.0 to 5.0 VDC to (+) 0.5 to 2.3 VDC) and back again about every 360° of rotation**	1C-1
	NOT OK **Replace the engine speed sensor** Refer to Procedure 019-038.	4A



STEP 1C-1: Check the engine speed sensor supply voltage.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

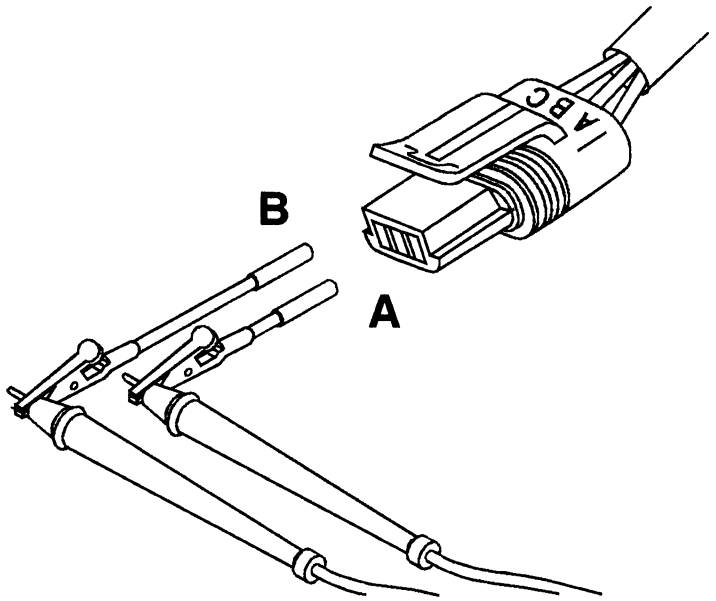
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Disconnect the engine harness from the engine speed sensor.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the engine speed sensor supply voltage. • Measure the voltage from pin A (or RED) to pin B (or BLACK) on the harness side of the engine speed sensor connector.	**OK** **(+) 4.75 to 5.25 VDC**	2A
	NOT OK **Replace the ECM** Refer to Procedure 019-031.	4A



19900917

STEP 2: Check the crankshaft engine speed sensor.

STEP 2A: Inspect the crankshaft engine speed sensor and engine harness connector pins.

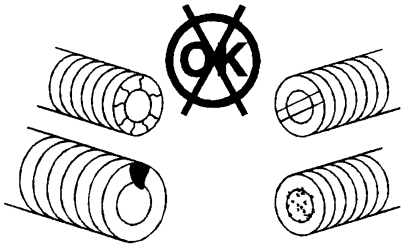
Condition:
- Turn keyswitch OFF.
- Disconnect the engine harness from the engine speed sensor.

Action	Specifications/Repair	Next Step
Inspect the engine speed sensor and engine harness connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	2B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness or the engine speed sensor, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-024. • Replace the engine harness. Refer to Procedure 019-043. • Replace the engine speed sensor. Refer to Procedure 019-038.	4A

STEP 2B: Inspect the crankshaft engine speed sensor.

Condition:
- Turn keyswitch OFF.
- Disconnect the engine harness from the engine speed sensor.
- Remove the engine speed sensor.

Action	Specifications/Repair	Next Step
Inspect engine speed sensor for the following: • Metal debris on end of sensor • Damage to end of sensor caused by crankshaft gear • Oil leakage or insulation problems such as swelling • Damaged electrical potting in sensing end of sensor.	**OK** **No damaged engine speed sensor**	2C
	NOT OK **Replace the engine speed sensor** Refer to Procedure 019-038.	4A



19400003

STEP 2C: Check the crankshaft engine speed sensor operation.

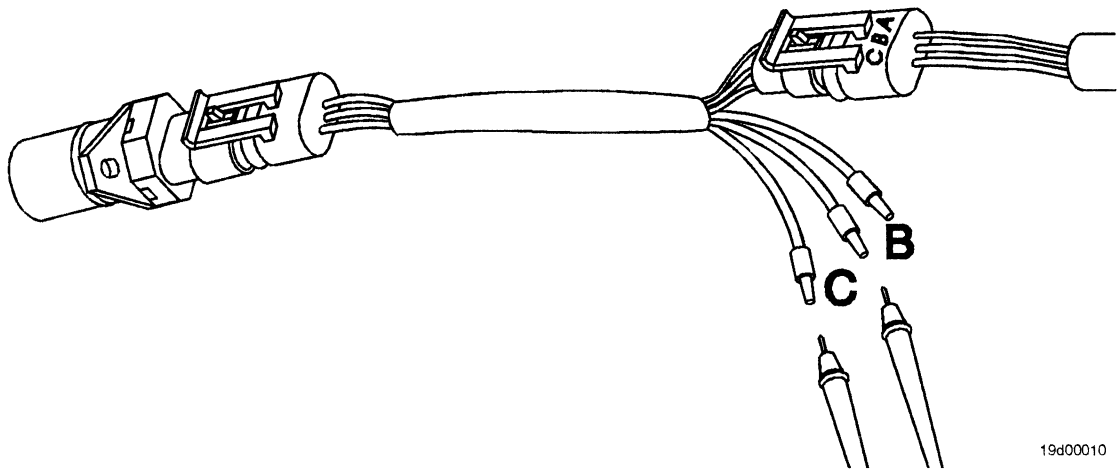
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3824775 - breakout cable.

Condition:

- Install wiring breakout cable, Part No. 3824775 between the crankshaft engine speed sensor and the engine harness.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check for a signal from the engine speed sensor. • Measure the voltage from pin B (or BLACK) to pin C (or YELLOW) at the breakout cable, while barring the engine over.	**OK** **Positive ([+] 4.0 to 5.0 VDC to (+) 0.5 to 2.3 VDC) and back again about every 60° of rotation**	2C-1
	NOT OK **Replace the engine speed sensor** Refer to Procedure 019-038.	4A



STEP 2C-1: Check the engine speed sensor supply voltage

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

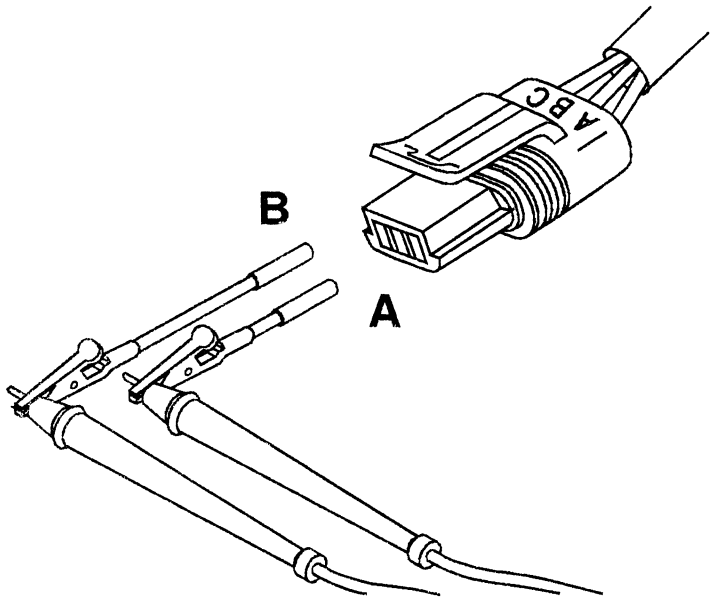
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Disconnect the engine harness from the engine speed sensor.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the engine speed sensor supply voltage. • Measure the voltage from pin A (or RED) to pin B (or BLACK) on the harness side of the engine speed sensor connector.	**OK** **(+) 4.75 to 5.25 VDC**	4A
	NOT OK **Replace the ECM** Refer to Procedure 019-031.	4A



19900917

STEP 3: Check the engine harness for both circuits.

STEP 3A: Inspect the engine harness and ECM connector pins.

⚠CAUTION⚠

To avoid damaging the new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Inspect engine harness and ECM connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	3B
	NOT OK **Repair damaged pins** Repair or replace the engine harness or the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-250 and 019-199. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	4A

STEP 3B: Check for an open circuit.

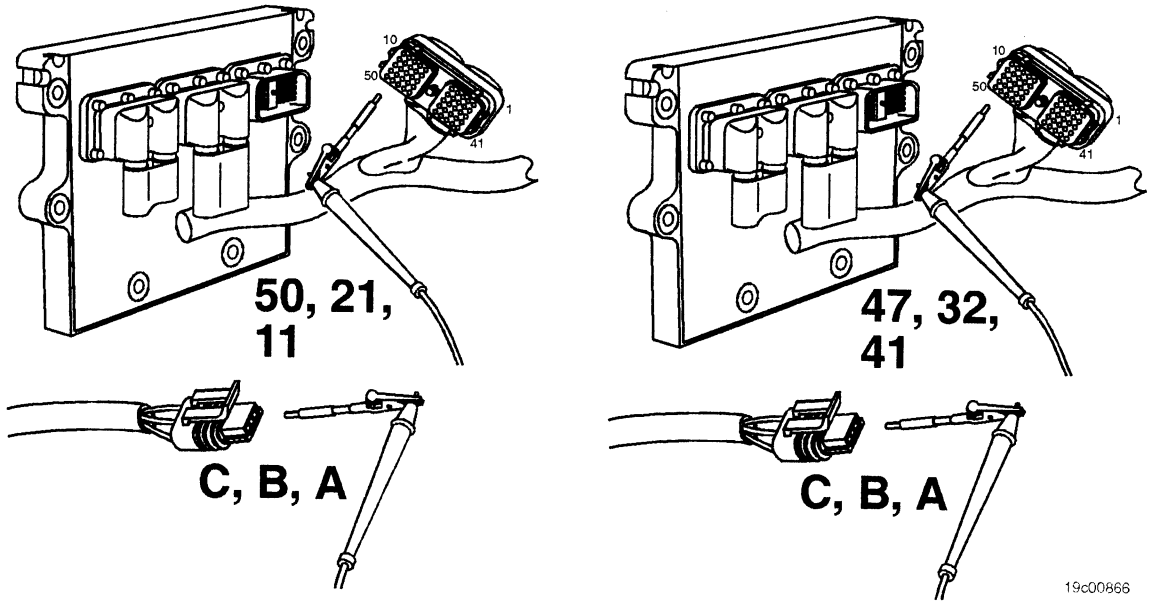
⚠CAUTION⚠

**To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead**

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.
- Connect the engine harness to the engine speed sensor.

Action	Specifications/Repair	Next Step
Check for open circuit. • Measure resistance from pin 50 of the sensor harness ECM connector to pin C (or 3) at the **camshaft** position sensor connector. • Measure resistance from pin 21 of the sensor harness ECM connector to pin B (or 2) at the **camshaft** position sensor connector. • Measure resistance from pin 11 of the sensor harness ECM connector to pin A (or 1) at the **camshaft** position sensor connector. • Measure resistance from pin 47 of the sensor harness ECM connector to pin C (or 3) at the **crankshaft** position sensor connector. • Measure resistance from pin 32 of the sensor harness ECM connector to pin B (or 2) at the **crankshaft** position sensor connector. • Measure resistance from pin 41 of the sensor harness ECM connector to pin A (or 1) at the **crankshaft** position sensor connector.	**OK** **Less than 10 ohms**	3C
	NOT OK **Repair or replace engine harness** • Repair the engine harness. Refer to Procedures 019-250 and 019-199. • Replace the engine harness. Refer to Procedure 019-043.	4A



STEP 3C: Check for a short circuit to engine block ground.

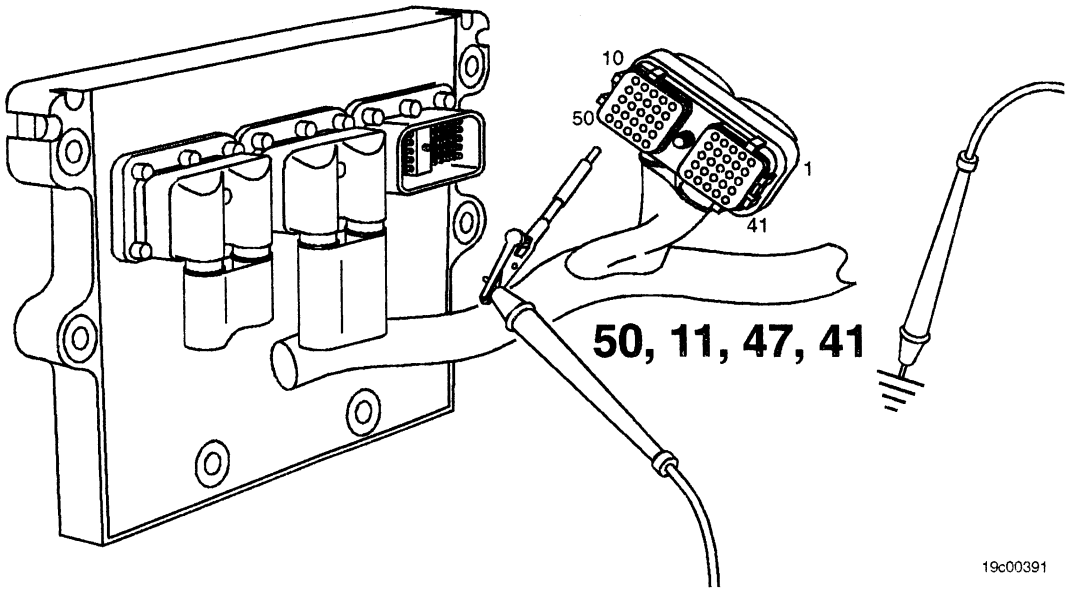
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.
- Disconnect the engine harness from the engine speed sensor.

Action	Specifications/Repair	Next Step
Check for short circuit to ground. • Measure the resistance from pin 50 of the sensor harness ECM connector to the engine block ground. • Measure the resistance from pin 11 of the sensor harness ECM connector to the engine block ground. • Measure the resistance from pin 47 of the sensor harness ECM connector to the engine block ground. • Measure the resistance from pin 41 of the sensor harness ECM connector to the engine block ground.	**OK** **More than 100k ohms**	3D
	NOT OK **Repair or replace engine harness** • Repair the engine harness. Refer to Procedures 019-250 and 019-199. • Replace the engine harness. Refer to Procedure 019-043.	4A



STEP 3D: Check for a short circuit from pin to pin.

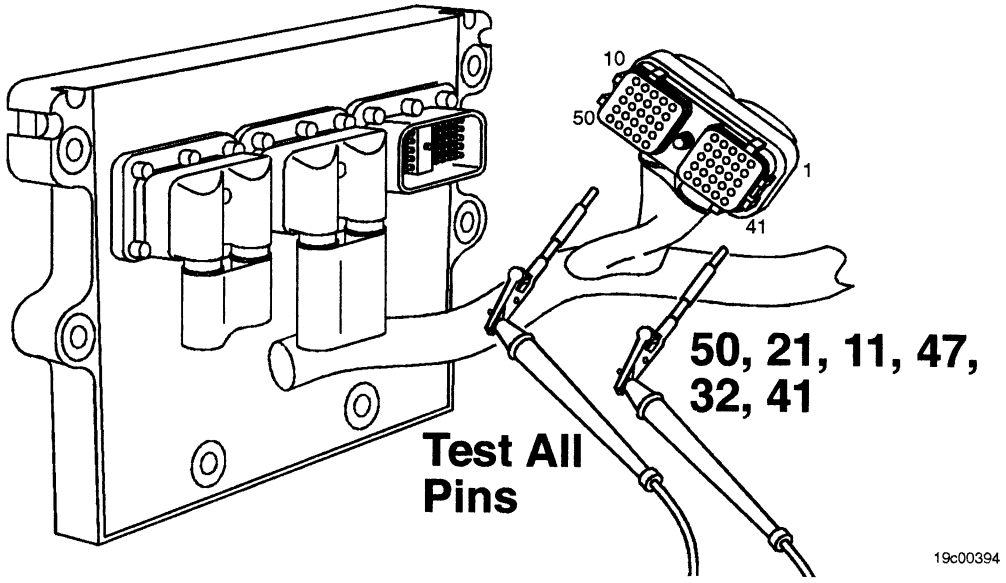
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.
- Disconnect the engine harness from the engine speed sensor.

Action	Specifications/Repair	Next Step
Check for short circuit from pin to pin • Measure resistance from pin 50 to all other pins of the sensor harness ECM connector. • Measure resistance from pin 21 to all other pins of the sensor harness ECM connector. • Measure resistance from pin 11 to all other pins of the sensor harness ECM connector. • Measure resistance from pin 47 to all other pins of the sensor harness ECM connector. • Measure resistance from pin 32 to all other pins of the sensor harness ECM connector. • Measure resistance from pin 41 to all other pins of the sensor harness ECM connector.	**OK** **More than 100k ohms**	4A
	NOT OK **Repair or replace engine harness** • Repair the engine harness. Refer to Procedures 019-250 and 019-199. • Replace the engine harness. Refer to Procedure 019-043.	4A



STEP 4: Clear the fault codes.

STEP 4A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it idle for 1 minute. • Using INSITE™, verify that Fault Code 753 is inactive.	**OK** **Fault Code 753 inactive**	4B
	NOT OK Return to troubleshooting steps or contact your local Cummins Authorized Repair Location if all steps have been completed and checked again.	1A

STEP 4B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Using INSITE™, clear the inactive fault codes.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	4C

STEP 4C: Should the fault code return.

Condition:
- Complete all steps above and recheck.

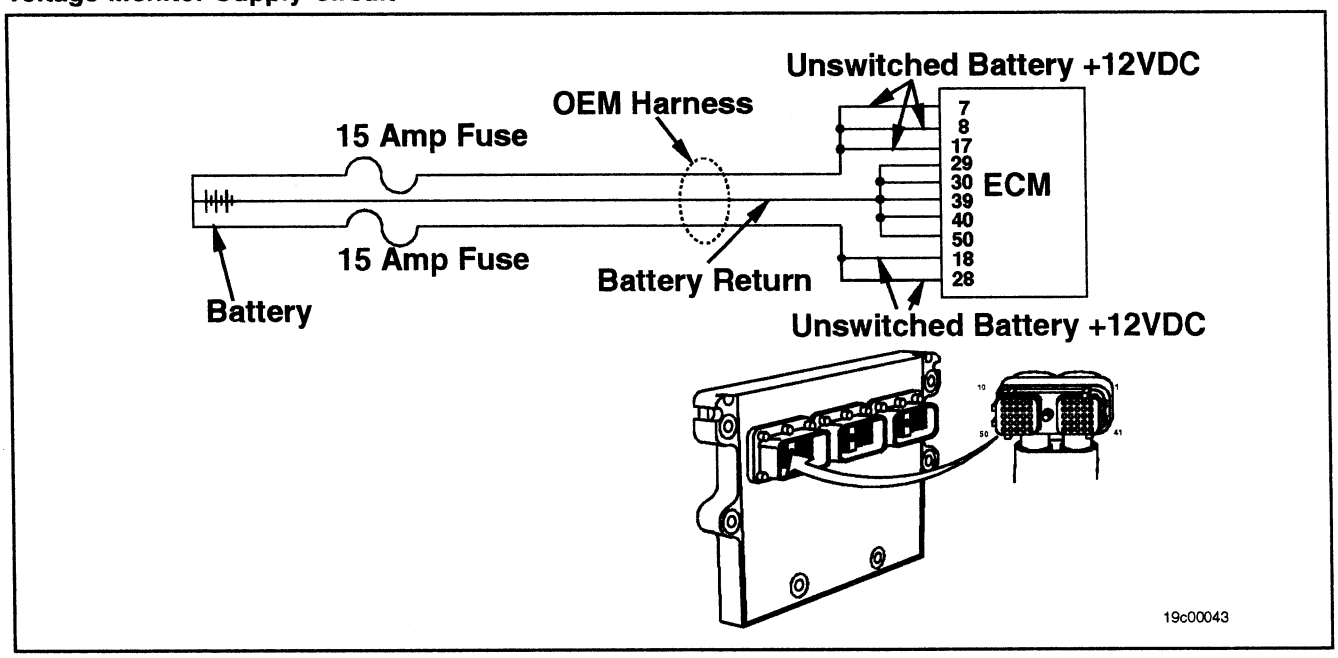
Action	Specifications/Repair	Next Step
Check the static timing of the injector camshaft. • Refer to Procedure 003-004 in the Signature, ISX and QSX15 Troubleshooting and Repair Bulletin No. 3666239.	**OK** **All fault codes cleared and timing checked**	Repair complete
	NOT OK Refer to appropriate troubleshooting charts for any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 598

Voltage Monitor - Very Low Voltage

CODES	REASON	EFFECT
Fault Code: 598 PID(P), SID(S): P167 SPN: 167 FMI: 1/1 Lamp: Red	Very low battery voltage detected by the battery voltage monitor feature.	Red lamp lit until very low battery voltage condition is corrected. The electronic control module (ECM) can increase idle speed and deactivate idle decrement switch if idle speedup is enabled. The engine will run continuously if ICON™ is active (automotive **only**).

Voltage Monitor Supply Circuit



Circuit Description:

The ECM receives unswitched battery input through the OEM harness. There are two in-line 15-amp fuses in the unswitched battery wire of the OEM harness to protect the engine harness from overheating. The battery return wires are connected directly to the negative (–) battery post.

Component Location:

The ECM is connected to the battery by the OEM harness. This direct link provides a constant power supply for the ECM. The location of the battery will vary with the OEM. Refer to the OEM manual for the battery location.

Shop Talk:

Make sure the ECM unswitched battery supply is coming directly from the battery and **not** the starter.
Possible causes of this fault code:

- Undercharged batteries caused by a faulty alternator or regulator.

TROUBLESHOOTING SUMMARY

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the equipment battery system.		
STEP 1A: Inspect the battery cable and alternator connections.	No damaged connections	
STEP 1B: Check the battery voltage.	Normal conditions: At least (+) 12 VDC During cranking: At least (+) 6.2 VDC	
STEP 2: Check the alternator and OEM harness.		
STEP 2A: Inspect the alternator.	Alternator charging within OEM specifications	
STEP 2B: Inspect the battery power connector.	No damaged pins	
STEP 2C: Check for an open circuit in the unswitched battery supply circuit.	Less than 10 ohms	
STEP 2D: Check for a short circuit.	More than 100k ohms	
STEP 2E: Check the add-on or accessory wiring at the positive (+) terminal of the battery.	No damaged wires	
STEP 3: Clear the fault codes.		
STEP 3A: Disable the fault code.	Fault Code 598 inactive	
STEP 3B: Clear the inactive fault codes.	All fault codes cleared	

TROUBLESHOOTING STEP

STEP 1: Check the equipment battery system.

STEP 1A: Inspect the battery cable and alternator connections.

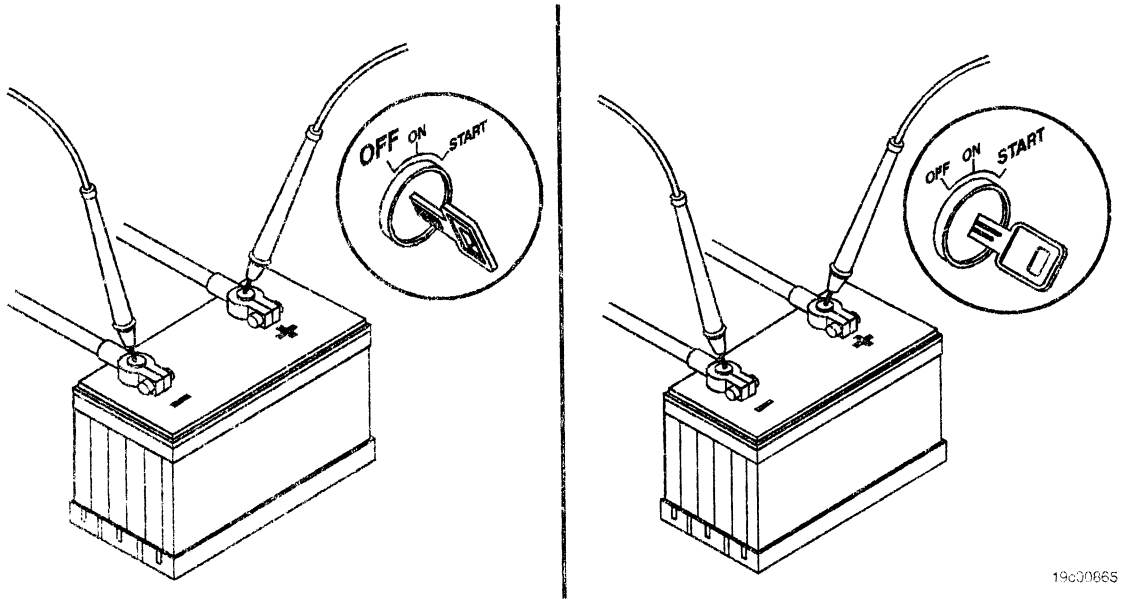
Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Inspect the battery cable and alternator connections for the following: • Corrosion • Loose connection.	**OK** **No damaged connections**	1B
	NOT OK **Repair the damaged connections** Tighten the battery connections and clean the battery terminals. Refer to the OEM troubleshooting and repair manual.	3A

STEP 1B: Check the battery voltage.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Check the battery voltage. • Measure the battery voltage from the positive (+) terminal to the negative (−) terminal. • Measure the battery voltage from the positive (+) terminal to the negative (−) terminal while trying to start the engine.	**OK** **Normal conditions:** At least (+) 12 VDC **During cranking:** At least (+) 6.2 VDC	2A
	NOT OK **Charge or replace the battery** Refer to the OEM troubleshooting and repair manual.	2A



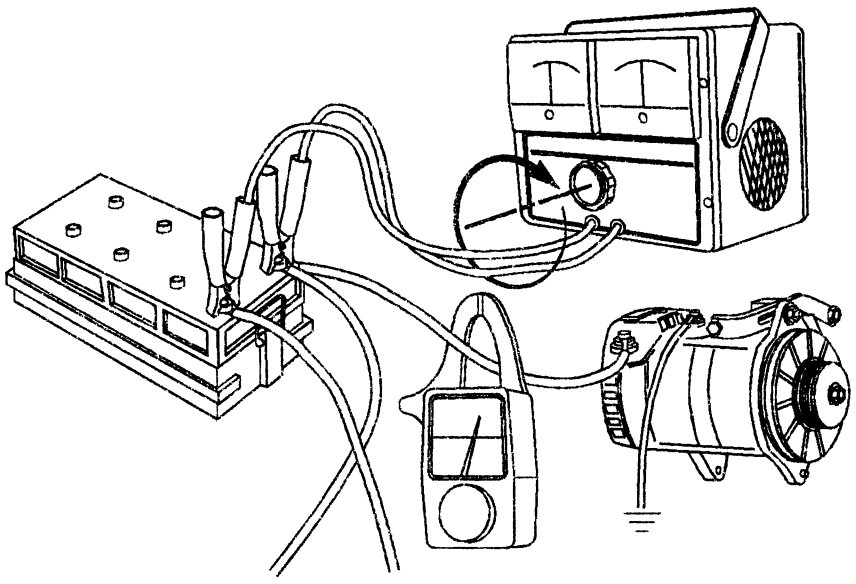
STEP 2: Check the alternator and OEM harness.

STEP 2A: Inspect the alternator.

Condition:

- Turn keyswitch OFF.
- Use OEM ammeter or install an ammeter between the alternator and the battery.

Action	Specifications/Repair	Next Step
Check the charging rate of the alternator. Start the engine and check the alternator's charging rate (amps).	**OK** **Alternator charging within OEM specifications**	2B
NOTE: It will probably be necessary to place a load on the batteries to measure the alternator output properly.	**NOT OK** **Repair or replace the alternator and/or OEM wiring to the alternator** Refer to the OEM troubleshooting and repair manual.	3A



19c00586

STEP 2B: Inspect the battery power connector.

Condition:
- Turn keyswitch OFF.
- Disconnect the OEM harness from the battery at the power connector.

Action	Specifications/Repair	Next Step
Inspect the battery power connector on both the battery side and the harness side for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	2C
	NOT OK **Repair the battery power connector** Refer to the OEM troubleshooting and repair manual for location and procedure. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing.	3A

STEP 2C: Check for an open circuit in the unswitched battery supply circuit.

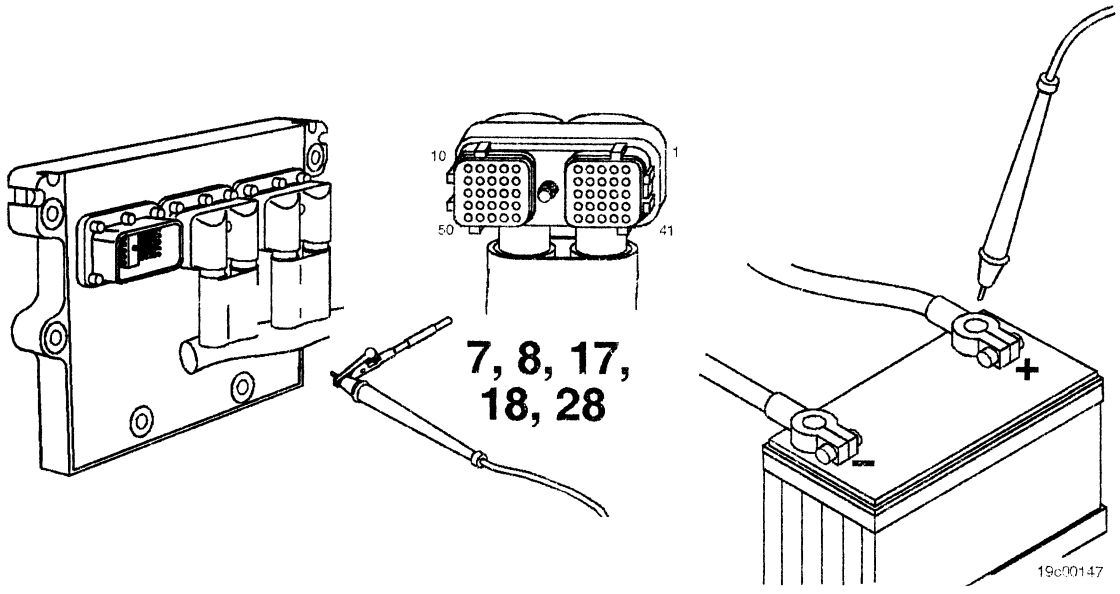
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the OEM harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for an open circuit in the unswitched battery supply circuit. • Measure the resistance between pin 7 of the OEM harness connector and the positive (+) terminal of the battery. • Measure the resistance between pin 8 of the OEM harness connector and the positive (+) terminal of the battery. • Measure the resistance between pin 17 of the OEM harness connector and the positive (+) terminal of the battery. • Measure the resistance between pin 18 of the OEM harness connector and the positive (+) terminal of the battery. • Measure the resistance between pin 28 of the OEM harness connector and the positive (+) terminal of the battery.	**OK** **Less than 10 ohms**	2D
	NOT OK **Repair or replace the battery harness** Refer to the OEM troubleshooting and repair manual.	3A



STEP 2D: Check for a short circuit.

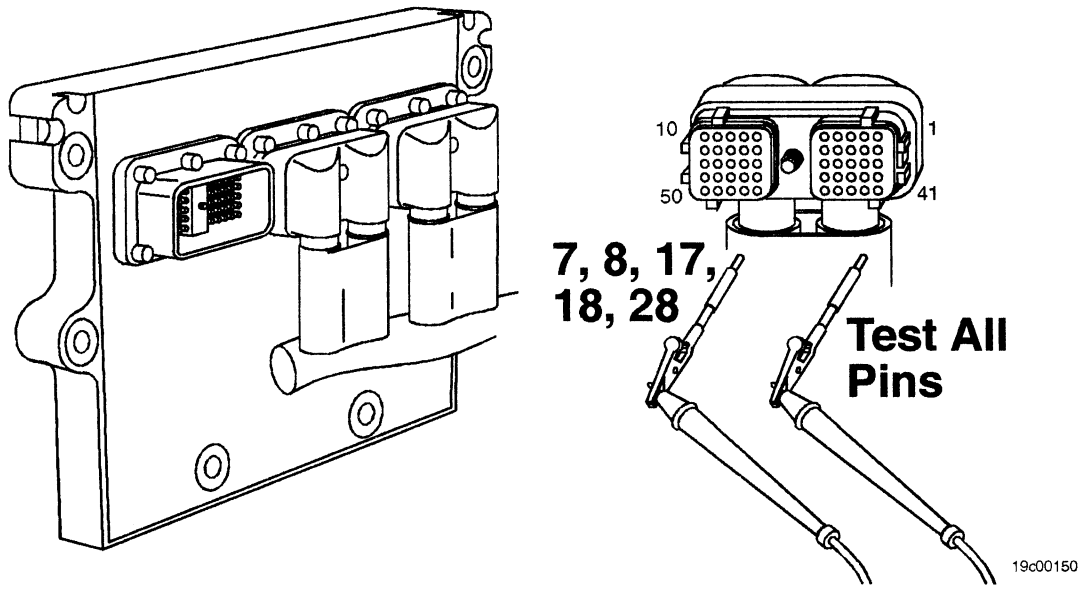
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the OEM harness connector from the ECM.
- Disconnect the OEM harness at the battery power connector.

Action	Specifications/Repair	Next Step
Check for a short circuit. • Measure the resistance from pin 7 of the OEM harness connector to all other pins in the OEM harness connector. • Measure the resistance from pin 8 of the OEM harness connector to all other pins in the OEM harness connector. • Measure the resistance from pin 17 of the OEM harness connector to all other pins in the OEM harness connector. • Measure the resistance from pin 18 of the OEM harness connector to all other pins in the OEM harness connector. • Measure the resistance from pin 28 of the OEM harness connector to all other pins in the OEM harness connector. **NOTE:** Pin 7, 8, 17, 18, and 28 should have continuity.	**OK** **More than 100k ohms**	2E
	NOT OK **Repair or replace the OEM harness** • Repair the OEM harness. Refer to Procedure 019-250. • Replace the OEM harness. Refer to Procedure 019-071.	3A



STEP 2E: Check the add-on or accessory wiring at the positive (+) terminal of the battery.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Check the add-on or accessory wiring at the positive (+) terminal of the battery. Starting at the positive (+) terminal, follow any add-on or accessory wiring and examine the wire(s) for damaged insulation or installation error that can cause a short circuit at supply wire to the engine block ground.	**OK** **No damaged wires**	3A
	NOT OK **Repair the damaged wiring.**	3A

STEP 3: Clear the fault codes.

STEP 3A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it idle for 1 minute. • Using INSITE™, verify that Fault Code 598 is inactive.	**OK** **Fault Code 598 inactive**	3B
	NOT OK Return to the troubleshooting steps or contact your local Cummins Authorized Repair Location if all the steps have been completed and checked again.	1A

STEP 3B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

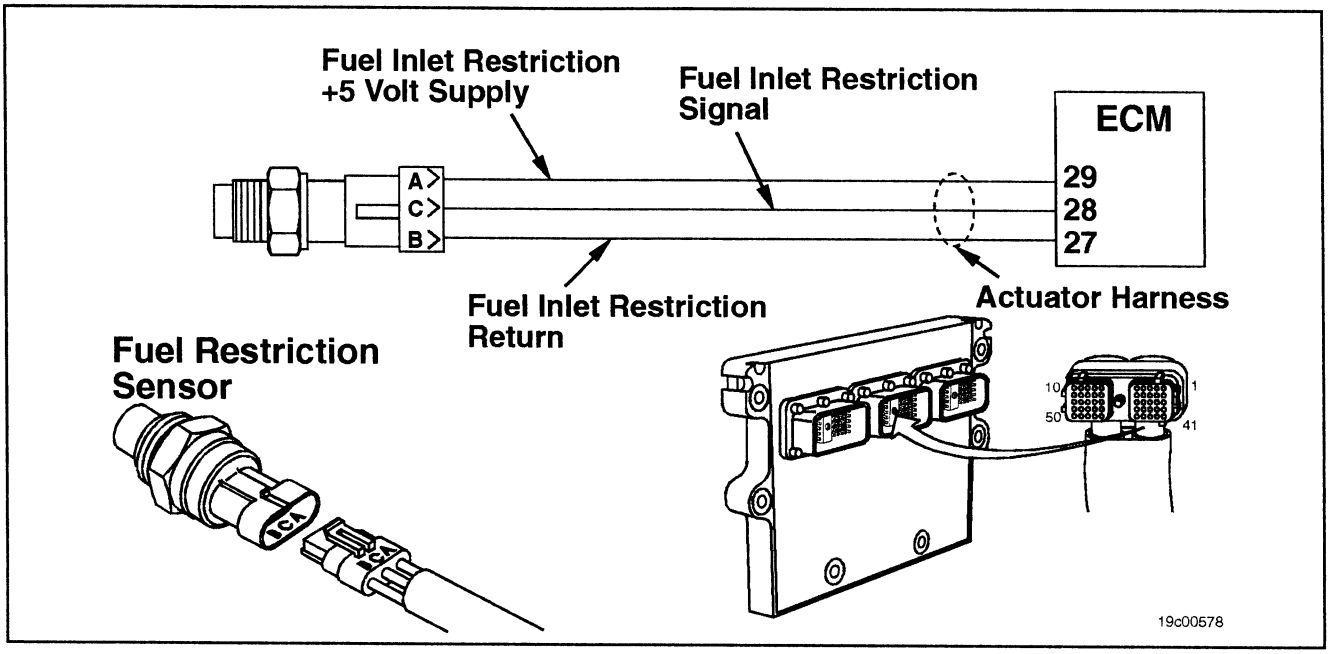
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 583

Fuel Inlet Restriction Sensor Circuit

CODES	REASON	EFFECT
Fault Code: 583 PID(P), SID(S): P015 SPN: 1381 FMI: 1/18 Lamp: Yellow	Restriction has been detected by the fuel inlet restriction sensor.	Fuel inlet restriction monitor warning is set.

Fuel Inlet Restriction Sensor Circuit



Circuit Description:

The fuel inlet restriction sensor provides a signal to the electronic control module (ECM).

Component Location:

The fuel inlet restriction sensor is located on the inlet to the fuel filter head.

Shop Talk:

This fault indicates that the fuel inlet restriction has exceeded 12 in Hg. Typical causes for this fault code include a plugged fuel filter and a collapsed fuel supply hose.

TROUBLESHOOTING SUMMARY

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Measure the fuel inlet restriction.		
STEP 1A: Measure the fuel inlet restriction.	Less than 12 in Hg	
STEP 1A-1: Recheck the fuel inlet restriction.	Less than 6 in Hg	
STEP 2: Inspect the fuel lines or fuel hoses.		
STEP 2A: Inspect the metal fuel lines.	No damage	
STEP 2B: Inspect the fuel hoses.	No damage	
STEP 3: Clear the fault codes.		
STEP 3A: Disable the fault code.	Fault Code 583 inactive	
STEP 3B: Clear the inactive fault codes.	All fault codes cleared	

TROUBLESHOOTING STEP

STEP 1: Measure the fuel inlet restriction.

STEP 1A: Measure the fuel inlet restriction.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Measure the fuel inlet restriction. • Remove the fuel supply hose from the gear pump and install a manometer. • Hold the manometer at the same level as the gear pump connection. • Operate the engine at rated speed and no load. • Observe the fuel inlet restriction reading on the manometer.	OK Less than 12 in Hg	3A
	NOT OK Replace the fuel filter	1A-1

STEP 1A-1: Recheck the fuel inlet restriction.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Measure the fuel inlet restriction. • Remove the fuel supply hose to the gear pump and install a manometer. • Hold the manometer at the same level as the gear pump connection. • Operate the engine at rated speed and no load. • Observe the fuel inlet restriction reading on the manometer.	OK Less than 6 in Hg	3A
	NOT OK Does **not** meet specifications.	2A

STEP 2: Inspect the fuel lines or fuel hoses.

STEP 2A: Inspect the metal fuel lines.

Condition:

Action	Specifications/Repair	Next Step
Inspect the metal fuel lines for these conditions: • Sharp bends, which can cause a pressure restriction.	**OK** **No damage**	2B
	NOT OK **Replace the damaged line(s)**	3A

STEP 2B: Inspect the fuel hoses.

Condition:
• Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Inspect the fuel hoses. • Check fuel hoses for separation of the inner lining from the center of the hose, which can cause restriction.	**OK** **No damage**	3A
	NOT OK **Replace the damaged hose**	3A

STEP 3: Clear the fault codes.

STEP 3A: Disable the fault code.

Condition:
• Connect all components.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it idle for 1 minute. • Verify that Fault Code 583 is inactive.	**OK** **Fault Code 583 inactive**	3B
	NOT OK Return to the troubleshooting steps, or contact your local Cummins Authorized Repair Location if all troubleshooting steps have been completed and checked again.	1A

STEP 3B: Clear the inactive fault codes.

Condition:
• Connect all components.

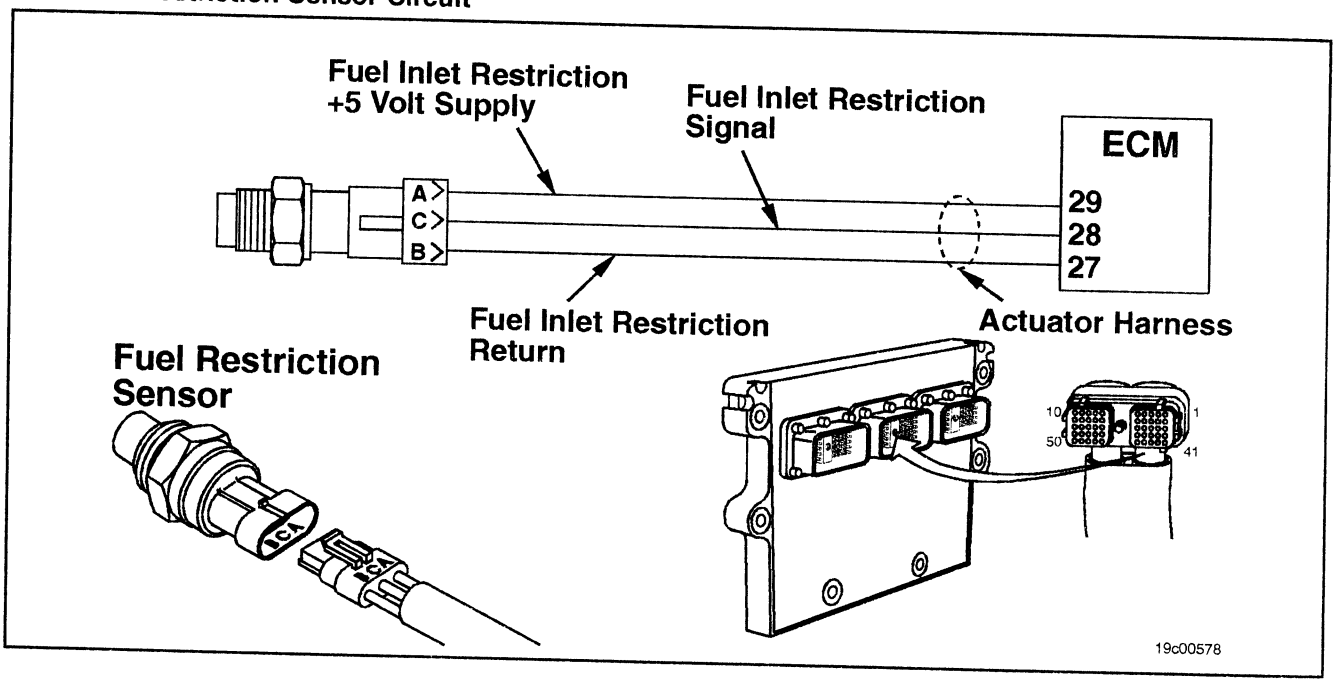
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Clear the inactive fault codes using INSITE™.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 582

Fuel Inlet Restriction Sensor Circuit

CODES	REASON	EFFECT
Fault Code: 582 PID(P), SID(S): P015 SPN: 1381 FMI: 4/4 Lamp: Yellow	Low voltage detected at the fuel inlet restriction sensor signal pin.	Fuel inlet restriction monitor deactivated.

Fuel Inlet Restriction Sensor Circuit



Circuit Description:

The fuel inlet restriction sensor provides a fuel pressure signal to the electronic control module (ECM).

Component Location:

The fuel inlet restriction sensor is located on the fuel filter head.

Shop Talk:

- This fault indicates that the voltage at signal pin 28 on the ECM is out of specification.
- The ECM provides a supply voltage of (+) 4.75 to 5.25 VDC. The sensor signal voltage to the ECM is from (+) 4.16 to 4.83 VDC.
- A quick check to determine if the sensor is functioning is to measure the pin-to-pin resistance of the sensor.

Description	Pin-to-Pin Resistance (k ohms)
Supply voltage to ground	13.35
Supply voltage to signal	1.77
Signal to ground	14.68

TROUBLESHOOTING SUMMARY

⚠ CAUTION ⚠

To avoid damaging the new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead
Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead
Part No. 3824776 - breakout cable.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the fuel inlet restriction sensor.		
STEP 1A: Inspect the harness and sensor connector pins.	No damaged pins	
STEP 1B: Read the fault codes.	Fault Code 582 inactive	
STEP 1C: Check the supply voltage.	(+) 4.75 to 5.25 VDC	
STEP 1C-1: Measure the voltage from the ECM.	(+) 4.75 to 5.25 VDC	
STEP 1D: Check the signal voltage.	(+) 0.5 to 4.16 VDC	
STEP 1D-1: Check for a short circuit to ground in the supply and signal wires.	More than 100k ohms	
STEP 1D-2: Check for a short circuit from the supply and signal wires to all other wires in the engine harness.	More than 100k ohms	
STEP 2: Check the engine harness.		
STEP 2A: Inspect the engine harness and ECM connector pins.	No damaged pins	
STEP 2B: Read the fault codes.	Fault Code 582 inactive	
STEP 2C: Check for an open circuit in the supply and signal wires.	Less than 10 ohms	
STEP 3: Check for an ECM response.		
STEP 3A: Check for the appropriate ECM response.	Fault Code 582 inactive Fault Code 581 active	
STEP 4: Clear the fault codes.		
STEP 4A: Disable the fault code.	Fault Code 582 inactive	
STEP 4B: Clear the inactive fault codes.	All fault codes cleared	

TROUBLESHOOTING STEP

STEP 1: Check the fuel inlet restriction sensor.

STEP 1A: Inspect the engine harness and sensor connector pins.

Condition:
- Turn keyswitch OFF.
- Disconnect the fuel inlet restriction sensor from the engine harness.

Action	Specifications/Repair	Next Step
Inspect the fuel inlet restriction sensor and engine harness connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	1B
	NOT OK **Repair the damaged pins** • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Replace the 3-pin Metri-Pack connector. Refer to Procedure 019-203. • Replace the fuel inlet restriction sensor. Refer to Procedure 019-128.	4A

STEP 1B: Read the fault codes.

Condition:
- Connect all components.
- Connect the INSITE™ electronic service tool.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Start the engine and let it idle for 1 minute. • Using INSITE™, read the fault codes.	**OK** **Fault Code 582 inactive**	4B
	NOT OK Fault Code 581 active.	1C

STEP 1C: Check the supply voltage.

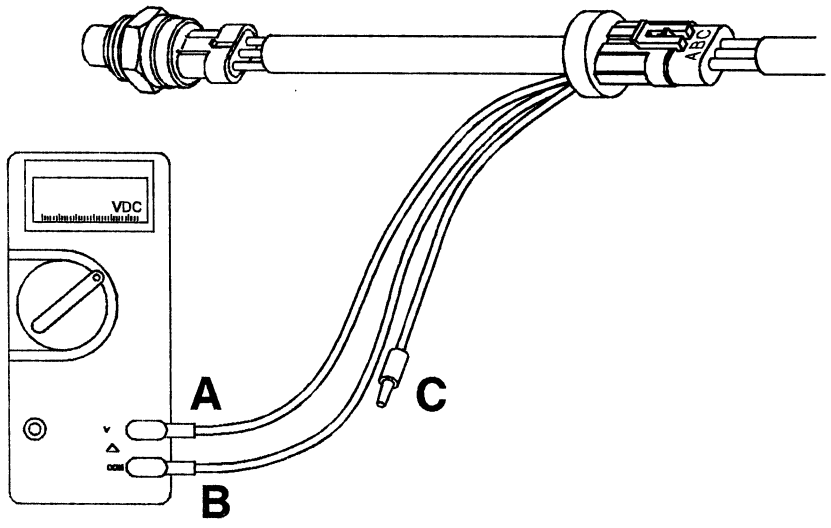
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3824776 - breakout cable.

Condition:

- Install breakout cable, Part No. 3824776, between the sensor and the engine harness sensor connector.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the supply voltage. • Measure the supply voltage by install the breakout cable's supply pin A (or RED) and return pin B (or BLACK) connectors into the multimeter.	**OK** **(+) 4.75 to 5.25 VDC**	1D
	NOT OK Does **not** meet specifications.	1C-1



19c00828

STEP 1C-1: Measure the voltage from the ECM.

⚠CAUTION⚠

To avoid damaging the new ECM, all other active fault codes must be investigated prior to replacing the ECM.

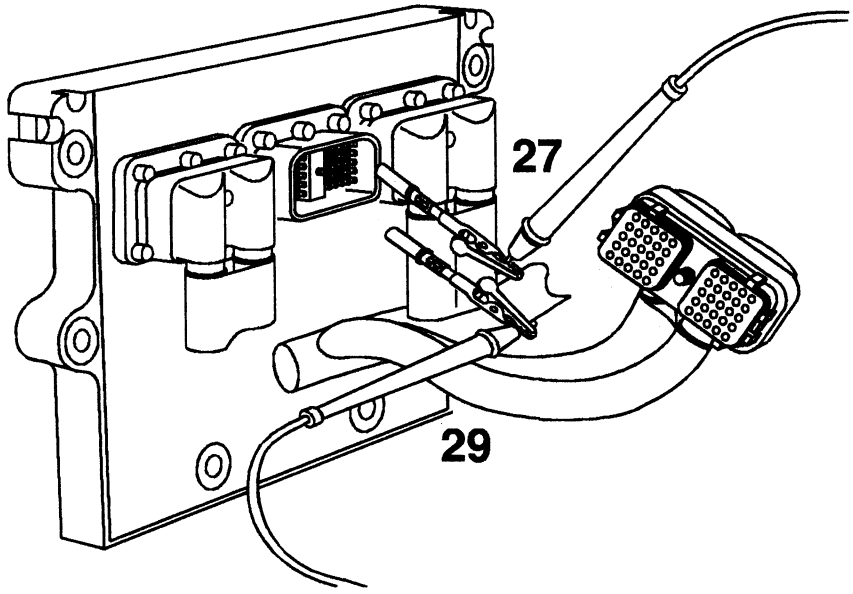
⚠CAUTION⚠

To avoid pin and harness damage, use the following test leads when taking a measurement: Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

Condition:

- Disconnect the actuator harness connector from the ECM.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Measure the ECM output voltage. • Measure the voltage from pin 29 to pin 27 at the actuator port of the ECM.	**OK** **(+) 4.75 to 5.25 VDC** **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 091-043.	4A
	NOT OK **Replace the ECM** Refer to Procedure 019-031.	4A



19c00852

STEP 1D: Check the signal voltage.

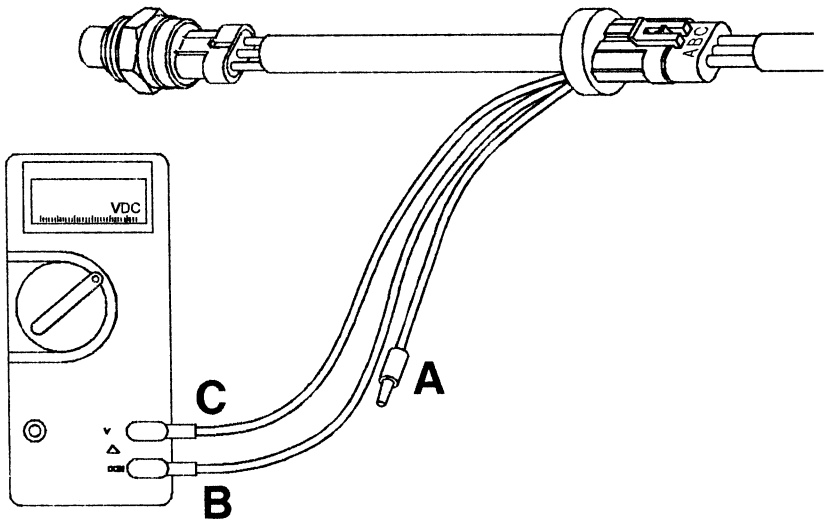
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3824776 - breakout cable.

Condition:

- Install breakout cable, Part No. 3824776, between the sensor and the engine harness sensor connector.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the signal voltage. • Measure the supply voltage by installing the breakout cable's signal pin C (or YELLOW) and return pin B (or BLACK) connectors into the multimeter.	**OK** **(+) 0.5 to 4.16 VDC**	2A
	NOT OK Does **not** meet specifications.	1D-1



19c00875

STEP 1D-1: Check for a short circuit to ground in the supply and signal wires.

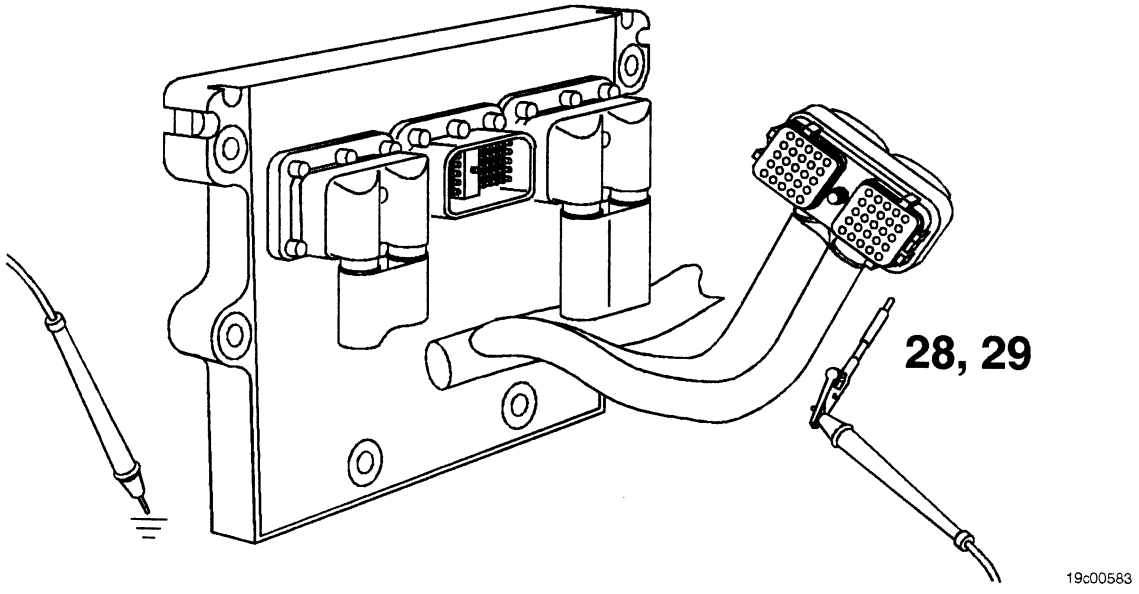
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the 50-pin actuator harness connector from the ECM.
- Disconnect the fuel inlet restriction sensor from the engine harness.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground in the supply and signal wires. • Measure the resistance from pin 28 in the actuator harness connector to the engine block ground. • Measure the resistance from pin 29 in the actuator harness connector to the engine block ground.	**OK** **More than 100k ohms**	1D-2
	NOT OK **Replace the engine harness** Replace the engine harness. Refer to Procedure 019-043.	4A



STEP 1D-2: Check for a short circuit from the supply and signal wires to all other wires in the engine harness.

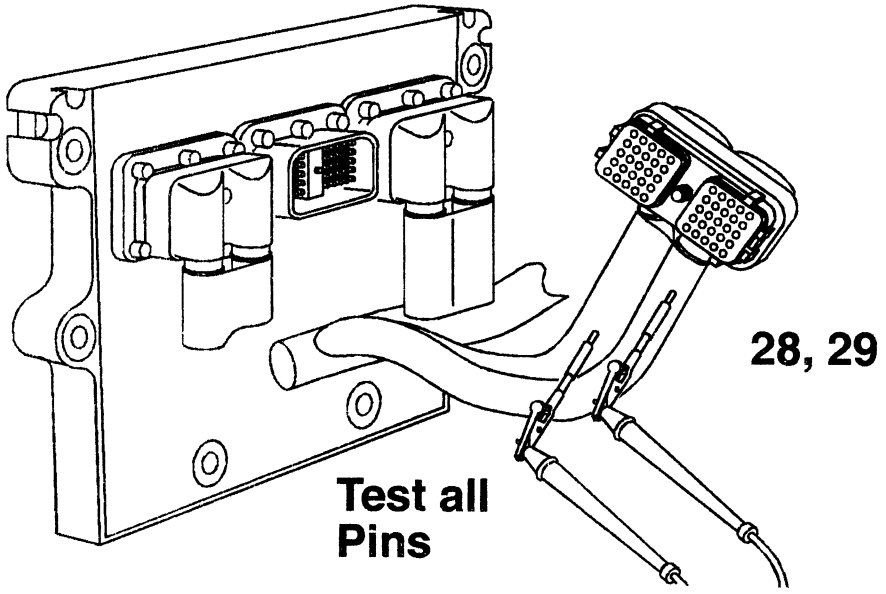
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness connector from the ECM.
- Disconnect the fuel inlet restriction sensor from the engine harness.

Action	Specifications/Repair	Next Step
Check for a short circuit from the supply and signal wires to all other wires in the engine harness. • Measure the resistance from pin 28 in the actuator harness connector to all other pins in the connector. • Measure the resistance from pin 29 in the actuator harness connector to all other pins in the connector.	**OK** **More than 100k ohms** **Replace the fuel inlet restriction sensor** Refer to Procedure 019-128.	4A
	NOT OK **Replace the engine harness** Replace the engine harness. Refer to Procedure 019-043.	4A



STEP 2: Check the engine harness.

STEP 2A: Inspect the engine harness and ECM connector pins.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:
- Turn keyswitch OFF.
- Disconnect the actuator harness connector from the ECM.

Action	Specifications/Repair	Next Step
Inspect the engine harness and ECM connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	2B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	4A

STEP 2B: Read the fault codes.

Condition:
- Connect all components.
- Connect the INSITE™ electronic service tool.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Start the engine and let it idle for 1 minute. • Using INSITE™, read the fault codes.	**OK** **Fault Code 582 inactive**	4B
	NOT OK Fault Code 582 active.	2C

STEP 2C: Check for an open circuit in the supply and signal wires.

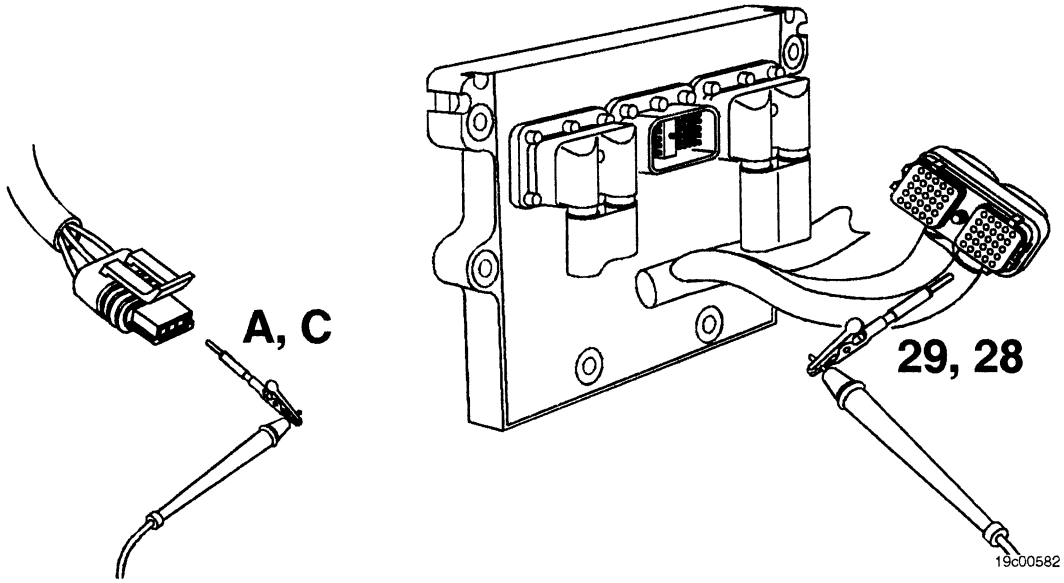
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness connector from the ECM.
- Disconnect the fuel inlet restriction sensor from the engine harness.

Action	Specifications/Repair	Next Step
Check for an open circuit in the supply and signal wires. • Measure the resistance from pin 29 of the actuator harness connector to pin A (or 1) of the 3-pin connector. • Measure the resistance from pin 28 of the actuator harness connector to pin C (or 3) of the 3-pin connector.	**OK** **Less than 10 ohms**	3A
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250 or 019-203. • Replace the engine harness. Refer to Procedure 019-043.	4A



STEP 3: Check for an ECM response.

STEP 3A: Check for the appropriate ECM response.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

Condition:

- Disconnect the actuator harness connector from the ECM.
- Install a jumper wire, Part No. 3822917, from pin 28 to pin 29 at the ECM actuator port.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check for the appropriate ECM response. • Using INSITE™, read the fault codes.	**OK** **Fault Code 582 inactive** **Fault Code 581 active**	4A
	NOT OK **Fault Code 582 active** **Replace the ECM** Refer to Procedure 019-031.	4A

STEP 4: Clear the fault codes.

STEP 4A: Disable the fault code.

Condition:

- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it idle for 1 minute. • Verify that Fault Code 582 inactive.	**OK** **Fault Code 582 inactive**	4B
	NOT OK Return to troubleshooting steps or contact your local Cummins Authorized Repair Location, if all steps have been completed and checked again	1A

STEP 4B: Clear the inactive fault codes.

Condition:

- Connect all components.
- Turn keyswitch ON.

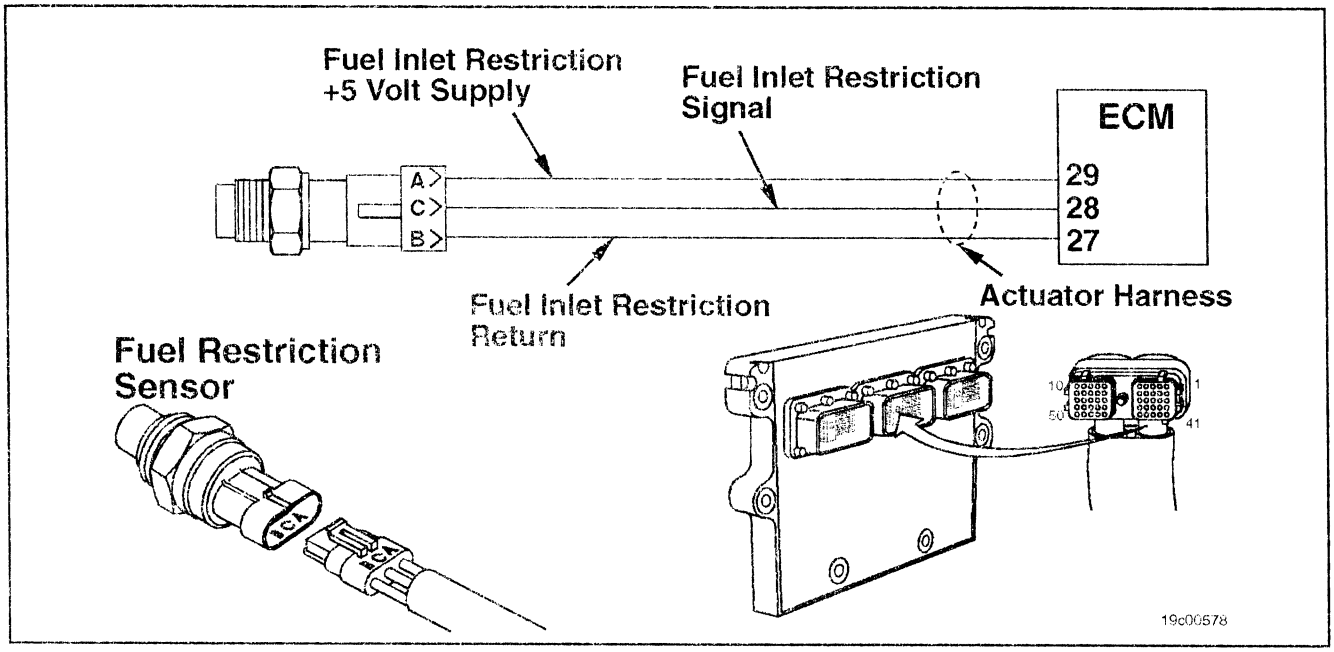
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 581

Fuel Inlet Restriction Sensor Circuit

CODES	REASON	EFFECT
Fault Code: 581 PID(P), SID(S): P015 SPN: 1381 FMI: 3/3 Lamp: Yellow	High voltage detected on fuel inlet restriction sensor signal pin.	Fuel inlet restriction monitor deactivated.

Fuel Inlet Restriction Sensor Circuit



Circuit Description:

The fuel inlet restriction sensor provides a fuel pressure signal to the electronic control module (ECM).

Component Location:

The fuel inlet restriction sensor is located on the fuel filter head.

Shop Talk:

This fault indicates that a short circuit of at least positive (+) 5 VDC has occurred at signal pin 28 on the actuator harness connector at the ECM.

TROUBLESHOOTING SUMMARY

⚠ CAUTION ⚠

To avoid damaging the new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead
Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead
Part No. 3824775 - breakout cable.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the fuel inlet restriction sensor.		
STEP 1A: Inspect the harness and sensor connector pins.	No damaged pins	
STEP 1B: Read the fault codes.	Fault Code 581 inactive	
STEP 1C: Check the supply voltage.	(+) 4.75 to 5.25 VDC	
STEP 1C-1: Measure the voltage from the ECM.	(+) 4.75 to 5.25 VDC	
STEP 1D: Check the signal voltage.	(+) 0.5 to 4.16 VDC	
STEP 2: Check the engine harness.		
STEP 2A: Inspect the engine harness and ECM connector pins.	No damaged pins	
STEP 2B: Read the fault codes.	Fault Code 581 inactive	
STEP 2C: Check for an open circuit in the return wire.	Less than 10 ohms	
STEP 2D: Check for a short circuit to ground in the supply, signal, and return wires.	More than 100k ohms	
STEP 2E: Check for a short circuit from the supply, signal, and return wires to all other wires in the engine harness.	More than 100k ohms	
STEP 3: Check for an ECM response.		
STEP 3A: Check for the appropriate ECM response.	Fault Code 581 inactive Fault Code 582 active	
STEP 4: Clear the fault codes.		
STEP 4A: Disable the fault code.	Fault Code 581 inactive	
STEP 4B: Clear the inactive fault codes.	All fault codes cleared	

TROUBLESHOOTING STEP

STEP 1: Check the fuel inlet restriction sensor.

STEP 1A: Inspect the engine harness and sensor connector pins.

Condition:
- Turn keyswitch OFF.
- Disconnect the fuel inlet restriction sensor from the engine harness.

Action	Specifications/Repair	Next Step
Inspect fuel inlet restriction sensor and engine harness connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	1B
	NOT OK **Repair the damaged pins** • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Replace the 3-pin Metri-Pack connector. Refer to Procedure 019-203. • Replace the fuel inlet restriction sensor. Refer to Procedure 019-128.	4A

STEP 1B: Read the fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Start the engine and let it idle for 1 minute. • Using INSITE™, read the fault codes.	**OK** **Fault Code 581 inactive**	4B
	NOT OK Fault Code 582 active.	1C

STEP 1C: Check the supply voltage.

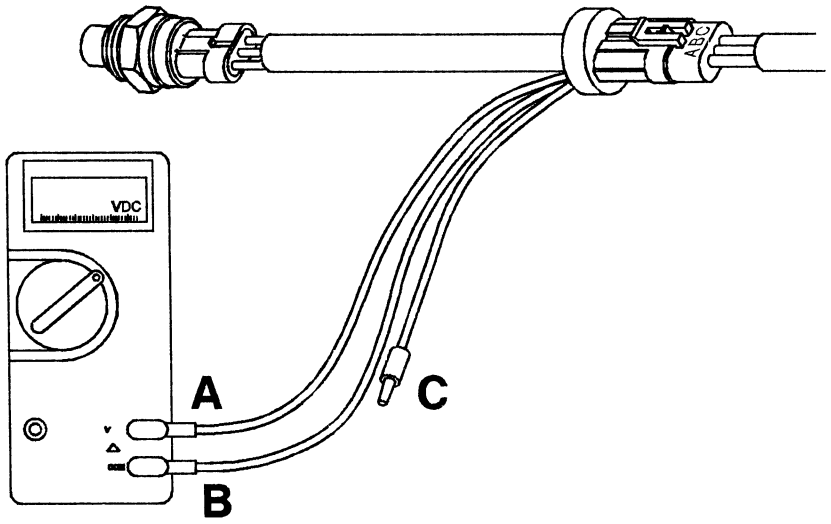
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3824775 - breakout cable.

Condition:

- Install breakout cable, Part No. 3824775, between the sensor and the harness connector.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the supply voltage. • Measure the supply voltage by installing the breakout cable's supply pin A (or RED) and return pin B (or BLACK) connectors into the multimeter.	**OK** **(+) 4.75 to 5.25 VDC**	1D
	NOT OK Does **not** meet specifications.	1C-1



19c00828

STEP 1C-1: Measure the voltage from the ECM.

⚠CAUTION⚠

To avoid damaging the new ECM, all other active fault codes must be investigated prior to replacing the ECM.

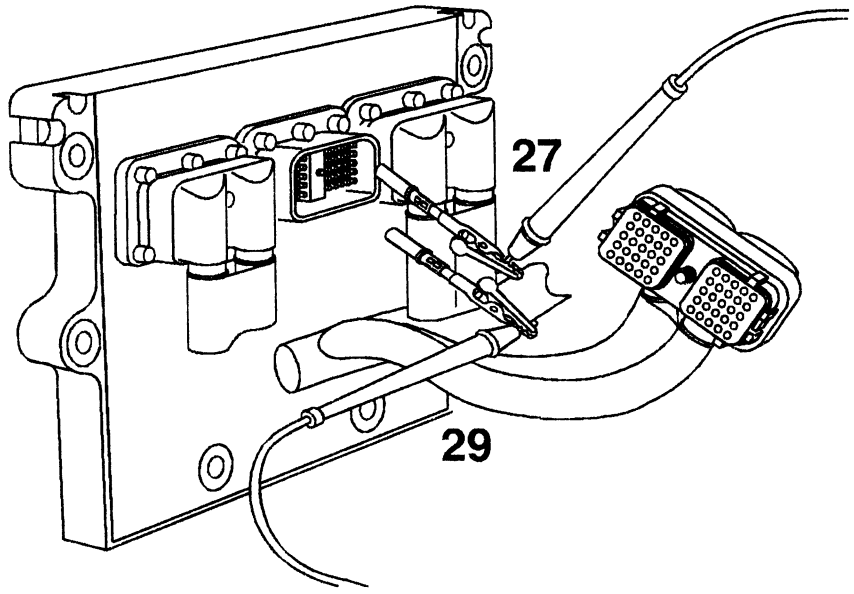
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

Condition:

- Disconnect the actuator harness connector from the ECM.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Measure the ECM output voltage. • Measure the voltage from pin 29 to pin 27 at the actuator port of the ECM.	**OK** **(+) 4.75 to 5.25 VDC** **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	1D
	NOT OK **Replace the ECM** Refer to Procedure 019-031.	4A



STEP 1D: Check the signal voltage.

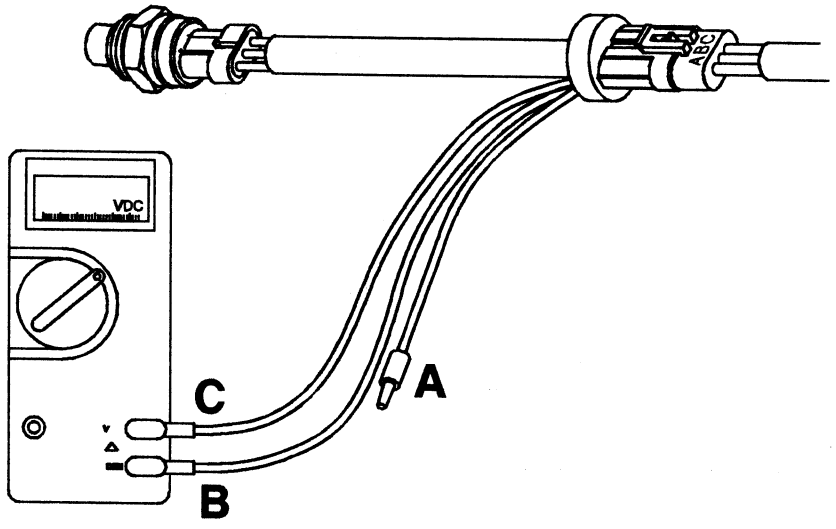
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3824775 - breakout cable.

Condition:

- Install breakout cable, Part No. 3824775, between the sensor and the harness connector.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the signal voltage. • Measure the signal voltage by installing the breakout cable's signal pin C (or YELLOW) and return pin B (or BLACK) connectors into the multimeter.	**OK** **(+) 0.5 to 4.16 VDC**	3A
	NOT OK Does **not** meet specifications.	2A



19c00875

STEP 2: Check the engine harness.

STEP 2A: Inspect the engine harness and ECM connector pins.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:
- Turn keyswitch OFF.
- Disconnect the actuator harness connector from the ECM.

Action	Specifications/Repair	Next Step
Inspect the ECM and engine harness connectors for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	2B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	4A

STEP 2B: Read the fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Start the engine and let it idle for 1 minute. • Using INSITE™, read the fault codes.	**OK** **Fault Code 581 inactive**	4A
	NOT OK Fault Code 581 active.	2C

STEP 2C: Check for an open circuit in the return wire.

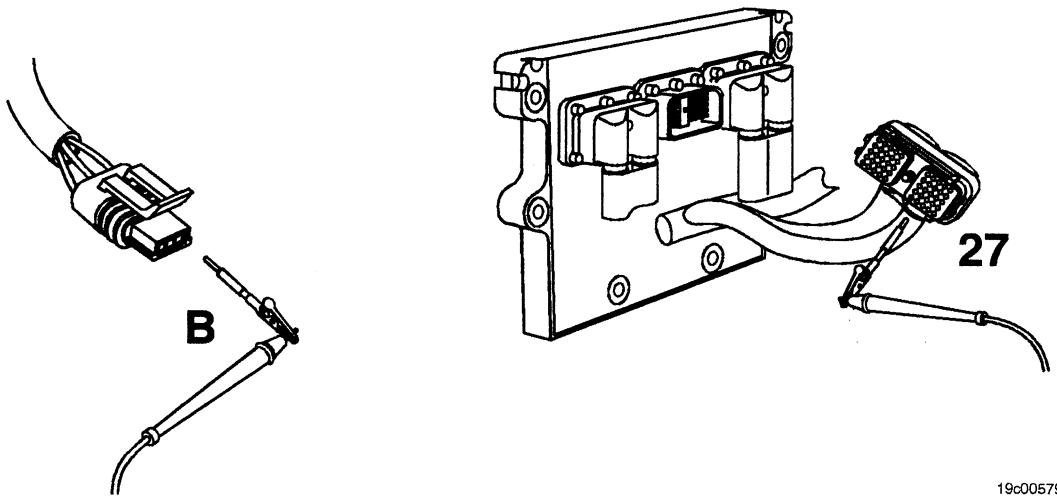
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness connector from the ECM.
- Disconnect the fuel inlet restriction sensor from the engine harness.

Action	Specifications/Repair	Next Step
Check for an open circuit in the return wire. • Measure the resistance from pin 27 of the actuator harness connector to pin B (or 2) of the 3-pin connector at the sensor.	**OK** **Less than 10 ohms**	2D
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-203 or 019-250. • Replace the engine harness. Refer to Procedure 019-043.	4A



STEP 2D: Check for a short circuit to ground in the supply, signal, and return wires.

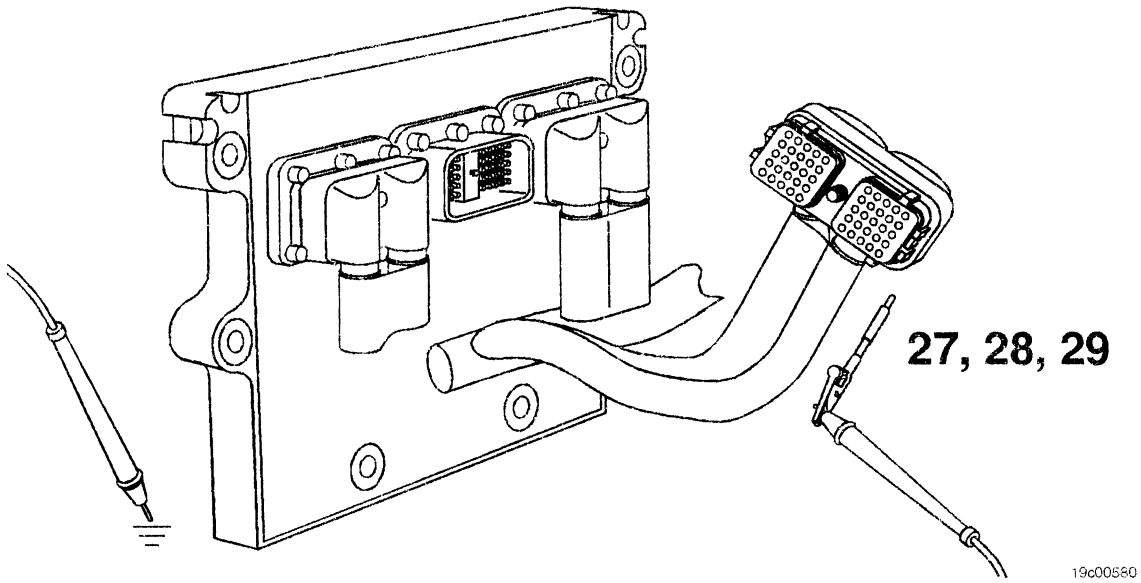
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness connector from the ECM.
- Disconnect the fuel inlet restriction sensor from the engine harness.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground in the supply, signal, and return wires. • Measure the resistance from pin 27 in the actuator harness connector to the engine block ground. • Measure the resistance from pin 28 in the actuator harness connector to the engine block ground. • Measure the resistance from pin 29 in the actuator harness connector to the engine block ground.	**OK** **More than 100k ohms**	2E
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-203 or 019-250. • Replace the engine harness. Refer to Procedure 019-043.	4A



STEP 2E: Check for a short circuit from the supply, signal, and return wires to all other wires in the engine harness.

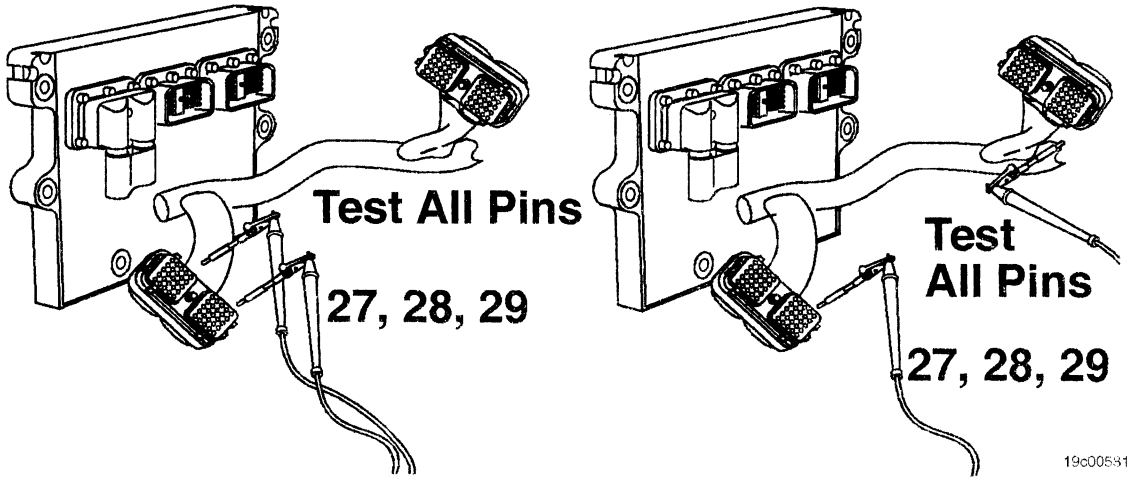
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness connector from the ECM.
- Disconnect the sensor harness connector from the ECM.
- Disconnect the fuel inlet restriction sensor from the engine harness.

Action	Specifications/Repair	Next Step
Check for a short circuit from the supply, signal, and return wires to all other wires in the engine harness. • Measure the resistance from pin 27 in the actuator harness connector to all other pins in the connector. • Measure the resistance from pin 27 in the actuator harness connector to all other pins in the sensor harness connector. • Measure the resistance from pin 28 in the actuator harness connector to all other pins in the connector. • Measure the resistance from pin 28 in the actuator harness connector to all other pins in the sensor harness connector. • Measure the resistance from pin 29 in the actuator harness connector to all other pins in the connector. • Measure the resistance from pin 29 in the actuator harness connector to all other pins in the sensor harness connector.	**OK** **More than 100k ohms** **Replace the fuel inlet restriction sensor** Refer to Procedure 019-128.	4A
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	4A



STEP 3: Check for an ECM response.

STEP 3A: Check for the appropriate ECM response.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:
- Disconnect the sensor harness connector from the ECM.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check for the appropriate ECM response. • Read the fault codes using INSITE™.	**OK** **Fault Code 581 inactive** **Fault Code 582 active**	4A
	NOT OK **Fault Code 581 active** **Replace the ECM** Refer to Procedure 019-031.	4A

STEP 4: Clear the fault codes.

STEP 4A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it idle for 1 minute. • Verify that Fault Code 581 is inactive.	**OK** **Fault Code 581 inactive**	4B
	NOT OK Return to troubleshooting steps, or contact your local Cummins Authorized Repair Location, if all steps have been completed and checked again.	1A

STEP 4B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

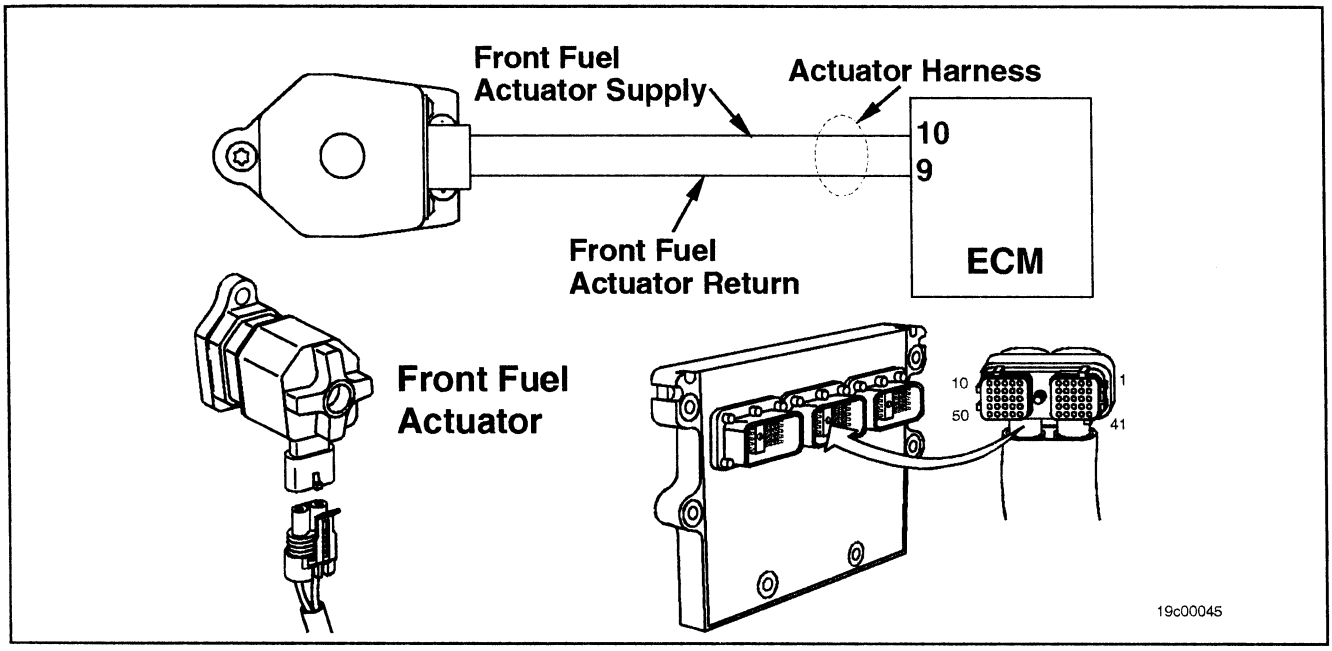
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 553

Fuel System Overfueling

CODES	REASON	EFFECT
Fault Code: 553 PID(P), SID(S): P157 SPN: 157 FMI: 0/16 Lamp: Red	Unexpectedly high rail pressure was detected on the front three cylinders.	Engine will return to idle speed, then **only** idle or shut down.

Hydraulic Fuel System



Circuit Description:

The electronic control module (ECM) supplies voltage to open the fueling actuators for a short length of time. This allows a short pulse of fuel to flow to the injector. The injector then injects this fuel into the cylinder for combustion.

Component Location:

The front fueling actuators are located on the fuel delivery housing below the air inlet horn. It is the actuator that is closest to the front of the engine. The injectors are located in the cylinder head under the valve cover.

Shop Talk:

The ECM measures the amount of fuel metered into the injector by using the front rail pressure sensor. If the amount of fuel is above what the ECM expected, the fault code is activated.

TROUBLESHOOTING SUMMARY

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check for active fault codes.		
STEP 1A: Inspect for Fault Code 449 or high inactive counts.	Fault Code 449 is not active	
STEP 1A-1: Check for air in pressure-side fuel.	No air in fuel	
STEP 1A-2: Measure for drain line restriction	Less than 4.0 in Hg	
STEP 2: Check the front fueling actuators.		
STEP 2A: Inspect the front fueling actuators.	Fault Code 553 goes inactive	
STEP 3: Clear the fault codes.		
STEP 3A: Disable the fault code.	Fault Code 553 inactive	
STEP 3B: Clear the inactive fault codes.	All fault codes cleared	

TROUBLESHOOTING STEP

STEP 1: Check for active fault codes.

STEP 1A: Inspect for Fault Code 449 or high inactive counts.

Condition:
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Read the fault codes using INSITE™.	**OK** **Fault Code 449 is not active**	1A-1
	NOT OK Fault Code 449 active.	Refer to Fault Code 449

STEP 1A-1: Check for air in pressure-side fuel.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Check for air in pressure-side fuel.	**OK** **No air in fuel**	1A-2
	NOT OK **Air in fuel** Refer to Procedure 006-003 in the Signature, ISX and QSX15 Troubleshooting and Repair Manual, Bulletin No. 3666239.	3A

STEP 1A-2: Measure for drain line restriction.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Inspect drain line. • Measure for drain line restriction.	**OK** **Less than 4.0 in Hg**	2A
	NOT OK **More than 4.0 in Hg** Refer to Procedure 006-012 in the Signature, ISX and QSX15 Troubleshooting and Repair Manual, Bulletin No. 3666239.	3A

STEP 2: Check the front fueling actuators.

STEP 2A: Inspect the front fueling actuators.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Replace the front fueling actuators.	**OK** **Fault Code 553 goes inactive**	3A
	NOT OK **Replace the front fueling actuators** Refer to Procedure 019-110.	3A

STEP 3: Clear the fault codes.

STEP 3A: Disable the fault code.

Condition:
- Connect all the components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it idle for 1 minute. • Using INSITE™, verify Fault Code 553 is inactive	**OK** **Fault Code 553 inactive**	3B
	NOT OK Return to the troubleshooting steps or contact your local Cummins Authorized Repair Location it all the steps have been completed and checked again.	1A

STEP 3B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

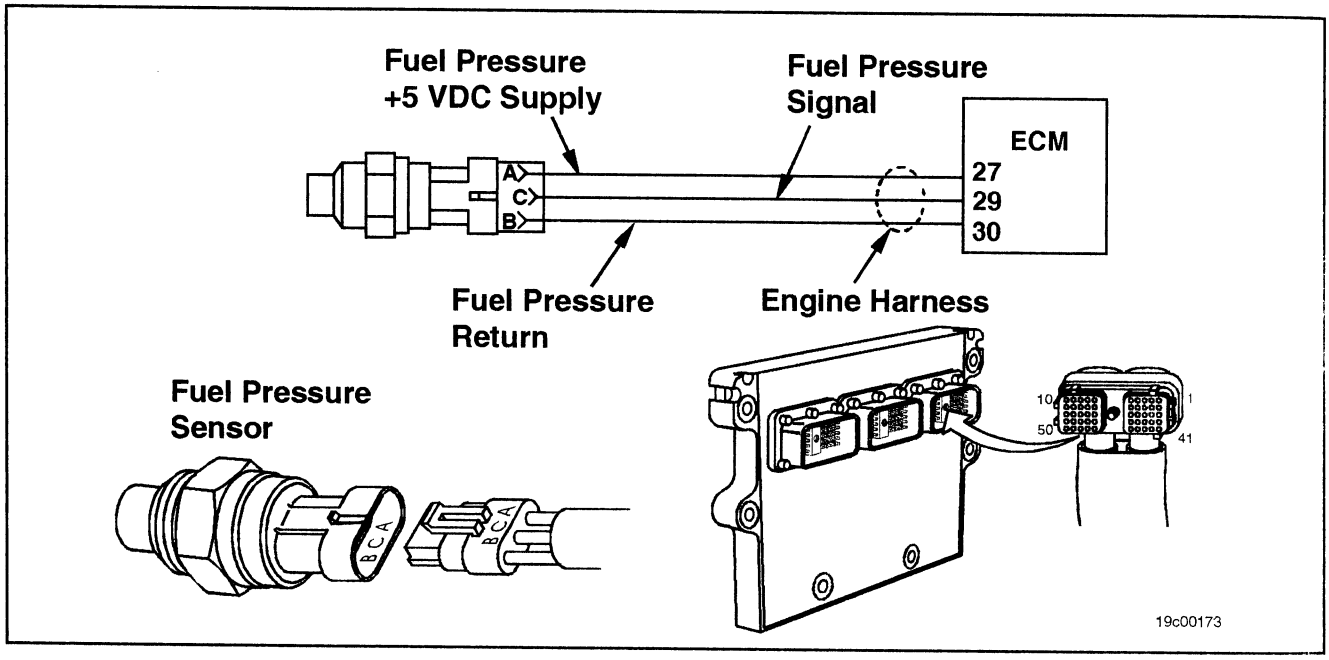
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 547

Fuel Pressure Sensor Circuit

CODES	REASON	EFFECT
Fault Code: 547 PID(P), SID(S): P094 SPN: 94 FMI: 4/4 Lamp: Yellow	Low voltage detected on the fuel pressure sensor circuit.	Engine will run derated.

Fuel Pressure Sensor Circuit



Circuit Description:

The fuel pressure sensor provides the fuel supply pressure signal to the electronic control module (ECM).

Component Location:

The fuel pressure sensor is located on the fuel delivery housing to the left of the front fueling actuator.

Shop Talk:

This fault indicates that voltage at signal pin 29 on the ECM has a short circuit to ground.

TROUBLESHOOTING SUMMARY

⚠ CAUTION ⚠

To avoid damaging the new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead
Part No. 3824775 - breakout cable.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check for multiple fault codes.		
STEP 1A: Read fault codes.	Fault Code 352 is not active	
STEP 2: Check the fuel pressure sensor.		
STEP 2A: Inspect the engine harness and sensor connector pins.	No damaged pins	
STEP 2B: Read the fault codes.	Fault Code 547 inactive	
STEP 2C: Check the supply voltage.	(+) 4.75 to 5.25 VDC	
STEP 2C-1: Check the voltage from the ECM.	(+) 4.75 to 5.25 VDC	
STEP 2D: Check the signal voltage.	(+) 0.4 to 4.5 VDC	
STEP 2D-1: Check for a short circuit to ground.	More than 100k ohms	
STEP 2D-2: Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 3: Check the engine harness.		
STEP 3A: Inspect the engine harness and ECM connector pins.	No damaged pins	
STEP 3B: Read the fault codes.	Fault Code 547 inactive	
STEP 3C: Check for an open circuit in the engine harness.	Less than 10 ohms	
STEP 4: Check for an ECM response.		
STEP 4A: Check for the appropriate ECM response.	Fault Code 547 inactive and Fault Code 546 active	
STEP 5: Clear the fault codes.		
STEP 5A: Disable the fault code.	Fault Code 547 inactive	
STEP 5B: Clear the inactive fault codes.	All fault codes cleared	

TROUBLESHOOTING STEP

STEP 1: Check for multiple fault codes.

STEP 1A: Read fault codes.

Condition:
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read fault codes. • Read active fault codes using INSITE™.	**OK** **Fault Code 352 is not active**	2A
	NOT OK	Fault Code 352

STEP 2: Check the fuel pressure sensor.

STEP 2A: Inspect the engine harness and sensor connector pins.

Condition:
- Turn keyswitch OFF.
- Disconnect the fuel pressure sensor from the engine harness.

Action	Specifications/Repair	Next Step
Inspect the engine harness and sensor connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	2B
	NOT OK **Repair the damaged pins** Replace the sensor connector or the sensor, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Replace the sensor connector. Refer to Procedure 019-203. • Replace the fuel pressure sensor. Refer to Procedure 019-188.	5A

STEP 2B: Read the fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Start the engine and let it idle for 1 minute. • Read the fault codes using INSITE™.	**OK** **Fault Code 547 inactive**	5B
	NOT OK Fault Code 547 active.	2C

STEP 2C: Check the supply voltage.

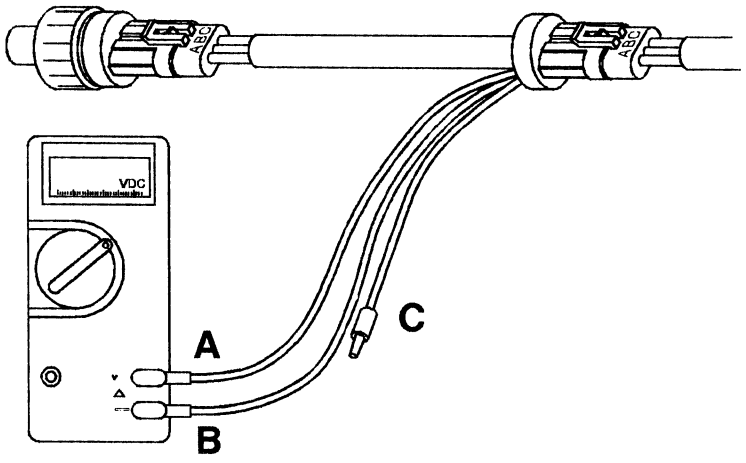
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3824775 - breakout cable.

Condition:

- Install breakout cable, Part No. 3824775, between the sensor and the engine harness connector.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the supply voltage. • Measure the supply voltage at supply, pin A (or RED) and return, pin B (or BLACK) connectors with the multimeter.	**OK** **(+) 4.75 to 5.25 VDC**	2D
	NOT OK Does **not** meet specifications.	2C-1



19c00094

STEP 2C-1: Check the voltage from the ECM.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

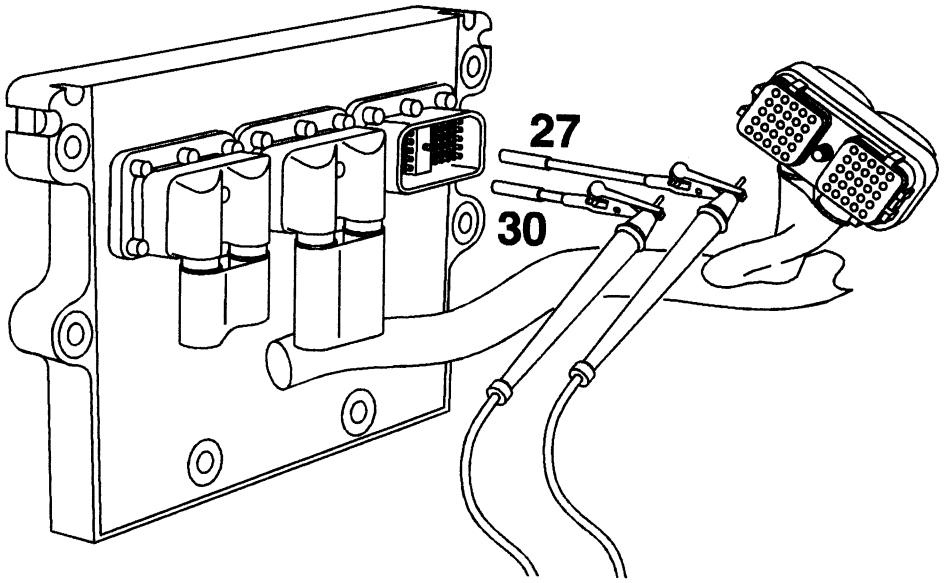
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

Condition:

- Disconnect the sensor harness connector from the ECM.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the voltage from the ECM. • Measure the voltage at the ECM from pin 27 to pin 30 of the ECM sensor port.	**OK** **(+) 4.75 to 5.25 VDC** **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	5A
	NOT OK **Replace the ECM** Refer to Procedure 019-031.	5A



STEP 2D: Check the signal voltage.

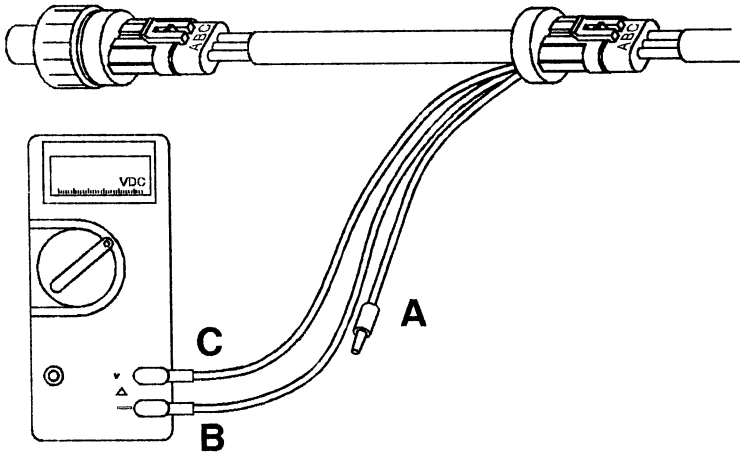
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3824775 - breakout cable.

Condition:

- Install breakout cable, Part No. 3824775, between the sensor and the engine harness.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the signal voltage. • Measure the signal voltage by installing the break out cable's signal, pin C (or YELLOW) and return, pin B (or BLACK) into the multimeter.	**OK** **(+) 0.4 to 4.5 VDC**	2D-1
	NOT OK Does **not** meet specifications.	3A



19c00095

STEP 2D-1: Check for a short circuit to ground.

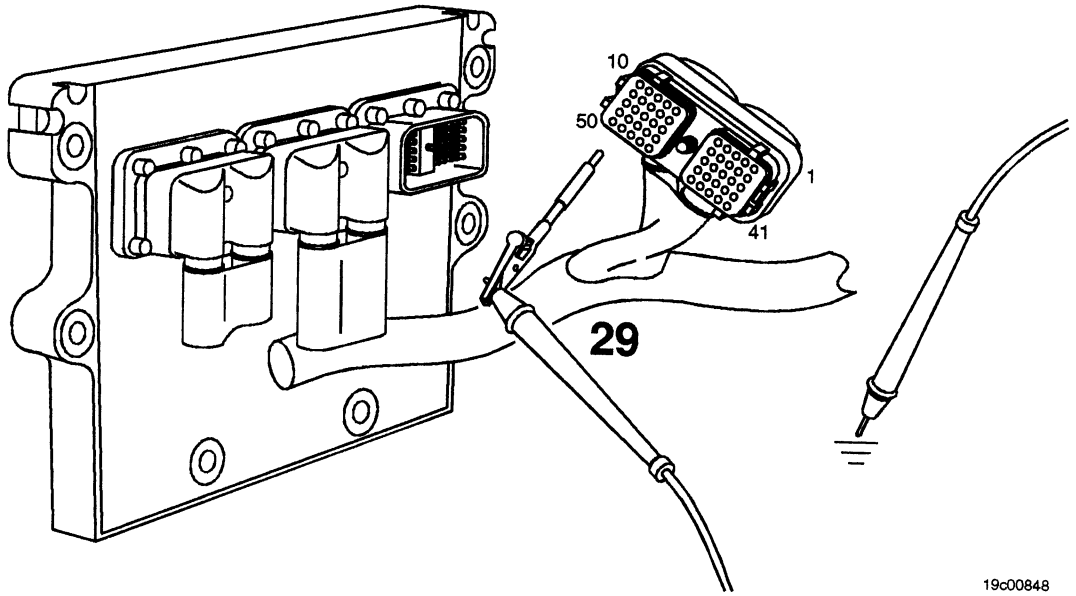
⚠CAUTION⚠

To avoid pin and harness damage use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the fuel pressure sensor from the engine harness.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground. • Measure the resistance from pin 29 of the sensor harness connector to chassis ground.	**OK** **More than 100k ohms**	2D-2
	NOT OK **Replace the engine harness** Refer to Procedure 019-043.	5A



STEP 2D-2: Check for a short circuit from pin to pin.

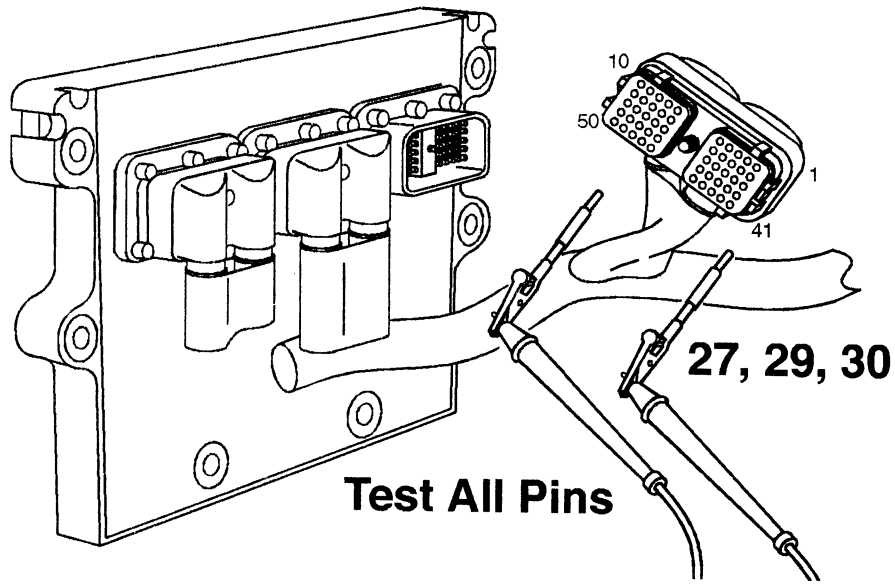
⚠CAUTION⚠

To avoid pin and harness damage use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.
- Disconnect the engine harness from the fuel pressure sensor.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pin 27 of the sensor harness connector to all other pins in the connector. • Measure the resistance from pin 29 of the sensor harness connector to all other pins in the connector. • Measure the resistance from pin 30 of the sensor harness connector to all other pins in the connector.	**OK** **More than 100k ohms** **Replace the fuel pressure sensor** Refer to Procedure 019-188.	5A
	NOT OK **Replace the engine harness** Refer to Procedure 019-043.	5A



STEP 3: Check the engine harness.

STEP 3A: Inspect the engine harness and ECM connector pins.

⚠CAUTION⚠

To avoid damaging the new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:
- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.
- Disconnect the engine harness from the fuel pressure sensor.

Action	Specifications/Repair	Next Step
Inspect the engine harness and ECM connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	3B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	5A

STEP 3B: Read the fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Start engine and let it idle for 1 minute. • Read the fault codes using INSITE™.	**OK** **Fault Code 547 inactive**	5B
	NOT OK Fault Code 547 active.	3C

STEP 3C: Check for an open circuit in the engine harness.

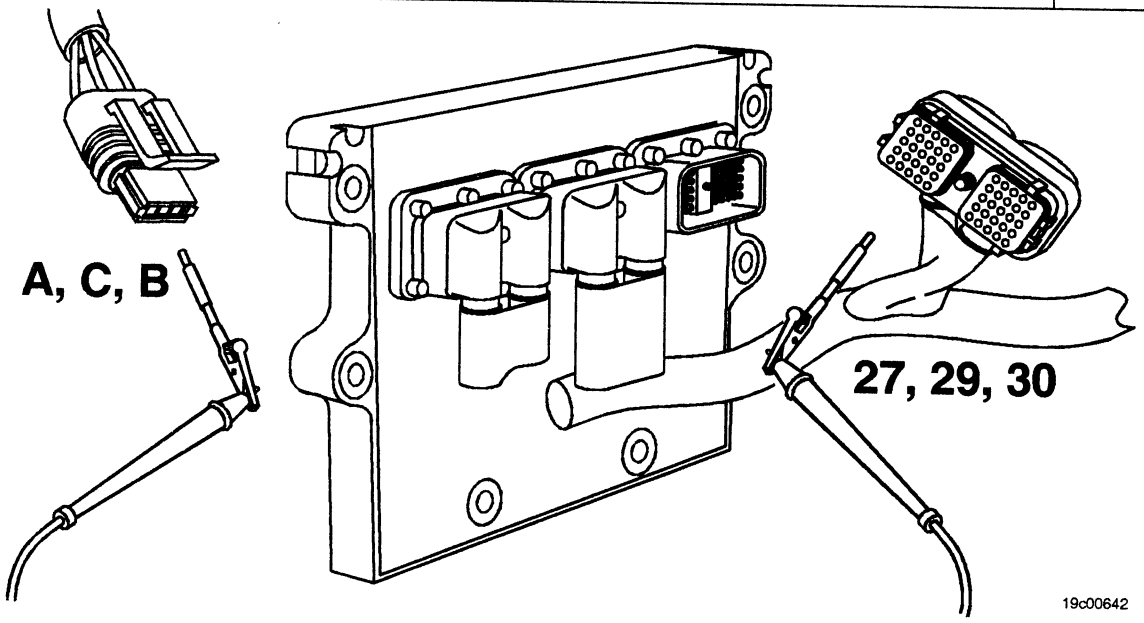
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.
- Disconnect the engine harness from the fuel pressure sensor.

Action	Specifications/Repair	Next Step
Check for an open circuit in the engine harness. • Measure the resistance from pin 27 of the sensor harness connector to pin A (or 1) on the engine harness side of the fuel pressure sensor connector. • Measure the resistance from pin 29 of the sensor harness connector to pin C (or 3) on the engine harness side of the fuel pressure sensor connector. • Measure the resistance from pin 30 of the sensor harness connector to pin B (or 2) on the engine harness side of the fuel pressure sensor connector.	**OK** **Less than 10 ohms**	4A
	NOT OK **Correct the pin to pin wiring or open circuit** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	5A



STEP 4: Check for an ECM response.

STEP 4A: Check for the appropriate ECM response.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:
- Disconnect the sensor harness connector from the ECM.
- Install a jumper wire, Part No. 3822917, between pin 27 and 29 at the ECM sensor port.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check for the appropriate ECM response. • Using INSITE™, read the fault codes.	**OK** **Fault Code 546 active and** **Fault Code 547 inactive**	5A
	NOT OK **Fault Code 547 active** **Replace the ECM** Refer to Procedure 019-031.	5A

STEP 5: Clear the fault codes.

STEP 5A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it idle for 1 minute. • Using INSITE™, verify that Fault Code 547 is inactive.	**OK** **Fault Code 547 inactive**	5B
	NOT OK Return to the troubleshooting steps or contact your local Cummins Authorized Repair Location, if all steps have been completed and checked again.	1A

STEP 5B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

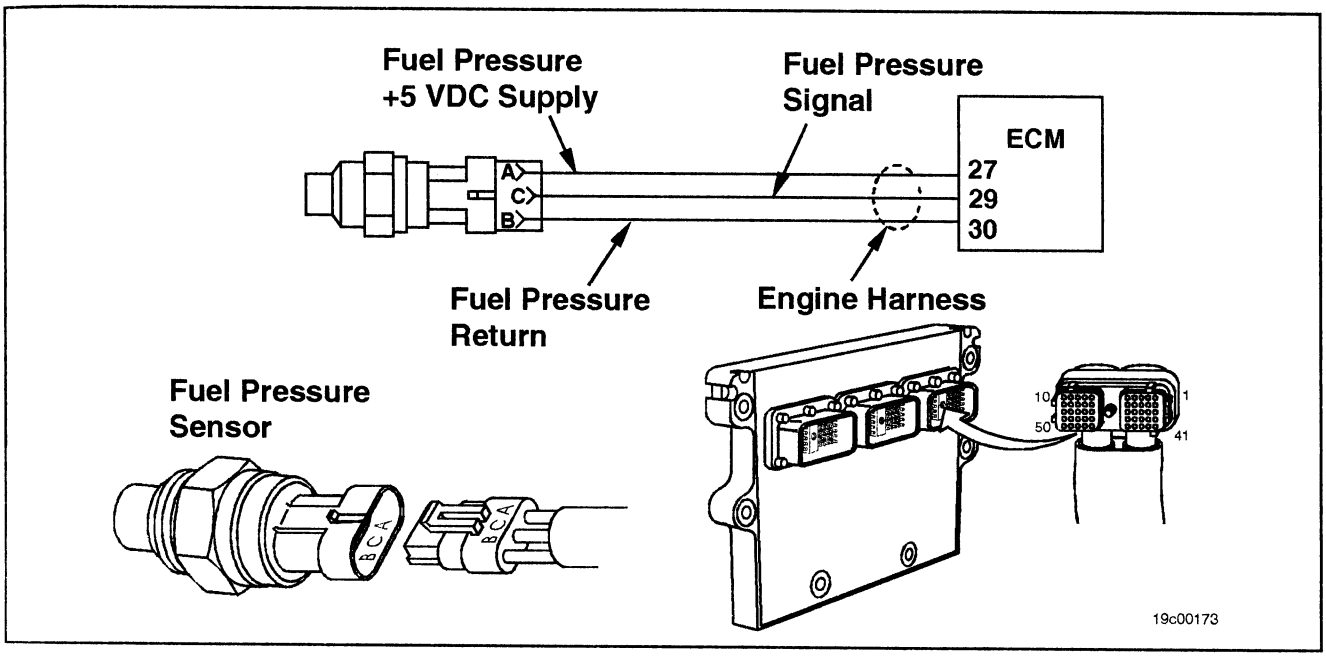
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Use INSITE™ to clear all inactive fault codes.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 546

Fuel Pressure Sensor Circuit

CODES	REASON	EFFECT
Fault Code: 546 PID(P), SID(S): P094 SPN: 94 FMI: 3/3 Lamp: Yellow	High voltage detected on the fuel pressure sensor circuit.	Engine will run derated.

Fuel Pressure Sensor Circuit



Circuit Description:

The fuel pressure sensor provides the fuel supply pressure signal to the electronic control module (ECM).

Component Location:

The fuel pressure sensor is located on the fuel delivery housing to the left of the front fueling actuator.

Shop Talk:

This fault indicates that signal pin 29 on the ECM has been shorted on the circuit to at least positive (+) 5 VDC.

TROUBLESHOOTING SUMMARY

CAUTION

To avoid damaging the new ECM, all other active fault codes must be investigated prior to replacing the ECM.

CAUTION

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead
Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead
Part No. 3824775 - breakout cable.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the fuel pressure sensor.		
STEP 1A: Inspect the sensor harness and sensor connector pins.	No damaged pins	
STEP 1B: Read the fault codes.	Fault Code 546 inactive	
STEP 1C: Check the supply voltage.	(+) 4.75 to 5.25 VDC	
STEP 1C-1: Check the voltage from the ECM.	(+) 4.75 to 5.25 VDC	
STEP 1D: Check the signal voltage.	(+) 0.4 to 4.5 VDC	
STEP 2: Check the engine harness.		
STEP 2A: Inspect the engine harness and the ECM connector pins for damage.	No damaged pins	
STEP 2B: Read the fault codes.	Fault Code 546 inactive	
STEP 2C: Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 2D: Check for an open circuit in the return wire.	Less than 10 ohms	
STEP 3: Check for an ECM response.		
STEP 3A: Check for the appropriate ECM response.	Fault Code 546 inactive and Fault Code 547 active	
STEP 4: Clear the fault codes.		
STEP 4A: Disable the fault code.	Fault Code 546 inactive	
STEP 4B: Clear the inactive fault codes.	All fault codes cleared	

TROUBLESHOOTING STEP

STEP 1: Check the fuel pressure sensor.

STEP 1A: Inspect the sensor harness and sensor connector pins.

Condition:
- Disconnect the fuel pressure sensor from the sensor harness.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Inspect the sensor harness and sensor connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	1B
	NOT OK **Repair the damaged pins** Replace the sensor connector or the sensor, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Replace the sensor connector. Refer to Procedure 019-203. • Replace the fuel pressure sensor. Refer to Procedure 019-188.	4A

STEP 1B: Read the fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Start engine and let idle for 1 minute. • Read the fault codes using INSITE™.	**OK** **Fault Code 546 inactive**	4B
	NOT OK Fault Code 546 active.	1C

STEP 1C: Check the supply voltage.

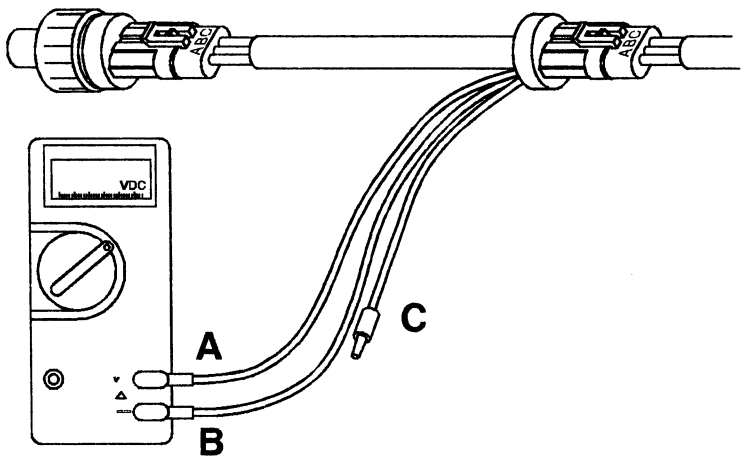
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3824775 - breakout cable.

Condition:

- Install breakout cable, Part No. 3824775, between the fuel pressure sensor and the harness connector.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the supply voltage. • Measure the supply voltage at supply, pin A (or RED) and return, pin B (or BLACK) connectors with the multimeter.	**OK** **(+) 4.75 to 5.25 VDC**	1D
	NOT OK Does **not** meet specifications.	1C-1



19c00094

STEP 1C-1: Check the voltage from the ECM.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

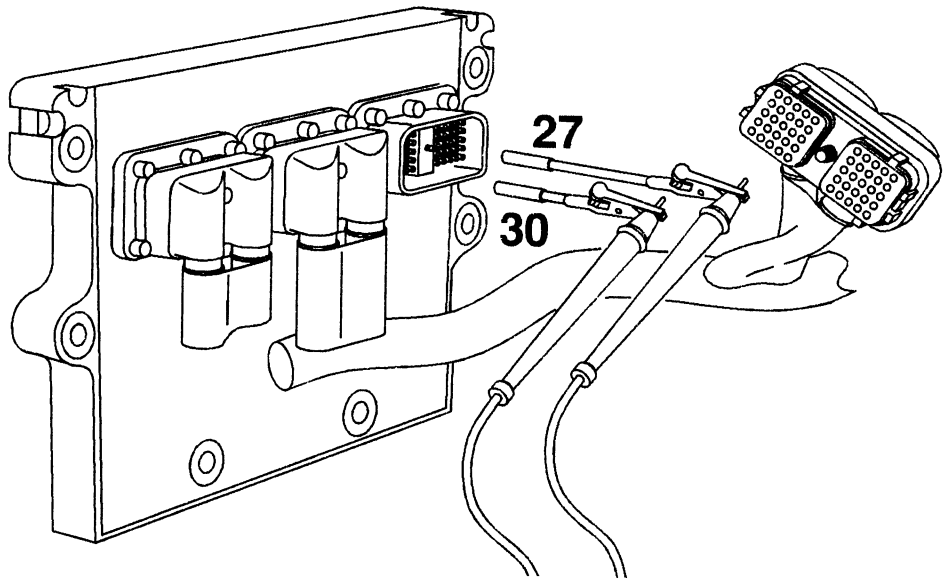
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

Condition:

- Disconnect the sensor harness connector from the ECM.
- Connect test lead, Part No. 3822917, to ECM sensor port pins 27 and 30.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Measure the voltage from the ECM. • Measure the voltage at the ECM from pin 27 to pin 30 of the ECM sensor port.	**OK** **(+) 4.75 to 5.25 VDC** **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	1D
	NOT OK **Replace the ECM** Refer to Procedure 019-031.	4A



19c00157

STEP 1D: Check the signal voltage.

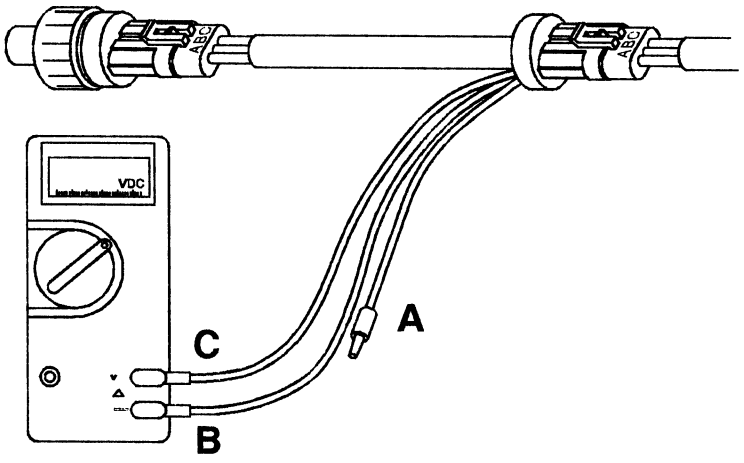
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3824775 - breakout cable.

Condition:

- Turn keyswitch ON.
- Install breakout cable, Part No. 3824775, between the fuel pressure sensor and the engine harness.

Action	Specifications/Repair	Next Step
Check the signal voltage. • Measure the signal voltage by installing the breakout cable's signal, pin C (or YELLOW) and return, pin B (or BLACK) connectors into the multimeter.	**OK** **(+) 0.4 to 4.5 VDC**	3A
	NOT OK Does **not** meet specifications.	2A



19c00095

STEP 2: Check the engine harness.

STEP 2A: Inspect the engine harness and the ECM connector pins for damage.

⚠CAUTION⚠

To avoid damaging the new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:
- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.
- Disconnect the engine harness from the fuel pressure sensor.

Action	Specifications/Repair	Next Step
Inspect the engine harness and the ECM connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	2B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	4A

STEP 2B: Read the fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Start engine and let idle for 1 minute. • Read the fault codes using INSITE™.	**OK** **Fault Code 546 inactive**	4B
	NOT OK Fault Code 546 active.	2C

STEP 2C: Check for a short circuit from pin to pin.

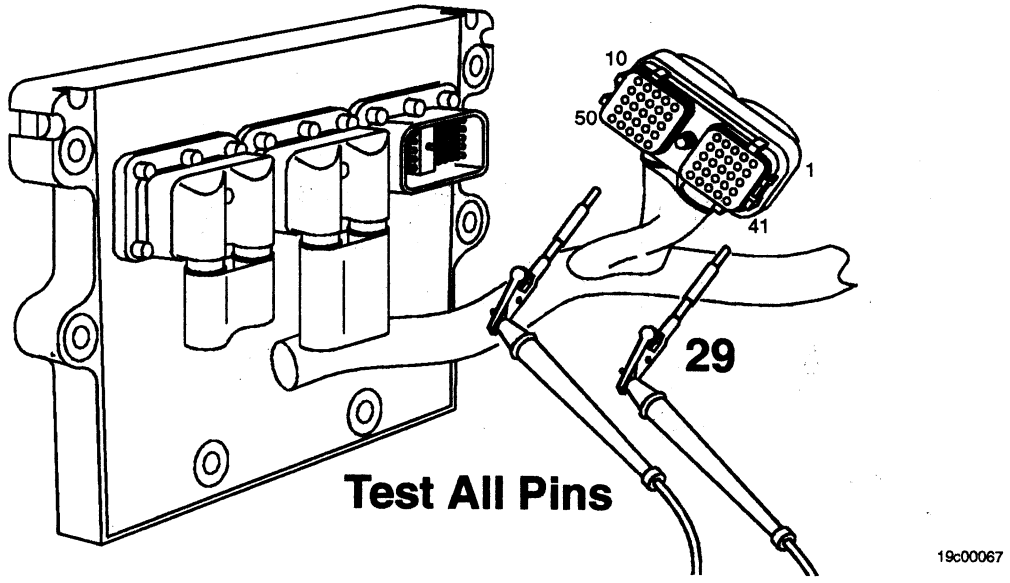
⚠CAUTION⚠

To avoid pin and harness damage use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.
- Disconnect the engine harness from the fuel pressure sensor.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance between pin 29 of the sensor harness connector to **all** other pins in the connector.	**OK** **More than 100k ohms**	2D
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	4A



STEP 2D: Check for an open circuit in the return wire.

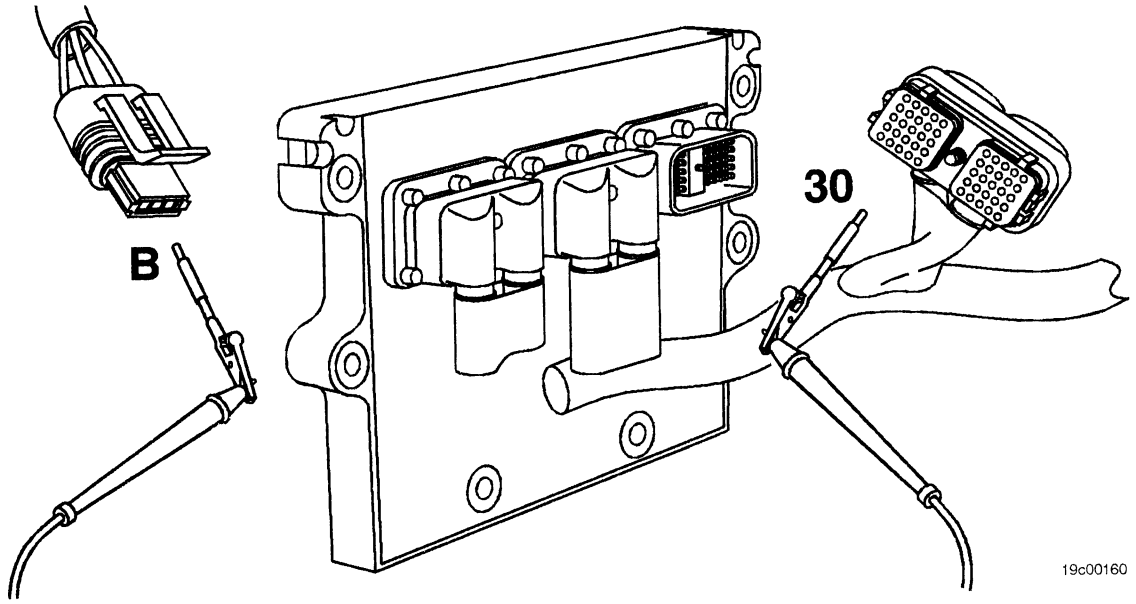
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.
- Disconnect the engine harness from the fuel pressure sensor.

Action	Specifications/Repair	Next Step
Check for an open circuit. • Measure the resistance from pin 30 of the sensor harness connector to pin B on the engine harness side of the fuel pressure sensor connector.	**OK** **Less than 10 ohms** **Replace the fuel pressure sensor** Refer to Procedure 019-188.	4A
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	4A



STEP 3: Check for an ECM response.

STEP 3A: Check for the appropriate ECM response.

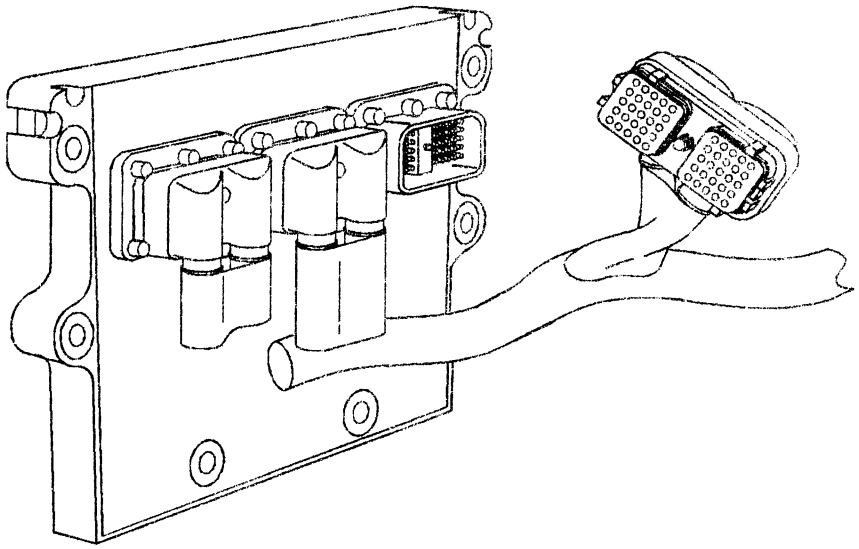
⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Disconnect the sensor harness connector from the ECM.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check for the appropriate ECM response. • Using INSITE™, read the fault codes.	**OK** **Fault Code 546 inactive and Fault Code 547 active**	4A
	NOT OK **Replace the ECM** Refer to Procedure 019-031.	4A



19600008

STEP 4: Clear the fault codes.

STEP 4A: Disable the fault code.

Condition:

- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it idle for 1 minute. • Using INSITE™, verify that Fault Code 546 is inactive.	**OK** **Fault Code 546 inactive**	4B
	NOT OK Return to the troubleshooting steps or contact your local Cummins Authorized Repair Location, if all steps have been completed and checked again.	1A

STEP 4B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

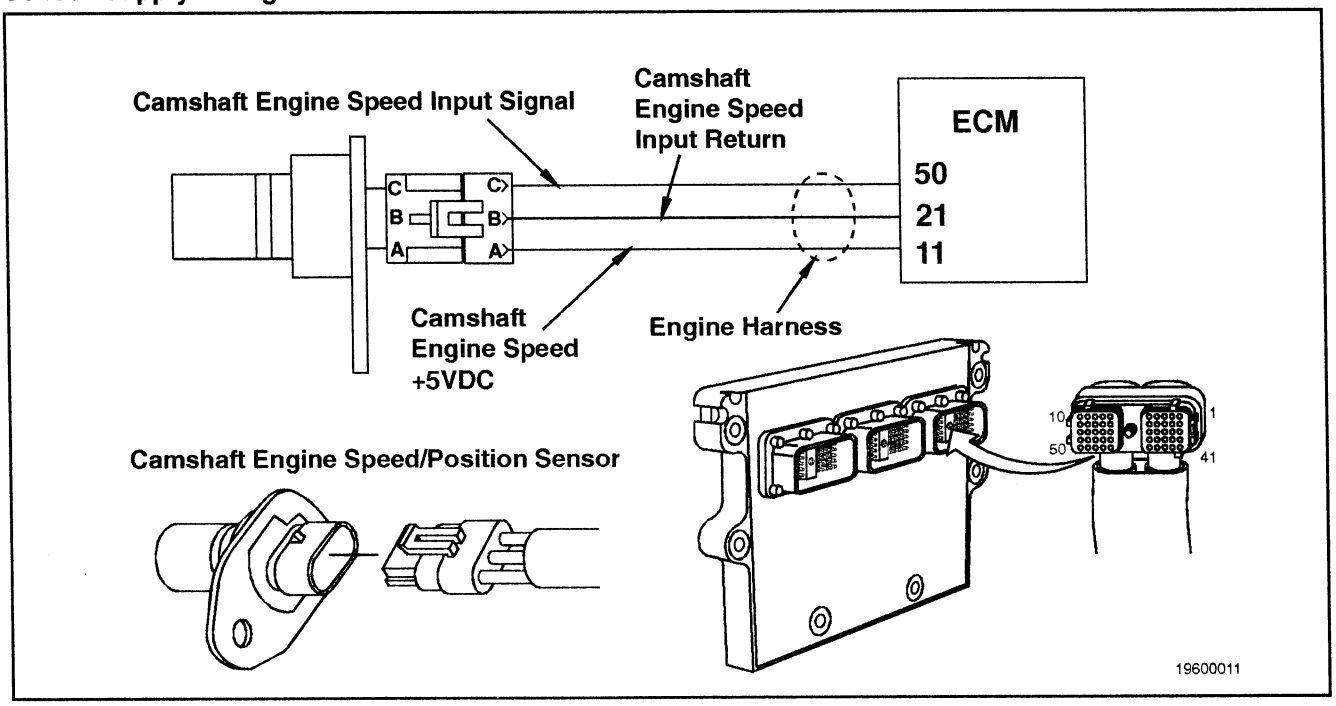
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Use INSITE™ to clear all inactive fault codes.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 496

Sensor Supply Voltage

CODES	REASON	EFFECT
Fault Code: 496 PID(P), SID(S): S221 SPN: 1043 FMI: 11/11 Lamp: Yellow	Incorrect voltage detected on the electronic control module (ECM) voltage supply line to the camshaft engine position sensor.	Engine does **not** run, is hard to start, or will run derated.

Sensor Supply Voltage Circuit



Circuit Description:

The ECM supplies the camshaft engine position with positive (+) 5 VDC. If the supply line is damaged, the sensors will **not** work correctly.

Component Location:

The camshaft engine position sensor is located on the intake side of the engine block on the cylinder head to the right of the ECM.

Shop Talk:

Low voltage on the positive (+) 5-VDC supply line will be caused by a short circuit to ground in a supply line, a short circuit between a supply line or a return line, a failed sensor, or a failed ECM power supply.

TROUBLESHOOTING SUMMARY

⚠ CAUTION ⚠

To avoid damaging the new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead
Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead
Part No. 3824775 - breakout cable.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the failed sensor.		
STEP 1A: Check the camshaft engine position sensor.	Fault Code 496 active	
STEP 2: Check the sensor harness.		
STEP 2A: Inspect the sensor harness and ECM connector pins.	No damaged pins	
STEP 2B: Check the sensor supply voltage.	(+) 4.75 to 5.25 VDC	
STEP 2B-1: Check the voltage from the ECM.	(+) 4.75 to 5.25 VDC	
STEP 2C: Check for a short circuit to ground in the sensor supply line.	More than 100k ohms	
STEP 2D: Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 3: Check the camshaft engine position sensor.		
STEP 3A: Check for a signal from the camshaft engine position sensor.	Signal present	
STEP 4: Clear the fault codes.		
STEP 4A: Disable the fault code.	Fault Code 496 inactive	
STEP 4B: Clear the inactive fault codes.	All fault codes cleared	

TROUBLESHOOTING STEP

STEP 1: Check the failed sensor.

STEP 1A: Check the camshaft engine position sensor.

Condition:
- Connect INSITE™.

Action	Specifications/Repair	Next Step
Check the camshaft engine position sensor. • Start the engine and let it idle for 1 minute. • Using INSITE™, verify Fault Code 496 is still active.	**OK** **Fault Code 496 active**	2A
	NOT OK **Replace the camshaft engine position sensor** Refer to Procedure 019-038.	4A

STEP 2: Check the sensor harness.

STEP 2A: Inspect the sensor harness and ECM connector pins.

⚠CAUTION⚠

To avoid damaging the new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:
- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Inspect the harness and the ECM connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	2B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	4A

STEP 2B: Check the sensor supply voltage.

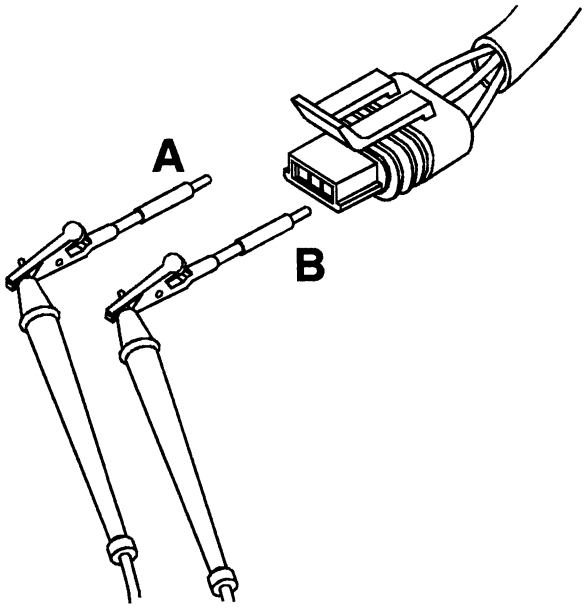
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

Condition:

- Disconnect the sensor harness connector from the ECM.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the sensor supply voltage. • Measure the voltage from pin A (or 1) to pin B (or 2) on the engine harness connector side of the camshaft engine sensor.	**OK** **(+) 4.75 to 5.25 VDC**	2C
	NOT OK Does **not** meet specifications.	2B-1



19400751

STEP 2B-1: Check the voltage from the ECM.

⚠CAUTION⚠

To avoid damaging the new ECM, all other active fault codes must be investigated prior to replacing the ECM.

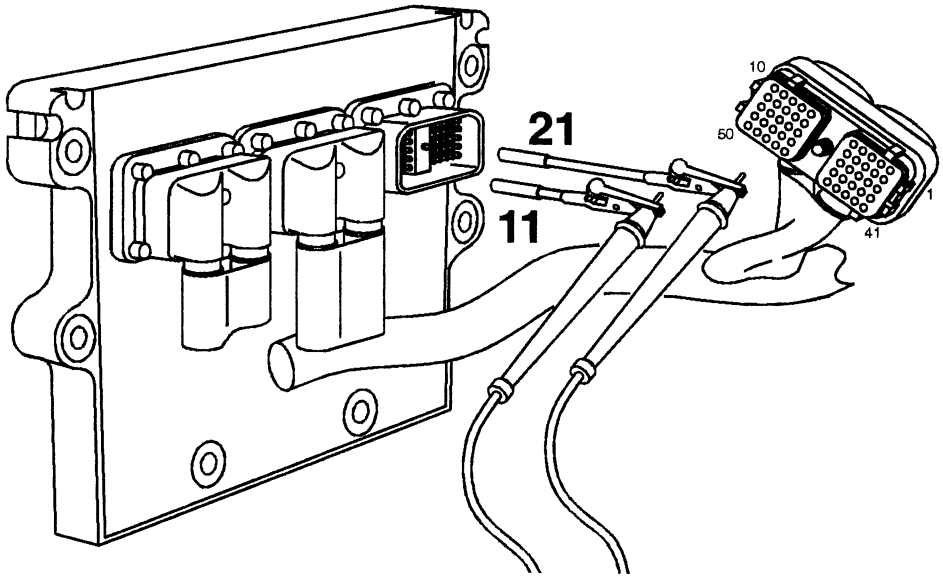
⚠CAUTION⚠

To avoid pin and harness damage use the following test lead when taking a measurement: Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

Condition:

- Disconnect the camshaft engine speed sensor from the sensor harness.
- Disconnect the sensor harness connector from the ECM.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the voltage from the ECM. • Measure the voltage at the ECM from pin 11 to pin 21 of the ECM sensor port.	**OK** **(+) 4.75 to 5.25 VDC** **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	4A
	NOT OK **Replace the ECM** Refer to Procedure 019-031.	4A



STEP 2C: Check for a short circuit to ground in the sensor supply line

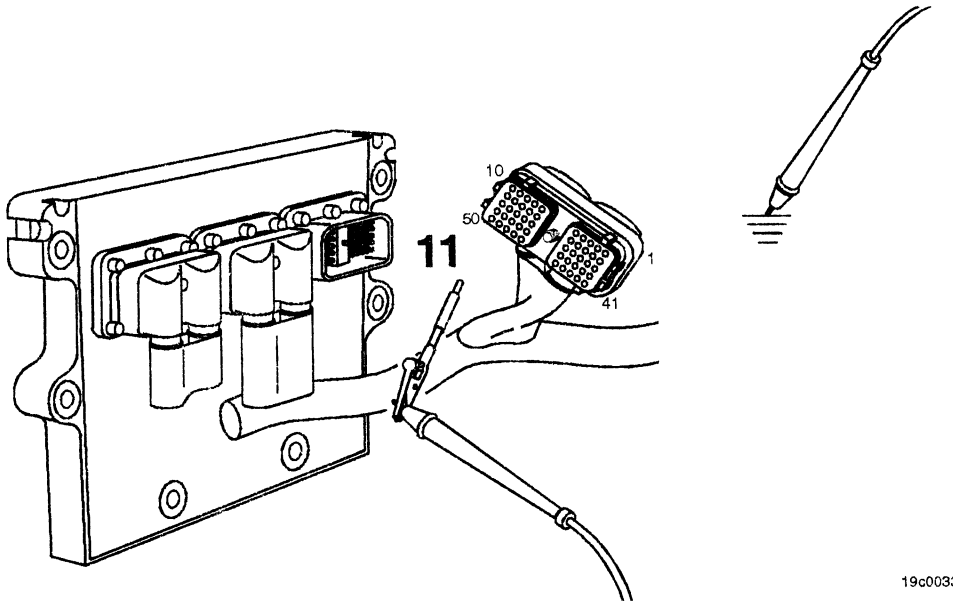
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground in the sensor supply line. • Measure the resistance from pin 11 in the sensor harness connector to engine block ground.	**OK** **More than 100k ohms**	2D
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	4A



STEP 2D: Check for a short circuit from pin to pin.

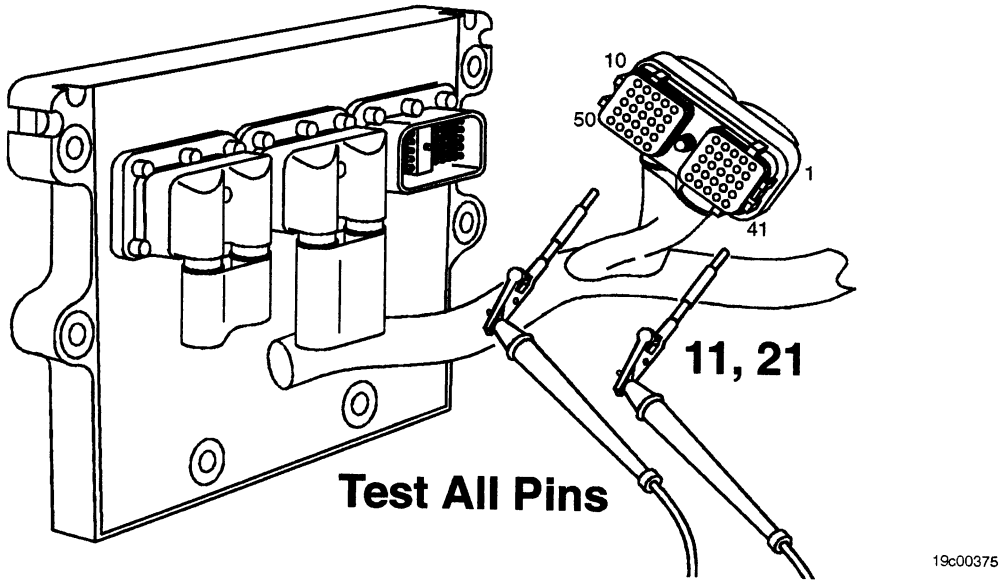
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pin 11 in the sensor harness connector to all other pins in the connector. • Measure the resistance from pin 21 in the sensor harness connector to all other pins in the connector.	**OK** **More than 100k ohms**	3A
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	4A



STEP 3: Check the camshaft engine position sensor.

STEP 3A: Check for a signal from the camshaft engine position sensor.

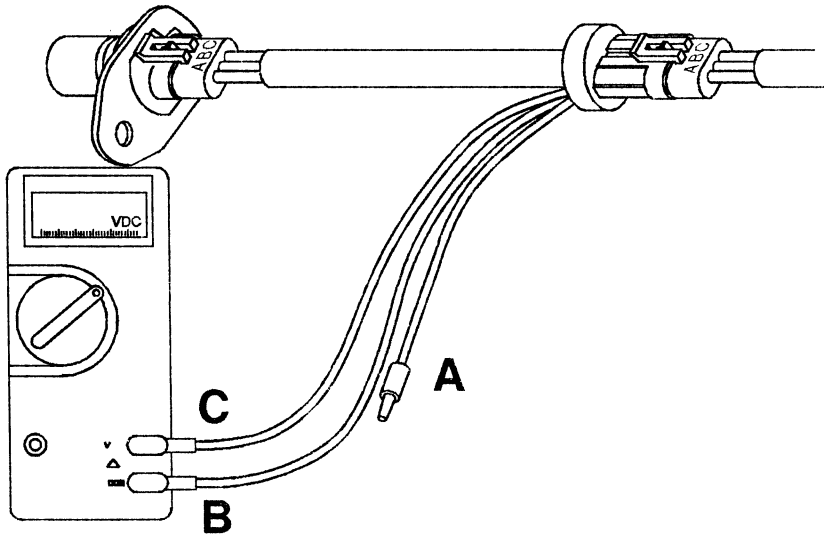
△CAUTION△

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3824775 - breakout cable.

Condition:

- Install breakout cable, Part No. 3824775, between the camshaft engine position sensor and the engine harness.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check for a signal from the camshaft engine position sensor. • Measure the voltage from the signal, pin C (or YELLOW) to the return, pin B (or BLACK) on the breakout cable, while barring the engine over.	**OK** **Signal present;** **signal should change from positive (+) 4 to 5 VDC to positive (+) 0.5 to 2.3 VDC and back about every 60° of crankshaft rotation.**	4A
	NOT OK **Replace camshaft engine position sensor** Refer to Procedure 019-038.	4A



19c00765

STEP 4: Clear the fault codes.

STEP 4A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it idle for 1 minute. • Using INSITE™, verify Fault Code 496 is inactive.	**OK** **Fault Code 496 inactive**	4B
	NOT OK Return to the troubleshooting steps or contact your local Cummins Authorized Repair Location if all the steps have been completed and checked again.	1A

STEP 4B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

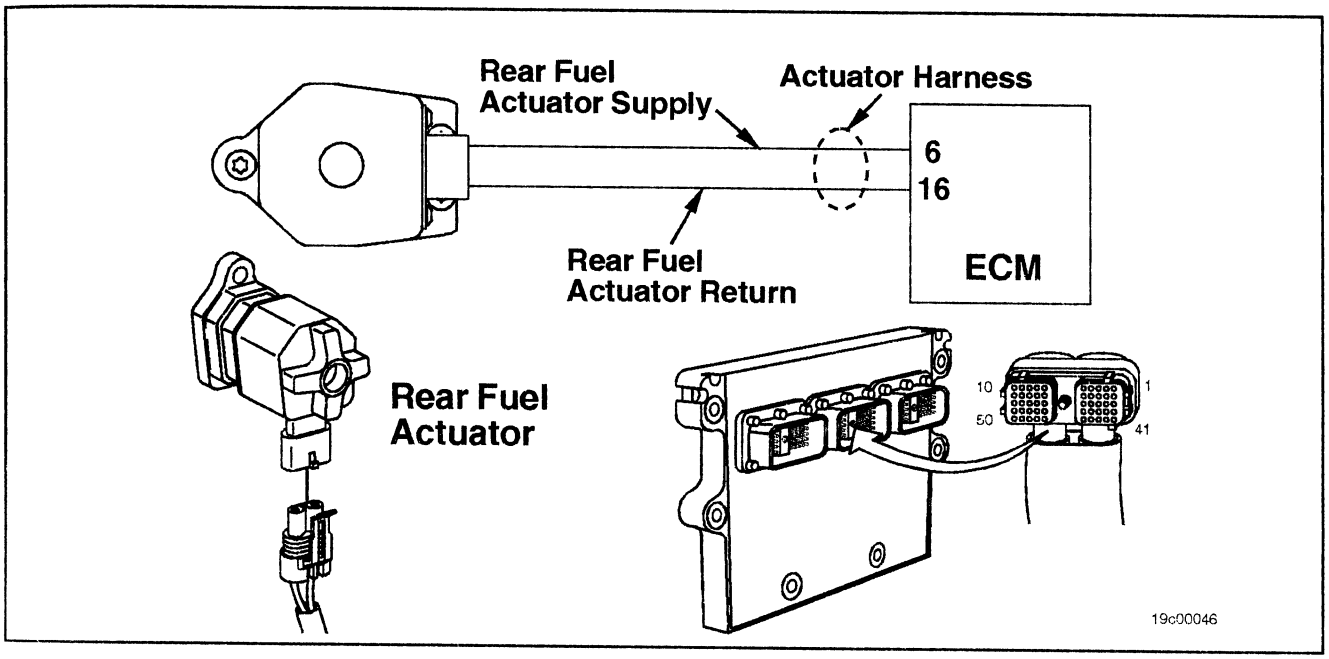
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 486

Fuel System Underfueling

CODES	REASON	EFFECT
Fault Code: 486 PID(P), SID(S): P129 SPN: 1349 FMI: 1/18 Lamp: Yellow	Unexpectedly low rail pressure was detected on the rear three cylinders.	Low power or rough idle.

Hydraulic Fuel System



Circuit Description:

The electronic control module (ECM) supplies voltage to open the fueling actuators for a short length of time. This allows a short pulse of fuel to flow to the injector. The injector then injects this fuel into the cylinder for combustion.

Component Location:

The rear fueling actuators are located on the fuel delivery housing below the air inlet horn. It is the actuator that is closest to the rear of the engine. The injectors are located in the cylinder head under the valve cover.

Shop Talk:

The ECM measures the amount of fuel metered into the injector by using the rear rail pressure sensor. If the amount of fuel is below what the ECM expected, the fault code is activated.

TROUBLESHOOTING SUMMARY

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check for active fault codes.		
STEP 1A: Inspect for Fault Codes 396, 397, and 482 or high inactive counts.	Fault Codes 396, 397, and 482 are not active	
STEP 2: Check for air in the pressure-side fuel.		
STEP 2A: Inspect for air in the pressure-side fuel.	No air in fuel	
STEP 3: Check the rear fueling actuators.		
STEP 3A: Inspect the rear fueling actuators.	Fault Code 486 goes inactive	
STEP 4: Check the injector o-rings.		
STEP 4A: Inspect the bottom two injector o-rings on the rear three cylinders.	The o-rings are OK	
STEP 5: Check the fuel passages in the head.		
STEP 5A: Inspect the fuel passages in the rear of the head.	No leaks to the drain passage, crankcase, cylinders, or coolant system	
STEP 6: Clear the fault codes.		
STEP 6A: Disable the fault code.	Fault Code 486 inactive	
STEP 6B: Clear the inactive fault codes.	All fault codes cleared	

TROUBLESHOOTING STEP

STEP 1: Check for active fault codes.

STEP 1A: Inspect for Fault Codes 396, 397, and 482 or high inactive counts.

Condition:
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check for active or high counts of inactive fault codes.	**OK** **Fault Codes 396, 397, and 482 are not active**	2A
	NOT OK Fault Codes 396, 397, and 482 are active.	Refer to Fault Codes 396, 397, and 482

STEP 2: Check for air in the pressure-side fuel.

STEP 2A: Inspect for air in the pressure-side fuel.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Check for air in the pressure-side fuel.	**OK** **No air in fuel**	3A
	NOT OK **Air in fuel** Refer to Procedure 006-003, in the Trouble-shooting and Repair Manual, Signature, ISX and QSX15 Engines, Bulletin No. 3666239.	6A

STEP 3: Check the rear fueling actuators.

STEP 3A: Inspect the rear fueling actuators.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Replace the rear fueling actuators. • Refer to Procedure 019-110. • Check that Fault Code 486 goes inactive.	**OK** **Fault Code 486 goes inactive**	6A
	NOT OK **Reinstall the rear fueling actuator** Refer to Procedure 019-110.	4A

STEP 4: Check the injector o-rings.

STEP 4A: Inspect the bottom two injector o-rings on the rear three cylinders.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Inspect for nicks or tears on the bottom two o-rings. • Check that o-rings are in good condition.	**OK** **The o-rings are OK**	5A
	NOT OK **Replace the o-rings** Refer to Procedure 005-011 in the Trouble-shooting and Repair Manual, Signature, ISX and QSX15 Engines Bulletin No. 3666239.	6A

STEP 5: Check the fuel passages in the head.

STEP 5A: Inspect the fuel passages in the rear of the head.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Inspect the rear of the head for leaks or obstructions.	**OK** **No leaks to the drain passage, crankcase, cylinders, or coolant system**	6A
	NOT OK Correct the problem. Refer to the Troubleshooting and Repair Manual, Signature, ISX and QSX15 Engines, Bulletin No. 3666239.	6A

STEP 6: Clear the fault codes.

STEP 6A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it run above 1000 rpm for at least 1 minute. • Using INSITE™, verify Fault Code 486 is inactive	**OK** **Fault Code 486 inactive**	6B
	NOT OK Return to the troubleshooting steps or contact your local Cummins Authorized Repair Location if all the steps have been completed and checked again.	1A

STEP 6B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

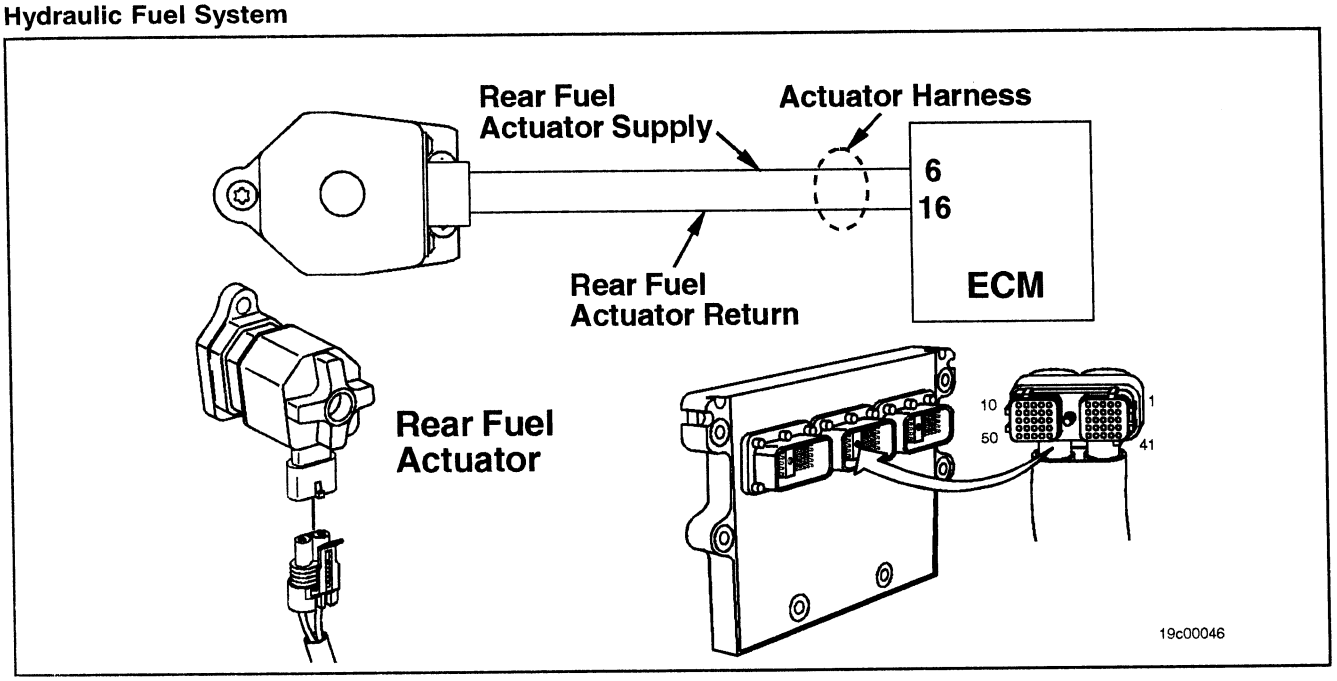
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 485

Fuel System Overfueling

CODES	REASON	EFFECT
Fault Code: 485 PID(P), SID(S): P129 SPN: 1349 FMI: 0/16 Lamp: Red	Unexpectedly high rail pressure was detected on the rear three cylinders.	Engine will return to idle speed, then **only** idle or shut down.

Hydraulic Fuel System



Circuit Description:

The electronic control module (ECM) supplies voltage to open the fueling actuators for a short length of time. This allows a short pulse of fuel to flow to the injector. The injector then injects this fuel into the cylinder for combustion.

Component Location:

The rear fueling actuators are located on the fuel delivery housing below the air inlet horn. It is the actuator that is closest to the rear of the engine. The injectors are located in the cylinder head under the valve cover.

Shop Talk:

The ECM measures the amount of fuel metered into the injector by using the rear rail pressure sensor. If the amount of fuel is above what the ECM expected, the fault code is activated.

TROUBLESHOOTING SUMMARY

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check for active fault codes.		
STEP 1A: Inspect for Fault Code 449 or high inactive counts.	Fault Code 449 inactive	
STEP 1A-1: Check for air in the pressure-side fuel.	No air in fuel	
STEP 1A-2: Measure for drain line restriction.	Less than 4.0 in Hg	
STEP 2: Check the rear fueling actuators.		
STEP 2A: Inspect the rear fueling actuators.	Fault Code 485 inactive	
STEP 3: Clear the fault codes.		
STEP 3A: Disable the fault code.	Fault Code 485 inactive	
STEP 3B: Clear the inactive fault codes.	All fault codes cleared	

TROUBLESHOOTING STEP

STEP 1: Check for active fault codes.

STEP 1A: Inspect for Fault Code 449 or high inactive counts.

Condition:
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Read the fault codes using INSITE™.	**OK** **Fault Code 449 inactive**	1A-1
	NOT OK Fault Code 449 active.	Fault Code 449

STEP 1A-1: Check for air in the pressure-side fuel.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Inspect for air in the pressure-side fuel.	**OK** **No air in fuel**	1A-2
	NOT OK **Air in fuel** Refer to Procedure 006-003 in the Troubleshooting and Repair Manual, Signature, ISX and QSX15 Engines, Bulletin No. 3666239.	3A

STEP 1A-2: Measure for drain line restriction

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Measure for drain line restriction.	**OK** **Less than 4.0 in Hg**	2A
	NOT OK **More than 4.0 in Hg** Refer to Procedure 006-012 in the Troubleshooting and Repair Manual, Signature, ISX and QSX15 Engines, Bulletin No. 3666239.	3A

STEP 2: Check the rear fueling actuators.

STEP 2A: Inspect the rear fueling actuators.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Replace the rear fueling actuators.	**OK** **Fault Code 485 inactive**	3A
	NOT OK **Reinstall the original rear fueling actuators** Refer to Procedure 019-110.	3A

STEP 3: Clear the fault codes.

STEP 3A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and run above 1000 rpm for 1 minute. • Using INSITE™, verify Fault Code 485 inactive	**OK** **Fault Code 485 inactive**	3B
	NOT OK Return to the troubleshooting steps or contact your local Cummins Authorized Repair Location if all the steps have been completed and checked again.	1A

STEP 3B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

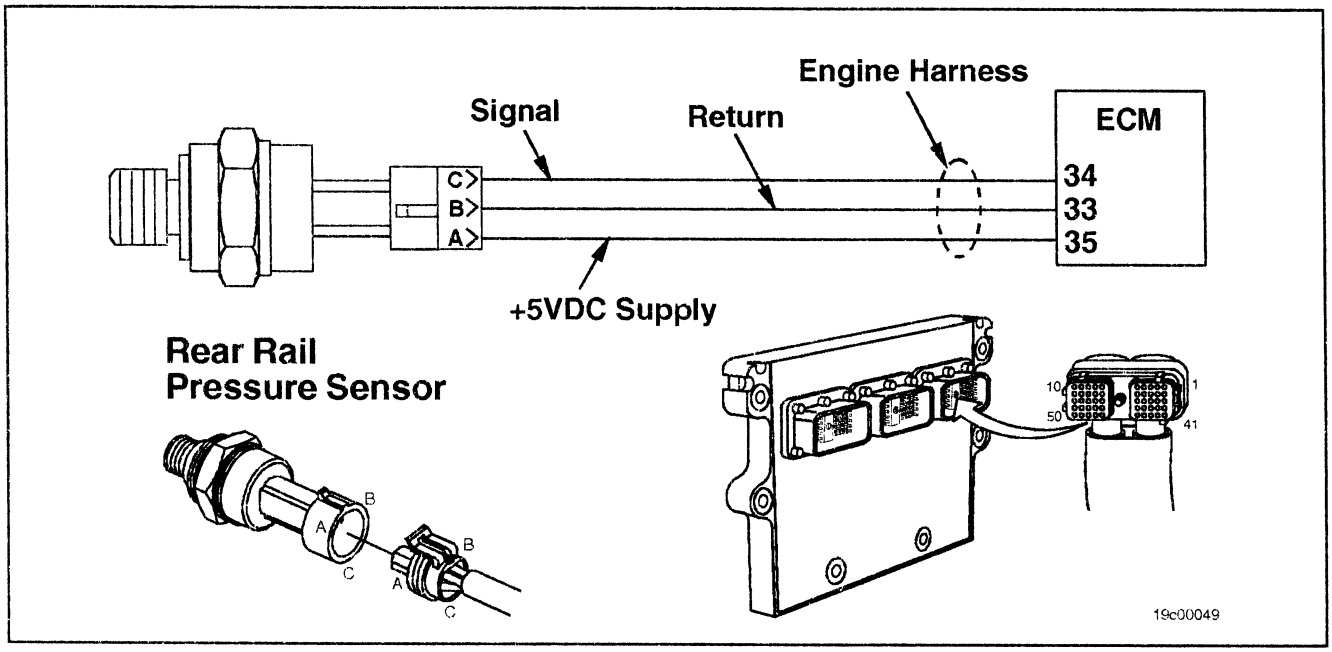
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 484

Rear Rail Pressure Sensor Circuit

CODES	REASON	EFFECT
Fault Code: 484 PID(P), SID(S): P129 SPN: 1349 FMI: 4/4 Lamp: Yellow	Low voltage detected on the rear rail pressure sensor circuit.	Engine will run derated.

Rear Rail Pressure Sensor Circuit



Circuit Description:

The rear rail pressure sensor provides the rail pressure signal to the electronic control module (ECM).

Component Location:

The rear rail pressure sensor is located on the fuel delivery housing below the gear pump.

Shop Talk:

This fault could be caused by the signal wire shorted to ground, the supply wire shorted to ground, an open circuit in the supply wire, an open circuit in the signal wire, a failed sensor, or a faulty ECM power supply.

TROUBLESHOOTING SUMMARY

⚠ CAUTION ⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead
Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead
Part No. 3824774 - breakout cable.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check for active fault codes.		
STEP 1A: Read the fault codes.	Fault Code 187 inactive	
STEP 2: Check the rear rail pressure sensor.		
STEP 2A: Inspect the engine harness and sensor connector pins.	No damaged pins	
STEP 2B: Read the fault codes.	Fault Code 484 inactive	
STEP 2C: Check the supply voltage.	(+) 4.75 to 5.25 VDC	
STEP 2C-1: Measure the voltage from the ECM.	(+) 4.75 to 5.25 VDC	
STEP 2D: Check the signal voltage.	(+) 0.5 to 4.7 VDC	
STEP 2D-1: Check for a short circuit to ground.	More than 100k ohms	
STEP 2D-2: Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 3: Check the sensor harness.		
STEP 3A: Inspect the sensor harness connector pins and the ECM for damage.	No damaged pins	
STEP 3B: Read the fault codes.	Fault Code 484 inactive	
STEP 3C: Check for an open circuit in the signal wire.	Less than 10 ohms	
STEP 4: Check for an ECM response.		
STEP 4A: Check for the appropriate ECM response.	Fault Code 484 inactive and Fault Code 483 active	
STEP 5: Clear the fault codes.		
STEP 5A: Disable the fault code.	Fault Code 484 inactive	
STEP 5B: Clear the inactive fault codes.	All fault codes cleared	

TROUBLESHOOTING STEP

STEP 1: Check for active fault codes.

STEP 1A: Read the fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check for active fault codes. • Using INSITE™, read the fault codes.	**OK** **Fault Code 187 inactive**	2A
	NOT OK Fault Code 187 active.	Fault Code 187

STEP 2: Check the rear rail pressure sensor.

STEP 2A: Inspect the engine harness and sensor connector pins.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:
- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.
- Disconnect the rear rail pressure sensor from the engine harness.

Action	Specifications/Repair	Next Step
Inspect the engine harness and sensor connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	2B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-203 or 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	5A

STEP 2B: Read the fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Start the engine and let it idle for 1 minute. • Read the fault codes using INSITE™.	**OK** **Fault Code 484 inactive**	5B
	NOT OK Fault Code 484 active.	2C

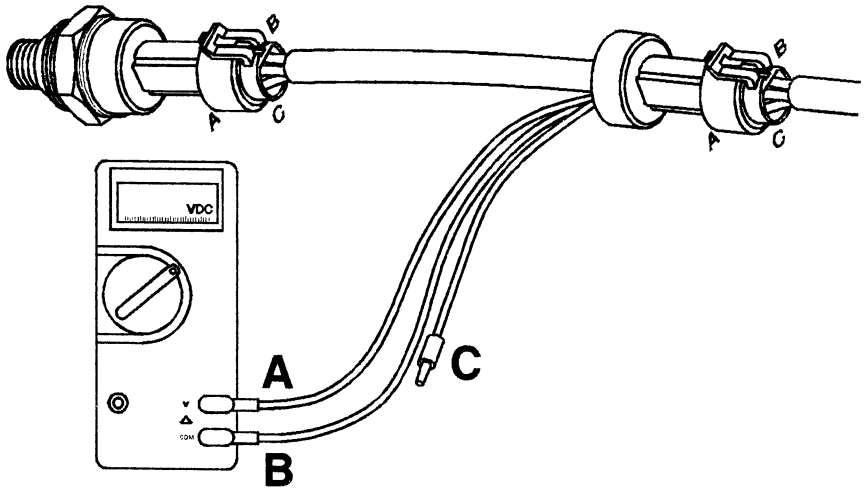
STEP 2C: Check the supply voltage.

⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3824774 - breakout cable.

Condition:
- Install breakout cable, Part No. 3824774, between the sensor and the engine harness connector.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the supply voltage. • Measure the supply voltage by installing the breakout cable's supply, pin A (or RED) and return, pin B (or BLACK) connectors into the multimeter.	**OK** **(+) 4.75 to 5.25 VDC**	2D
	NOT OK Does **not** meet specifications.	2C-1



19c00841

STEP 2C-1: Measure the voltage from the ECM.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

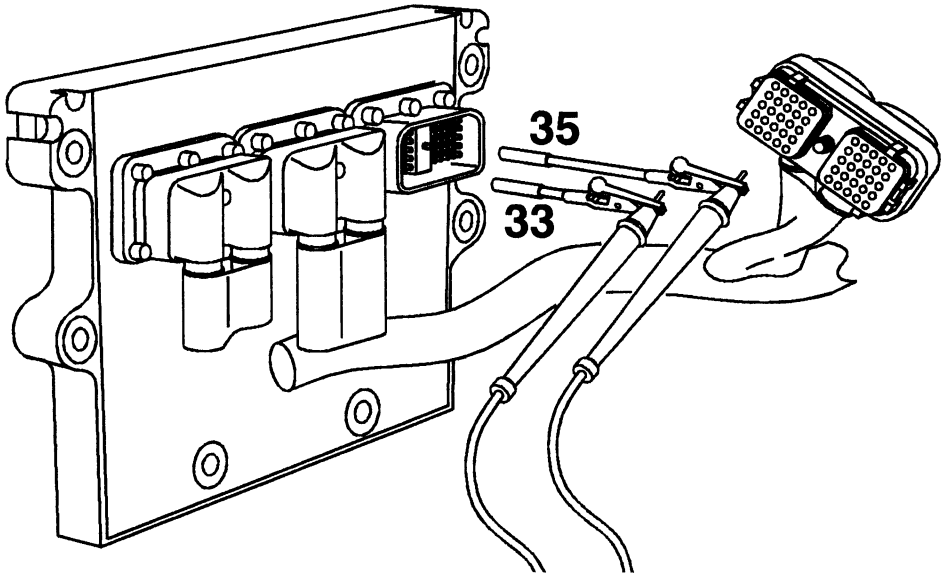
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

Condition:

- Disconnect the sensor harness connector from the ECM.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Measure the voltage from the ECM. • Measure the voltage at the ECM from pin 35 to pin 33 of the ECM sensor port.	**OK** **(+) 4.75 to 5.25 VDC** **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	5A
	NOT OK **Replace the ECM** Refer to Procedure 019-031.	5A



STEP 2D: Check the signal voltage.

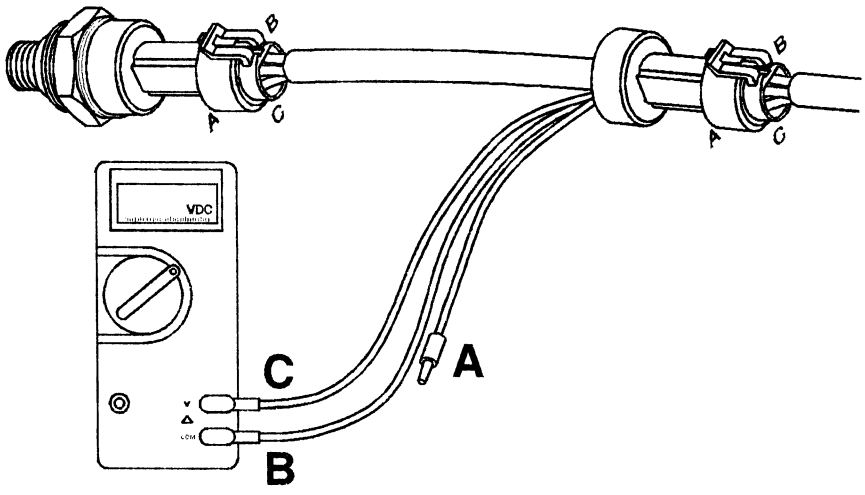
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3824774 - breakout cable.

Condition:

- Disconnect the rear rail pressure sensor from the engine harness.
- Install the breakout cable, Part No. 3824774, between the engine harness and the rear rail pressure sensor.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the signal voltage. • Measure the signal voltage by installing the breakout cable's signal pin C (or YELLOW) and return pin B (or BLACK) connectors into the multimeter.	**OK** **(+) 0.5 to 4.7 VDC**	2D-1
	NOT OK Does **not** meet specifications.	3A



19c00842

STEP 2D-1: Check for a short circuit to ground.

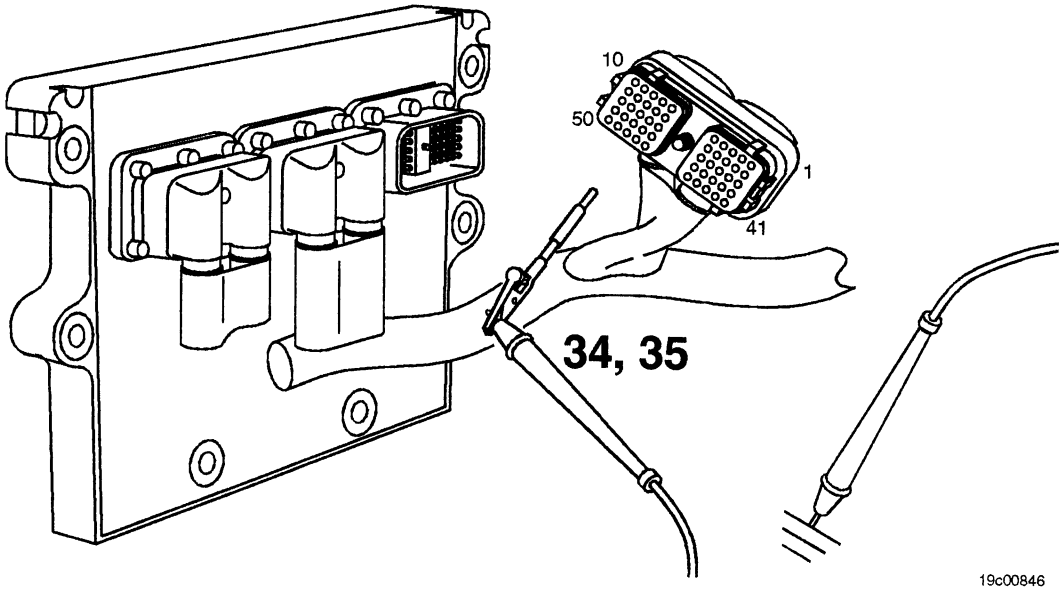
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the rear rail pressure sensor from the engine harness.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground. • Measure the resistance from pin 34 of the sensor harness connector to engine block ground. • Measure the resistance from pin 35 of the sensor harness connector to engine block ground.	**OK** **More than 100k ohms**	2D-2
	NOT OK **Replace the engine harness** Refer to Procedure 019-043.	5A



STEP 2D-2: Check for a short circuit from pin to pin.

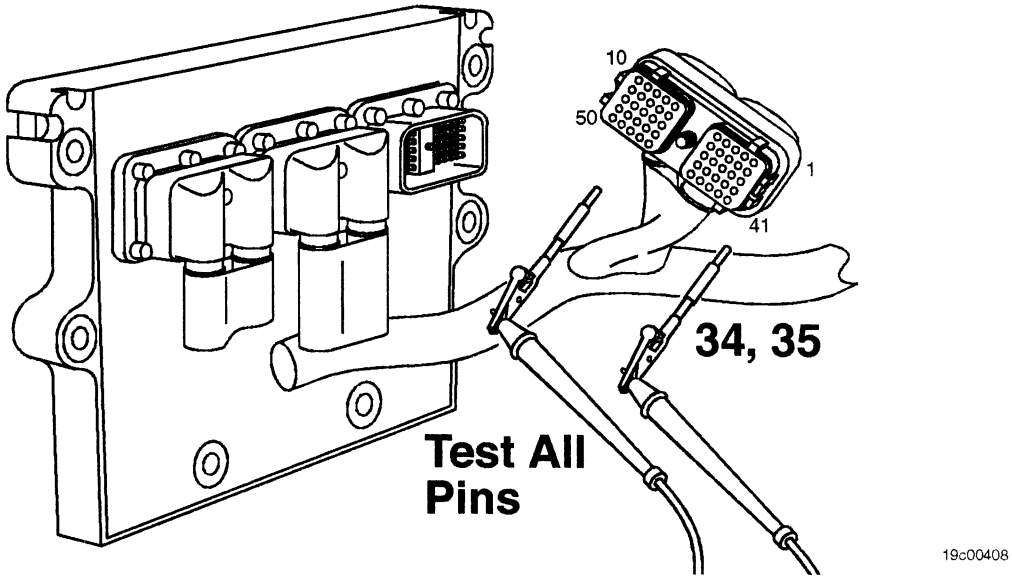
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.
- Disconnect the engine harness from the rear rail pressure sensor.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pin 34 of the sensor harness connector to all other pins in the connector. • Measure the resistance from pin 35 of the sensor harness connector to all other pins in the connector.	**OK** **More than 100k ohms** **Replace the rear rail pressure sensor** Refer to Procedure 019-115.	5A
	NOT OK **Replace the engine harness** Refer to Procedure 019-043.	5A



STEP 3: Check the sensor harness.

STEP 3A: Inspect the sensor harness connector pins and the ECM for damage.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:
- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.
- Disconnect the rear rail pressure sensor from the engine harness.

Action	Specifications/Repair	Next Step
Inspect the sensor harness connector pins and the ECM for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	3B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-203 or 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	5A

STEP 3B: Read the fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Start the engine and let it idle for 1 minute. • Read the fault codes using INSITE™.	**OK** **Fault Code 484 inactive**	5B
	NOT OK Fault Code 484 active.	3C

STEP 3C: Check for an open circuit in the signal wire.

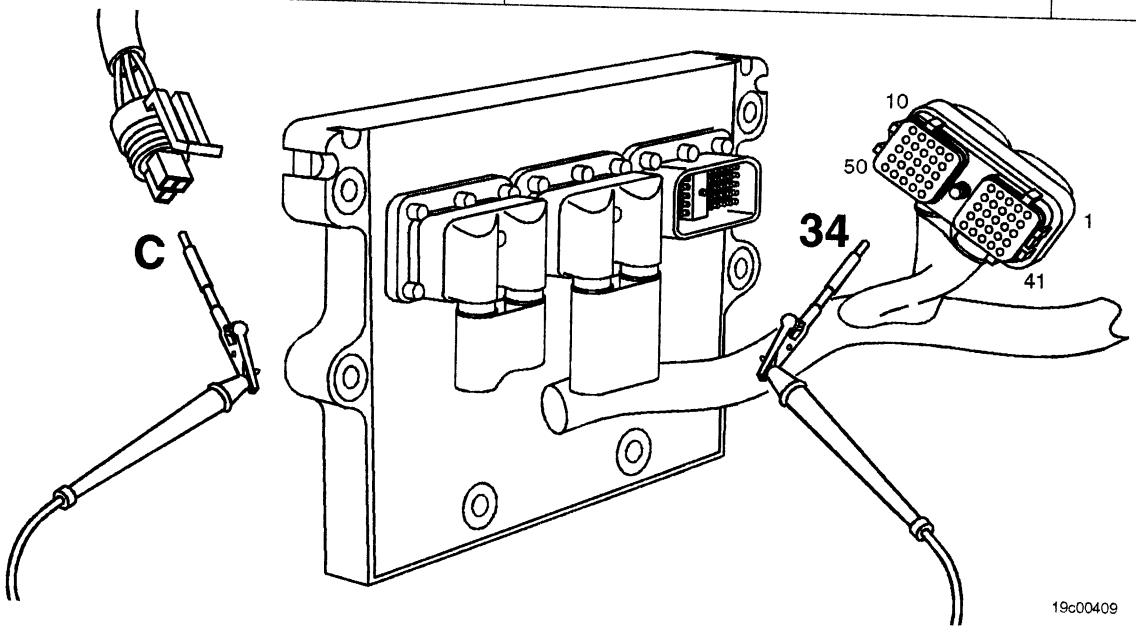
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.
- Disconnect the engine harness from the rear rail pressure sensor.

Action	Specifications/Repair	Next Step
Check for an open circuit in the signal wire. • Measure the resistance from pin 34 of the sensor harness connector to pin C (or 3) of the rear rail pressure sensor connector.	**OK** **Less than 10 ohms** **Replace the rear rail pressure sensor** Refer to Procedure 019-115.	4A
	NOT OK **Repair or replace the sensor harness** • Repair the sensor harness. Refer to Procedure 019-250. • Replace the sensor harness. Refer to Procedure 019-043.	5A



STEP 4: Check for an ECM response.

STEP 4A: Check for the appropriate ECM response.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

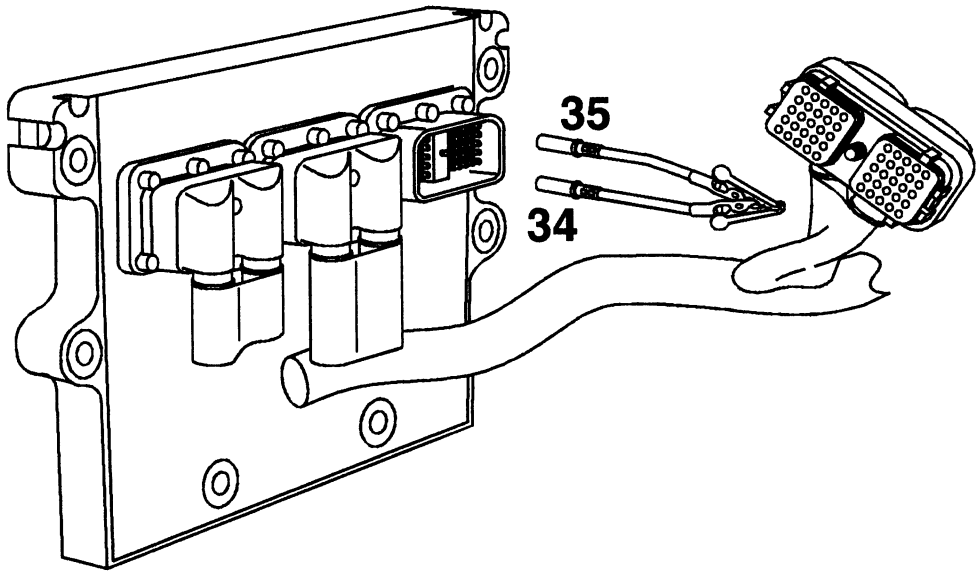
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the ECM response. • Install Part No. 3822917 as a jumper wire between pin 35 and pin 34 in the ECM sensor harness port. • Read the fault codes using INSITE™.	**OK** **Fault Code 484 inactive and** **Fault Code 483 active**	5A
	NOT OK **Replace the ECM** Refer to Procedure 019-031.	5A



19c00847

STEP 5: Clear the fault codes.

STEP 5A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Using INSITE™, verify that Fault Code 484 is inactive.	**OK** **Fault Code 484 inactive**	5B
	NOT OK Return to troubleshooting steps or contact your local Cummins Authorized Repair Location if all steps have been completed and checked again.	1A

STEP 5B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

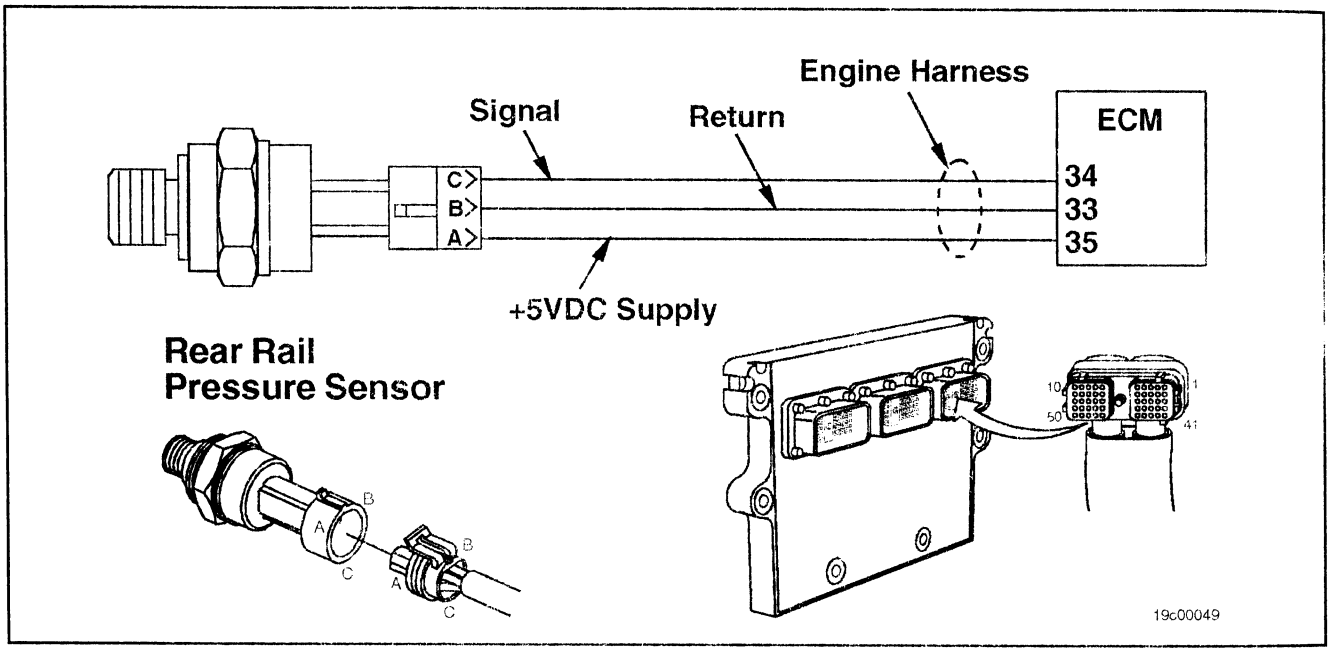
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Using INSITE™, clear the inactive fault codes.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 483

Rear Rail Pressure Sensor Circuit

CODES	REASON	EFFECT
Fault Code: 483 PID(P), SID(S): P129 SPN: 1349 FMI: 3/3 Lamp: Yellow	High voltage detected on the rear rail pressure sensor circuit.	Engine will run derated.

Rear Rail Pressure Sensor



Circuit Description:

The rear rail pressure sensor provides the rail pressure signal to the electronic control module (ECM).

Component Location:

The rear rail pressure sensor is located on the rear of the fuel delivery housing.

Shop Talk:

This fault could be caused by the return or signal wire shorted to positive (+) 5 VDC or positive (+) 12 VDC, an open circuit in the return wire, or a failed sensor.

TROUBLESHOOTING SUMMARY

⚠ CAUTION ⚠

To avoid damaging the new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead
Part No. 3824774 - breakout cable.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the rear rail pressure sensor.		
STEP 1A: Inspect the engine harness and sensor connector pins.	No damaged pins	
STEP 1B: Read the fault codes.	Fault Code 483 inactive	
STEP 1C: Check the supply voltage.	(+) 4.75 to 5.25 VDC	
STEP 1C-1: Measure the voltage from the ECM.	(+) 4.75 to 5.25 VDC	
STEP 1D: Check the signal voltage.	(+) 0.5 to 4.7 VDC	
STEP 2: Check the sensor harness.		
STEP 2A: Inspect the sensor harness connector pins and the ECM for damage.	No damaged pins	
STEP 2B: Read the fault codes.	Fault Code 483 inactive	
STEP 2C: Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 2D: Check for an open circuit in the return wire.	Less than 10 ohms	
STEP 3: Check for an ECM response.		
STEP 3A: Check for the appropriate ECM response.	Fault Code 483 inactive and Fault Code 484 active	
STEP 4: Clear the fault codes.		
STEP 4A: Disable the fault code.	Fault Code 483 inactive	
STEP 4B: Clear the inactive fault codes.	All faults codes cleared	

TROUBLESHOOTING STEP

STEP 1: Check the rear rail pressure sensor.

STEP 1A: Inspect the engine harness and sensor connector pins.

Condition:
- Turn keyswitch OFF.
- Disconnect the rear rail pressure sensor from the engine harness.

Action	Specifications/Repair	Next Step
Inspect the sensor harness and sensor connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	1B
	NOT OK **Repair the damaged pins** Replace the 3-pin Metri-Pack connector or the sensor, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Replace the 3-pin Metri-Pack connector. Refer to Procedure 019-203. • Replace the rear rail pressure sensor. Refer to Procedure 019-115.	4A

STEP 1B: Read the fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Start the engine and let it idle for 1 minute. • Read the fault codes using INSITE™.	**OK** **Fault Code 483 inactive**	4B
	NOT OK Fault Code 483 active.	1C

STEP 1C: Check the supply voltage.

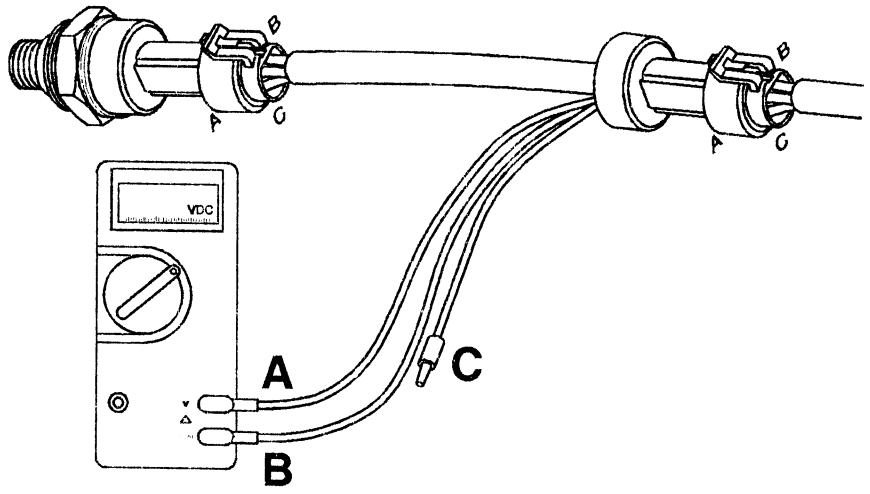
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3824774 - breakout cable.

Condition:

- Install breakout cable, Part No. 3824774, between the sensor and the engine harness connector.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the supply voltage. • Measure the supply voltage by installing the breakout cable's supply pin A (or RED) and return pin B (or BLACK) connectors into the multimeter.	**OK** **(+) 4.75 to 5.25 VDC**	1D
	NOT OK Does **not** meet specifications.	1C-1



19c00841

STEP 1C-1: Measure the voltage from the ECM.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

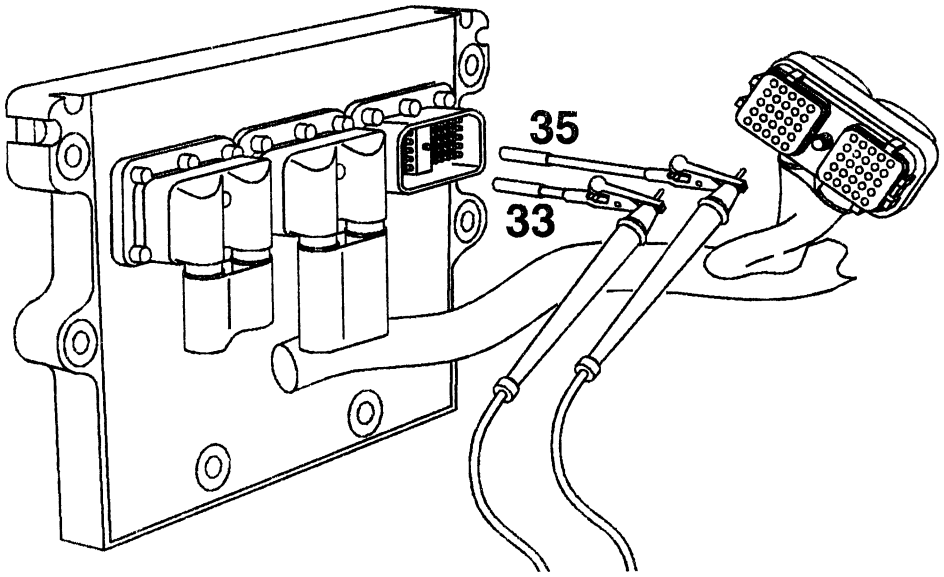
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

Condition:

- Disconnect the sensor harness connector from the ECM.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Measure the voltage from the ECM. • Measure the voltage at the ECM from pin 35 to pin 33 of the ECM sensor port.	**OK** **(+) 4.75 to 5.25 VDC** **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	4A
	NOT OK **Replace the ECM** Refer to Procedure 019-031.	4A



STEP 1D: Check the signal voltage.

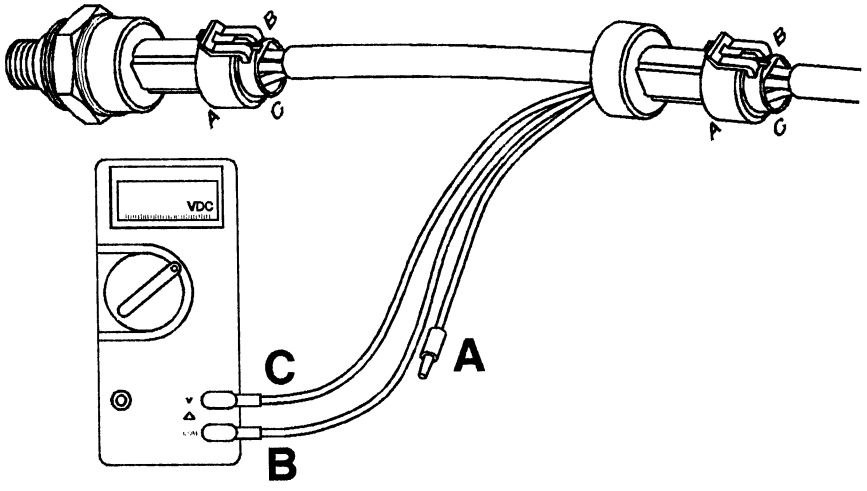
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3824774 - breakout cable.

Condition:

- Install breakout cable, Part No. 3824774, between the engine harness connector and the rear rail pressure sensor.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the signal voltage. • Measure the signal voltage by installing the breakout cable's signal pin C (or YELLOW) and return pin B (or BLACK) connectors into the multimeter.	**OK** **(+) 0.5 to 4.7 VDC**	3A
	NOT OK Does **not** meet specifications.	2A



19c00842

STEP 2: Check the sensor harness.

STEP 2A: Inspect the sensor harness connector pins and the ECM for damage.

⚠CAUTION⚠

To avoid damaging the new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:
- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Inspect the sensor harness connector pins and the ECM for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	2B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	4A

STEP 2B: Read the fault codes

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Start the engine and let it idle for 1 minute. • Read the fault codes.	**OK** **Fault Code 483 inactive**	4B
	NOT OK Fault Code 483 active.	2C

STEP 2C: Check for a short circuit from pin to pin.

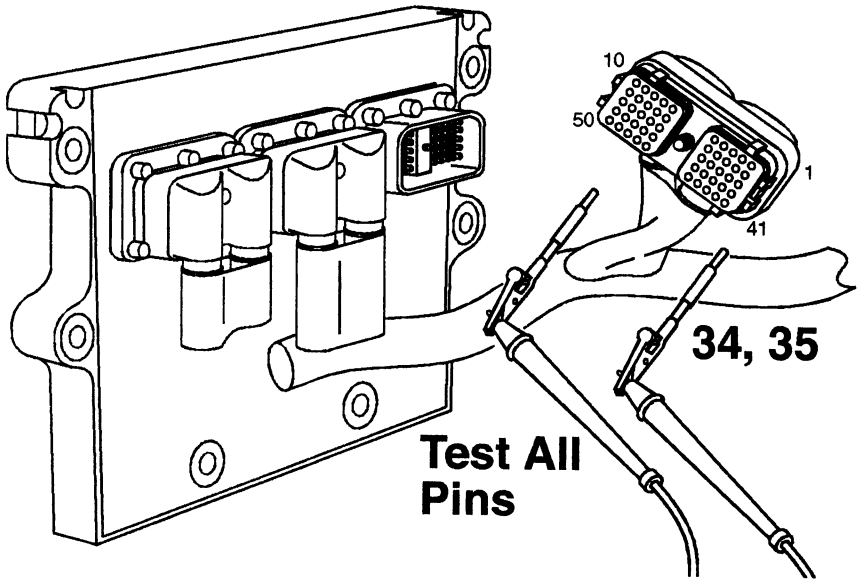
⚠CAUTION⚠

To avoid pin and harness, damage use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.
- Disconnect the rear rail pressure sensor from the sensor harness.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance between pin 35 in the sensor harness connector to all other pins in the connector. • Measure the resistance between pin 34 in the sensor harness connector to all other pins in the connector.	**OK** **More than 100k ohms**	2D
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	4A



STEP 2D: Check for an open circuit in the return wire.

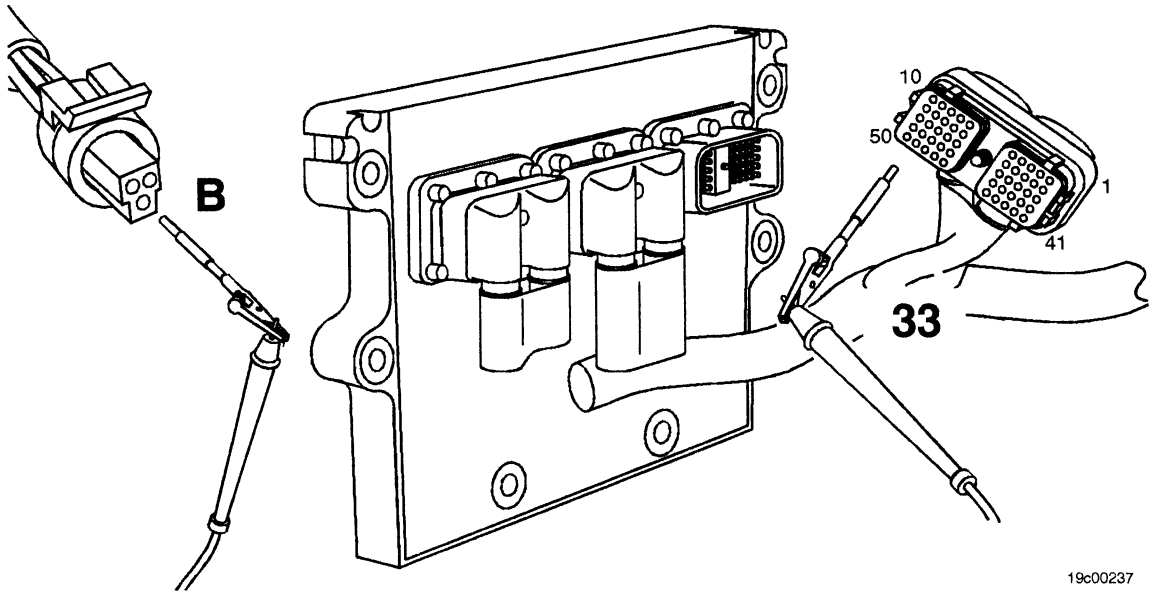
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.
- Disconnect the rear rail pressure sensor from the sensor harness.

Action	Specifications/Repair	Next Step
Check for an open circuit in the return wire. • Measure the resistance from pin 33 on the ECM sensor harness connector to pin B (or 2) on the rear rail pressure sensor harness connector.	**OK** **Less than 10 ohms** **Replace the rear rail pressure sensor** Refer to Procedure 019-115.	4A
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-202 or 019-250. • Replace the engine harness. Refer to Procedure 019-043.	4A



STEP 3: Check for an ECM response.

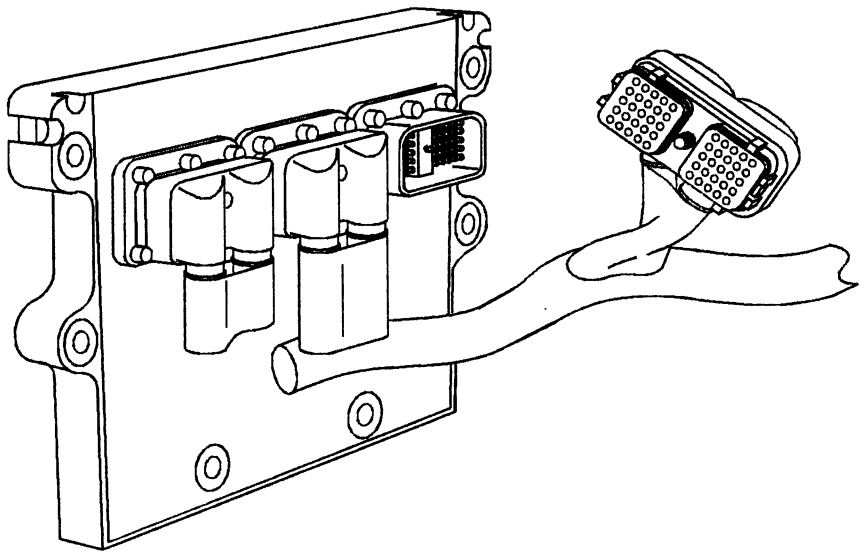
STEP 3A: Check for the appropriate ECM response.

⚠CAUTION⚠

To avoid damaging the new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:
- Disconnect the sensor harness connector from the ECM.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check for the appropriate ECM response. • Read the fault codes using INSITE™.	**OK** **Fault Code 483 inactive and Fault Code 484 active**	4A
	NOT OK **Replace the ECM** Refer to Procedure 019-031.	4A



19600008

STEP 4: Clear the fault codes.

STEP 4A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it idle for 1 minute. • Using INSITE™, verify that Fault Code 483 is inactive.	**OK** **Fault Code 483 inactive**	4B
	NOT OK Return to the troubleshooting steps or contact your local Cummins Authorized Repair Location, if all steps have been completed and checked again.	1A

STEP 4B: Clear the inactive fault codes.

Condition:
- Connect all components
- Turn keyswitch ON.

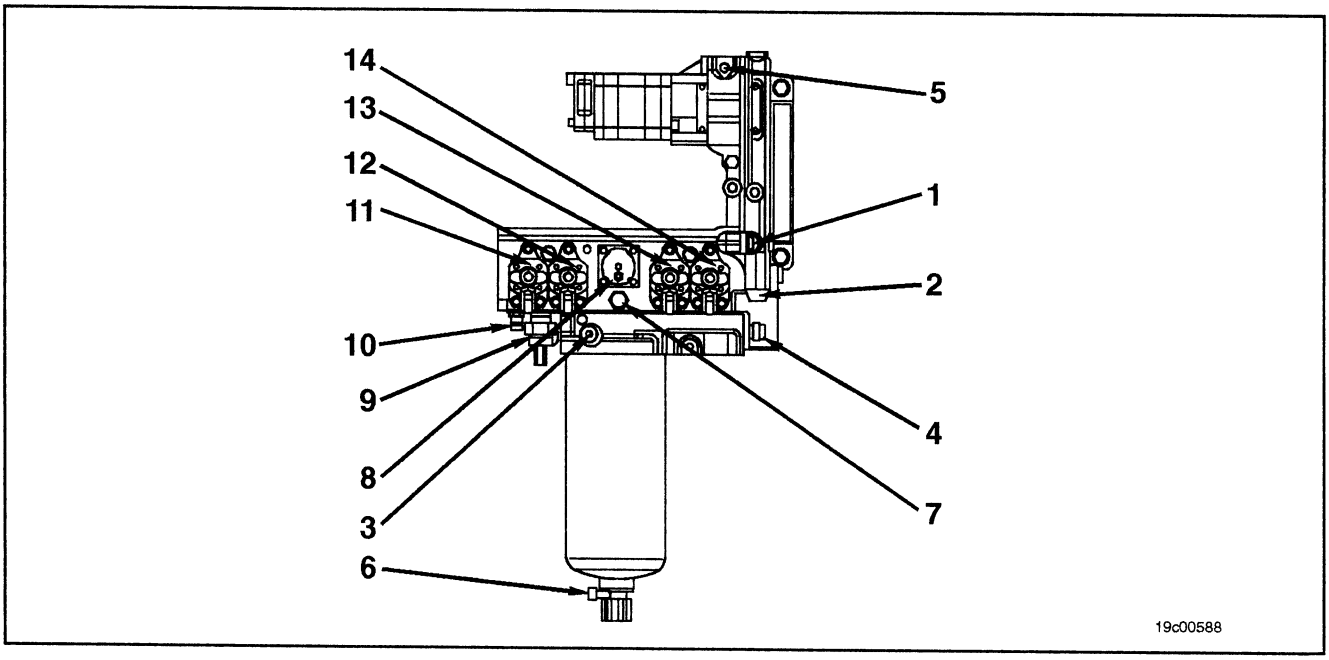
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Use INSITE™ to clear all inactive fault codes.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 482

Low Fuel Pressure

CODES	REASON	EFFECT
Fault Code: 482 PID(P), SID(S): P094 SPN: 94 FMI: 1/18 Lamp: Yellow	Low fuel supply pressure was detected at the fuel pressure sensor.	Engine does **not** start, has low power, may have white smoke, or run rough.

Fuel System Circuit



Circuit Description:

The gear pump draws fuel from the fuel tank through the fuel filter and antidrainback valve. The gear pump develops 100 to 320 psi of fuel pressure. The fuel flows through the fuel filter screen and fuel shutoff valve to the fueling and timing actuators and the fuel pressure sensor.

Component Location:

Hydraulic Fuel System Circuit Callouts							
1	320-psi Pressure RegulatorPriming By-pass Valve	5	Quick-Disconnect Pressure Tap-Suction Side	9	Fuel Pressure Sensor	13	Rear Timing Actuator
2	36 mc Filter Screen	6	WIF Sensor	10	Quick-Disconnect Pressure Tap-Pressure Side	14	Rear Rail Actuator
3	Fuel Inlet Restriction Sensor	7	250-psi Pressure Regulator	11	Front Rail Actuator		
4	Fuel Inlet	8	Fuel Shutoff Valve	12	Front Timing Actuator		

The 250 psi regulator controls the fuel pressure. All components are located on the fuel delivery housing on the intake side of the engine

Shop Talk:

The fuel pressure is monitored by the electronic control module (ECM). If the fuel pressure is outside an acceptable range, the fault code is activated. The acceptable range of fuel pressure can be viewed as "Fuel Pressure Lower Limit" and "Fuel Pressure Upper Limit" in INSITE™ using the monitor screen. The fault will log quickly for large differences in pressure and slower for small differences in pressure.

TROUBLESHOOTING SUMMARY

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check for active fault codes.		
STEP 1A: Check for active fault codes.	Fault Code 254 or 259 inactive	
STEP 2: Check fuel supply.		
STEP 2A: Check fuel supply.	Fuel in tank	
STEP 3: Check engine operation.		
STEP 3A: Check engine operation.	Engine starts	
STEP 4: Check fuel inlet restriction.		
STEP 4A: Check fuel inlet restriction.	Clean filter: 8 in Hg (max) Dirty filter: 12 in Hg (max)	
STEP 4A-1: Replace fuel filter and check fuel inlet restriction pressure.	Less than 8 in Hg (max)	
STEP 4A-2: Inspect the fuel lines and supply tank for debris and obstructions.	Lines clear	
STEP 5: Inspect the check valves.		
STEP 5A: Remove and inspect check valves for debris.	Check valves clear	
STEP 6: Check for air in the pressure-side fuel.		
STEP 6A: Check for air in the pressure-side fuel.	No air in the pressure-side fuel	
STEP 7: Check the fuel pressure sensor accuracy.		
STEP 7A: Verify the fuel pressure sensor accuracy by comparing the reading in INSITE™ to a mechanical gauge connected to the pressure-side Compuchek™ fitting.	Fuel pressure while cranking engine: at least 50 psi Fuel pressure at idle: (600-700 rpm): 250 to 265 psi Fuel pressure at 2000 rpm: 250 to 285 psi NOTE: Gauge and sensor should read within 10 psi	
STEP 8: Inspect the filter screen.		
STEP 8A: Inspect the filter screen for debris.	No debris in the filter screen	
STEP 9: Check for fuel shutoff valve restriction.		
STEP 9A: Check for mechanical restriction of the fuel shutoff valve; disassemble fuel shutoff valve and verify that parts are free to move.	Fuel shutoff valve not restricted	
STEP 10: Read the fault codes.		
STEP 10A: Read the fault codes.	Fault Code 482 inactive	

STEP 11: Read the fault codes.

STEP 11A: Read the fault codes.	Fault Code 482 inactive

STEP 12: Inspect the priming bypass valve.

STEP 12A: Inspect the priming bypass valve.	Priming bypass valve functions properly

STEP 13: Read the fault codes.

STEP 13A: Read the fault codes.	Fault Code 482 inactive

STEP 14: Inspect the gear pump.

STEP 14A: Remove and inspect the gear pump and check for sheared hex shaft or damaged gears.	No damage to gear pump

STEP 15: Check the fuel injectors.

STEP 15A: Remove and inspect the injectors for damaged or missing o-rings.	No damaged or missing injector o-rings

STEP 16: Inspect the fuel delivery housing.

STEP 16A: Inspect the fuel delivery housing for obstructions or internal leaks from the pressure-side of the pump to the drain of the inlet side of the pump.	No internal leaks or obstructions

STEP 17: Check for fuel coming out of the drain while cranking the engine.

STEP 17A: Check for fuel coming out of the drain while cranking the engine.	Fuel coming out of drain line

STEP 18: Prime the fuel system.

STEP 18A: Prime the system and verify that it maintains prime.	System holds prime
STEP 18A-1: Check for loose fittings on fuel delivery housing.	No loose fittings
STEP 18A-2: Inspect check valves for debris.	No debris in check valves

STEP 19: Check the fuel pressure sensor accuracy.

STEP 19A: Verify the fuel pressure sensor accuracy by comparing the reading in INSITE™ to a mechanical gauge connected to the pressure-side Compuchek™ fitting.	Fuel pressure while cranking engine: at least 50 psi Fuel pressure at idle: (600-700 rpm): 250 to 265 psi Fuel pressure at 2000 rpm: 250 to 285 psi NOTE: Gauge and sensor should read within 10 psi

STEP 20: Inspect the filter screen.

STEP 20A: Inspect the filter screen for debris.	No debris in the filter screen

STEP 21: Check the fuel shutoff valve.

STEP 21A: Check to see if the fuel shutoff valve is mechanically or electrically stuck closed.
Fuel shutoff valve not stuck closed

STEP 22: Read the fault codes.

STEP 22A: Read the fault codes.
Fault Code 482 inactive

STEP 23: Read the fault codes.

STEP 23A: Read the fault codes.
Fault Code 482 inactive

STEP 24: Inspect the priming bypass valve.

STEP 24A: Inspect and replace the priming bypass valve.
Priming bypass valve functions properly

STEP 25: Read the fault codes.

STEP 25A: Read the fault codes.
Fault Code 482 inactive

STEP 26: Inspect the gear pump.

STEP 26A: Remove and inspect the gear pump and check for sheared hex shaft or damaged gears.
No damage to hex shaft or gear teeth

STEP 27: Inspect the injectors.

STEP 27A: Remove and inspect the injectors for damaged or missing o-rings.
No damaged injector o-rings

STEP 28: Inspect the fuel delivery housing.

STEP 28A: Inspect the fuel delivery housing for obstructions or internal leaks from the pressure-side of the pump to the drain of the inlet side of the pump.
No internal leaks or obstructions

STEP 29: Clear the fault codes.

STEP 29A: Disable the fault code.
Fault Code 482 inactive

STEP 29B: Clear the inactive fault codes.
All fault codes cleared

TROUBLESHOOTING STEP

STEP 1: Check for active fault codes.

STEP 1A: Check for active fault codes.

Condition:
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check for active fault codes. • Using INSITE™, check for active fault codes. • Refer to the Troubleshooting and Repair Manual, Signature, ISX and QSX15 Engines, Bulletin No. 3666239, for test procedures.	**OK** **Fault Codes 254 or 259 inactive**	2A
	NOT OK Fault Codes 254 or 259 active.	Check fault codes that are active

STEP 2: Check fuel supply.

STEP 2A: Check fuel supply.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Check fuel in tank.	**OK** **Fuel in tank**	3A
	NOT OK **No fuel in tank** Fill tank.	3A

STEP 3: Check engine operation.

STEP 3A: Check engine operation.

Condition:
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check engine operation. - Start the engine.	**OK** **Engine starts**	4A
	NOT OK Engine does **not** start.	17A

STEP 4: Check fuel inlet restriction.

STEP 4A: Check fuel inlet restriction.

Condition:
- Turn keyswitch OFF.
- Check for fuel inlet restriction.

Action	Specifications/Repair	Next Step
Check for fuel inlet restriction. - Refer to Procedure 006-020 in the Troubleshooting and Repair Manual, Signature, ISX and QSX15 Engines, Bulletin No. 3666239.	**OK** **Clean filter: 8 in. Hg (max)** **Dirty filter: 12 in Hg (max)**	5A
	NOT OK Does **not** meet specifications.	4A-1

STEP 4A-1: Replace fuel filter and check fuel inlet restriction pressure.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Remove and replace the fuel filter. Recheck fuel inlet restriction. - Refer to the Troubleshooting and Repair Manual, Signature, ISX and QSX15 Engines, Bulletin No. 3666239, for repair and test procedures.	**OK** **Less than 8 in Hg (max)**	29A
	NOT OK **More than 12 in Hg (max)** Does **not** meet specifications.	4A-2

STEP 4A-2: Inspect the fuel lines and supply tank for debris and obstructions.

Condition: • Turn keyswitch OFF.		
Action	**Specifications/Repair**	**Next Step**
Inspect the fuel lines and supply tank for debris and obstructions. • Refer to Procedure 006-024 in the Troubleshooting and Repair Manual, Signature, ISX and QSX15 Engines, Bulletin No. 3666239.	**OK** **Lines clear**	29A
	NOT OK **Fuel lines and/or tank obstructed** Remove the debris or obstructions.	29A

STEP 5: Inspect the check valves.

STEP 5A: Inspect the check valves.

Condition: Turn keyswitch OFF.		
Action	**Specifications/Repair**	**Next Step**
Remove check valves and check for debris. • Refer to Procedure 005-073 in the Troubleshooting and Repair Manual, Signature, ISX and QSX15 Engines, Bulletin No. 3666239.	**OK** **Check valves clear**	6A
	NOT OK **Clear or replace the check valves** Refer to Procedure 005-073 in the Troubleshooting and Repair Manual, Signature, ISX and QSX15 Engines, Bulletin No. 3666239.	29A

STEP 6: Check for air in the pressure-side fuel.

STEP 6A: Check for air in the pressure-side fuel.

Condition: • Turn keyswitch OFF.		
Action	**Specifications/Repair**	**Next Step**
Check for air in the pressure-side fuel. • Refer to Procedure 006-003 in the Troubleshooting and Repair Manual, Signature, ISX and QSX15 Engines, Bulletin No. 3666239.	**OK** **No air in the pressure-side fuel**	7A
	NOT OK **Air in pressure-side fuel** Refer to Procedure 006-003 in the Troubleshooting and Repair Manual, Signature, ISX and QSX15 Engines, Bulletin No. 3666239.	29A

STEP 7: Check the fuel pressure sensor accuracy.

STEP 7A: Verify the fuel pressure sensor accuracy.

Condition:
- Turn keyswitch OFF.
- Install a mechanical gauge to the Compuchek™ fitting.
- Install INSITE™.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the fuel pressure while cranking the engine, running the engine at idle, and with the engine at 2000 rpm. • Refer to the Troubleshooting and Repair Manual, Signature, ISX and QSX15 Engines, Bulletin No. 3666239, for repair and test procedures.	**OK** **Fuel pressure while cranking engine: at least 50 psi** **Fuel pressure at idle: (600-700 rpm): 250 to 265 psi** **Fuel pressure at 2000 rpm: 250 to 285 psi** **NOTE: Gauge and sensor should read within 10 psi.**	8A
	NOT OK **Replace the sensor** Refer to Procedure 019-188.	29A

STEP 8: Inspect the filter screen.

STEP 8A: Inspect the filter screen for debris.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Remove and inspect the filter screen for debris. • Refer to Procedure 006-057 in the Troubleshooting and Repair Manual, Signature, ISX and QSX15 Engines, Bulletin No. 3666239.	**OK** **No debris in the filter screen**	9A
	NOT OK **Clean or replace the filter screen** Refer to Procedure 006-057 in the Troubleshooting and Repair Manual, Signature, ISX and QSX15 Engines, Bulletin No. 3666239.	29A

STEP 9: Check for fuel shutoff valve restriction.

STEP 9A: Check for mechanical restriction of the fuel shutoff valve.

Condition: Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Remove and inspect the fuel shutoff valve for mechanical restriction. • Refer to Procedure 005-043 in the Troubleshooting and Repair Manual, Signature, ISX and QSX15 Engines, Bulletin No. 3666239.	**OK** **Fuel shutoff valve not restricted** **Replace the 250 psi regulator** Refer to Procedure 005-073 in the Troubleshooting and Repair Manual, Signature, ISX and QSX15 Engines, Bulletin No. 3666239.	10A
	NOT OK **Repair or replace the fuel shutoff valve** Refer to Procedure 019-050.	29A

STEP 10: Read the fault codes.

STEP 10A: Read the fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Start the engine and let it idle for 1 minute. • Using INSITE™, read the fault codes.	**OK** **Fault Code 482 inactive**	29B
	NOT OK Fault Code 482 active. **Replace the 320 psi regulator** Refer to Procedure 005-073 in the Trouble-shooting and Repair Manual, Signature, ISX and QSX15 Engines, Bulletin No. 3666239.	11A

STEP 11: Read the fault codes.

STEP 11A: Read the fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Start the engine and let it idle for 1 minute. • Using INSITE™, read the fault codes.	**OK** **Fault Code 482 inactive**	29A
	NOT OK Fault Code 482 active.	12A

STEP 12: Inspect the priming bypass valve.

STEP 12A: Inspect the priming bypass valve.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Inspect the priming bypass valve and replace it if the fuel delivery housing matches the part number below. • Refer to Procedure 005-016 in the Trouble-shooting and Repair Manual, Signature, ISX and QSX15 Engines, Bulletin No. 3666239. **NOTE:** Fuel delivery housing part numbers are as follows: For 12 VDC: 4001840 or 4009811 HD-129. For 24 VDC: 4001843 or 4009813 HD-129.	**OK** **Replaced priming bypass valve (if part number matched)**	13A
	NOT OK Did not replace priming bypass valve.	14A

STEP 13: Read the fault codes.

STEP 13A: Read the fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Start the engine and let it idle for 1 minute. • Using INSITE™, read the fault codes.	**OK** **Fault Code 482 inactive**	29B
	NOT OK Fault Code 482 active.	14A

STEP 14: Inspect the gear pump.

STEP 14A: Remove and inspect the gear pump.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Remove and inspect the gear pump. • Refer to Procedure 005-016 in the Troubleshooting and Repair Manual, Signature, ISX and QSX15 Engines, Bulletin No. 3666239.	**OK** **No damage to gear pump**	15A
	NOT OK **Gear pump damaged** **Replace gear pump** Refer to Procedure 005-016 in the Troubleshooting and Repair Manual, Signature, ISX and QSX15 Engines, Bulletin No. 3666239.	29A

STEP 15: Check the fuel injectors.

STEP 15A: Remove and inspect the fuel injectors.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Remove and inspect the fuel injectors for damaged or missing o-rings. • Refer to Procedure 006-026 in the Troubleshooting and Repair Manual, Signature, ISX and QSX15 Engines, Bulletin No. 3666239.	**OK** **No damaged or missing injector o-rings**	16A
	NOT OK **Replace damaged injector o-rings** Refer to Procedure 006-026 in the Troubleshooting and Repair Manual, Signature, ISX and QSX15 Engines, Bulletin No. 3666239.	29A

STEP 16: Inspect the fuel delivery housing.

STEP 16A: Inspect the fuel delivery housing.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Inspect the fuel delivery housing. Inspect the fuel delivery housing for obstructions or internal leaks from the pressure-side of the pump to the drain of the inlet side of the pump. • Refer to Procedure 005-073 in the in the Troubleshooting and Repair Manual, Signature, ISX and QSX15 Engines, Bulletin No. 3666239.	**OK** **No internal leaks or obstructions**	29A
	NOT OK **Replace the fuel delivery housing** Refer to Procedure 005-016 in the Troubleshooting and Repair Manual, Signature, ISX and QSX15 Engines, Bulletin No. 3666239.	29A

STEP 17: Check for fuel coming out of drain while cranking the engine.

STEP 17A: Check for fuel coming out of drain while cranking the engine.

Condition:
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check for fuel coming out of drain while cranking engine. • Crank engine over while watching for fuel coming out of drain.	**OK** **Fuel coming out of drain line**	19A
	NOT OK No fuel coming out of drain line. **Replace the fuel filter** Refer to Procedure 005-016 in the Troubleshooting and Repair Manual, Signature, ISX and QSX15 Engines, Bulletin No. 3666239.	18A

STEP 18: Prime the fuel system.

STEP 18A: Prime the fuel system.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Prime the fuel system and verify that it maintains prime. • Refer to Procedure 005-016 in the Troubleshooting and Repair Manual, Signature, ISX and QSX15 Engines, Bulletin No. 3666239.	**OK** **System holds prime**	19A
	NOT OK System does **not** hold prime.	18A-1

STEP 18A-1: Check for loose fittings on fuel delivery housing.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Check for loose fittings on fuel delivery housing.	**OK** **No loose fittings**	18A-2
	NOT OK **Repair loose fittings**	29A

STEP 18A-2: Inspect check valves for debris.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Inspect check valves for debris. • Refer to Procedure 005-073 in the Troubleshooting and Repair Manual, Signature, ISX and QSX15 Engines, Bulletin No. 3666239.	**OK** **No debris in check valves**	29A
	NOT OK **Clean or replace check valves** Refer to Procedure 005-073 in the Troubleshooting and Repair Manual, Signature, ISX and QSX15 Engines, Bulletin No. 3666239.	29A

STEP 19: Check the fuel pressure sensor accuracy.

STEP 19A: Verify the fuel pressure sensor accuracy.

Condition:
- Turn keyswitch OFF.
- Install a mechanical gauge to the Compuchek™ fitting.
- Connect INSITE™.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the fuel pressure while cranking the engine. • Refer to the Troubleshooting and Repair Manual, Signature, ISX and QSX15 Engines, Bulletin No. 3666239, for repair and test procedures.	**OK** **Fuel pressure while cranking engine: at least 50 psi** **Fuel pressure at idle: (600-700 rpm): 250 to 265 psi** **Fuel pressure at 2000 rpm: 250 to 285 psi** **NOTE: Gauge and sensor should read within 10 psi.**	20A
	NOT OK **Replace the sensor** Refer to Procedure 019-188.	29A

STEP 20: Inspect the filter screen.

STEP 20A: Inspect the filter screen for debris.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Remove and inspect the filter screen. • Remove the filter screen and inspect it for debris. Refer to Procedure 006-057 in the Troubleshooting and Repair Manual, Signature, ISX and QSX15 Engines, Bulletin No. 3666239.	**OK** **No debris in the filter screen**	21A
	NOT OK **Clean or replace the filter screen** Refer to Procedure 006-057 in the Troubleshooting and Repair Manual, Signature, ISX and QSX15 Engines, Bulletin No. 3666239.	29A

STEP 21: Check the fuel shutoff valve.

STEP 21A: Check the fuel shutoff valve to see if it is mechanically or electrically stuck closed.

Condition: Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Check to see if the fuel shutoff valve is mechanically or electrically stuck closed. • Disassemble the fuel shutoff valve and check that the parts are free to move. Refer to Procedure 005-043 in the Troubleshooting and Repair Manual, Signature, ISX and QSX15 Engines, Bulletin No. 3666239, and Procedures 019-049 and 019-050.	**OK** **Fuel shutoff valve not stuck closed** **Replace the 250 psi regulator** Refer to Procedure 005-073 in the Troubleshooting and Repair Manual, Signature, ISX and QSX15 Engines, Bulletin No. 3666239.	22A
	NOT OK **Replace the fuel shutoff valve** Refer to Procedure 019-050.	29A

STEP 22: Read the fault codes.

STEP 22A: Read the fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Start the engine and let it idle for 1 minute. • Using INSITE™, read the fault codes.	**OK** **Fault Code 482 inactive**	29A
	NOT OK Engine fails to start or Fault Code 482 is active **Replace the 320 psi regulator** Refer to Procedure 005-073 in the Troubleshooting and Repair Manual, Signature, ISX and QSX15 Engines, Bulletin No. 3666239.	23A

STEP 23: Read the fault codes.

STEP 23A: Read the fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Start the engine and let it idle for 1 minute. • Using INSITE™, read the fault codes.	**OK** **Fault Code 482 inactive**	29B
	NOT OK Engine fails to start or Fault Code 482 is active.	24A

STEP 24: Check the priming bypass valve.

STEP 24A: Check the priming bypass valve.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Inspect the priming bypass valve and replace it if the fuel delivery housing matches the part number below. • Refer to Procedure 005-016 in the Troubleshooting and Repair Manual, Signature, ISX and QSX15 Engines, Bulletin No. 3666239. **NOTE:** Fuel delivery housing part numbers are as follows: For 12 VDC: 4001840 or 4009811 HD-129. For 24 VDC: 4001843 or 4009813 HD-129.	**OK** **Replaced priming bypass valve (if part number matched)**	25A
	NOT OK Did not replace priming bypass valve.	26A

STEP 25: Read the fault codes.

STEP 25A: Read the fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Start the engine and let it idle for 1 minute. • Using INSITE™, read the fault codes.	**OK** **Fault Code 482 inactive**	29B
	NOT OK Engine fails to start or Fault Code 482 is active	26A

STEP 26: Inspect the gear pump.

STEP 26A: Remove and inspect the gear pump.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Check the gear pump. • Remove the gear pump and check for sheared hex shaft or damaged gears. Refer to Procedure 005-016 in the Troubleshooting and Repair Manual, Signature, ISX and QSX15 Engines, Bulletin No. 3666239.	**OK** **No damage to the hex shaft or the gear teeth**	27A
	NOT OK **Replace the fuel gear pump** Refer to Procedure 005-016 in the Troubleshooting and Repair Manual, Signature, ISX and QSX15 Engines, Bulletin No. 3666239.	29A

STEP 27: Inspect the injectors.

STEP 27A: Remove and inspect the injectors.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Check the injectors for missing or damaged o-rings. • Refer to Procedure 006-026 in the Troubleshooting and Repair Manual, Signature, ISX and QSX15 Engines, Bulletin No. 3666239.	**OK** **No damaged or missing o-rings**	28A
	NOT OK **Replace damaged injector o-rings** Refer to Procedure 006-026 in the Troubleshooting and Repair Manual, Signature, ISX and QSX15 Engines, Bulletin No. 3666239.	29A

STEP 28: Inspect the fuel delivery housing.

STEP 28A: Inspect the fuel delivery housing.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Inspect the fuel delivery housing for obstructions or internal leaks. • Inspect the fuel delivery housing for obstructions or internal leaks from the pressure-side of the pump to the drain of the inlet side of the pump. Refer to Procedure 005-073 in the Troubleshooting and Repair Manual, Signature, ISX and QSX15 Engines, Bulletin No. 3666239.	**OK** **No internal leaks or obstructions**	29A
	NOT OK **Repair or replace the fuel delivery housing** Refer to Procedure 005-073 in the Troubleshooting and Repair Manual, Signature, ISX and QSX15 Engines, Bulletin No. 3666239.	29A

STEP 29: Clear the fault codes.

STEP 29A: Disable the fault code.

Condition:
- Connect all components.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it idle for 1 minute. • Verify that Fault Code 482 is inactive.	**OK** **Fault Code 482 inactive**	29B
	NOT OK Return to the troubleshooting steps, or contact your local Cummins Authorized Repair Location if all the steps have been completed and checked again.	1A

STEP 29B: Clear the inactive fault codes.

Condition:
- Connect all components.

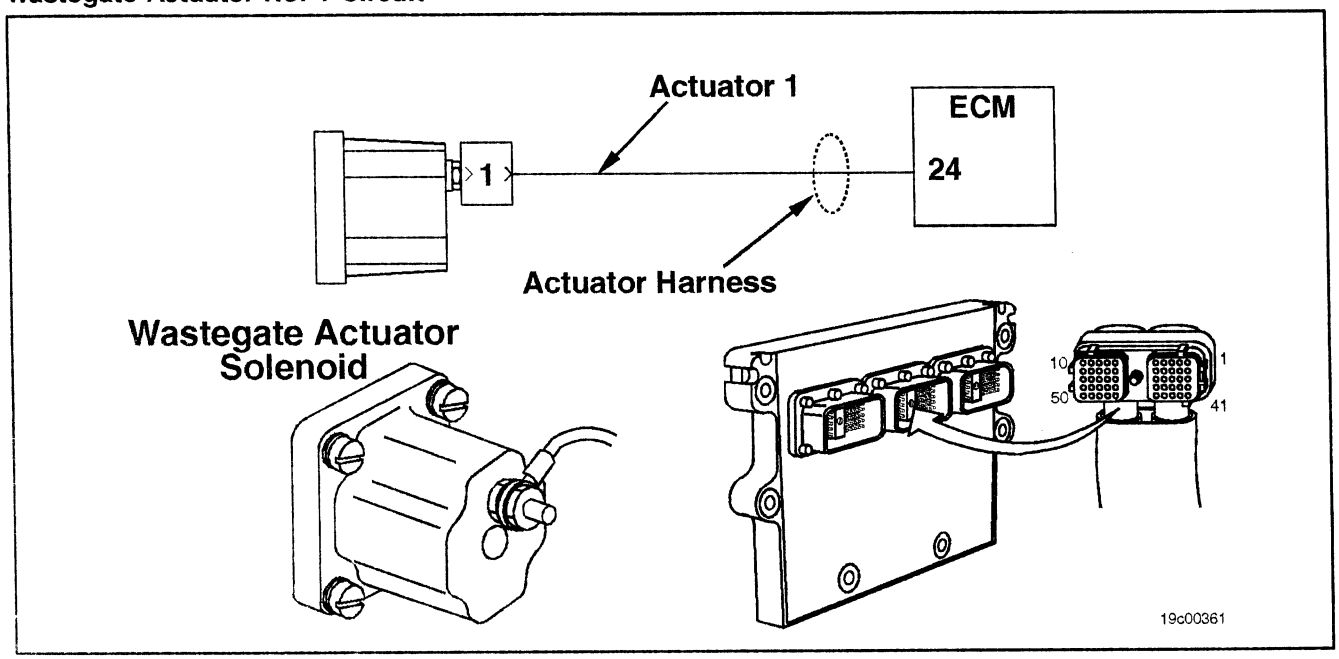
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting chart

Fault Code 466

Wastegate Actuator No. 1 Circuit

CODES	REASON	EFFECT
Fault Code: 466 PID(P), SID(S): S032 SPN: 1188 FMI: 4/4 Lamp: Yellow	Less than (+) 6 VDC detected at the wastegate actuator No. 1 circuit when on indicates an excessive current draw from the electronic control module (ECM) or faulty ECM output circuit.	Engine will run derated.

Wastegate Actuator No. 1 Circuit



Circuit Description:
The wastegate actuators are devices used by the ECM to control boost pressure.

Component Location:
The wastegate controller is located on the air inlet horn. Actuator No. 1 is the frontmost solenoid on the controller.

Shop Talk:
- Inspect the engine block to chassis ground wire to make sure it is securely fastened to a clean, dry surface.
- Check the starter solenoid (+) terminal for a loose connector or accessory wiring with damaged insulation.
- Low voltage can be caused by a short circuit to ground, a short circuit to another wire in the harness, or a shorted solenoid coil.
- Inspect the wastegate actuator No. 1 circuit for external wires that can be spliced into powering another device. Remove any extra wires that are found in the circuit.

TROUBLESHOOTING SUMMARY

⚠ CAUTION ⚠

To avoid damaging the new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the engine harness and ECM connector pins.		
STEP 1A: Inspect the engine harness and ECM connector pins.	No damaged pins	
STEP 1B: Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 1C: Check for a short circuit to ground.	More than 100k ohms	
STEP 1D: Check for an open circuit.	Less than 10 ohms	
STEP 2: Check the wastegate actuator.		
STEP 2A: Inspect the wastegate actuator connector for damaged pins.	No damaged pins	
STEP 2B: Check the actuator post for corrosion.	No corrosion	
STEP 2C: Check the wastegate actuator resistance.	7 to 8 ohms for (+) 12-VDC solenoids, 28 to 32 ohms for (+) 24-VDC solenoids	
STEP 3: Clear the fault codes.		
STEP 3A: Disable the fault code.	Fault Code 466 inactive	
STEP 3B: Clear the inactive fault codes.	All fault codes cleared	

TROUBLESHOOTING STEP

STEP 1: Check the engine harness and ECM connector pins.

STEP 1A: Inspect the engine harness and ECM connector pins.

⚠CAUTION⚠

To avoid damaging the new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness connector from the ECM.
- Disconnect the engine harness from the wastegate actuator No. 1.

Action	Specifications/Repair	Next Step
Inspect the engine harness and ECM connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	1B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	3A

STEP 1B: Check for a short circuit from pin to pin.

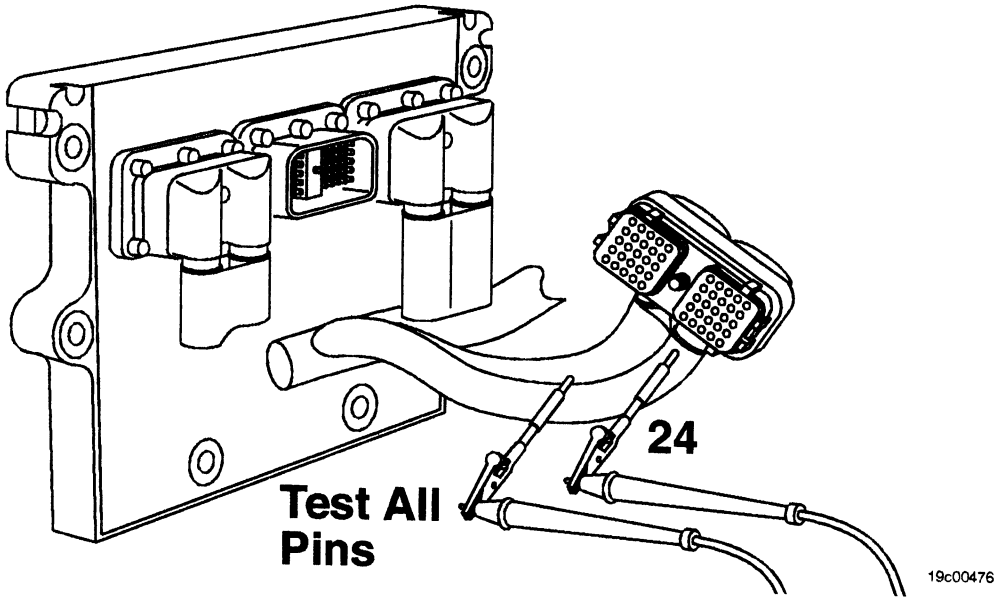
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness connector from the ECM.
- Disconnect the engine harness from the wastegate actuator No. 1.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pin 24 of the actuator harness connector to all other pins in the connector.	**OK** **More than 100k ohms**	1C
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	3A



STEP 1C: Check for a short circuit to ground.

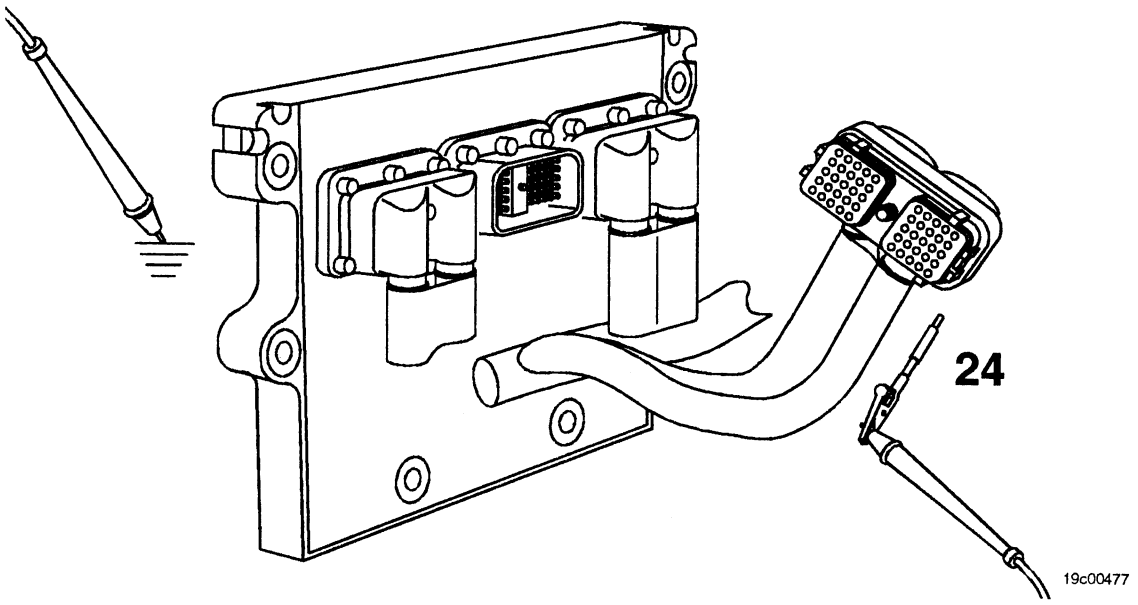
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness connector from the ECM.
- Disconnect the engine harness from the wastegate actuator No. 1.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground. • Measure the resistance from pin 24 of the actuator harness connector to ground.	**OK** **More than 100k ohms**	1D
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	3A



STEP 1D: Check for an open circuit.

⚠CAUTION⚠

To avoid damaging the new ECM, all other active fault codes must be investigated prior to replacing the ECM.

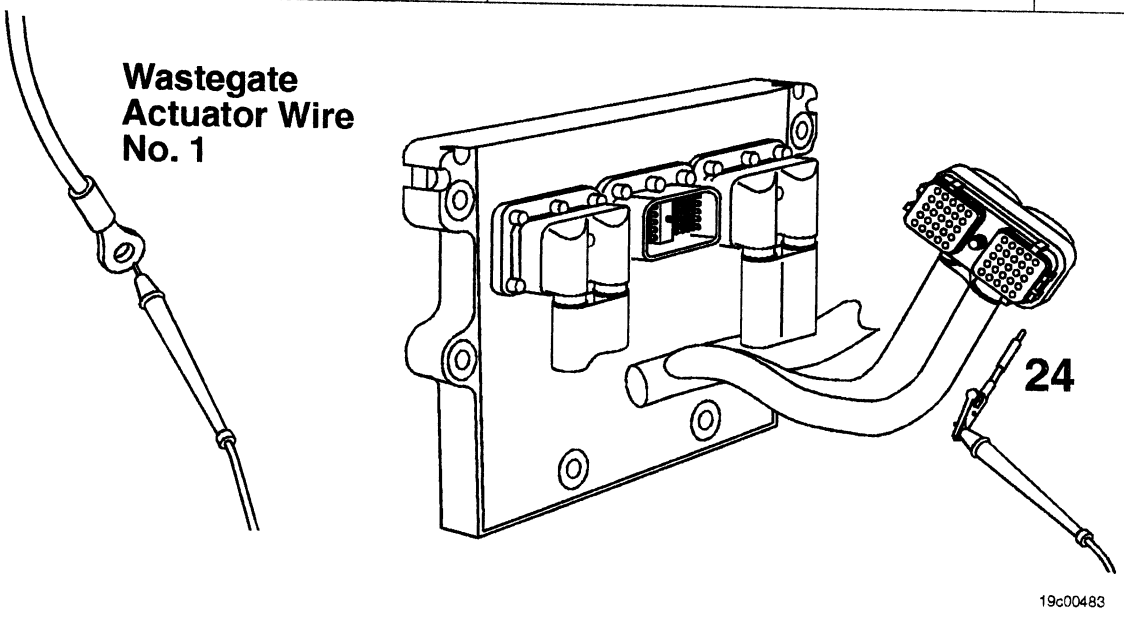
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness connector from the ECM.
- Disconnect the engine harness from the wastegate actuator No. 1.

Action	Specifications/Repair	Next Step
Check for an open circuit. • Measure the resistance from pin 24 of the actuator harness connector to the wastegate actuator No. 1 wire.	**OK** **Less than 10 ohms**	2A
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	3A



STEP 2: Check the wastegate actuator.

STEP 2A: Inspect the wastegate actuator connector for damaged pins.

Condition:
- Turn keyswitch OFF.
- Disconnect the engine harness from the wastegate actuator No. 1.
- Disconnect the actuator harness connector from the ECM.

Action	Specifications/Repair	Next Step
Inspect the wastegate actuator connector. • Check the wastegate actuator connector for damaged pins.	**OK** **No damaged pins**	2B
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-202. • Replace the engine harness. Refer to Procedure 019-043.	3A

STEP 2B: Check the actuator post for corrosion.

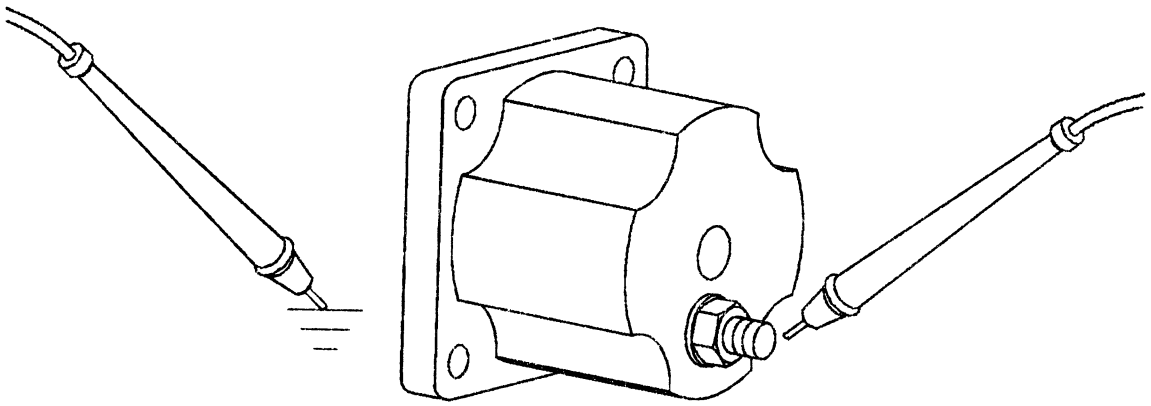
Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Inspect the solenoid post. • Check the solenoid post for corrosion.	**OK** **No corrosion**	2C
	NOT OK Clean the solenoid post.	3A

STEP 2C: Check the wastegate actuator resistance.

Condition:
- Turn keyswitch OFF.
- Disconnect the wastegate actuator from the engine harness.

Action	Specifications/Repair	Next Step
Check the wastegate actuator resistance. • Measure the resistance from the wastegate actuator No. 1 to engine block ground.	**OK** **7 to 8 ohms for (+) 12-VDC solenoids** **28 to 32 ohms for (+) 24-VDC solenoids**	3A
	NOT OK **Replace the actuator solenoid** Refer to Procedure 010-109 in the Troubleshooting and Repair Manual, Signature, ISX and QSX15 Engines, Bulletin No. 3666239.	3A



19400724

STEP 3: Clear the fault codes.

STEP 3A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it idle for 1 minute. • Using INSITE™, verify that Fault Code 466 is inactive.	**OK** **Fault Code 466 inactive**	3B
	NOT OK Return to the troubleshooting steps or contact your local Cummins Authorized Repair Location if all steps have been completed and checked again.	1A

STEP 3B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

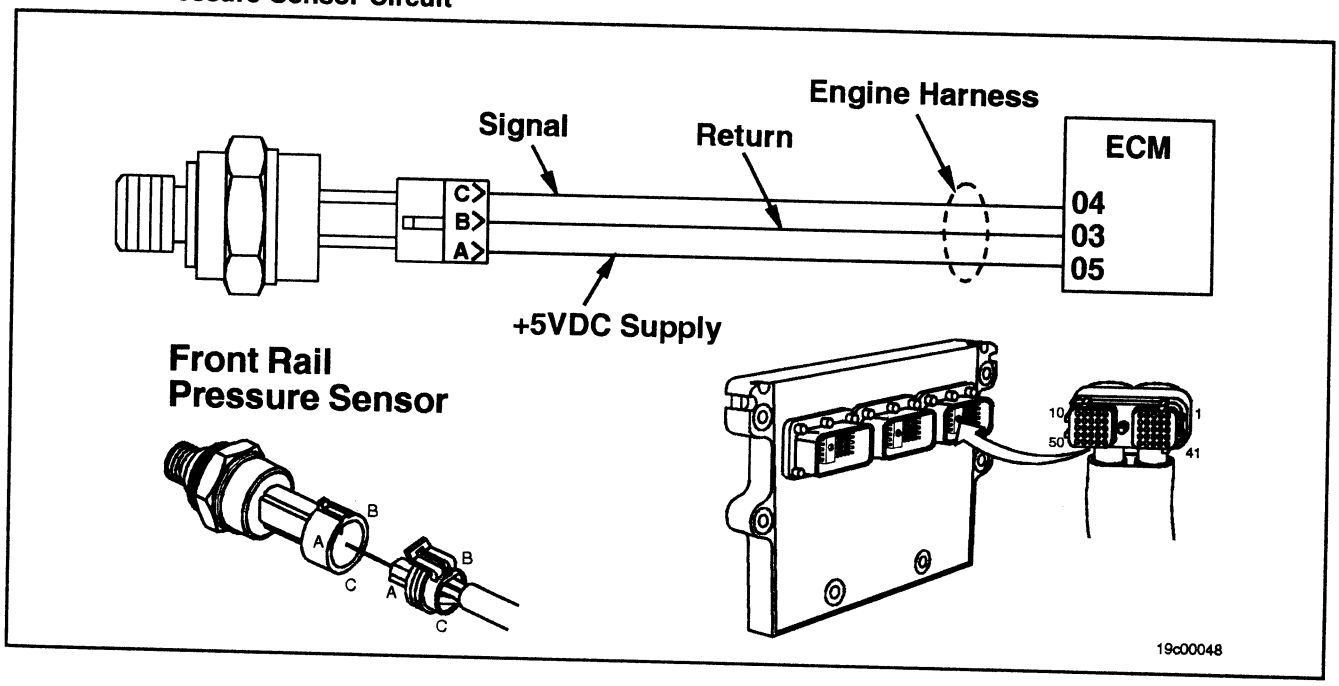
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Clear the inactive fault codes using INSITE™.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 452

Front Rail Pressure Sensor Circuit

CODES	REASON	EFFECT
Fault Code: 452 PID(P), SID(S): P157 SPN: 157 FMI: 4/4 Lamp: Yellow	Low voltage detected on the front rail pressure sensor circuit.	Engine will run derated.

Front Rail Pressure Sensor Circuit



Circuit Description:

The front rail pressure sensor provides the rail pressure signal to the electronic control module (ECM).

Component Location:

The front rail pressure sensor is located on the front of the fuel delivery housing.

Shop Talk:

This fault could be caused by the signal wire having a short circuit to ground, the supply wire having a short circuit to ground, an open circuit in the supply wire, an open circuit in the signal wire, a failed sensor, or a faulty ECM power supply.

TROUBLESHOOTING SUMMARY

⚠ CAUTION ⚠

To avoid damaging the new ECM, all other active fault codes must be investigated before replacing the ECM.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead
Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead
Part No. 3824774 - breakout cable.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check for multiple fault codes.		
STEP 1A: Read the fault codes.	Fault Code 187 inactive	
STEP 2: Check the front rail pressure sensor.		
STEP 2A: Inspect the sensor harness and sensor connector pins.	No damaged pins	
STEP 2B: Read the fault codes.	Fault Code 452 inactive	
STEP 2C: Check the supply voltage.	(+) 4.75 to 5.25 VDC	
STEP 2C-1: Measure the voltage from the ECM.	(+) 4.75 to 5.25 VDC	
STEP 2D: Check the front rail pressure sensor signal voltage.	(+) 0.5 to 4.7 VDC	
STEP 2D-1: Check for a short circuit to ground.	More than 100k ohms	
STEP 2D-2: Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 3: Check the sensor harness.		
STEP 3A: Inspect the sensor harness connector pins and the ECM for damage.	No damaged pins	
STEP 3B: Read the fault codes.	Fault Code 452 inactive	
STEP 3C: Check for an open circuit in the signal wire.	Less than 10 ohms	
STEP 4: Check for an ECM response.		
STEP 4A: Check for the appropriate ECM response.	Fault Code 452 inactive and Fault Code 451 active	
STEP 5: Clear the fault codes.		
STEP 5A: Disable the fault code.	Fault Code 452 inactive	
STEP 5B: Clear the inactive fault codes.	All fault codes cleared	

TROUBLESHOOTING STEP

STEP 1: Check for multiple fault codes.

STEP 1A: Read the fault codes.

Condition:
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read fault codes. • Read active fault codes using INSITE™.	**OK** **Fault Code 187 inactive**	2A
	NOT OK Possible sensor failure, short circuit to ground in the sensor, or in the sensor (+) 5 VDC common supply.	Fault Code 187

STEP 2: Check the front rail pressure sensor.

STEP 2A: Inspect the sensor harness and sensor connector pins.

Condition:
- Turn keyswitch OFF.
- Disconnect the front rail pressure sensor from the sensor harness.

Action	Specifications/Repair	Next Step
Inspect the sensor harness and sensor connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	2B
	NOT OK **Repair the damaged pins** Repair or replace the connector, or replace the sensor, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair or replace the connector. Refer to Procedure 019-203. • Replace the front rail pressure sensor. Refer to Procedure 019-115.	5A

STEP 2B: Read the fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Start the engine and let it idle for 1 minute. • Read the fault codes using INSITE™.	**OK** **Fault Code 452 inactive**	5B
	NOT OK Fault Code 452 active.	2C

STEP 2C: Check the supply voltage.

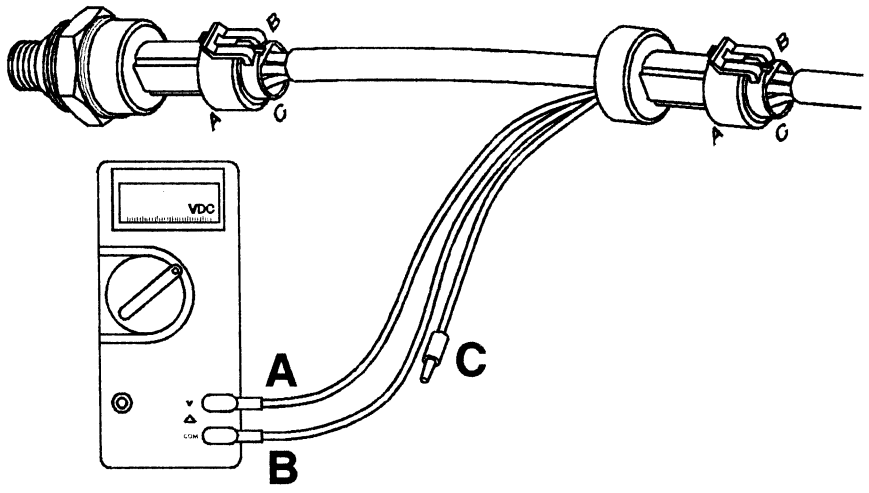
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3824774 - breakout cable.

Condition:

- Install breakout cable, Part No. 3824774, between the sensor and the harness connector.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the supply voltage. • Measure the supply voltage by installing the breakout cable's supply pin A (or RED) and return pin B (or BLACK) connectors into the multimeter.	**OK** **(+) 4.75 to 5.25 VDC**	2D
	NOT OK Does **not** meet specifications.	2C-1



19c00841

STEP 2C-1: Measure the voltage from the ECM.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

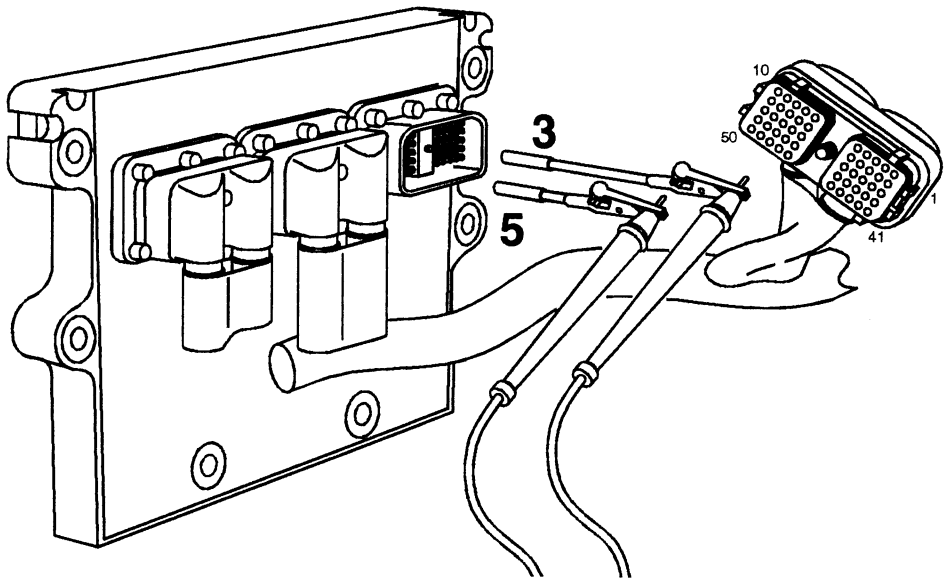
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

Condition:

- Disconnect the sensor harness connector from the ECM.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Measure the voltage from the ECM. • Measure the voltage at the ECM from pin 5 to pin 3 of the ECM sensor port.	**OK** **(+) 4.75 to 5.25 VDC** **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	5A
	NOT OK **Replace the ECM** Refer to Procedure 019-031.	5A



STEP 2D: Check the front rail pressure sensor signal voltage.

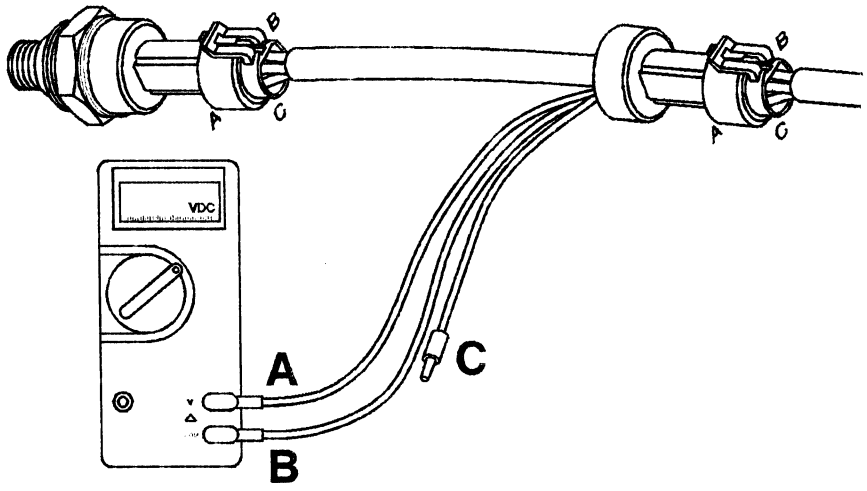
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3854774 - breakout cable.

Condition:

- Install breakout cable between the sensor and the harness connector.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the supply voltage. • Measure the signal voltage from pin C (or YELLOW) to pin B (or BLACK) of the breakout cable.	**OK** **(+) 0.5 to 4.7 VDC**	2D-1
	NOT OK Does **not** meet specifications.	3A



19c00841

STEP 2D-1: Check for a short circuit to ground.

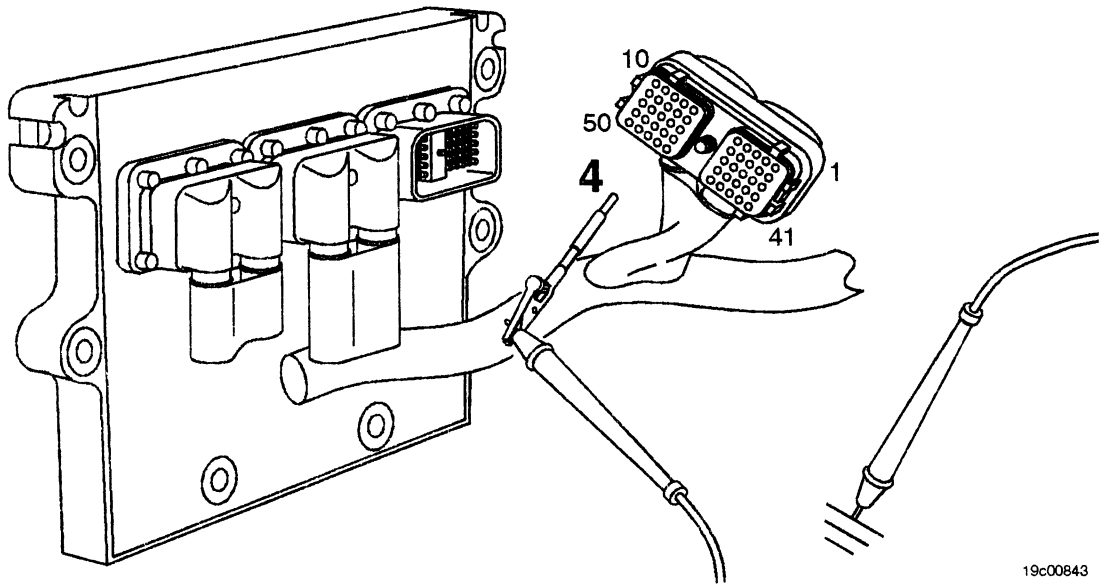
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the front rail pressure sensor from the engine harness.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground. • Measure the resistance from pin 4 of the sensor harness connector to ground.	**OK** **More than 100k ohms**	2D-2
	NOT OK **Replace the engine harness** Refer to Procedure 019-043.	5A



STEP 2D-2: Check for a short circuit from pin to pin.

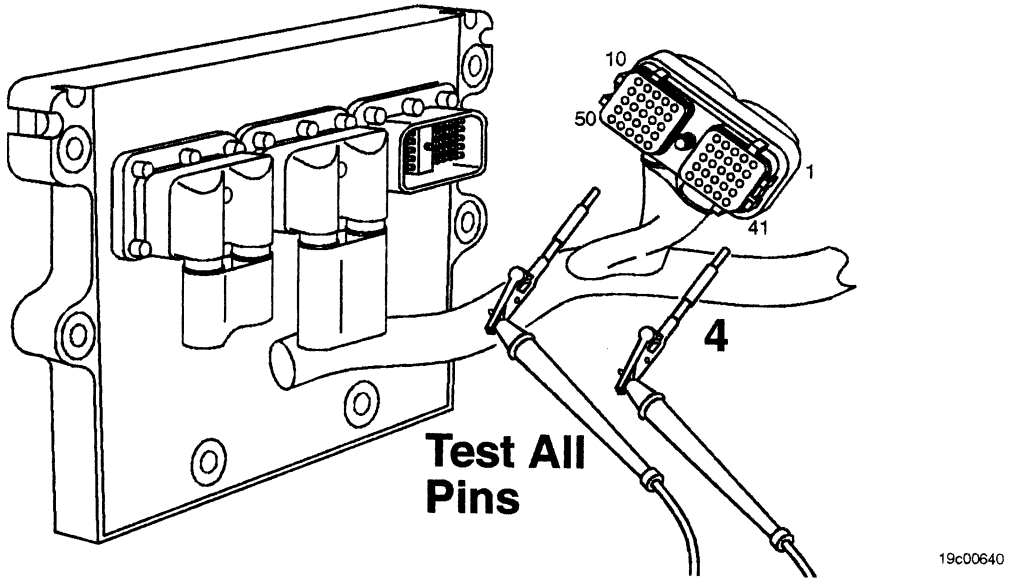
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.
- Disconnect the front rail pressure sensor from the sensor harness

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pin 4 of the sensor harness connector at the ECM to all other pins in the connector.	**OK** **More than 100k ohms** **Replace the front rail pressure sensor** Refer to Procedure 019-115.	5A
	NOT OK **Replace the engine harness** Refer to Procedure 019-043.	5A



STEP 3: Check the sensor harness.

STEP 3A: Inspect the sensor harness connector pins and the ECM for damage.

⚠CAUTION⚠

To avoid damaging the new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:
- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Inspect the sensor harness connector pins and the ECM for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	3B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	5A

STEP 3B: Read the fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Start the engine and let it idle for 1 minute. • Read the fault codes, using INSITE™.	**OK** **Fault Code 452 inactive**	5B
	NOT OK Fault Code 452 active.	3C

STEP 3C: Check for an open circuit in the signal wire.

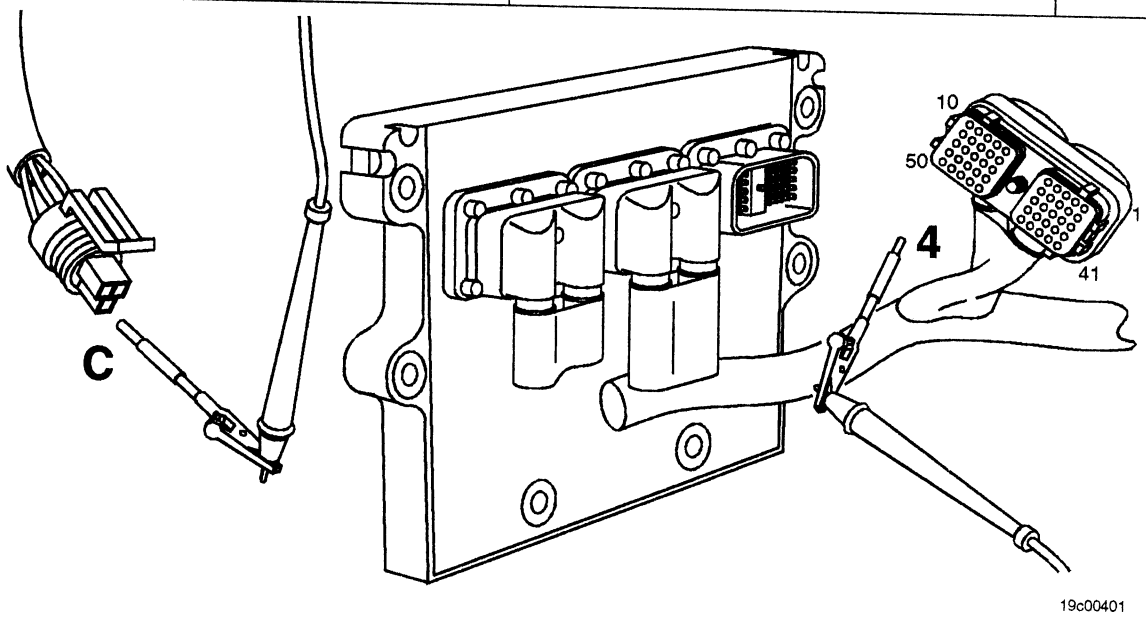
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.
- Disconnect the front rail pressure sensor from the sensor harness.

Action	Specifications/Repair	Next Step
Check for an open circuit in the signal wire. • Measure the resistance from pin 4 of the sensor harness connector to pin C (or 3) of the fuel rail pressure sensor connector.	**OK** **Less than 10 ohms**	4A
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	5A



STEP 4: Check for an ECM response.

STEP 4A: Check for the appropriate ECM response.

⚠CAUTION⚠

To avoid damaging the new ECM, all other active fault codes must be investigated prior to replacing the ECM.

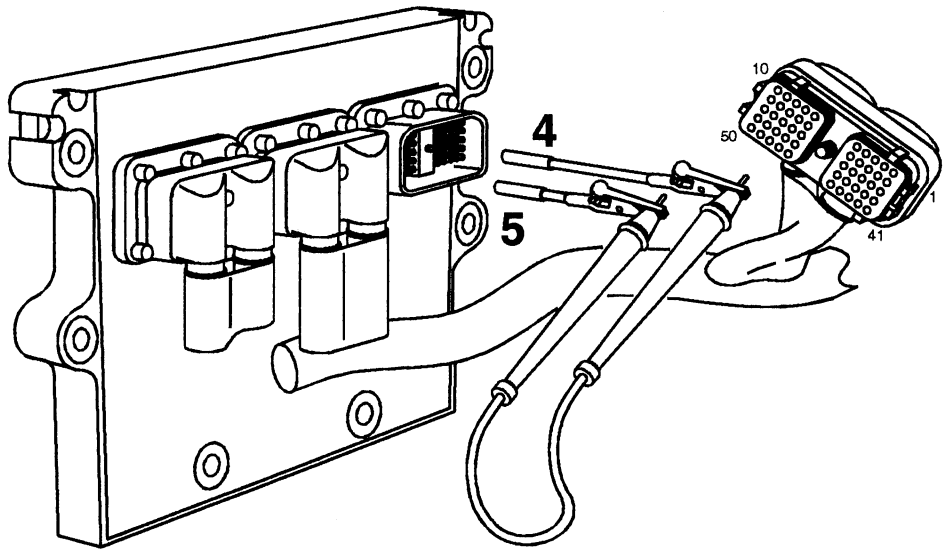
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

Condition:

- Disconnect the sensor harness connector from the ECM.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check for the appropriate ECM response. • Install a jumper wire between ECM sensor port pin 4 and pin 5.	**OK** **Fault Code 452 inactive and** **Fault Code 451 active**	5A
	NOT OK **Fault Code 452 active** **Replace the ECM** Refer to Procedure 019-031.	5A



STEP 5: Clear the fault codes.

STEP 5A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it idle for 1 minute. • Using INSITE™, verify that Fault Code 452 is inactive.	**OK** **Fault Code 452 inactive**	5B
	NOT OK Return to the troubleshooting steps or contact your local Cummins Authorized Repair Location, if all steps have been completed and checked again.	1A

STEP 5B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

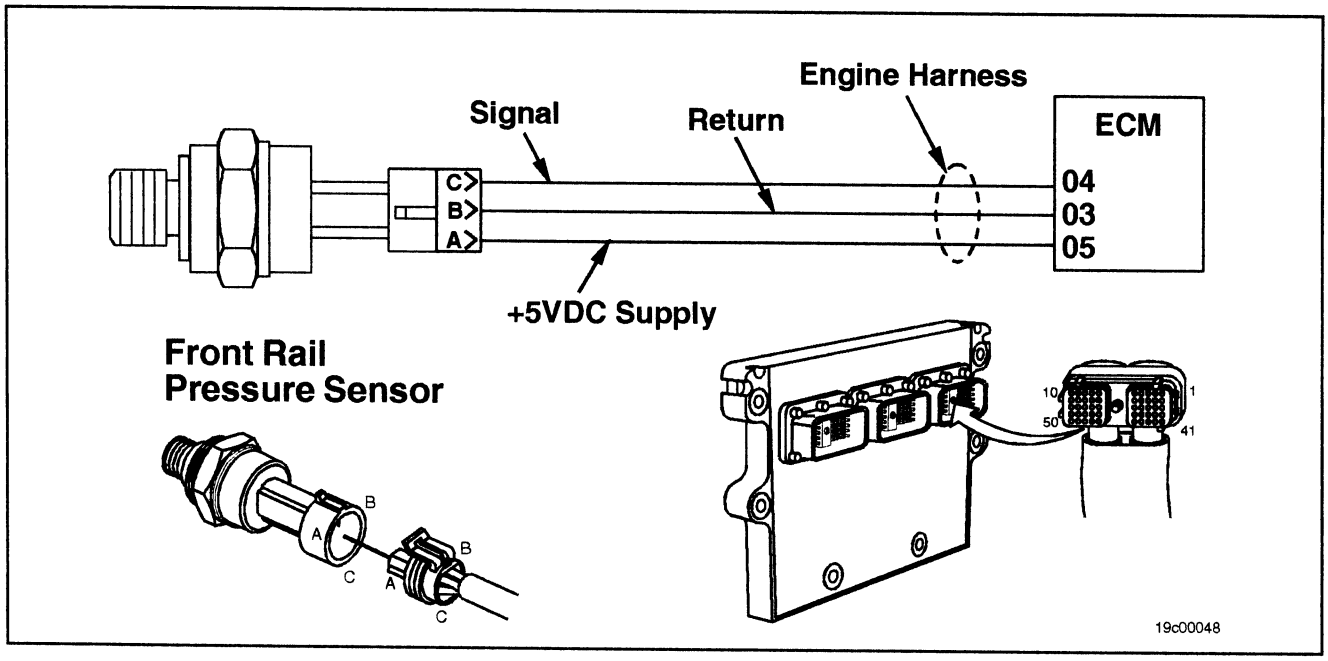
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Use INSITE™ to clear all inactive fault codes.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 451

Front Rail Pressure Sensor Circuit

CODES	REASON	EFFECT
Fault Code: 451 PID(P), SID(S): P157 SPN: 157 FMI: 3/3 Lamp: Yellow	High voltage detected on the front rail pressure sensor circuit.	Engine will run derated.

Front Rail Pressure Sensor Circuit



Circuit Description:

The front rail pressure sensor provides the rail pressure signal to the electronic control module (ECM).

Component Location:

The front rail pressure sensor is located on the front of the fuel delivery housing.

Shop Talk:

This fault could be caused by the return or signal wire that has a short circuit to (+) 5 VDC or (+) 12 VDC, an open circuit in the return wire, or a failed sensor.

TROUBLESHOOTING SUMMARY

CAUTION

To avoid damaging the new ECM, all other active fault codes must be investigated before replacing the ECM.

CAUTION

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead
Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead
Part No. 3824774 - breakout cable.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the front rail pressure sensor.		
STEP 1A: Inspect the sensor harness and sensor connector pins.	No damaged pins	
STEP 1B: Read the fault codes.	Fault Code 451 inactive	
STEP 1C: Check the supply voltage.	(+) 4.75 to 5.25 VDC	
STEP 1C-1: Measure the voltage from the ECM.	(+) 4.75 to 5.25 VDC	
STEP 1D: Check the front rail pressure sensor signal voltage.	(+) 0.5 to 4.7 VDC	
STEP 2: Check the sensor harness.		
STEP 2A: Inspect the sensor harness connector pins and the ECM for damage.	No damaged pins	
STEP 2B: Read the fault codes.	Fault Code 451 inactive	
STEP 2C: Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 2D: Check for open circuit in the return wire.	Less than 10 ohms	
STEP 3: Check for an ECM response.		
STEP 3A: Check for the appropriate ECM response.	Fault Code 451 inactive and Fault Code 452 active	
STEP 4: Clear fault code.		
STEP 4A: Disable fault code.	Fault Code 451 inactive	
STEP 4B: Clear inactive fault codes.	All fault codes cleared	

TROUBLESHOOTING STEP

TEP 1: Check the front rail pressure sensor.

STEP 1A: Inspect the sensor harness and sensor connector pins.

Condition:
- Turn keyswitch OFF.
- Disconnect the front rail pressure sensor from the engine harness.

Action	Specifications/Repair	Next Step
Inspect the sensor harness and sensor connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	1B
	NOT OK **Repair the damaged pins** Replace the 3-pin Metri-Pack connector or the sensor, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Replace the 3-pin Metri-Pack connector. Refer to Procedure 019-203. • Replace the front rail pressure sensor. Refer to Procedure 019-115.	4A

STEP 1B: Read the fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Start the engine and let it idle for 1 minute. • Read the fault codes using INSITE™.	**OK** **Fault Code 451 inactive**	4B
	NOT OK Fault Code 451 active.	1C

STEP 1C: Check the supply voltage.

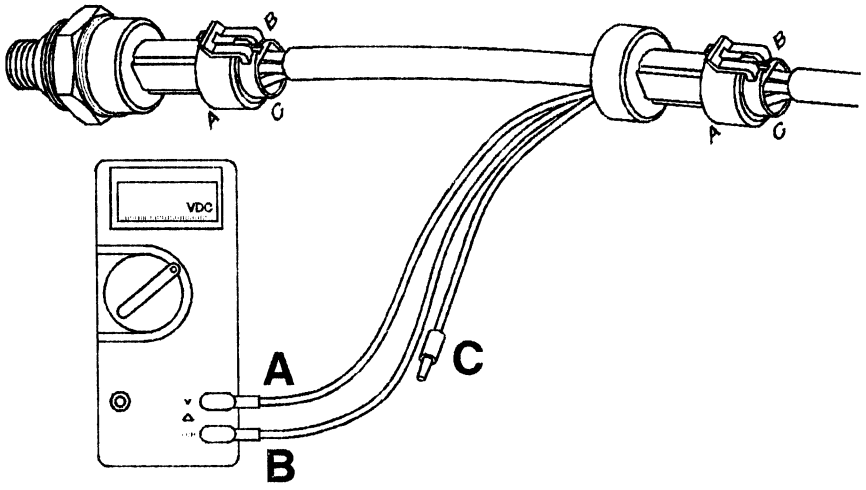
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3854774 - breakout cable.

Condition:

- Install breakout cable between the sensor and the harness connector.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the supply voltage. • Measure the supply voltage by installing the breakout cable's supply pin A (or RED) and return pin B (or BLACK) leads into the multimeter.	**OK** **(+) 4.75 to 5.25 VDC**	1D
	NOT OK Does **not** meet specifications.	1C-1



19c00841

STEP 1C-1: Measure the voltage from the ECM.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

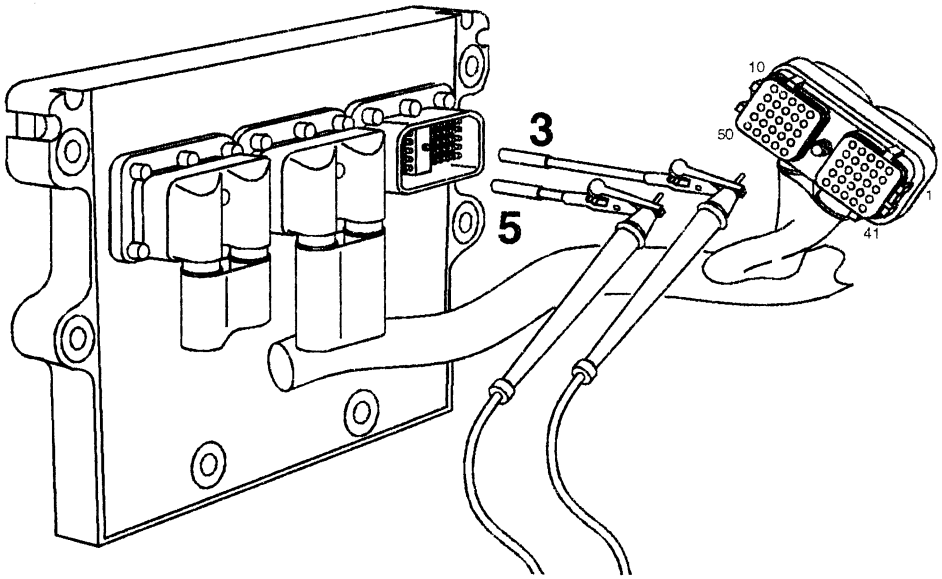
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

Condition:

- Disconnect the sensor harness connector from the ECM.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Measure the voltage from the ECM. • Measure the voltage at the ECM from pin 5 to pin 3 of the ECM sensor port.	**OK** **(+) 4.75 to 5.25 VDC** **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	4A
	NOT OK **Replace the ECM** Refer to Procedure 019-031.	4A



STEP 1D: Check the front rail pressure sensor signal voltage.

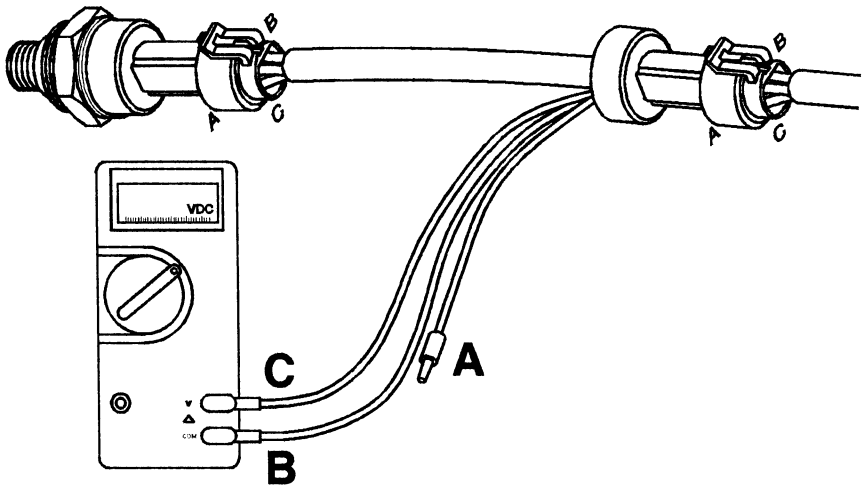
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3854774 - breakout cable.

Condition:

- Install breakout cable between the sensor and the harness connector.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the front rail pressure sensor signal voltage. • Measure the signal voltage from pin C (or YELLOW) to pin B (or BLACK) of the breakout cable.	**OK** **(+) 0.5 to 4.7 VDC**	3A
	NOT OK Does **not** meet specifications.	2A



19c00842

STEP 2: Check the sensor harness.

STEP 2A: Inspect the sensor harness connector pins and the ECM for damage.

⚠CAUTION⚠

To avoid damaging the new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:
- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Inspect the sensor harness connector pins and the ECM for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	2B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	4A

STEP 2B: Read the fault codes.

Condition:
- Connect all the components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Start the engine and let it idle for 1 minute. • Read the fault codes using INSITE™.	**OK** **Fault Code 451 inactive**	4A
	NOT OK Fault Code 451 active.	2C

STEP 2C: Check for a short circuit from pin to pin.

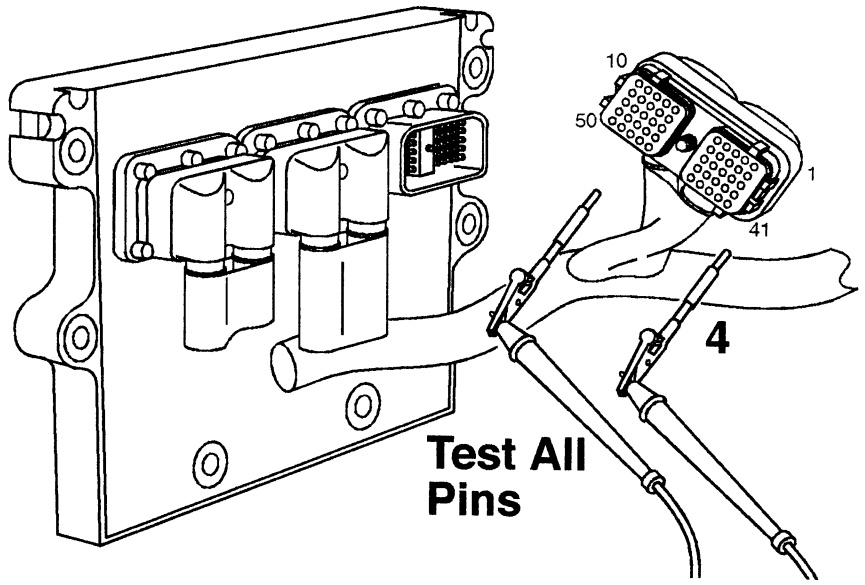
⚠CAUTION⚠

To avoid pin and harness damage use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.
- Disconnect the front rail pressure sensor from the engine harness.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pin 4 of the sensor harness connector to all other pins in the connector.	**OK** **More than 100k ohms**	2D
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	4A



STEP 2D: Check for an open circuit in the return wire.

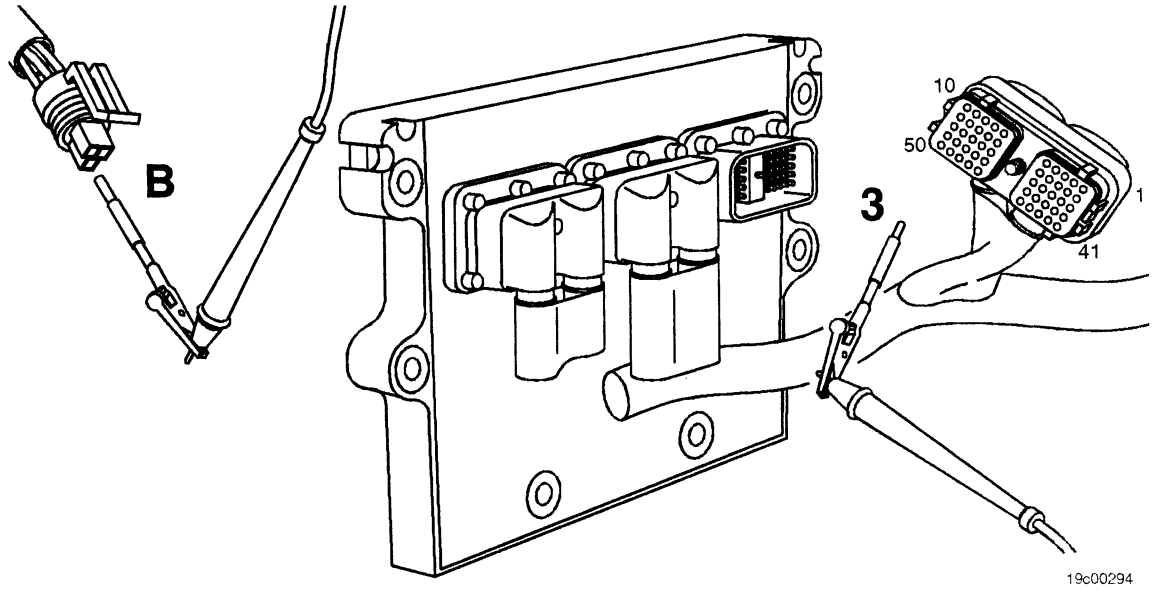
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.
- Disconnect the front rail pressure sensor from the sensor harness.

Action	Specifications/Repair	Next Step
Check for an open circuit in the return wire. • Measure the resistance from pin 3 of the ECM sensor harness connector to pin B (or 2) of the front rail pressure sensor harness connector.	**OK** **Less than 10 ohms** **Replace the front rail pressure sensor** Refer to Procedure 019-115.	4A
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	4A



STEP 3: Check for an ECM response.

STEP 3A: Check for the appropriate ECM response.

⚠CAUTION⚠

To avoid damaging the new ECM, all other active fault codes must be investigated prior to replacing the ECM.

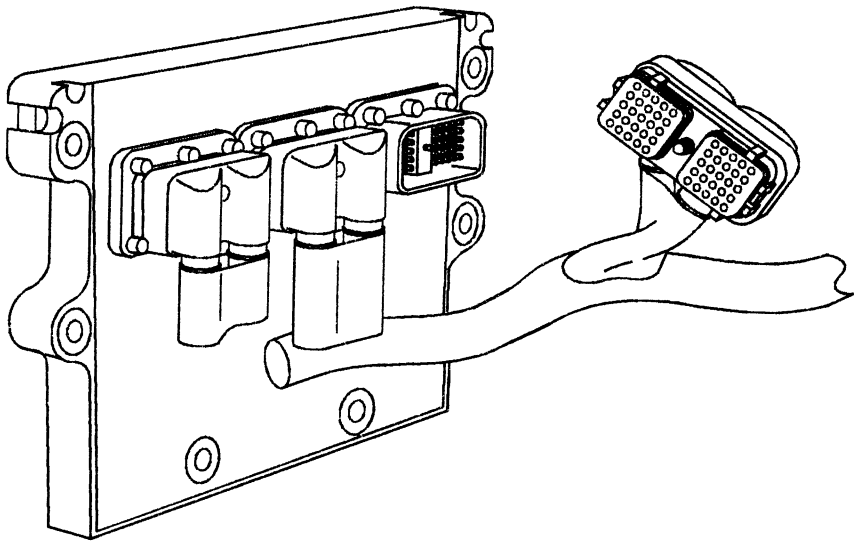
⚠CAUTION⚠

To avoid pin and harness damage use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Disconnect the sensor harness connector from the ECM.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check for the appropriate ECM response. • Read the fault codes using INSITE™.	**OK** **Fault Code 451 inactive and** **Fault Code 452 active**	4A
	NOT OK **Fault Code 451 active** **Replace the ECM** Refer to Procedure 019-031.	4A



19600008

STEP 4: Clear fault code.

STEP 4A: Disable fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable fault code. • Start the engine and let it idle for 1 minute. • Using INSITE™, verify that Fault Code 451 inactive.	**OK** **Fault Code 451 inactive**	4B
	NOT OK Return to the troubleshooting steps or contact your local Cummins Authorized Repair Location, if all steps have been completed and checked again.	1A

STEP 4B: Clear inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

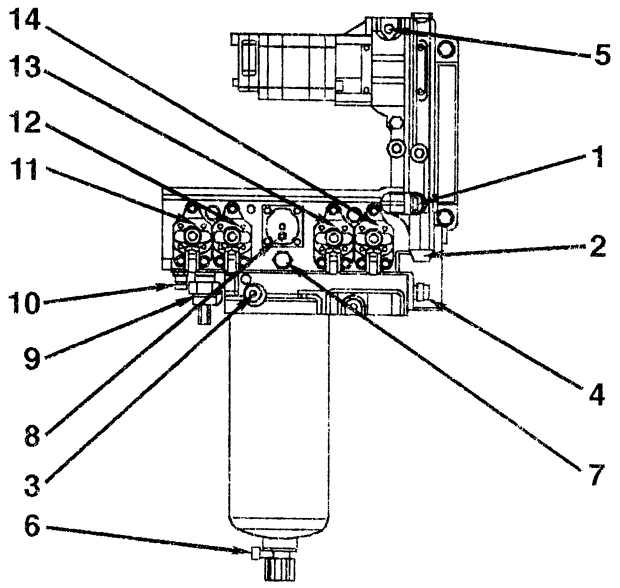
Action	Specifications/Repair	Next Step
Clear inactive fault codes. • Use INSITE™ to clear all inactive fault codes.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 449

High Fuel Pressure

CODES	REASON	EFFECT
Fault Code: 449 PID(P), SID(S): P094 SPN: 94 FMI: 0/16 Lamp: Yellow	Excessive fuel supply pressure was detected at the fuel pressure sensor.	Engine will have black smoke and will run derated.

Hydraulic Fuel System Circuit



Circuit Description:

The gear pump draws fuel from the fuel tank through the fuel filter and antidrainback valve. The gear pump develops 100 to 320 psi of fuel pressure. The fuel flows through the fuel filter screen and fuel shutoff valve to the fueling and timing actuators and the fuel pressure sensor. The 250-psi regulator controls the fuel pressure.

Component Location:

Hydraulic Fuel System Circuit Callouts							
1	320-psi Pressure Regulator	5	Quick-Disconnect Pressure Tap-Suction Side	9	Fuel Pressure Sensor	13	Rear Timing Actuator
2	36-mc Filter Screen	6	WIF Sensor	10	Quick-Disconnect Pressure Tap-Pressure Side	14	Rear Rail Actuator
3	Fuel Inlet Restriction Sensor	7	250-psi Pressure Regulator	11	Front Rail Actuator		
4	Fuel Inlet	8	Fuel Shutoff Valve	12	Front Timing Actuator		

The 250-psi regulator controls the fuel pressure. All components are located on the fuel delivery housing on the intake side of the engine.

Shop Talk:

The fuel pressure is monitored by the ECM. If the fuel pressure is outside an acceptable range, the fault code is activated. The acceptable range of the fuel pressure can be viewed as "Minimum Fuel Pressure" and "Maximum Fuel Pressure" using the INSITE™ monitor screen. The fault will log quickly for large differences and slower for small differences.

TROUBLESHOOTING SUMMARY

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check for fuel restriction.		
STEP 1A: Check for fuel restriction in the drain line.	Restriction below 4.0 in Hg	
STEP 2: Check the sensor accuracy.		
STEP 2A: Verify the sensor accuracy with a mechanical gauge.	Gauge and sensor pressures are within 10 psi	
STEP 3: Replace fuel regulator.		
STEP 3A: Replace the 250-psi fuel regulator.	Fault Code 449 goes inactive	
STEP 4: Clear the fault code.		
STEP 4A: Disable the fault code.	Fault Code 449 inactive	
STEP 4B: Clear the inactive fault code.	All fault codes cleared	

TROUBLESHOOTING STEP

STEP 1: Check for fuel restriction.

STEP 1A: Check for fuel restriction in the drain line.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Check for fuel restriction in the drain line. • Install restriction gauge in fuel return line.	**OK** **Restriction below 4.0 in Hg**	2A
	NOT OK **Correct drain line restriction** Refer to the Signature, ISX and QSX15 Engines, Troubleshooting and Repair Manual, Bulletin No. 3666239.	4A

STEP 2: Check the sensor accuracy.

STEP 2A: Verify the sensor accuracy with a mechanical gauge.

Condition:
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Verify the sensor accuracy. • Connect a mechanical fuel pressure gauge to the pressure-side Compuchek™ fitting. • Connect INSITE™ to the vehicle datalink. • Start the engine and compare the fuel pressure reading on the service tool monitor screen to the reading on the mechanical fuel pressure gauge.	**OK** **Gauge and sensor pressures are within 10 psi**	3A
	NOT OK **Replace the fuel pressure sensor** Refer to Procedure 019-115.	4A

STEP 3: Replace the fuel regulator.

STEP 3A: Replace the 250-psi regulator.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Replace the 250-psi regulator. • Refer to the Troubleshooting and Repair Manual, Signature, ISX and QSX15 Engines, Bulletin No. 3666239.	**OK** **Fault Code 449 goes inactive**	4A
	NOT OK	4A

STEP 4: Clear the fault code.

STEP 4A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it idle for 1 minute. • Using INSITE™, verify that Fault Code 449 is inactive.	**OK** **Fault Code 449 inactive**	4B
	NOT OK Return to the troubleshooting steps or contact your local Cummins Authorized Repair Location if all the steps have been completed and checked again.	1A

STEP 4B: Clear the fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

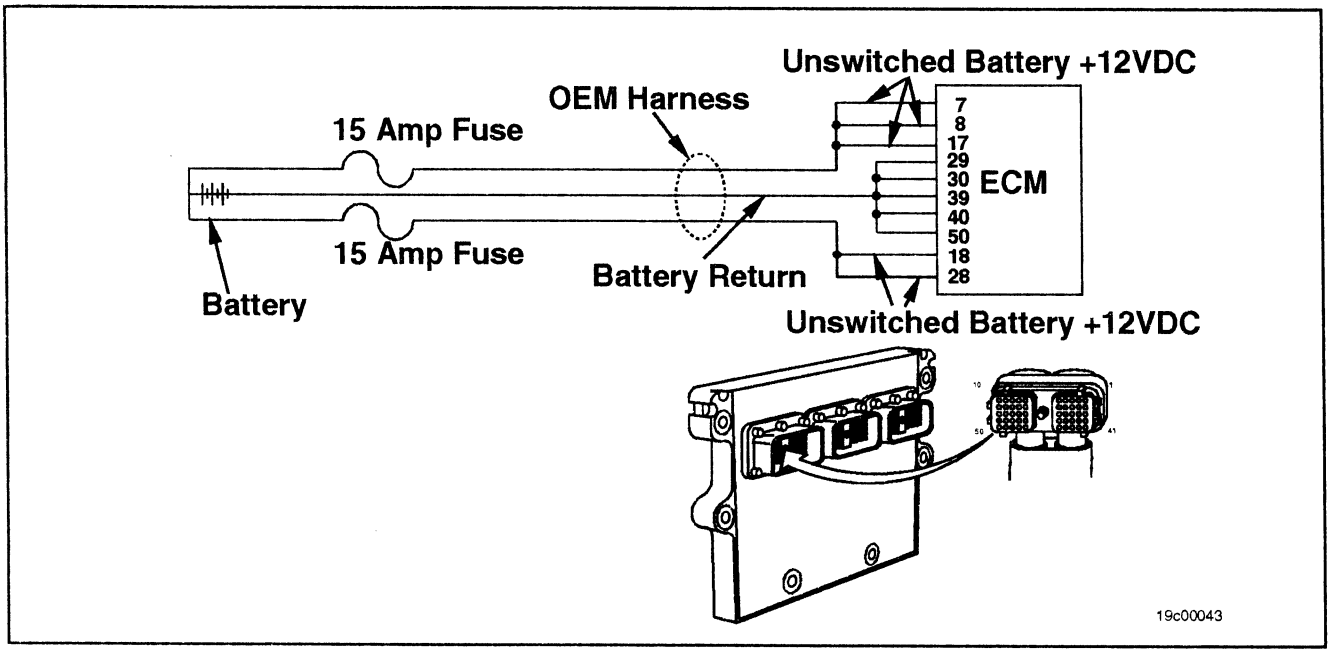
Action	Specifications/Repair	Next Step
Clear the fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 442

Unswitched Battery Supply Circuit

CODES	REASON	EFFECT
Fault Code: 442 PID(P), SID(S): P168 SPN: 168 FMI: 0/16 Lamp: Yellow	Battery voltage above normal operating level.	None on performance.

Unswitched Battery Supply Circuit



Circuit Description:

The electronic control module (ECM) receives unswitched battery input through the OEM harness. There are two in-line 15-amp fuses in the unswitched battery wire to protect the OEM harness from overheating. The battery return wires are connected directly to the negative (–) battery post.

Component Location:

The ECM is connected to the battery by the OEM harness. This direct link provides a constant power supply for the ECM. Refer to the OEM troubleshooting and repair manual for battery location.

Shop Talk:

Disconnect all aftermarket devices from the battery supply circuit. Make sure the proper-size fuses are being used (15-amp fuses).

TROUBLESHOOTING SUMMARY

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the equipment battery system.		
STEP 1A: Check the battery voltage.	Normal conditions: At least (+) 12 VDC During cranking: At least (+) 6.2 VDC	
STEP 1B: Check the alternator.	Alternator functioning normally	
STEP 2: Clear the fault code.		
STEP 2A: Disable the fault code.	Fault Code 442 inactive	
STEP 2B: Clear the inactive fault codes.	All fault codes cleared	

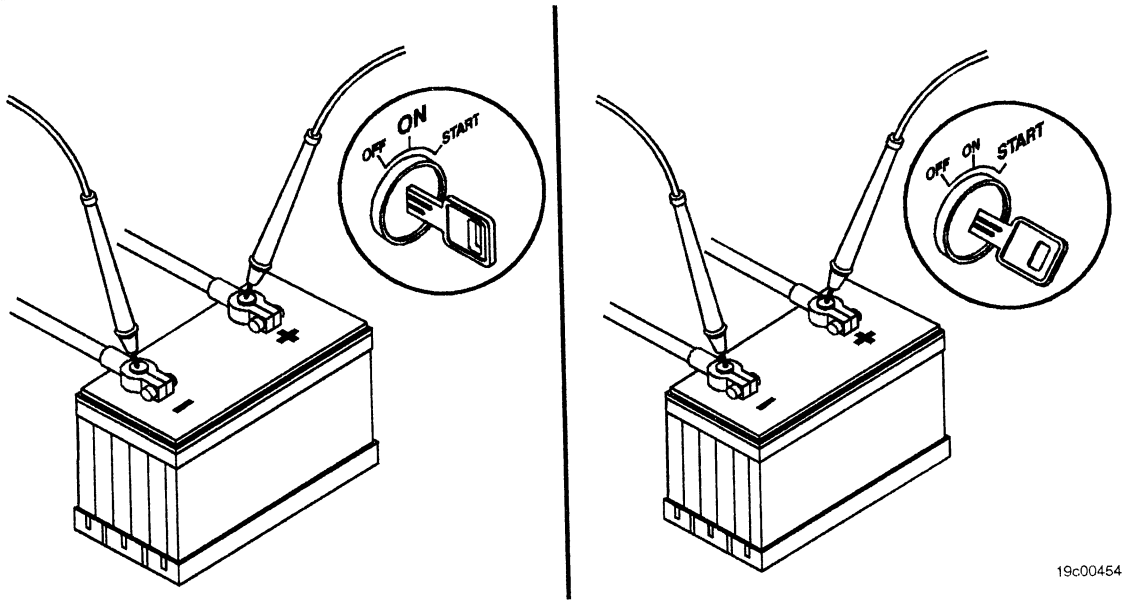
TROUBLESHOOTING STEP

STEP 1: Check the equipment battery system.

STEP 1A: Check the battery voltage.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Check the battery voltage. • Measure the battery voltage from the positive (+) terminal to the (–) terminal. • Measure the battery voltage from the (+) terminal to the (–) terminal while cranking the engine.	**OK** **Normal conditions:** **At least (+) 12 VDC** **During cranking:** **At least (+) 6.2 VDC**	1B
	NOT OK **Charge or replace the battery** Refer to the OEM troubleshooting and repair manual.	2A



STEP 1B: Check the alternator.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Inspect the alternator for normal operation. Refer to the OEM troubleshooting and repair manual for procedure.	**OK** **Alternator functioning normally**	2A
	NOT OK **Repair the alternator** Refer to the OEM troubleshooting and repair manual.	2A

STEP 2: Clear the fault code.

STEP 2A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it idle for 1 minute. • Using INSITE™, verify Fault Code 442 is inactive.	**OK** **Fault Code 442 inactive**	2B
	NOT OK Return to the troubleshooting steps or contact your local Cummins Authorized Repair Location if all the steps have been completed and checked again.	1A

STEP 2B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

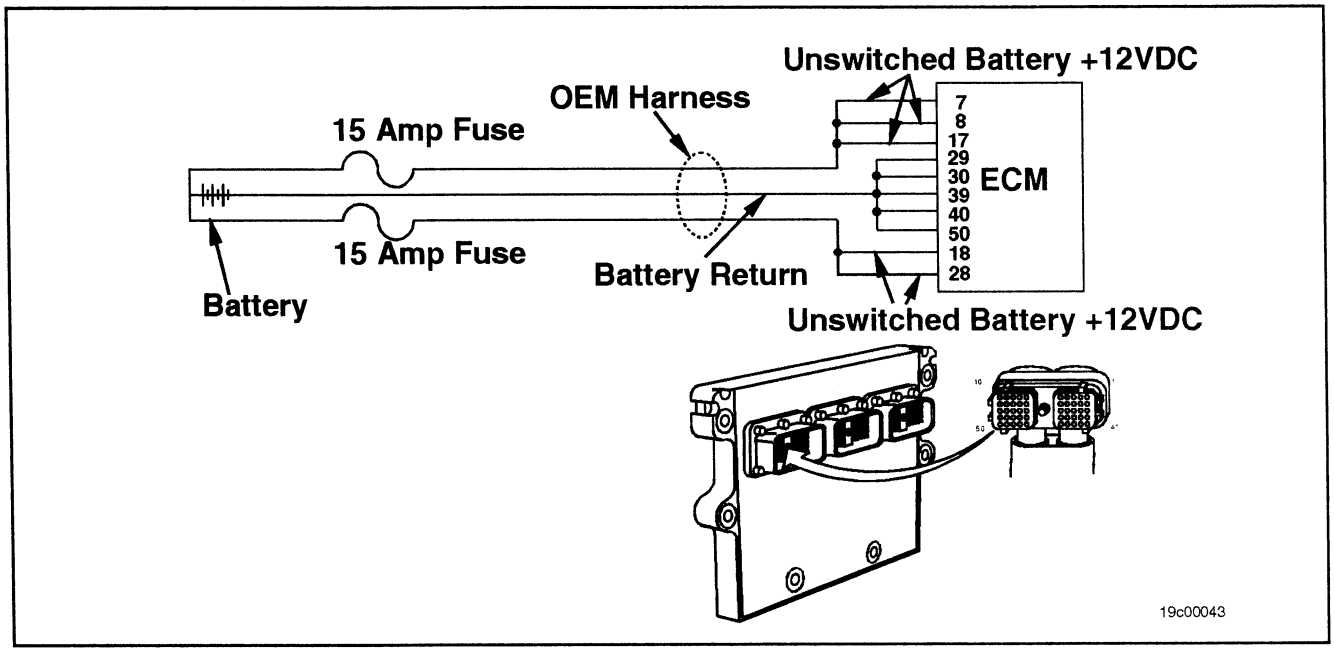
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 441

Unswitched Battery Supply Circuit

CODES	REASON	EFFECT
Fault Code: 441 PID(P), SID(S): P168 SPN: 168 FMI: 1/18 Lamp: Yellow	Battery voltage below normal operating level.	Possible no noticeable performance effects or possible rough idle.

Unswitched Battery Supply Circuit



Circuit Description:

The electronic control module (ECM) receives unswitched battery input through the OEM harness. There are two in-line 15-amp fuses in the unswitched battery wire of the OEM harness to protect the engine harness from overheating. The battery return wires are connected directly to the negative (–) battery post.

Component Location:

The ECM is connected to the battery by the OEM harness. This direct link provides a constant power supply for the ECM. Refer to the OEM troubleshooting and repair manual for the battery location.

Shop Talk:

Make sure the ECM unswitched battery supply is coming directly from the battery and **not** the starter.

TROUBLESHOOTING SUMMARY

⚠ CAUTION ⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

**To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.**

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the equipment battery system.		
STEP 1A: Inspect the battery cable connections.	No damaged connections	
STEP 1B: Check the battery voltage.	Normal conditions: At least (+) 12 VDC During cranking: At least (+) 6.2 VDC	
STEP 2: Check the OEM harness.		
STEP 2A: Inspect the fuse connections.	Fuses installed correctly	
STEP 2B: Check the fuses.	Fuses not blown	
STEP 2C: Inspect the OEM harness and ECM connector pins.	No damaged pins	
STEP 2D: Check for an open circuit in the battery power circuit.	Less than 10 ohms	
STEP 2E: Check for a short circuit.	More than 100k ohms	
STEP 2F: Check the add-on or the accessory wiring at (+) terminal of the battery.	No damaged wires	
STEP 3: Clear the fault codes.		
STEP 3A: Disable the fault code.	Fault Code 441 inactive	
STEP 3B: Clear the inactive fault codes.	All fault codes cleared	

TROUBLESHOOTING STEP

STEP 1: Check the equipment battery system.

STEP 1A: Inspect the battery cable connections.

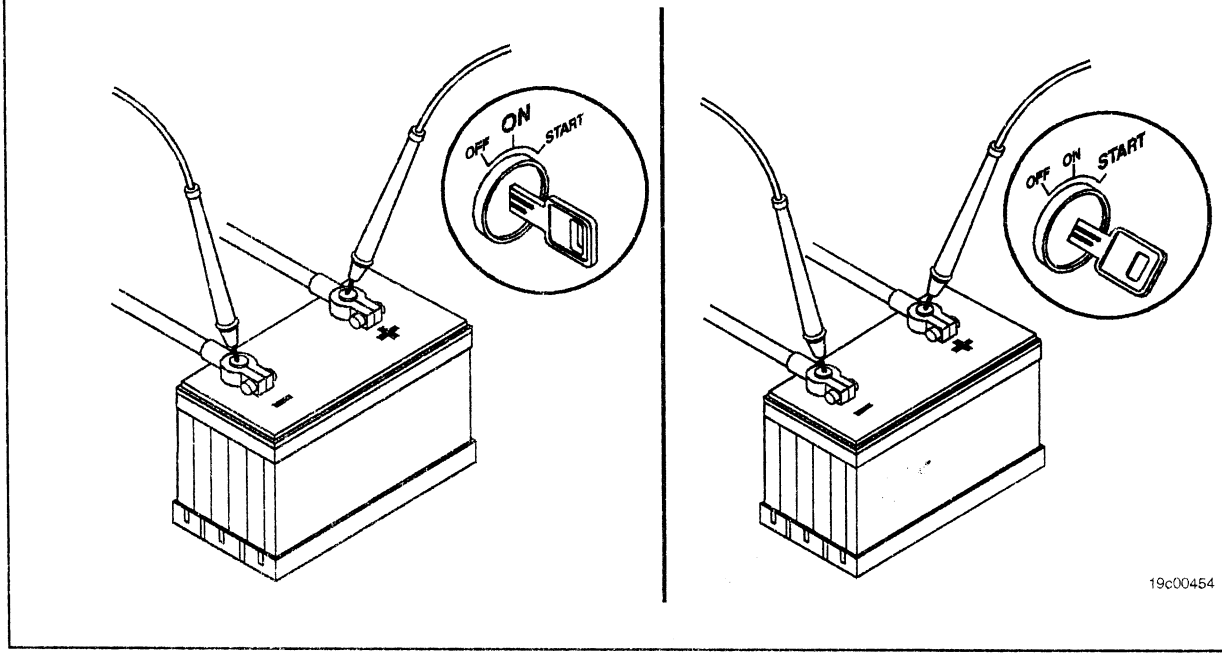
Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Inspect the battery cable connections for the following: • Corrosion • Loose connections.	**OK** **No damaged connections**	1B
	NOT OK **Repair the damaged connections** Tighten the battery connections and clean the battery terminals. Refer to the OEM troubleshooting and repair manual.	3A

STEP 1B: Check the battery voltage.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Check the battery voltage. • Measure the battery voltage from the positive (+) terminal to the negative (–) terminal. • Measure the battery voltage from the positive (+) terminal to the negative (–) terminal while trying to start the engine.	**OK** **Normal conditions:** **At least (+) 12 VDC** **During cranking:** **At least (+) 6.2 VDC**	2A
	NOT OK **Charge or replace the battery** Refer to the OEM troubleshooting and repair manual.	3A



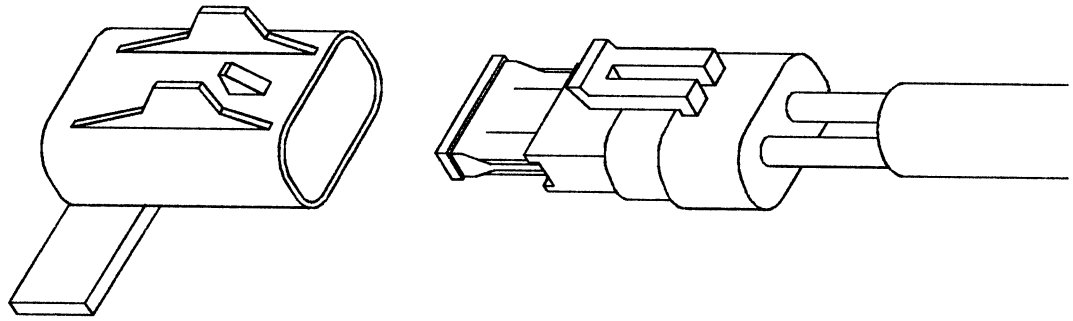
STEP 2: Check the OEM harness.

STEP 2A: Inspect the fuse connections.

Condition:

- Turn keyswitch OFF.
- Disconnect the 15-amp fuses from the OEM harness.

Action	Specifications/Repair	Next Step
Check if the two 15-amp fuses are installed correctly.	**OK** **Fuses installed correctly**	2B
	NOT OK **Install fuses correctly** Refer to Procedure 019-003.	3A

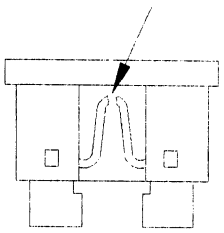


19c00455

STEP 2B: Check the fuses.

Condition:
- Turn keyswitch OFF.
- Disconnect the 15-amp fuses from the OEM harness.

Action	Specifications/Repair	Next Step
Check if the two 15-amp fuses are blown.	**OK** **Fuses not blown**	2C
	NOT OK **Replace the fuses** Refer to Procedure 019-003.	3A



19800238

STEP 2C: Inspect the OEM harness and ECM connector pins.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness connector from the ECM.

Action	Specifications/Repair	Next Step
Inspect the OEM harness and ECM connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	2D
	NOT OK **Replace the damaged pins** Repair or replace the engine harness, or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	3A

STEP 2D: Check for an open circuit in the battery power circuit.

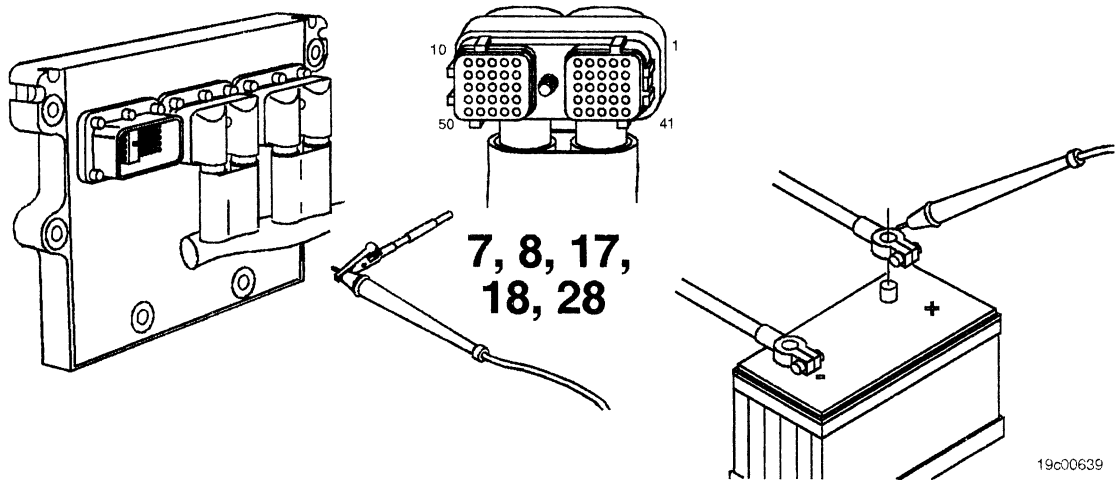
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the OEM harness connector from the ECM.
- Disconnect the positive (+) battery terminal.

Action	Specifications/Repair	Next Step
Check for an open circuit in the battery power circuit. • Measure the resistance from pin 7 of the OEM harness connector to the positive (+) battery terminal connector. • Measure the resistance from pin 8 of the OEM harness connector to the positive (+) battery terminal connector. • Measure the resistance from pin 17 of the OEM harness connector to the positive (+) battery terminal connector. • Measure the resistance from pin 18 of the OEM harness connector to the positive (+) battery terminal connector. • Measure the resistance from pin 28 of the OEM harness connector to the positive (+) battery terminal connector.	**OK** **Less than 10 ohms**	2E
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	3A



STEP 2E: Check for a short circuit.

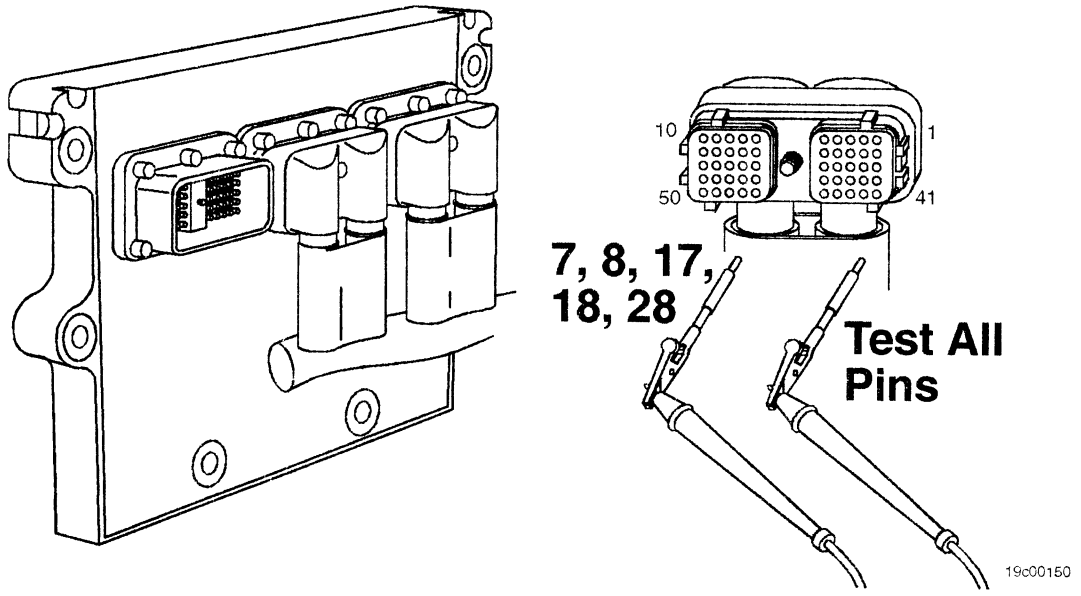
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the OEM harness connector from the ECM.
- Disconnect the positive (+) battery terminal.

Action	Specifications/Repair	Next Step
Check for a short circuit. • Measure the resistance from pin 7 to all other pins in the OEM harness connector **except** for pins 8, 17, 18, and 28. • Measure the resistance from pin 8 to all other pins in the OEM harness connector **except** for pins 7, 17, 18, and 28. • Measure the resistance from pin 17 to all other pins in the OEM harness connector **except** for pins 7, 8, 18, and 28. • Measure the resistance from pin 18 to all other pins in the OEM harness connector **except** for pins 7, 8, 17, and 28. • Measure the resistance from pin 28 to all other pins in the OEM harness connector **except** for pins 7, 8, 17, and 18.	**OK** **More than 100k ohms**	2F
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	3A



STEP 2F: Check the add-on or the accessory wiring at (+) terminal of the battery.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Check the add-on or the accessory wiring at (+) terminal of the battery. • Starting at the (+) terminal, follow any add-on or accessory wiring and examine the wire(s) for damaged insulation or installation error that can cause the supply wire to have a short circuit to the engine block.	**OK** **No damaged wires**	3A
	NOT OK **Repair the damaged wiring**	3A

STEP 3: Clear the fault codes.

STEP 3A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it idle for 1 minute. • Using INSITE™, verify that Fault Code 441 is inactive.	**OK** **Fault Code 441 inactive**	3B
	NOT OK Return to the troubleshooting steps or contact your local Cummins Authorized Repair Location if all the steps have been completed and checked again.	1A

STEP 3B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

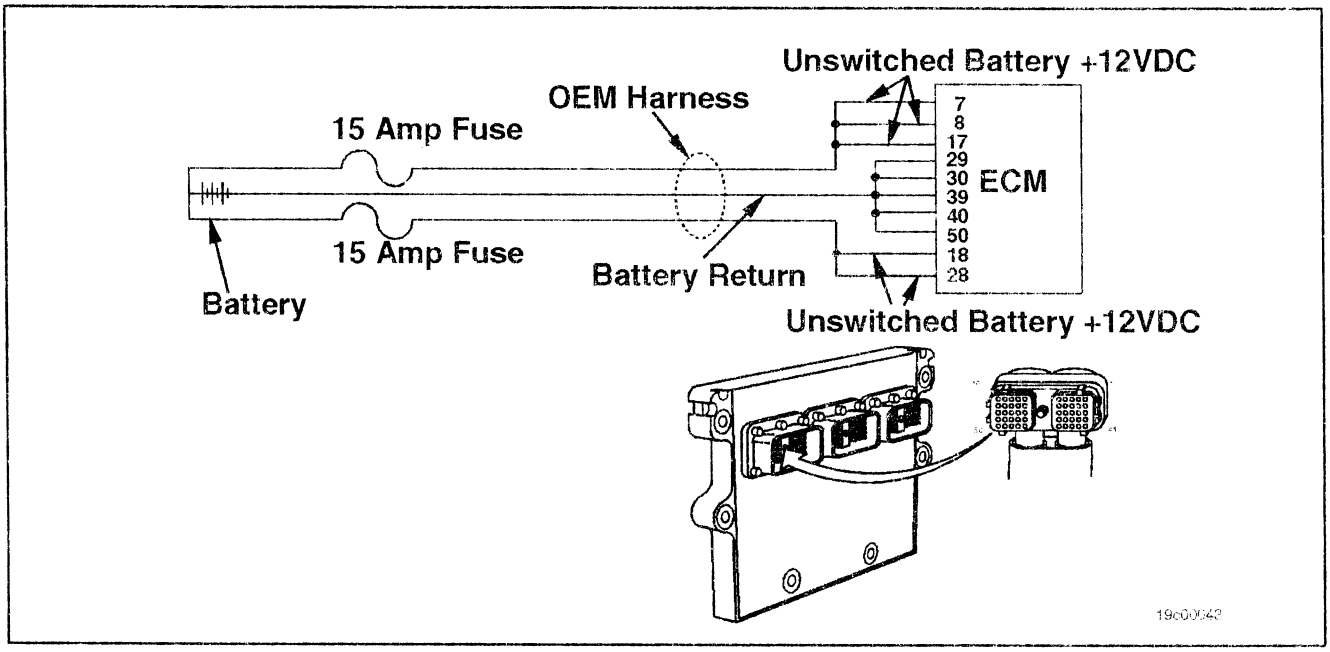
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 434

Unswitched Battery Supply Circuit

CODES	REASON	EFFECT
Fault Code: 434 PID(P), SID(S): S251 SPN: 627 FMI: 2/2 Lamp: Yellow	Supply voltage to the electronic control module (ECM) fell below (+) 6.2 VDC for a fraction of a second or the ECM was **not** allowed to power down correctly (retain battery voltage for 30 seconds after keyswitch is turned off).	Possible no noticeable performance effects or engine dying or hard starting. Fault information, trip information, and maintenance monitor data can be inaccurate.

Unswitched Battery Supply



Circuit Description:

The ECM receives constant voltage from the batteries through the unswitched battery wires that are connected directly to the positive (+) battery post. There are two in-line 15-amp fuses in the unswitched battery wires to protect the engine harness from overheating. The ECM receives switched battery input through the vehicle keyswitch wire, and one 5-amp fuse when the vehicle keyswitch is turned on. The battery return wires are connected directly to the negative (–) battery post.

Component Location:

The ECM is connected to the battery by the OEM harness. This direct link provides a constant power supply for the ECM. The location of the battery will vary with the OEM. Refer to the OEM troubleshooting and repair manual.

Shop Talk:

If the ECM unswitched battery supply is taken from the starter, check for low voltage during cranking. Low voltage during cranking can cause the ECM power supply to drop below specifications and log Fault Code 434.

TROUBLESHOOTING SUMMARY

⚠ WARNING ⚠

The injector solenoids receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the injector solenoids or the solenoid wires when the engine is operating.

⚠ CAUTION ⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the batteries and the power connector.		
STEP 1A: Check the resistance of the battery supply circuit.	Less than 10 ohms	
STEP 1B: Check the battery voltage.	Normal conditions: At least (+) 12 VDC During cranking: At least (+) 6.2 VDC	
STEP 1C: Check the battery connections.	Connections are tight and corrosion-free	
STEP 2: Check the fuses.		
STEP 2A: Check if the two 15-amp fuses are installed correctly.	Fuses installed correctly	
STEP 2B: Check if the two 15-amp fuses are blown.	Fuses not blown	
STEP 2C: Check if the 5-amp fuse is installed correctly.	Fuses installed correctly	
STEP 2D: Check if the 5-amp fuse is blown.	Fuse not blown	
STEP 3: Check the OEM harness.		
STEP 3A: Inspect the OEM harness and the ECM connector pins.	No damaged pins	
STEP 3B: Check for an open circuit in the battery power circuits.	(+) 10 to 15 VDC	
STEP 3C: Check for a short circuit.	More than 100k ohms	
STEP 3D: Check the add-on or the accessory wiring at (+) terminal of the battery.	No damaged wires	
STEP 4: Clear the fault codes.		
STEP 4A: Disable the fault code.	Fault Code 434 inactive	
STEP 4B: Clear the inactive fault codes.	All fault codes cleared	

TROUBLESHOOTING STEP

STEP 1: Check the batteries and the power connector.

STEP 1A: Check the resistance of the battery supply circuit.

⚠WARNING⚠

The injector solenoids receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the injector solenoids or the solenoid wires when the engine is operating.

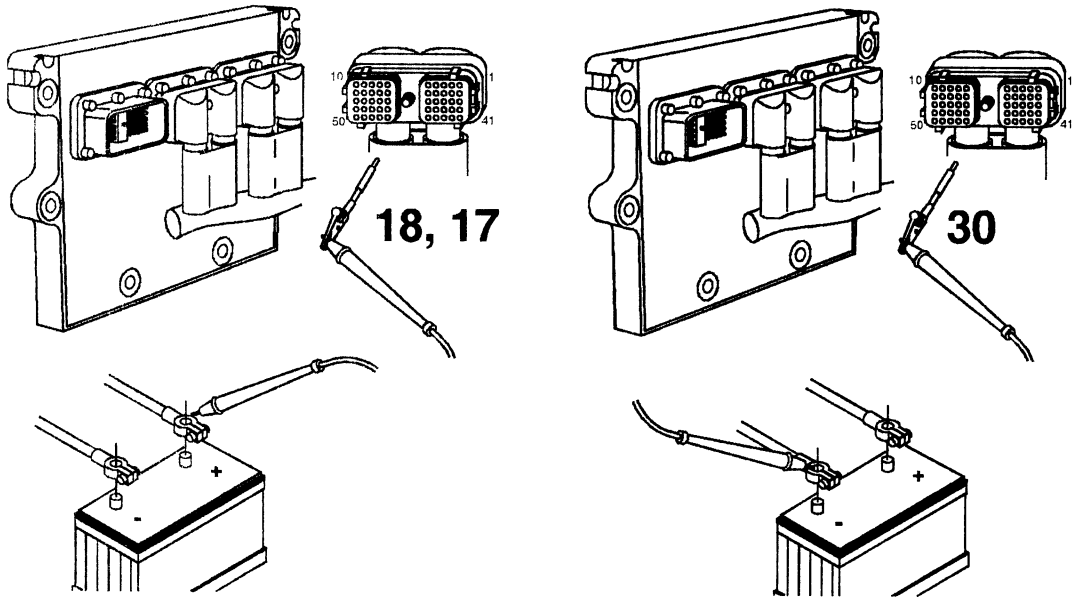
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the OEM harness connector from the ECM.
- Disconnect both positive and negative terminals from the battery.

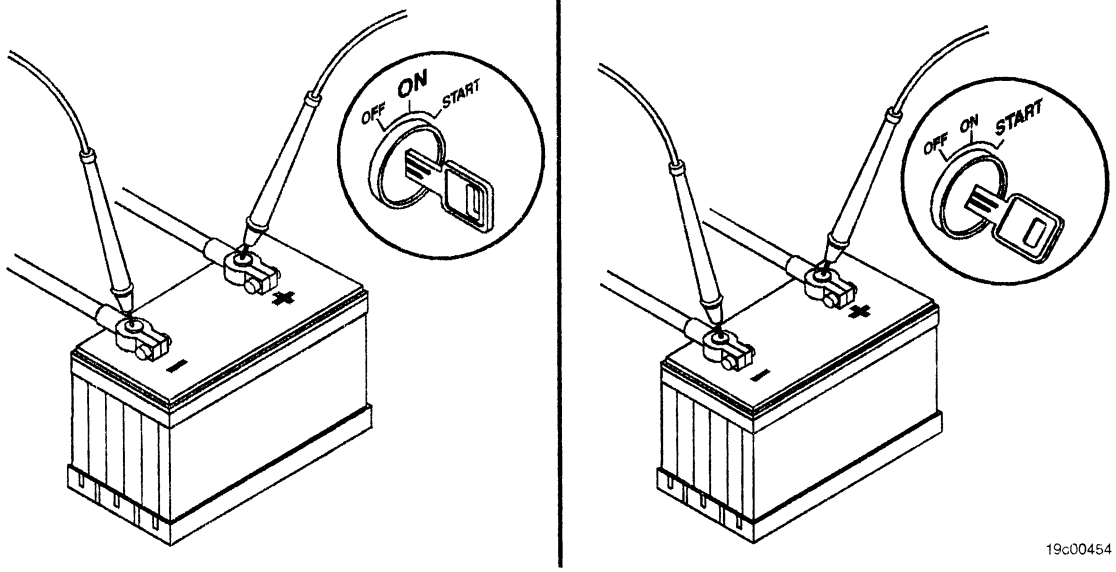
Action	Specifications/Repair	Next Step
Check the resistance of the battery supply circuit. • Measure the resistance from pin 18 of the OEM harness connector to the positive (+) battery terminal connector. • Measure the resistance from pin 17 of the OEM harness connector to the positive (+) battery terminal connector. • Measure the resistance from pin 30 of the OEM harness connector to the negative (–) battery terminal connector.	**OK** **Less than 10 ohms**	1B
	NOT OK **Repair or replace the OEM harness** • Repair the OEM harness. Refer to Procedure 019-250. • Replace the OEM harness. Refer to the OEM troubleshooting and repair manual.	4A



STEP 1B: Check the battery voltage.

Condition:
- Turn keyswitch ON.

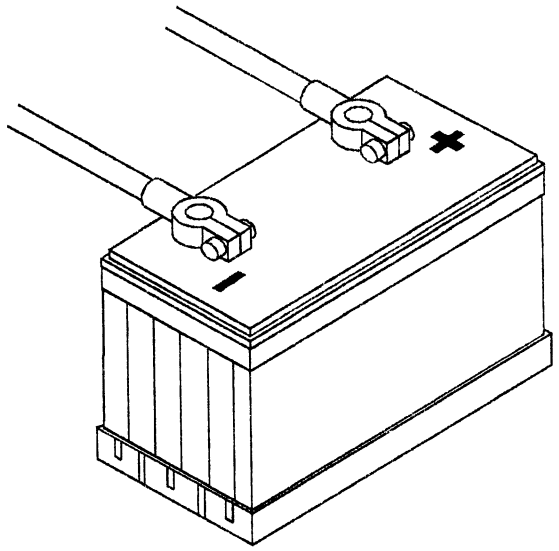
Action	Specifications/Repair	Next Step
Check the battery voltage. • Place positive (+) probe of the multimeter on the positive battery terminal and touch negative (–) probe to the negative battery terminal while trying to start engine.	**OK** **Normal conditions: At least (+) 12 VDC** **During cranking: At least (+) 6.2 VDC**	1C
	NOT OK **Charge or replace the battery** Refer to the OEM troubleshooting and repair manual.	4A



STEP 1C: Check the battery connections.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Check the battery connections. • Check the battery terminal connections.	**OK** **Connections are tight and corrosion-free**	2A
	NOT OK **Tighten the connections** Tighten the loose connections and clean the terminals. Refer to the OEM troubleshooting and repair manual.	4A



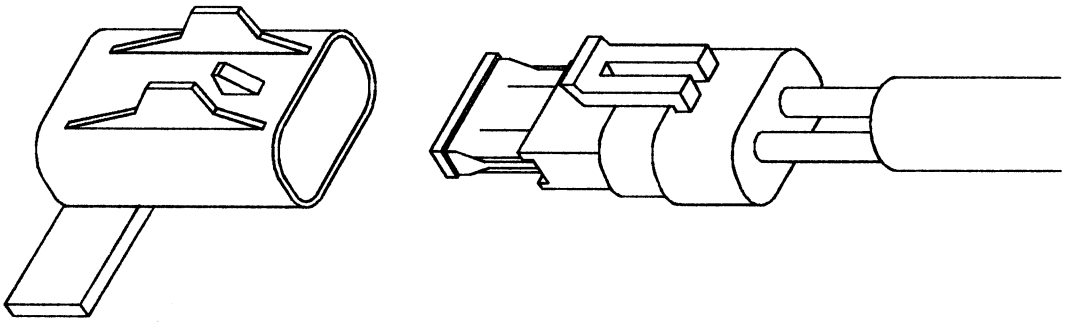
19c00460

STEP 2: Check the fuses.

STEP 2A: Check if the two 15-amp fuses are installed correctly.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Check if the two 15-amp fuses are installed correctly. • Inspect the two 15-amp fuses for correct installation.	**OK** **Fuses installed correctly**	2B
	NOT OK **Install the fuses correctly** Refer to Procedure 019-198.	4A

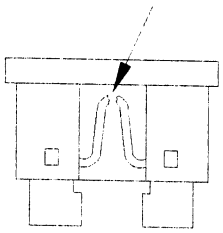


19c00455

STEP 2B: Check if the two 15-amp fuses are blown.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Check if the two 15-amp fuses are blown. • Inspect the two 15-amp fuses to see if they are blown.	**OK** **Fuses not blown**	2C
	NOT OK **Locate the short circuit** • Replace the engine harness. Refer to Procedure 019-043. • Replace the blown fuse(s).	4A

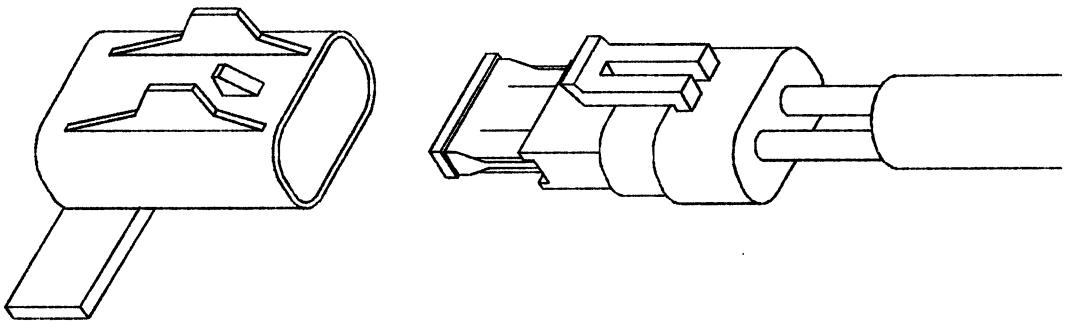


19800238

STEP 2C: Check if the 5-amp fuse is installed correctly.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Check if the 5-amp fuse is installed correctly. • Inspect the 5-amp fuse for correct installation.	**OK** **Fuse installed correctly**	2D
	NOT OK **Install the fuse correctly** Refer to Procedure 019-198.	4A

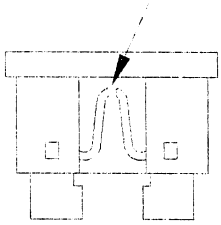


19c00455

STEP 2D: Check if the 5-amp fuse is blown.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Check if the 5-amp fuse is blown. • Inspect the 5-amp fuse to see if it is blown.	**OK** **Fuse not blown**	3A
	NOT OK **Locate the short circuit** • Replace the engine harness. Refer to Procedure 019-043. • Replace the blown fuse.	4A



19800238

STEP 3: Check the OEM harness.

STEP 3A: Inspect the harness and the ECM connector pins.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch OFF.
- Disconnect the OEM harness connector from the ECM.

Action	Specifications/Repair	Next Step
Inspect the harness and the ECM connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	3B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	4A

STEP 3B: Check for an open circuit in the battery power circuits.

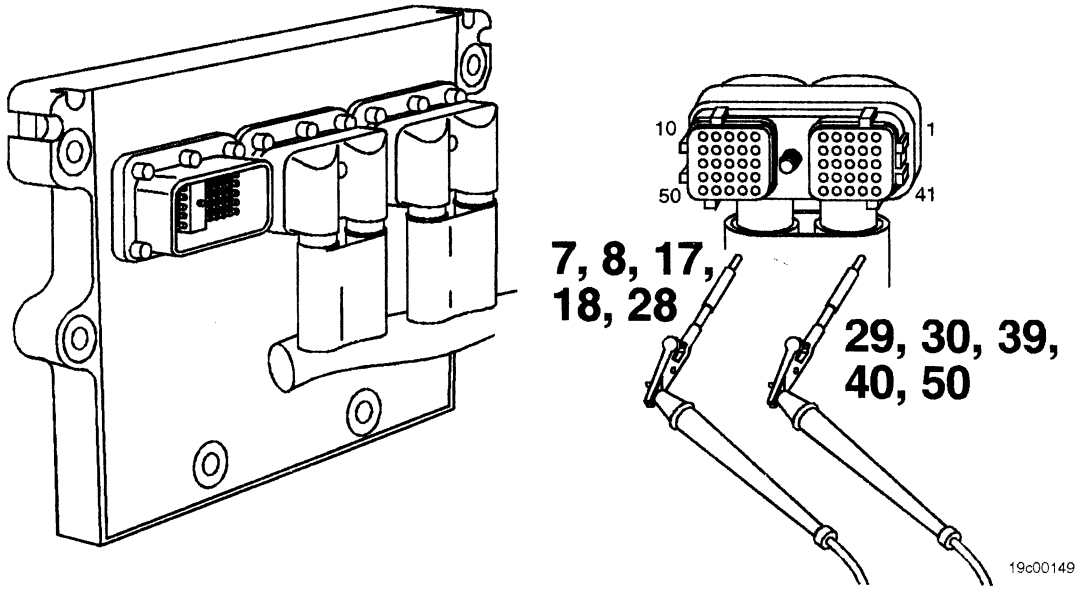
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the OEM harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for an open circuit in the battery power circuits. • Measure the voltage from pin 7 to pin 29 of the OEM harness connector. • Measure the voltage from pin 8 to pin 30 of the OEM harness connector. • Measure the voltage from pin 17 to pin 39 of the OEM harness connector. • Measure the voltage from pin 18 to pin 40 of the OEM harness connector. • Measure the voltage from pin 28 to pin 50 of the OEM harness connector.	**OK** **(+) 10 to 15 VDC**	3C
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	4A



STEP 3C: Check for a short circuit.

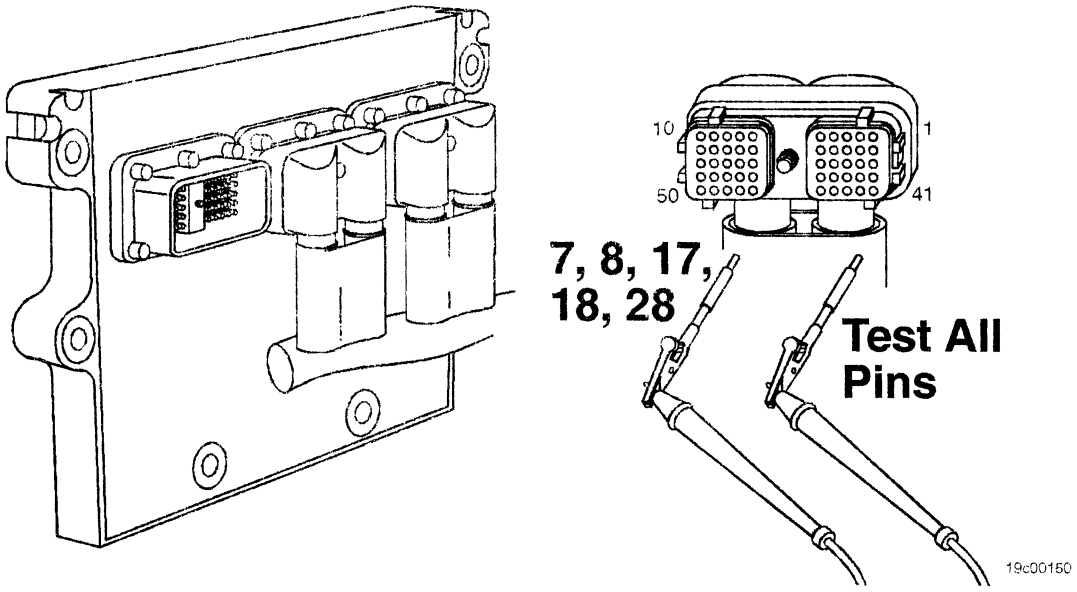
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the OEM harness connector from the ECM.
- Disconnect both positive (+) and negative (-) terminals from the battery.

Action	Specifications/Repair	Next Step
Check for a short circuit. • Measure the resistance from pin 7 of the OEM harness connector to all other pins in the connector **except** pins 8, 17, 18, and 28. • Measure the resistance from pin 8 of the OEM harness connector to all other pins in the connector **except** pins 7, 17, 18, and 28. • Measure the resistance from pin 17 of the OEM harness connector to all other pins in the connector **except** pins 7, 8, 18, and 28. • Measure the resistance from pin 18 of the OEM harness connector to all other pins in the connector **except** pins 7, 8, 17, and 28. • Measure the resistance from pin 28 of the OEM harness connector to all other pins in the connector **except** pins 7, 8, 17, and 18.	**OK** **More than 100k ohms**	3D
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	4A



STEP 3D: Check the add-on or the accessory wiring at (+) terminal of the battery.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Check the add-on or the accessory wiring at (+) terminal of the battery. • Starting at the (+) terminal, follow any add-on or accessory wiring and examine wire(s) for damaged insulation or an installation error that can cause the supply wire to be shorted to the engine block.	**OK** **No damaged wires**	4A
	NOT OK **Repair or replace the damaged wiring**	4A

STEP 4: Clear the fault codes.

STEP 4A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it idle for 1 minute. • Using INSITE™, verify Fault Code 434 is inactive.	**OK** **Fault Code 434 inactive**	4B
	NOT OK Return to the troubleshooting steps or contact your local Cummins Authorized Repair Location if all the steps have been completed and checked again.	1A

STEP 4B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

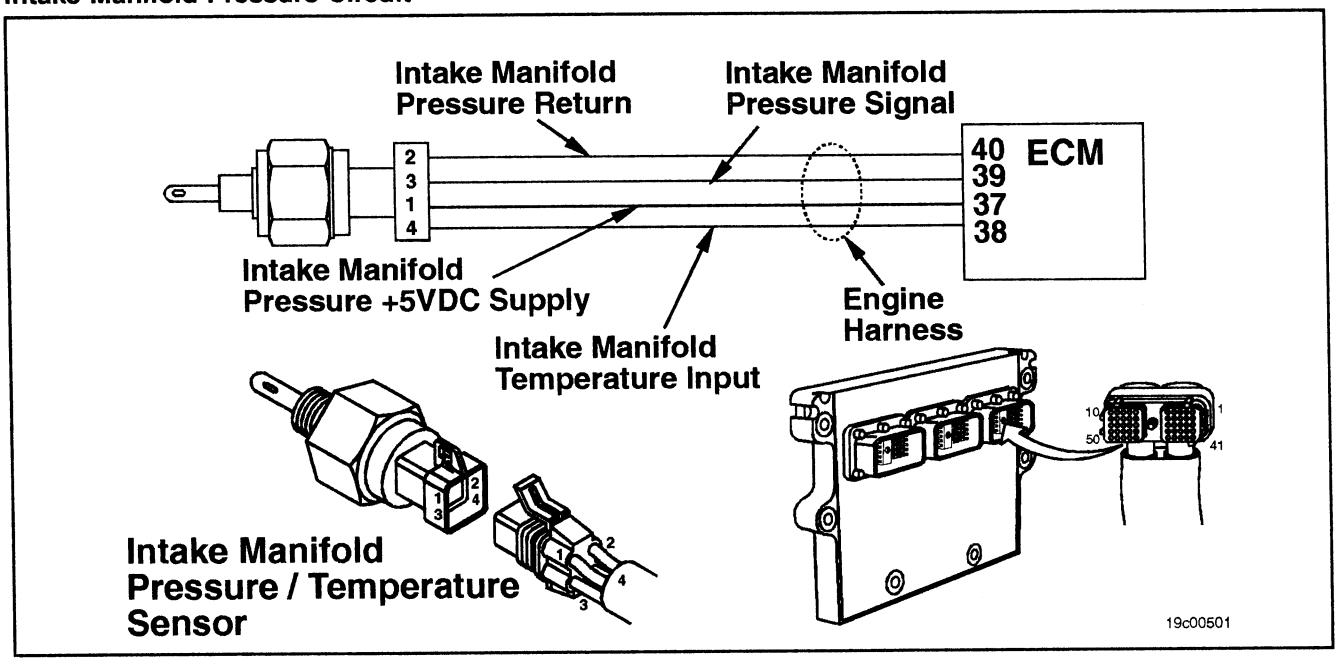
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 433

Intake Manifold Pressure Circuit

CODES	REASON	EFFECT
Fault Code: 433 PID(P), SID(S): P102 SPN: 102 FMI: 2/2 Lamp: Yellow	Voltage signal at the intake manifold pressure circuit indicates high intake manifold pressure, but other engine characteristics indicate that intake manifold pressure **must** be low.	Derate to no-air setting.

Intake Manifold Pressure Circuit



Circuit Description:

The intake manifold pressure/temperature sensor monitors intake manifold pressure and passes information to the electronic control module (ECM) through the sensor harness. If intake manifold pressure becomes too high, it will cause a derate condition.

Component Location:

The intake manifold pressure/temperature sensor is located on the cylinder head between the air horn and the front of engine.

Shop Talk:

The ECM checks for this fault **only** at idle speed. If the intake manifold pressure shows too high of a value at this time, the ECM will log this fault code.

TROUBLESHOOTING SUMMARY

⚠ CAUTION ⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the intake manifold pressure/temperature sensor.		
STEP 1A: Inspect the sensor circuit for tampering.	No tampering	
STEP 1B: Inspect the harness and sensor connector pins.	No damaged pins	
STEP 2: Check the sensor harness.		
STEP 2A: Inspect the sensor harness and ECM connector pins.	No damaged pins	
STEP 2B: Check for an open circuit in the return line.	Less than 10 ohms	
STEP 2C: Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 2D: Check for a short circuit to ground.	More than 100k ohms	
STEP 3: Clear the fault codes.		
STEP 3A: Disable the fault code.	Fault Code 433 inactive	
STEP 3B: Clear the inactive fault codes.	All fault codes cleared	

TROUBLESHOOTING STEP

STEP 1: Check the intake manifold pressure/temperature sensor.

STEP 1A: Inspect the sensor circuit for tampering.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Inspect the sensor circuit for tampering. • Check the intake manifold pressure/ temperature sensor and the sensor harness for external wires or damaged harness braiding.	**OK** **No tampering**	1B
	NOT OK **Remove and record tampering** If tampering has occurred, repair the circuit and record the tampering.	3A

STEP 1B: Inspect the harness and sensor connector pins.

Condition:
- Turn keyswitch OFF.
- Disconnect the engine harness from the intake manifold pressure/temperature sensor.

Action	Specifications/Repair	Next Step
Inspect the harness and sensor connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	2A
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the sensor, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-204. • Replace the engine harness. Refer to Procedure 019-043. • Replace the intake manifold pressure/ temperature sensor. Refer to Procedure 019-159.	3A

STEP 2: Check the sensor harness.

STEP 2A: Inspect the sensor harness and ECM connector pins.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Inspect the harness and the ECM connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	2B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	3A

STEP 2B: Check for an open circuit in the return line.

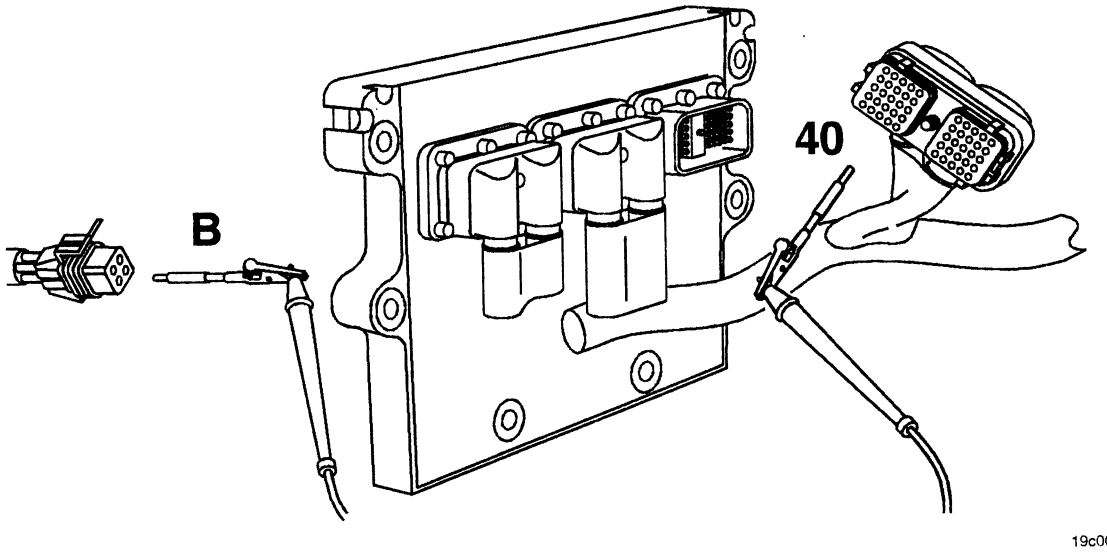
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness from the intake manifold pressure/temperature sensor.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for an open circuit in the return line. • Measure the resistance from pin 40 of the sensor harness connector to pin 2 (or B) of the intake manifold pressure/temperature sensor connector on the harness side.	**OK** **Less than 10 ohms**	2C
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-204 or 019-250. • Replace the engine harness. Refer to Procedure 019-043.	3A



STEP 2C: Check for a short circuit from pin to pin.

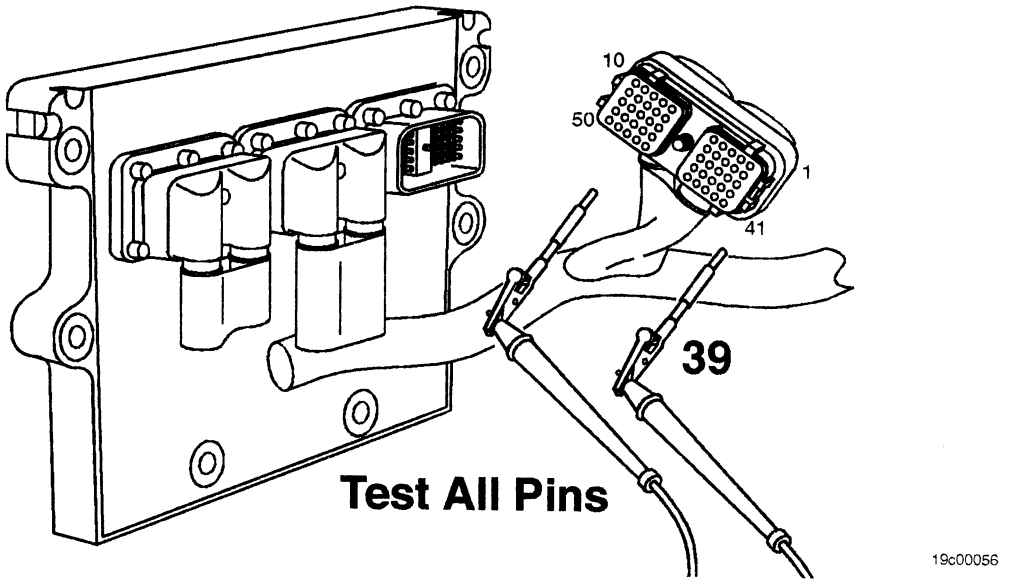
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness from the intake manifold pressure/temperature sensor.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pin 39 of the sensor harness connector to all other pins in the connector.	**OK** **More than 100k ohms**	2D
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	3A



STEP 2D: Check for a short circuit to ground.

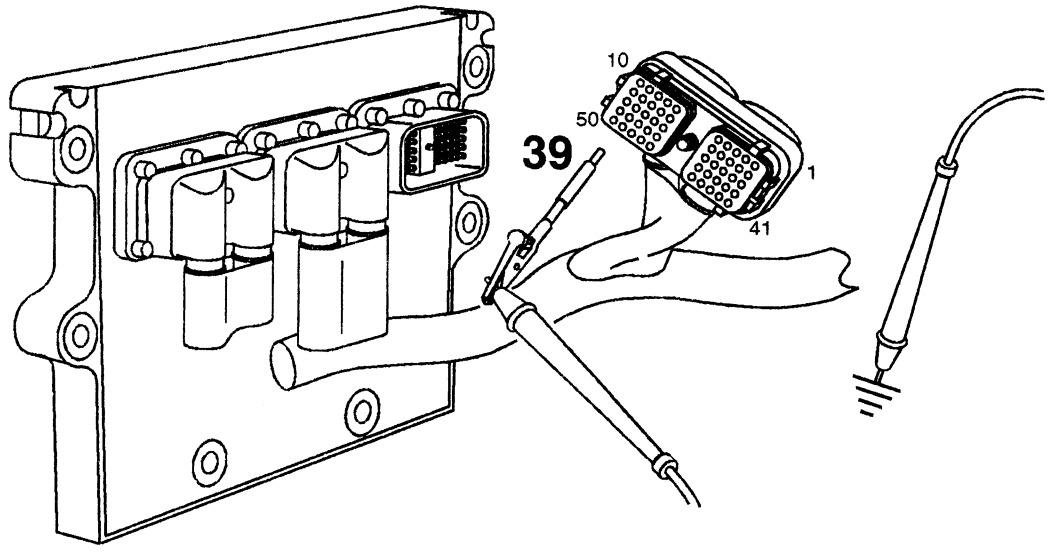
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Disconnect the sensor harness from the intake manifold pressure/temperature sensor.
- Disconnect the sensor harness connector from the ECM.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground. • Measure the voltage from pin 39 in the sensor harness connector to the engine block ground.	**OK** **More than 100k ohms** **Replace the intake manifold pressure/ temperature sensor** Refer to Procedure 019-159.	3A
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250 and Procedure 019-204. • Replace the engine harness. Refer to Procedure 019-043.	3A



19c00057

STEP 3: Clear the fault codes.

STEP 3A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it idle for 1 minute. • Using INSITE™, verify Fault Code 433 is inactive.	**OK** **Fault Code 433 inactive**	3B
	NOT OK Return to the troubleshooting steps or contact your local Cummins Authorized Repair Location if all the steps have been completed and checked again.	1A

STEP 3B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

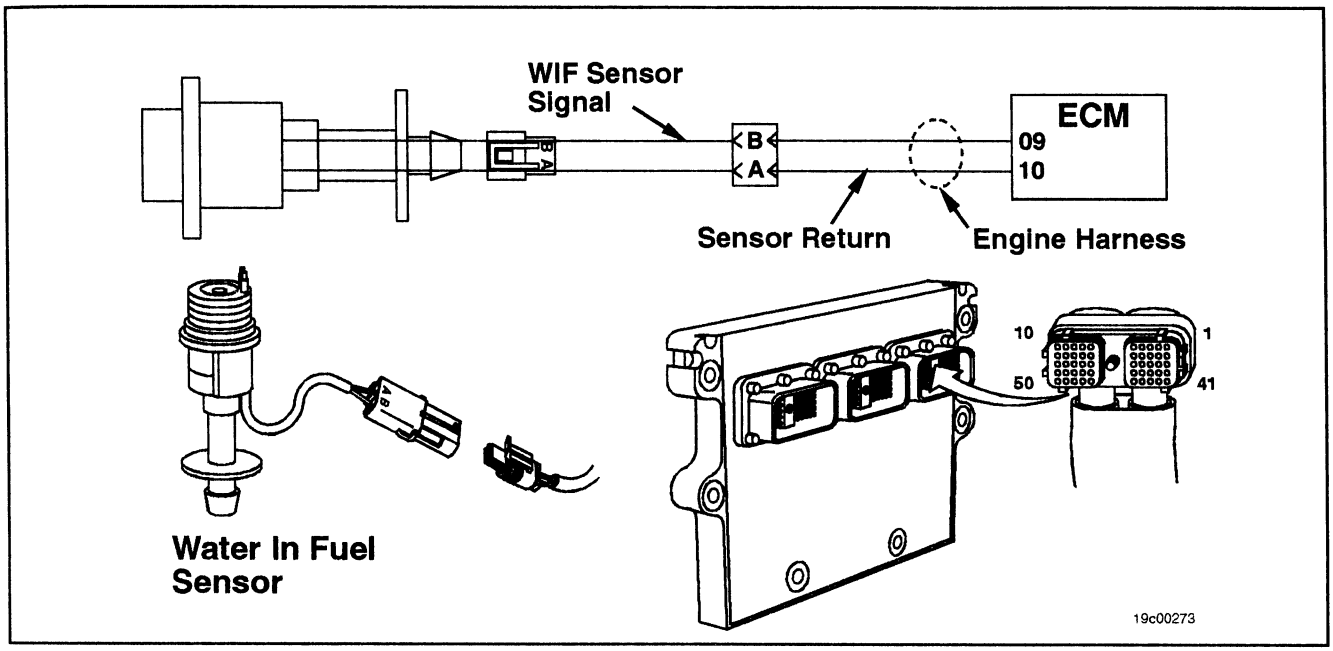
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 429

Water-In-Fuel (WIF) Sensor Circuit

CODES	REASON	EFFECT
Fault Code: 429 PID(P), SID(S): P097 SPN: 97 FMI: 4/4 Lamp: Yellow	Low voltage detected at water-in-fuel (WIF) sensor circuit.	None on performance.

WIF Sensor Circuit



Circuit Description:

The WIF sensor is attached to the fuel filter. The WIF sensor sends a signal to the electronic control module (ECM) when a set volume of water has accumulated in the fuel filter. The WIF circuit contains two wires: A return ground (pin 10) and a signal wire (pin 9).

Component Location:

The WIF sensor is installed in the fuel filter and is located on the side of the head approximately midengine.

Shop Talk:

The WIF sensor uses the same internal ECM power supply as sensors on engine harness. If Fault Code 352 is also active, use that troubleshooting logic and tree.

TROUBLESHOOTING SUMMARY

⚠ CAUTION ⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead
Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check engine harness.		
STEP 1A: Inspect the engine harness, WIF sensor, and ECM connectors.	No damaged pins	
STEP 1B: Check for a short circuit to ground.	More than 100k ohms	
STEP 1C: Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 1D: Check sensor supply voltage.	(+) 4.75 to 5.25 VDC	
STEP 1E: Measure supply voltage from the ECM.	(+) 4.75 to 5.25 VDC	
STEP 2: Clear the fault codes.		
STEP 2A: Disable the fault code.	Fault Code 429 inactive	
STEP 2B: Clear the inactive fault codes.	All fault codes cleared	

TROUBLESHOOTING STEP

STEP 1: Check engine harness.

STEP 1A: Inspect the engine harness, WIF sensor, and ECM connectors.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness from the WIF sensor.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Inspect the sensor harness, WIF sensor, and ECM connectors for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	1B
	NOT OK **Repair the damaged pins** Repair or replace the OEM harness, or replace the WIF sensor or ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal, if it is damaged or missing. • Repair engine harness. Refer to Procedure 019-202 or 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the WIF sensor. Refer to Procedure 019-127. • Replace the ECM. Refer to Procedure 019-031.	2A

STEP 1B: Check for a short circuit to ground.

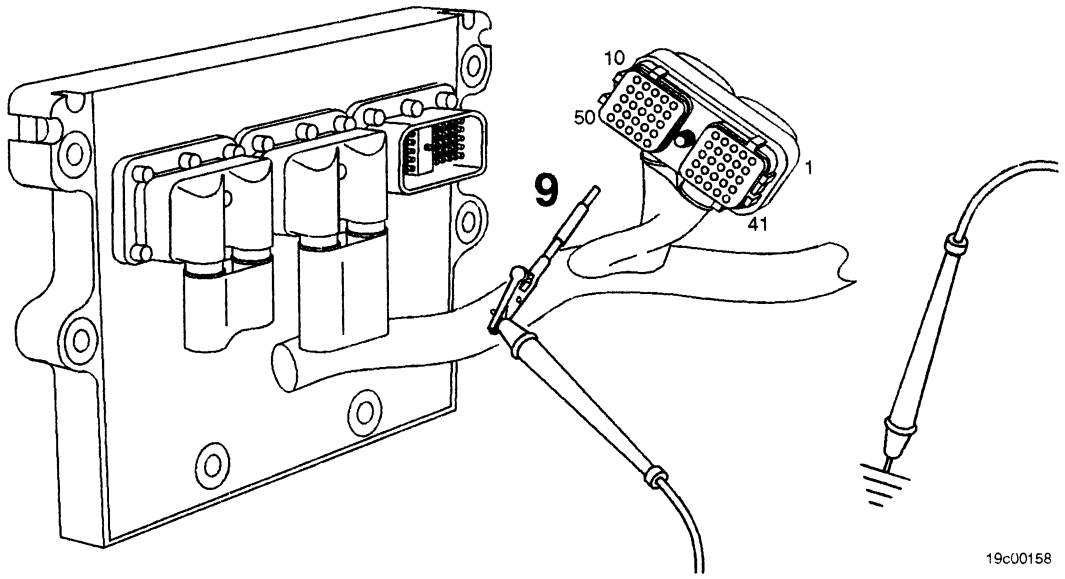
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness from the WIF sensor.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground. • Measure the resistance from pin 9 of the sensor harness connector to engine block ground.	**OK** **More than 100k ohms**	1C
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	2A



STEP 1C: Check for a short circuit from pin to pin.

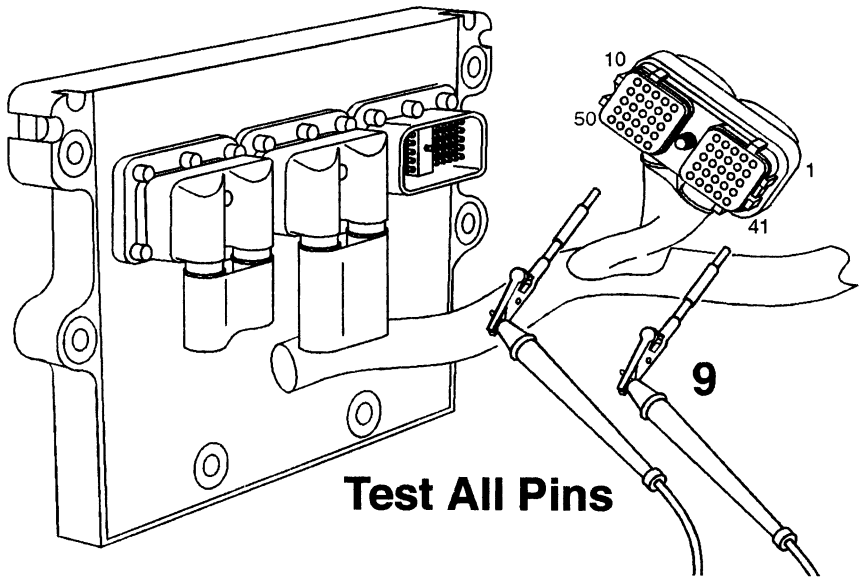
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness from the WIF sensor.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pin 9 in the sensor harness connector to all other pins in the connector.	**OK** **More than 100k ohms**	1D
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	2A



STEP 1D: Check sensor supply voltage.

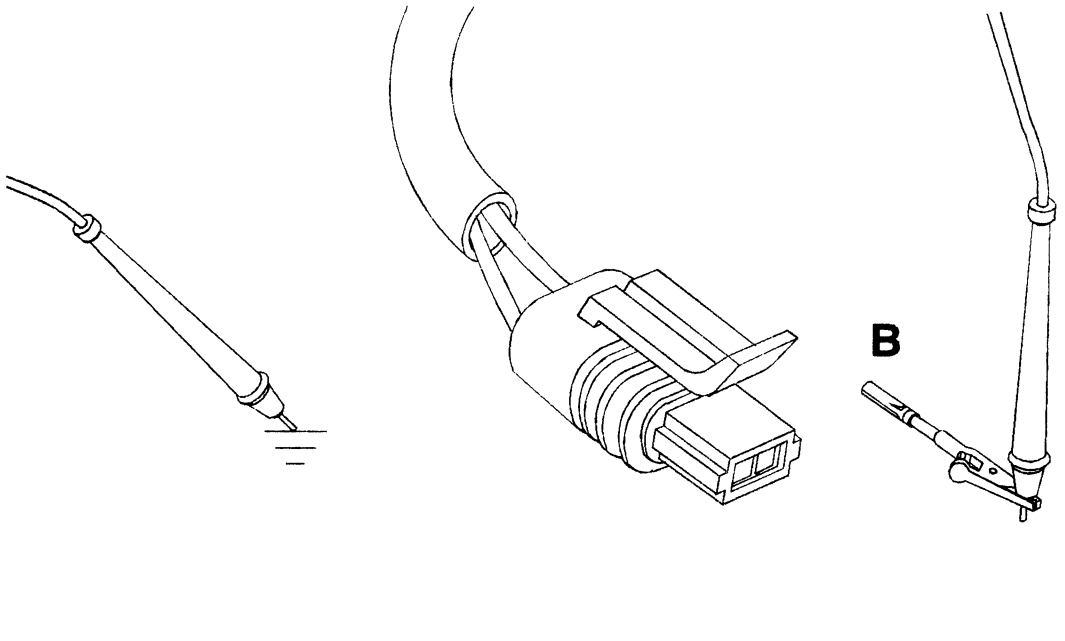
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Disconnect the sensor harness from the WIF sensor.
- Connect the sensor harness connector to the ECM.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check sensor supply voltage. • Measure the voltage from pin B (or 2) on the harness side of the WIF sensor connector to engine block ground.	**OK** **(+) 4.75 to 5.25 VDC** **Replace WIF sensor** Refer to Procedure 019-127.	2A
	NOT OK Does **not** meet specifications.	1E



19900474

STEP 1E: Measure supply voltage from the ECM.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

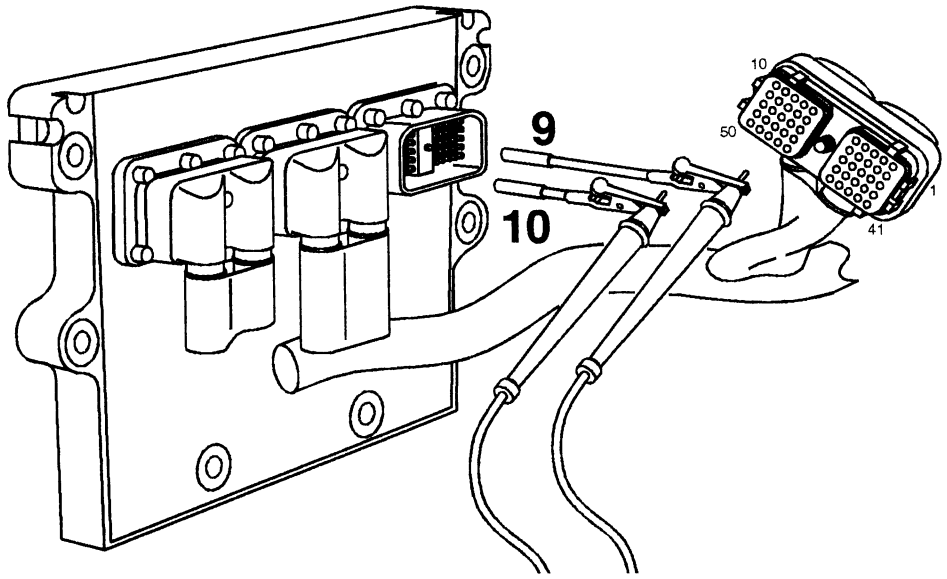
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

Condition:

- Disconnect the sensor harness from the WIF sensor.
- Disconnect the sensor harness connector from the ECM.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Measure supply voltage out of ECM. • Measure the voltage from pin 9 to pin 10 of the ECM sensor port.	**OK** **(+) 4.75 to 5.25 VDC**	2A
	NOT OK **Replace the ECM** Refer to Procedure 019-031.	2A



STEP 2: Clear the fault codes.

STEP 2A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let idle for 1 minute. • Using INSITE™, verify that Fault Code 429 is inactive.	**OK** **Fault Code 429 inactive**	2B
	NOT OK Return to troubleshooting steps or contact your local Cummins Authorized Repair Location if all steps have been completed and checked again.	1A

STEP 2B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

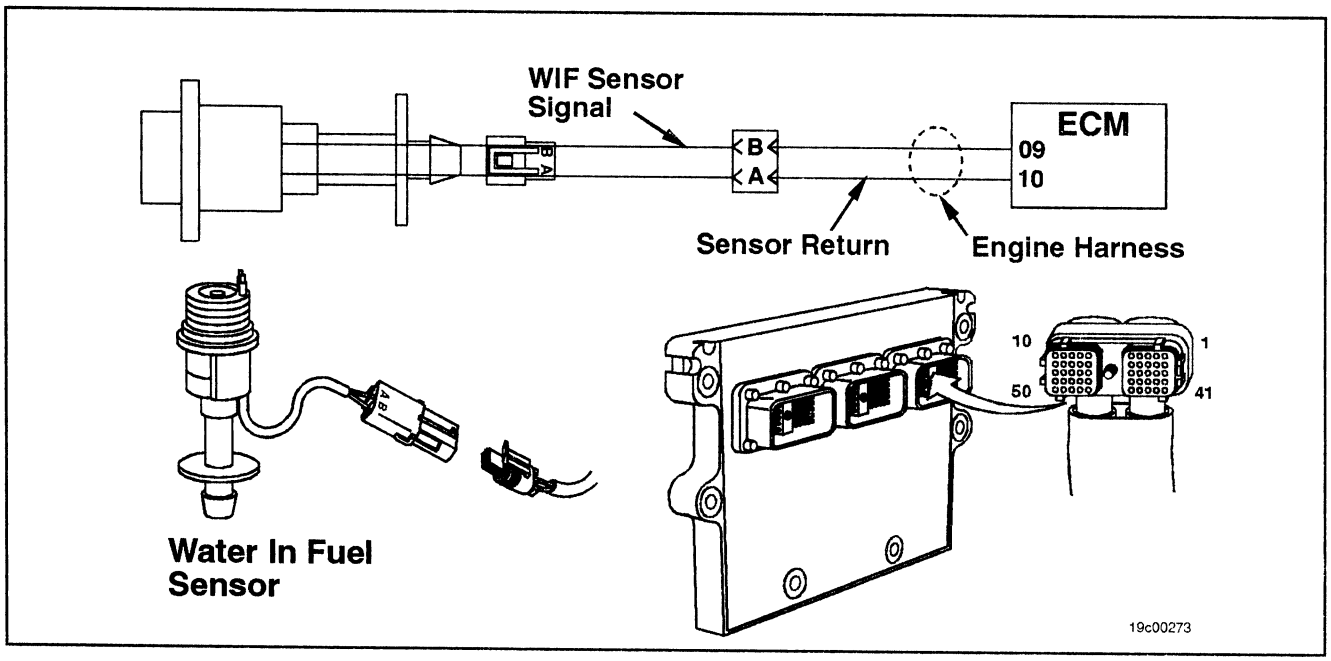
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 428

Water-In-Fuel (WIF) Sensor Circuit

CODES	REASON	EFFECT
Fault Code: 428 PID(P), SID(S): P097 SPN: 97 FMI: 3/3 Lamp: Yellow	High voltage detected at water-in-fuel (WIF) sensor circuit.	None on performance.

WIF Sensor Circuit



Circuit Description:

The WIF sensor is attached to the fuel filter. The WIF sensor sends a signal to the electronic control module (ECM) when a set volume of water has accumulated in the fuel filter. The WIF circuit contain two wires: A return ground (pin 10) and a signal wire (pin 9).

Component Location:

The WIF sensor is installed in the fuel filter and is located on the side of the head, approximately midengine.

Shop Talk:

Possible causes for this fault code include:
Short circuit to a (+) 5-VDC supply wire.

TROUBLESHOOTING SUMMARY

⚠ CAUTION ⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead
Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check engine harness.		
STEP 1A: Inspect the engine harness, WIF sensor, and ECM connectors.	No damaged pins	
STEP 1B: Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 1C: Check sensor supply voltage.	(+) 4.75 to 5.25 VDC	
STEP 1D: Measure the voltage from the ECM.	(+) 4.75 to 5.25 VDC	
STEP 2: Clear the fault codes.		
STEP 2A: Disable the fault code.	Fault Code 428 inactive	
STEP 2B: Clear the inactive fault codes.	All fault codes cleared	

TROUBLESHOOTING STEP

STEP 1: Check engine harness.

STEP 1A: Inspect the engine harness, WIF sensor, and ECM connectors.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness from the WIF sensor.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Inspect the sensor harness, WIF sensor, and ECM connectors for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	1B
	NOT OK **Repair the damaged pins** Repair or replace the OEM harness, or replace the ECM or WIF sensor, or whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair engine harness. Refer to Procedure 019-202 or 019-250 • Replace the engine harness. Refer to Procedure 019-043. • Replace the WIF sensor. Refer to Procedure 019-127. • Replace the ECM. Refer to Procedure 019-031.	2A

STEP 1B: Check for a short circuit from pin to pin.

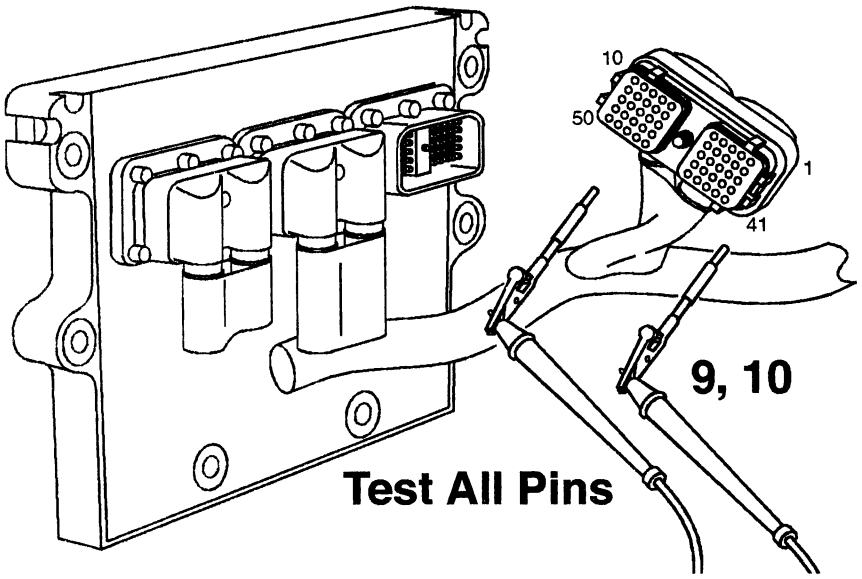
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness from the WIF sensor.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pin 9 of the sensor harness connector to all other pins in the connector. • Measure the resistance from pin 10 of the sensor harness connector to all other pins in the connector.	**OK** **More than 100k ohms**	1C
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-202 or 019-250. • Replace the engine harness. Refer to Procedure 019-043.	2A



STEP 1C: Check sensor supply voltage.

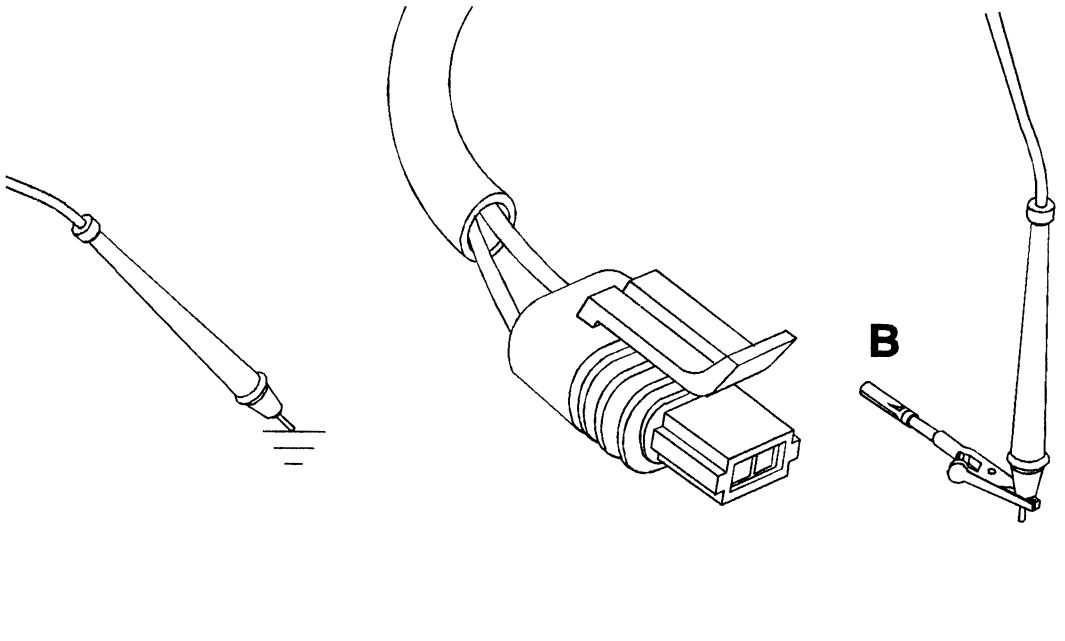
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Disconnect the sensor harness from the WIF sensor.
- Connect the sensor harness connector to the ECM.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check sensor supply voltage. • Measure the voltage from pin B (or 2) on the harness side of the WIF sensor connector to engine block ground.	**OK** **(+) 4.75 to 5.25 VDC** **Replace the WIF sensor** Refer to Procedure 019-127.	2A
	NOT OK	1D



19900474

STEP 1D: Measure the voltage from the ECM.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

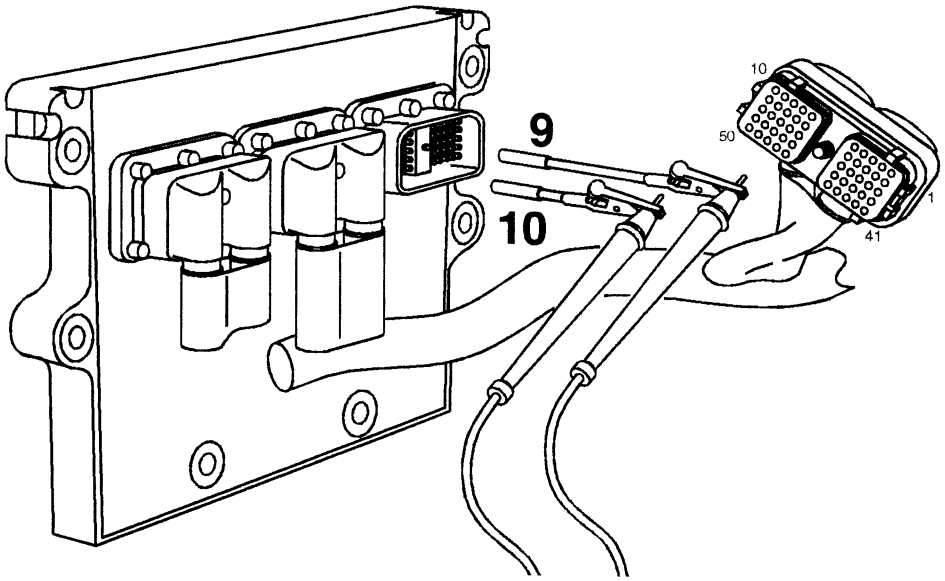
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

Condition:

- Disconnect the sensor harness from the WIF sensor.
- Connect the sensor harness connector to the ECM.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Measure the voltage from the ECM. • Measure the voltage out of the ECM from pins 9 to pin 10 of the ECM sensor port.	**OK** **(+) 4.75 to 5.25 VDC** **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-202 or 019-250. • Replace the engine harness. Refer to Procedure 019-043.	2A
	NOT OK **Replace the ECM** Refer to Procedure 019-031.	2A



19c00635

STEP 2: Clear the fault codes.

STEP 2A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it idle for 1 minute. • Using INSITE™, verify that the Fault Code 428 is inactive.	**OK** **Fault Code 428 inactive**	2B
	NOT OK Return to troubleshooting steps or contact your local Cummins Authorized Repair Location if all steps have been completed and checked again.	1A

STEP 2B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

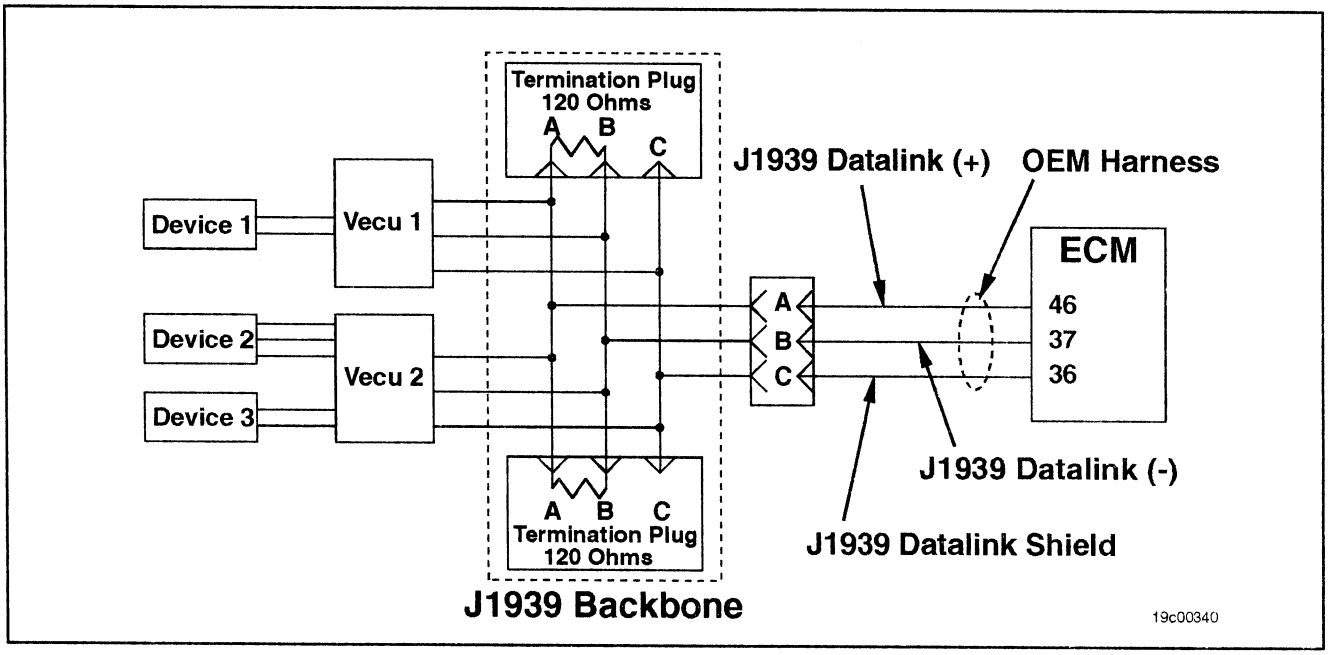
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 426

J1939 Datalink Communication

CODES	REASON	EFFECT
Fault Code: 426 PID(P), SID(S): S231 SPN: 639 FMI: 2/2 Lamp: None	Communication between the electronic control module (ECM) and another device on the J1939 datalink has been lost.	None on performance. J1939 devices possibly do **not** operate.

J1939 Datalink Circuit



Circuit Description:

Devices such as ABS controllers, autoshift transmissions, ASR systems, electronic displays, electronic information systems, electronic service tools, and VECUs can communicate with the ECM over the J1939 datalink. Messages sent from the devices are received by the ECM and used for controlling the engine. The ECM also transmits information to these devices over the J1939 datalink.

Component Location:

The ECM is located on the intake side of the engine, near the front. The J1939 datalink wiring and the J1939 devices vary by OEM options.

Shop Talk:

This fault occurs whenever the ECM starts communicating with **any** other device using the J1939 datalink and then can no longer transmit on the datalink. Possible causes could be the following: Unplugging an electronic service tool before keying off the ECM, the J1939 datalink having an intermittent electrical problem, the ECM (or another J1939 device) tying up communications by an electrical problem, or by sending too many messages without stopping.

TROUBLESHOOTING SUMMARY

⚠ CAUTION ⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the ECM for proper multiplexing configuration.		
STEP 1A: Verify that the proper devices are set.	INSITE™ readout matches ECM settings for devices	
STEP 1B: Check datalink output by reading INSITE™.	Fault Code 426 inactive	
STEP 2: Inspect the SAE J1939 connectors on the backbone harness and engine harness connectors.		
STEP 2A: Inspect the ECM connectors.	No damaged pins	
STEP 2B: Inspect the connectors on any other device connected to the J1939 data-link.	No damaged pins	
STEP 3: Inspect the SAE J1939 backbone harness.		
STEP 3A: Check for an open circuit in the supply wire.	Less than 10 ohms	
STEP 3B: Check for an open circuit in the return wire.	Less than 10 ohms	
STEP 3C: Check the resistance value in the J1939 harness.	55 to 65 ohms	
STEP 3D: Check for an open circuit in the shield wire.	Less than 10 ohms	
STEP 3E: Check for a short circuit to power in the supply wire.	Less than (+) 1.5 VDC	
STEP 3F: Check for a short circuit to power in the return wire.	Less than (+) 1.5 VDC	
STEP 3G: Check for a short circuit to ground in the supply wire.	More than 100k ohms	
STEP 3H: Check for a short circuit to ground in the return wire.	More than 100k ohms	
STEP 3I: Check for a short circuit from pin to pin in the OEM connector.	More than 100k ohms	
STEP 4: Check for malfunctioning J1939 devices.		
STEP 4A: Check communication between the ECM and the multiplex devices.	Established communication	

STEP 4A-1: Check for malfunctioning J1939 devices. — **Proper communication between J1939 devices and J1939 backbone**

STEP 5: Clear the fault codes.

STEP 5A: Disable the fault code. — **Fault Code 426 inactive**

STEP 5B: Clear the inactive fault codes. — **All fault codes cleared**

TROUBLESHOOTING STEP

STEP 1: Check the ECM for proper multiplexing configuration.

STEP 1A: Verify that the proper devices are set.

Condition:
- Install INSITE™.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check that the vehicle inputs are multiplexed over the J1939 datalink. • Read the devices that are sending input information with INSITE™. • Information for settings are in menu: Adjustable Features and Parameters – J1939 Multiplexing.	**OK** **INSITE™ readout matches ECM settings for devices**	1B
	NOT OK **Configure the ECM to match the multiplexing devices**	5A

STEP 1B: Check datalink output by reading INSITE™.

Condition:
- Install the INLINE 2™ datalink adapter.
- Install INSITE™. Refer to the INSITE™ manual for details.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Using INSITE™, read the engine speed. • Check for any active fault codes.	**OK** **Fault Code 426 inactive**	5A
	NOT OK	2A

STEP 2: Inspect the SAE J1939 connectors on the backbone harness and engine harness connectors.

STEP 2A: Inspect the ECM connectors.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Disconnect the OEM harness connector from the ECM.
- Disconnect the multiplexed devices.

Action	Specifications/Repair	Next Step
Inspect the ECM, OEM harness, J1939 connectors, and multiplexed devices for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	2B
	NOT OK **Repair the damaged pins** Repair or replace the OEM harness, J1939, 3-pin, or multiplexed devices, or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair or replace the OEM harness. Refer to Procedure 019-071. • Repair or replace the 3-pin connectors. Refer to Procedure 019-203. • Refer to Signature, ISX and QSX15 Troubleshooting and Repair Manual, Bulletin No. 3666239, for specific multiplexed device. • Replace the ECM. Refer to Procedure 019-031.	5A

STEP 2B: Inspect the connectors on any other device connected to the J1939 datalink.

Condition:
- Turn keyswitch OFF.
- Disconnect the VECU(s) from the J1939 backbone harness.
- Disconnect the multiplexed devices from the VECU(s).

Action	Specifications/Repair	Next Step
Inspect the connectors on the VECU(s), 3-pin, and multiplexed devices connectors for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	3A
	NOT OK **Repair the damaged pins** Repair or replace the VECU(s), 3-pin connector, or multiplexed devices, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair or replace the VECU(s). Refer to the OEM troubleshooting and repair manual for repair procedure. • Repair the 3-pin connector. Refer to Procedure 019-203. • Repair or replace the multiplexed devices. Refer to the Signature, ISX and QSX15 Troubleshooting and Repair Manual, Bulletin No. 3666239.	5A

STEP 3: Inspect the SAE J1939 backbone harness.

STEP 3A: Check for an open circuit in the supply wire.

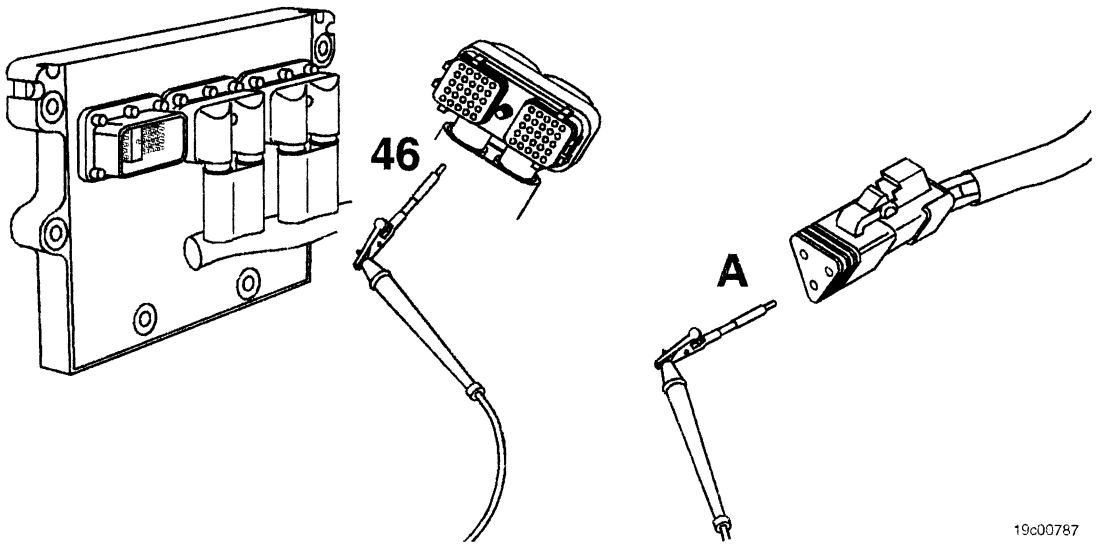
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the OEM harness connector from the ECM.
- Disconnect the J1939 connector from the VECU(s).

Action	Specifications/Repair	Next Step
Check for an open circuit in the supply wire. • Measure resistance from supply pin 46 at the OEM harness connector to pin A at the datalink connector at the VECU(s).	**OK** **Less than 10 ohms**	3B
	NOT OK **Repair or replace the OEM harness** • Repair the OEM harness. Refer to Procedure 019-203 or 019-250. • Replace the OEM harness. Refer to Procedure 019-071.	5A



STEP 3B: Check for an open circuit in the return wire.

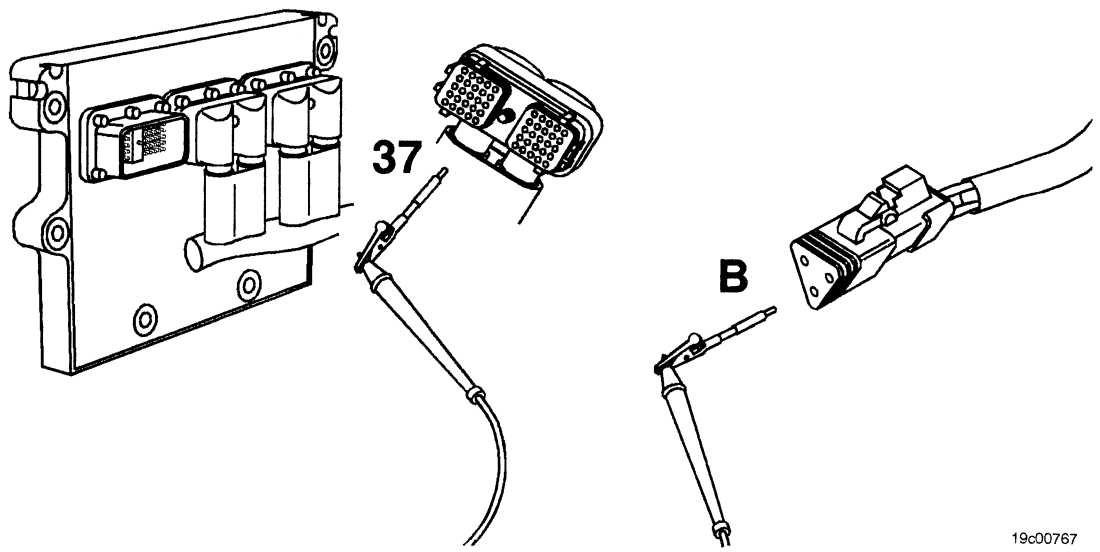
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the OEM harness connector from the ECM.
- Disconnect the J1939 harness from the VECU(s).

Action	Specifications/Repair	Next Step
Check for an open circuit in the return wire. • Measure the resistance from pin 37 at the OEM connector to pin B at the VECU(s).	**OK** **Less than 10 ohms**	3C
	NOT OK **Repair or replace the OEM harness** • Repair the OEM harness. Refer to Procedure 019-203 or 019-250. • Replace the OEM harness. Refer to Procedure 019-071.	5A



STEP 3C: Check the resistance value in the J1939 harness.

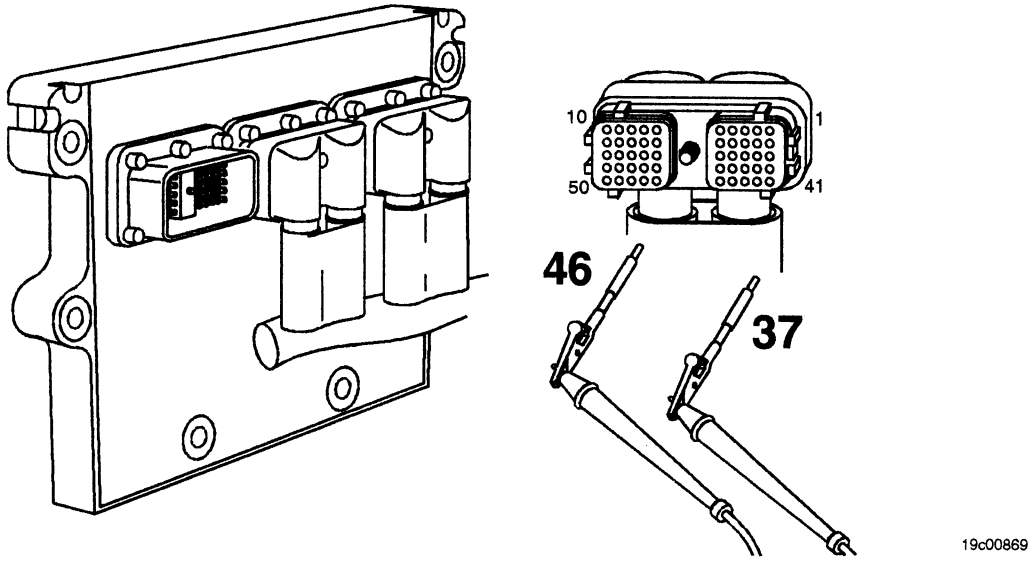
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the J1939 harness form the VECU(s).
- Disconnect the OEM harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check the resistance value of the J1939 harness. • Measure from pin 46 in the OEM harness connector to pin 37 in the OEM harness connector.	**OK** **55 to 65 ohms**	3D
	NOT OK **J1939 backbone termination resistors missing or damaged** Replace both termination resistors.	5A



STEP 3D: Check for an open circuit in the shield wire.

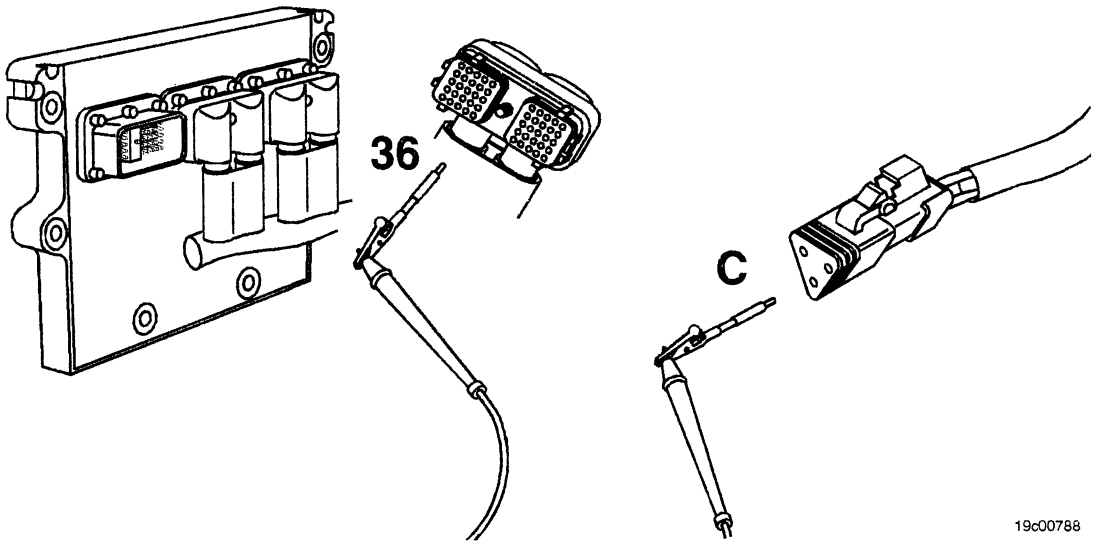
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the OEM harness connector from the ECM.
- Disconnect the J1939 harness from the VECU(s).

Action	Specifications/Repair	Next Step
Check for an open circuit in the shield wire. • Measure the resistance from pin 36 at the OEM harness connector at the ECM to pin C at the VECU(s).	**OK** **Less than 10 ohms**	3E
	NOT OK **Repair or replace the OEM harness** • Repair the OEM harness. Refer to Procedure 019-203 or 019-250. • Replace the OEM harness. Refer to Procedure 019-071.	5A



STEP 3E: Check for a short circuit to power in the supply wire.

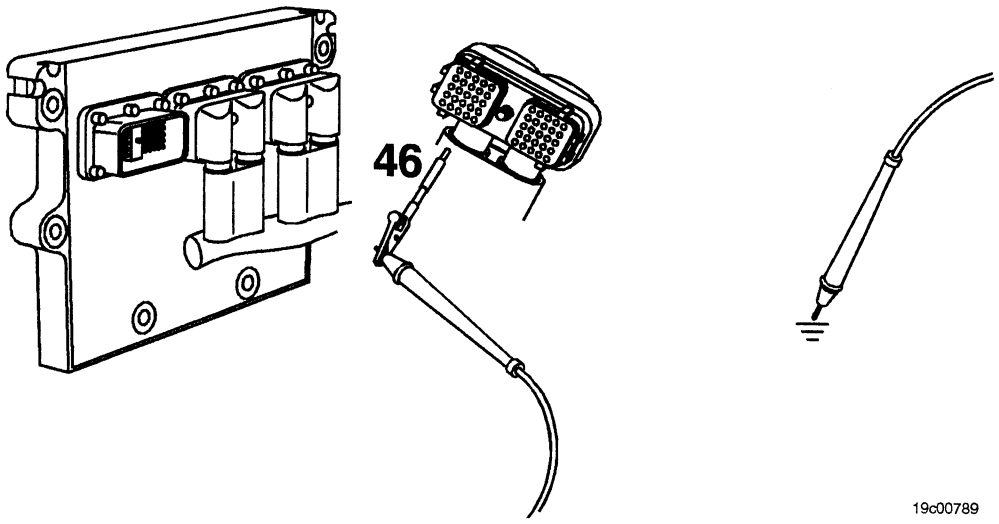
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the J1939 harness from the VECU(s).
- Disconnect the OEM harness connector from the ECM.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check for a short to power in the supply wire. • Measure the voltage from pin 46 at the ECM to ground at the J1939 connector.	**OK** **Less than (+) 1.5 VDC**	3F
	NOT OK **Repair or replace the OEM harness** • Repair the OEM harness. Refer to Procedure 019-203 or 019-250. • Replace the OEM harness. Refer to Procedure 019-071.	5A



STEP 3F: Check for a short circuit to power in the return wire.

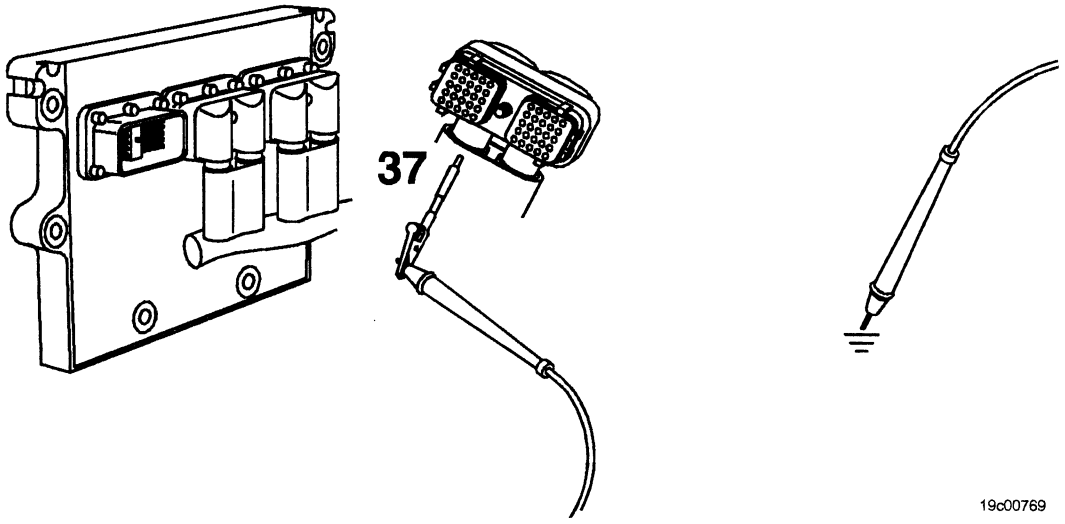
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the J1939 harness from the VECU(s).
- Disconnect the OEM harness connector from the ECM.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check for a short circuit to power in the return wire. • Measure the voltage from pin 37 at the OEM harness connector to ground at the VECU(s) connector.	**OK** **Less than (+) 1.5 VDC**	3G
	NOT OK **Repair or replace the OEM harness** • Repair the OEM harness. Refer to Procedure 019-203 or 019-250. • Replace the OEM harness. Refer to Procedure 019-071.	5A



STEP 3G: Check for a short circuit to ground in the supply wire.

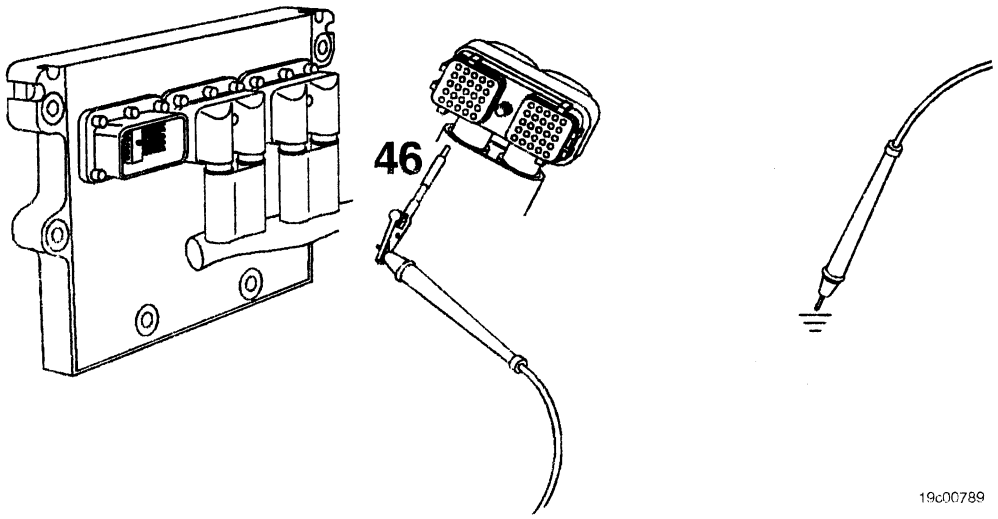
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the OEM harness connector from the ECM.
- Disconnect the J1939 harness from the VECU(s).

Action	Specifications/Repair	Next Step
Check for short to ground in the supply wire. • Measure the resistance from pin 46 in the OEM harness connector to ground.	**OK** **More than 100k ohms**	3H
	NOT OK **Repair or replace the OEM harness** • Repair the OEM harness. Refer to Procedure 019-203 or 019-250. • Replace the OEM harness. Refer to Procedure 019-071.	5A



STEP 3H: Check for a short circuit to ground in the return wire.

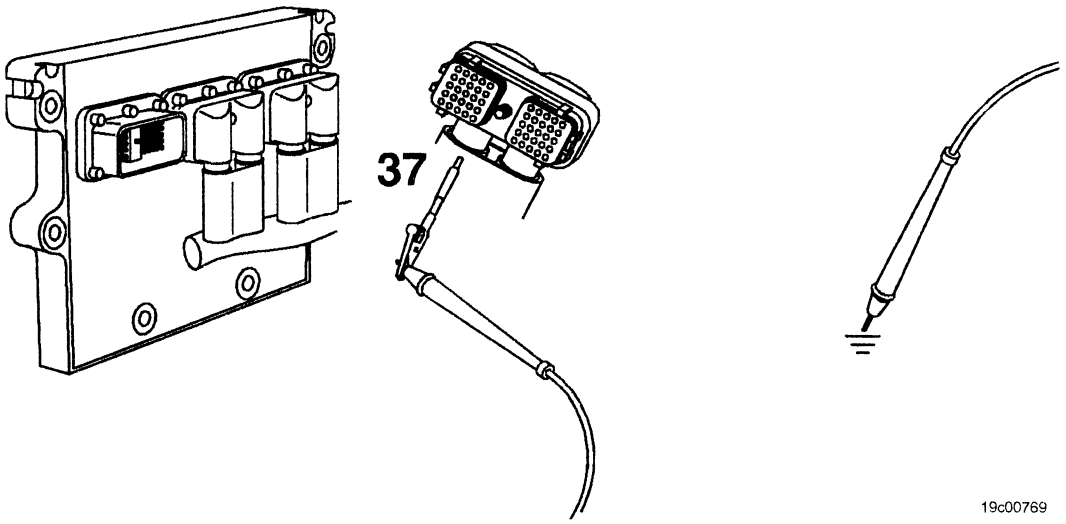
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the OEM harness connector from the ECM.
- Disconnect the J1939 harness from the VECU(s).

Action	Specifications/Repair	Next Step
Check for a short to ground in the return wire. • Measure the resistance from pin 37 in the OEM harness connector to ground.	**OK** **More than 100k ohms**	3I
	NOT OK **Repair or replace the OEM harness** • Repair the OEM harness. Refer to Procedure 019-250. • Replace the OEM harness. Refer to Procedure 019-071.	5A



STEP 3I: Check for a short circuit from pin to pin in the OEM connector.

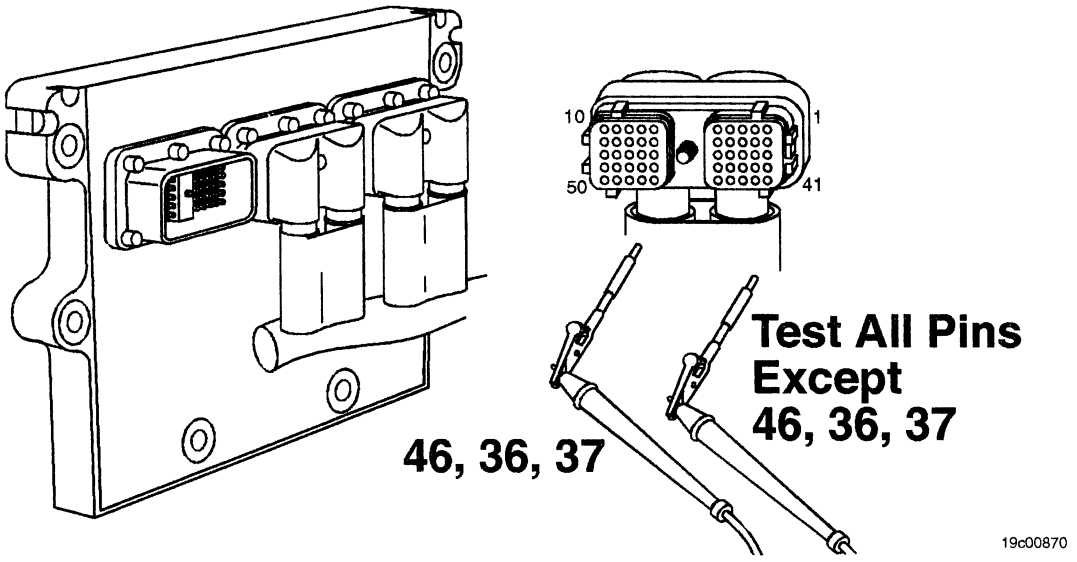
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the OEM harness connector from the ECM.
- Disconnect the J1939 harness from the VECU(s).

Action	Specifications/Repair	Next Step
Check for a short from pin to pin in the OEM connector. • Measure the resistance from pin 46 in the OEM harness connector to all other pins in the connector, except pins 36 and 37. • Measure the resistance from pin 36 in the OEM harness connector to all other pins in the connector, except pins 46 and 37. • Measure the resistance from pin 37 in the OEM harness connector to all other pins in the connector, except pins 36 and 46.	**OK** **More than 100k ohms**	4A
	NOT OK **Repair or replace the OEM harness** • Repair the OEM harness. Refer to Procedure 019-250. • Replace the OEM harness. Refer to Procedure 019-071.	5A



STEP 4: Check for malfunctioning J1939 devices.

STEP 4A: Check communication between the ECM and the multiplex devices.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:
- Install INSITE™.
- Install INLINE 2™ datalink adapter.
- Disconnect all J1939 devices from the J1939 datalink.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check communication with ECM using INSITE over J1939. • Using INSITE™, confirm communication between ECM and multiplexing devices.	**OK** **Established communication**	4A-1
	NOT OK **Replace the ECM** Refer to Procedure 019-031.	5A

STEP 4A-1: Check for malfunctioning J1939 devices.

Condition:
- Install INSITE™.
- Install INLINE 2™ datalink adapter.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check for malfunctioning J1939 devices. • Disconnect J1939 devices from the J1939 backbone one-by-one until communication can be established using INSITE™. **NOTE: BEFORE** disconnecting J1939 devices, remember to turn keyswitch OFF, so ECM will **not** register fault code.	**OK** **Proper communication between J1939 devices and J1939 backbone**	5A
	NOT OK **Replace malfunctioning J1939 device** Refer to OEM troubleshooting and repair manual for repair procedures.	5A

STEP 5: Clear the fault codes.

STEP 5A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it idle for 1 minute. • Using INSITE™, verify that Fault Code 426 is inactive.	**OK** **Fault Code 426 inactive**	5B
	NOT OK Return to the troubleshooting steps or contact your local Cummins Authorized Repair Location if all the steps have been completed and checked again.	1A

STEP 5B: Clear the inactive fault codes.

Condition:
- Connect all the components.
- Turn keyswitch ON.

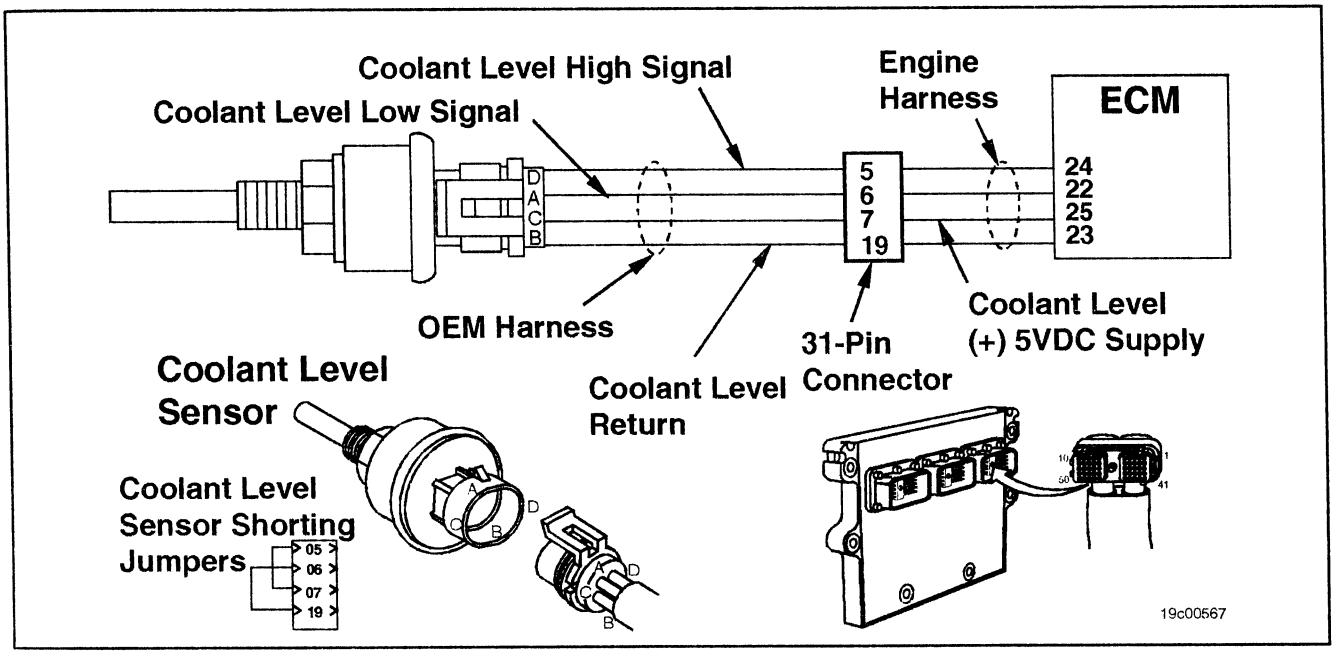
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 422

Coolant Level Sensor Circuit

CODES	REASON	EFFECT
Fault Code: 422 PID(P), SID(S): P111 SPN: 111 FMI: 2/2 Lamp: Yellow	Voltage detected simultaneously on both the coolant level high and low signal circuits **or** no voltage detected on **both** circuits.	No engine protection for coolant level.

Coolant Level Sensor Circuit



Circuit Description:

The coolant level sensor monitors the coolant level within the coolant system and passes information to the electronic control module (ECM) through the sensor harness. This sensor is very complex. Do **not** use a multimeter to check the coolant level sensor. If the radiator coolant level drops below a certain level, a power derate will occur and become greater as time goes by.

Component Location:

The coolant level sensor is located in the radiator top tank or surge tank.

Shop Talk:

Possible causes for this fault code include:

- Open circuit
- Short circuit to ground
- Short circuit to another wire.

TROUBLESHOOTING SUMMARY

⚠ WARNING ⚠

Do not remove the pressure cap from a hot engine. Wait until the coolant temperature is below 50°C [122°F] before removing the pressure cap. Heated coolant spray or steam can cause personal injury.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead
Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead
Part No. 3823995 - male Weather-Pack test lead.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check for multiple fault codes and the presence of the coolant level sensor.		
STEP 1A: Read the fault codes.	Fault Code 187 inactive	
STEP 1B: Check if vehicle has a coolant level sensor.	Coolant level sensor present	
STEP 1B-1: Check if a shorting plug is installed in place of the coolant level sensor harness connection.	Shorting plug installed	
STEP 2: Check the coolant level sensor.		
STEP 2A: Inspect the harness and coolant level sensor connectors.	No damaged pins	
STEP 2B: Inspect the harness and ECM connectors.	No damaged pins	
STEP 2C: Check for an open circuit in the coolant level sensor circuit.	Less than 10 ohms	
STEP 2C-1: Inspect the 31-pin Deutsch connector pins.	No damaged pins	
STEP 2C-2: Check for an open circuit in the engine harness.	Less than 10 ohms	
STEP 2C-3: Check for an open circuit in the OEM harness.	Less than 10 ohms	
STEP 3: Check for a short circuit to ground in the signal wires.		
STEP 3A: Check for a short circuit to ground in the coolant level signal wires.	More than 100k ohms	
STEP 3A-1: Check for a short circuit to ground in the engine harness.	More than 100k ohms	
STEP 3A-2: Check for a short circuit to ground in the OEM harness.	More than 100k ohms	
STEP 4: Check for a short circuit between the signal wires and any other wires in the engine harness or OEM harness.		
STEP 4A: Check for a short circuit between the signal wires and any other wires in the engine harness or OEM harness.	More than 100k ohms	

STEP 4A-1: Check for a short circuit in the engine harness. — More than 100k ohms

STEP 4A-2: Check for a short circuit in the OEM harness. — More than 100k ohms

STEP 5: Check for a short circuit to ground in the supply wires.

STEP 5A: Check for a short circuit to ground in the supply wires. — More than 100k ohms

STEP 5A-1: Check for a short circuit in the engine harness. — More than 100k ohms

STEP 5A-2: Check for a short circuit in the OEM harness. — More than 100k ohms

STEP 6: Clear the fault codes.

STEP 6A: Disable the fault code. — Fault Code 422 inactive

STEP 6B: Clear the inactive fault codes. — All fault codes cleared

TROUBLESHOOTING STEP

STEP 1: Check for multiple fault codes and the presence of the coolant level sensor.

STEP 1A: Read the fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the active fault codes. • Read fault codes using INSITE™.	**OK** **Fault Code 187 inactive**	1B
	NOT OK Fault Code 187 active.	Fault Code 187

STEP 1B: Check if vehicle has a coolant level sensor.

⚠WARNING⚠

Do not remove the pressure cap from a hot engine. Wait until the coolant temperature is below 50°C [122°F] before removing the pressure cap. Heated coolant spray or steam can cause personal injury.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Check to see if the vehicle has a coolant level sensor.	**OK** **Coolant level sensor present**	2A
	NOT OK	1B-1

STEP 1B-1: Check if a shorting plug is installed in place of the coolant level sensor harness connection.

⚠WARNING⚠

Do not remove the pressure cap from a hot engine. Wait until the coolant temperature is below 50°C [122°F] before removing the pressure cap. Heated coolant spray or steam can cause personal injury.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Check if a shorting plug is installed in place of the coolant level sensor harness connection. **NOTE:** Check the OEM wiring from the shorting plug to the engine harness connection for problems. Refer to the OEM and the engine harness wiring diagrams.	**OK** **Shorting plug installed**	2A
	NOT OK **Install the shorting plug**	6A

STEP 2: Check the coolant level sensor.

STEP 2A: Inspect the harness and the coolant level sensor connectors.

⚠WARNING⚠

Do not remove the pressure cap from a hot engine. Wait until the coolant temperature is below 50°C [122°F] before removing the pressure cap. Heated coolant spray or steam can cause personal injury.

Condition:
- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.
- Disconnect the OEM harness from the coolant level sensor.

Action	Specifications/Repair	Next Step
Inspect the harness and the coolant level sensor connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	2B
	NOT OK **Repair the damaged pins** Repair or replace the OEM harness, or replace the coolant level sensor, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the OEM harness. Refer to Procedure 019-204 or 019-231. • Replace the OEM harness. Refer to Procedure 019-071. • Replace the coolant level sensor. Refer to Procedure 019-017.	6A

STEP 2B: Inspect the harness and the ECM connectors.

⚠WARNING⚠

Do not remove the pressure cap from a hot engine. Wait until the coolant temperature is below 50°C [122°F] before removing the pressure cap. Heated coolant spray or steam can cause personal injury.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Inspect the harness and the ECM connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	2C
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	6A

STEP 2C: Check for an open circuit in the coolant level sensor circuit.

⚠WARNING⚠

Do not remove the pressure cap from a hot engine. Wait until the coolant temperature is below 50°C [122°F] before removing the pressure cap. Heated coolant spray or steam can cause personal injury.

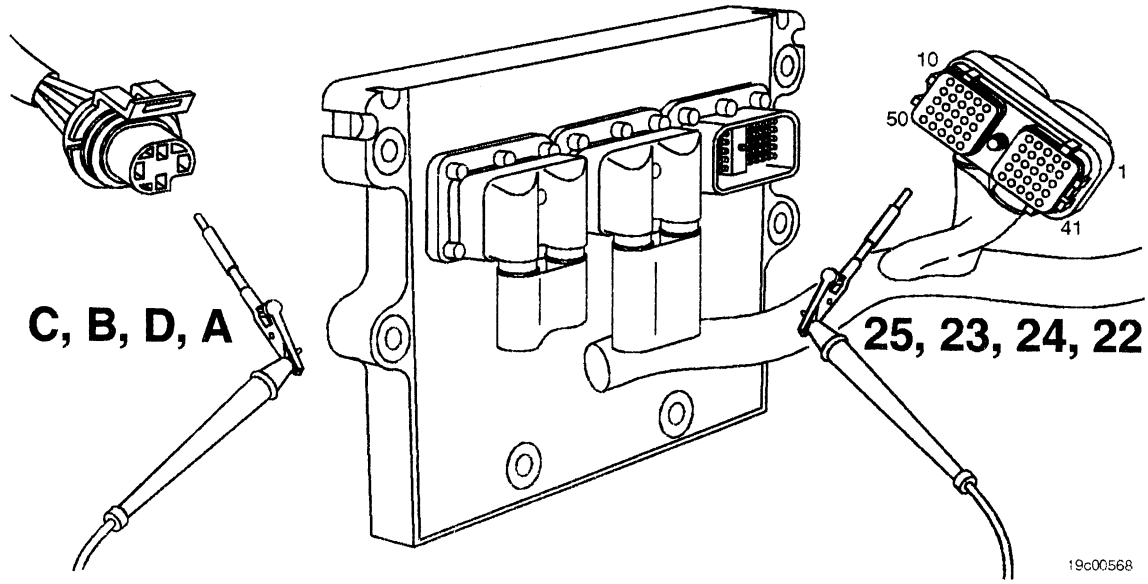
⚠CAUTION⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead
Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.
- Disconnect the OEM harness from the coolant level sensor.

Action	Specifications/Repair	Next Step
Check for an open circuit in the coolant level sensor circuit. • Measure the resistance from pin 25 in the sensor harness connector to pin C (or 3) on the harness side of the coolant level sensor connector. • Measure the resistance from pin 23 in the sensor harness connector to pin B (or 2) on the harness side of the coolant level sensor connector. • Measure the resistance from pin 24 in the sensor harness connector to pin D (or 4) on the harness side of the coolant level sensor connector. • Measure the resistance from pin 22 in the sensor harness connector to pin A (or 1) on the harness side of the coolant level sensor connector.	**OK** **Less than 10 ohms**	3A
	NOT OK	2C-1



STEP 2C-1: Inspect the 31-pin Deutsch connector pins.

⚠WARNING⚠

Do not remove the pressure cap from a hot engine. Wait until the coolant temperature is below 50°C [122°F] before removing the pressure cap. Heated coolant spray or steam can cause personal injury.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.
- Disconnect the OEM harness from the coolant level sensor.
- Disconnect the engine harness from the OEM harness at the Deutsch 31-pin connector.

Action	Specifications/Repair	Next Step
Inspect the harness and the sensor connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	2C-2
	NOT OK **Repair the damaged pins** Repair or replace the engine harness or the OEM harness, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-231. • Replace the engine harness. Refer to Procedure 019-043. • Repair the OEM harness. Refer to Procedure 019-231 or 019-250. • Replace the OEM harness. Refer to Procedure 019-071.	6A

STEP 2C-2: Check for an open circuit in the engine harness.

⚠WARNING⚠

Do not remove the pressure cap from a hot engine. Wait until the coolant temperature is below 50°C [122°F] before removing the pressure cap. Heated coolant spray or steam can cause personal injury.

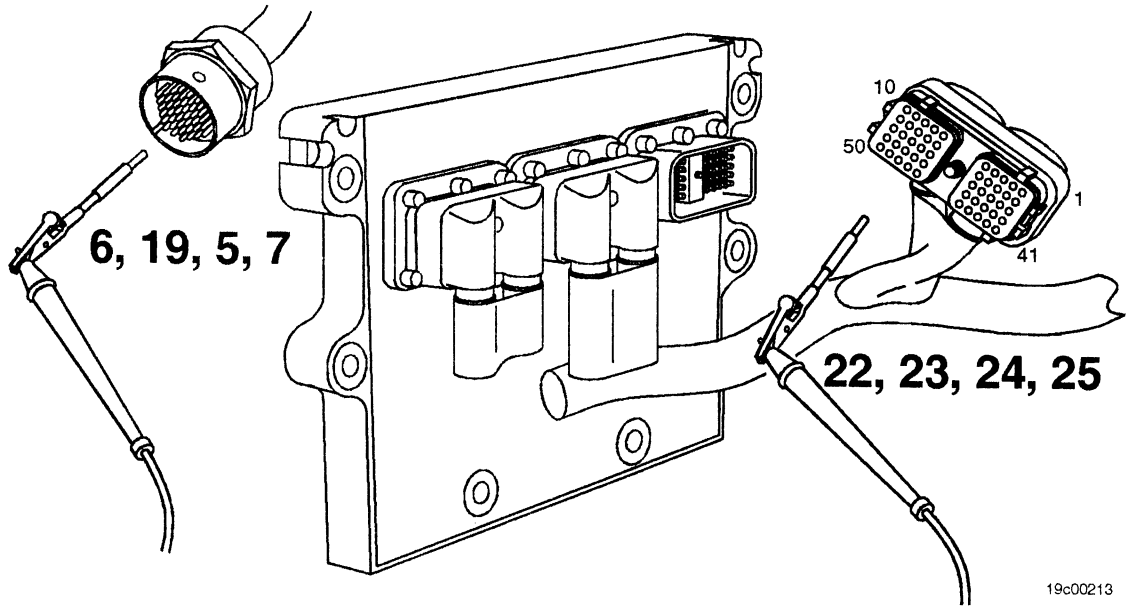
⚠CAUTION⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead
Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.
- Disconnect the OEM harness from the coolant level sensor.
- Disconnect the engine harness from the OEM harness at the Deutsch 31-pin connector.

Action	Specifications/Repair	Next Step
Check for an open circuit in the engine harness. • Measure the resistance from pin 22 in the sensor harness connector to pin 6 on the engine harness side of the 31-pin connector. • Measure the resistance from pin 23 in the sensor harness connector to pin 19 on the engine harness side of the 31-pin connector. • Measure the resistance from pin 24 in the sensor harness connector to pin 5 on the engine harness side of the 31-pin connector. • Measure the resistance from pin 25 in the sensor harness connector to pin 7 on the engine harness side of the 31-pin connector.	**OK** **Less than 10 ohms**	2C-3
	NOT OK **Repair or replace the engine harness or OEM harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Repair the OEM harness. Refer to Procedure 019-231. • Replace the OEM harness. Refer to Procedure 019-071.	6A



STEP 2C-3: Check for an open circuit in OEM harness.

⚠WARNING⚠

Do not remove the pressure cap from a hot engine. Wait until the coolant temperature is below 50°C [122°F] before removing the pressure cap. Heated coolant spray or steam can cause personal injury.

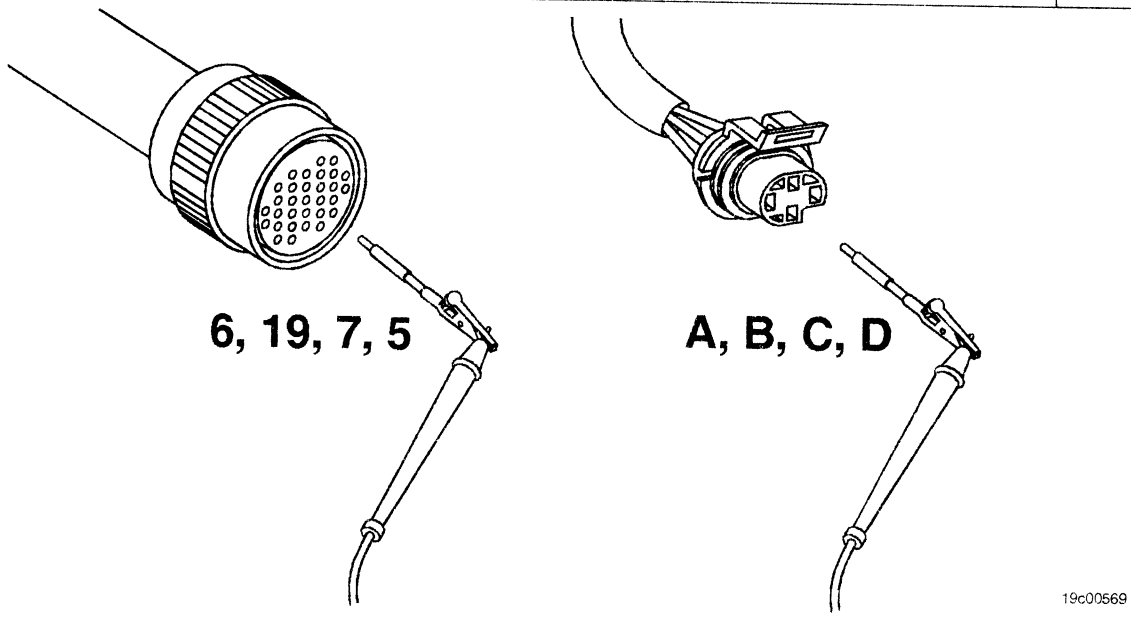
△CAUTION△

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead
Part No. 3823995 - male Weather-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the engine harness from the OEM harness at the Deutsch 31-pin connector.
- Disconnect the OEM harness at the Weather-Pack four-way connector.

Action	Specifications/Repair	Next Step
Check for an open circuit in the OEM harness. • Measure the resistance from pin 6 on the OEM wiring harness side of the 31-pin connector to pin A (or 1) on the OEM harness side of the 4-pin connector. • Measure the resistance from pin 19 on the OEM wiring harness side of the 31-pin connector to pin B (or 2) on the OEM harness side of the 4-pin connector. • Measure the resistance from pin 7 on the OEM wiring harness side of the 31-pin connector to pin C (or 3) on the OEM harness side of the 4-pin connector. • Measure the resistance from pin 5 on the OEM wiring harness side of the 31-pin connector to pin D (or 4) on the OEM harness side of the 4-pin connector.	**OK** **Less than 10 ohms**	3A
	NOT OK **Repair or replace the OEM harness** • Repair the OEM harness. Refer to Procedure 019-204 or 019-231. • Replace the OEM harness. Refer to Procedure 019-071.	6A



STEP 3: Check for a short circuit to ground in the signal wires.

STEP 3A: Check for a short circuit to ground in the coolant level sensor signal wires.

⚠WARNING⚠

Do not remove the pressure cap from a hot engine. Wait until the coolant temperature is below 50°C [122°F] before removing the pressure cap. Heated coolant spray or steam can cause personal injury.

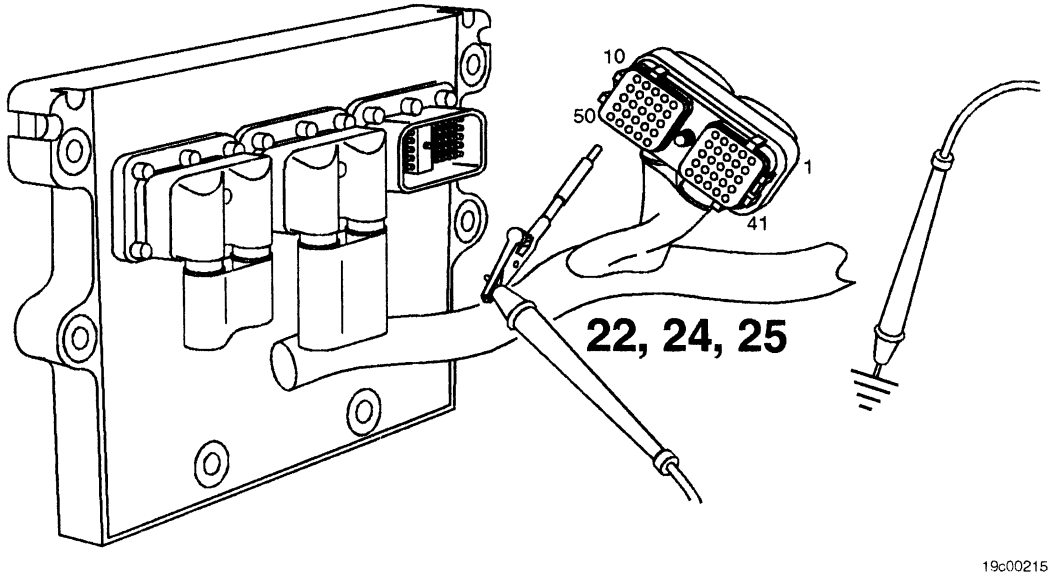
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.
- Disconnect the OEM harness from the coolant level sensor.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground in the coolant level sensor signal wires. • Measure the resistance from pin 22 to engine block ground. • Measure the resistance from pin 24 to engine block ground. • Measure the resistance from pin 25 to engine block ground.	**OK** **More than 100k ohms**	4A
	NOT OK Does **not** meet specifications.	3A-1



STEP 3A-1: Check for a short circuit to ground in the engine harness.

⚠WARNING⚠

Do not remove the pressure cap from a hot engine. Wait until the coolant temperature is below 50°C [122°F] before removing the pressure cap. Heated coolant spray or steam can cause personal injury.

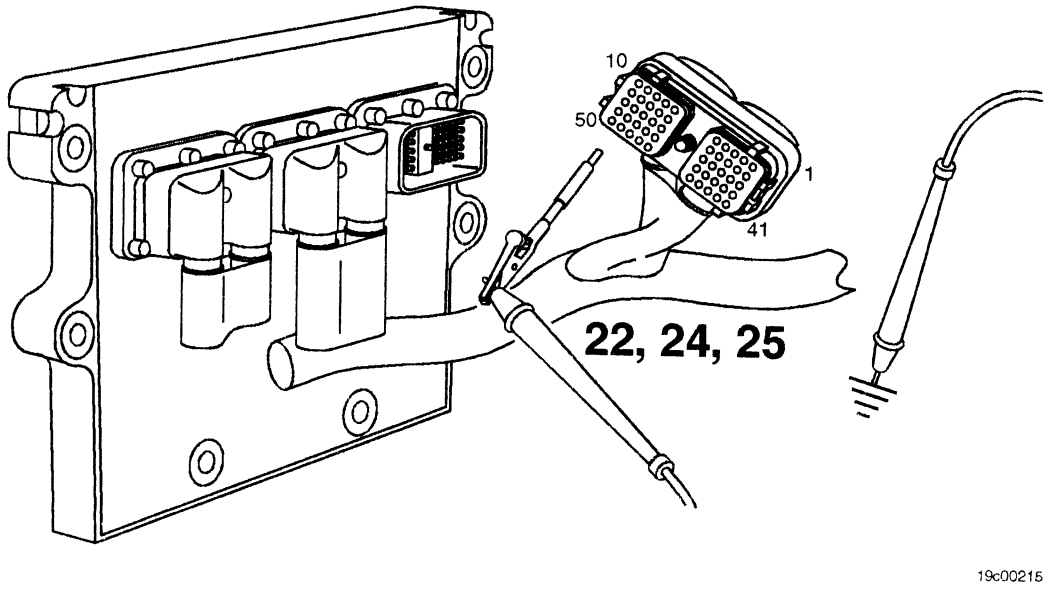
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.
- Disconnect the OEM harness from the coolant level sensor.
- Disconnect the engine harness from the OEM harness at the Deutsch 31-pin connector.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground in the engine harness. • Measure the resistance from pin 22 in the sensor harness connector to the engine block ground. • Measure the resistance from pin 24 in the sensor harness connector to the engine block ground. • Measure the resistance from pin 25 in the sensor harness connector to the engine block ground.	**OK** **More than 100k ohms**	3A-2
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	6A



19c00215

STEP 3A-2: Check for a short circuit to ground in the OEM harness.

⚠WARNING⚠

Do not remove the pressure cap from a hot engine. Wait until the coolant temperature is below 50°C [122°F] before removing the pressure cap. Heated coolant spray or steam can cause personal injury.

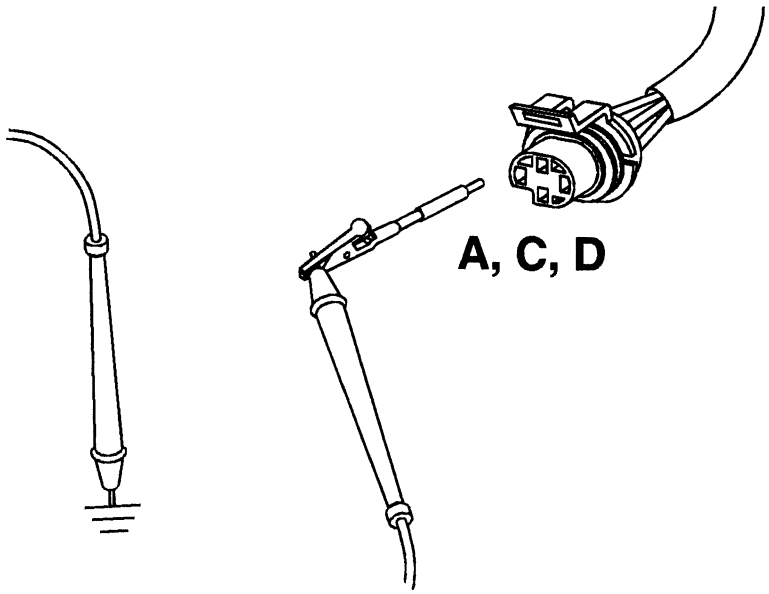
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3823995 - male Weather-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the OEM harness from the coolant level sensor.
- Disconnect the engine harness from the OEM harness at the 31-pin Deutsch connector.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground in the OEM harness. • Measure the resistance from pin A (or 1) on the OEM harness side of the 4-pin connector to engine block ground. • Measure the resistance from pin C (or 3) on the OEM harness side of the 4-pin connector to engine block ground. • Measure the resistance from pin D (or 4) on the OEM harness side of the 4-pin connector to engine block ground.	**OK** **More than 100k ohms**	4A
	NOT OK **Repair or replace the OEM harness** • Repair the OEM harness. Refer to Procedure 019-204 or 019-231. • Replace the OEM harness. Refer to Procedure 019-071.	6A



19c00216

STEP 4: Check for a short circuit between the signal wires and any other wires in the engine harness or OEM harness.

STEP 4A: Check for a short circuit between the signal wires and any other wires in the engine harness or OEM harness.

⚠WARNING⚠

Do not remove the pressure cap from a hot engine. Wait until the coolant temperature is below 50°C [122°F] before removing the pressure cap. Heated coolant spray or steam can cause personal injury.

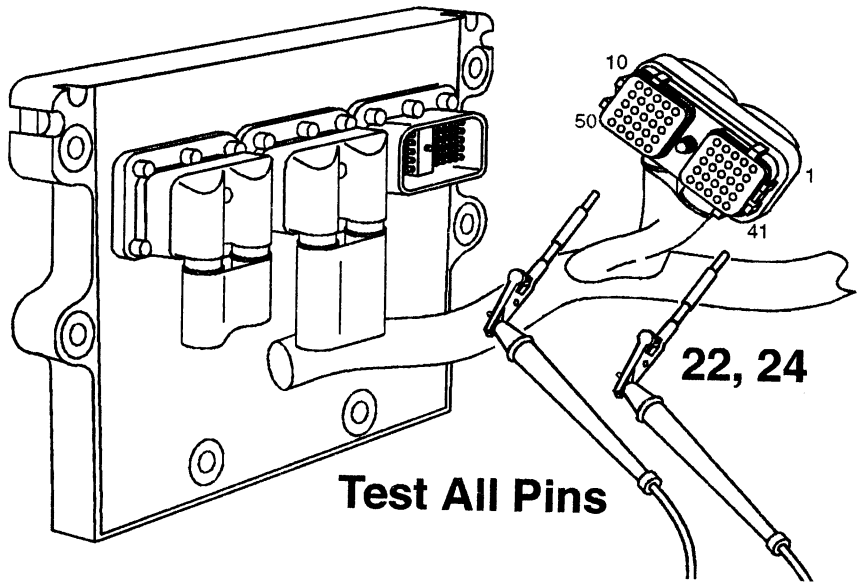
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.
- Disconnect the OEM connector from the coolant level sensor.

Action	Specifications/Repair	Next Step
Check for a short circuit between the signal wires and any other wires in the OEM harness or engine harness. • Measure the resistance from pin 22 of the sensor harness connector to all other pins in the connector. • Measure the resistance from pin 24 of the sensor harness connector to all other pins in the connector.	**OK** **More than 100k ohms** **Replace the coolant level sensor** Refer to Procedure 019-017.	6A
	NOT OK	4A-1



STEP 4A-1: Check for a short circuit in the engine harness.

⚠WARNING⚠

Do not remove the pressure cap from a hot engine. Wait until the coolant temperature is below 50°C [122°F] before removing the pressure cap. Heated coolant spray or steam can cause personal injury.

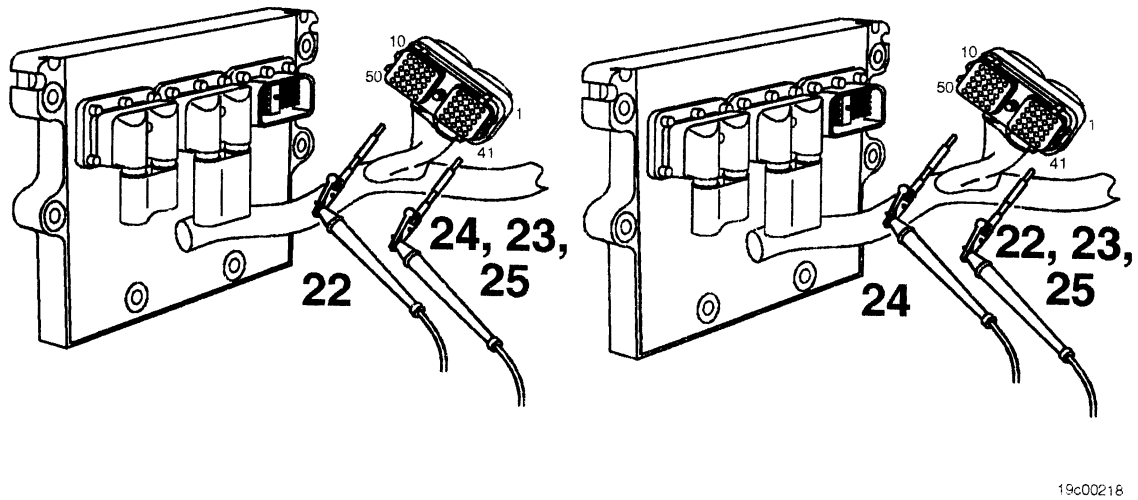
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.
- Disconnect the OEM connector from the coolant level sensor.
- Disconnect the engine harness from the OEM harness at the 31-pin Deutsch connector.

Action	Specifications/Repair	Next Step
Check for a short circuit in the engine harness. • Measure the resistance from pin 22 in the sensor harness connector to pins 24, 23, and 25. • Measure the resistance from pin 24 in the sensor harness connector to pins 22, 23, and 25.	**OK** **More than 100k ohms**	4A-2
	NOT OK **Repair or replace the engine or OEM harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Repair the OEM harness. Refer to OEM troubleshooting and repair manual. • Replace the OEM harness. Refer to the OEM troubleshooting and repair manual.	6A



19c00218

STEP 4A-2: Check for a short circuit in the OEM harness.

⚠WARNING⚠

Do not remove the pressure cap from a hot engine. Wait until the coolant temperature is below 50°C [122°F] before removing the pressure cap. Heated coolant spray or steam can cause personal injury.

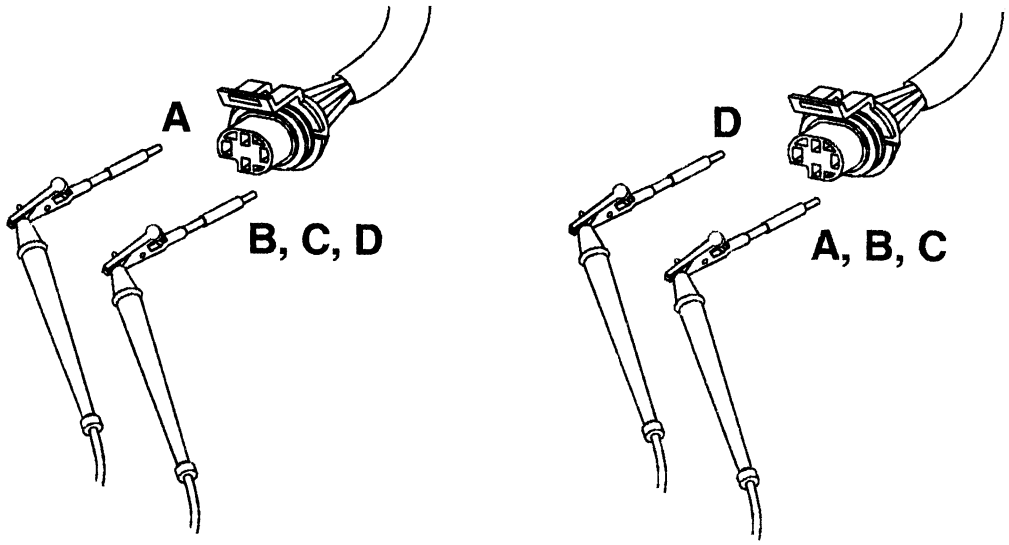
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3823995 - male Weather-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the OEM harness from the coolant level sensor.
- Disconnect the OEM harness at the OEM side of the Deutsch 31-pin connector.

Action	Specifications/Repair	Next Step
Check for a short circuit in the OEM harness. • Measure the resistance from pin A (or 1) in the OEM harness connector to pins B (or 2), C (or 3), and D (or 4). • Measure the resistance from pin D (or 4) in the OEM harness connector to pins A (or 1), B (or 2), and C (or 3).	**OK** **More than 100k ohms**	5A
	NOT OK **Repair or replace the OEM harness** • Repair the OEM harness. Refer to the OEM troubleshooting and repair manual. • Replace the OEM harness. Refer to the OEM troubleshooting and repair manual.	6A



19c00219

STEP 5: Check for a short circuit to ground in the supply wires.

STEP 5A: Check for a short circuit to ground in the supply wires.

⚠WARNING⚠

Do not remove the pressure cap from a hot engine. Wait until the coolant temperature is below 50°C [122°F] before removing the pressure cap. Heated coolant spray or steam can cause personal injury.

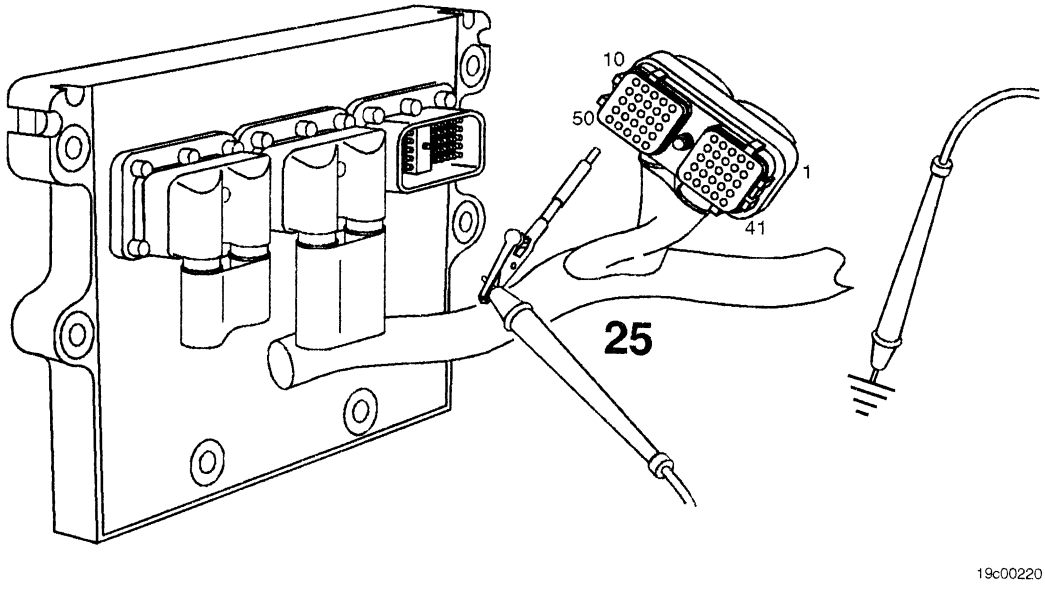
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.
- Disconnect the OEM harness from the coolant level sensor.

Action	Specifications/Repair	Next Step
Check for a short circuit between the supply wire and ground. • Measure the resistance from pin 25 in the sensor harness connector to engine block ground.	**OK** **More than 100k ohms**	5A-1
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	6A



19c00220

STEP 5A-1: Check for a short circuit in the engine harness.

⚠WARNING⚠

Do not remove the pressure cap from a hot engine. Wait until the coolant temperature is below 50°C [122°F] before removing the pressure cap. Heated coolant spray or steam can cause personal injury.

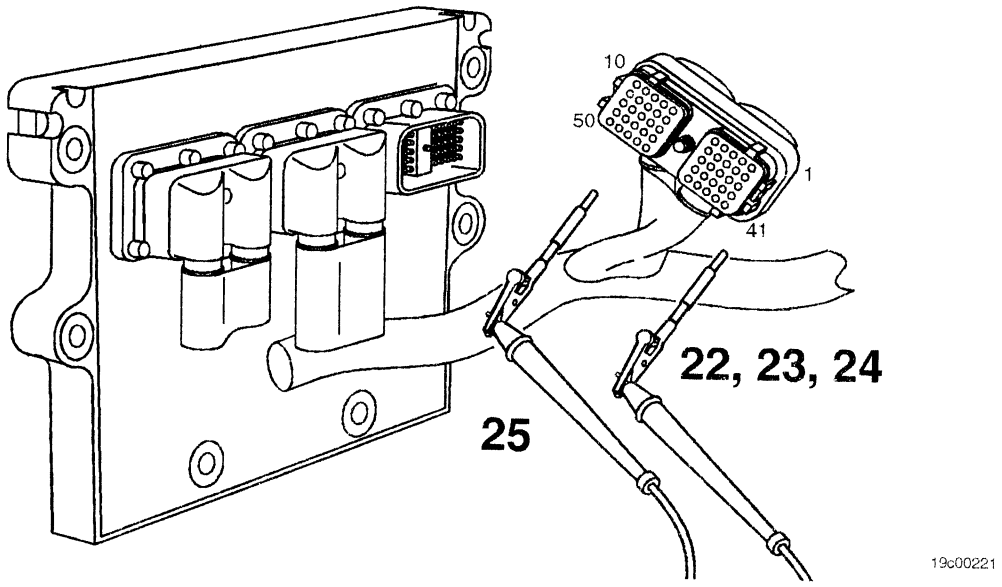
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.
- Disconnect the OEM harness from the coolant level sensor.
- Disconnect the sensor harness from the OEM harness at the Deutsch 31-pin connector.

Action	Specifications/Repair	Next Step
Check for a short circuit in the engine harness. • Measure the resistance from pin 25 in the sensor harness connector to pins 22, 23, and 24.	**OK** **More than 100k ohms**	5A-2
	NOT OK **Repair or replace the engine or OEM harnesses** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Repair the OEM harness. Refer to OEM troubleshooting and repair manual. • Replace the OEM harness. Refer to the OEM troubleshooting and repair manual.	6A



STEP 5A-2: Check for a short circuit in the OEM harness.

⚠WARNING⚠

Do not remove the pressure cap from a hot engine. Wait until the coolant temperature is below 50°C [122°F] before removing the pressure cap. Heated coolant spray or steam can cause personal injury.

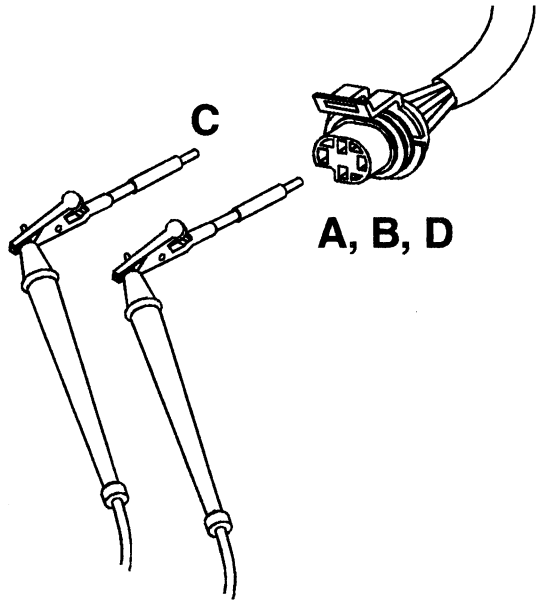
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3823995 - male Weather-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.
- Disconnect the OEM harness from the coolant level sensor.
- Disconnect the sensor harness from the OEM harness at the Deutsch 31-pin connector.
- Disconnect the OEM harness at the Weather-Pack four-way connector.

Action	Specifications/Repair	Next Step
Check for a short circuit in the OEM harness. • Measure the resistance from pin C (or 3) in the OEM harness connector to pins A (or 1), B (or 2), and D (or 4).	**OK** **More than 100k ohms**	6A
	NOT OK **Repair or replace the OEM harness** • Repair the OEM harness. Refer to the OEM troubleshooting and repair manual. • Replace the OEM harness. Refer to the OEM troubleshooting and repair manual.	6A



19c00222

STEP 6: Clear the fault codes.

STEP 6A: Disable the fault code.

⚠WARNING⚠

Do not remove the pressure cap from a hot engine. Wait until the coolant temperature is below 50°C [122°F] before removing the pressure cap. Heated coolant spray or steam can cause personal injury.

Condition:

- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it idle for 1 minute. • Using INSITE™, verify that Fault Code 422 is inactive.	**OK** **Fault Code 422 inactive**	6B
	NOT OK Return to troubleshooting steps or contact your local Cummins Authorized Repair Location if all steps have been completed and checked again.	1A

STEP 6B: Clear the inactive fault codes.

⚠WARNING⚠

Do not remove the pressure cap from a hot engine. Wait until the coolant temperature is below 50°C [122°F] before removing the pressure cap. Heated coolant spray or steam can cause personal injury.

Condition:

- Connect all components.
- Turn keyswitch ON.

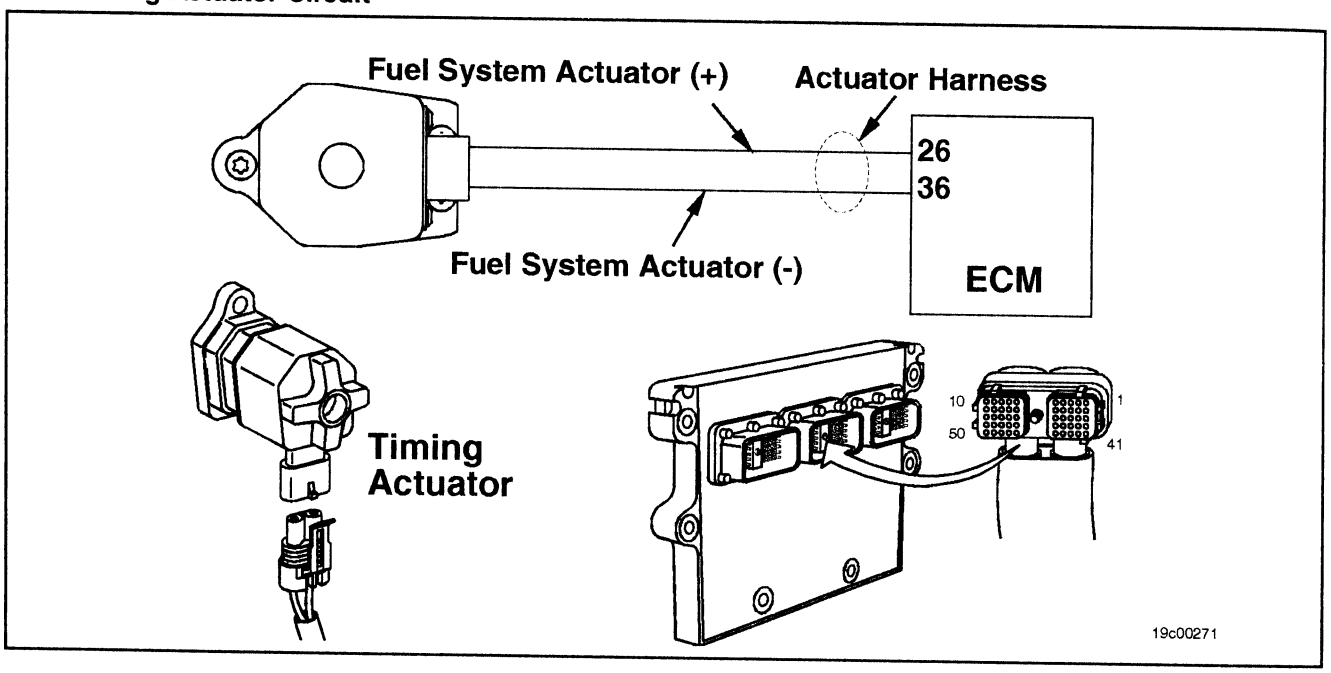
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 399

Actuator Circuit

CODES	REASON	EFFECT
Fault Code: 399 PID(P), SID(S): S084 SPN: 1245 FMI: 6/6 Lamp: Yellow	High current detected at rear timing actuator circuit.	Engine is run using **only** the front three cylinders.

Rear Timing Actuator Circuit



Circuit Description:

The timing actuators are actuated by the electronic control module (ECM) to control fuel timing. Each timing actuator is connected to the ECM by a supply and a return wire. An electrical pulse is sent to the timing actuator from the ECM on the supply wire and returns to the ECM on the return wire. Each solenoid valve is normally closed, and it is **only** opened by an electrical pulse from the ECM during metering.

Component Location:

The rear timing actuator is mounted on the fuel delivery housing. It is the third actuator from the front of the engine.

Shop Talk:

The possible failure modes are short circuit to battery, low actuator resistance, or short circuit between supply and return.

TROUBLESHOOTING SUMMARY

⚠ WARNING ⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

⚠ CAUTION ⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the actuator harness.		
STEP 1A: Inspect the harness and ECM connector pins.	No damaged pins	
STEP 1B: Check the resistance of the whole circuit.	Less than 10 ohms	
STEP 1B-1: Inspect the actuator harness and connector pins.	No damaged pins	
STEP 1B-2: Check the resistance of the actuator solenoid.	0.87 ohm at -17°C [0° F] to 1.73 ohms at 54°C [130°F] 1.10 ohms at 38°C [100°F] to 1.97 ohms at 93°C [200°F]	
STEP 1C: Check for a short circuit to battery in the circuit.	More than 100k ohms	
STEP 1D: Check for a short circuit from pin to pin in the ECM connector.	More than 100k ohms	
STEP 2: Clear the fault codes.		
STEP 2A: Disable the fault code.	Fault Code 399 is inactive	
STEP 2B: Clear the inactive fault codes.	All fault codes cleared	

TROUBLESHOOTING STEP

STEP 1: Check the actuator harness.

STEP 1A: Inspect the harness and ECM connector pins.

⚠WARNING⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness connector from the ECM.

Action	Specifications/Repair	Next Step
Inspect the harness and ECM connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	1B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	2A

STEP 1B: Check the resistance of the whole circuit.

⚠WARNING⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

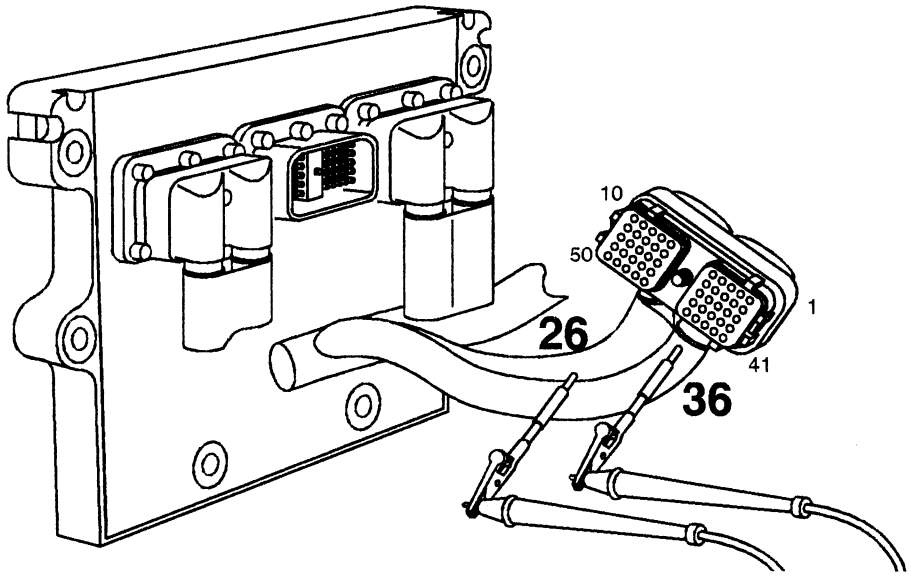
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check the resistance of the whole circuit. • Measure the resistance from pin 26 to pin 36 of the actuator harness connector.	**OK** **Less than 10 ohms**	1B-1
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	2A



STEP 1B-1: Inspect the actuator harness and connector pins.

⚠WARNING⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness from the timing actuator solenoid.

Action	Specifications/Repair	Next Step
Inspect the actuator harness and connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	1B-2
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	2A

STEP 1B-2: Check the resistance of the actuator solenoid.

⚠WARNING⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

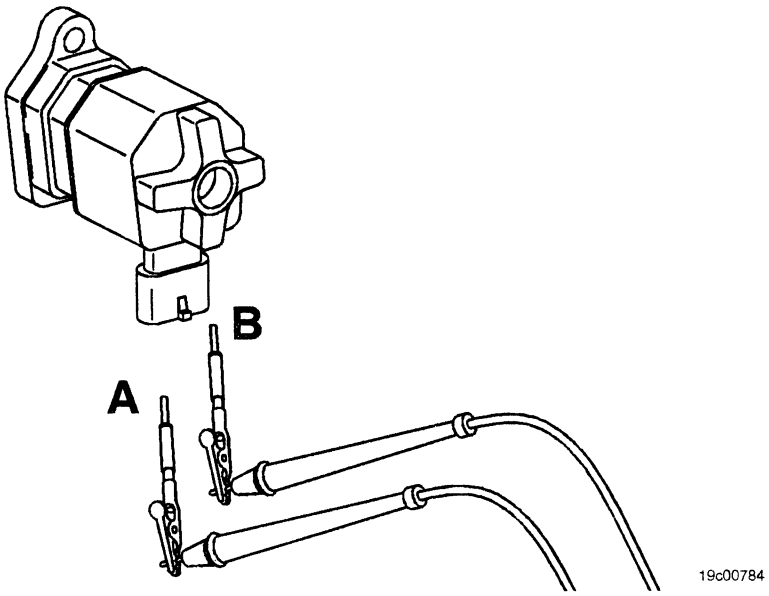
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness from the timing actuator solenoid.

Action	Specifications/Repair	Next Step
Check the resistance of the actuator solenoid. • Measure the resistance across the two terminals on the timing actuator solenoid.	**OK** **0.87 ohm at -17°C [0°F]** **to 1.73 ohms at 54°C [130°F]** **1.10 ohms at 38°C [100°]** **to 1.97 ohms at 93°C [200°F]**	1C
	NOT OK **Replace the rear timing actuator solenoid** Refer to Procedure 019-111.	2A



STEP 1C: Check for a short circuit to battery in the circuit.

⚠WARNING⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

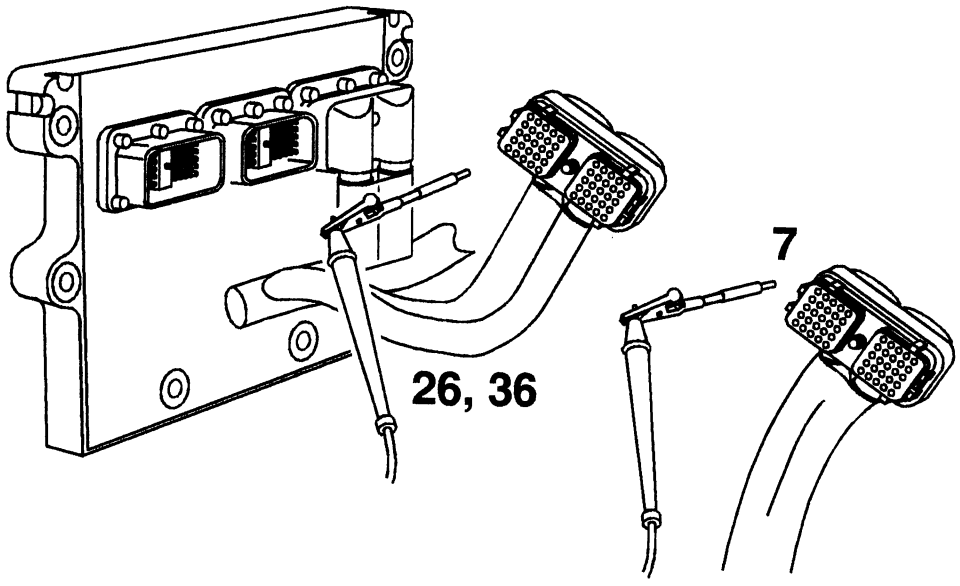
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness from the timing actuator solenoid.
- Disconnect the OEM harness connector from the ECM.
- Disconnect the actuator harness connector from the ECM.
- Disconnect the positive (+) battery terminal from battery.

Action	Specifications/Repair	Next Step
Check for a short circuit to battery in the circuit. • Measure the resistance between actuator harness connector pins 26 and 36 to pin 7 of the OEM harness connector.	**OK** **More than 100k ohms**	1D
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	2A



STEP 1D: Check for a short circuit from pin to pin in the ECM connector.

⚠WARNING⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

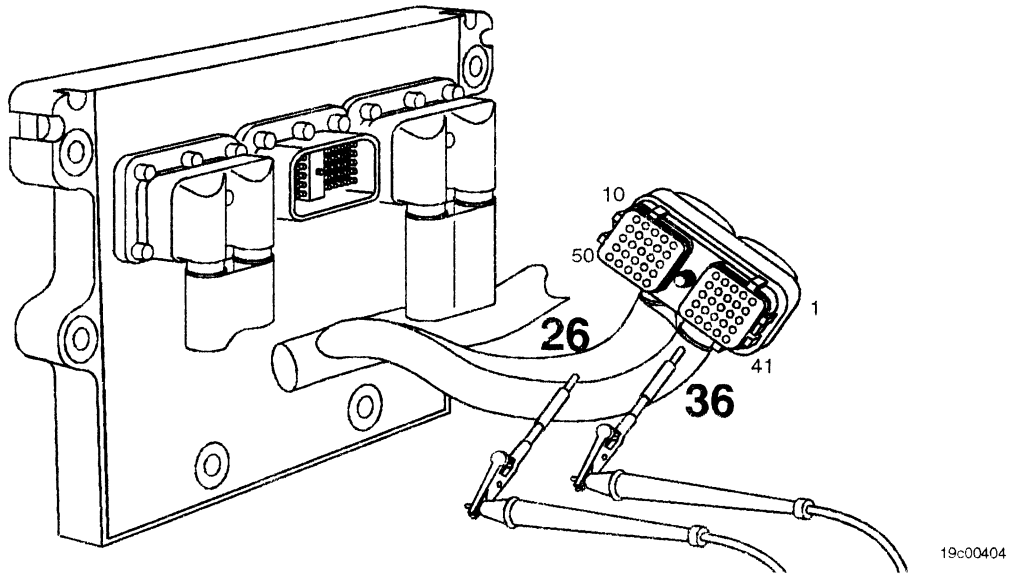
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness connector from the ECM.
- Disconnect the actuator harness from the timing actuator solenoid.

Action	Specifications/Repair	Next Step
Check for short circuit from pin to pin in the ECM connector. • Measure the resistance from pin 26 in the actuator harness connector to all other pins in the connector. • Measure the resistance from pin 36 in the actuator harness connector to all other pins in the connector.	**OK** **More than 100k ohms**	2A
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	2A



STEP 2: Clear the fault codes.

STEP 2A: Disable the fault code.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and road test it for at least 1 mile. • Using INSITE™, verify that Fault Code 399 is inactive.	**OK** **Fault Code 399 inactive**	2B
	NOT OK **Fault Code 399 active** **Replace the ECM** Refer to Procedure 019-031.	2B

STEP 2B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

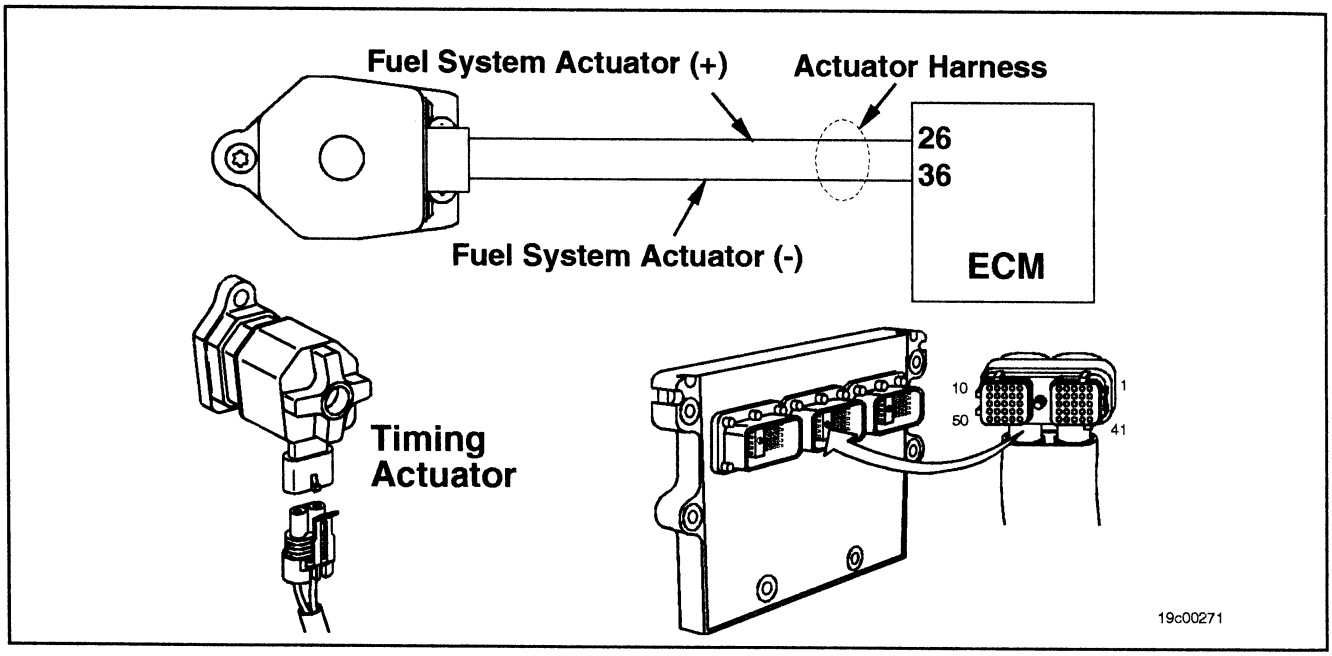
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 398

Actuator Circuit

CODES	REASON	EFFECT
Fault Code: 398 PID(P), SID(S): S084 SPN: 1245 FMI: 5/5 Lamp: Yellow	Low current or open circuit detected at rear timing actuator circuit.	Engine is run using **only** the front three cylinders.

Rear Timing Actuator Circuit



Circuit Description:

The timing actuators are actuated by the electronic control module (ECM) to control fuel metering. Each timing actuator is connected to the ECM by a supply and a return wire. An electrical pulse is sent to the timing actuator from the ECM on the supply wire and returns to the ECM on the return wire. Each solenoid valve is normally closed, and it is **only** opened by an electrical pulse from the ECM during metering.

Component Location:

The rear timing actuator is mounted on the fuel delivery housing. It is the third actuator from the front of the engine.

Shop Talk:

The possible failure modes are an open circuit, a short circuit to ground, high actuator resistance, and loss of boost voltage inside of ECM.

TROUBLESHOOTING SUMMARY

⚠ WARNING ⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

⚠ CAUTION ⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the actuator harness.		
STEP 1A: Inspect the harness and ECM connector pins.	No damaged pins	
STEP 1B: Check the resistance of the whole circuit.	Less than 10 ohms	
STEP 1B-1: Inspect the actuator harness and connector pins.	No damaged pins	
STEP 1B-2: Check for an open circuit in the actuator harness.	Less than 5 ohms	
STEP 1B-3: Check the resistance of the actuator solenoid.	0.87 ohm at -17°C (0°F) to 1.73 ohms at 54°C (130°F) 1.10 ohms at 38°C (100°F) to 1.97 ohms at 93°C (200°F)	
STEP 1C: Check for a short circuit from pin to pin in the ECM connector.	More than 100k ohms	
STEP 1D: Check for a short circuit to ground in the actuator solenoid.	More than 100k ohms	
STEP 2: Clear the fault codes.		
STEP 2A: Disable the fault code.	Fault Code 398 inactive	
STEP 2B: Clear the inactive fault codes.	All fault codes cleared	

TROUBLESHOOTING STEP

STEP 1: Check the actuator harness.

STEP 1A: Inspect the harness and ECM connector pins.

⚠WARNING⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness connector from the ECM.

Action	Specifications/Repair	Next Step
Inspect the harness and ECM connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	1B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	2A

STEP 1B: Check the resistance of the whole circuit.

⚠WARNING⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

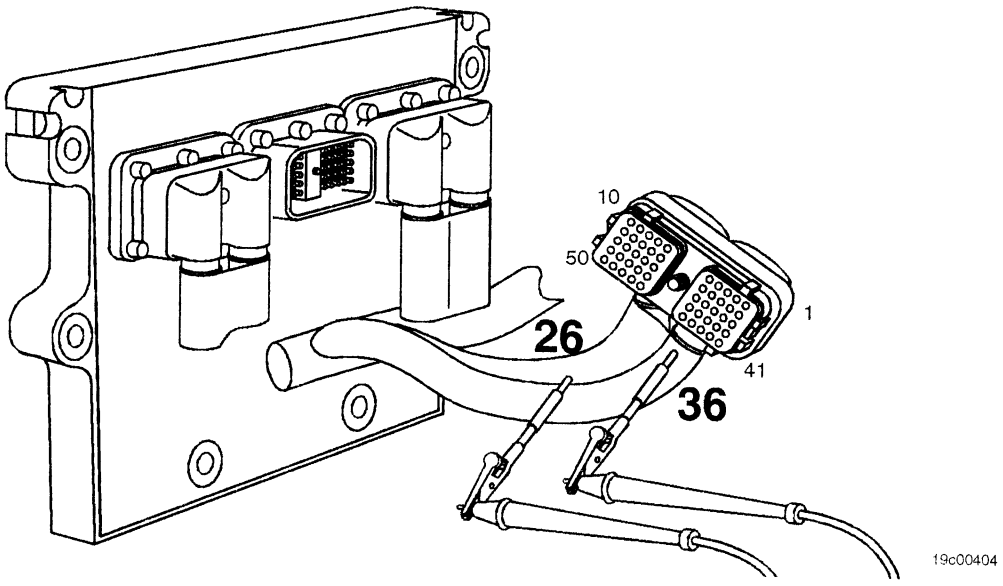
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check the resistance of the whole circuit. • Measure the resistance from pin 26 to pin 36 of the actuator harness connector.	**OK** **Less than 10 ohms**	1B-1
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	2A



STEP 1B-1: Inspect the actuator harness and connector pins.

⚠WARNING⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness from the actuator solenoid.

Action	Specifications/Repair	Next Step
Inspect the actuator harness and connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	1B-2
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	2A

STEP 1B-2: Check for an open circuit in the actuator harness.

⚠WARNING⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

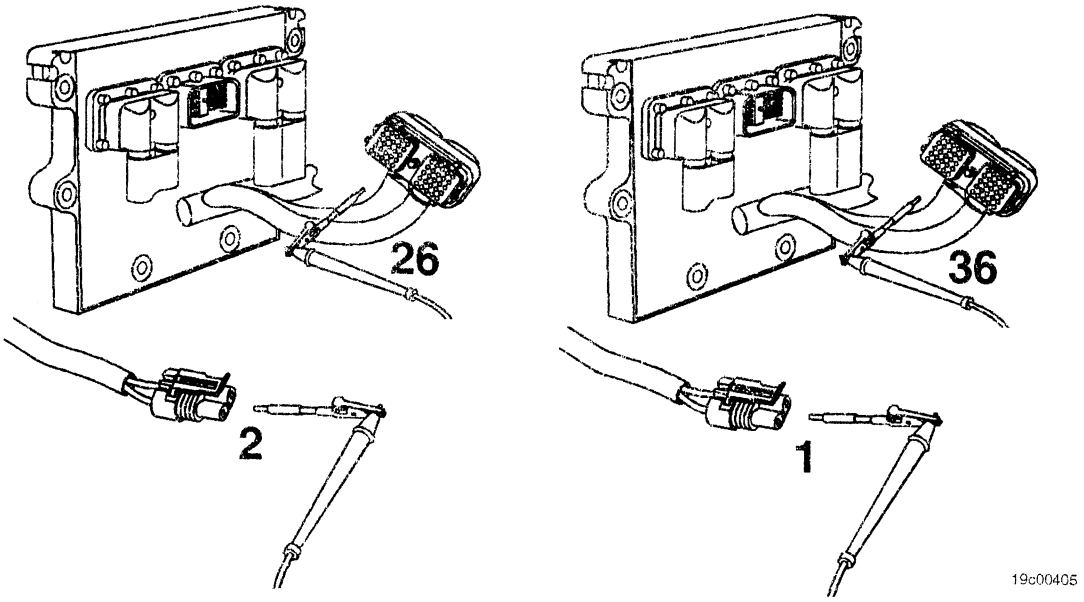
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness from the actuator solenoid.
- Disconnect the actuator harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for an open circuit in the actuator harness. • Measure the resistance from pin 26 of the actuator harness connector to pin 2 (or B) of the actuator solenoid connector. • Measure the resistance from pin 36 of the actuator harness connector to pin 1 (or A) of the actuator solenoid connector.	**OK** **Less than 5 ohms**	1B-3
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	2A



STEP 1B-3: Check the resistance of the actuator solenoid.

⚠WARNING⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

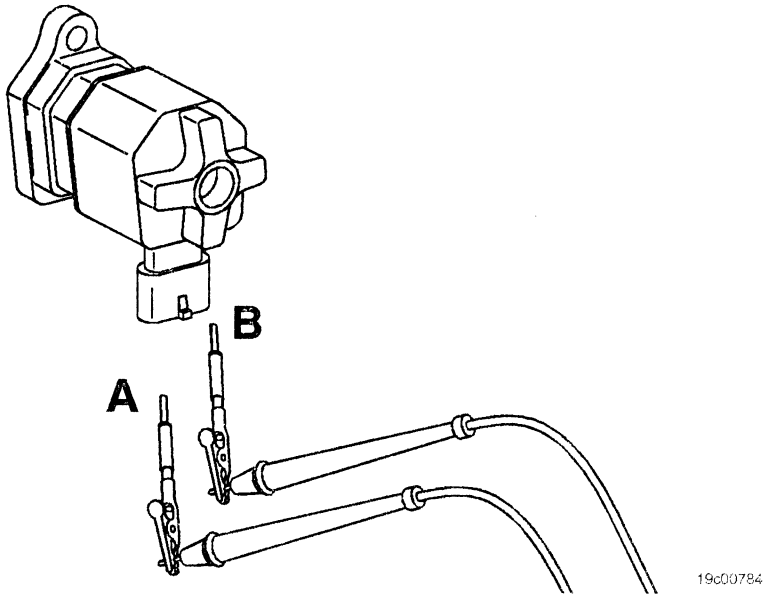
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness from the actuator solenoid.

Action	Specifications/Repair	Next Step
Check the resistance of the actuator solenoid. • Measure the resistance across the two terminals on the actuator solenoid.	**OK** **0.87 ohm at -17°C (0°F)** **to 1.73 ohms at 54°C (130°F)** **1.10 ohms at 38°C (100°F)** **to 1.97 ohms at 93°C (200°F)**	1C
	NOT OK **Replace the rear timing actuator solenoid** Refer to Procedure 019-111.	2A



STEP 1C: Check for a short circuit from pin to pin in the ECM connector.

⚠WARNING⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

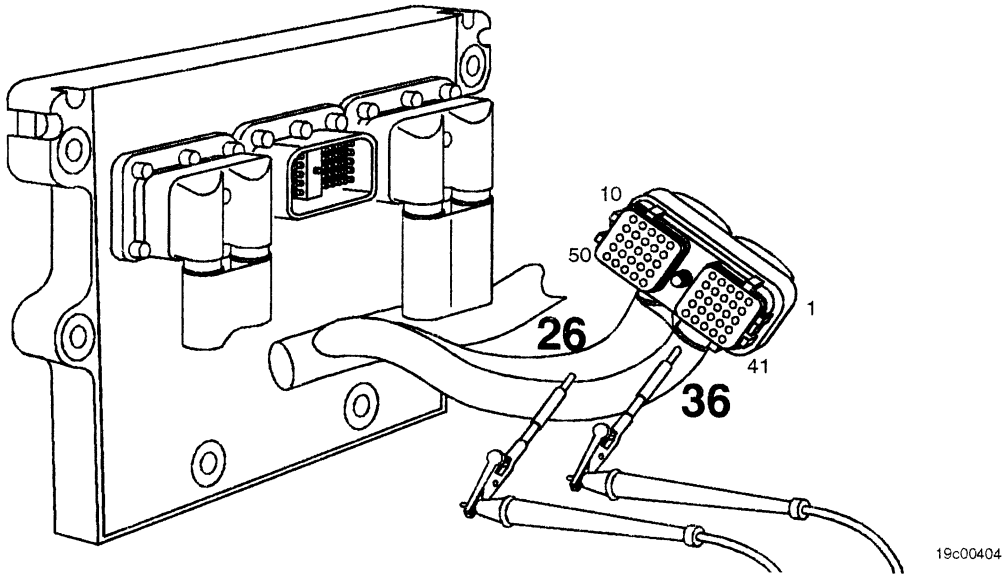
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness connector from the ECM.
- Disconnect the actuator harness from the actuator solenoid.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pin 26 in the actuator harness connector to all other pins in the connector. • Measure the resistance from pin 36 in the actuator harness connector to all other pins in the connector.	**OK** **More than 100k ohms**	1D
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	2A



STEP 1D: Check for a short circuit to ground in the actuator solenoid.

⚠WARNING⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

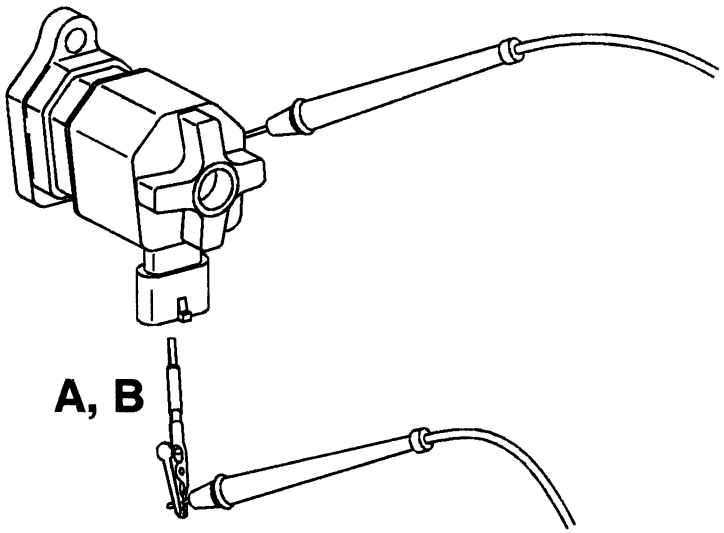
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness from the actuator solenoid.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground in the actuator solenoid. • Measure the resistance between each of the actuator solenoid pins to the actuator body.	**OK** **More than 100k ohms**	2A
	NOT OK **Replace the rear timing actuator solenoid** Refer to Procedure 019-111.	2A



19c00798

STEP 2: Clear the fault codes.

STEP 2A: Disable the fault code.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and road test the vehicle for at least 1 mile. • Using INSITE™, verify that Fault Code 398 is inactive.	**OK** **Fault Code 398 inactive**	2B
	NOT OK **Fault Code 398 active** **Replace the ECM** Refer to Procedure 019-031.	2B

STEP 2B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

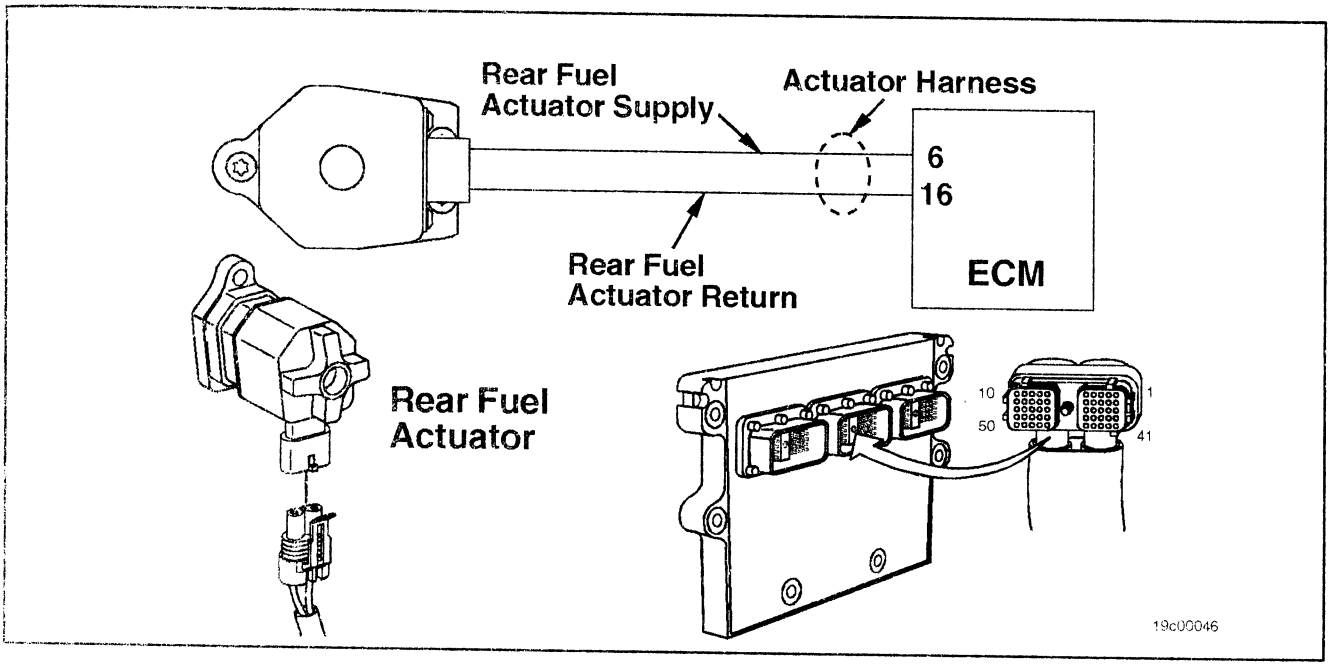
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 397

Actuator Circuit

CODES	REASON	EFFECT
Fault Code: 397 PID(P), SID(S): S083 SPN: 1244 FMI: 6/6 Lamp: Yellow	High current detected at rear fueling actuator circuit.	Engine will run using **only** the front three cylinders.

Rear Fueling Actuator Circuit



Circuit Description:

The fuel actuators are actuated by the electronic control module (ECM) to control fuel metering. Each fuel actuator is connected to the ECM by a supply and a return wire. An electrical pulse is sent to the fuel actuator from the ECM on the supply wire and returns to the ECM on the return wire. Each solenoid valve is normally closed, and it is **only** opened by an electrical pulse from the ECM during metering.

Component Location:

The rear fueling actuator is mounted on the fuel delivery housing. It is the actuator closest to the rear of the engine.

Shop Talk:

The possible failure modes are short circuit to battery, low actuator resistance, or short circuit between supply and return.

TROUBLESHOOTING SUMMARY

⚠ WARNING ⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

⚠ CAUTION ⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

**To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.**

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the actuator harness.		
STEP 1A: Inspect the harness and ECM connector pins.	No damaged pins	
STEP 1B: Check the resistance of the whole circuit.	Less than 10 ohms	
STEP 1B-1: Inspect the actuator harness and connector pins.	No damaged pins	
STEP 1B-2: Check the resistance of the actuator solenoid.	0.5 to 1.5 ohms	
STEP 1C: Check for a short circuit to battery in the circuit.	More than 100k ohms	
STEP 1D: Check for a short circuit from pin to pin in the ECM connector.	More than 100k ohms	
STEP 2: Clear the fault codes.		
STEP 2A: Disable the fault code.	Fault Code 397 inactive	
STEP 2B: Clear the inactive fault codes.	All fault codes cleared	

TROUBLESHOOTING STEP

STEP 1: Check the actuator harness.

STEP 1A: Inspect the harness and ECM connector pins.

⚠WARNING⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness connector from the ECM.

Action	Specifications/Repair	Next Step
Inspect the harness and ECM connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	1B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	2A

STEP 1B: Check the resistance of the whole circuit.

⚠WARNING⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

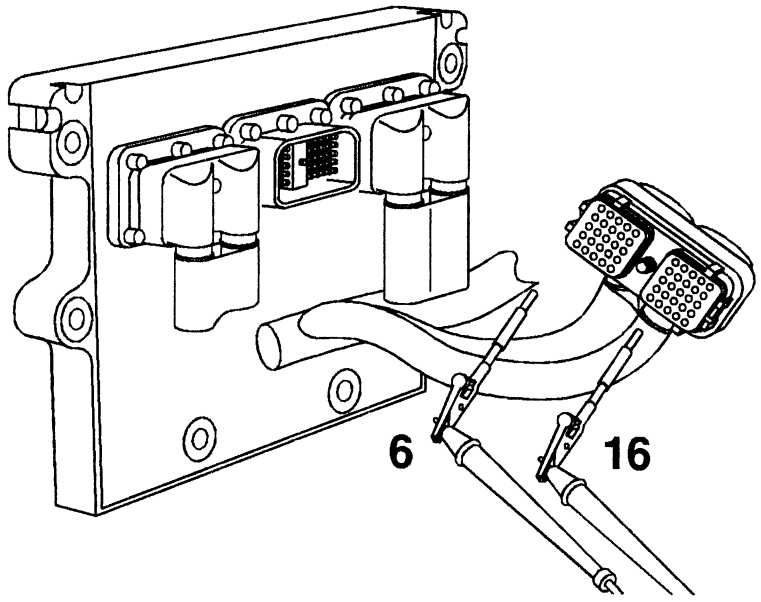
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check the resistance of the whole circuit. • Measure the resistance from pin 6 to pin 16 of the actuator harness connector.	**OK** **Less than 10 ohms**	1B-1
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	2A



19c00208

STEP 1B-1: Inspect the actuator harness and connector pins.

⚠WARNING⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness from the actuator solenoid.

Action	Specifications/Repair	Next Step
Inspect the harness and the actuator connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	1B-2
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-202 or 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	2A

STEP 1B-2: Check the resistance of the actuator solenoid.

⚠WARNING⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

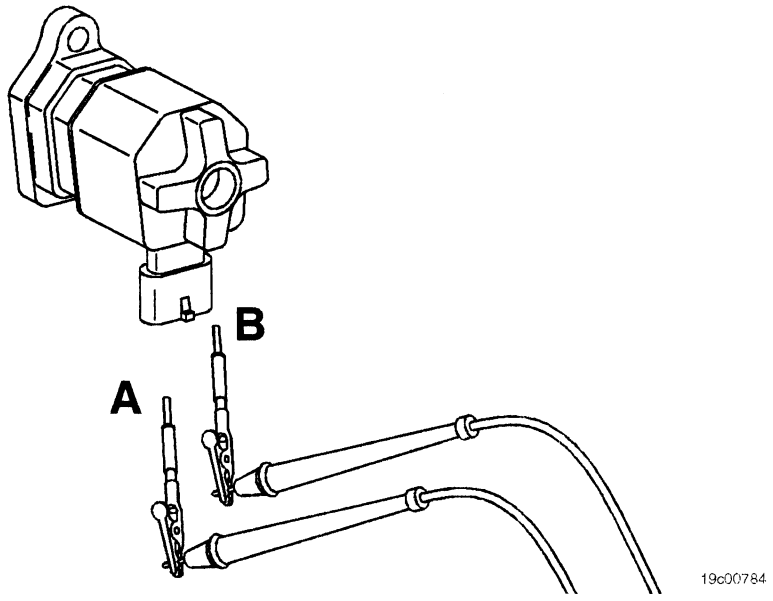
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness from the actuator solenoid.

Action	Specifications/Repair	Next Step
Check the resistance of the actuator solenoid. • Measure the resistance across the two terminals on the actuator solenoid.	**OK** **0.5 to 1.5 ohms**	1C
	NOT OK **Replace the rear fueling actuator solenoid** Refer to Procedure 019-110.	2A



STEP 1C: Check for a short circuit to battery in the circuit.

⚠WARNING⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

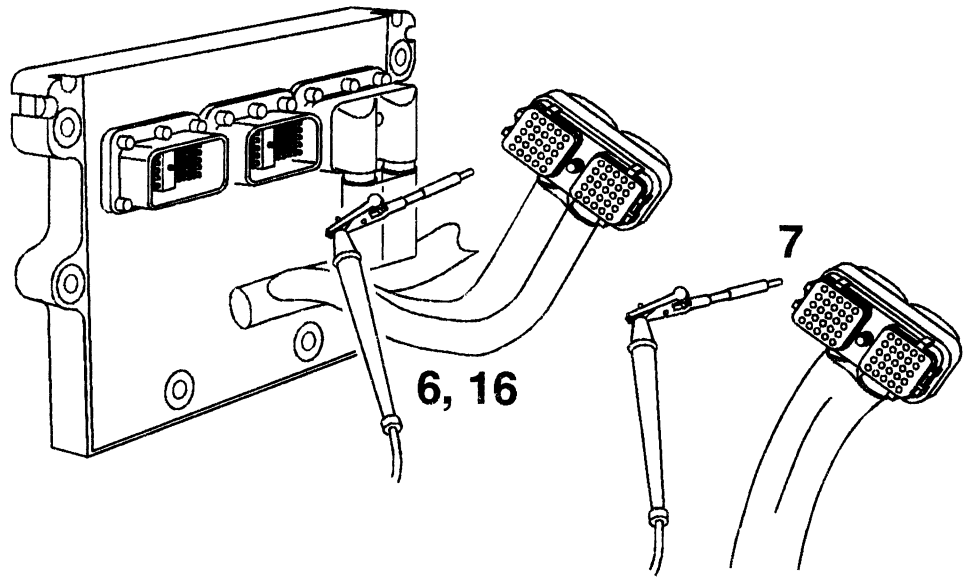
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness from the actuator solenoid.
- Disconnect the OEM harness connector from the ECM.
- Disconnect the actuator harness connector from the ECM.
- Disconnect the positive (+) battery terminal from battery.

Action	Specifications/Repair	Next Step
Check for short circuit to battery in the actuator solenoid. • Measure the resistance between pins 6 and 16 in the actuator harness connector to pin 7 of the OEM harness connector.	**OK** **More than 100k ohms**	1D
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	2A



STEP 1D: Check for a short circuit from pin to pin in the ECM connector.

⚠WARNING⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

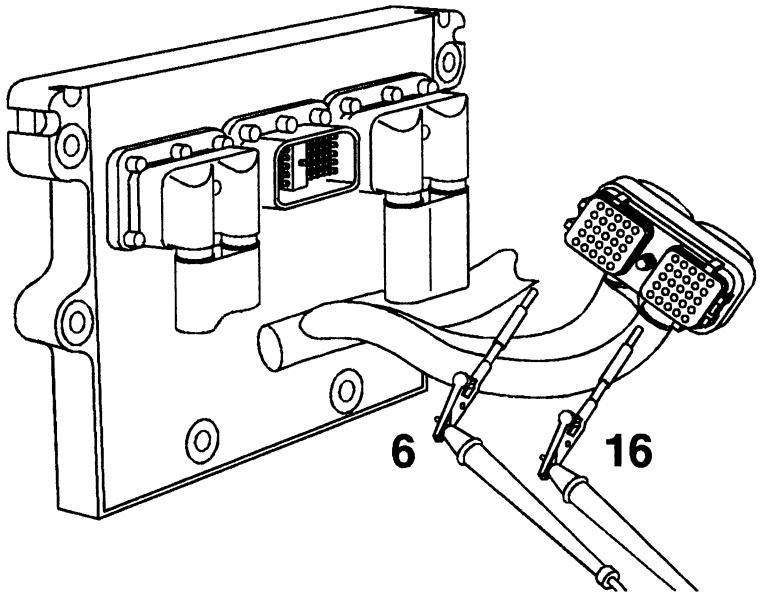
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness connector from the ECM.
- Disconnect the actuator harness from the actuator solenoid.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pin 6 in the actuator harness connector to all other pins in the connector. • Measure the resistance from pin 16 in the actuator harness connector to all other pins in the connector.	**OK** **More than 100k ohms**	2A
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	2A



19c00208

STEP 2: Clear the fault codes.

STEP 2A: Disable the fault code.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and test drive the vehicle for at least 1 mile. • Using INSITE™, verify that Fault Code 397 is inactive.	**OK** **Fault Code 397 inactive**	2B
	NOT OK **Fault Code 397 active** **Replace the ECM** Refer to Procedure 019-031.	2B

STEP 2B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

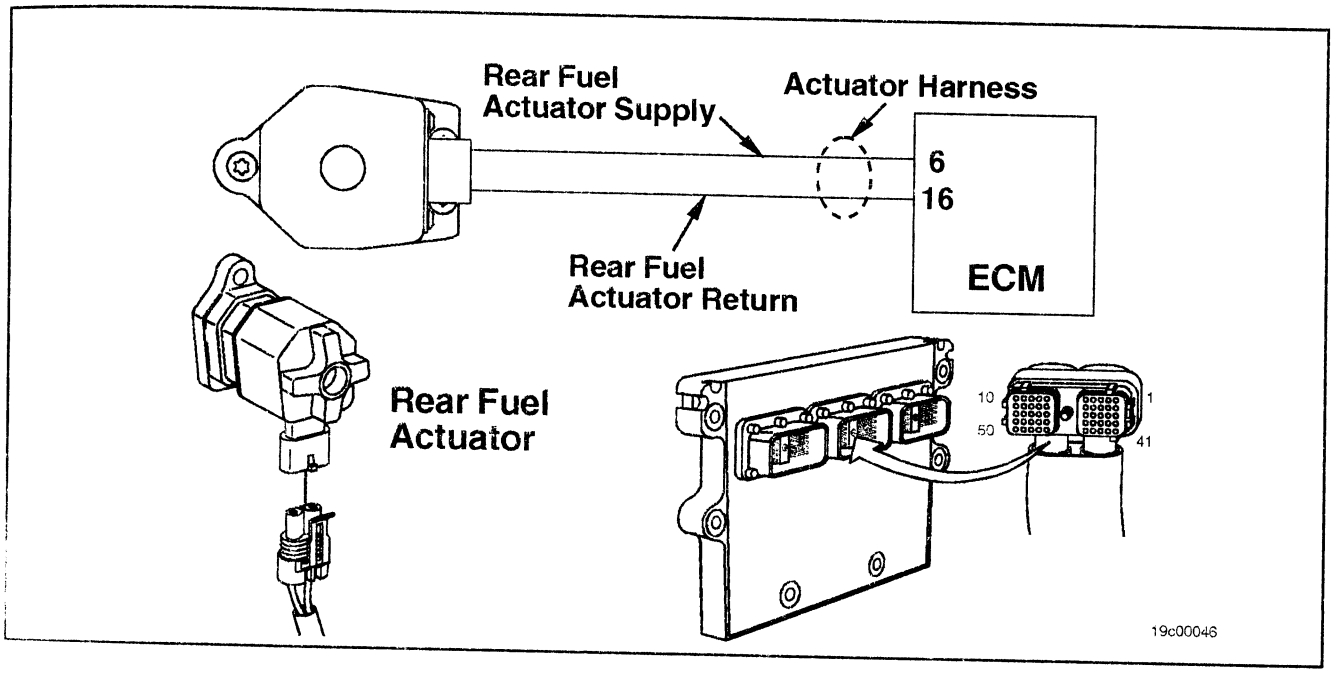
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 396

Actuator Circuit

CODES	REASON	EFFECT
Fault Code: 396 PID(P). SID(S): S083 SPN: 1244 FMI: 5/5 Lamp: Yellow	Low current or open circuit detected at rear fueling actuator circuit.	Engine will run using **only** the front three cylinders.

Rear Fueling Actuator Circuit



Circuit Description:

The fuel actuators are actuated by the electronic control module (ECM) to control fuel metering. Each fuel actuator is connected to the ECM by a supply and a return wire. An electrical pulse is sent to the fuel actuator from the ECM on the supply wire and returns to the ECM on the return wire. Each solenoid valve is normally closed, and it is **only** opened by an electrical pulse from the ECM during metering.

Component Location:

The rear fueling actuator is mounted on the fuel delivery housing. It is the actuator closest to the rear of the engine.

Shop Talk:

The possible failure modes are an open circuit, short to ground, and high actuator resistance.

TROUBLESHOOTING SUMMARY

WARNING

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

CAUTION

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

CAUTION

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the actuator harness.		
STEP 1A: Inspect the harness and ECM connector pins.	No damaged pins	
STEP 1B: Check the resistance of the whole circuit.	Less than 10 ohms	
STEP 1B-1: Inspect the actuator harness and connector pins.	No damaged pins	
STEP 1B-2: Check for an open circuit in the actuator harness.	Less than 5 ohms	
STEP 1B-3: Check the resistance of the actuator solenoid.	0.5 to 1.5 ohms	
STEP 1C: Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 1D: Check for a short circuit to ground in the actuator solenoid.	More than 100k ohms	
STEP 2: Clear the fault codes.		
STEP 2A: Disable the fault code.	Fault Code 396 inactive	
STEP 2B: Clear the inactive fault codes.	All fault codes cleared	

TROUBLESHOOTING STEP

STEP 1: Check the actuator harness.

STEP 1A: Inspect the harness and the ECM connector pins.

⚠WARNING⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness connector from the ECM.

Action	Specifications/Repair	Next Step
Inspect the harness and the ECM connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins.**	1B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	2A

STEP 1B: Check the resistance of the whole circuit.

⚠WARNING⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

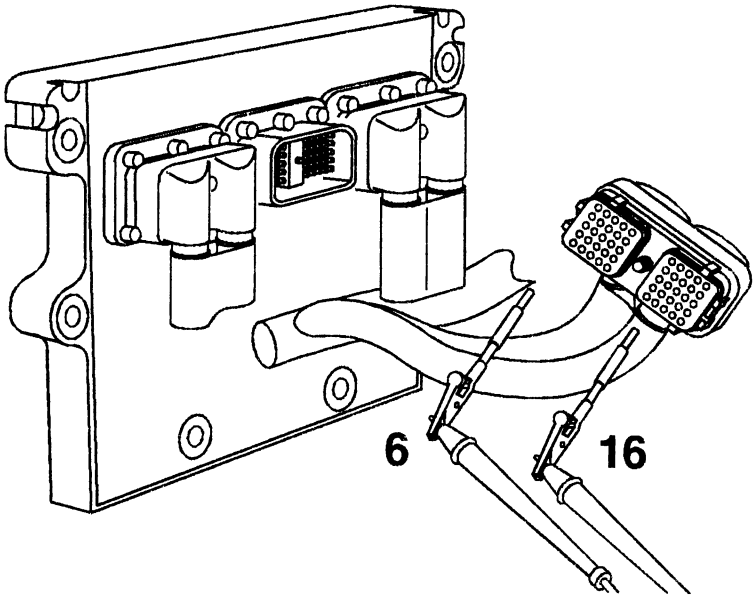
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check the resistance of the actuator harness. • Measure the resistance from pin 6 to pin 16 of the actuator harness connector.	**OK** **Less than 10 ohms**	1B-1
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	2A



19c00208

STEP 1B-1: Inspect the actuator harness and connector pins.

⚠WARNING⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

△CAUTION△

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness from the actuator solenoid.

Action	Specifications/Repair	Next Step
Inspect the actuator harness and connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	1B-2
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	2A

STEP 1B-2: Check for an open circuit in the actuator harness.

⚠WARNING⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

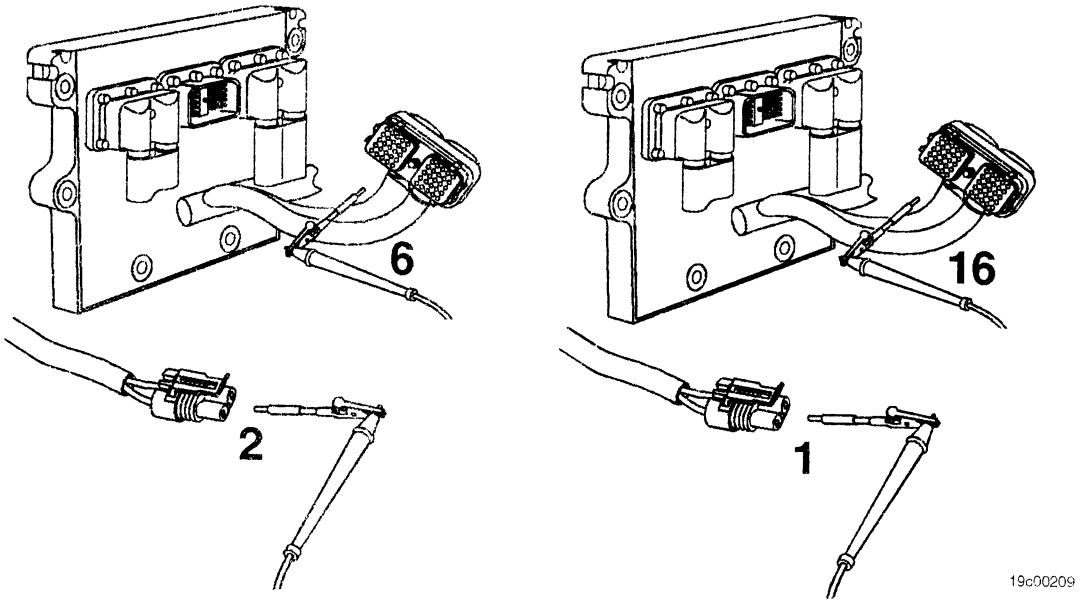
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness from the actuator solenoid.
- Disconnect the actuator harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for an open circuit in the actuator harness. • Measure the resistance from pin 6 of the actuator harness connector to pin 2 (or B) of the actuator solenoid connector. • Measure the resistance from pin 16 of the actuator harness connector to pin 1 (or A) of the actuator solenoid connector.	**OK** **Less than 5 ohms**	1B-3
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-202 or 019-250. • Replace the engine harness. Refer to Procedure 019-043.	2A



STEP 1B-3: Check the resistance of the actuator solenoid.

⚠WARNING⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

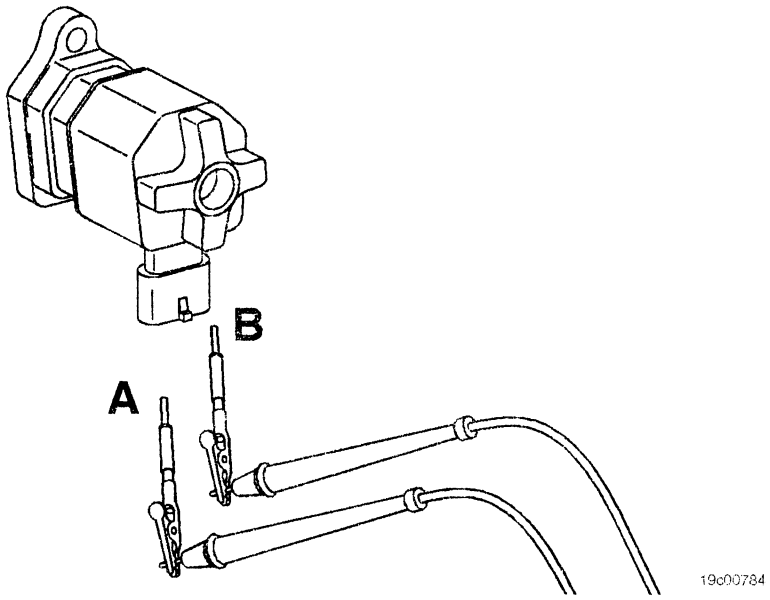
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness from the actuator solenoid.

Action	Specifications/Repair	Next Step
Check the resistance of the actuator solenoid. • Measure the resistance across the two terminals on the actuator solenoid.	**OK** **0.5 to 1.5 ohms**	1C
	NOT OK **Replace the rear fueling actuator solenoid** Refer to Procedure 019-110.	2A



STEP 1C: Check for a short circuit from pin to pin.

⚠WARNING⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

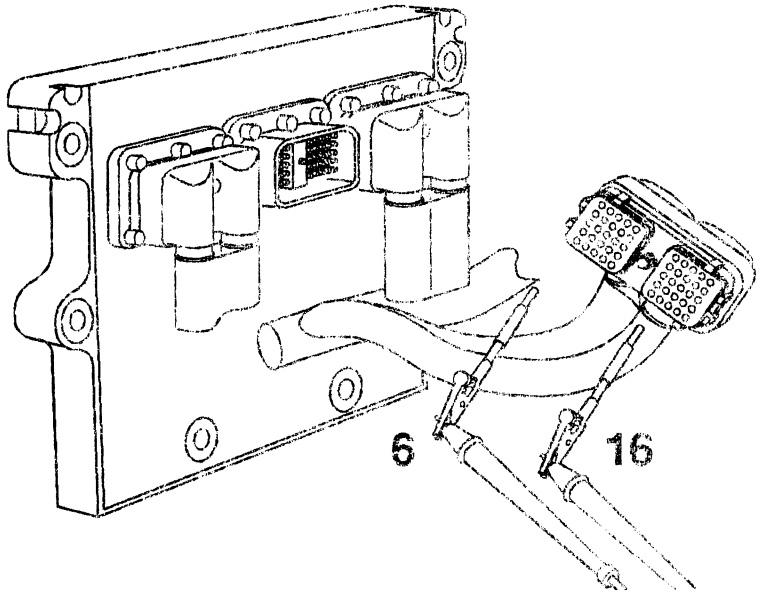
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness connector from the ECM.
- Disconnect the actuator harness from the actuator solenoid.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pin 6 in the actuator harness connector to all other pins in the connector. • Measure the resistance from pin 16 in the actuator harness connector to all other pins in the connector.	**OK** **More than 100k ohms**	1D
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	2A



STEP 1D: Check for a short circuit to ground in the actuator solenoid.

⚠WARNING⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

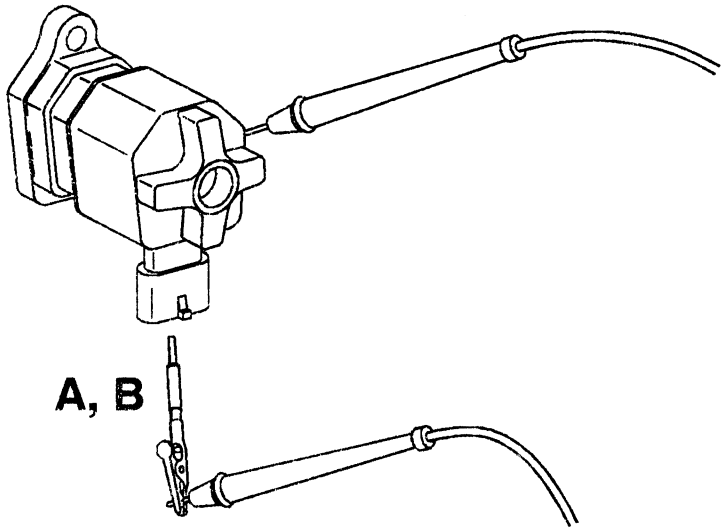
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness connector from the actuator solenoid.

Action	Specifications/Repair	Next Step
Check for short circuit to ground in the actuator solenoid. • Measure the resistance between pin 1 (or A) on the actuator connector to the actuator body. • Measure the resistance between pin 2 (or B) on the actuator connector to the actuator body.	**OK** **More than 100k ohms**	2A
	NOT OK **Replace the rear fueling actuator solenoid** Refer to Procedure 019-110.	2A



19c00798

STEP 2: Clear the fault codes.

STEP 2A: Disable the fault code.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and road test vehicle for at least 1 mile. • Using INSITE™, verify that Fault Code 396 is inactive.	**OK** **Fault Code 396 inactive**	2B
	NOT OK **Fault Code 396 active** **Replace the ECM** Refer to Procedure 019-031.	2B

STEP 2B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

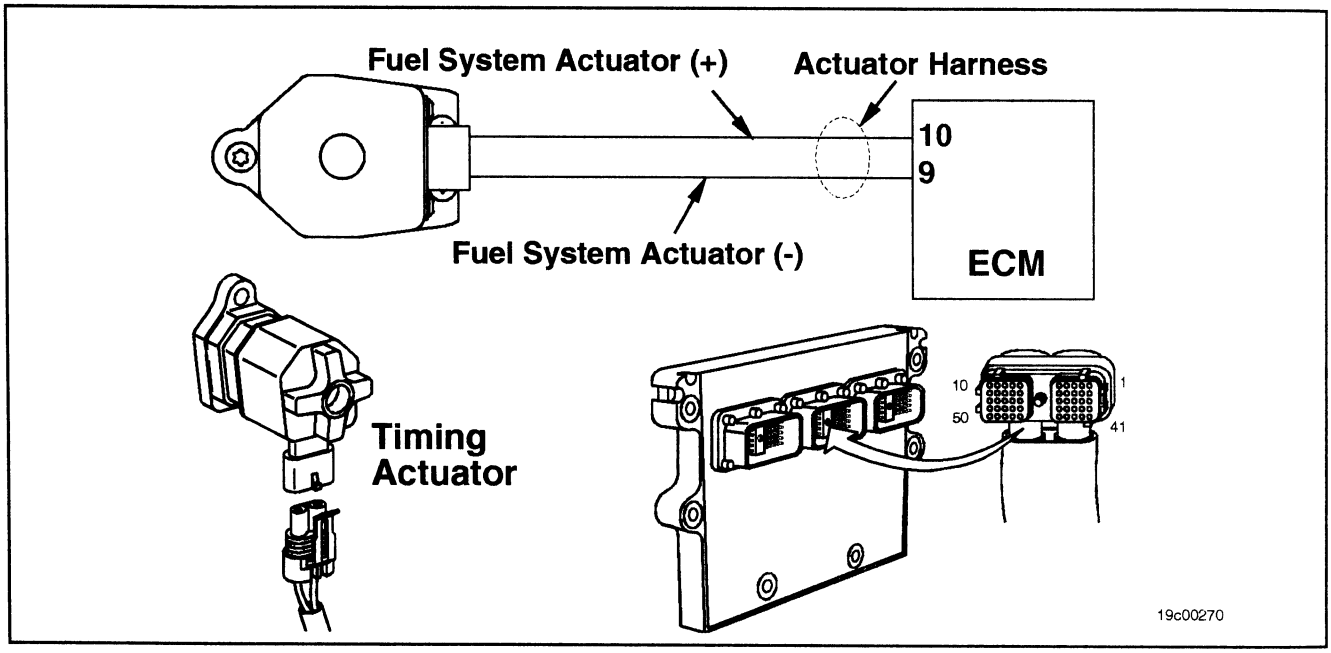
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 395

Actuator Circuit

CODES	REASON	EFFECT
Fault Code: 395 PID(P), SID(S): S020 SPN: 635 FMI: 6/6 Lamp: Yellow	High current detected at front timing actuator circuit.	Engine is run using **only** the rear three cylinders.

Front Timing Actuator Circuit



Circuit Description:

The timing actuators are actuated by the electronic control module (ECM) to control fuel timing. Each timing actuator is connected to the ECM by a supply and a return wire. An electrical pulse is sent to the timing actuator from the ECM on the supply wire and returns to the ECM on the return wire. Each solenoid valve is normally closed, and it is **only** opened by an electrical pulse from the ECM during metering.

Component Location:

The front timing actuator is mounted on the fuel delivery housing. It is the second actuator from the front of the engine.

Shop Talk:

The possible failure modes are short circuit to battery, low actuator resistance, or short circuit between supply and return wires.

TROUBLESHOOTING SUMMARY

⚠ WARNING ⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jeweiry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

⚠ CAUTION ⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the actuator harness.		
STEP 1A: Inspect the harness and ECM connector pins.	No damaged pins	
STEP 1B: Check the resistance of the whole circuit.	Less than 10 ohms	
STEP 1B-1: Inspect the actuator harness and connector pins.	No damaged pins	
STEP 1B-2: Check the resistance of the actuator solenoid.	0.87 ohms at -17°C (0°F) to 1.73 ohms at 54°C (130°F) 1.10 ohms at 38°C (100°F) to 1.97 ohms at 93°C (200°F)	
STEP 1C: Check for a short circuit to battery in the circuit.	More than 100k ohms	
STEP 1D: Check for a short circuit from pin to pin in the ECM connector.	More than 100k ohms	
STEP 2: Clear the fault codes.		
STEP 2A: Disable the fault code.	Fault Code 395 inactive	
STEP 2B: Clear the inactive fault codes.	All fault codes cleared	

TROUBLESHOOTING STEP

STEP 1: Check the actuator harness.

STEP 1A: Inspect the harness and the ECM connector pins.

⚠WARNING⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness connector from the ECM.

Action	Specifications/Repair	Next Step
Inspect the harness and the ECM connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	1B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	2A

STEP 1B: Check the resistance of the whole circuit.

⚠WARNING⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

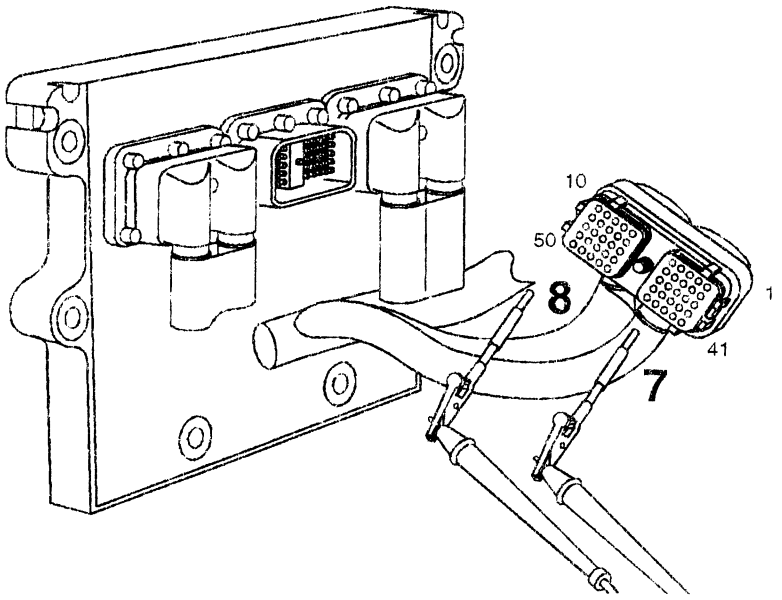
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check the resistance of the actuator harness. • Measure the resistance from pin 7 to pin 8 of the actuator harness connector.	**OK** **Less than 10 ohms**	1B-1
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	2A



STEP 1B-1: Inspect the actuator harness and connector pins.

⚠WARNING⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness from the timing actuator solenoid.

Action	Specifications/Repair	Next Step
Inspect the actuator harness and connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	1B-2
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	2A

STEP 1B-2: Check the resistance of the actuator solenoid.

⚠WARNING⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

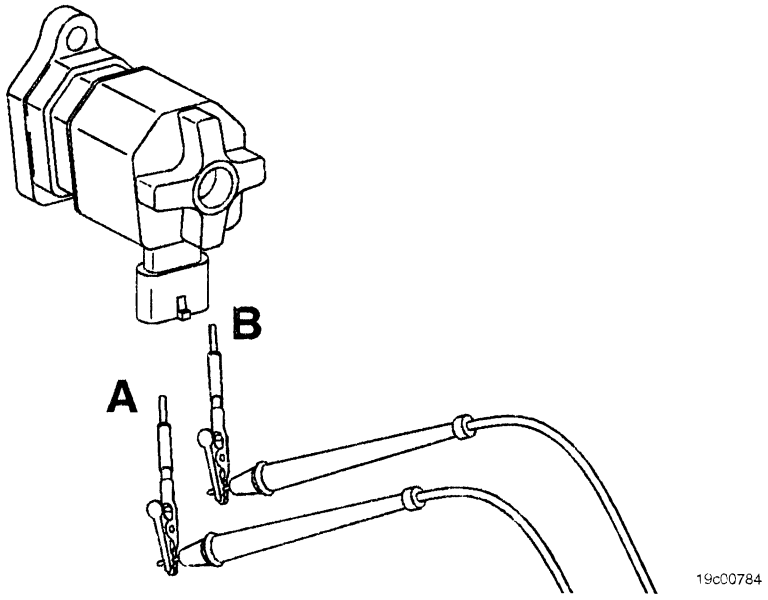
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness from the timing actuator solenoid.

Action	Specifications/Repair	Next Step
Check the resistance of the timing actuator solenoid. • Measure the resistance across the two terminals on the timing actuator solenoid.	**OK** **0.87 ohms at -17°C (0°F)** **to 1.73 ohms at 54°C (130°F)** **1.10 ohms at 38°C (100°F)** **to 1.97 ohms at 93°C (200°F)**	1C
	NOT OK **Replace the timing actuator solenoid** Refer to Procedure 019-111.	2A



STEP 1C: Check for a short circuit to battery in the circuit.

⚠WARNING⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

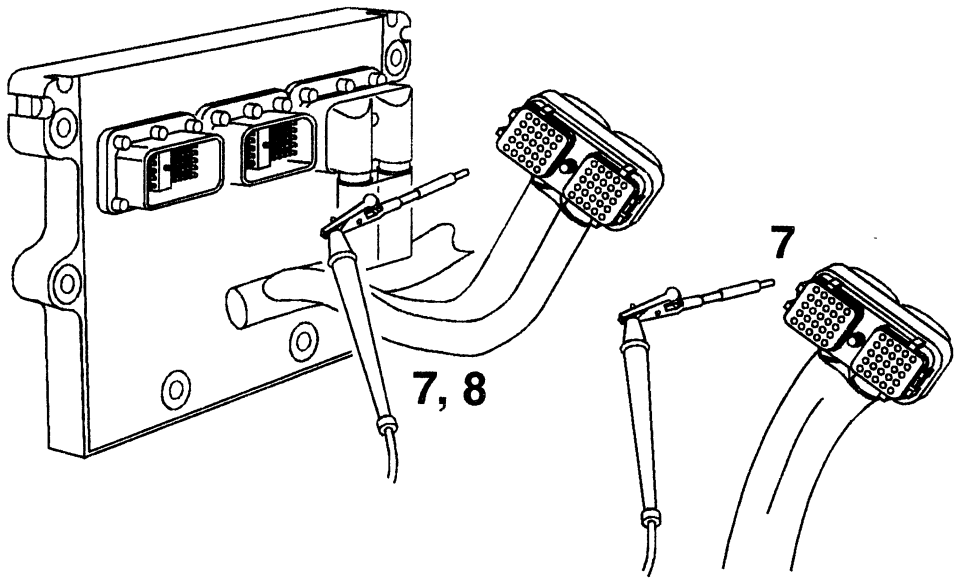
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness from the timing actuator solenoid.
- Disconnect the OEM harness connector from the ECM.
- Disconnect the actuator harness connector from the ECM.
- Disconnect the positive (+) battery terminal from battery.

Action	Specifications/Repair	Next Step
Check for short circuit to battery in the timing actuator solenoid. • Measure the resistance between the timing actuator harness connector pins 7 and 8 to pin 7 of the OEM harness connector.	**OK** **More than 100k ohms**	1D
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	2A



STEP 1D: Check for a short circuit from pin to pin in the ECM connector.

⚠WARNING⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

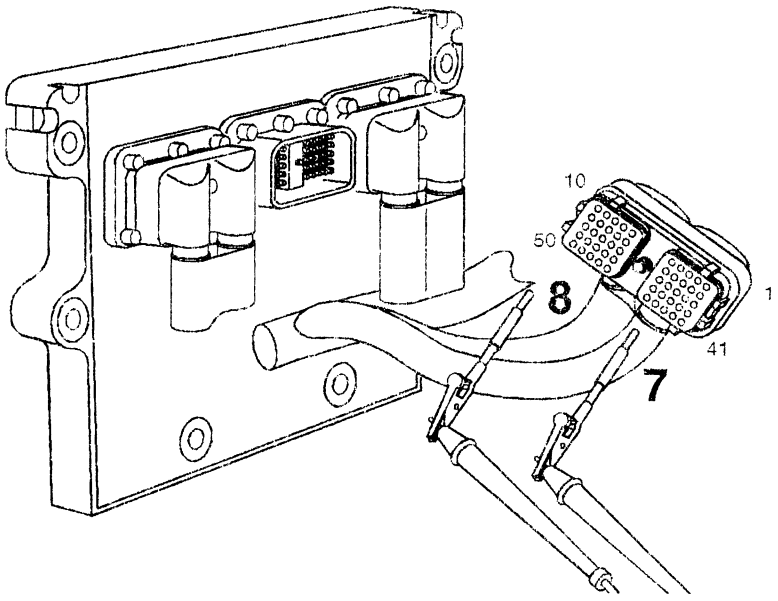
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness connector from the ECM.
- Disconnect the actuator harness from the timing actuator solenoid.

Action	Specifications/Repair	Next Step
Check for short circuit from pin to pin. • Measure the resistance from pin 7 in the actuator harness connector to all other pins in the connector. • Measure the resistance from pin 8 in the actuator harness connector to all other pins in the connector.	**OK** **More than 100k ohms**	2A
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	2A



STEP 2: Clear the fault codes.

STEP 2A: Disable the fault code.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it idle for 1 minute. • Using INSITE™, verify that Fault Code 395 is inactive.	**OK** **Fault Code 395 inactive**	2B
	NOT OK **Fault Code 395 active** **Replace the ECM** Refer to Procedure 019-031.	2B

STEP 2B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

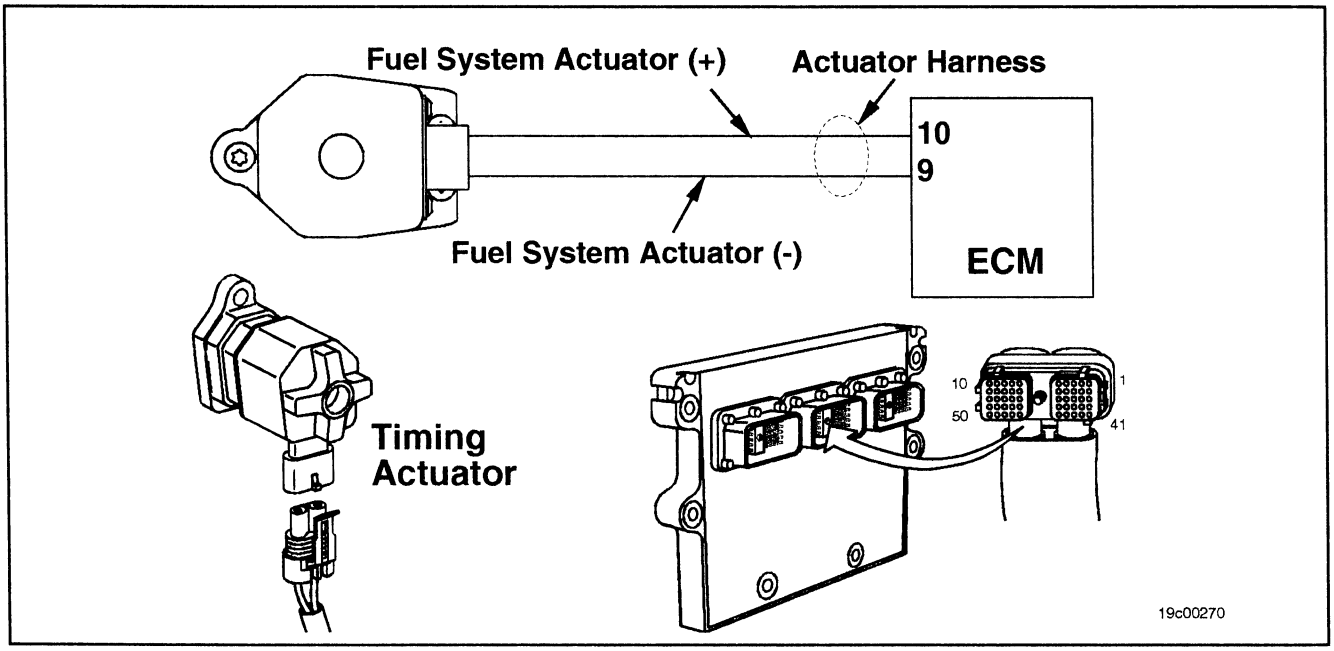
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 394

Actuator Circuit

CODES	REASON	EFFECT
Fault Code: 394 PID(P), SID(S): S020 SPN: 635 FMI: 5/5 Lamp: Yellow	Low current or open circuit detected at front timing actuator circuit.	Engine is run using **only** the rear three cylinders.

Front Timing Actuator Circuit



Circuit Description:

The timing actuators are actuated by the electronic control module (ECM) to control fuel metering. Each timing actuator is connected to the ECM by a supply and a return wire. An electrical pulse is sent to the timing actuator from the ECM on the supply wire and returns to the ECM on the return wire. Each solenoid valve is normally closed, and it is **only** opened by an electrical pulse from the ECM during metering.

Component Location:

The front timing actuator is mounted on the fuel delivery housing. It is the second actuator from the front of the engine.

Shop Talk:

The possible failure modes are open circuit, short circuit to ground, high actuator resistance, and loss of boost voltage inside the ECM.

TROUBLESHOOTING SUMMARY

⚠ WARNING ⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

⚠ CAUTION ⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the actuator harness.		
STEP 1A: Inspect the harness and the ECM connector pins.	No damaged pins	
STEP 1B: Check the resistance of the whole circuit.	Less than 10 ohms	
STEP 1B-1: Inspect the actuator harness and connector pins.	No damaged pins	
STEP 1B-2: Check for an open circuit in the actuator harness.	Less than 5 ohms	
STEP 1B-3: Check the resistance of the actuator solenoid.	0.87 ohm at -17°C (0°F) to 1.73 ohms at 54°C (130°F) 1.10 ohms at 38°C (100°F) to 1.97 ohms at 93°C (200°F)	
STEP 1C: Check for a short circuit from pin to pin in the ECM connector.	More than 100k ohms	
STEP 1D: Check for a short circuit to ground in the actuator solenoid.	More than 100k ohms	
STEP 2: Clear the fault codes.		
STEP 2A: Disable the fault code.	Fault Code 394 inactive	
STEP 2B: Clear the inactive fault codes.	All fault codes cleared	

TROUBLESHOOTING STEP

STEP 1: Check the actuator harness.

STEP 1A: Inspect the harness and the ECM connector pins.

⚠WARNING⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness connector from the ECM.

Action	Specifications/Repair	Next Step
Inspect the harness and the ECM connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	1B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	2A

STEP 1B: Check the resistance of the whole circuit.

⚠WARNING⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

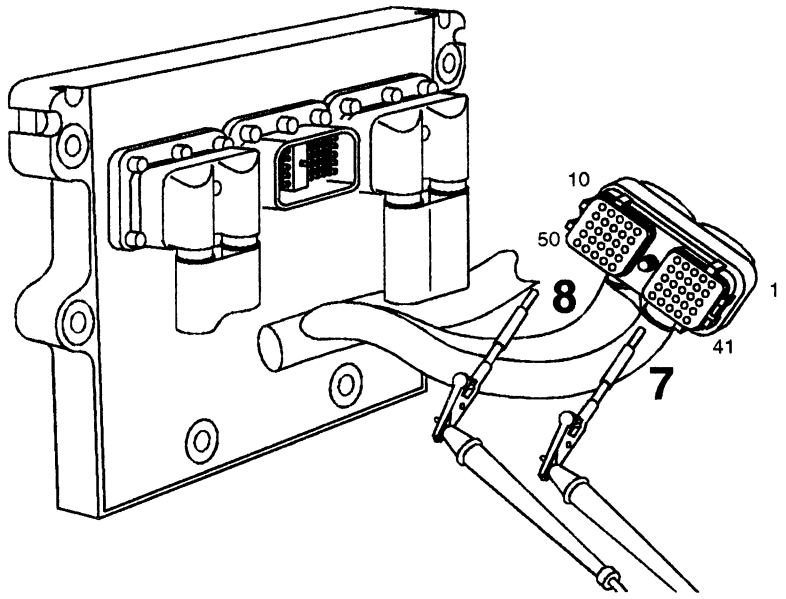
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check the resistance of the whole circuit. • Measure the resistance from pin 7 to pin 8 of the actuator harness connector.	**OK** **Less than 10 ohms**	1B-1
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	2A



STEP 1B-1: Inspect the actuator harness and connector pins.

⚠WARNING⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:
- Turn keyswitch OFF.
- Disconnect the actuator harness from the actuator solenoid.

Action	Specifications/Repair	Next Step
Inspect the harness and the connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	1B-2
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-202 or 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	2A

STEP 1B-2: Check for an open circuit in the actuator harness.

⚠WARNING⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

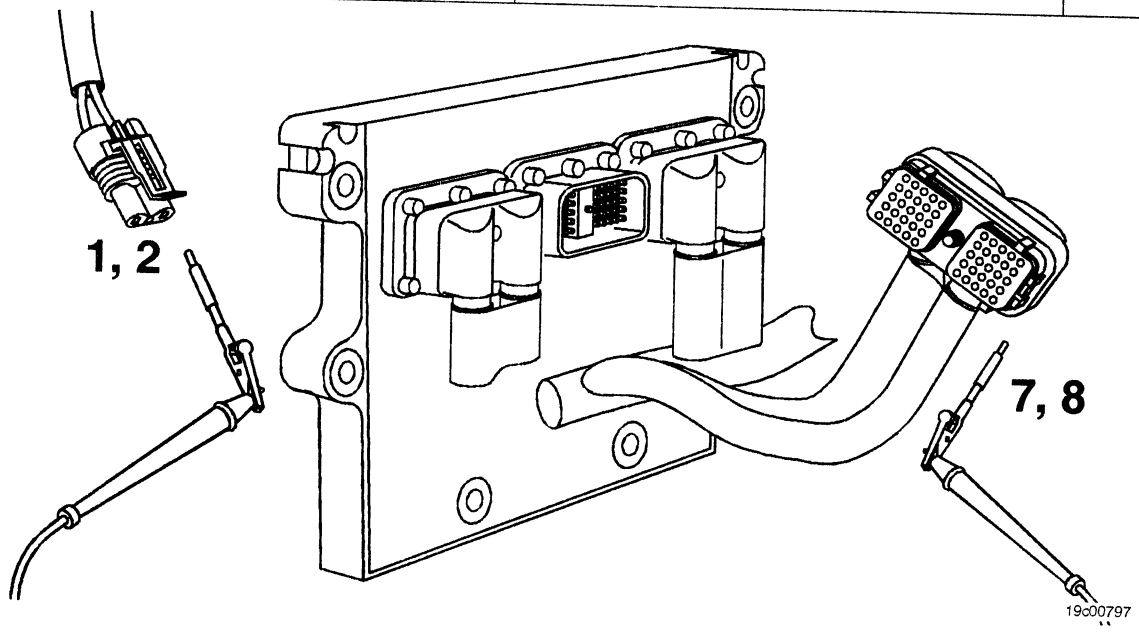
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness from the actuator solenoid.
- Disconnect the actuator harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for an open circuit in the actuator harness. • Measure the resistance from pin 7 of the actuator harness connector to pin 1 (or A) of the actuator solenoid connector. • Measure the resistance from pin 8 of the actuator harness connector to pin 2 (or B) of the actuator solenoid connector.	**OK** **Less than 5 ohms**	1B-3
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-202 or 019-250. • Replace the engine harness. Refer to Procedure 019-043.	2A



STEP 1B-3: Check the resistance of the actuator solenoid.

⚠WARNING⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

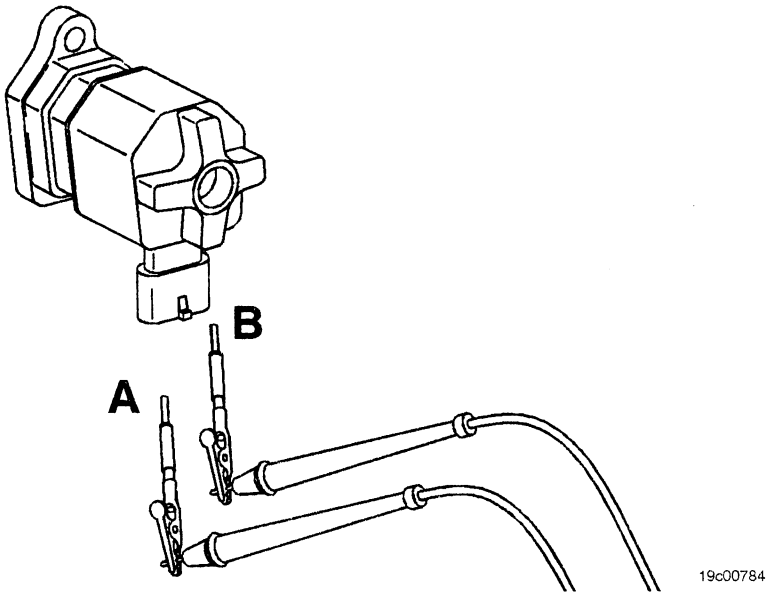
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness from the actuator solenoid.

Action	Specifications/Repair	Next Step
Check the resistance of the actuator solenoid. • Measure the resistance across the two terminals on the actuator solenoid.	**OK** **0.87 ohms at -17°C (0°F)** **to 1.73 ohms at 54°C (130°F)** **1.10 ohms at 38°C (100°F)** **to 1.97 ohms at 93°C (200°F)**	1C
	NOT OK **Replace the actuator solenoid** Refer to Procedure 019-110.	2A



STEP 1C: Check for a short circuit from pin to pin in the ECM connector.

⚠WARNING⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

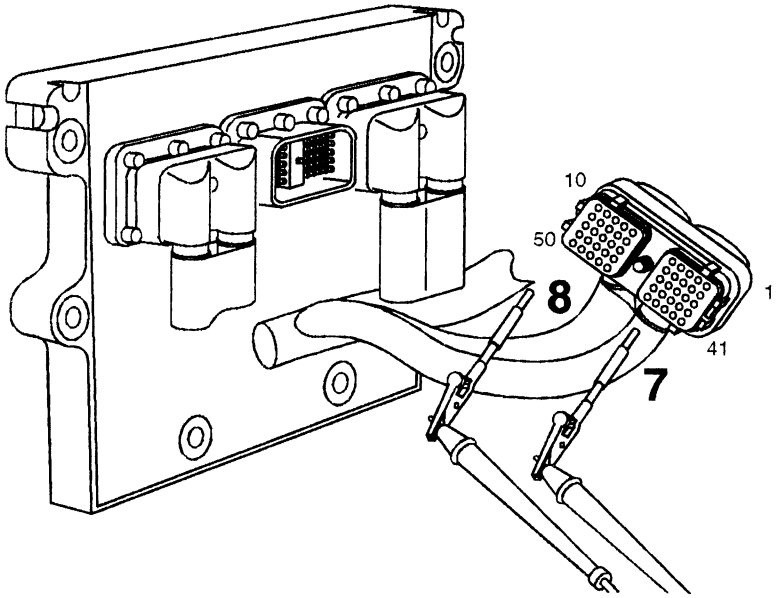
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness connector from the ECM.
- Disconnect the actuator harness from the actuator solenoid.

Action	Specifications/Repair	Next Step
Check for short circuit from pin to pin. • Measure the resistance from pin 7 in the actuator harness connector to all other pins in the connector. • Measure the resistance from pin 8 in the actuator harness connector to all other pins in the connector.	**OK** **More than 100k ohms**	1D
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	2A



STEP 1D: Check for a short circuit to ground in the actuator solenoid.

⚠WARNING⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

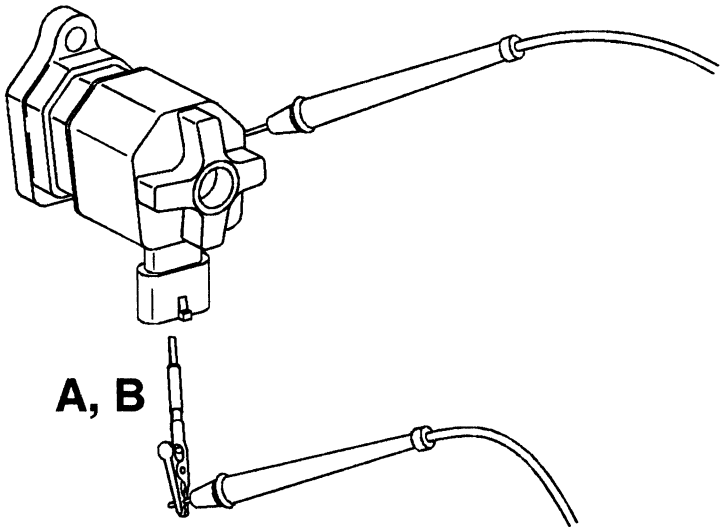
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness from the actuator solenoid.

Action	Specifications/Repair	Next Step
Check for short circuit to ground in the actuator solenoid. • Measure the resistance between both actuator solenoid pins to the actuator body.	**OK** **More than 100k ohms**	2A
	NOT OK **Replace the actuator solenoid** Refer to Procedure 019-110.	2A



19c00798

STEP 2: Clear the fault codes.

STEP 2A: Disable the fault code.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and road test vehicle for 1 mile. • Using INSITE™, verify that Fault Code 394 is inactive.	**OK** **Fault Code 394 inactive**	2B
	NOT OK **Fault Code 394 active** **Replace the ECM** Refer to Procedure 019-031.	2B

STEP 2B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

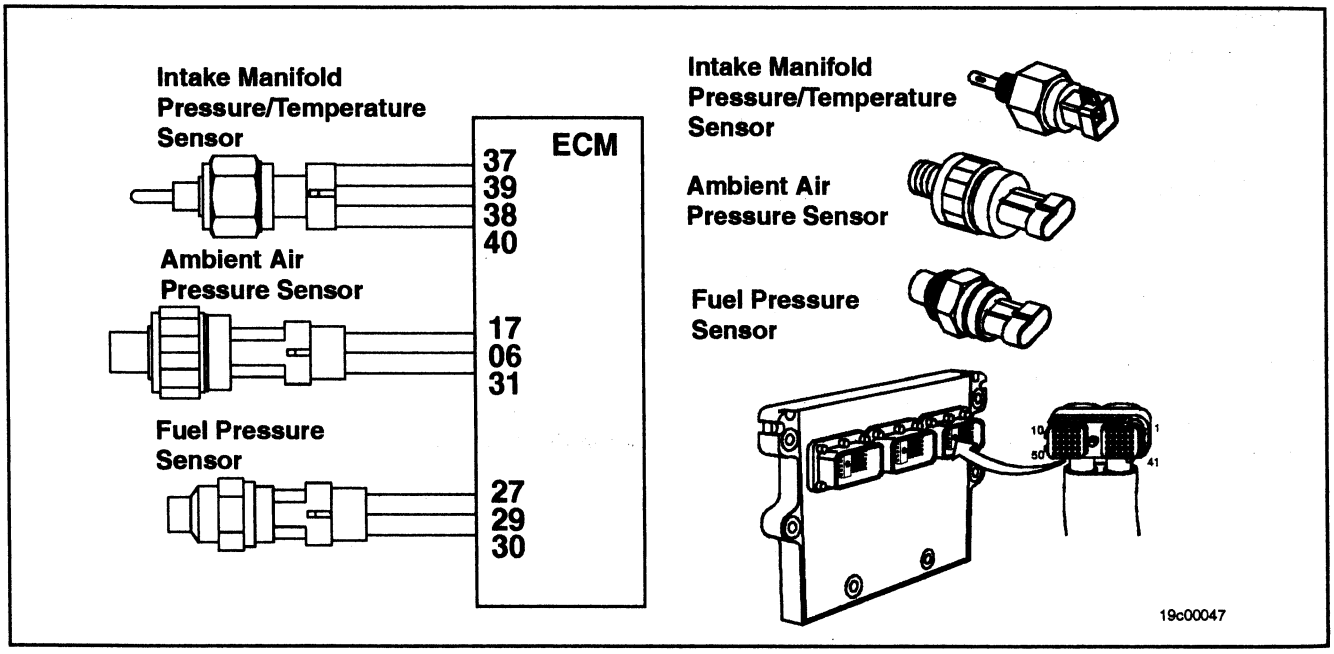
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 386

Sensor Voltage Supply

CODES	REASON	EFFECT
Fault Code: 386 PID(P), SID(S): S232 SPN: 1079 FMI: 3/3 Lamp: Yellow	High voltage detected on the electronic control module (ECM) voltage supply wire to the sensors (VSEN1 supply).	Engine is derated to no-air setting.

Sensor Voltage Supply Circuit



Circuit Description:

The electronic control module (ECM) supplies each of these sensors with positive (+) 5 VDC. If the supply wire to any sensor is damaged, the sensor will **not** work correctly.

Component Location:

There are three components involved in the sensor voltage supply: Intake manifold pressure/temperature sensor, ambient air pressure/temperature sensor, and the fuel pressure sensor. See Section E for component location.

Shop Talk:

High voltage on the sensor (+) 5-VDC supply wire will be caused by a short circuit to battery of the supply wire or a short circuit between an actuator wire and the supply wire.

TROUBLESHOOTING SUMMARY

⚠ CAUTION ⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead
Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the sensor harness.		
STEP 1A: Inspect the harness and the ECM connector pins.	No damaged pins	
STEP 1B: Check the supply voltage.	(+) 4.75 to 5.25 VDC	
STEP 1C: Check for a short circuit to the battery.	More than 100k ohms	
STEP 1D: Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 2: Clear the fault codes.		
STEP 2A: Disable the fault code.	Fault Code 386 inactive	
STEP 2B: Clear the inactive fault codes.	All fault codes cleared	

TROUBLESHOOTING STEP

STEP 1: Check the sensor harness.

STEP 1A: Inspect the harness and the ECM connector pins.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.
- Disconnect the engine harness from each sensor.

Action	Specifications/Repair	Next Step
Inspect the sensor harness and the ECM connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector. • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	1B
	NOT OK **Repair the damaged pins** Repair or replace the harness, or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-203, 019-204, or 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	2A

STEP 1B: Check the supply voltage.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

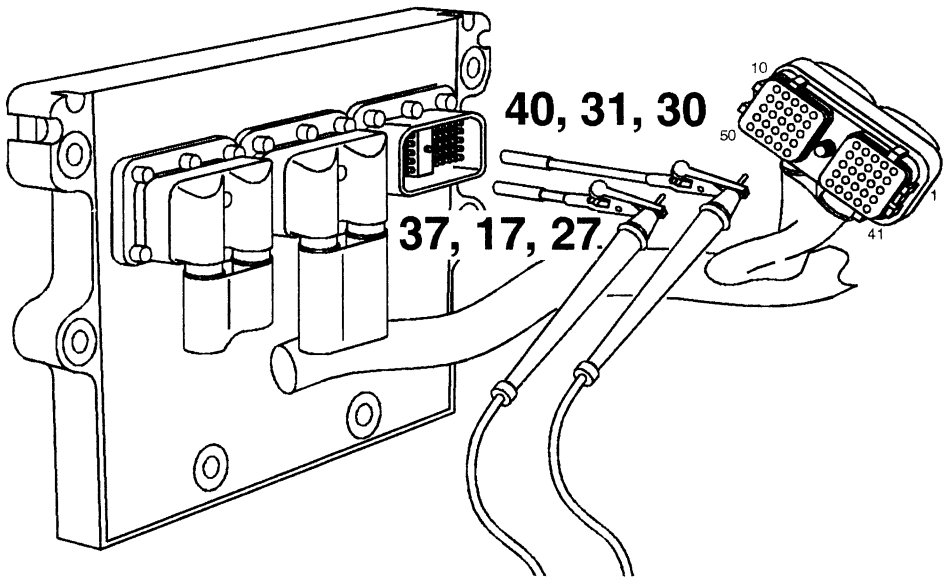
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

Condition:

- Disconnect the sensor harness connector from the ECM.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Measure the voltage out of the ECM for each sensor. • Measure the voltage from pin 37 to pin 40 in the sensor port of the ECM. • Measure the voltage from pin 17 to pin 31 in the sensor port of the ECM. • Measure the voltage from pin 27 to pin 30 in the sensor port of the ECM.	**OK** **(+) 4.75 to 5.25 VDC**	1C
	NOT OK **Replace the ECM** Refer to Procedure 019-031.	2A



19c00791

STEP 1C: Check for a short circuit to the battery.

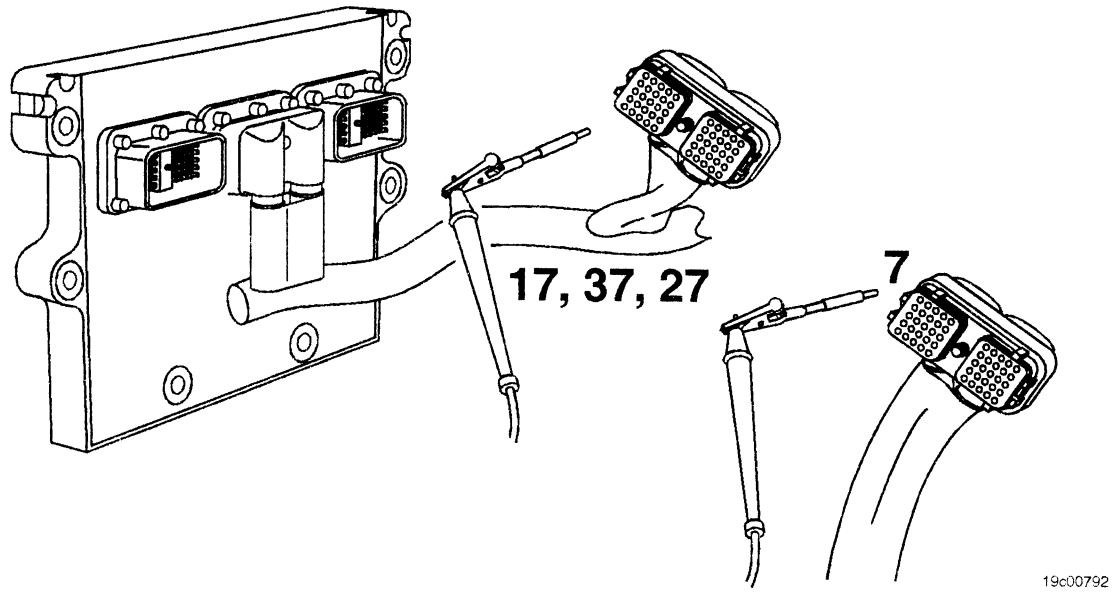
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the OEM harness connector from the ECM.
- Disconnect the sensor harness connector from the ECM.
- Disconnect the engine harness from the intake manifold pressure/temperature sensor.
- Disconnect the engine harness from the ambient air pressure sensor.
- Disconnect the engine harness from the fuel pressure sensor.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground. • Measure the resistance from pin 17 of the sensor harness connector to pin 7 of the OEM harness connector. • Measure the resistance from pin 37 of the sensor harness connector to pin 7 of the OEM harness connector. • Measure the resistance from pin 27 of the sensor harness connector to pin 7 of the OEM harness connector.	**OK** **More than 100k ohms**	1D
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	2A



STEP 1D: Check for a short circuit from pin to pin.

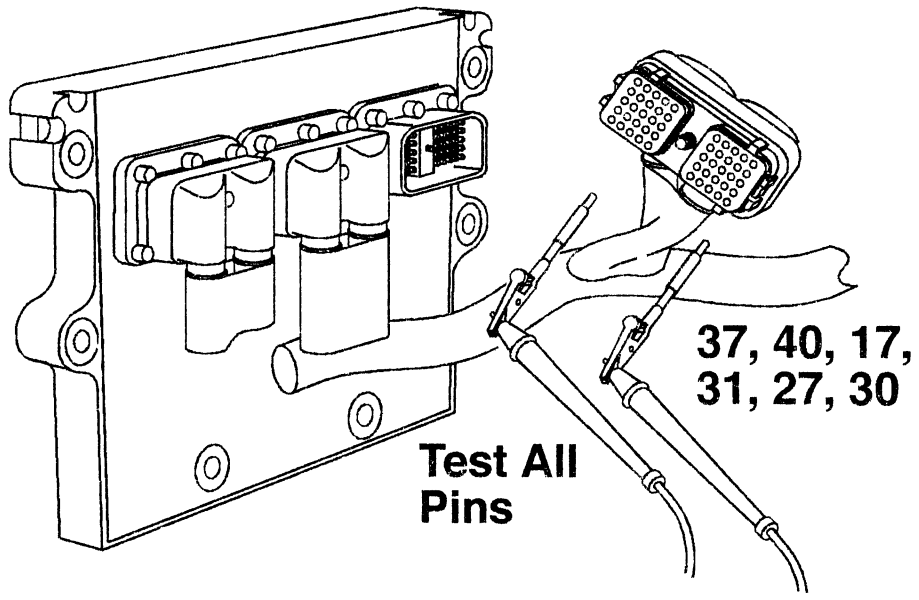
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.
- Disconnect the engine harness from the intake manifold pressure/temperature sensor.
- Disconnect the engine harness from the ambient air pressure sensor.
- Disconnect the engine harness from the fuel pressure sensor.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pin 37 of the sensor harness connector to all other pins in the connector. • Measure the resistance from pin 40 of the sensor harness connector to all other pins in the connector. • Measure the resistance from pin 17 of the sensor harness connector to all other pins in the connector. • Measure the resistance from pin 31 of the sensor harness connector to all other pins in the connector. • Measure the resistance from pin 27 of the sensor harness connector to all other pins in the connector. • Measure the resistance from pin 30 of the sensor harness connector to all other pins in the connector.	**OK** **More than 100k ohms**	2A
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	2A



STEP 2: Clear the fault codes.

STEP 2A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Using INSITE™, verify that Fault Code 386 is inactive.	**OK** **Fault Code 386 inactive**	2B
	NOT OK Return to the troubleshooting steps or contact your local Cummins Authorized Repair Location if all the steps have been completed and checked again.	1A

STEP 2B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

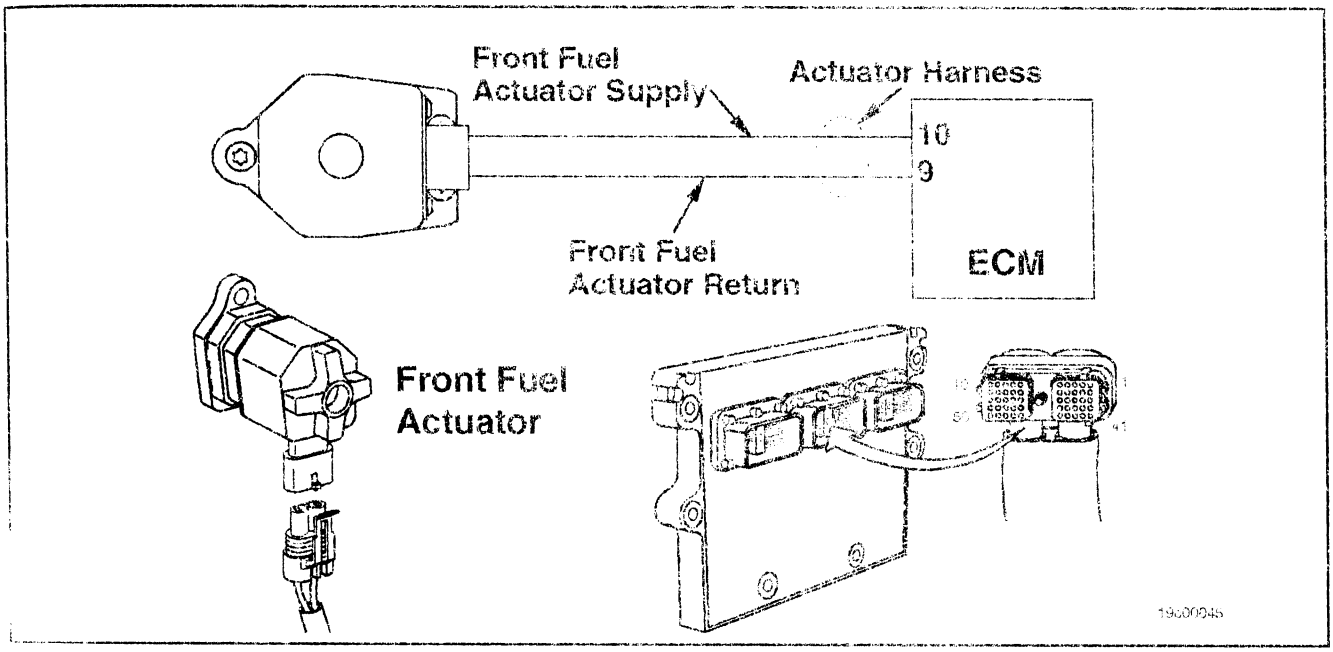
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 379

Actuator Circuit

CODES	REASON	EFFECT
Fault Code: 379 PID(P), SID(S): S018 SPN: 633 FMI: 6/6 Lamp: Yellow	High current detected at front fueling actuator circuit.	Engine will run using **only** the rear three cylinders.

Front Fueling Actuator Circuit



Circuit Description:

The fuel actuators are actuated by the electronic control module (ECM) to control fuel metering. Each fuel actuator is connected to the ECM by a supply and a return wire. An electrical pulse is sent to the fuel actuator from the ECM on the supply wire and returns to the ECM on the return wire. Each solenoid valve is normally closed, and it is **only** opened by an electrical pulse from the ECM during metering.

Component Location:

The front fueling actuator is mounted on the fuel delivery housing. It is the actuator closest to the front of the engine.

Shop Talk:

The possible failure modes are short circuit to battery, low actuator resistance, or short circuit between supply and return wires.

TROUBLESHOOTING SUMMARY

WARNING

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

CAUTION

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

CAUTION

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the actuator harness.		
STEP 1A: Inspect the harness and the ECM connector pins.	No damaged pins	
STEP 1B: Check the resistance of the whole circuit.	Less than 10 ohms	
STEP 1B-1: Inspect the actuator harness and connector pins.	No damaged pins	
STEP 1B-2: Check the resistance of the actuator solenoid.	0.5 to 1.5 ohms	
STEP 1C: Check for a short circuit to battery in the circuit.	More than 100k ohms	
STEP 1D: Check for a short circuit from pin to pin in the ECM connector.	More than 100k ohms	
STEP 2: Clear the fault codes.		
STEP 2A: Disable the fault code.	Fault Code 379 inactive	
STEP 2B: Clear the inactive fault codes.	All fault codes cleared	

TROUBLESHOOTING STEP

STEP 1: Check the actuator harness.

STEP 1A: Inspect the harness and the ECM connector pins.

⚠WARNING⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness connector from the ECM.

Action	Specifications/Repair	Next Step
Inspect the harness and the ECM connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	1B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	2A

STEP 1B: Check the resistance of the whole circuit.

⚠WARNING⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

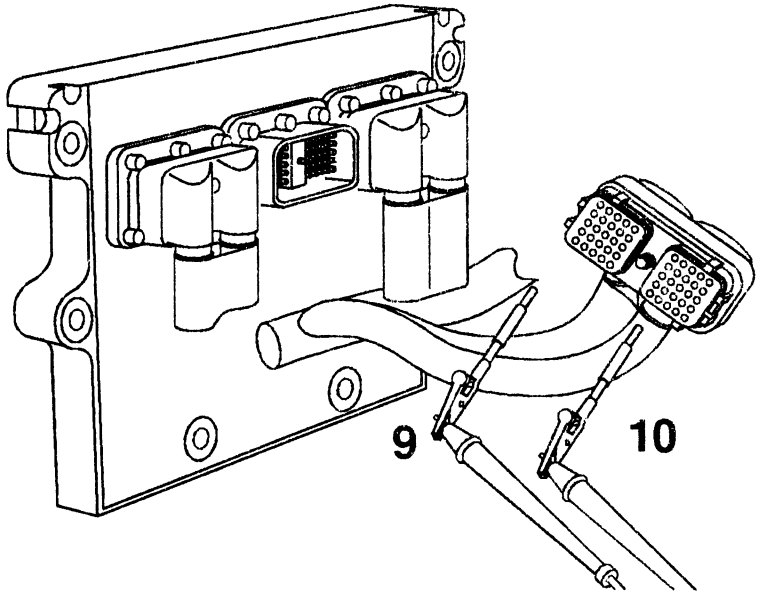
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check the resistance of the whole circuit. • Measure the resistance from pin 9 to pin 10 of the actuator harness connector.	**OK** **Less than 10 ohms**	1B-1
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	2A



19c00205

STEP 1B-1: Inspect the actuator harness and connector pins.

⚠WARNING⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness from the actuator solenoid.

Action	Specifications/Repair	Next Step
Inspect the harness and the actuator connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	1B-2
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	2A

STEP 1B-2: Check the resistance of the actuator solenoid.

⚠WARNING⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

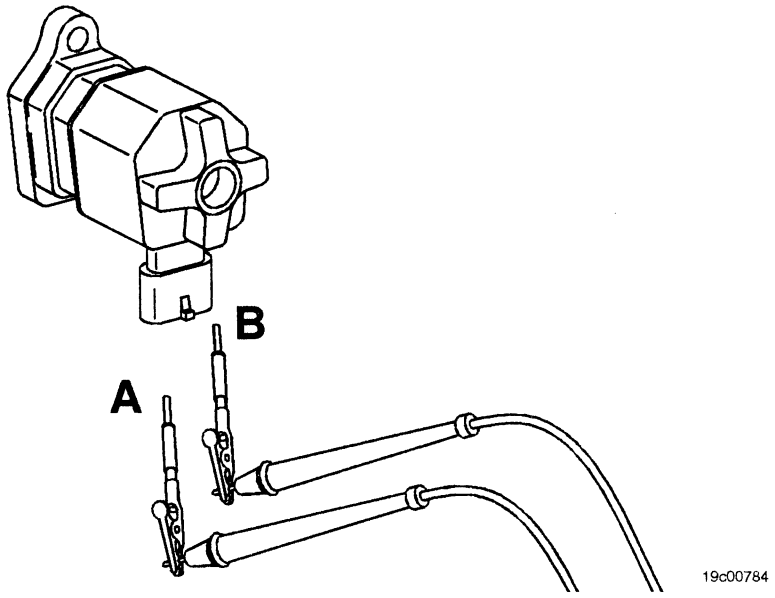
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness from the actuator solenoid.

Action	Specifications/Repair	Next Step
Check the resistance of the actuator solenoid. • Measure the resistance across the two terminals on the actuator solenoid.	**OK** **0.5 to 1.5 ohms**	1C
	NOT OK **Replace the actuator solenoid** Refer to Procedure 019-110.	2A



STEP 1C: Check for a short circuit to battery in the circuit.

⚠WARNING⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

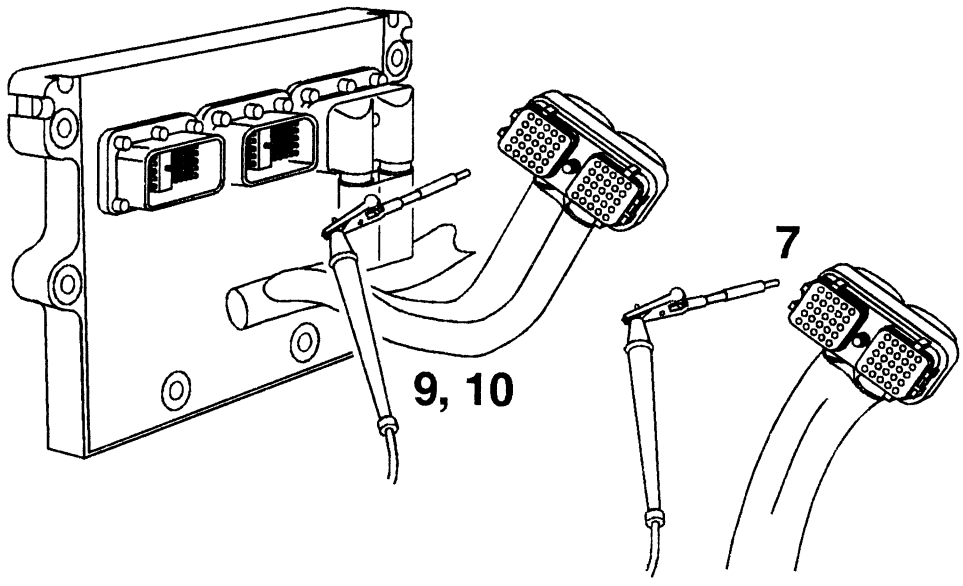
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness from the actuator solenoid.
- Disconnect the OEM harness connector from the ECM.
- Disconnect the actuator harness connector from the ECM.
- Disconnect the positive (+) battery terminal from battery.

Action	Specifications/Repair	Next Step
Check for a short circuit to battery in the actuator solenoid. • Measure the resistance between connector pin 9 of the actuator harness connector to pin 7 of the OEM harness connector. • Measure the resistance between connector pin 10 of the actuator harness connector to pin 7 of the OEM harness connector.	**OK** **More than 100k ohms**	1D
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	2A



STEP 1D: Check for a short circuit from pin to pin in the ECM connector.

⚠WARNING⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

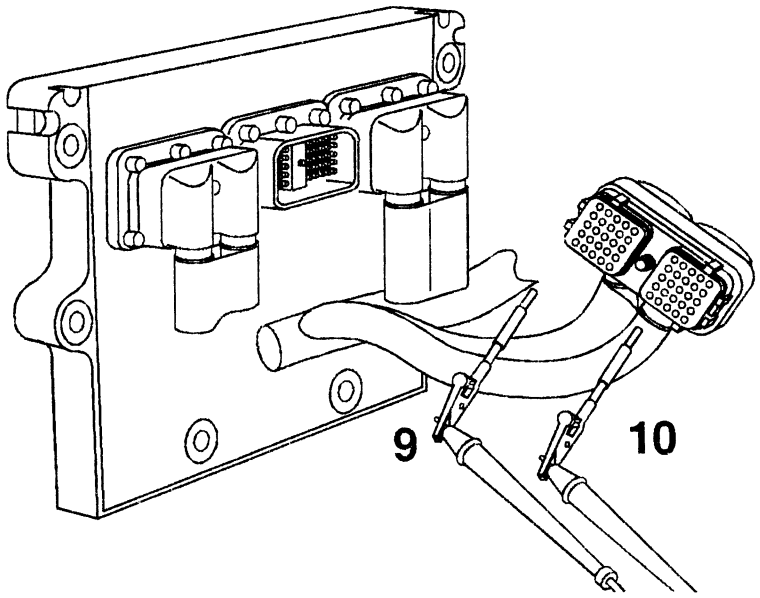
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness connector from the ECM.
- Disconnect the actuator harness from the actuator solenoid.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pin 9 in the actuator harness connector to all other pins in the connector. • Measure the resistance from pin 10 in the actuator harness connector to all other pins in the connector.	**OK** **More than 100k ohms**	2A
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	2A



19c00205

STEP 2: Clear the fault codes.

STEP 2A: Disable the fault code.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and road test vehicle for at least 1 mile. • Using INSITE™, verify that Fault Code 379 is inactive.	**OK** **Fault Code 379 inactive**	2B
	NOT OK **Fault Code 379 active** **Replace the ECM** Refer to Procedure 019-031.	2B

STEP 2B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

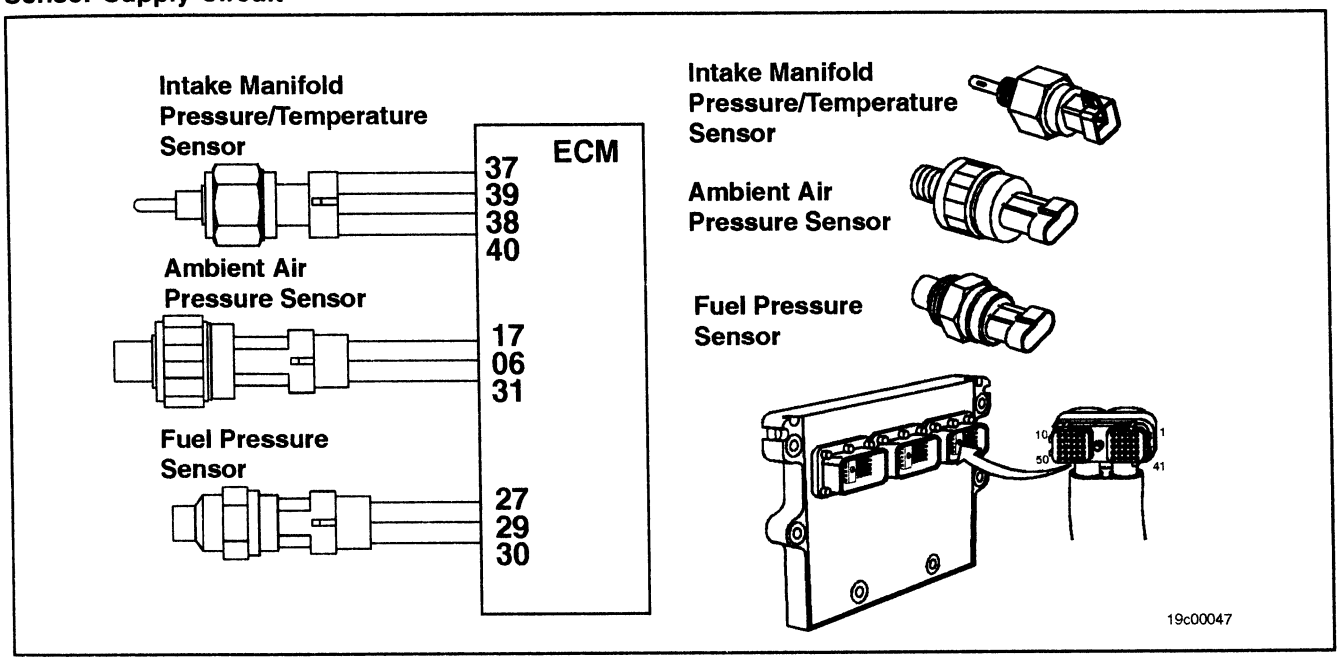
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 352

Sensor Voltage Supply

CODES	REASON	EFFECT
Fault Code: 352 PID(P), SID(S): S232 SPN: 620 FMI: 4/4 Lamp: Yellow	Low voltage detected on the electronic control module (ECM) voltage supply line to some of the sensors.	Engine is derated to no-air setting.

Sensor Supply Circuit



Circuit Description:

The electronic control module (ECM) supplies each of these sensors with (+) 5 VDC. If the supply line to any sensor is damaged, the sensor will **not** work correctly.

Component Location:

- Intake manifold pressure/temperature sensor is located on the intake manifold housing.
- Ambient air pressure sensor is located below the ECM.
- Fuel pressure sensor is located on the fuel manifold housing.

Shop Talk:

Low voltage on the sensor (+) 5-VDC supply line will be caused by a short circuit to ground in a supply line, a short circuit between a supply line or a return line, a failed sensor, or a failed ECM power supply.

TROUBLESHOOTING SUMMARY

⚠ CAUTION ⚠

To avoid damaging the new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead
Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check for failed sensors.		
STEP 1A: Check the intake manifold pressure/ temperature sensor.	Less than (+) 4.5 VDC	
STEP 1B: Check the ambient air pressure sensor.	Less than (+) 4.5 VDC	
STEP 1C: Check the fuel pressure sensor.	Less than (+) 4.5 VDC	
STEP 2: Check the sensor harness.		
STEP 2A: Inspect the harness and the ECM connector pins.	No damaged pins	
STEP 2B: Check the supply voltage.	(+) 4.75 to 5.25 VDC	
STEP 2C: Check for a short circuit to ground in the sensor supply lines.	More than 100k ohms	
STEP 2D: Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 3: Clear the fault codes.		
STEP 3A: Disable the fault code.	Fault Codes 352 inactive	
STEP 3B: Clear the inactive fault codes.	All fault codes cleared	

TROUBLESHOOTING STEP

STEP 1: Check for failed sensors.

STEP 1A: Check the intake manifold pressure/temperature sensor.

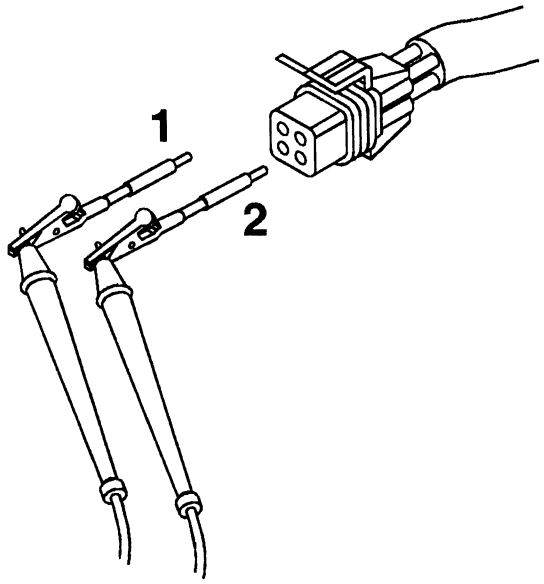
⚠CAUTION⚠

**To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.**

Condition:

- Disconnect the engine harness from the intake manifold pressure/temperature sensor.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the intake manifold pressure/temperature sensor. • Measure the voltage from pin A (or 1) to pin B (or 2) on the intake manifold pressure/ temperature sensor connector.	**OK** **Less than (+) 4.5 VDC**	1B
	NOT OK **Replace the intake manifold pressure/ temperature sensor** Refer to Procedure 019-159.	3A



19c00081

STEP 1B: Check the ambient air pressure sensor.

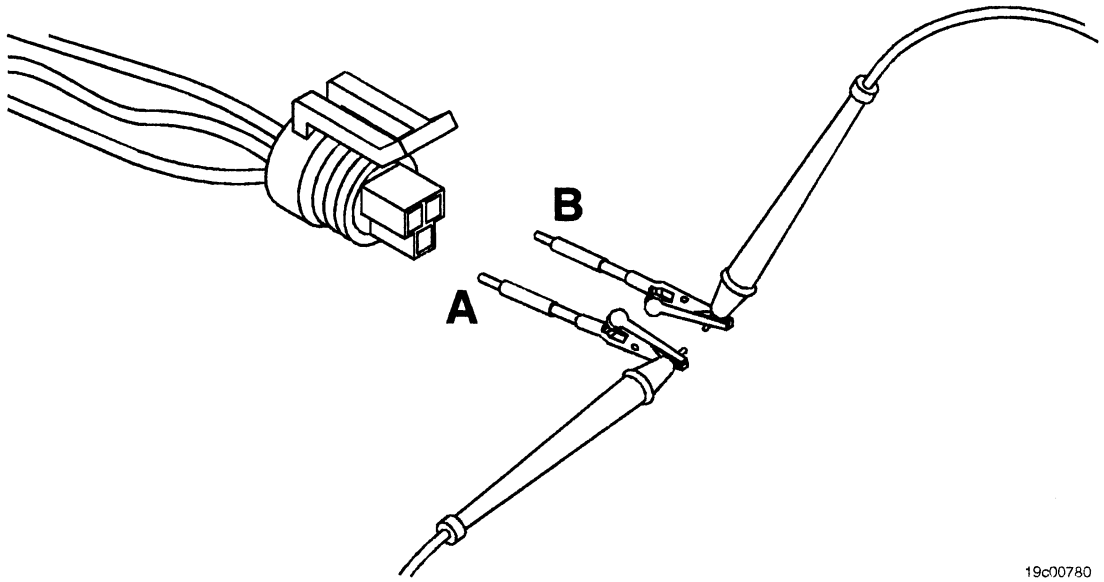
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Disconnect the engine harness from the ambient air pressure sensor.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the ambient air pressure sensor. • Measure the voltage from pin A (or 1) to pin B (or 2) on the ambient air pressure sensor connector.	**OK** **Less than (+) 4.5 VDC**	1C
	NOT OK **Replace the ambient air pressure sensor** Refer to Procedure 019-004.	3A



STEP 1C: Check the fuel pressure sensor.

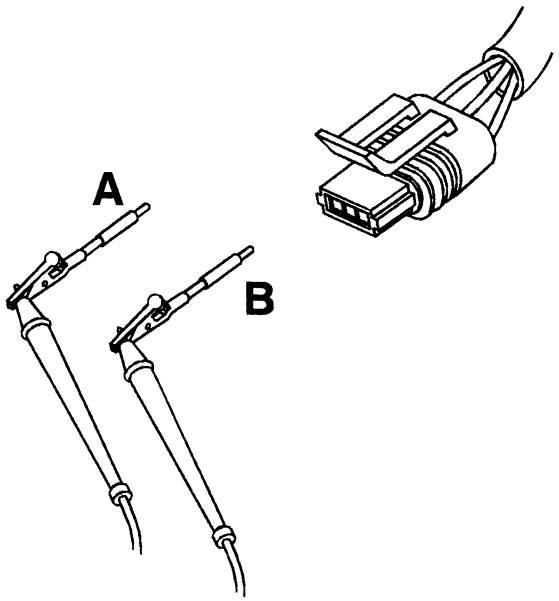
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Disconnect the engine harness from the fuel pressure sensor.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the fuel pressure sensor. • Measure the voltage from pin A (or 1) to pin B (or 2) on the fuel pressure sensor connector.	**OK** **Less than (+) 4.5 VDC**	2A
	NOT OK **Replace the fuel pressure sensor** Refer to Procedure 019-188.	3A



19200191

STEP 2: Check the sensor harness.

STEP 2A: Inspect harness and the ECM connector pins.

⚠CAUTION⚠

To avoid damaging the new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Inspect the harness and the ECM connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	2B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	3A

STEP 2B: Check the supply voltage.

⚠CAUTION⚠

To avoid damaging the new ECM, all other active fault codes must be investigated prior to replacing the ECM.

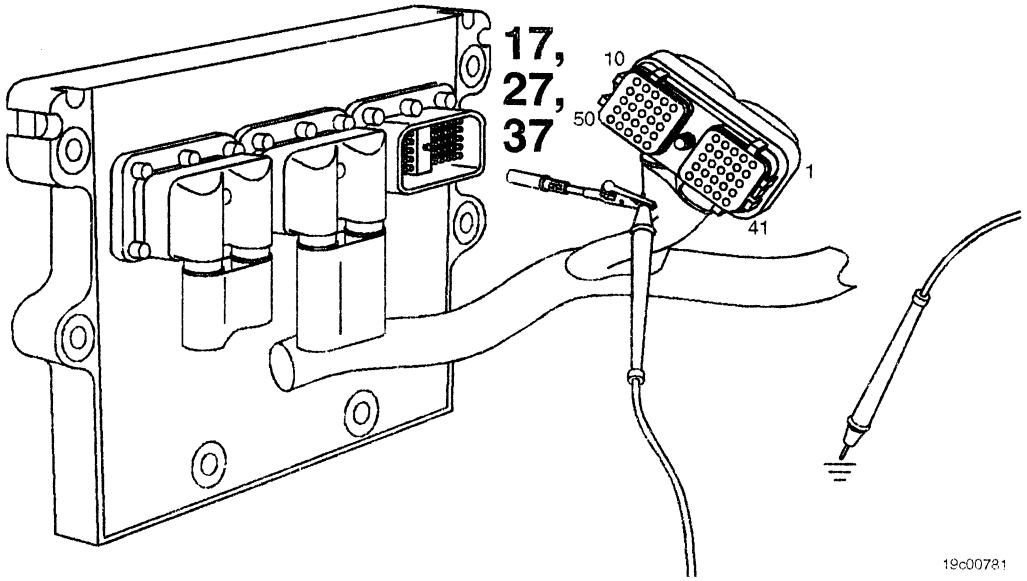
⚠CAUTION⚠

To avoid pin and harness damage use the following test lead when taking a measurement: Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

Condition:

- Disconnect the sensor harness connector from the ECM.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the supply voltage. • Measure the supply voltage from the ECM sensor harness port pins 17, 27, and 37 to ground.	**OK** **(+) 4.75 to 5.25 VDC**	2C
	NOT OK **Replace the ECM** Refer to Procedure 019-031.	3A



STEP 2C: Check for a short circuit to ground in the sensor supply lines.

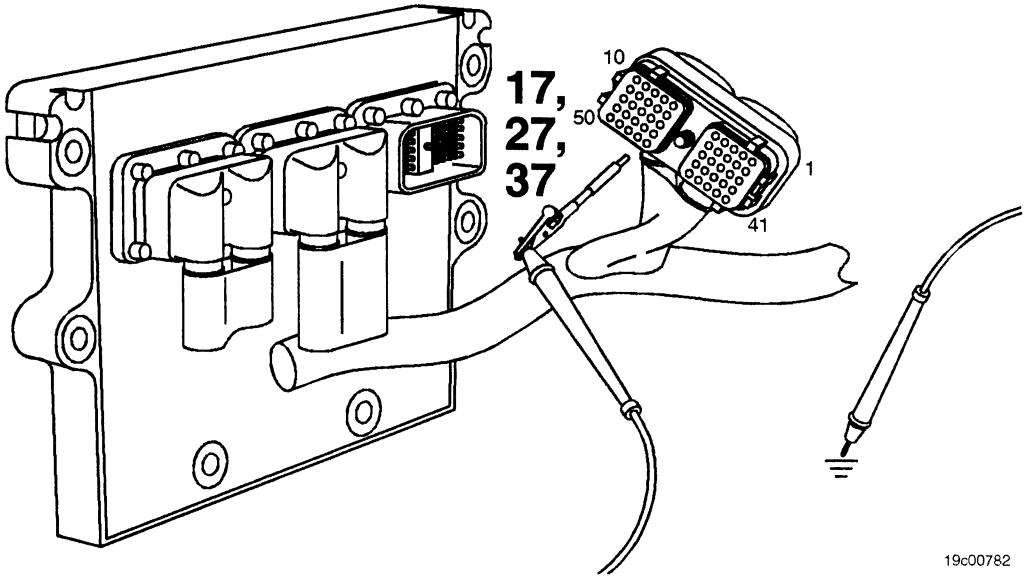
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground in the sensor supply lines. • Measure the resistance from pins 17, 27, and 37 in the sensor harness to engine block ground.	**OK** **More than 100k ohms**	2D
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	3A



STEP 2D: Check for a short circuit from pin to pin.

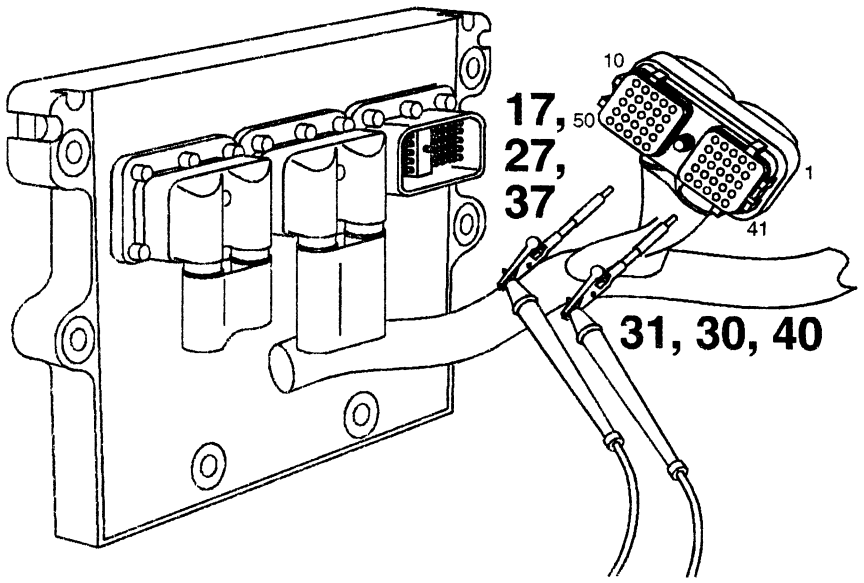
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.
- Disconnect the fuel pressure sensor from the engine harness.
- Disconnect the ambient air pressure sensor from the engine harness.
- Disconnect the intake manifold pressure/temperature sensor from the engine harness.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pin 17 to pin 31 in the sensor harness. • Measure the resistance from pin 27 to pin 30 in the sensor harness. • Measure the resistance from pin 37 to pin 40 in the sensor harness.	**OK** **More than 100k ohms**	3A
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	3A



STEP 3: Clear the fault codes.

STEP 3A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it idle for 1 minute. • Using INSITE™, verify Fault Code 352 is inactive.	**OK** **Fault Code 352 inactive**	3B
	NOT OK Return to the troubleshooting steps or contact your local Cummins Authorized Repair Location if all the steps have been completed and checked again.	1A

STEP 3B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

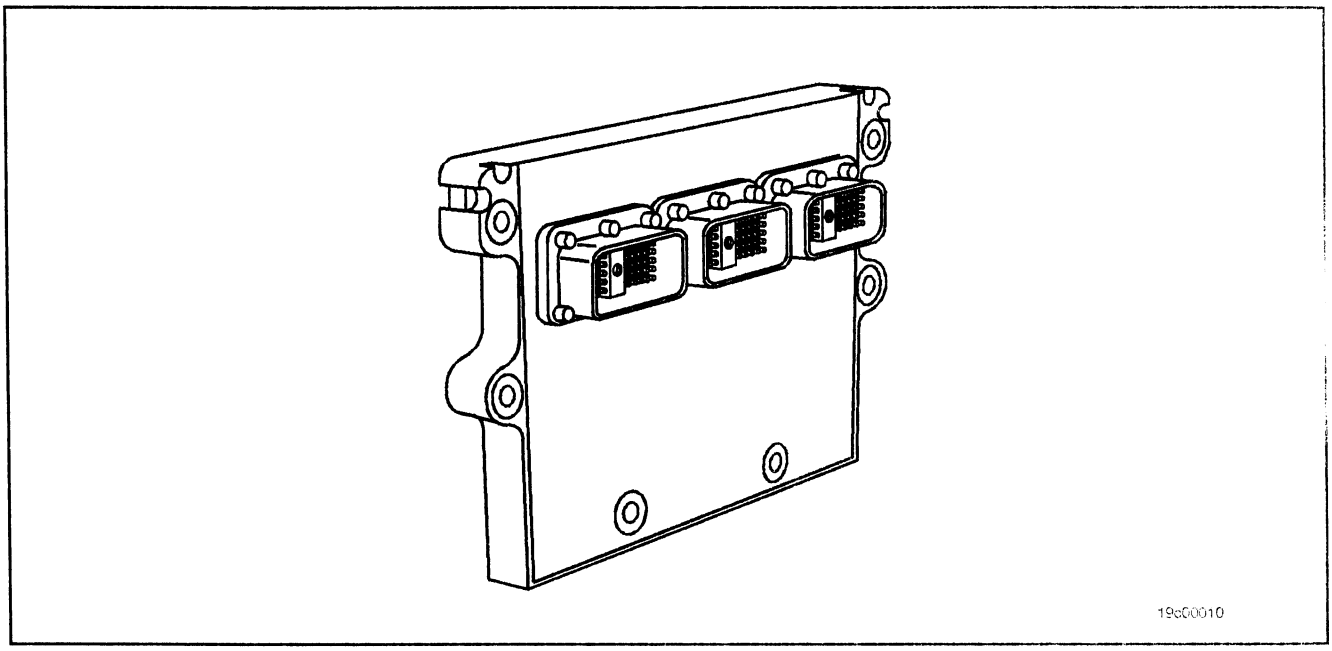
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 343

Electronic Control Module (ECM)

CODES	REASON	EFFECT
Fault Code: 343 PID(P), SID(S): S254 SPN: 629 FMI: 12/12 Lamp: Yellow	Internal ECM error.	Possibly none on performance or severe derate.

Electronic Control Module



Circuit Description:

The ECM monitors both signal voltage output to the injectors and ECM input from the engine sensors.

Component Location:

The ECM is bolted to the intake side of the cylinder head between the air inlet horn and the front of the engine.

Shop Talk:

- Loose engine or chassis ground connections can cause Fault Code 343 to be logged, as well as complaints of an intermittent stumble. Pay special attention to the negative starter post connection.
- Moisture in the ECM connectors can also cause the ECM to log Fault Code 343.

TROUBLESHOOTING SUMMARY

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check for multiple fault codes.		
STEP 1A: Read the fault codes.	Fault Codes 115 and 121 are not active	
STEP 2: Check the power and ground connections.		
STEP 2A: Check all engine and chassis power and ground connections.	Clean and tight	
STEP 2B: Check all power resistances.	Less than 10 ohms	
STEP 2C: Check all ground resistances.	Less than 10 ohms	
STEP 3: Check for moisture in the ECM connectors.		
STEP 3A: Check for moisture in the ECM connectors.	All connectors dry	
STEP 4: Clear the fault codes.		
STEP 4A: Disable the fault code.	Fault Code 343 inactive	
STEP 4B: Clear the inactive fault codes.	All fault codes cleared	

TROUBLESHOOTING STEP

STEP 1: Check for multiple fault codes.

STEP 1A: Read the fault codes.

Condition:
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Read the fault codes using INSITE™.	**OK** **Fault Codes 115 and 121 are not active**	2A
	NOT OK Go to Fault Codes 115 and 121.	Fault Code 115 and 121

STEP 2: Check the power and ground connections.

STEP 2A: Check all engine and chassis power and ground connections.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Check all engine and vehicle power and ground connections for the following: • Corrosion • Loose connections.	**OK** **Clean and tight**	2B
	NOT OK **Repair damaged connections** Repair or replace the damaged connections.	4A

STEP 2B: Check all power resistances.

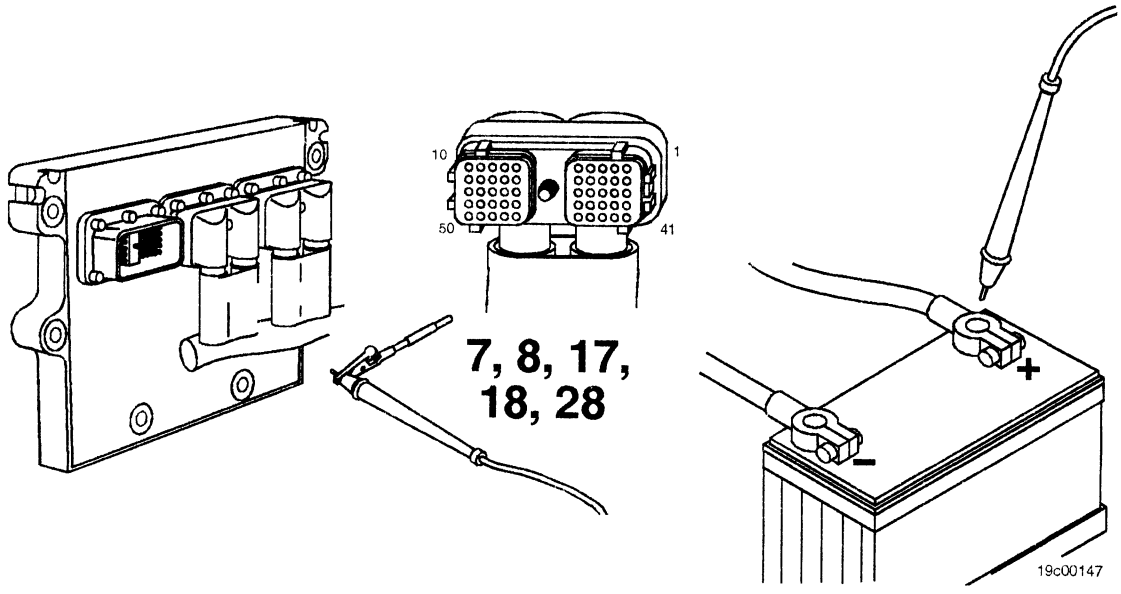
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the OEM harness connector from the ECM.
- Disconnect the negative (-) battery cable from the battery.
- Disconnect the positive (+) battery cable from the battery.

Action	Specifications/Repair	Next Step
Check all power resistances. • Measure the resistance from pin 7 of OEM harness connector to the positive (+) battery terminal connector. • Measure the resistance from pin 8 of OEM harness connector to the positive (+) battery terminal connector. • Measure the resistance from pin 17 of OEM harness connector to the positive (+) battery terminal connector. • Measure the resistance from pin 18 of OEM harness connector to the positive (+) battery terminal connector. • Measure the resistance from pin 28 of OEM harness connector to the positive (+) battery terminal connector.	**OK** **Less than 10 ohms**	2C
	NOT OK **Repair or replace the OEM harness** • Repair the OEM harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-071.	4A



STEP 2C: Check all ground resistances.

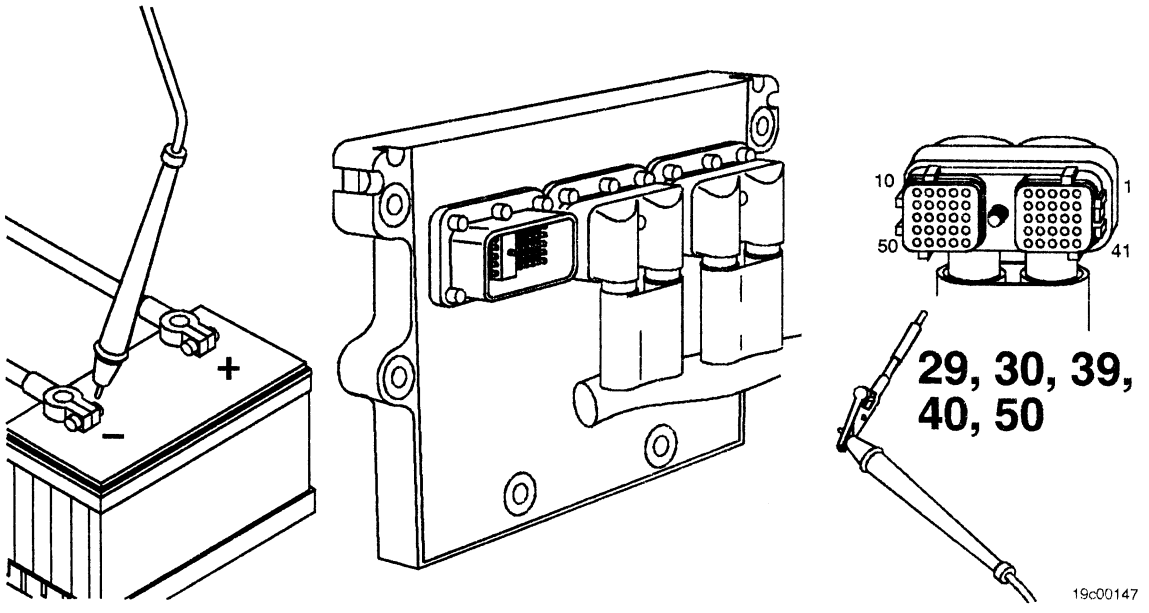
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the OEM harness connector from the ECM.
- Disconnect the negative (–) battery cable from the battery.
- Disconnect the positive (+) battery cable from the battery.

Action	Specifications/Repair	Next Step
Check all ground resistances. • Measure the resistance from pin 29 of OEM harness connector to the negative (–) battery terminal connector. • Measure the resistance from pin 30 of OEM harness connector to the negative (–) battery terminal connector. • Measure the resistance from pin 39 of OEM harness connector to the negative (–) battery terminal connector. • Measure the resistance from pin 40 of OEM harness connector to the negative (–) battery terminal connector. • Measure the resistance from pin 50 of OEM harness connector to the negative (–) battery terminal connector.	**OK** **Less than 10 ohms**	3A
	NOT OK **Repair or replace the OEM harness** • Repair the OEM harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-071.	4A



STEP 3: Check for moisture in the ECM connectors.

STEP 3A: Check for moisture in the ECM connectors.

Condition:
- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for moisture in the ECM connectors. • Check for moisture in the ECM connectors.	**OK** **All connectors dry**	4A
	NOT OK **Dry the connectors** Dry the connectors with electrical contact cleaner, Part No. 3824510.	4A

STEP 4: Clear the fault codes.

STEP 4A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let idle for 1 minute. • Using INSITE™, verify Fault Code 343 is inactive.	**OK** **Fault Code 343 inactive**	4B
	NOT OK Return to the troubleshooting steps or contact your local Cummins Authorized Repair Location if all the steps have been completed and checked again.	1A

STEP 4B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

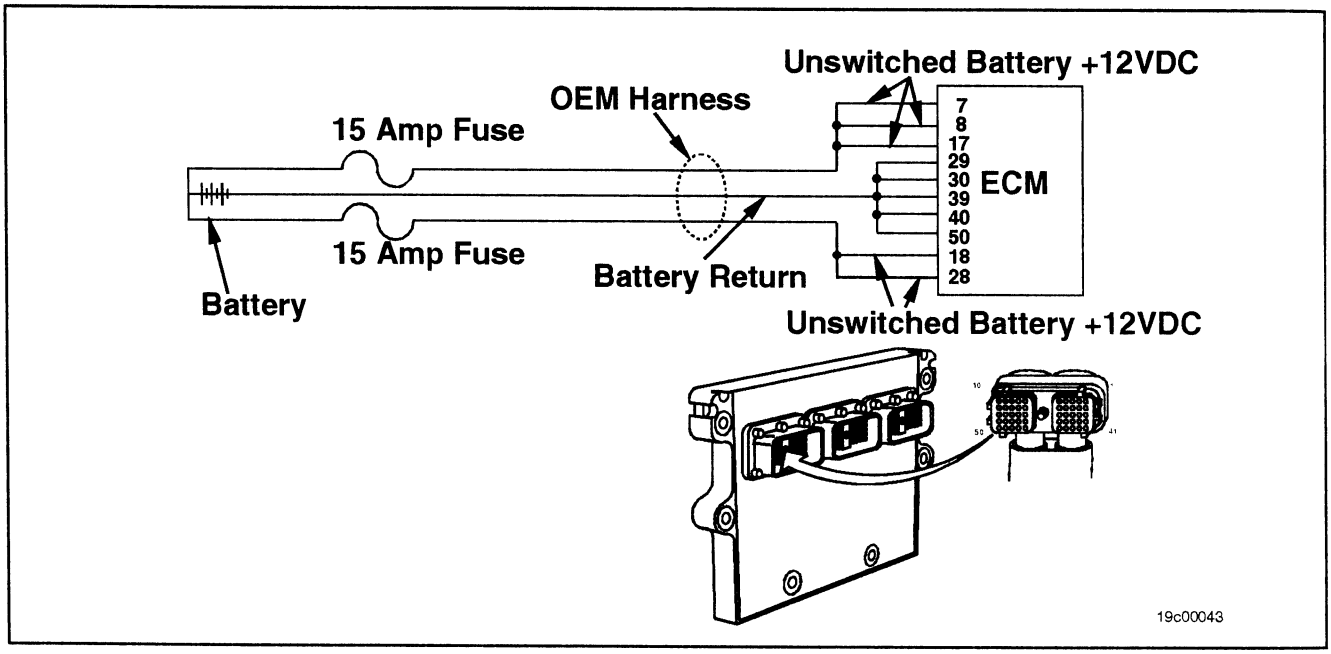
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 341

Unswitched Battery Supply Circuit

CODES	REASON	EFFECT
Fault Code: 341 PID(P), SID(S): S253 SPN: 630 FMI: 2/2 Lamp: Yellow	Severe loss of data from the ECM.	Possibly no noticeable performance effects, **or** engine dying, **or** difficulty in starting the engine. Fault information, trip information, and maintenance monitor data can be inaccurate.

Unswitched Battery Supply



Circuit Description:

The ECM receives constant voltage from the batteries through the unswitched battery wires that are connected directly to the positive (+) battery post. There are two in-line 15-amp fuses in the unswitched battery wires to protect the engine harness from overheating. The ECM receives switched battery input through the vehicle keyswitch wire when the vehicle keyswitch is turned on. The battery return wires are connected directly to the negative (–) battery post.

Component Location:

The ECM is connected to the battery by the OEM harness. This direct link provides a constant power supply for the ECM. The location of the battery will vary with the OEM. Refer to the OEM troubleshooting and repair manual.

TROUBLESHOOTING SUMMARY

⚠ CAUTION ⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Read the fault codes.		
STEP 1A: Read the fault codes.	No other active fault codes	
STEP 2: Check the batteries and the power connector.		
STEP 2A: Check the resistance of the battery supply circuit.	Less than 10 ohms	
STEP 2B: Check the battery voltage.	Normal conditions: At least (+) 12 VDC During cranking: At least (+) 6.2 VDC	
STEP 2C: Check the battery connections.	Connections are tight and corrosion-free	
STEP 3: Check the two 15-amp fuses.		
STEP 3A: Verify that the two 15-amp fuses are installed correctly.	Fuses installed correctly	
STEP 3B: Verify that the two 15-amp fuses are not blown.	Fuses not blown	
STEP 4: Check the OEM harness		
STEP 4A: Check the add-on or the accessory wiring at (+) terminal of the battery.	No damaged wires	
STEP 5: Recalibrate the ECM.		
STEP 5A: Recalibrate the ECM.	Fault Code 341 inactive	
STEP 6: Clear the fault codes.		
STEP 6A: Disable the fault code.	Fault Code 341 inactive	
STEP 6B: Clear the inactive fault codes.	All fault codes cleared	

TROUBLESHOOTING STEP

STEP 1: Read the fault codes.

STEP 1A: Read the fault codes.

Condition:
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Read the fault codes using INSITE™.	**OK** **No other active fault codes**	2A
	NOT OK Troubleshoot the active fault codes.	5A

STEP 2: Check the batteries and the power connector.

STEP 2A: Check the resistance of the battery supply circuit.

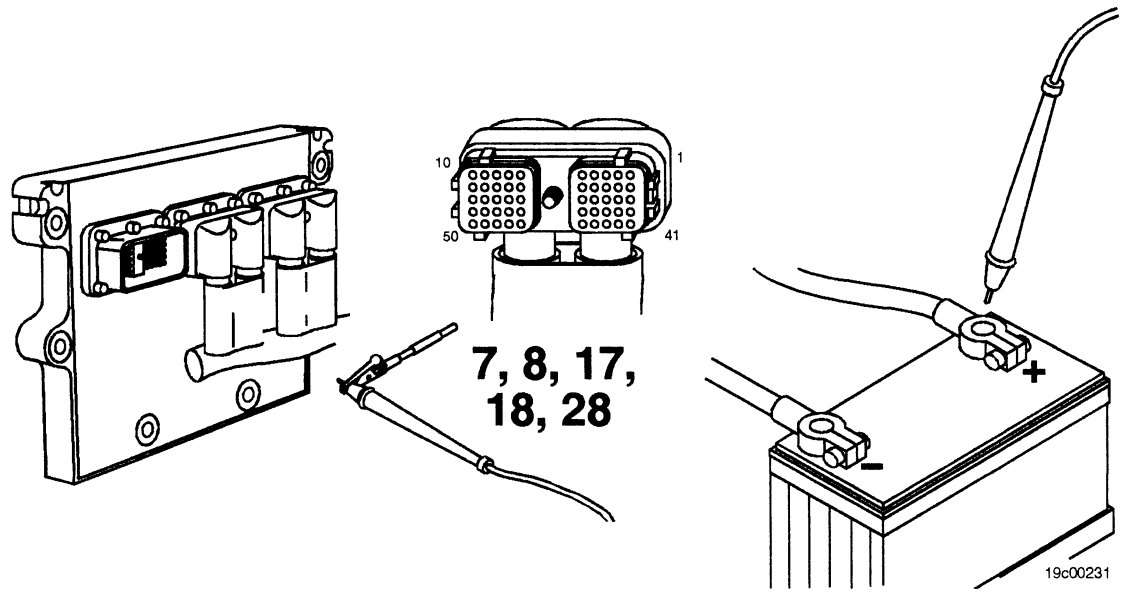
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the OEM harness connector from the ECM.

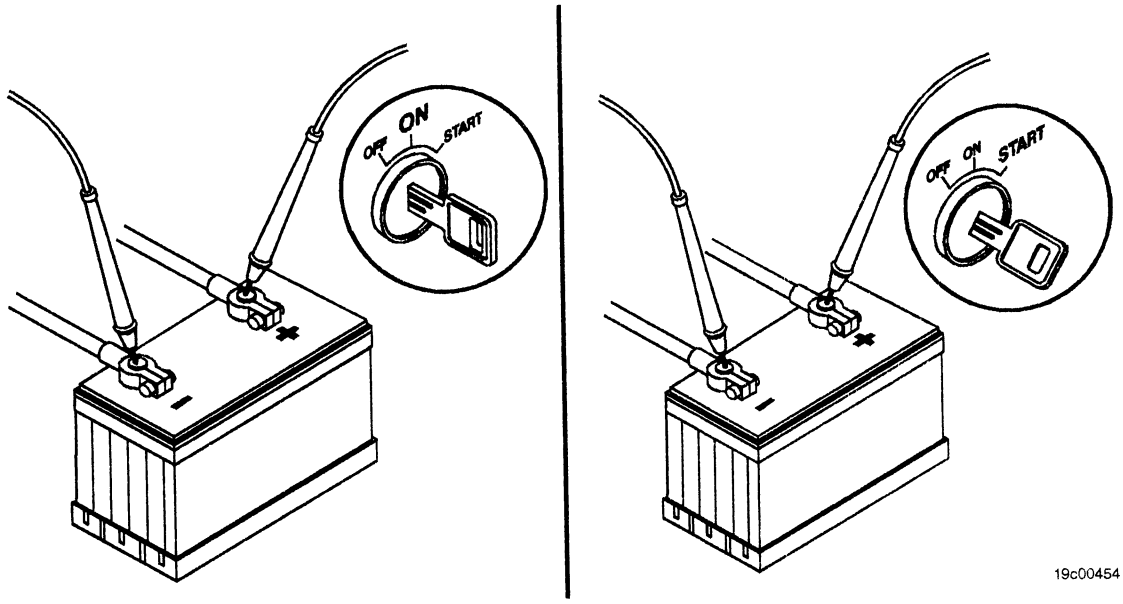
Action	Specifications/Repair	Next Step
Check the resistance of the battery supply circuit. • Measure the resistance from pin 7 of the OEM harness connector to the positive (+) battery terminal. • Measure the resistance from pin 8 of the OEM harness connector to the positive (+) battery terminal. • Measure the resistance from pin 17 of the OEM harness connector to the positive (+) battery terminal. • Measure the resistance from pin 18 of the OEM harness connector to the positive (+) battery terminal. • Measure the resistance from pin 28 of the OEM harness connector to the positive (+) battery terminal.	**OK** **Less than 10 ohms**	2B
	NOT OK **Repair or replace the OEM harness** • Repair the OEM harness. Refer to Procedure 019-250. • Replace the OEM harness. Refer to Procedure 019-071.	5A



STEP 2B: Check the battery voltage.

Condition:
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the battery voltage. • Place positive (+) probe of the multimeter on the positive battery terminal and touch negative (–) probe to the negative battery terminal while trying to start engine.	**OK** **Normal conditions: at least (+) 12 VDC** **During cranking: at least (+) 6.2 VDC**	2C
	NOT OK **Charge or replace the battery** Refer to the OEM troubleshooting and repair manual.	5A



STEP 2C: Check the battery connections.

Condition:
- Turn keyswitch OFF.

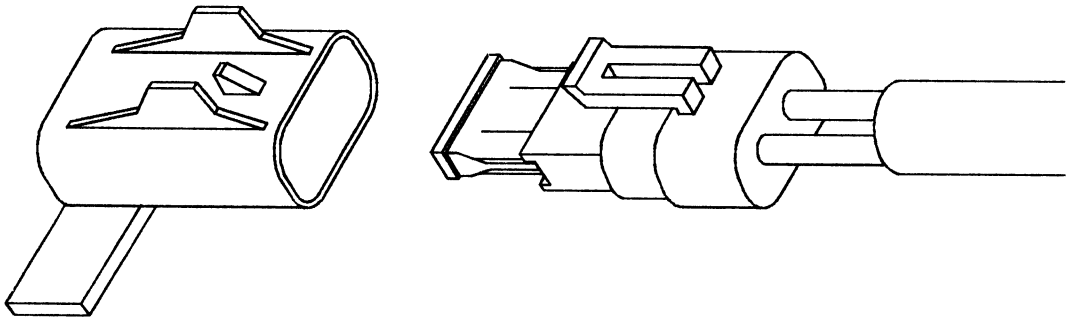
Action	Specifications/Repair	Next Step
Check the battery connections. • Inspect the battery terminal connections.	**OK** **Connections are tight and corrosion-free**	3A
	NOT OK **Tighten the connections** Tighten the loose connections and clean the terminals. Refer to the OEM troubleshooting and repair manual.	5A

STEP 3: Check the two 15-amp fuses.

STEP 3A: Verify that the two 15-amp fuses are installed correctly.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Verify that the two 15-amp fuses are installed correctly. • Inspect the two 15 AMP fuses for correct installation.	**OK** **Fuses installed correctly**	3B
	NOT OK **Install the fuses correctly** Refer to Procedure 019-198.	5A

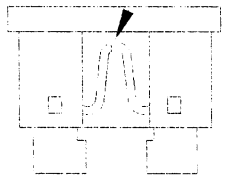


19c00455

STEP 3B: Verify that the two 15-amp fuses are not blown.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Verify that the two 15-amp fuses are not blown. • Inspect the two 15 AMP fuses to see if they are blown.	**OK** **Fuses not blown**	4A
	NOT OK **Locate the short circuit** • Replace the engine harness. Refer to Procedure 019-043. • Replace the blown fuse(s). Refer to Procedure 019-198.	5A



19800238

STEP 4: Check the OEM harness.

STEP 4A: Check the add-on or the accessory wiring at (+) terminal of the battery.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Check the add-on or the accessory wiring at (+) terminal of the battery. • Starting at the (+) terminal, follow any add-on or accessory wiring and examine wire(s) for damaged insulation or an installation error that can cause the supply wire to be shorted to the engine block.	**OK** **No damaged wires**	5A
	NOT OK **Repair or replace the damaged wiring**	5A

STEP 5: Recalibrate the ECM.

STEP 5A: Recalibrate the ECM.

Condition: Connect all components.

Action	Specifications/Repair	Next Step
Recalibrate the ECM • Use ESDN™ to recalibrate the ECM.	**OK** **Fault Code 341 inactive**	6A
	NOT OK Fault code active.	6A

STEP 6: Clear the fault codes.

STEP 6A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it idle for 1 minute. • Using INSITE™, verify Fault Code 341 is inactive.	**OK** **Fault Code 341 inactive**	6B
	NOT OK Return to the troubleshooting steps or contact your local Cummins Authorized Repair Location if all the steps have been completed and checked again.	1A

STEP 6B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

TROUBLESHOOTING SUMMARY

⚠ CAUTION ⚠

To avoid damaging the new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead
Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check for failed sensors.		
STEP 1A: Check the intake manifold pressure/ temperature sensor.	Less than (+) 4.5 VDC	
STEP 1B: Check the ambient air pressure sensor.	Less than (+) 4.5 VDC	
STEP 1C: Check the fuel pressure sensor.	Less than (+) 4.5 VDC	
STEP 2: Check the sensor harness.		
STEP 2A: Inspect the harness and the ECM connector pins.	No damaged pins	
STEP 2B: Check the supply voltage.	(+) 4.75 to 5.25 VDC	
STEP 2C: Check for a short circuit to ground in the sensor supply lines.	More than 100k ohms	
STEP 2D: Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 3: Clear the fault codes.		
STEP 3A: Disable the fault code.	Fault Codes 352 inactive	
STEP 3B: Clear the inactive fault codes.	All fault codes cleared	

TROUBLESHOOTING STEP

STEP 1: Check for failed sensors.

STEP 1A: Check the intake manifold pressure/temperature sensor.

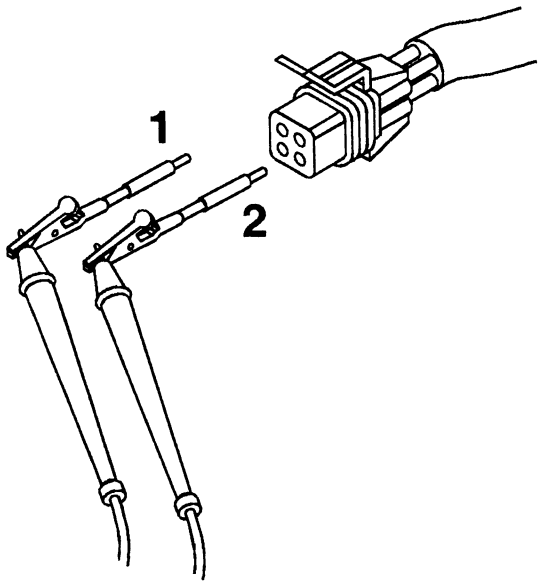
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Disconnect the engine harness from the intake manifold pressure/temperature sensor.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the intake manifold pressure/temperature sensor. • Measure the voltage from pin A (or 1) to pin B (or 2) on the intake manifold pressure/ temperature sensor connector.	**OK** **Less than (+) 4.5 VDC**	1B
	NOT OK **Replace the intake manifold pressure/ temperature sensor** Refer to Procedure 019-159.	3A



19c00081

STEP 1B: Check the ambient air pressure sensor.

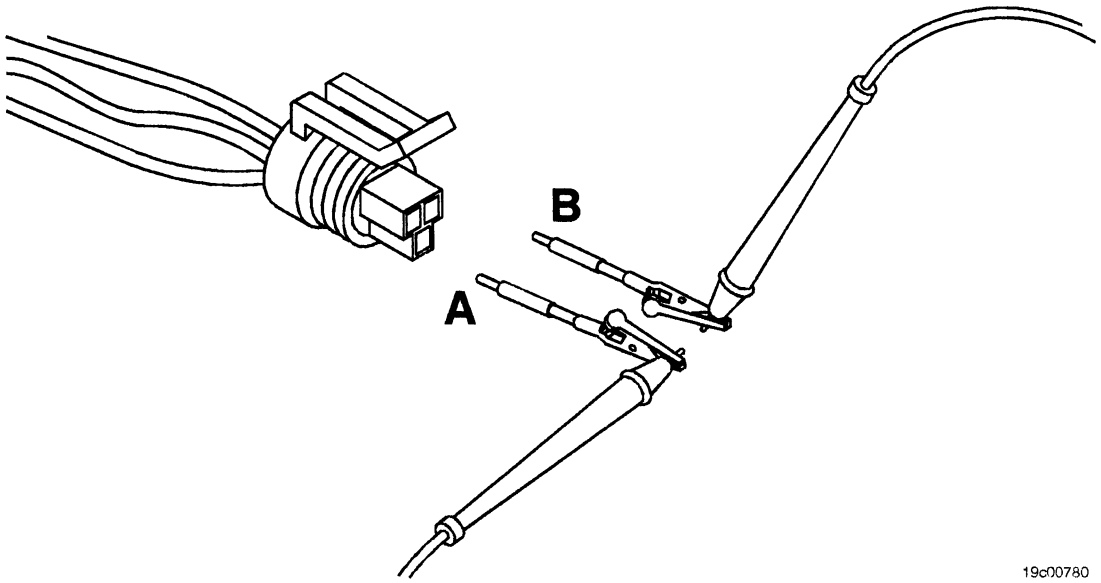
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Disconnect the engine harness from the ambient air pressure sensor.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the ambient air pressure sensor. • Measure the voltage from pin A (or 1) to pin B (or 2) on the ambient air pressure sensor connector.	**OK** **Less than (+) 4.5 VDC**	1C
	NOT OK **Replace the ambient air pressure sensor** Refer to Procedure 019-004.	3A



STEP 1C: Check the fuel pressure sensor.

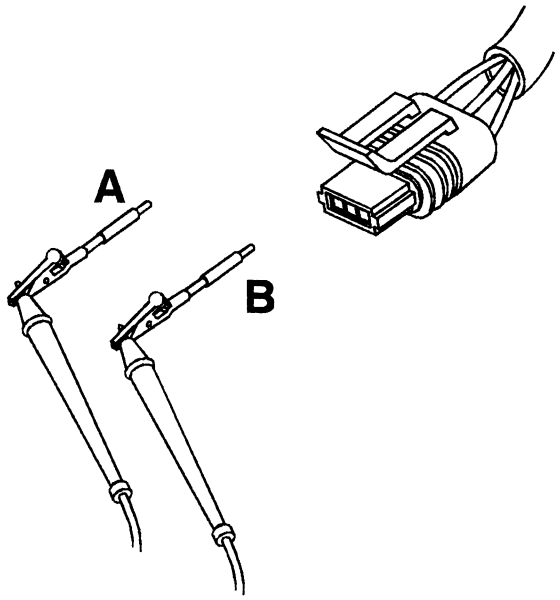
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Disconnect the engine harness from the fuel pressure sensor.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the fuel pressure sensor. • Measure the voltage from pin A (or 1) to pin B (or 2) on the fuel pressure sensor connector.	**OK** **Less than (+) 4.5 VDC**	2A
	NOT OK **Replace the fuel pressure sensor** Refer to Procedure 019-188.	3A



19200191

STEP 2: Check the sensor harness.

STEP 2A: Inspect harness and the ECM connector pins.

⚠CAUTION⚠

To avoid damaging the new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Inspect the harness and the ECM connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	2B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	3A

STEP 2B: Check the supply voltage.

⚠CAUTION⚠

To avoid damaging the new ECM, all other active fault codes must be investigated prior to replacing the ECM.

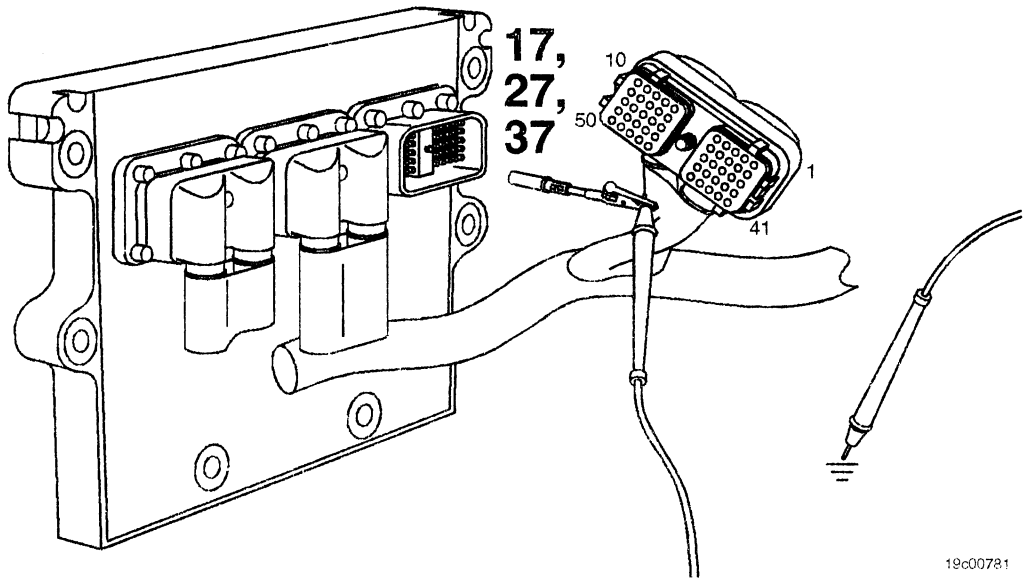
⚠CAUTION⚠

To avoid pin and harness damage use the following test lead when taking a measurement: Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

Condition:

- Disconnect the sensor harness connector from the ECM.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the supply voltage. • Measure the supply voltage from the ECM sensor harness port pins 17, 27, and 37 to ground.	**OK** **(+) 4.75 to 5.25 VDC**	2C
	NOT OK **Replace the ECM** Refer to Procedure 019-031.	3A



STEP 2C: Check for a short circuit to ground in the sensor supply lines.

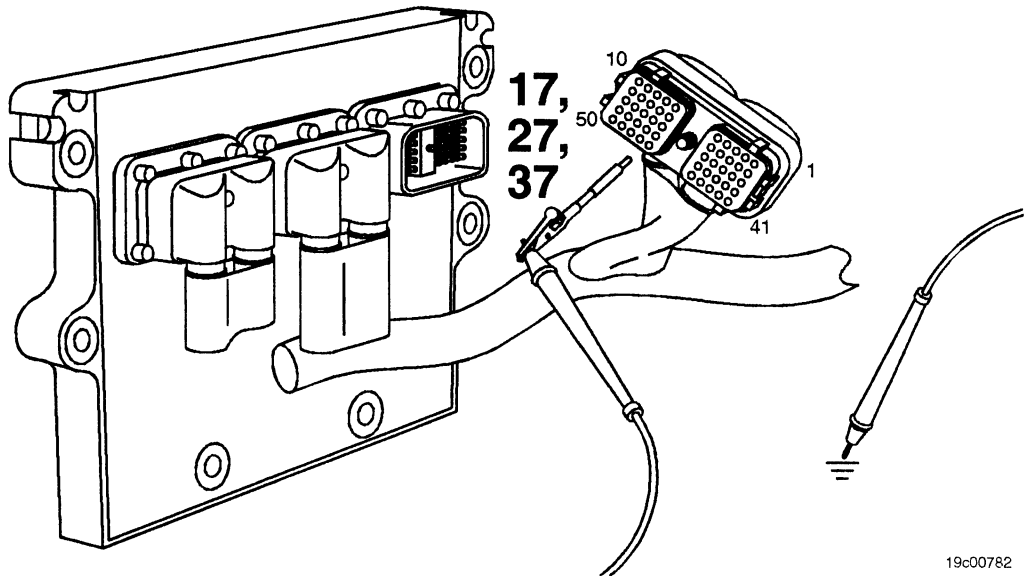
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground in the sensor supply lines. • Measure the resistance from pins 17, 27, and 37 in the sensor harness to engine block ground.	**OK** **More than 100k ohms**	2D
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	3A



STEP 2D: Check for a short circuit from pin to pin.

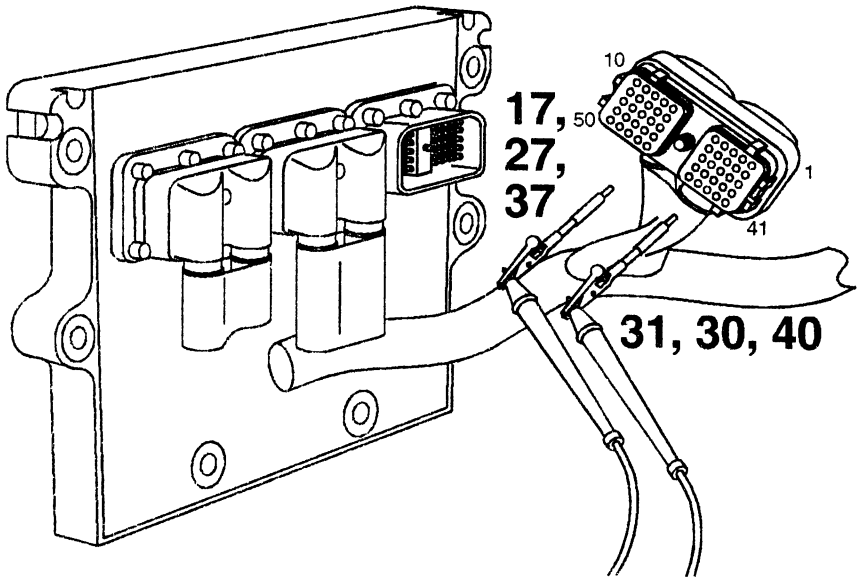
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.
- Disconnect the fuel pressure sensor from the engine harness.
- Disconnect the ambient air pressure sensor from the engine harness.
- Disconnect the intake manifold pressure/temperature sensor from the engine harness.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pin 17 to pin 31 in the sensor harness. • Measure the resistance from pin 27 to pin 30 in the sensor harness. • Measure the resistance from pin 37 to pin 40 in the sensor harness.	**OK** **More than 100k ohms**	3A
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	3A



STEP 3: Clear the fault codes.

STEP 3A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it idle for 1 minute. • Using INSITE™, verify Fault Code 352 is inactive.	**OK** **Fault Code 352 inactive**	3B
	NOT OK Return to the troubleshooting steps or contact your local Cummins Authorized Repair Location if all the steps have been completed and checked again.	1A

STEP 3B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

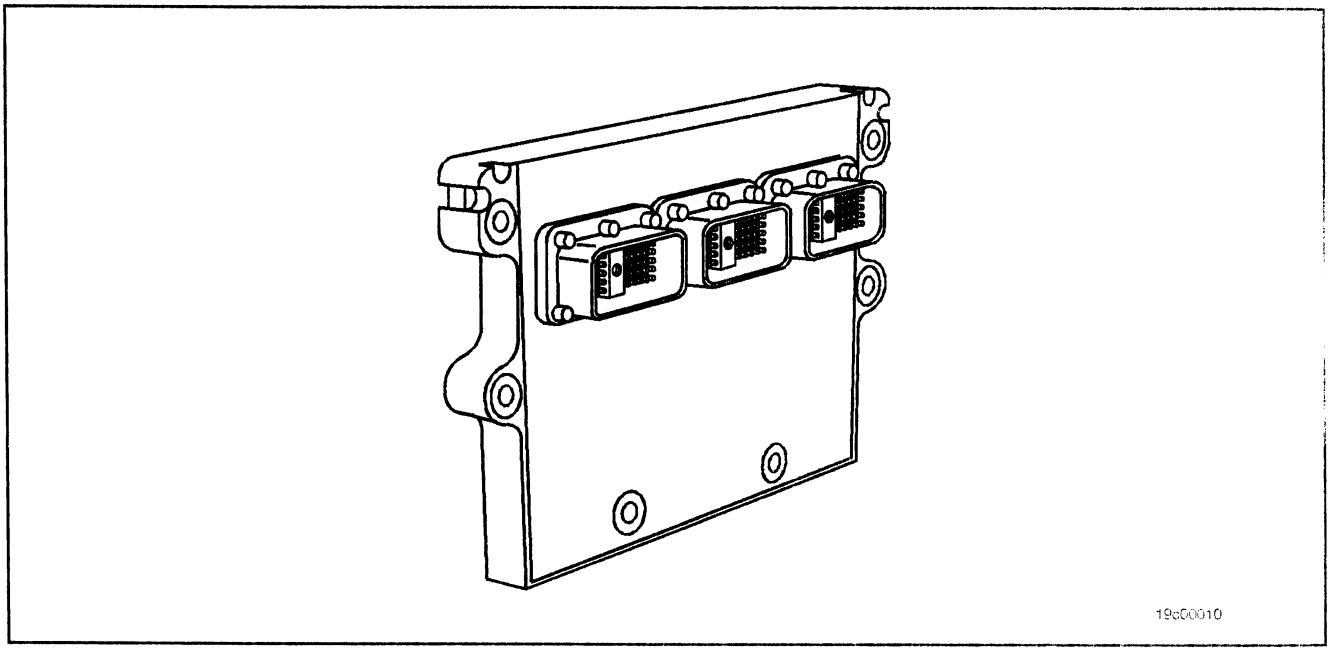
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 343

Electronic Control Module (ECM)

CODES	REASON	EFFECT
Fault Code: 343 PID(P), SID(S): S254 SPN: 629 FMI: 12/12 Lamp: Yellow	Internal ECM error.	Possibly none on performance or severe derate.

Electronic Control Module



Circuit Description:

The ECM monitors both signal voltage output to the injectors and ECM input from the engine sensors.

Component Location:

The ECM is bolted to the intake side of the cylinder head between the air inlet horn and the front of the engine.

Shop Talk:

- Loose engine or chassis ground connections can cause Fault Code 343 to be logged, as well as complaints of an intermittent stumble. Pay special attention to the negative starter post connection.
- Moisture in the ECM connectors can also cause the ECM to log Fault Code 343.

TROUBLESHOOTING SUMMARY

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check for multiple fault codes.		
STEP 1A: Read the fault codes.	Fault Codes 115 and 121 are not active	
STEP 2: Check the power and ground connections.		
STEP 2A: Check all engine and chassis power and ground connections.	Clean and tight	
STEP 2B: Check all power resistances.	Less than 10 ohms	
STEP 2C: Check all ground resistances.	Less than 10 ohms	
STEP 3: Check for moisture in the ECM connectors.		
STEP 3A: Check for moisture in the ECM connectors.	All connectors dry	
STEP 4: Clear the fault codes.		
STEP 4A: Disable the fault code.	Fault Code 343 inactive	
STEP 4B: Clear the inactive fault codes.	All fault codes cleared	

TROUBLESHOOTING STEP

STEP 1: Check for multiple fault codes.

STEP 1A: Read the fault codes.

Condition:
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Read the fault codes using INSITE™.	**OK** **Fault Codes 115 and 121 are not active**	2A
	NOT OK Go to Fault Codes 115 and 121.	Fault Code 115 and 121

STEP 2: Check the power and ground connections.

STEP 2A: Check all engine and chassis power and ground connections.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Check all engine and vehicle power and ground connections for the following: • Corrosion • Loose connections.	**OK** **Clean and tight**	2B
	NOT OK **Repair damaged connections** Repair or replace the damaged connections.	4A

STEP 2B: Check all power resistances.

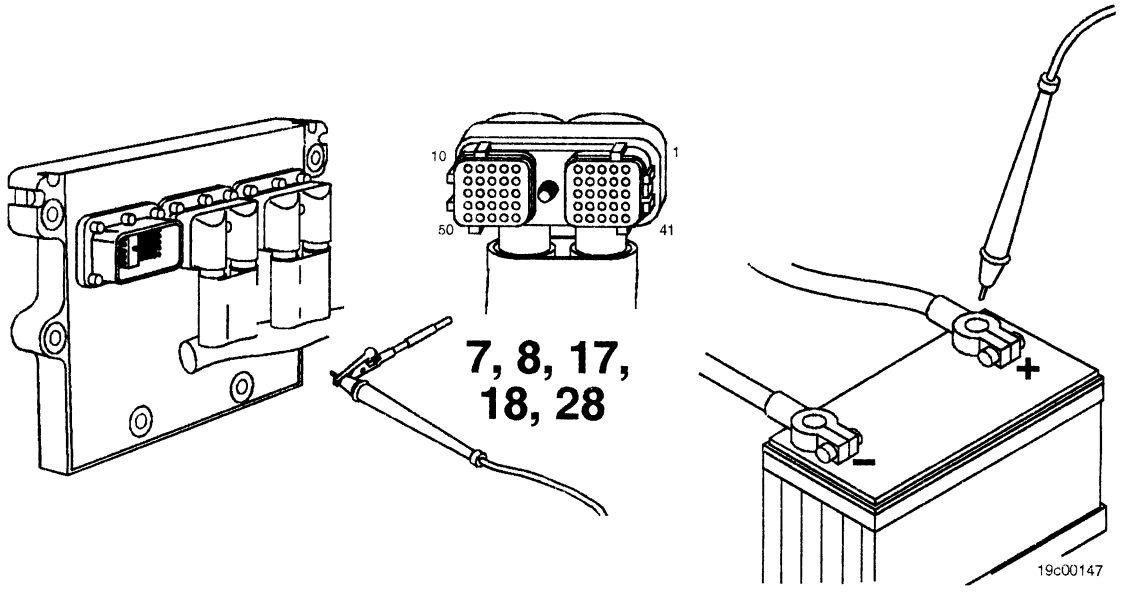
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the OEM harness connector from the ECM.
- Disconnect the negative (-) battery cable from the battery.
- Disconnect the positive (+) battery cable from the battery.

Action	Specifications/Repair	Next Step
Check all power resistances. • Measure the resistance from pin 7 of OEM harness connector to the positive (+) battery terminal connector. • Measure the resistance from pin 8 of OEM harness connector to the positive (+) battery terminal connector. • Measure the resistance from pin 17 of OEM harness connector to the positive (+) battery terminal connector. • Measure the resistance from pin 18 of OEM harness connector to the positive (+) battery terminal connector. • Measure the resistance from pin 28 of OEM harness connector to the positive (+) battery terminal connector.	**OK** **Less than 10 ohms**	2C
	NOT OK **Repair or replace the OEM harness** • Repair the OEM harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-071.	4A



STEP 2C: Check all ground resistances.

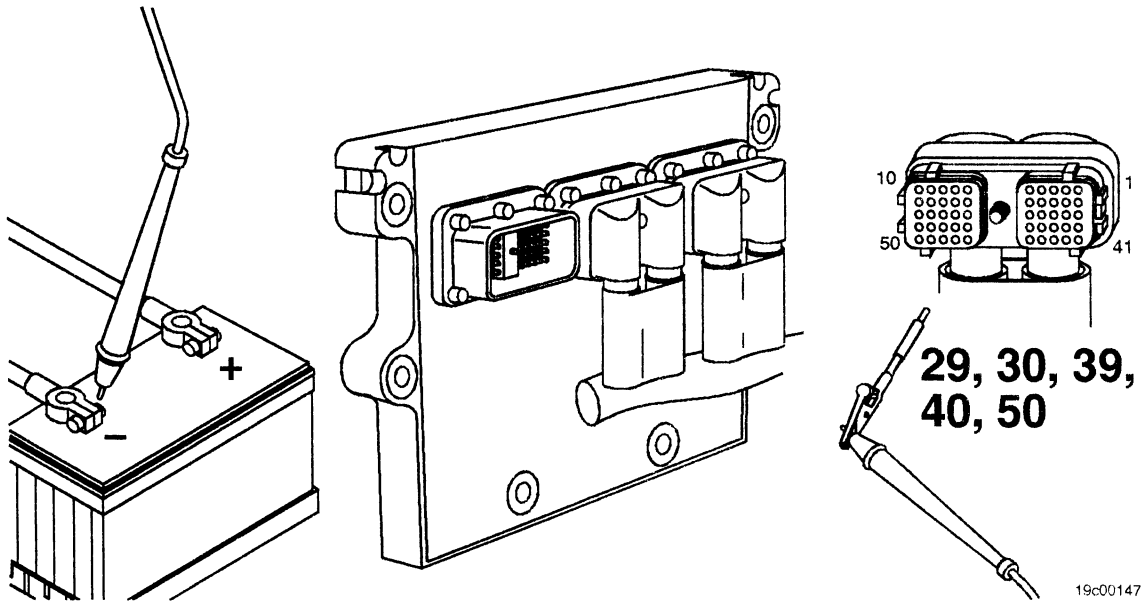
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the OEM harness connector from the ECM.
- Disconnect the negative (–) battery cable from the battery.
- Disconnect the positive (+) battery cable from the battery.

Action	Specifications/Repair	Next Step
Check all ground resistances. • Measure the resistance from pin 29 of OEM harness connector to the negative (–) battery terminal connector. • Measure the resistance from pin 30 of OEM harness connector to the negative (–) battery terminal connector. • Measure the resistance from pin 39 of OEM harness connector to the negative (–) battery terminal connector. • Measure the resistance from pin 40 of OEM harness connector to the negative (–) battery terminal connector. • Measure the resistance from pin 50 of OEM harness connector to the negative (–) battery terminal connector.	**OK** **Less than 10 ohms**	3A
	NOT OK **Repair or replace the OEM harness** • Repair the OEM harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-071.	4A



STEP 3: Check for moisture in the ECM connectors.

STEP 3A: Check for moisture in the ECM connectors.

Condition:
- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for moisture in the ECM connectors. • Check for moisture in the ECM connectors.	**OK** **All connectors dry**	4A
	NOT OK **Dry the connectors** Dry the connectors with electrical contact cleaner, Part No. 3824510.	4A

STEP 4: Clear the fault codes.

STEP 4A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let idle for 1 minute. • Using INSITE™, verify Fault Code 343 is inactive.	**OK** **Fault Code 343 inactive**	4B
	NOT OK Return to the troubleshooting steps or contact your local Cummins Authorized Repair Location if all the steps have been completed and checked again.	1A

STEP 4B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

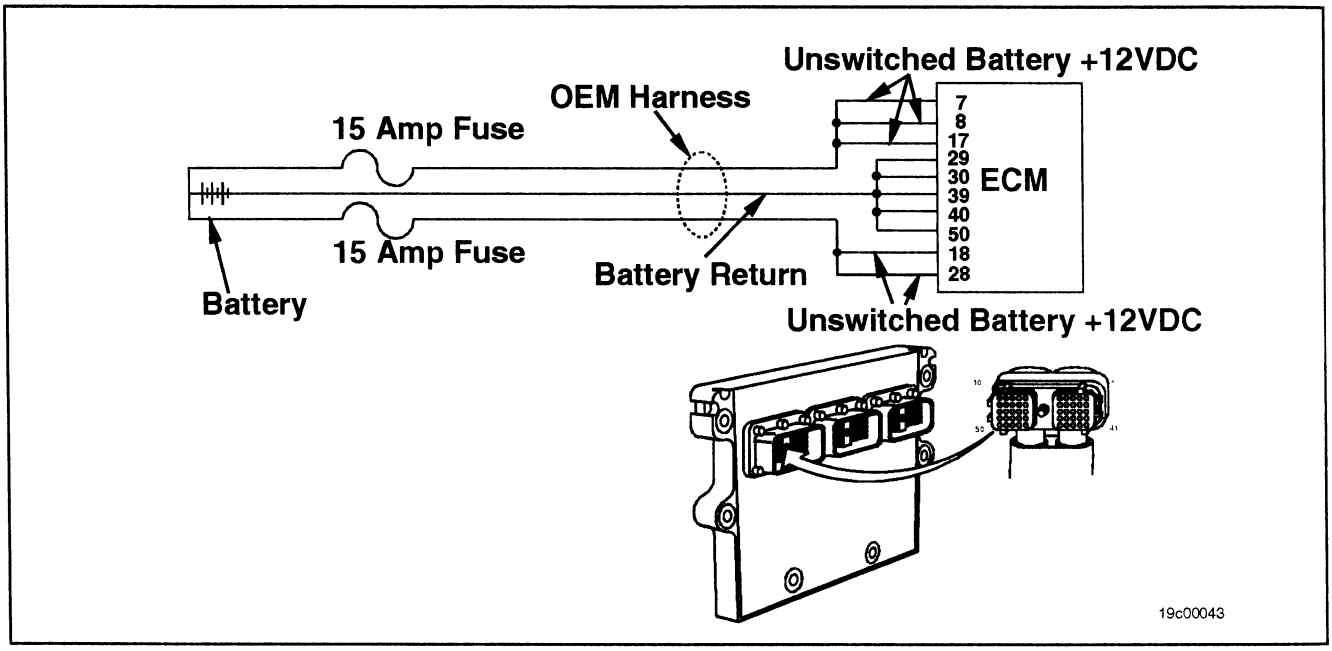
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 341

Unswitched Battery Supply Circuit

CODES	REASON	EFFECT
Fault Code: 341 PID(P), SID(S): S253 SPN: 630 FMI: 2/2 Lamp: Yellow	Severe loss of data from the ECM.	Possibly no noticeable performance effects, **or** engine dying, **or** difficulty in starting the engine. Fault information, trip information, and maintenance monitor data can be inaccurate.

Unswitched Battery Supply



Circuit Description:

The ECM receives constant voltage from the batteries through the unswitched battery wires that are connected directly to the positive (+) battery post. There are two in-line 15-amp fuses in the unswitched battery wires to protect the engine harness from overheating. The ECM receives switched battery input through the vehicle keyswitch wire when the vehicle keyswitch is turned on. The battery return wires are connected directly to the negative (–) battery post.

Component Location:

The ECM is connected to the battery by the OEM harness. This direct link provides a constant power supply for the ECM. The location of the battery will vary with the OEM. Refer to the OEM troubleshooting and repair manual.

TROUBLESHOOTING SUMMARY

⚠ CAUTION ⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Read the fault codes.		
STEP 1A: Read the fault codes.	No other active fault codes	
STEP 2: Check the batteries and the power connector.		
STEP 2A: Check the resistance of the battery supply circuit.	Less than 10 ohms	
STEP 2B: Check the battery voltage.	Normal conditions: At least (+) 12 VDC During cranking: At least (+) 6.2 VDC	
STEP 2C: Check the battery connections.	Connections are tight and corrosion-free	
STEP 3: Check the two 15-amp fuses.		
STEP 3A: Verify that the two 15-amp fuses are installed correctly.	Fuses installed correctly	
STEP 3B: Verify that the two 15-amp fuses are not blown.	Fuses not blown	
STEP 4: Check the OEM harness		
STEP 4A: Check the add-on or the accessory wiring at (+) terminal of the battery.	No damaged wires	
STEP 5: Recalibrate the ECM.		
STEP 5A: Recalibrate the ECM.	Fault Code 341 inactive	
STEP 6: Clear the fault codes.		
STEP 6A: Disable the fault code.	Fault Code 341 inactive	
STEP 6B: Clear the inactive fault codes.	All fault codes cleared	

TROUBLESHOOTING STEP

STEP 1: Read the fault codes.

STEP 1A: Read the fault codes.

Condition:
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Read the fault codes using INSITE™.	**OK** **No other active fault codes**	2A
	NOT OK Troubleshoot the active fault codes.	5A

STEP 2: Check the batteries and the power connector.

STEP 2A: Check the resistance of the battery supply circuit.

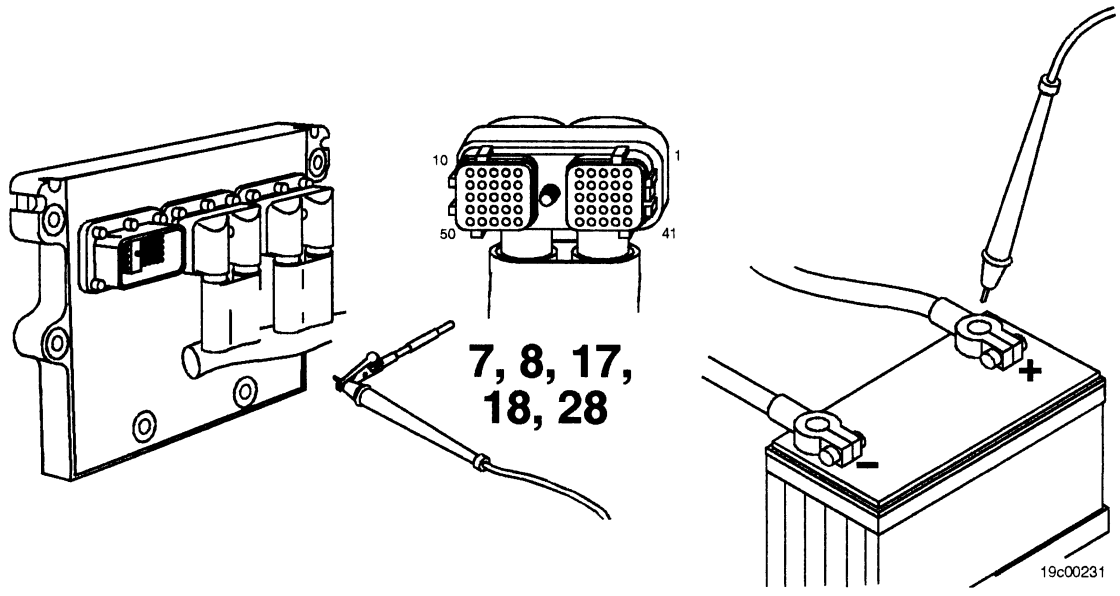
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the OEM harness connector from the ECM.

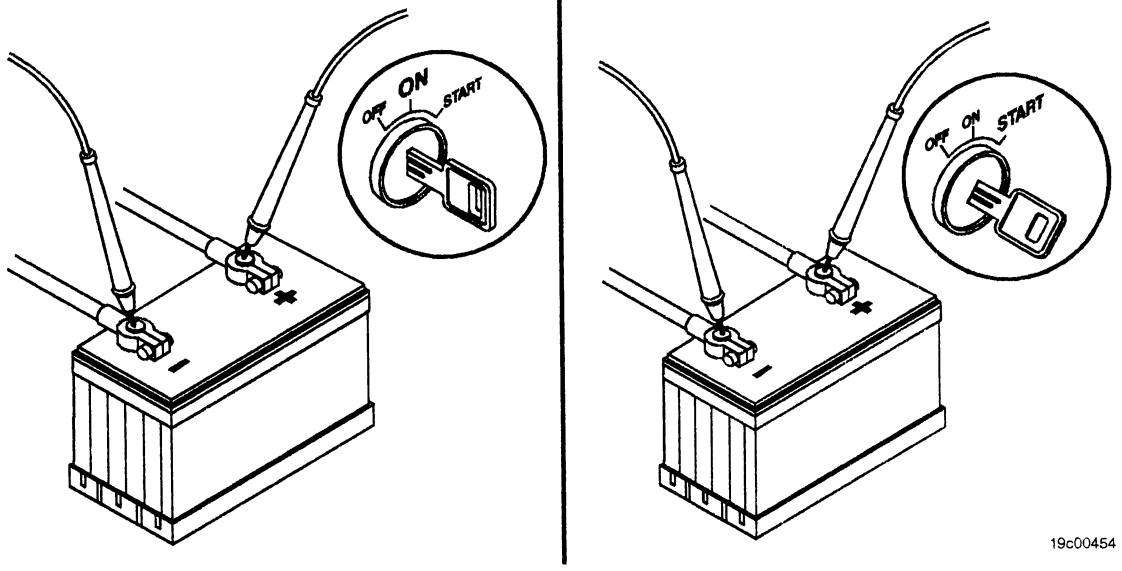
Action	Specifications/Repair	Next Step
Check the resistance of the battery supply circuit. • Measure the resistance from pin 7 of the OEM harness connector to the positive (+) battery terminal. • Measure the resistance from pin 8 of the OEM harness connector to the positive (+) battery terminal. • Measure the resistance from pin 17 of the OEM harness connector to the positive (+) battery terminal. • Measure the resistance from pin 18 of the OEM harness connector to the positive (+) battery terminal. • Measure the resistance from pin 28 of the OEM harness connector to the positive (+) battery terminal.	**OK** **Less than 10 ohms**	2B
	NOT OK **Repair or replace the OEM harness** • Repair the OEM harness. Refer to Procedure 019-250. • Replace the OEM harness. Refer to Procedure 019-071.	5A



STEP 2B: Check the battery voltage.

Condition:
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the battery voltage. • Place positive (+) probe of the multimeter on the positive battery terminal and touch negative (–) probe to the negative battery terminal while trying to start engine.	**OK** **Normal conditions: at least (+) 12 VDC** **During cranking: at least (+) 6.2 VDC**	2C
	NOT OK **Charge or replace the battery** Refer to the OEM troubleshooting and repair manual.	5A



STEP 2C: Check the battery connections.

Condition:
- Turn keyswitch OFF.

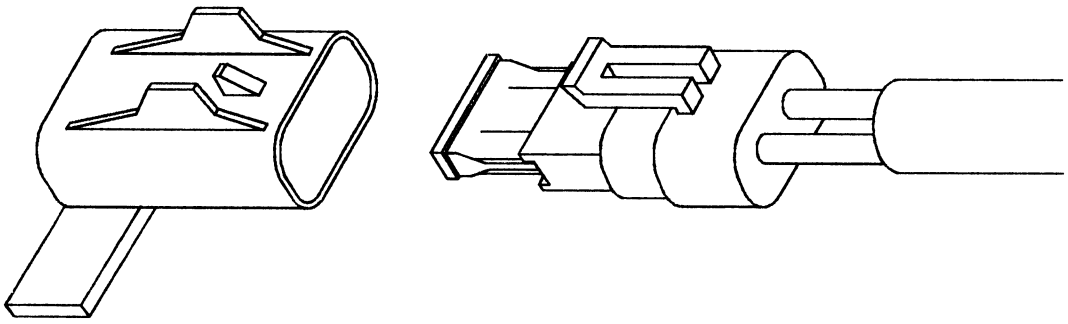
Action	Specifications/Repair	Next Step
Check the battery connections. • Inspect the battery terminal connections.	**OK** **Connections are tight and corrosion-free**	3A
	NOT OK **Tighten the connections** Tighten the loose connections and clean the terminals. Refer to the OEM troubleshooting and repair manual.	5A

STEP 3: Check the two 15-amp fuses.

STEP 3A: Verify that the two 15-amp fuses are installed correctly.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Verify that the two 15-amp fuses are installed correctly. • Inspect the two 15 AMP fuses for correct installation.	**OK** **Fuses installed correctly**	3B
	NOT OK **Install the fuses correctly** Refer to Procedure 019-198.	5A

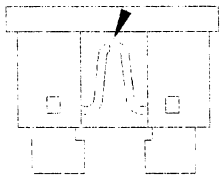


19c00455

STEP 3B: Verify that the two 15-amp fuses are not blown.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Verify that the two 15-amp fuses are not blown. • Inspect the two 15 AMP fuses to see if they are blown.	**OK** **Fuses not blown**	4A
	NOT OK **Locate the short circuit** • Replace the engine harness. Refer to Procedure 019-043. • Replace the blown fuse(s). Refer to Procedure 019-198.	5A



19800238

STEP 4: Check the OEM harness.

STEP 4A: Check the add-on or the accessory wiring at (+) terminal of the battery.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Check the add-on or the accessory wiring at (+) terminal of the battery. • Starting at the (+) terminal, follow any add-on or accessory wiring and examine wire(s) for damaged insulation or an installation error that can cause the supply wire to be shorted to the engine block.	**OK** **No damaged wires**	5A
	NOT OK **Repair or replace the damaged wiring**	5A

STEP 5: Recalibrate the ECM.

STEP 5A: Recalibrate the ECM.

Condition: Connect all components.

Action	Specifications/Repair	Next Step
Recalibrate the ECM • Use ESDN™ to recalibrate the ECM.	**OK** **Fault Code 341 inactive**	6A
	NOT OK Fault code active.	6A

STEP 6: Clear the fault codes.

STEP 6A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it idle for 1 minute. • Using INSITE™, verify Fault Code 341 is inactive.	**OK** **Fault Code 341 inactive**	6B
	NOT OK Return to the troubleshooting steps or contact your local Cummins Authorized Repair Location if all the steps have been completed and checked again.	1A

STEP 6B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

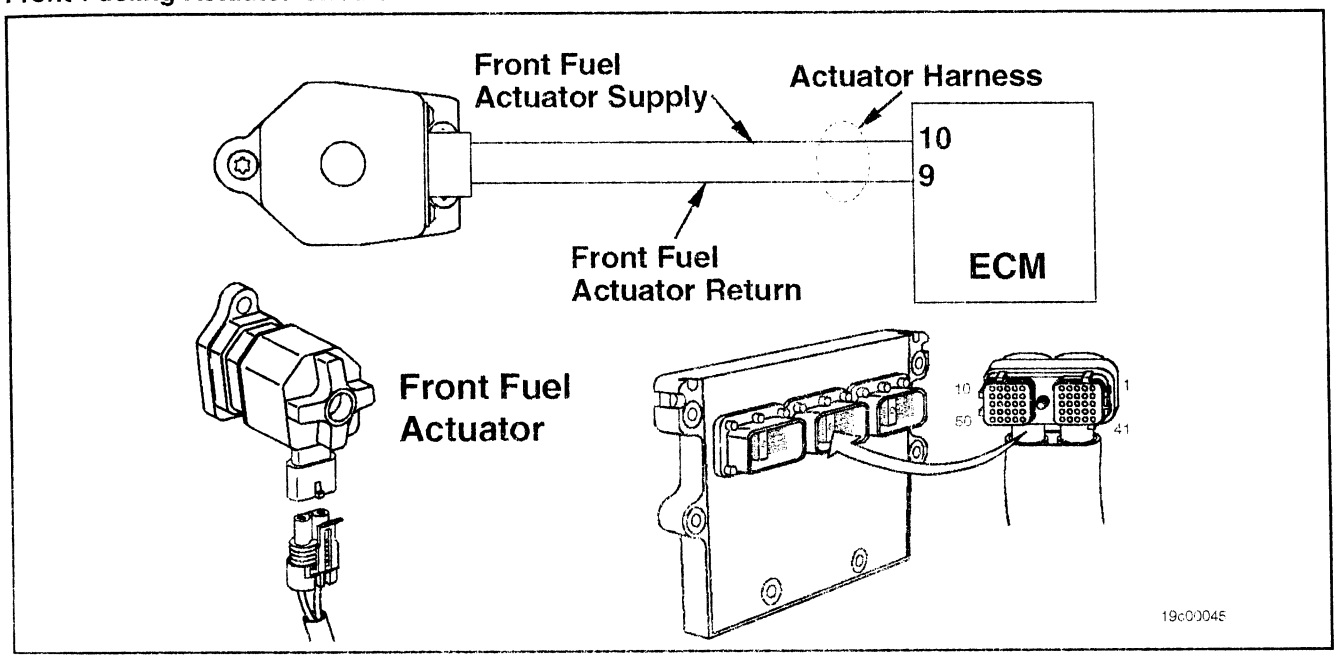
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 378

Actuator Circuit

CODES	REASON	EFFECT
Fault Code: 378 PID(P), SID(S): S018 SPN: 633 FMI: 5/5 Lamp: Yellow	Low current or open circuit detected at front fueling actuator circuit.	Engine will run using **only** the rear three cylinders.

Front Fueling Actuator Circuit



Circuit Description:

The fuel actuators are actuated by the electronic control module (ECM) to control fuel metering. Each fuel actuator is connected to the ECM by a supply and a return wire. An electrical pulse is sent to the fuel actuator from the ECM on the supply wire and returns to the ECM on the return wire. Each solenoid valve is normally closed, and it is **only** opened by an electrical pulse from the ECM during metering.

Component Location:

The front fueling actuator is mounted on the fuel delivery housing. It is the actuator closest to the front of the engine.

Shop Talk:

The possible failure modes are open circuit, short circuit to ground, high actuator resistance, supply wire shorted to battery, and loss of boost voltage inside of ECM.

TROUBLESHOOTING SUMMARY

⚠ WARNING ⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

⚠ CAUTION ⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

**To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.**

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the actuator harness.		
STEP 1A: Inspect the harness and ECM connector pins.	No damaged pins	
STEP 1B: Check the resistance of the whole circuit.	Less than 10 ohms	
STEP 1B-1: Inspect the actuator harness and connector pins.	No damaged pins	
STEP 1B-2: Check for an open circuit in the actuator harness.	Less than 5 ohms	
STEP 1B-3: Check the resistance of the actuator solenoid.	0.5 to 1.5 ohms	
STEP 1C: Check for a short circuit from pin to pin in the ECM connector.	More than 100k ohms	
STEP 1D: Check for a short circuit to ground in the actuator solenoid.	More than 100k ohms	
STEP 2: Clear the fault codes.		
STEP 2A: Disable the fault code.	Fault Code 378 inactive	
STEP 2B: Clear the inactive fault codes.	All fault codes cleared	

TROUBLESHOOTING STEP

STEP 1: Check the actuator harness.

STEP 1A: Inspect the harness and the ECM connector pins.

⚠WARNING⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness connector from the ECM.

Action	Specifications/Repair	Next Step
Inspect the harness and the ECM connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	1B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins with electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	2A

STEP 1B: Check the resistance of the whole circuit.

⚠WARNING⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

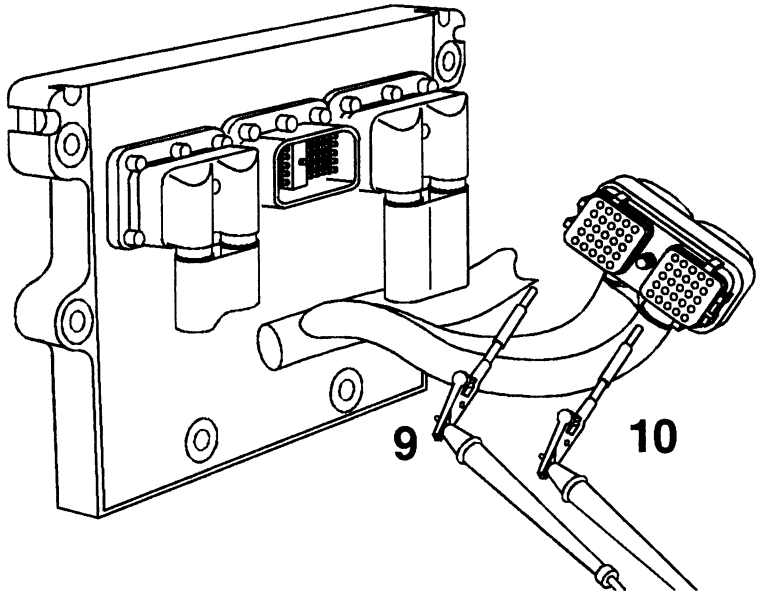
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check the resistance of the whole circuit. • Measure the resistance from pin 9 to pin 10 of the actuator harness connector.	**OK** **Less than 10 ohms**	1B-1
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	2A



19c00205

STEP 1B-1: Inspect the actuator harness and connector pins.

⚠WARNING⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness from the actuator solenoid.

Action	Specifications/Repair	Next Step
Inspect the harness and the actuator connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	1B-2
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins with electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-202 or 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	2A

STEP 1B-2: Check for an open circuit in the actuator harness.

⚠WARNING⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

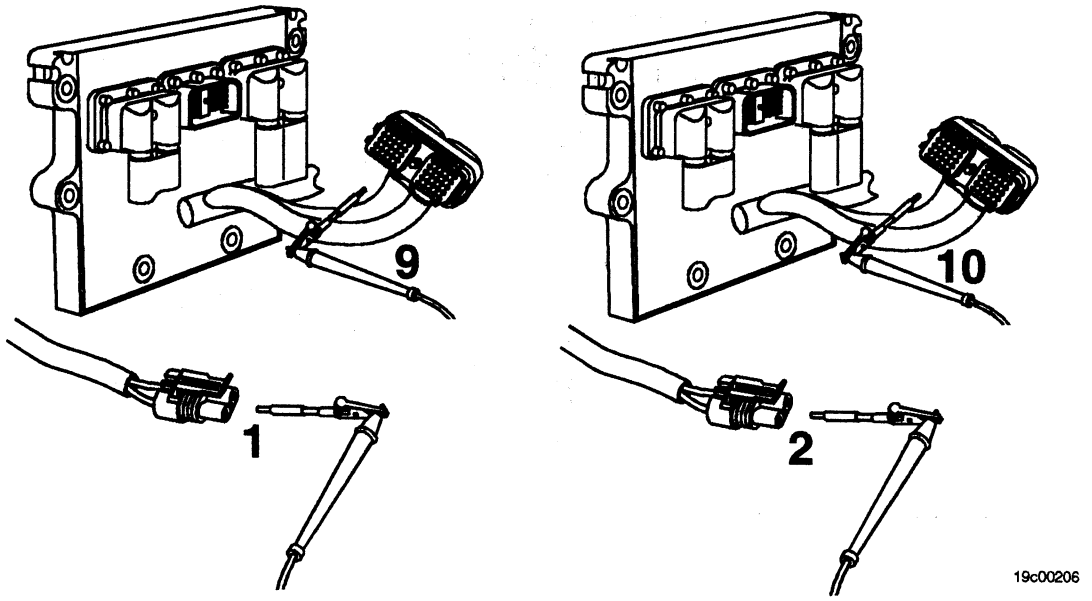
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness from the actuator solenoid.
- Disconnect the actuator harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for an open circuit in the actuator harness. • Measure the resistance from pin 9 of the actuator harness connector to pin 1 (or A) of the actuator solenoid connector. • Measure the resistance from pin 10 of the actuator harness connector to pin 2 (or B) of the actuator solenoid connector.	**OK** **Less than 5 ohms**	1B-3
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-202 or 019-250. • Replace the engine harness. Refer to Procedure 019-043.	2A



STEP 1B-3: Check the resistance of the actuator solenoid.

⚠WARNING⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

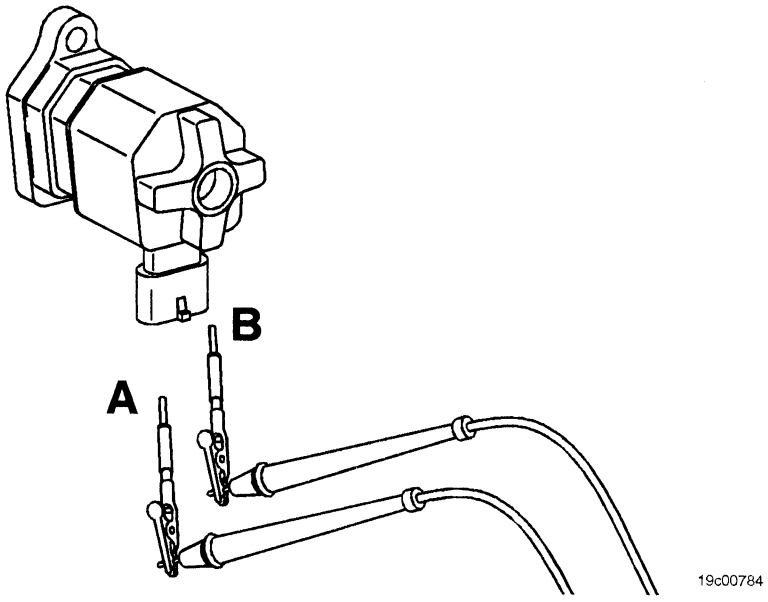
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness from the actuator solenoid.

Action	Specifications/Repair	Next Step
Check the resistance of the actuator solenoid. • Measure the resistance across the two terminals on the actuator solenoid.	**OK** **0.5 to 1.5 ohms**	1C
	NOT OK **Replace the actuator solenoid** Refer to Procedure 019-110.	2A



STEP 1C: Check for a short circuit from pin to pin in the ECM connector.

⚠WARNING⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

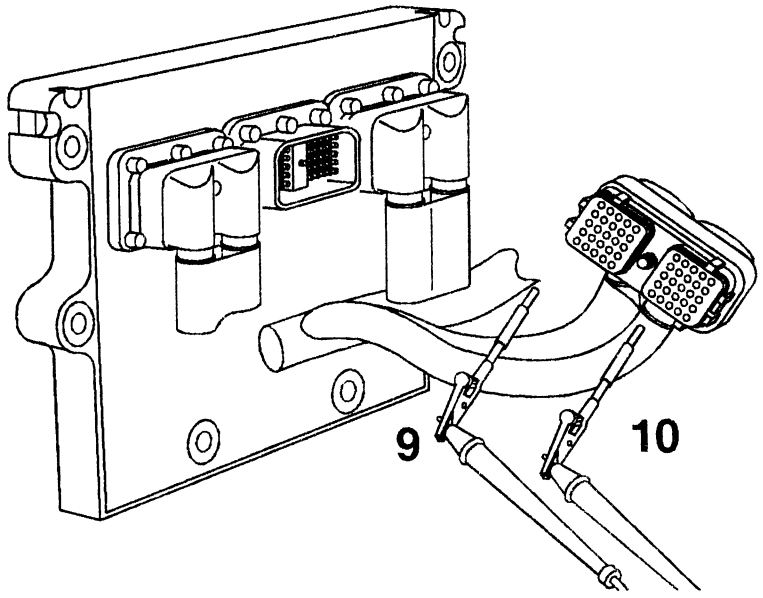
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness connector from the ECM.
- Disconnect the actuator harness from the actuator solenoid.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pin 9 in the actuator harness connector to all other pins in the connector. • Measure the resistance from pin 10 in the actuator harness connector to all other pins in the connector.	**OK** **More than 100k ohms**	1D
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	2A



STEP 1D: Check for a short circuit to ground in the actuator solenoid.

⚠WARNING⚠

The actuators receive high voltage when the engine is operating. To avoid personal injury or death from electrical shock, do not wear jewelry or damp clothing, and do not touch the actuators or the actuator wires when the engine is operating.

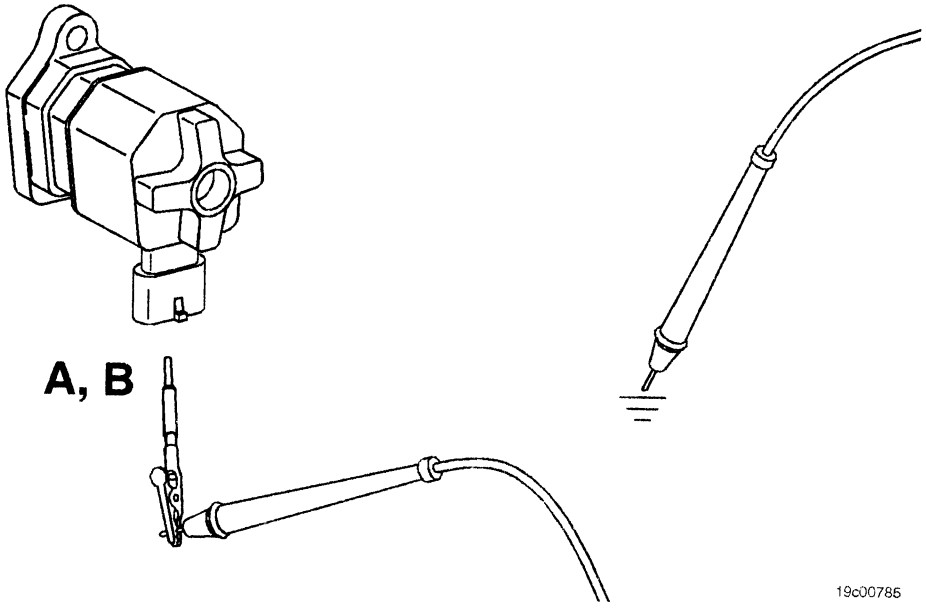
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness from the actuator solenoid.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground in the actuator solenoid. • Measure the resistance between both actuator solenoid pins to chassis ground.	**OK** **More than 100k ohms**	2A
	NOT OK **Replace the actuator solenoid** Refer to Procedure 019-110.	2A



STEP 2: Clear the fault codes.

STEP 2A: Disable the fault code.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and road test the vehicle for at least 1 mile. • Using INSITE™, verify that Fault Code 378 is inactive.	**OK** **Fault Code 378 inactive**	2B
	NOT OK **Fault Code 378 active** **Replace the ECM** Refer to Procedure 019-031.	2B

STEP 2B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

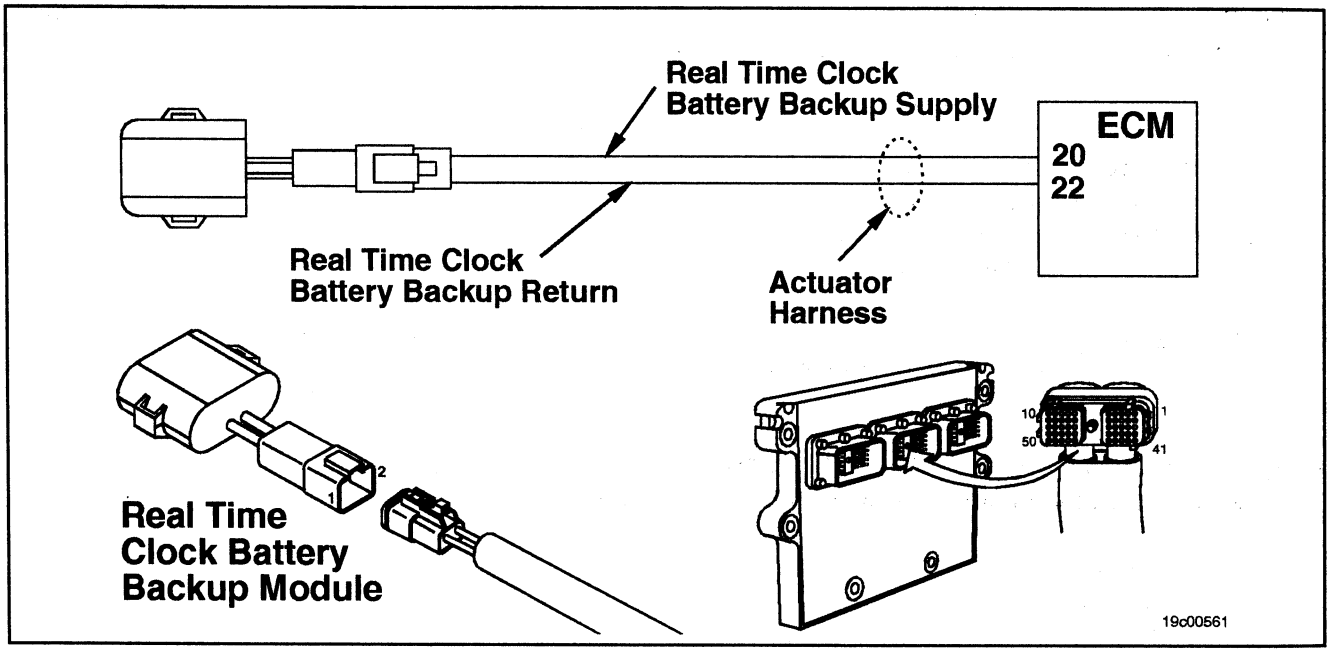
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 319

Real-Time Clock Power Circuit

CODES	REASON	EFFECT
Fault Code: 319 PID(P), SID(S): P251 SPN: 251 FMI: 2/2 Lamp: Maintenance	Real-time clock lost power.	None on performance. Data in the ECM will **not** have accurate time and date information.

Real-Time Clock Power Circuit



Circuit Description:

Under ordinary operating conditions, the real-time clock in the ECM is powered by the vehicle's batteries. If battery power to the ECM is lost, then the real-time clock will be powered by a battery backup module (if equipped).

Component Location:

The real-time clock battery backup module is secured to the wiring harness in the vicinity of the ECM.

Shop Talk:

This fault indicates that the real-time clock in the ECM lost power. Possible causes for this fault:

- A weak or failed battery backup module
- Failed wiring or connectors between the battery backup module and ECM
- The engine is **not** equipped with a battery backup module, and lost vehicle battery power to the ECM.

TROUBLESHOOTING SUMMARY

⚠ CAUTION ⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead
Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check battery backup module.		
STEP 1A: Inspect the ECM and actuator harness connectors.	No damaged pins	
STEP 1B: Check the battery backup voltage at the ECM actuator connector.	(+) 3.3 to 3.6 VDC	
STEP 1B-1: Inspect the battery backup module harness and actuator harness connector pins.	No damaged pins	
STEP 1B-2: Check the battery backup voltage at the battery module connector.	(+) 3.3 to 3.6 VDC	
STEP 2: Check the battery backup module harness.		
STEP 2A: Check for an open circuit in the supply line.	Less than 10 ohms	
STEP 2B: Check for an open circuit in the return line.	Less than 10 ohms	
STEP 2C: Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 2D: Check for a short circuit to ground.	More than 100k ohms	
STEP 3: Clear the fault codes.		
STEP 3A: Disable the fault code.	Fault Code 319 inactive	
STEP 3B: Clear the inactive fault codes.	All fault codes cleared	

TROUBLESHOOTING STEP

STEP 1: Check the battery backup module.

STEP 1A: Inspect the ECM and actuator harness connector pins.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness connector from the ECM.

Action	Specifications/Repair	Next Step
Inspect the ECM and actuator harness connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	1B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	3A

STEP 1B: Check the battery backup voltage at the ECM actuator connector.

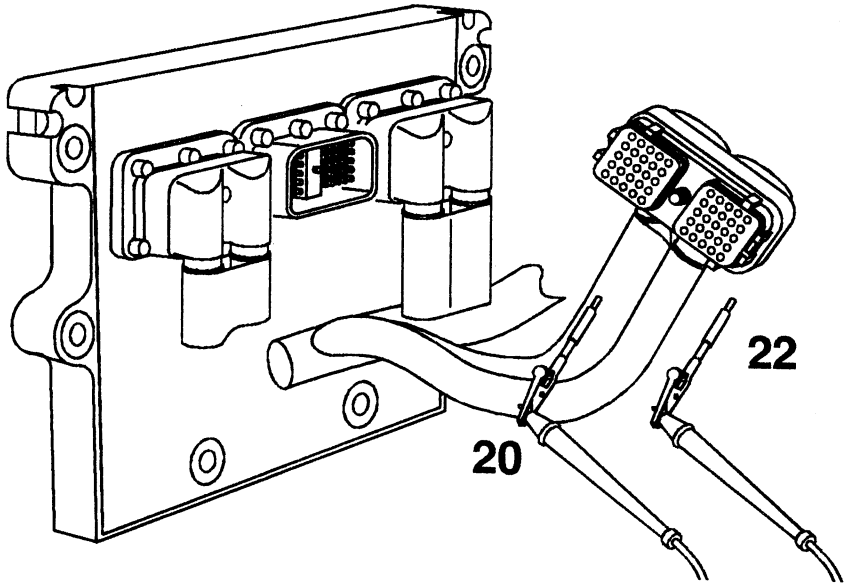
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Engine equipped with optional real-time clock battery backup module.
- Turn keyswitch OFF.
- Disconnect the actuator harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check the battery backup voltage at the ECM connector. • Measure battery voltage from pin 20 to pin 22 at the ECM connector. **NOTE:** Gently flex the harness when checking the voltage to check for internally broken or frayed wires.	**OK** **(+) 3.3 to 3.6 VDC**	3A
	NOT OK Does **not** meet specifications.	1B-1



STEP 1B-1: Inspect the battery backup module and actuator harness connector pins.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch OFF.
- Disconnect the battery backup module from the actuator harness.
- Disconnect the actuator harness connector from the ECM.

Action	Specifications/Repair	Next Step
Inspect the battery backup module and actuator harness connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	1B-2
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	3A

STEP 1B-2: Check the battery backup voltage at the battery module connector.

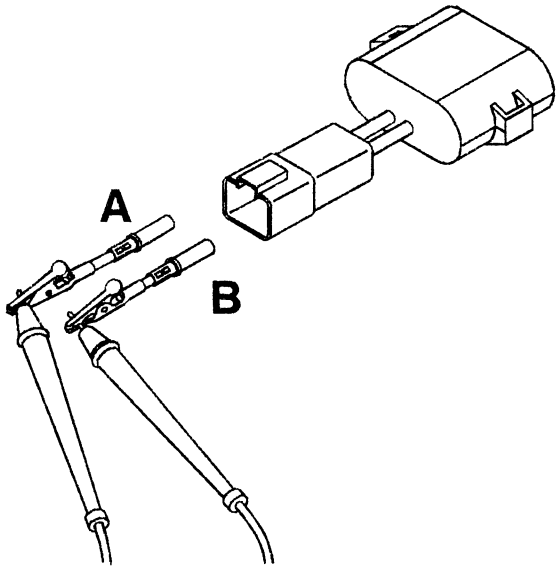
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

Condition:

- Engine equipped with optional real-time clock battery backup module.
- Turn keyswitch OFF.
- Disconnect the actuator harness connector from the ECM.
- Disconnect the engine harness from the battery backup module.

Action	Specifications/Repair	Next Step
Check the battery backup voltage at the battery module connector. • Measure the battery voltage from battery supply (+) to battery return (–) at the battery module connector, battery module side. **NOTE:** Gently flex the harness when checking the voltage to check for internally broken or frayed wires.	**OK** **(+) 3.3 to 3.6 VDC**	2A
	NOT OK Does **not** meet specifications. **Replace the battery backup module** Refer to Procedure 019-311.	3A



19c00772

STEP 2: Check the battery backup module harness.

STEP 2A: Check for an open circuit in the supply line.

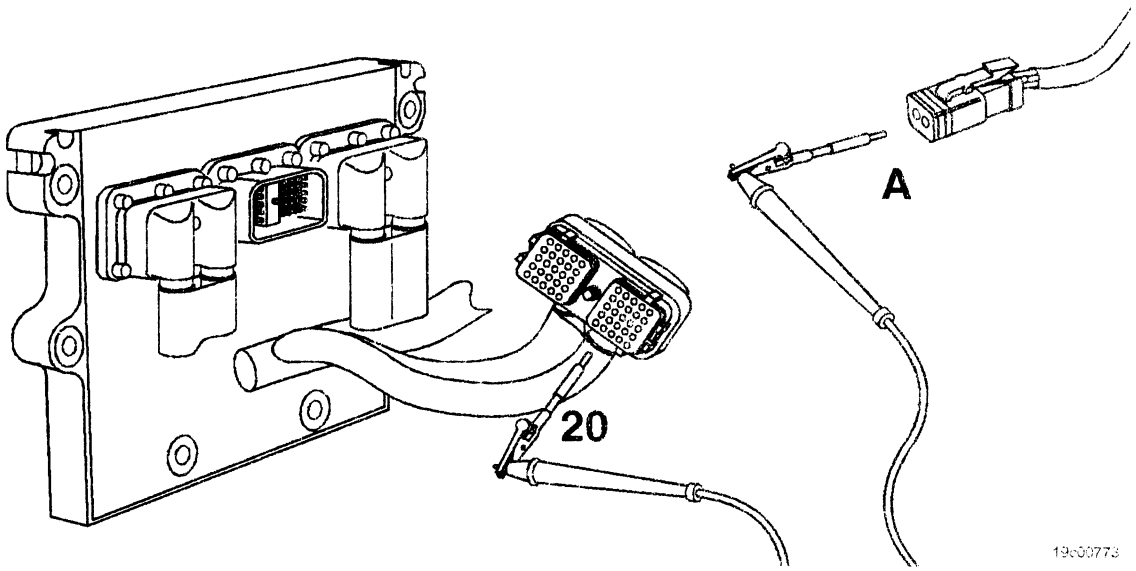
⚠CAUTION⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead
Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the battery backup module from the engine harness.
- Disconnect the actuator harness connector from the ECM.

Action	Specifications/Repair	Next Step
Inspect for continuity in the supply line. • Measure the resistance from pin 20 at the actuator harness connector to pin A (or 1) at the engine harness connector at the battery backup module. **NOTE:** Gently flex the harness when checking the resistance to check for internally broken or frayed wires.	**OK** **Less than 10 ohms**	2B
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-202 or 019-250. • Replace the engine harness. Refer to Procedure 019-043.	3A



STEP 2B: Check for an open circuit in the return line.

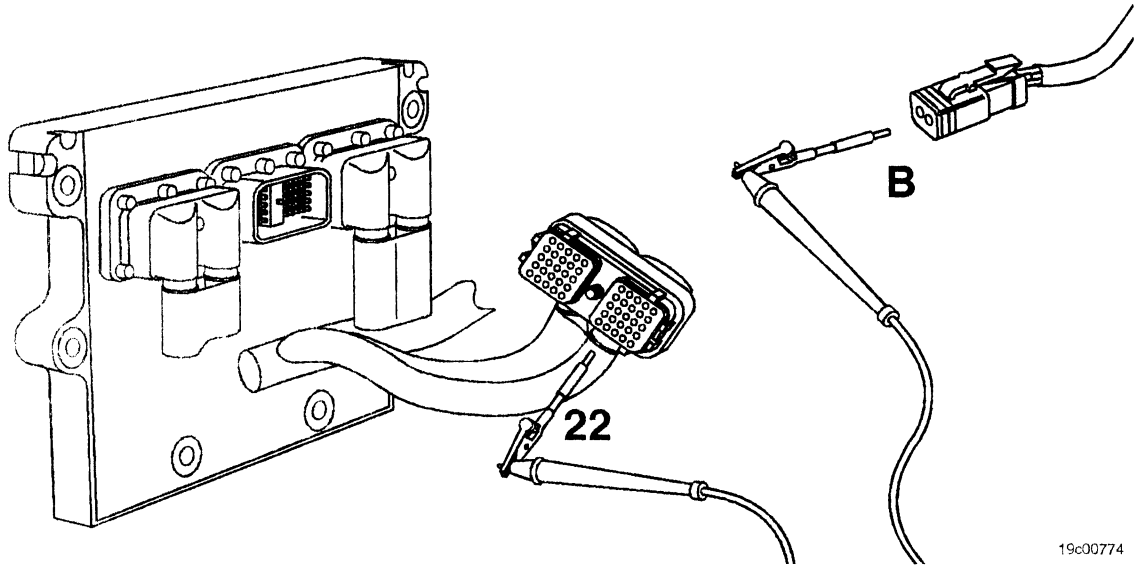
⚠CAUTION⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead
Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the battery backup module from the engine harness.
- Disconnect the actuator harness connector from the ECM.

Action	Specifications/Repair	Next Step
Inspect for continuity in the return line. • Measure the resistance from pin 22 at the actuator harness connector to pin B (or 2) at the engine harness connector at the battery backup module. **NOTE:** Gently flex the harness when checking the resistance to check for internally broken or frayed wires.	**OK** **Less than 10 ohms**	2C
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-202 or 019-250. • Replace the engine harness. Refer to Procedure 019-043.	3A



STEP 2C: Check for a short circuit from pin to pin.

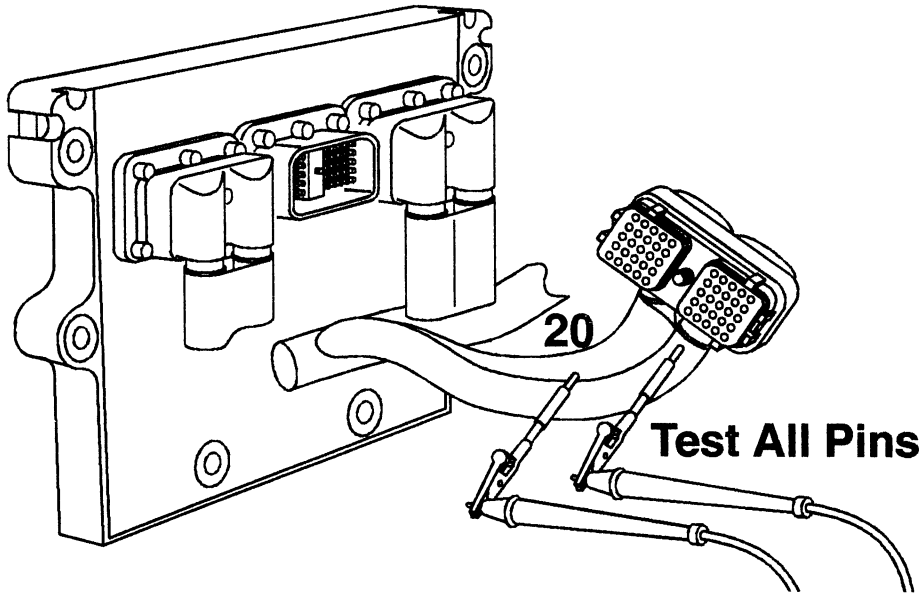
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness connector from the ECM.
- Disconnect the battery backup module from the engine harness.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pin 20 of the actuator harness connector to all the other pins in the connector. **NOTE:** Gently flex the harness when checking the resistance to check for internally broken or frayed wires.	**OK** **More than 100k ohms**	2D
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	3A



STEP 2D: Check for a short circuit to ground.

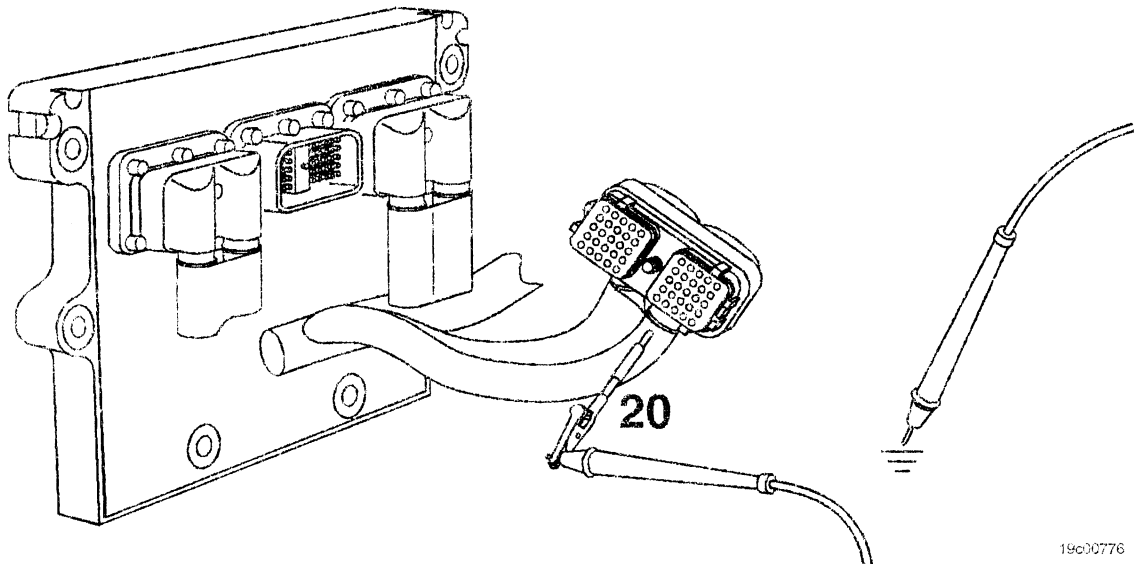
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness connector from the ECM.
- Disconnect the battery backup module from the engine harness.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground in the battery backup module harness. • Measure the resistance from pin 20 in the actuator harness connector to engine block ground. **NOTE:** Gently flex the harness when checking the resistance to check for internally broken or frayed wires.	**OK** **More than 100k ohms**	3A
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	3A



STEP 3: Clear the fault codes.

STEP 3A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Using INSITE™, set real-time clock to correct time. • Using INSITE™, verify that Fault Code 319 is inactive. **NOTE:** It is necessary to set the real-time clock with the INSITE™ service tool to make Fault Code 319 go inactive.	**OK** **Fault Code 319 inactive**	3B
	NOT OK Return to the troubleshooting steps or contact your local Cummins Authorized Repair Location if all the steps have been completed and checked again.	1A

STEP 3B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

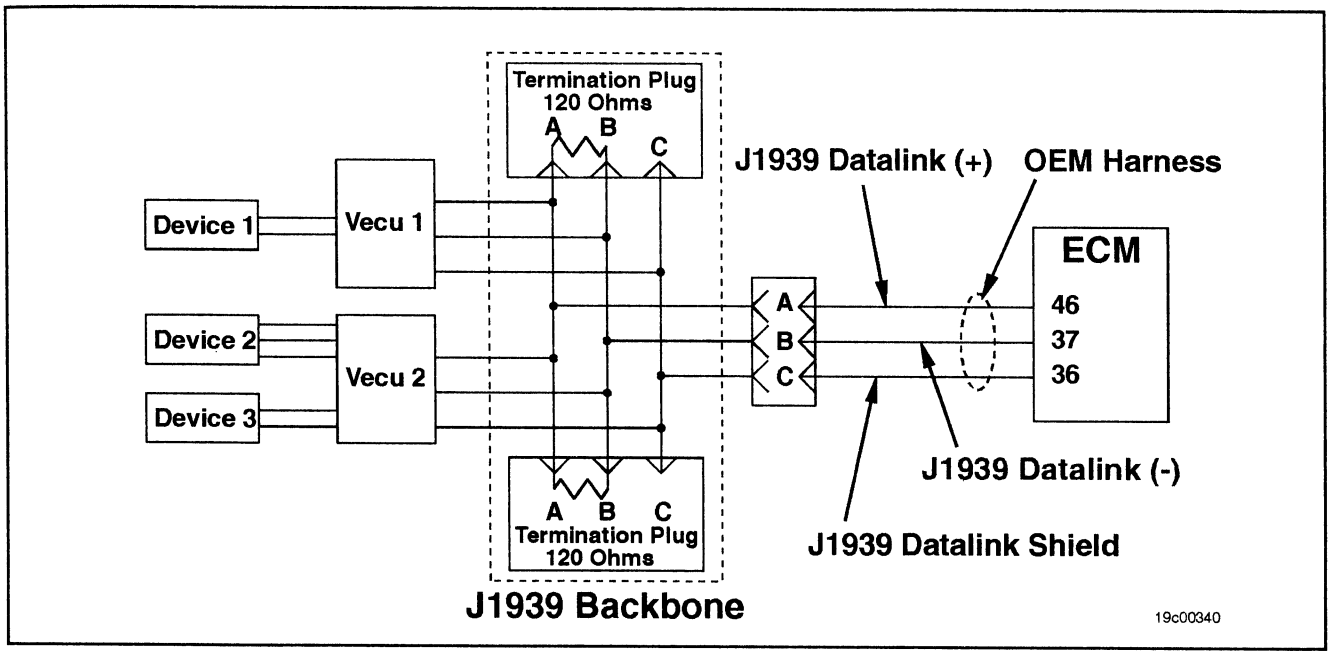
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 286

J1939 Datalink Multiplexing

CODES	REASON	EFFECT
Fault Code: 286 PID(P), SID(S): S231 SPN: 639 FMI: 13/13 Lamp: Yellow	The ECM expected information from a multiplexed device but **only** received a portion of the necessary information.	At least one multiplexed device will **not** operate properly.

J1939 Datalink Multiplexing Circuit



Circuit Description:

Inputs such as throttle pedals, switches, and sensors can be communicated to the ECM over the J1939 datalink. Messages sent from the vehicle electronic control units (VECU) are received by the ECM and used for controlling the engine. Both the ECM and VECU **must** be properly configured so that each device's information is transmitted by the VECU and received by the ECM.

Component Location:

The ECM is located on the intake side of the engine, near the front. The J1939 datalink wiring and VECU(s) vary by OEM options.

Shop Talk:

This fault occurs when the ECM is set up to receive information from several multiplexed switches from VECU(s) and **only** gets some of the switches. It indicates the ECM is setup to receive too many switches or the VECU(s) is set up to transmit too few switches.

TROUBLESHOOTING SUMMARY

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Verify that the VECU(s) and ECM have matching settings.		
STEP 1A: Consult OEM information and/or use OEM service tool to verify which input parameters are wired to VECU(s).	Physical input devices to VECU match VECU configuration	
STEP 1B: Determine which parameters are set to be received over the J1939 datalink. Look at the menu: Adjustments — Features and Parameters 2.	INSITE™ readout matches ECM setting for devices (devices in step 1B match step 1A)	
STEP 2: Change the settings.		
STEP 2A: ECM is set up to receive parameters that the VECU(s) is not transmitting.	ECM setting now matches VECU configuration	
STEP 2B: The VECU(s) is not set up to transmit information from all of the multiplex devices.	VECU(s) parameters match all input devices that are wired to VECU(s)	
STEP 3: Clear the fault code.		
STEP 3A: Disable the fault code.	Fault Code 286 inactive	
STEP 3B: Clear the inactive fault codes.	All faults cleared	

TROUBLESHOOTING STEP

STEP 1: Verify that the VECU(s) and ECM have matching settings.

STEP 1A: Consult OEM information and/or use OEM service tool to verify which input parameters are wired to VECU(s).

Condition:
- Turn keyswitch to the ON position.
- Connect to the vehicle VECU with OEM service tool.

Action	Specifications/Repair	Next Step
Check that the vehicle inputs are multiplexed. Determine which input devices (throttle, cruise switches, clutch switch, etc.) are wired to the vehicle's VECU(s).	**OK** **Physical input devices to VECU match VECU configuration**	1B
Using OEM service tool, verify the VECU is configured properly.	**NOT OK** **Change multiplex settings**	2B

STEP 1B: Determine which parameters are set to be received over the J1939 datalink. Look at the menu: Adjustments – Features and Parameters 2.

Condition:
- Install the INLINE 2™ datalink adapter to the engine and PC.
- Connect INSITE™.
- Turn keyswitch ON and start INSITE™ job.

Action	Specifications/Repair	Next Step
ECM settings match devices installed on vehicle. • Read the ECM settings for devices using INSITE™. • Information for settings in menu: Adjustments – Features and Parameters 2.	**OK** **INSITE™ readout matches ECM settings for devices (devices in step 1B match step 1A)**	3A
	NOT OK The INSITE™ configuration does **not** match the VECU configuration.	2A

STEP 2: Change the settings.

STEP 2A: ECM is set up to receive parameters that the VECU(s) is not transmitting.

Condition:
- Start INSITE™ and connect to ECM.

Action	Specifications/Repair	Next Step
Change ECM setting to match VECU configuration. • If the ECM is set up to receive any of the parameters that the VECU(s) is **not** transmitting over the datalink, turn off multiplexing for those parameters in the ECM using INSITE™ .	**OK** **ECM setting now matches VECU configuration**	3A
	NOT OK Check OEM multiplex settings.	1A

STEP 2B: The VECU(s) is not set up to transmit all of the information from all of the multiplex devices.

Condition:
- Install OEM service tool.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Change the setting of the VECU(s) to transmit all information. • VECU(s) is **not** set up to transmit information from all of the devices connected to it. Change the setting in the VECU(s). Refer to the OEM troubleshooting and repair manual for instruction.	**OK** **VECU(s) parameters match all input devices that are wired to VECU(s)**	3A
	NOT OK Check OEM multiplex settings.	1A

STEP 3: Clear the fault code.

STEP 3A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it idle for 1 minute. • Using INSITE™, verify that Fault Code 286 is inactive.	**OK** **Fault Code 286 inactive**	3B
	NOT OK Return to the troubleshooting steps or contact your local Cummins Authorized Repair Location if all the steps have been completed and checked again.	1A

STEP 3B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

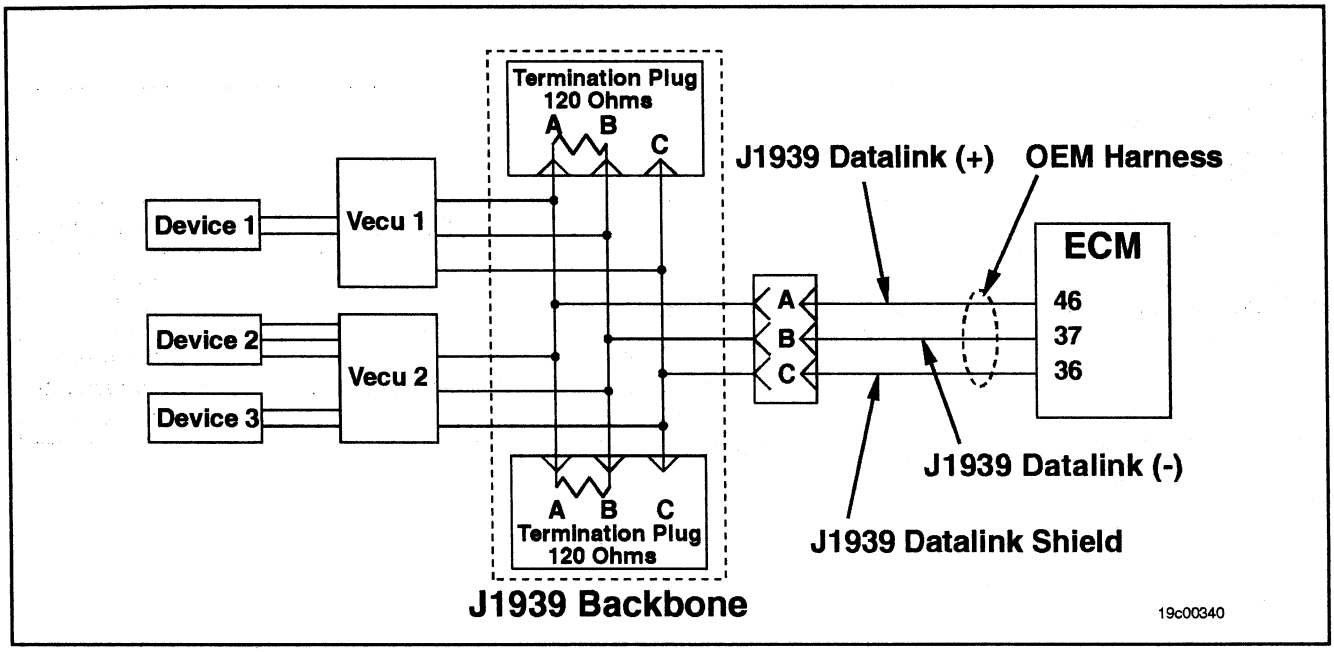
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All faults cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 285

J1939 Datalink Multiplexing

CODES	REASON	EFFECT
Fault Code: 285 PID(P), SID(S): S231 SPN: 639 FMI: 9/9 Lamp: Yellow	The ECM expected information from a multiplexed device but did **not** receive it soon enough, or did **not** receive it at all.	At least one multiplexed device will **not** operate properly.

J1939 Datalink Multiplexing Circuit



Circuit Description:

Inputs such as throttle pedals, switches, and sensors can be communicated to the ECM over the J1939 datalink. Messages sent from the vehicle electronic control units (VECU) are received by the ECM and used for controlling the engine. Both the ECM and VECU **must** be properly configured so that each device's information is transmitted by the VECU and received by the ECM.

Component Location:

The ECM is located on the intake side of the engine, near the front. The J1939 datalink wiring and VECU(s) vary by OEM options.

Shop Talk:

This fault occurs when the ECM is set up to receive information about a multiplexed device from a VECU over the J1939 datalink and does **not** receive a message with that information. This fault can also be caused if the ECM does **not** get the information fast enough to control the engine properly. This condition can be caused by the J1939 datalink having an electrical problem, a lack of terminating plugs on the J1939 datalink backbone, the ECM **not** being set up to receive information, a multiplexed device that truly is **not** multiplexed, or a VECU **not** being correctly set up to transmit information on one of its multiplexed devices.

TROUBLESHOOTING SUMMARY

⚠ CAUTION ⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead
Part No. 3823996 - female Weather-Pack test lead.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the ECM for proper multiplexing configuration.		
STEP 1A: Determine which vehicle inputs (throttle, switches, lamps, sensors) are multiplexed over the J1939 data-link.	Devices in step 1A must match devices in step 1B	
STEP 1B: Verify that the proper devices are set to be multiplexed in the ECM using INSITE™.	INSITE™ readout matches ECM settings for devices (devices in step 1A match step 1B)	
STEP 1B-1: Change the ECM settings to match the vehicle's multiplexed devices.	ECM matches multiplex devices	
STEP 2: Inspect the J1939 connectors on the backbone harness and engine harness connectors.		
STEP 2A: Inspect the ECM, OEM harness, and 3-pin connectors.	No damaged pins	
STEP 2B: Inspect the VECU 3-pin and associated connectors.	No damaged pins	
STEP 3: Inspect the SAE J1939 backbone harness and engine harness connectors.		
STEP 3A: Check for an open circuit in the supply wire.	Less than 10 ohms	
STEP 3B: Check for an open circuit in the return wire.	Less than 10 ohms	
STEP 3C: Check for an open circuit in the shield wire.	Less than 10 ohms	
STEP 3D: Check the resistance value of the J1939 harness.	55 to 65 ohms	
STEP 3E: Check for a short circuit to power in the supply wire.	Less than (+) 1.5 VDC	
STEP 3F: Check for a short circuit to power in the return wire.	Less than (+) 1.5 VDC	
STEP 3G: Check for a short circuit to ground in the supply wire.	More than 100k ohms	
STEP 3H: Check for a short circuit to ground in the return wire.	More than 100k ohms	

STEP 3I: Check for a short circuit pin to pin in the OEM connector. — More than 100k ohms

STEP 4: Check for proper communication with the J1939 devices.

STEP 4A: Check communication with the ECM. — Established communication by monitoring engine speed

STEP 4B: Check communication with the VECU(s). — Proper communication between multiplexing devices and VECU(s)

STEP 5: Clear the fault codes.

STEP 5A: Disable the fault code. — Fault Code 285 inactive

STEP 5B: Clear the inactive fault codes. — All fault codes cleared

TROUBLESHOOTING STEP

STEP 1: Check the ECM for proper multiplexing configuration.

STEP 1A: Determine which vehicle inputs (throttle, switches, lamps, sensors) are multiplexed over the J1939 datalink.

Condition:
- Install the INLINE 2™ datalink adapter.
- Install INSITE™.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check that the vehicle inputs are multiplexed over the J1939 datalink. • Read the devices that are sending input information with INSITE™.	**OK** **Devices in step 1A must match devices in step 1B**	1B
	NOT OK	1B

STEP 1B: Verify that the proper devices are set to be multiplexed in the ECM using INSITE™.

Condition:
- Install the INLINE 2™ datalink adapter.
- Install INSITE™.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
ECM settings match devices installed on vehicle. • Read the ECM settings for devices using INSITE™	**OK** **INSITE™ readout matches ECM settings for devices (devices in step 1A match step 1B)**	2A
	NOT OK Configure ECM to match vehicle devices.	1B-1

STEP 1B-1: Change the ECM settings to match the vehicle's multiplexed devices.

Condition:
- Install the INLINE 2™ datalink adapter.
- Install INSITE™.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Match the multiplexed devices to the ECM. • Using INSITE™, configure the ECM to work with the multiplexed devices.	**OK** **ECM matches multiplex devices**	2A
	NOT OK	5A

STEP 2: Inspect the J1939 connectors on the backbone harness and engine harness connectors.

STEP 2A: Inspect the ECM, OEM harness, and 3-pin connectors.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:
- Turn keyswitch OFF.
- Disconnect the ECM connector.
- Disconnect the OEM harness.
- Disconnect the multiplexed devices.

Action	Specifications/Repair	Next Step
Inspect the ECM, OEM harness, J1939 connectors, and multiplexed devices for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	2B
	NOT OK **Repair the damaged pins** Repair or replace the OEM harness, J1939 backbone harness, or the multiplexed device(s), or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using the electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the OEM harness. Refer to Procedure 019-203. • Replace the OEM harness. Refer to Procedure 019-071. • Repair or replace the backbone harness J1939 connector(s). Refer to Procedure 019-203. • Repair or replace the multiplexed devices. Refer to the Troubleshooting and Repair Manual, Signature, ISX and QSX15 Engines, Bulletin No. 3666239, for specific device. • Replace the ECM. Refer to Procedure 019-031.	5A

STEP 2B: Inspect the VECU 3-pin and associated connectors.

Condition:
- Disconnect the VECU(s) from the J1939 backbone harness.
- Disconnect the multiplexed devices from the VECU(s).

Action	Specifications/Repair	Next Step
Inspect the VECU(s), 3-pin, and multiplexed devices connectors for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	3A
	NOT OK **Repair the damaged pins** Repair or replace the VECU(s), 3-pin connector, or multiplexed devices, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair or replace the VECU(s). Refer to the OEM troubleshooting and repair manual for repair procedure. • Repair the 3-pin connector. Refer to Procedure 019-203. • Repair or replace the multiplexed devices. Refer to the Troubleshooting and Repair Manual, Signature, ISX and QSX15 Engines, Bulletin No. 3666239.	5A

STEP 3: Inspect the SAE J1939 backbone harness and engine harness connectors.

STEP 3A: Check for an open circuit in the supply wire.

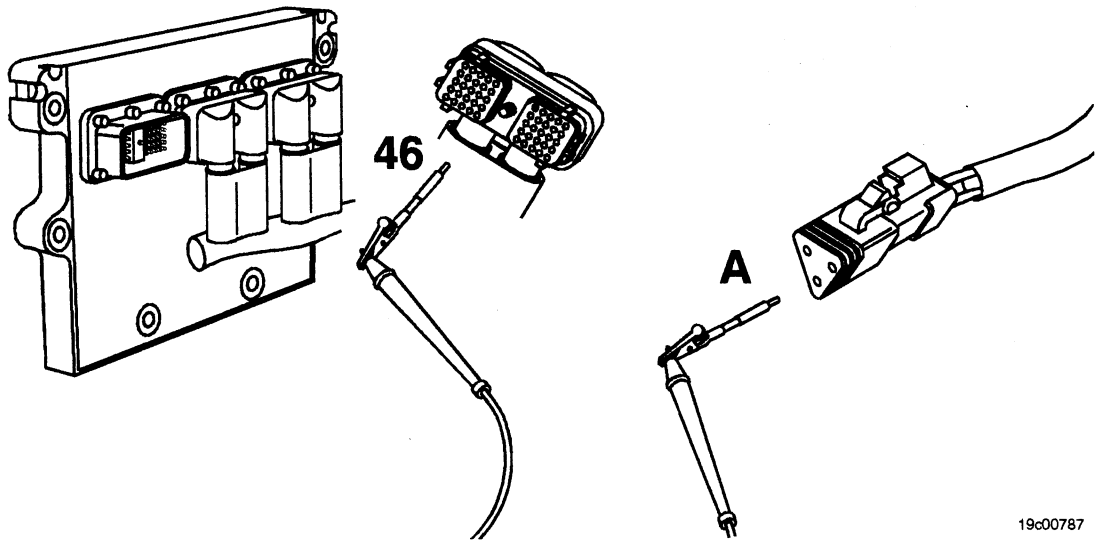
⚠CAUTION⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead
Part No. 3823996 - female Weather-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the OEM harness connector from the ECM.
- Disconnect the J1939 connector from the VECU(s).

Action	Specifications/Repair	Next Step
Check continuity in the supply wire. • Measure resistance from supply pin 46 at the OEM harness connector to pin A at the datalink connector at the VECU(s).	**OK** **Less than 10 ohms**	3B
	NOT OK **Repair or replace the OEM harness** • Repair the OEM harness. Refer to Procedure 019-250. • Replace the OEM harness. Refer to Procedure 019-071.	5A



STEP 3B: Check for an open circuit in the return wire.

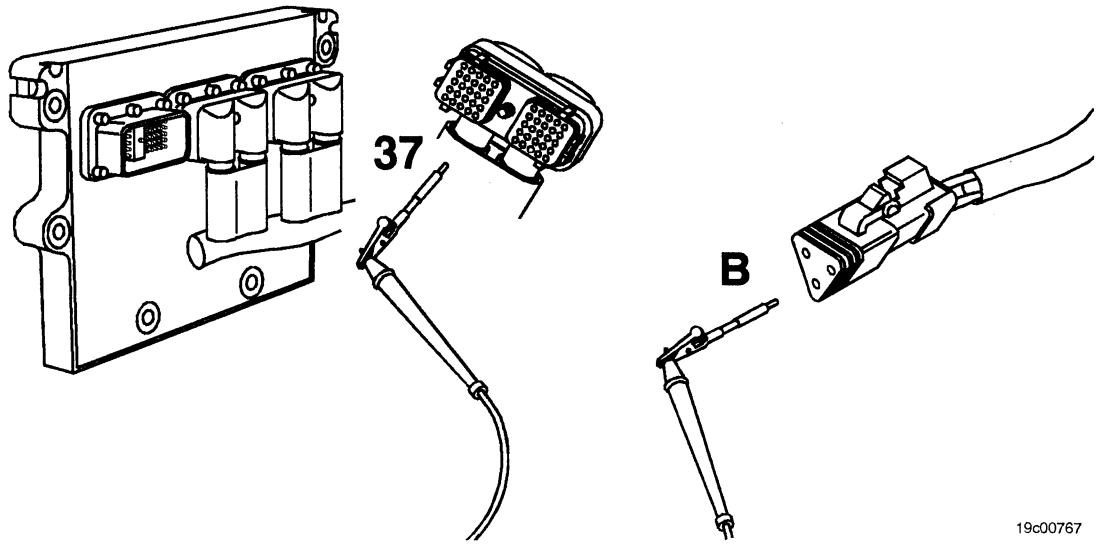
⚠CAUTION⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead
Part No. 3823996 - female Weather-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the OEM harness connector from the ECM.
- Disconnect the J1939 harness from the VECU(s).

Action	Specifications/Repair	Next Step
Check for an open circuit in the return wire. • Measure the resistance from pin 37 at the OEM connector to pin B at the VECU(s).	**OK** **Less than 10 ohms**	3C
	NOT OK **Repair or replace the OEM harness** • Repair the OEM harness. Refer to Procedure 019-250. • Replace the OEM harness. Refer to Procedure 019-071.	5A



STEP 3C: Check for an open circuit in the shield wire.

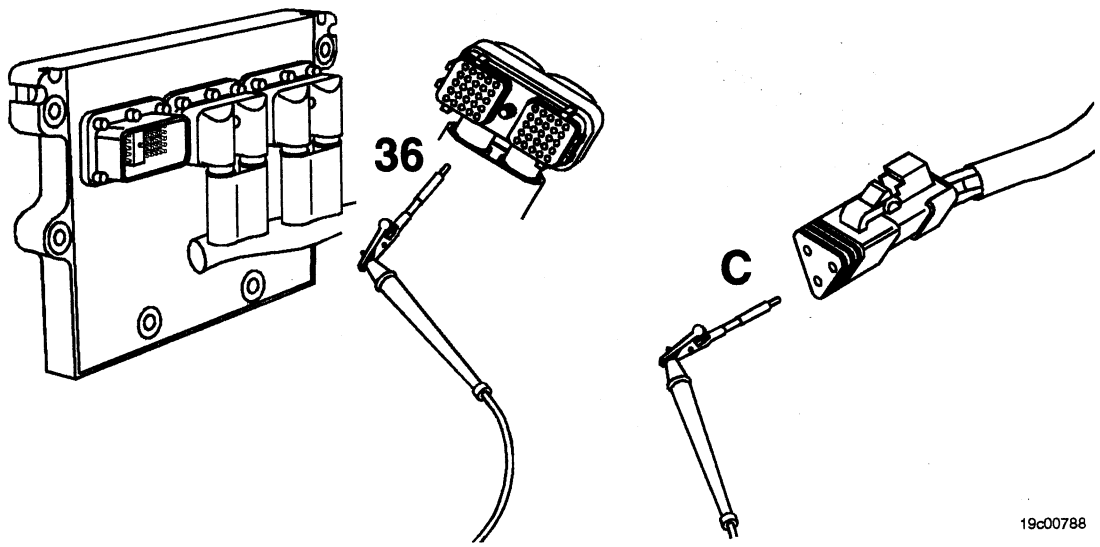
⚠CAUTION⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead
Part No. 3823996 - female Weather-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the OEM harness connector from the ECM.
- Disconnect the J1939 harness from the VECU(s).

Action	Specifications/Repair	Next Step
Check for an open circuit in the shield wire. • Measure the resistance from pin 36 at the OEM connector to pin C at the VECU(s).	**OK** **Less than 10 ohms**	3D
	NOT OK **Repair or replace the OEM harness** • Repair the OEM harness. Refer to Procedure 019-250. • Replace the OEM harness. Refer to Procedure 019-071.	5A



STEP 3D: Check the resistance value of the J1939 harness.

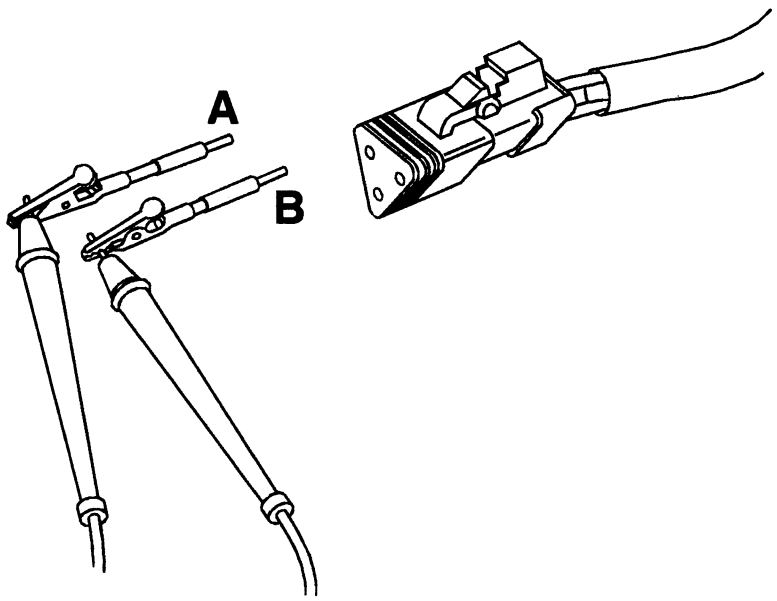
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3823996 - female Weather-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the J1939 harness from the VECU(s).
- Disconnect the engine harness from the J1939 backbone harness.

Action	Specifications/Repair	Next Step
Check the resistance value of the J1939 harness. • Measure the resistance from pin A to pin B of the J1939 harness connector, OEM side.	**OK** **55 to 65 ohms**	3E
	NOT OK **J1939 backbone termination resistors missing or damaged** Replace the termination resistors.	5A



19c00768

STEP 3E: Check for a short circuit to power in the supply wire.

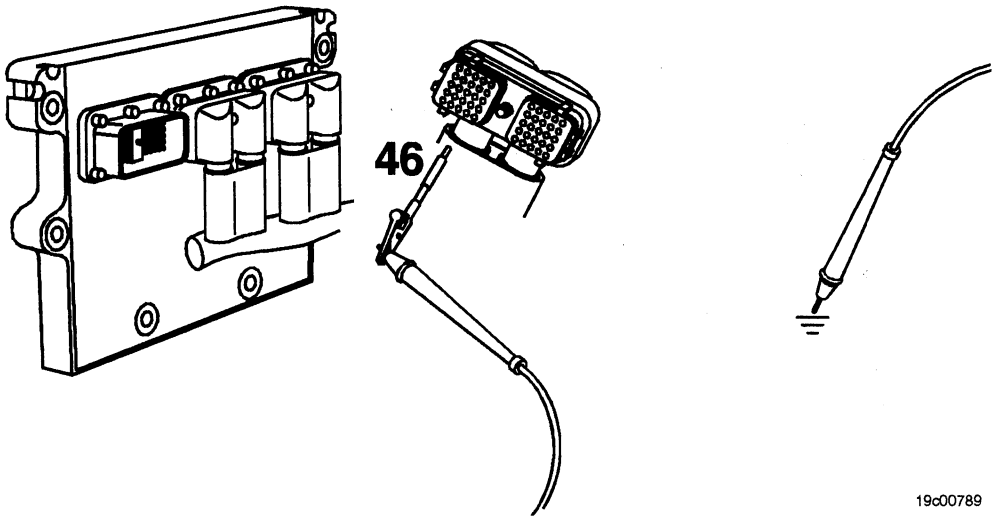
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the J1939 harness from the VECU(s).
- Disconnect the OEM harness connector from the ECM.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check for a short circuit to power in the supply wire. • Measure the voltage from pin 46 at the ECM to engine block ground.	**OK** **Less than (+) 1.5 VDC**	3F
	NOT OK **Repair or replace the OEM harness** • Repair the OEM harness. Refer to Procedure 019-250. • Replace the OEM harness. Refer to Procedure 019-071.	5A



STEP 3F: Check for a short circuit to power in the return wire.

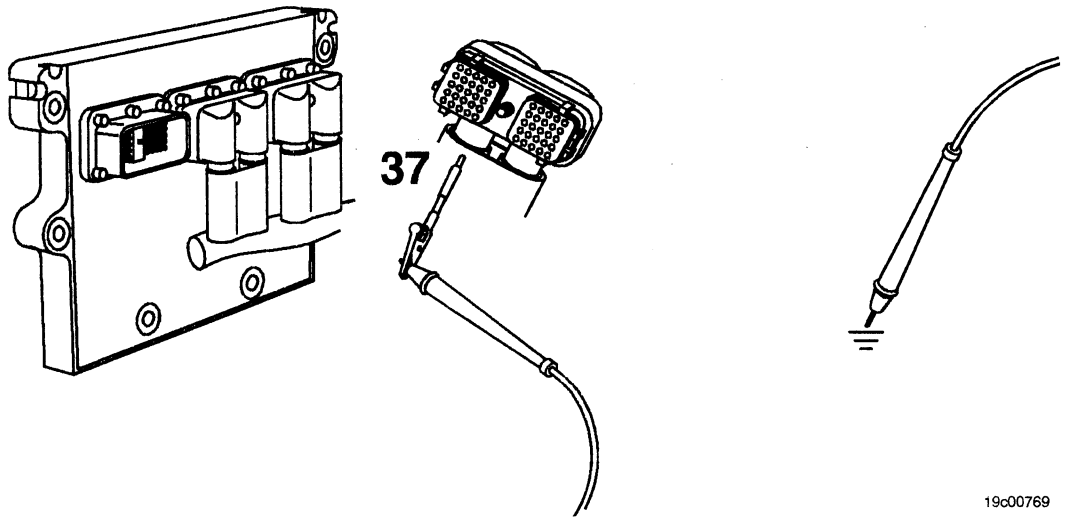
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the J1939 harness from the VECU(s).
- Disconnect the OEM harness connector from the ECM.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check for a short circuit to power in the return wire. • Measure the voltage from pin 37 at the OEM harness connector to engine block ground.	**OK** **Less than (+) 1.5 VDC**	3G
	NOT OK **Repair or replace the OEM harness** • Repair the OEM harness. Refer to Procedure 019-250. • Replace the OEM harness. Refer to Procedure 019-071.	5A



STEP 3G: Check for a short circuit to ground in the supply wire.

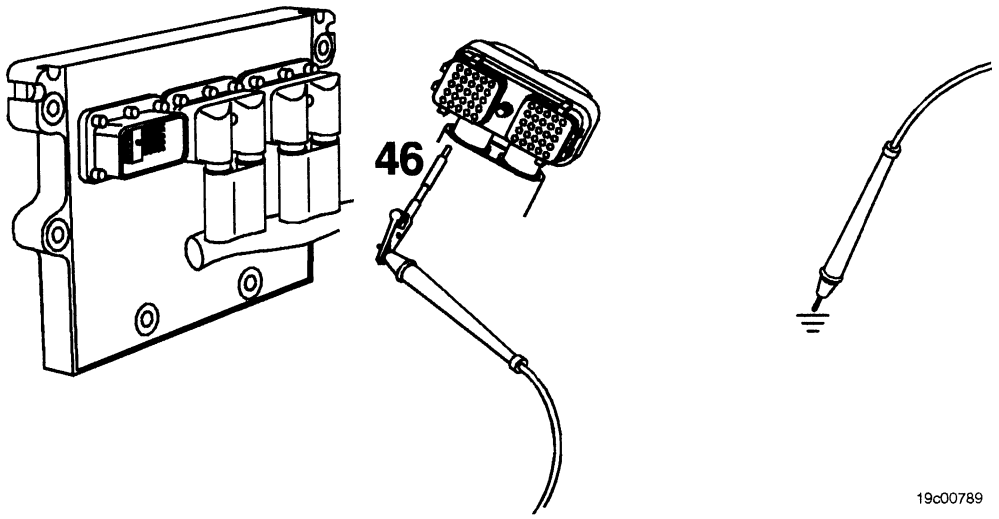
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the OEM harness connector from the ECM.
- Disconnect the J1939 harness from the VECU(s).

Action	Specifications/Repair	Next Step
Check for a short circuit to ground in the supply wire. • Measure the resistance from pin 46 in the OEM harness connector to ground.	**OK** **More than 100k ohms**	3H
	NOT OK **Repair or replace the OEM harness** • Repair the OEM harness. Refer to Procedure 019-250. • Replace the OEM harness. Refer to Procedure 019-071.	5A



STEP 3H: Check for a short circuit to ground in the return wire.

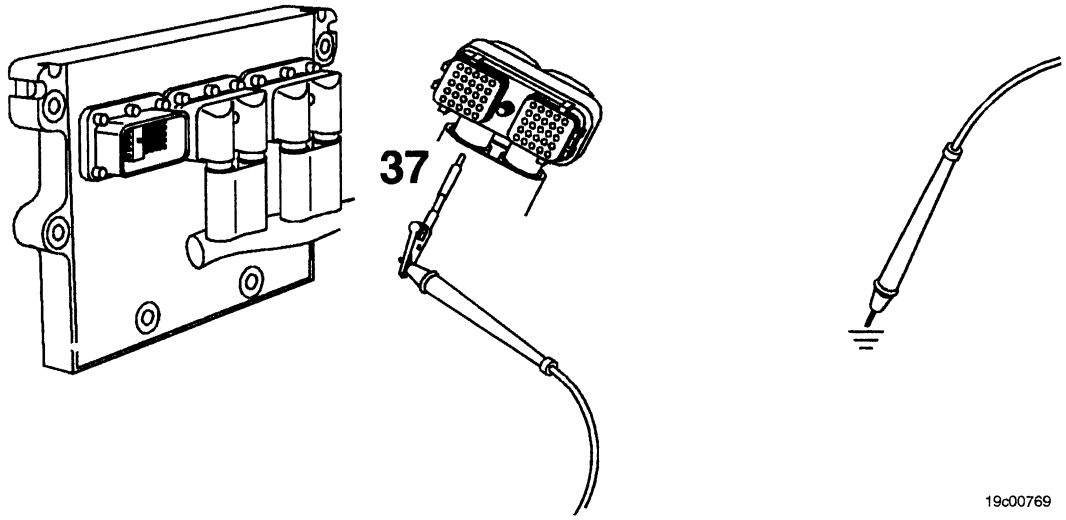
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the OEM harness connector from the ECM.
- Disconnect the J1939 harness from the VECU(s).

Action	Specifications/Repair	Next Step
Check for a short circuit to ground in the return wire. • Measure the resistance from pin 37 in the OEM harness connector to ground.	**OK** **More than 100k ohms**	3I
	NOT OK **Repair or replace the OEM harness** • Repair the OEM harness. Refer to Procedure 019-250. • Replace the OEM harness. Refer to Procedure 019-071.	5A



STEP 3I: Check for a short circuit from pin to pin in the OEM connector.

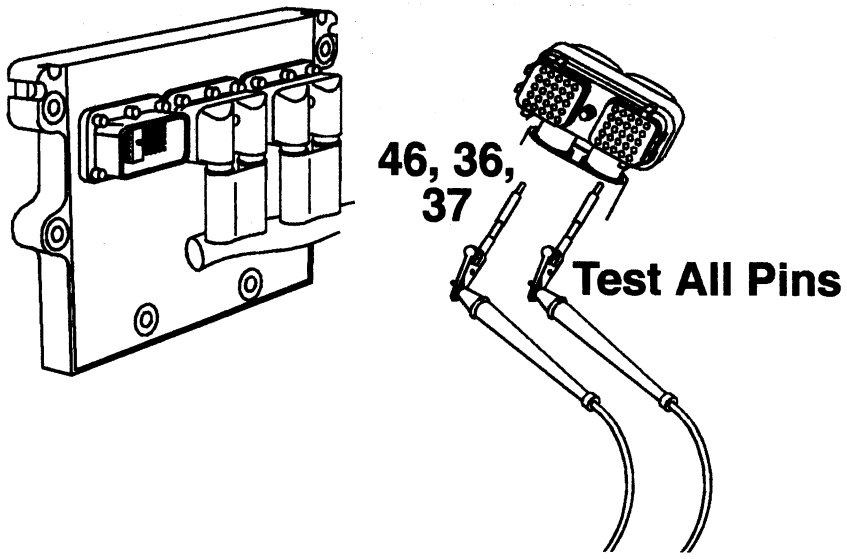
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the OEM harness connector from the ECM.
- Disconnect the J1939 harness from the VECU(s).
- Disconnect the engine harness from the J1939 backbone harness.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin in the OEM connector. • Measure the resistance from pin 46 in the OEM harness connector to all other pins in the connector. • Measure the resistance from pin 36 in the OEM harness connector to all other pins in the connector. • Measure the resistance from pin 37 in the OEM harness connector to all other pins in the connector.	**OK** **More than 100k ohms**	4A
	NOT OK **Repair or replace the OEM harness** • Repair the OEM harness. Refer to Procedure 019-250. • Replace the OEM harness. Refer to Procedure 019-071.	5A



STEP 4: Check for proper communication with the J1939 devices.

STEP 4A: Check communication with the ECM.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:
- Install INLINE 2™ datalink adapter.
- Install INSITE™.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check communication with ECM. • Set up INSITE™ to use the J1939 datalink. Refer to the INSITE™ manual for details.	**OK** **Established communication by monitoring engine speed**	4B
	NOT OK **Replace the ECM** Refer to Procedure 019-031.	5A

STEP 4B: Check communication with the VECU(s).

Condition:
- Install the OEM service tool software.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check communication with the VECU(s). • Using the OEM service tool software, confirm communication between VECU(s) and multiplexing devices.	**OK** **Proper communication between multiplexing devices and VECU(s)**	5A
	NOT OK **Replace the VECU(s)** Refer to the OEM troubleshooting and repair manual for repair procedures.	5A

STEP 5: Clear the fault codes.

STEP 5A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it idle for 1 minute. • Using INSITE™, verify that Fault Code 285 is inactive.	**OK** **Fault Code 285 inactive**	5B
	NOT OK Return to the troubleshooting steps or contact your local Cummins Authorized Repair Location if all the steps have been completed and checked again.	1A

STEP 5B: Clear the inactive fault codes.

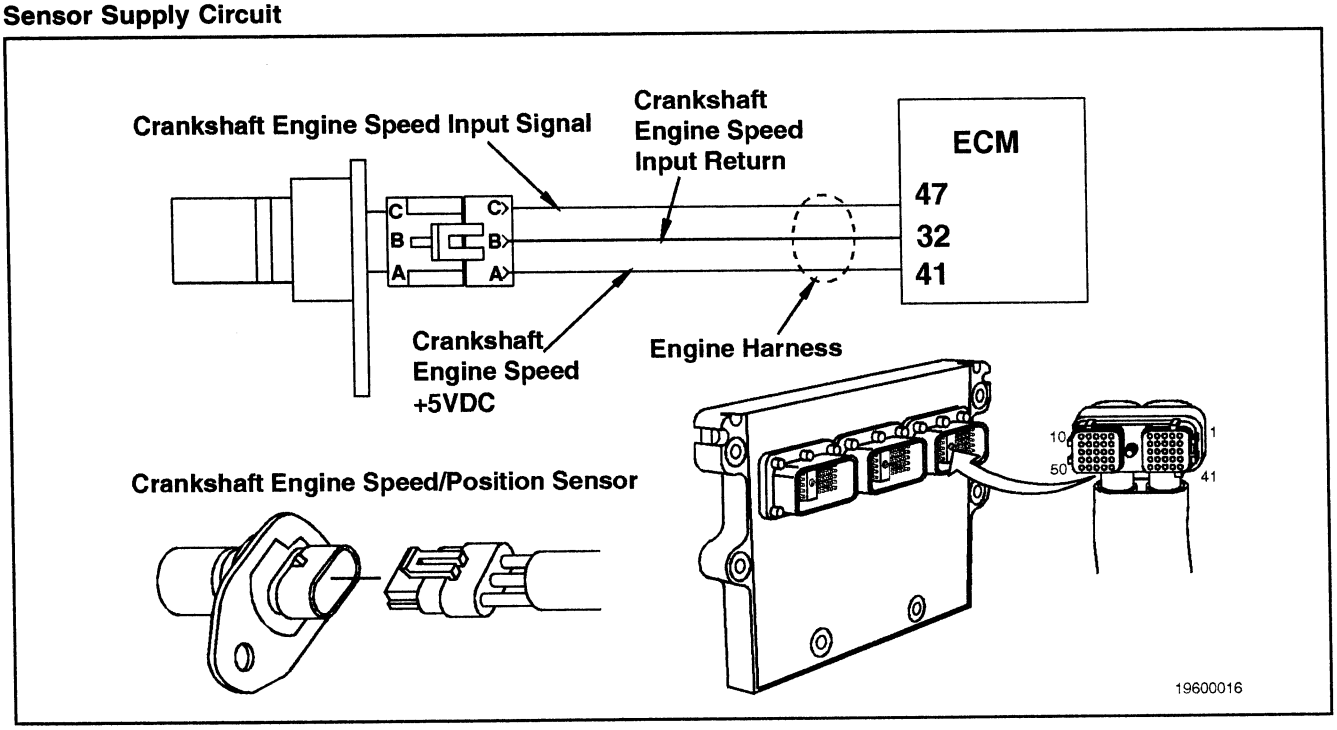
Condition: • Connect all components. • Turn keyswitch ON.		
Action	**Specifications/Repair**	**Next Step**
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 284

Sensor Supply Voltage

CODES	REASON	EFFECT
Fault Code: 284 PID(P), SID(S): P221 SPN: 1043 FMI: 4/4 Lamp: Yellow	Incorrect voltage detected on the electronic control module (ECM) voltage supply wire to the crankshaft engine position sensor.	Engine can possibly **not** run or will run derated. Possible hard starting, low power, or white smoke.

Sensor Supply Circuit



Circuit Description:

The ECM supplies the crankshaft engine position sensor with (+) 5 VDC. If the supply wire to any sensor is damaged, the sensor will **not** work correctly.

Component Location:

The crankshaft engine position sensor is located in the front cover on the intake side of the engine.

Shop Talk:

Incorrect voltage on the sensor (+) 5 VDC supply line will be caused by a short circuit to ground in a supply line, a short circuit between a supply line or a return line, a failed sensor, or a failed ECM power supply.

TROUBLESHOOTING SUMMARY

⚠ CAUTION ⚠

To avoid damaging the new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3824775 - breakout cable
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead
Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check for a signal from the crankshaft engine position sensor.		
STEP 1A: Check the crankshaft engine position sensor.	Signal present	
STEP 2: Check the sensor harness.		
STEP 2A: Inspect the harness and the ECM connector pins.	No damaged pins	
STEP 2B: Check the supply voltage.	(+) 4.75 to 5.25 VDC	
STEP 2C: Check for a short circuit to ground in the sensor supply wire.	More than 100k ohms	
STEP 2D: Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 3: Clear the fault code.		
STEP 3A: Disable the fault code.	Fault Code 284 inactive	
STEP 3B: Clear the inactive fault codes.	All faults cleared	

TROUBLESHOOTING STEP

STEP 1: Check for a signal from the crankshaft engine position sensor.

STEP 1A: Check the crankshaft engine position sensor.

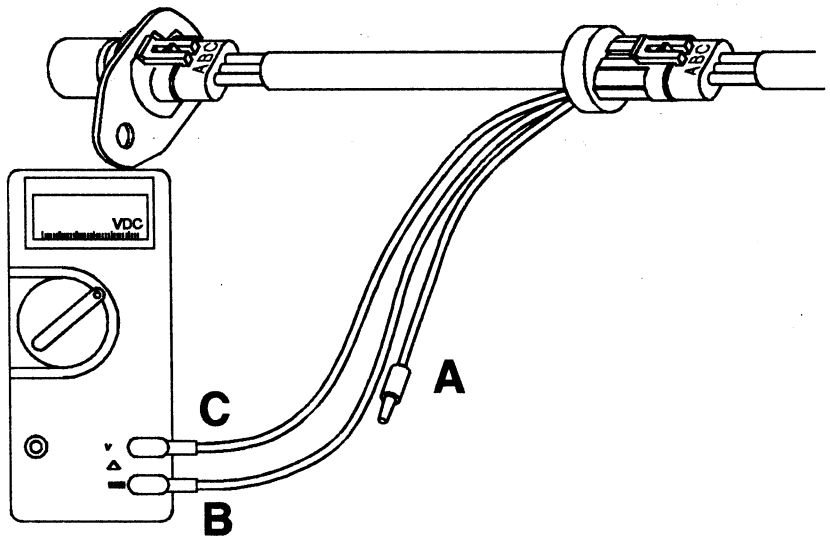
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3824775 - breakout cable.

Condition:

- Disconnect the engine harness from the crankshaft engine position sensor.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check for a signal from the crankshaft engine position sensor. • Measure the voltage from pin C (or YELLOW) to pin B (or BLACK) on the breakout cable while barring the engine over.	**OK** **Signal present;** **signal should change from (+) 4 - 5 VDC to (+) 0.5 - 2.3 VDC and back about every 60° of crankshaft rotation**	2A
	NOT OK **Replace the crankshaft engine position sensor** Refer to Procedure 019-038.	3A



19c00765

STEP 2: Check the sensor harness.

STEP 2A: Inspect the harness and the ECM connector pins.

⚠CAUTION⚠

To avoid damaging the new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Inspect the harness and the ECM connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	2B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using the electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	3A

STEP 2B: Check the supply voltage.

⚠CAUTION⚠

To avoid damaging the new ECM, all other active fault codes must be investigated prior to replacing the ECM

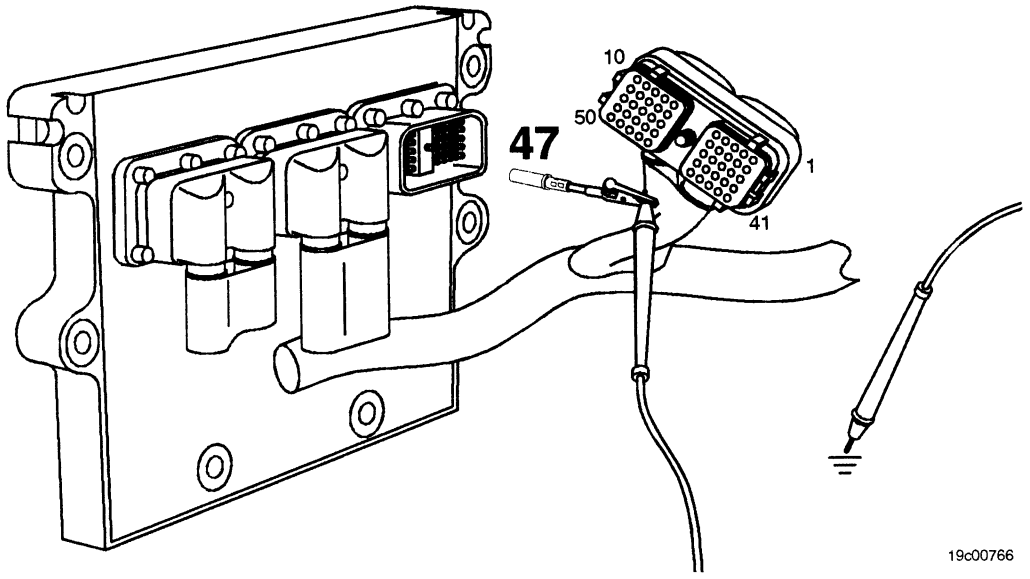
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

Condition:

- Disconnect the sensor harness connector from the ECM.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the supply voltage. • Measure the supply voltage from the ECM sensor port pin 47 to ground.	**OK** **(+) 4.75 to 5.25 VDC**	2C
	NOT OK **Replace the ECM** Refer to Procedure 019-031.	3A



STEP 2C: Check for a short circuit to ground in the sensor supply wire.

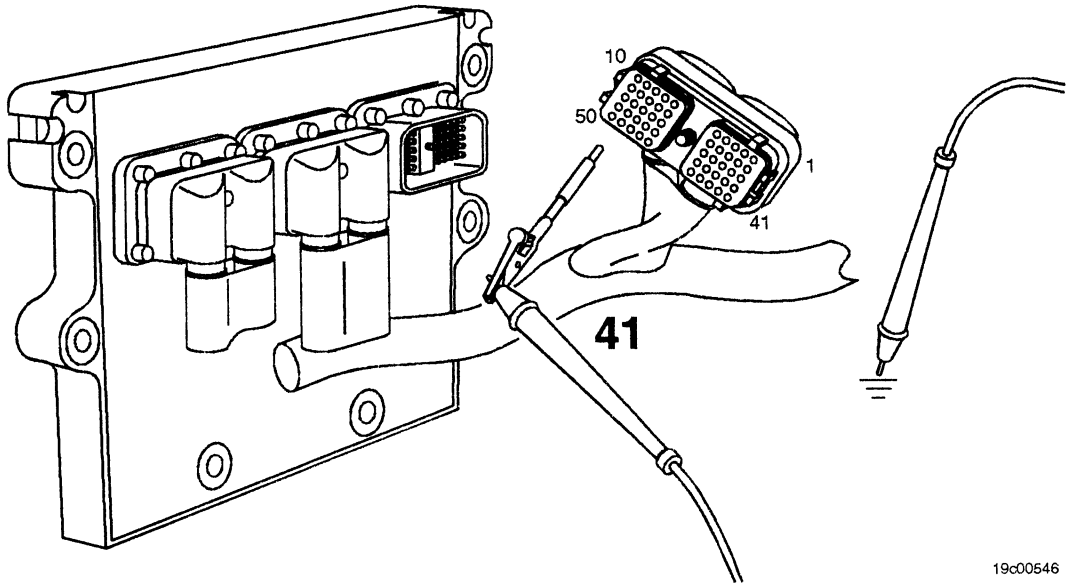
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground in the sensor supply wire. • Measure the resistance from pin 41 of the sensor harness connector to engine block ground.	**OK** **More than 100k ohms**	2D
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	3A



STEP 2D: Check for a short circuit from pin to pin.

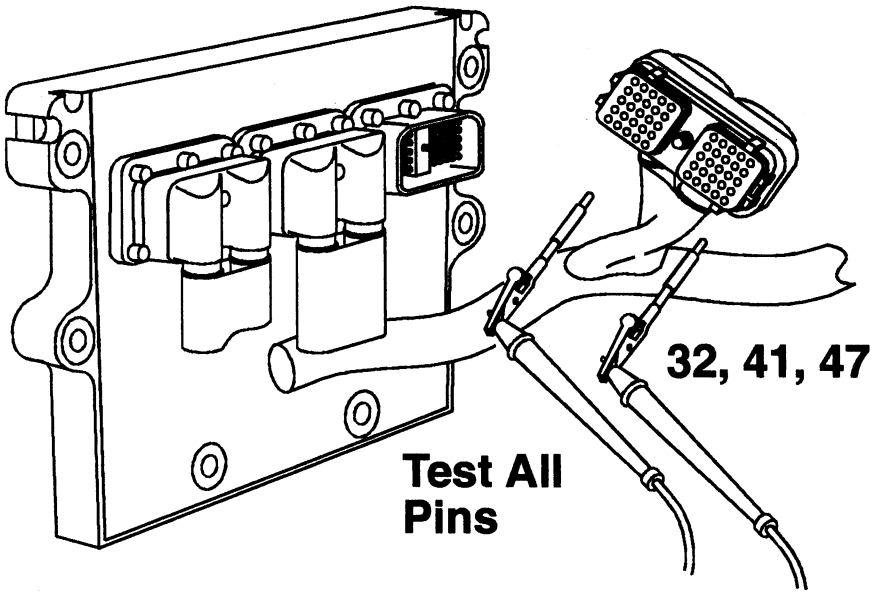
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pin 32 of the sensor harness connector to all other pins in the connector. • Measure the resistance from pin 41 of the sensor harness connector to all other pins in the connector. • Measure the resistance from pin 47 of the sensor harness connector to all other pins in the connector.	**OK** **More than 100k ohms**	3A
	NOT OK **Repair or replace the engine harness..** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	3A



STEP 3: Clear the fault code.

STEP 3A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it idle for 1 minute. • Using INSITE™, verify Fault Code 284 inactive.	**OK** **Fault Code 284 inactive**	3B
	NOT OK Return to the troubleshooting steps or contact your local Cummins Authorized Repair Location if all the steps have been completed and checked again.	1A

STEP 3B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

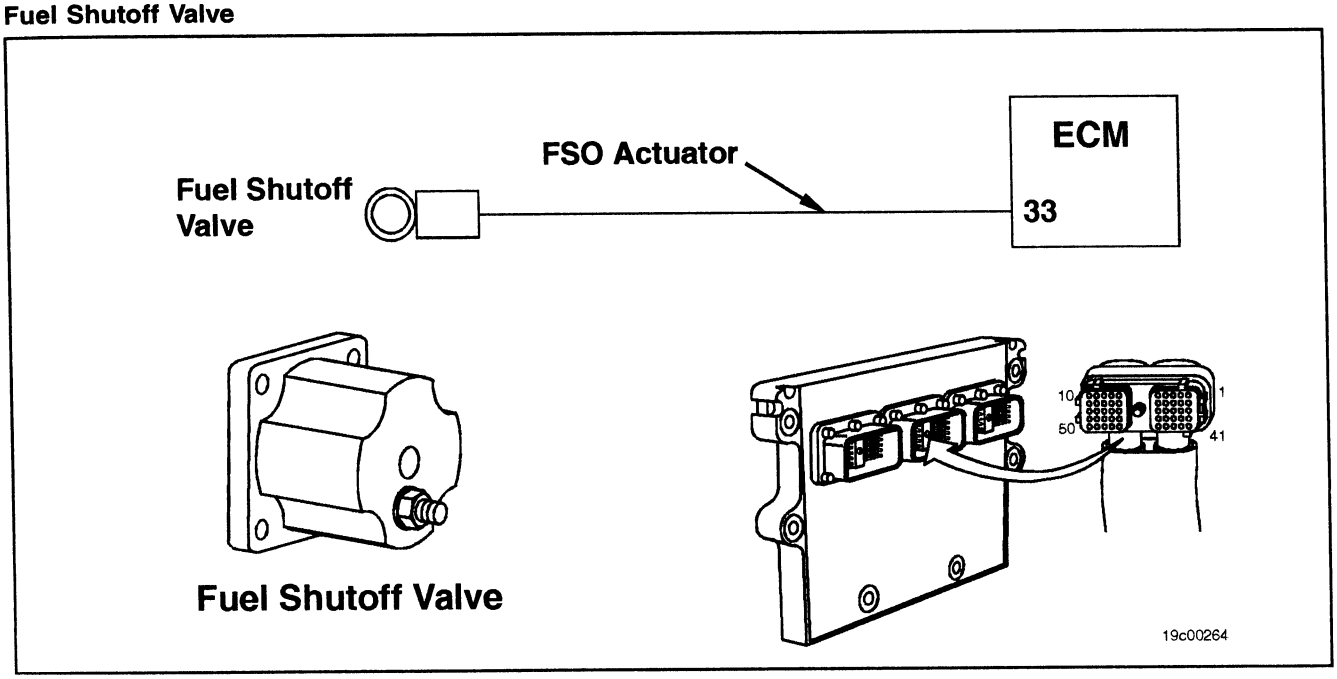
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All faults cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 259

Fuel Shutoff Valve

CODES	REASON	EFFECT
Fault Code: 259 PID(P), SID(S): S017 SPN: 632 FMI: 7/7 Lamp: Yellow	The ECM detected that the fuel shutoff valve is stuck open mechanically or leaking.	Engine will run derated.

Fuel Shutoff Valve



Circuit Description:

Voltage is supplied to the fuel shutoff valve by the ECM while the engine keyswitch is on. When the keyswitch is off, the voltage to the fuel shutoff valve is turned off by the ECM. The fuel shutoff valve closes and stops fuel from flowing to the fueling and timing actuators.

Component Location:

The fuel shutoff valve is located on the fuel delivery housing, below the air inlet horn.

Shop Talk:

Upon turning the keyswitch off, the ECM turns off the voltage supplied to keep the fuel shutoff open. The ECM continues to fire the fueling and timing actuators as the engine spins down. The ECM monitors fuel pressure using the fuel pressure sensor during this time. If the fuel pressure does **not** drop after the fuel shutoff valve is turned off, the ECM activates this fault.

TROUBLESHOOTING SUMMARY

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault status.		
STEP 1A: Check for active Fault Code 255 or high inactive counts.	Fault Code 255 not active	
STEP 2: Check for wires.		
STEP 2A: Check for extra wires attached to the fuel shutoff valve solenoid.	No extra wires	
STEP 3: Replace the fuel shutoff valve.		
STEP 3A: Replace the fuel shutoff valve.	Fault Code 259 inactive	
STEP 4: Clear the fault codes.		
STEP 4A: Disable the fault code.	Fault Code 259 inactive	
STEP 4B: Clear the inactive fault codes.	All fault codes cleared	

TROUBLESHOOTING STEP

STEP 1: Check the fault status.

STEP 1A: Check for active Fault Code 255 or high inactive counts.

Condition:
- All the components connected.
- Turn keyswitch ON.

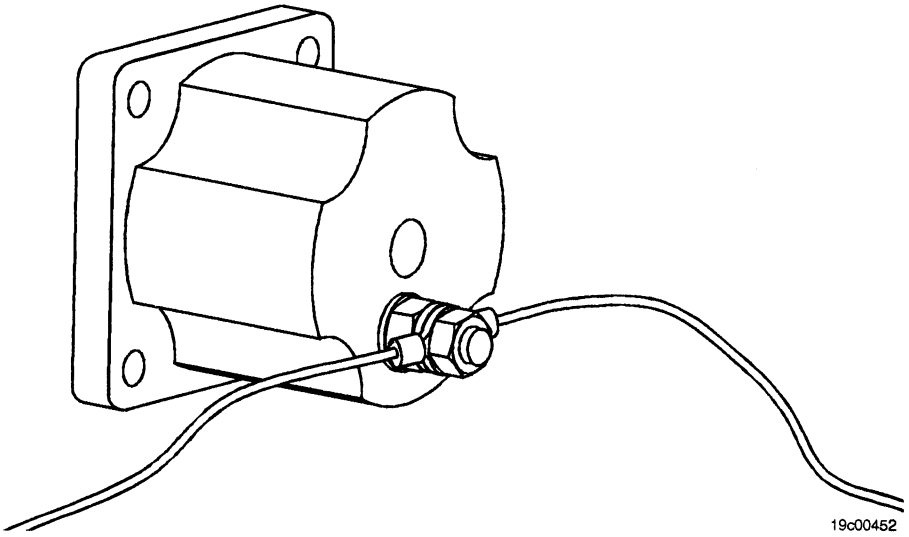
Action	Specifications/Repair	Next Step
Read the fault codes. • Read the fault codes using INSITE™.	**OK** **Fault Code 255 not active**	2A
	NOT OK Fault Code 255 active.	Refer to Fault Code 255

STEP 2: Check for wires.

STEP 2A: Check for extra wires attached to the fuel shutoff valve solenoid.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Check for extra wires attached to the fuel shutoff valve solenoid. • Visually check the fuel shutoff valve solenoid.	**OK** **No extra wires**	3A
	NOT OK **Remove extra wires attached to the fuel shutoff valve solenoid**	4A



STEP 3: Replace the fuel shutoff valve.

STEP 3A: Replace the fuel shutoff valve.

Condition:
- Turn keyswitch OFF.
- Disconnect the engine harness from the fuel shutoff valve.

Action	Specifications/Repair	Next Step
Replace the fuel shutoff valve. • Refer to Procedure 019-050.	**OK** **Fault Code 259 inactive**	4A
	NOT OK Return to troubleshooting steps or contact your local Cummins Authorized Repair Location if all steps have been completed and checked again.	1A

STEP 4: Clear the fault codes.

STEP 4A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it idle for 1 minute. • Turn keyswitch OFF for 30 seconds. • Using INSITE™, verify Fault Code 259 is inactive.	**OK** **Fault Code 259 inactive**	4B
	NOT OK Return to troubleshooting steps or contact your local Cummins Authorized Repair Location if all steps have been completed and checked again.	1A

STEP 4B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

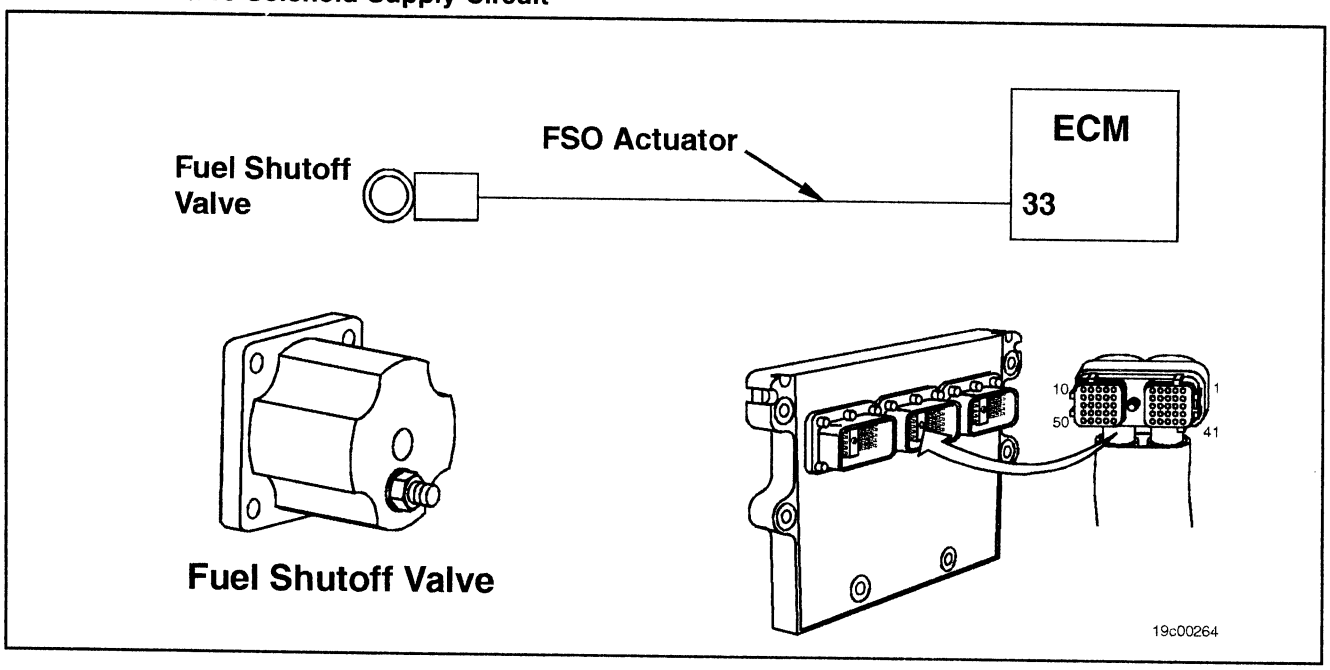
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 255

Fuel Shutoff Valve Solenoid Supply Circuit

CODES	REASON	EFFECT
Fault Code: 255 PID(P), SID(S): S017 SPN: 632 FMI: 3/3 Lamp: Yellow	Externally supplied voltage detected going to fuel shutoff valve solenoid supply circuit.	None on performance. Fuel shutoff valve stays on.

Fuel Shutoff Valve Solenoid Supply Circuit



Circuit Description:

If voltage is externally supplied to the fuel shutoff valve, it will stay open.

Component Location:

The fuel shutoff valve solenoid is located on the fuel delivery housing, below the air inlet horn. The solenoid is controlled by the ECM.

Shop Talk:

If there is an external shutdown system on the vehicle, make sure it is **not** miswired and feeding voltage into the fuel shutoff supply circuit.

TROUBLESHOOTING SUMMARY

⚠ CAUTION ⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the actuator harness.		
STEP 1A: Inspect the harness and the ECM connector pins.	No damaged pins	
STEP 1B: Check for the external voltage source.	Less than (+) 1.5 VDC	
STEP 1C: Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 2: Clear the fault codes.		
STEP 2A: Disable the fault code.	Fault Code 255 inactive	
STEP 2B: Clear the fault codes.	All fault codes cleared	

TROUBLESHOOTING STEP

STEP 1: Check the actuator harness.

STEP 1A: Inspect the harness and the ECM connector pins.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness connector from the ECM.

Action	Specifications/Repair	Next Step
Inspect the harness and the ECM connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	1B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	2A

STEP 1B: Check for the external voltage source.

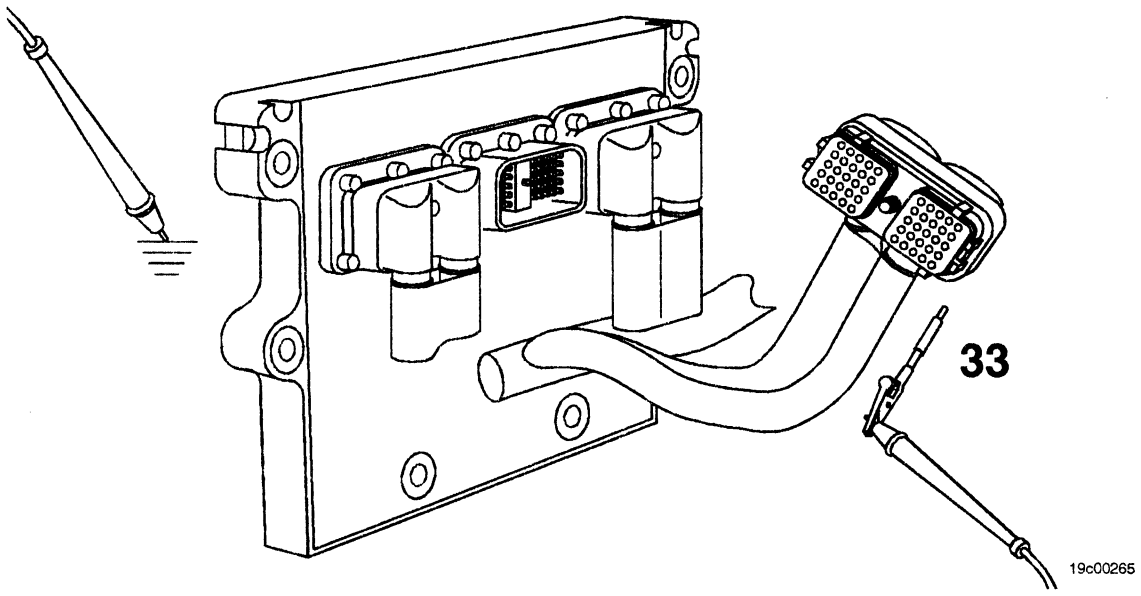
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Disconnect the actuator harness connector from the ECM.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check for the external voltage source. • Measure the voltage from pin 33 in actuator harness connector to engine block ground.	**OK** **Less than (+) 1.5 VDC**	1C
	NOT OK **Remove the external voltage source** There is an external source connected to the wire at which more than (+) 1.5 VDC was measured. Find the voltage source and remove it from the circuit.	2A



STEP 3E: Check for a short circuit to power in the supply wire.

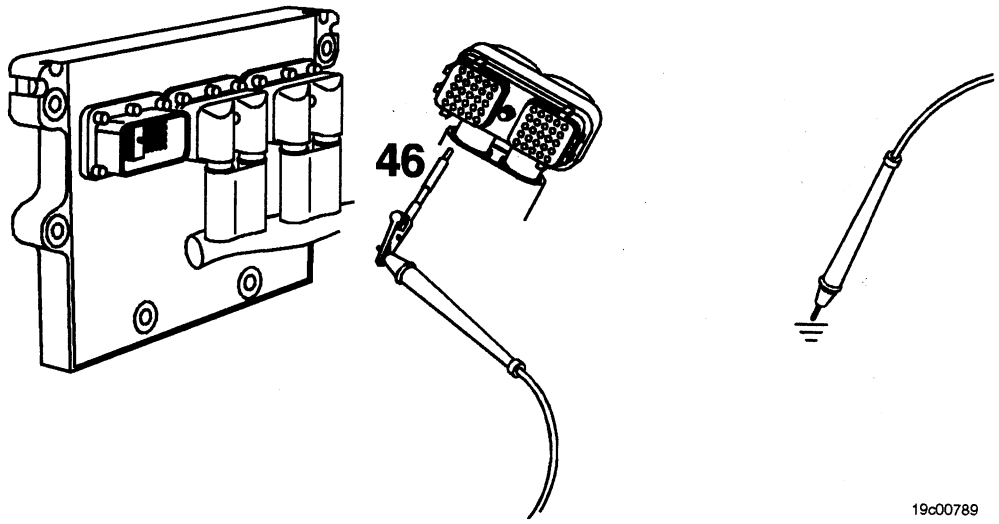
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the J1939 harness from the VECU(s).
- Disconnect the OEM harness connector from the ECM.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check for a short circuit to power in the supply wire. • Measure the voltage from pin 46 at the ECM to engine block ground.	**OK** **Less than (+) 1.5 VDC**	3F
	NOT OK **Repair or replace the OEM harness** • Repair the OEM harness. Refer to Procedure 019-250. • Replace the OEM harness. Refer to Procedure 019-071.	5A



STEP 3F: Check for a short circuit to power in the return wire.

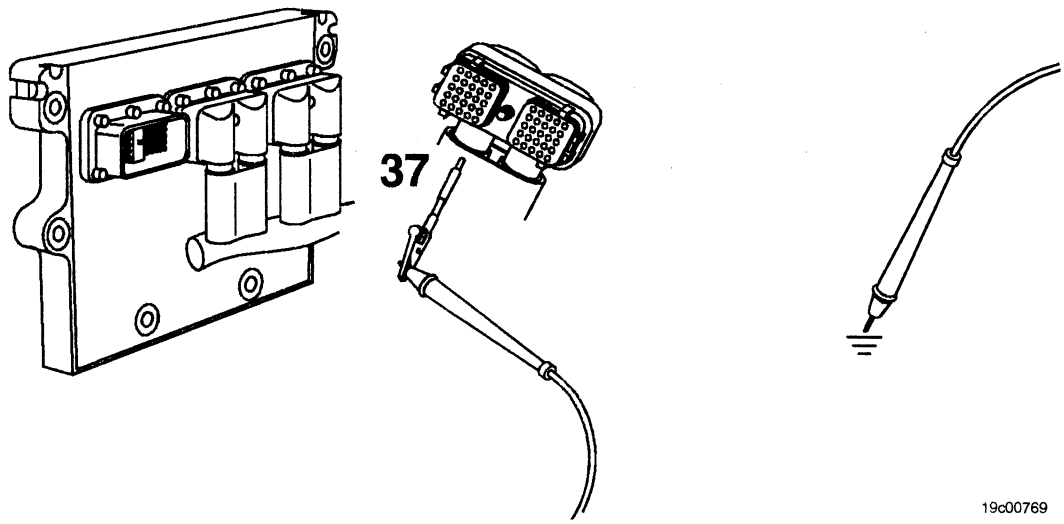
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the J1939 harness from the VECU(s).
- Disconnect the OEM harness connector from the ECM.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check for a short circuit to power in the return wire. • Measure the voltage from pin 37 at the OEM harness connector to engine block ground.	**OK** **Less than (+) 1.5 VDC**	3G
	NOT OK **Repair or replace the OEM harness** • Repair the OEM harness. Refer to Procedure 019-250. • Replace the OEM harness. Refer to Procedure 019-071.	5A



STEP 3G: Check for a short circuit to ground in the supply wire.

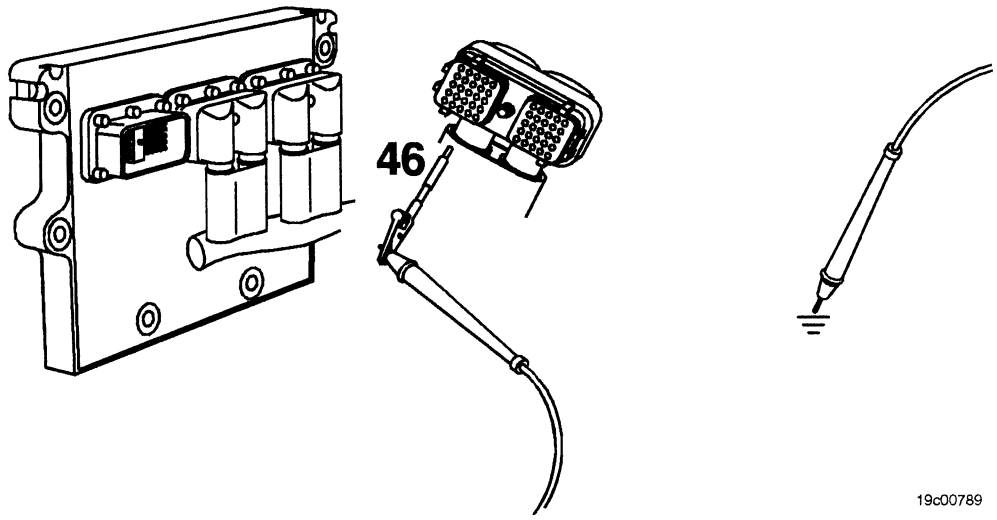
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the OEM harness connector from the ECM.
- Disconnect the J1939 harness from the VECU(s).

Action	Specifications/Repair	Next Step
Check for a short circuit to ground in the supply wire. • Measure the resistance from pin 46 in the OEM harness connector to ground.	**OK** **More than 100k ohms**	3H
	NOT OK **Repair or replace the OEM harness** • Repair the OEM harness. Refer to Procedure 019-250. • Replace the OEM harness. Refer to Procedure 019-071.	5A



STEP 3H: Check for a short circuit to ground in the return wire.

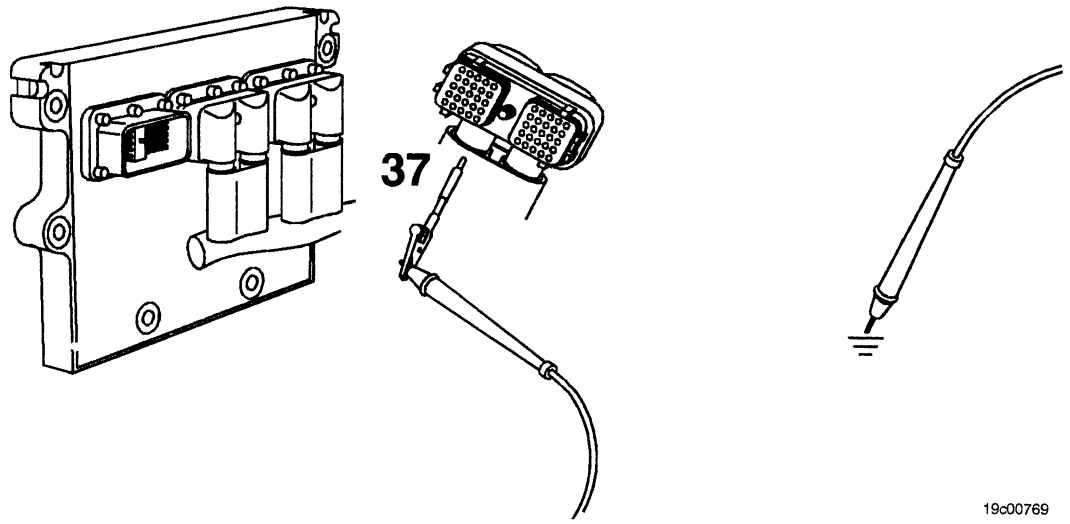
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the OEM harness connector from the ECM.
- Disconnect the J1939 harness from the VECU(s).

Action	Specifications/Repair	Next Step
Check for a short circuit to ground in the return wire. • Measure the resistance from pin 37 in the OEM harness connector to ground.	**OK** **More than 100k ohms**	3I
	NOT OK **Repair or replace the OEM harness** • Repair the OEM harness. Refer to Procedure 019-250. • Replace the OEM harness. Refer to Procedure 019-071.	5A



STEP 3I: Check for a short circuit from pin to pin in the OEM connector.

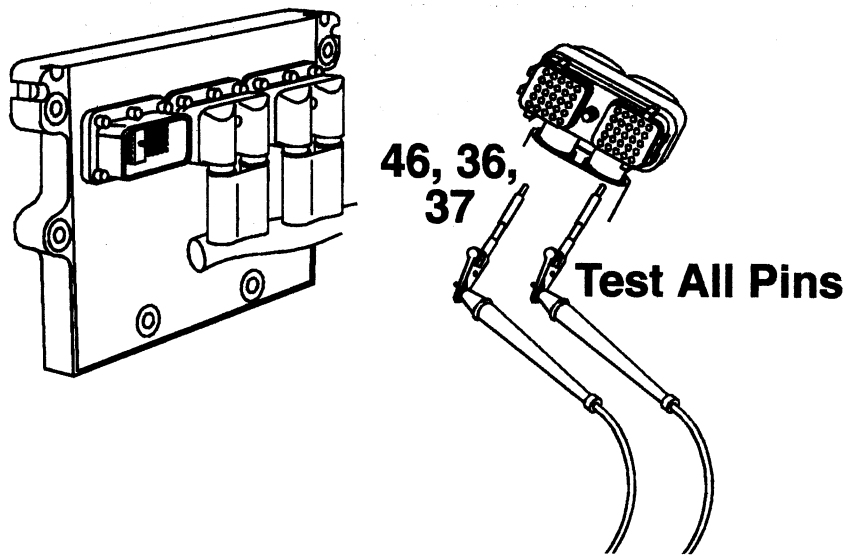
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the OEM harness connector from the ECM.
- Disconnect the J1939 harness from the VECU(s).
- Disconnect the engine harness from the J1939 backbone harness.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin in the OEM connector. • Measure the resistance from pin 46 in the OEM harness connector to all other pins in the connector. • Measure the resistance from pin 36 in the OEM harness connector to all other pins in the connector. • Measure the resistance from pin 37 in the OEM harness connector to all other pins in the connector.	**OK** **More than 100k ohms**	4A
	NOT OK **Repair or replace the OEM harness** • Repair the OEM harness. Refer to Procedure 019-250. • Replace the OEM harness. Refer to Procedure 019-071.	5A



STEP 4: Check for proper communication with the J1939 devices.

STEP 4A: Check communication with the ECM.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:
- Install INLINE 2™ datalink adapter.
- Install INSITE™.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check communication with ECM. • Set up INSITE™ to use the J1939 datalink. Refer to the INSITE™ manual for details.	**OK** **Established communication by monitoring engine speed**	4B
	NOT OK **Replace the ECM** Refer to Procedure 019-031.	5A

STEP 4B: Check communication with the VECU(s).

Condition:
- Install the OEM service tool software.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check communication with the VECU(s). • Using the OEM service tool software, confirm communication between VECU(s) and multiplexing devices.	**OK** **Proper communication between multiplexing devices and VECU(s)**	5A
	NOT OK **Replace the VECU(s)** Refer to the OEM troubleshooting and repair manual for repair procedures.	5A

STEP 5: Clear the fault codes.

STEP 5A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it idle for 1 minute. • Using INSITE™, verify that Fault Code 285 is inactive.	**OK** **Fault Code 285 inactive**	5B
	NOT OK Return to the troubleshooting steps or contact your local Cummins Authorized Repair Location if all the steps have been completed and checked again.	1A

STEP 5B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

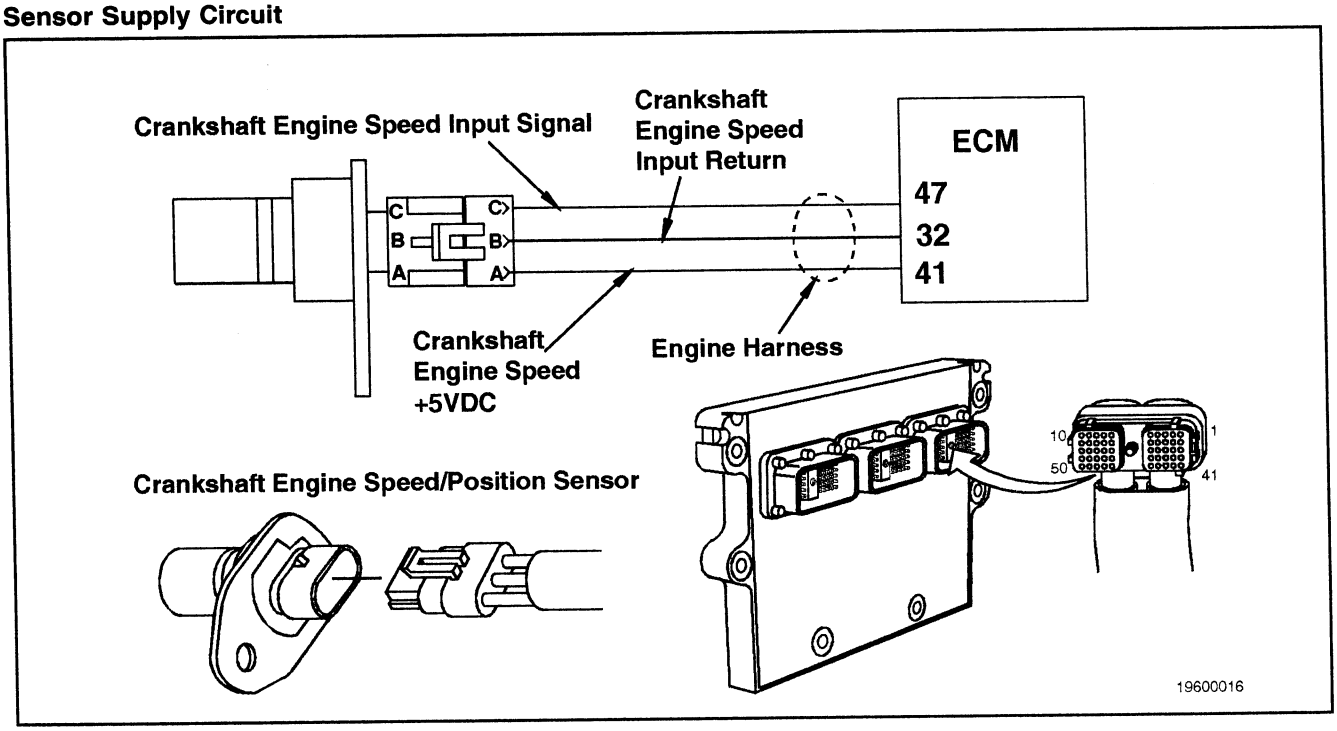
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 284

Sensor Supply Voltage

CODES	REASON	EFFECT
Fault Code: 284 PID(P), SID(S): P221 SPN: 1043 FMI: 4/4 Lamp: Yellow	Incorrect voltage detected on the electronic control module (ECM) voltage supply wire to the crankshaft engine position sensor.	Engine can possibly **not** run or will run derated. Possible hard starting, low power, or white smoke.

Sensor Supply Circuit



Circuit Description:

The ECM supplies the crankshaft engine position sensor with (+) 5 VDC. If the supply wire to any sensor is damaged, the sensor will **not** work correctly.

Component Location:

The crankshaft engine position sensor is located in the front cover on the intake side of the engine.

Shop Talk:

Incorrect voltage on the sensor (+) 5 VDC supply line will be caused by a short circuit to ground in a supply line, a short circuit between a supply line or a return line, a failed sensor, or a failed ECM power supply.

TROUBLESHOOTING SUMMARY

⚠ CAUTION ⚠

To avoid damaging the new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3824775 - breakout cable
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead
Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check for a signal from the crankshaft engine position sensor.		
STEP 1A: Check the crankshaft engine position sensor.	Signal present	
STEP 2: Check the sensor harness.		
STEP 2A: Inspect the harness and the ECM connector pins.	No damaged pins	
STEP 2B: Check the supply voltage.	(+) 4.75 to 5.25 VDC	
STEP 2C: Check for a short circuit to ground in the sensor supply wire.	More than 100k ohms	
STEP 2D: Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 3: Clear the fault code.		
STEP 3A: Disable the fault code.	Fault Code 284 inactive	
STEP 3B: Clear the inactive fault codes.	All faults cleared	

TROUBLESHOOTING STEP

STEP 1: Check for a signal from the crankshaft engine position sensor.

STEP 1A: Check the crankshaft engine position sensor.

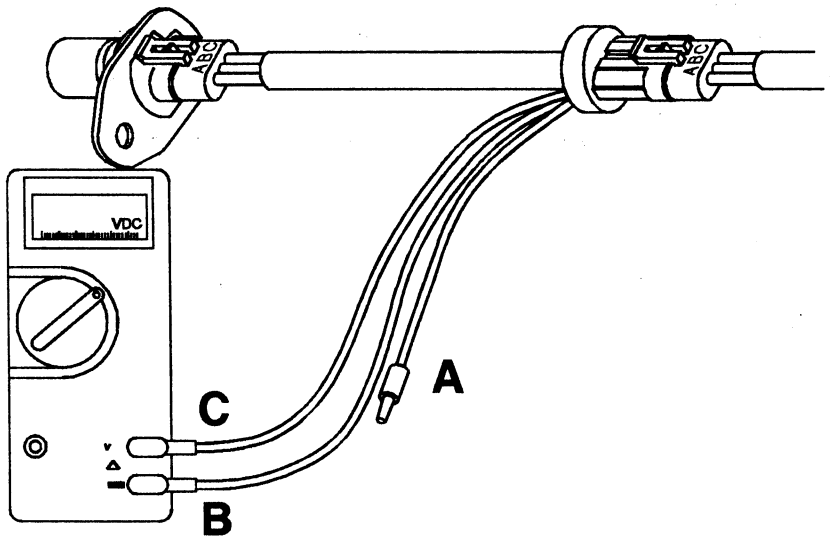
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3824775 - breakout cable.

Condition:

- Disconnect the engine harness from the crankshaft engine position sensor.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check for a signal from the crankshaft engine position sensor. • Measure the voltage from pin C (or YELLOW) to pin B (or BLACK) on the breakout cable while barring the engine over.	**OK** **Signal present;** **signal should change from (+) 4 - 5 VDC to (+) 0.5 - 2.3 VDC and back about every 60° of crankshaft rotation**	2A
	NOT OK **Replace the crankshaft engine position sensor** Refer to Procedure 019-038.	3A



19c00765

STEP 2: Check the sensor harness.

STEP 2A: Inspect the harness and the ECM connector pins.

⚠CAUTION⚠

To avoid damaging the new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Inspect the harness and the ECM connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	2B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using the electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	3A

STEP 2B: Check the supply voltage.

⚠CAUTION⚠

To avoid damaging the new ECM, all other active fault codes must be investigated prior to replacing the ECM

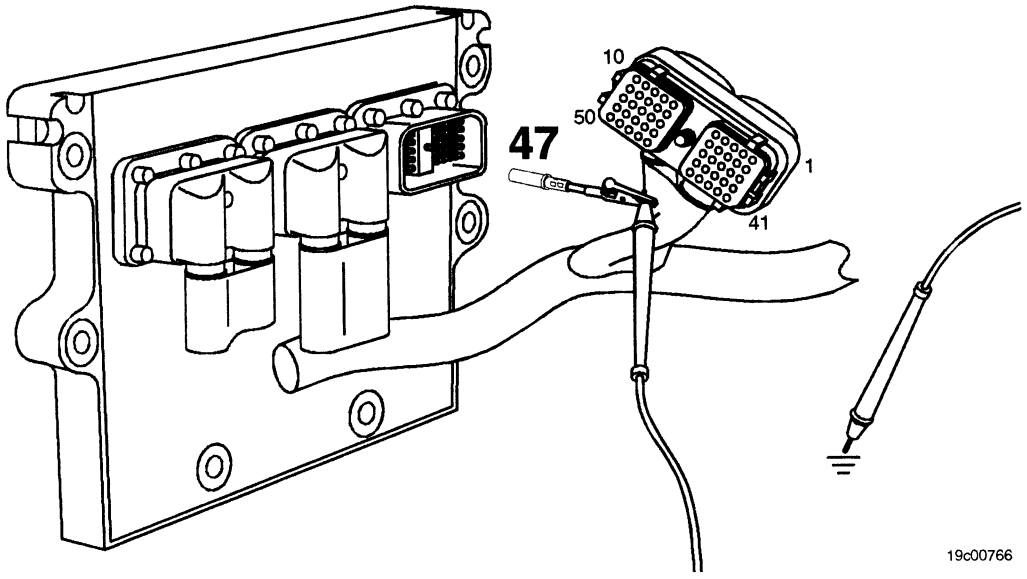
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

Condition:

- Disconnect the sensor harness connector from the ECM.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the supply voltage. • Measure the supply voltage from the ECM sensor port pin 47 to ground.	**OK** **(+) 4.75 to 5.25 VDC**	2C
	NOT OK **Replace the ECM** Refer to Procedure 019-031.	3A



STEP 2C: Check for a short circuit to ground in the sensor supply wire.

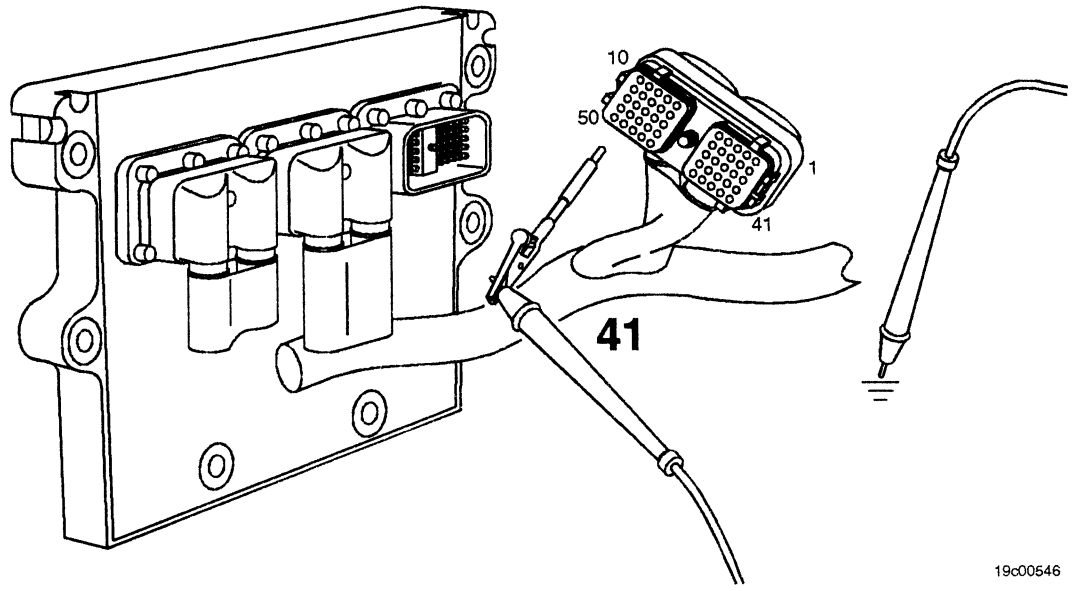
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground in the sensor supply wire. • Measure the resistance from pin 41 of the sensor harness connector to engine block ground.	**OK** **More than 100k ohms**	2D
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	3A



STEP 2D: Check for a short circuit from pin to pin.

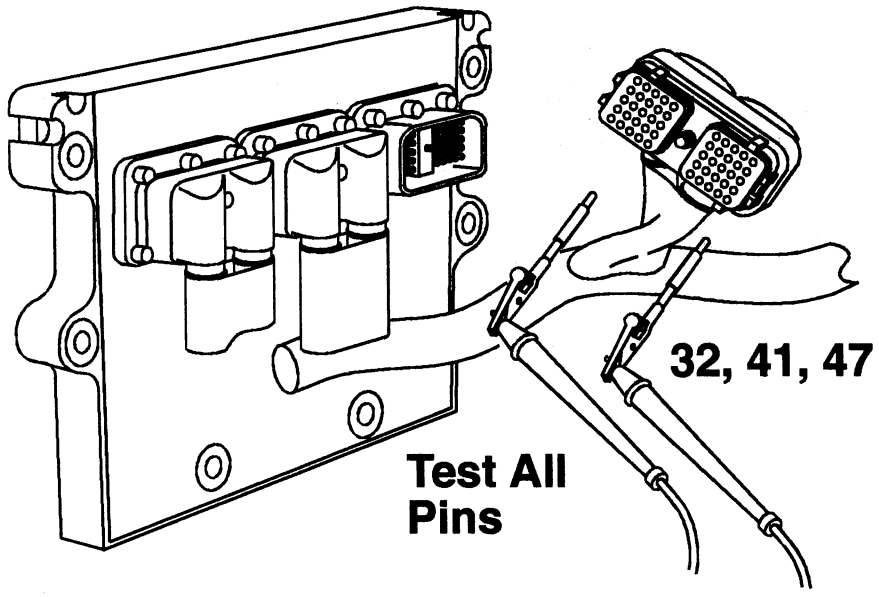
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pin 32 of the sensor harness connector to all other pins in the connector. • Measure the resistance from pin 41 of the sensor harness connector to all other pins in the connector. • Measure the resistance from pin 47 of the sensor harness connector to all other pins in the connector.	**OK** **More than 100k ohms**	3A
	NOT OK **Repair or replace the engine harness..** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	3A



STEP 3: Clear the fault code.

STEP 3A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it idle for 1 minute. • Using INSITE™, verify Fault Code 284 inactive.	**OK** **Fault Code 284 inactive**	3B
	NOT OK Return to the troubleshooting steps or contact your local Cummins Authorized Repair Location if all the steps have been completed and checked again.	1A

STEP 3B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

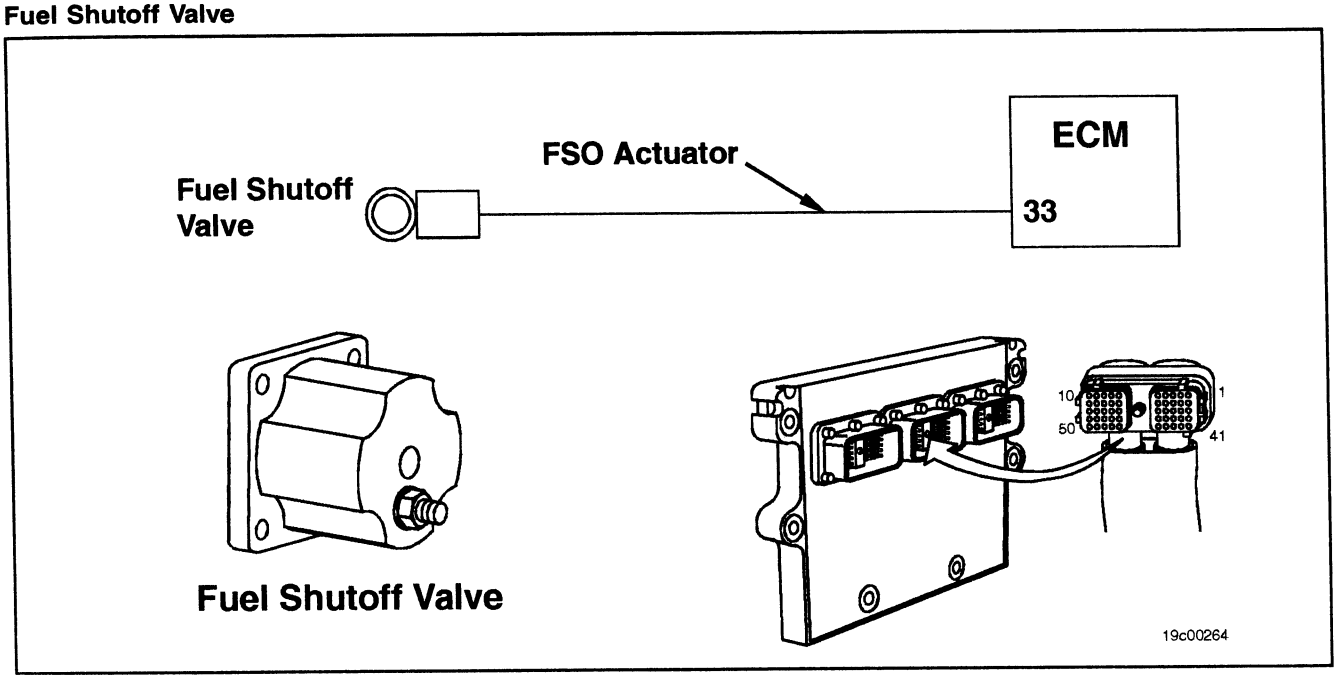
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All faults cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 259

Fuel Shutoff Valve

CODES	REASON	EFFECT
Fault Code: 259 PID(P), SID(S): S017 SPN: 632 FMI: 7/7 Lamp: Yellow	The ECM detected that the fuel shutoff valve is stuck open mechanically or leaking.	Engine will run derated.

Fuel Shutoff Valve



Circuit Description:

Voltage is supplied to the fuel shutoff valve by the ECM while the engine keyswitch is on. When the keyswitch is off, the voltage to the fuel shutoff valve is turned off by the ECM. The fuel shutoff valve closes and stops fuel from flowing to the fueling and timing actuators.

Component Location:

The fuel shutoff valve is located on the fuel delivery housing, below the air inlet horn.

Shop Talk:

Upon turning the keyswitch off, the ECM turns off the voltage supplied to keep the fuel shutoff open. The ECM continues to fire the fueling and timing actuators as the engine spins down. The ECM monitors fuel pressure using the fuel pressure sensor during this time. If the fuel pressure does **not** drop after the fuel shutoff valve is turned off, the ECM activates this fault.

TROUBLESHOOTING SUMMARY

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault status.		
STEP 1A: Check for active Fault Code 255 or high inactive counts.	Fault Code 255 not active	
STEP 2: Check for wires.		
STEP 2A: Check for extra wires attached to the fuel shutoff valve solenoid.	No extra wires	
STEP 3: Replace the fuel shutoff valve.		
STEP 3A: Replace the fuel shutoff valve.	Fault Code 259 inactive	
STEP 4: Clear the fault codes.		
STEP 4A: Disable the fault code.	Fault Code 259 inactive	
STEP 4B: Clear the inactive fault codes.	All fault codes cleared	

TROUBLESHOOTING STEP

STEP 1: Check the fault status.

STEP 1A: Check for active Fault Code 255 or high inactive counts.

Condition:
- All the components connected.
- Turn keyswitch ON.

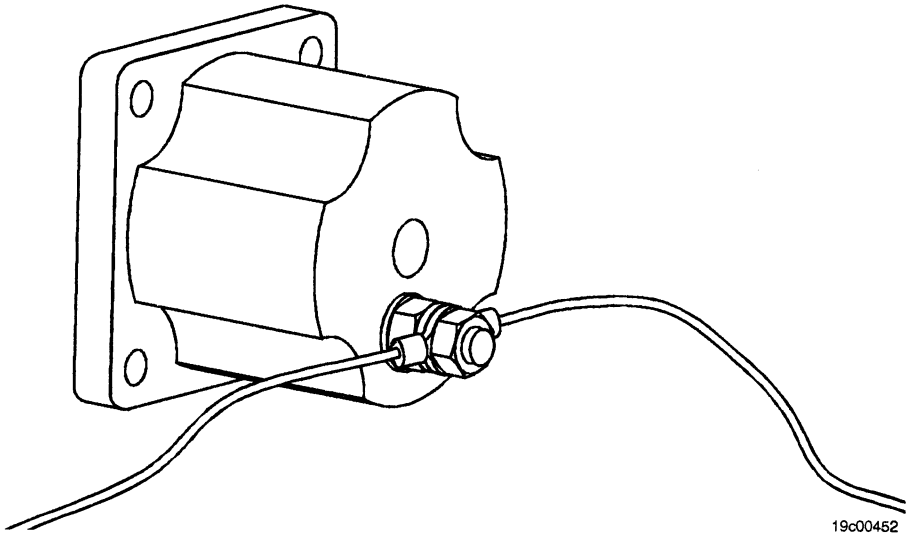
Action	Specifications/Repair	Next Step
Read the fault codes. • Read the fault codes using INSITE™.	**OK** **Fault Code 255 not active**	2A
	NOT OK Fault Code 255 active.	Refer to Fault Code 255

STEP 2: Check for wires.

STEP 2A: Check for extra wires attached to the fuel shutoff valve solenoid.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Check for extra wires attached to the fuel shutoff valve solenoid. • Visually check the fuel shutoff valve solenoid.	**OK** **No extra wires**	3A
	NOT OK **Remove extra wires attached to the fuel shutoff valve solenoid**	4A



STEP 3: Replace the fuel shutoff valve.

STEP 3A: Replace the fuel shutoff valve.

Condition:
- Turn keyswitch OFF.
- Disconnect the engine harness from the fuel shutoff valve.

Action	Specifications/Repair	Next Step
Replace the fuel shutoff valve. • Refer to Procedure 019-050.	**OK** **Fault Code 259 inactive**	4A
	NOT OK Return to troubleshooting steps or contact your local Cummins Authorized Repair Location if all steps have been completed and checked again.	1A

STEP 4: Clear the fault codes.

STEP 4A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it idle for 1 minute. • Turn keyswitch OFF for 30 seconds. • Using INSITE™, verify Fault Code 259 is inactive.	**OK** **Fault Code 259 inactive**	4B
	NOT OK Return to troubleshooting steps or contact your local Cummins Authorized Repair Location if all steps have been completed and checked again.	1A

STEP 4B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

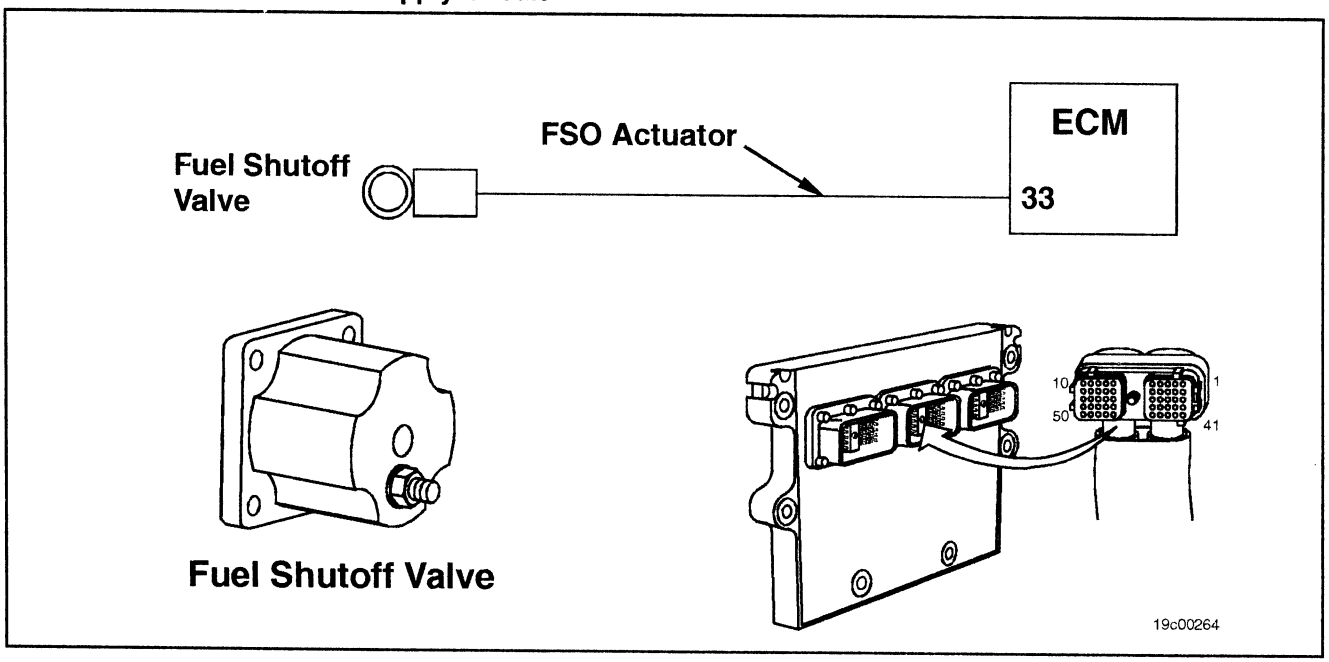
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 255

Fuel Shutoff Valve Solenoid Supply Circuit

CODES	REASON	EFFECT
Fault Code: 255 PID(P), SID(S): S017 SPN: 632 FMI: 3/3 Lamp: Yellow	Externally supplied voltage detected going to fuel shutoff valve solenoid supply circuit.	None on performance. Fuel shutoff valve stays on.

Fuel Shutoff Valve Solenoid Supply Circuit



Circuit Description:

If voltage is externally supplied to the fuel shutoff valve, it will stay open.

Component Location:

The fuel shutoff valve solenoid is located on the fuel delivery housing, below the air inlet horn. The solenoid is controlled by the ECM.

Shop Talk:

If there is an external shutdown system on the vehicle, make sure it is **not** miswired and feeding voltage into the fuel shutoff supply circuit.

TROUBLESHOOTING SUMMARY

⚠ CAUTION ⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

**To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.**

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the actuator harness.		
STEP 1A: Inspect the harness and the ECM connector pins.	No damaged pins	
STEP 1B: Check for the external voltage source.	Less than (+) 1.5 VDC	
STEP 1C: Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 2: Clear the fault codes.		
STEP 2A: Disable the fault code.	Fault Code 255 inactive	
STEP 2B: Clear the fault codes.	All fault codes cleared	

TROUBLESHOOTING STEP

STEP 1: Check the actuator harness.

STEP 1A: Inspect the harness and the ECM connector pins.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness connector from the ECM.

Action	Specifications/Repair	Next Step
Inspect the harness and the ECM connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	1B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	2A

STEP 1B: Check for the external voltage source.

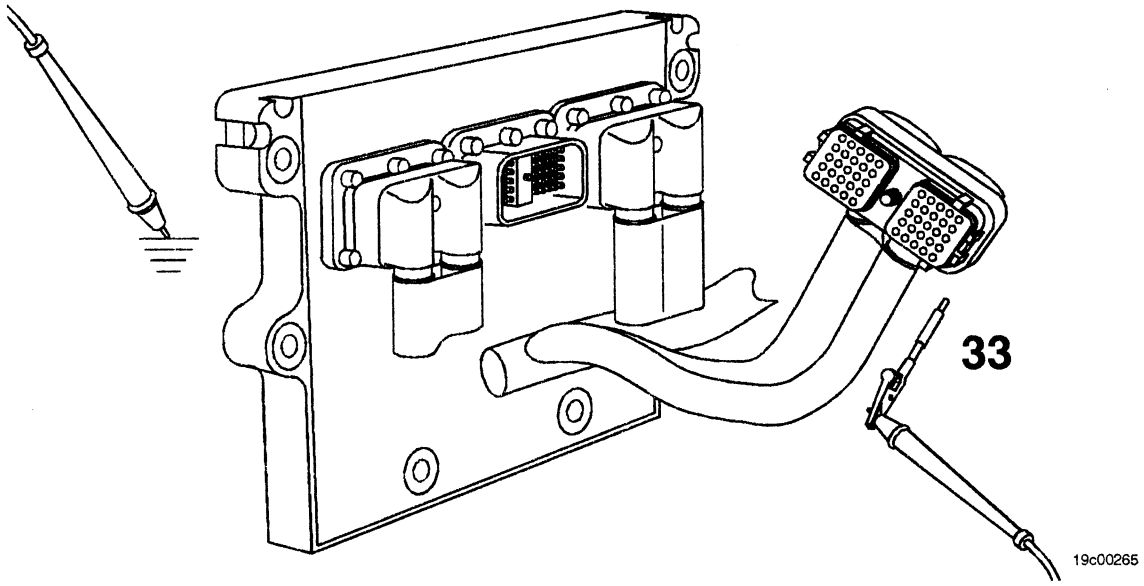
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Disconnect the actuator harness connector from the ECM.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check for the external voltage source. • Measure the voltage from pin 33 in actuator harness connector to engine block ground.	**OK** **Less than (+) 1.5 VDC**	1C
	NOT OK **Remove the external voltage source** There is an external source connected to the wire at which more than (+) 1.5 VDC was measured. Find the voltage source and remove it from the circuit.	2A



STEP 1C: Check for a short circuit from pin to pin.

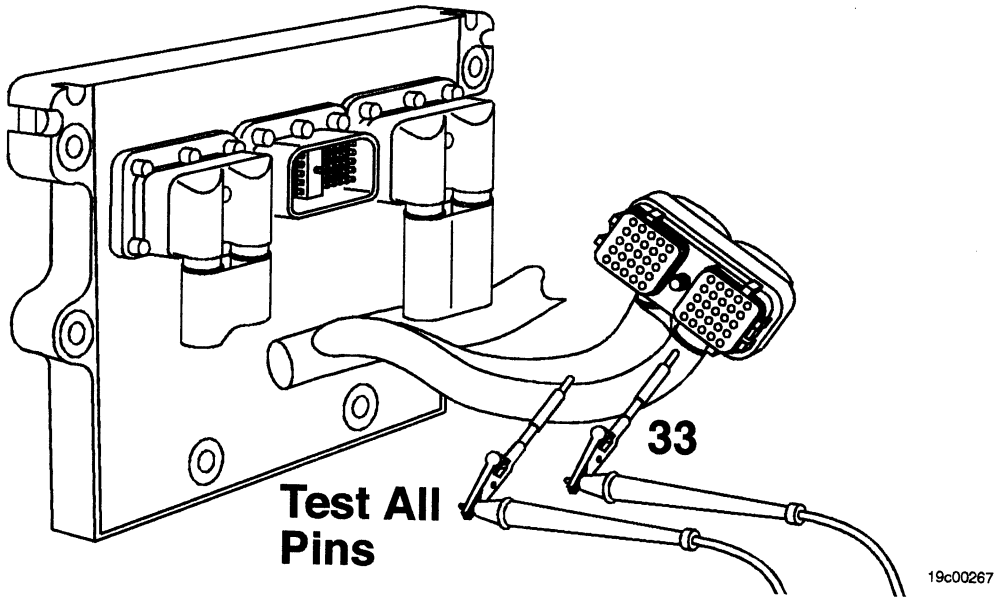
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness connector from the ECM.
- Disconnect the engine harness from the fuel shutoff valve solenoid.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pin 33 of the actuator harness connector to all other pins in the connector.	**OK** **More than 100k ohms**	2A
	NOT OK **Replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	2A



STEP 2: Clear the fault codes.

STEP 2A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it idle for 1 minute. • Using INSITE™, verify Fault Code 255 is inactive.	**OK** **Fault Code 255 inactive**	2B
	NOT OK Return to the troubleshooting steps or contact your local Cummins Authorized Repair Location if all the steps have been completed and checked again.	1A

STEP 2B: Clear the fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

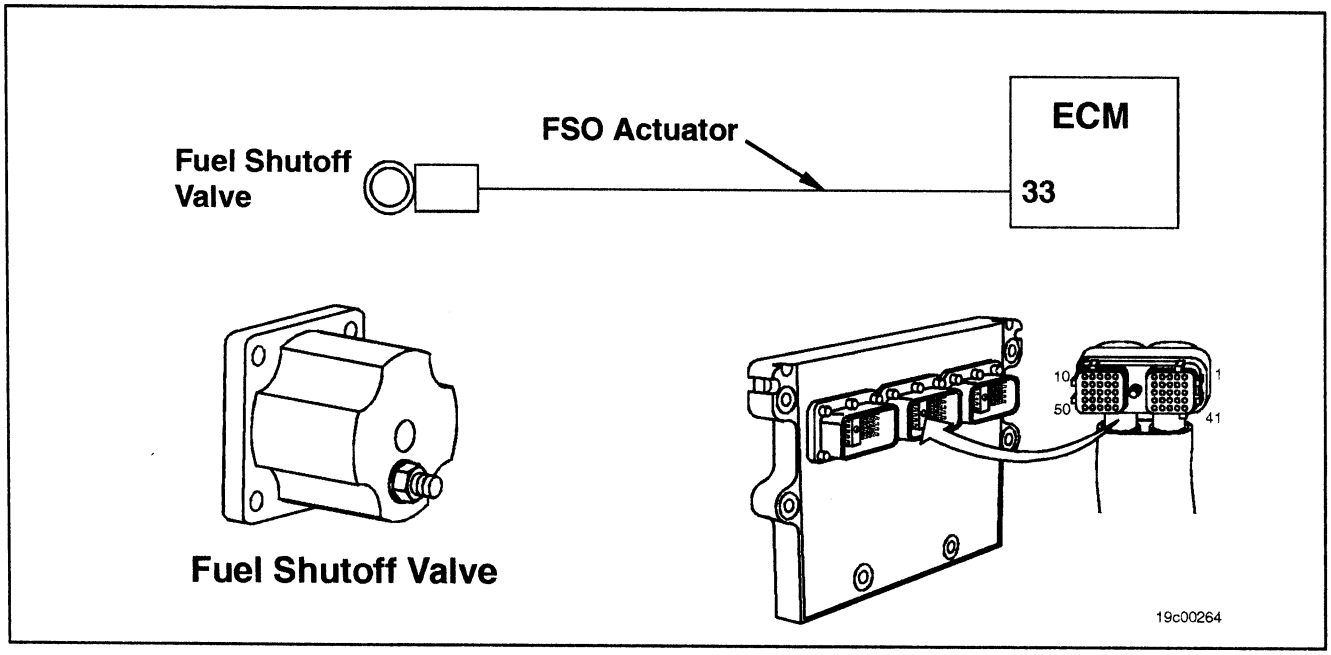
Action	Specifications/Repair	Next Step
Clear the fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 254

Fuel Shutoff Valve Solenoid Supply Circuit

CODES	REASON	EFFECT
Fault Code: 254 PID(P), SID(S): S017 SPN: 632 FMI: 4/4 Lamp: Red	Less than (+) 6 VDC detected at fuel shutoff circuit or an excessive current draw from the ECM or faulty ECM output circuit.	The ECM turns off the fuel shutoff supply voltage. The engine will shut down.

Fuel Shutoff Valve Solenoid Supply Circuit



Circuit Description:

The fuel shutoff valve solenoid is a device used by the ECM to control the engine fuel supply. The ECM can shut down the engine by cutting off the power to the fuel shutoff valve solenoid.

Component Location:

The fuel shutoff valve solenoid is located on the fuel delivery housing above the fuel filter.

Shop Talk:

- Inspect the fuel shutoff supply circuit for external wires that can be spliced in to power another device. Remove any extra wires that are found in the circuit.
- If there is an external shutdown system on the vehicle that uses the fuel shutoff valve for engine shutdown, make sure it has **not** failed and pulled down the voltage on the fuel shutoff circuit.
- Inspect the engine-block-to-chassis ground wire to make sure it is securely fastened to a clean, dry, conductive surface.
- Check the starter solenoid (+) terminal for a loose connector or accessory wiring with damaged insulation.

TROUBLESHOOTING SUMMARY

⚠ CAUTION ⚠

To avoid damaging the new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead
Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the fuel shutoff valve solenoid.		
STEP 1A: Check for extra wires on the fuel shutoff valve solenoid post.	No extra wires	
STEP 1B: Check for corrosion on the solenoid post.	No corrosion found	
STEP 1C: Check the supply voltage at the fuel shutoff valve solenoid.	More than (+) 6 VDC	
STEP 1C-1: Check the actuator harness and the ECM connector pins.	No damaged pins	
STEP 1C-2: Check for an open circuit.	Less than 10 ohms	
STEP 1C-3: Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 1C-4: Measure the voltage from the ECM.	More than (+) 6 VDC	
STEP 1D: Check the fuel shutoff valve solenoid resistance.	7 to 8 ohms for (+) 12-VDC solenoids, 28 to 32 ohms for (+) 24-VDC solenoids	
STEP 2: Clear the fault codes.		
STEP 2A: Disable the fault code.	Fault Code 254 inactive	
STEP 2B: Clear the inactive fault codes.	All fault codes cleared	

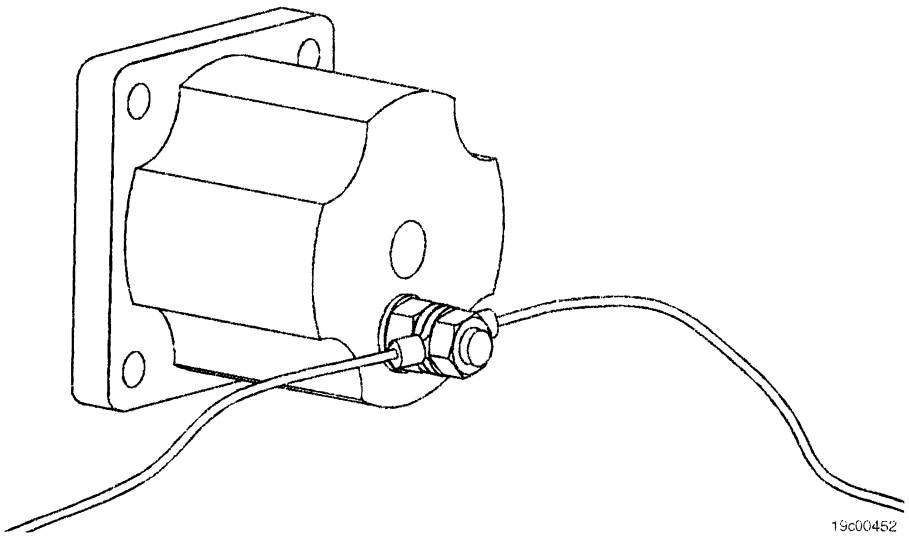
TROUBLESHOOTING STEP

STEP 1: Check the fuel shutoff valve solenoid.

STEP 1A: Check for extra wires on the fuel shutoff valve solenoid post.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Check for extra wires on the fuel shutoff valve solenoid post.	**OK** **No extra wires**	1B
	NOT OK **Remove extra wires and connect to (+) 12-VDC supply**	2A



STEP 1B: Check for corrosion on the solenoid post.

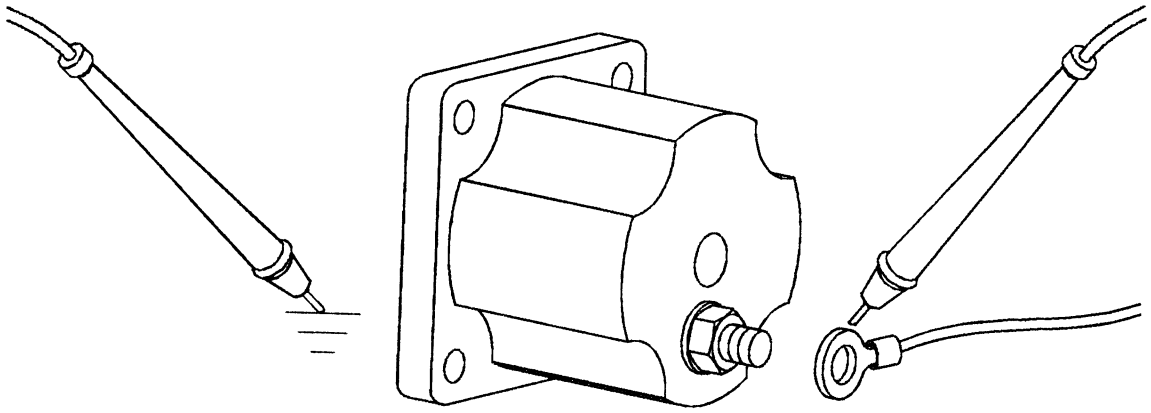
Condition:
- Turn keyswitch OFF.
- Disconnect the fuel shutoff control wire from the fuel shutoff valve solenoid.

Action	Specifications/Repair	Next Step
Check for corrosion on the solenoid post.	**OK** **No corrosion found**	1C
	NOT OK **Clean the solenoid post and the wiring terminal** Refer to Procedure 019-050.	2A

STEP 1C: Check the supply voltage at the fuel shutoff valve solenoid.

Condition:
- Disconnect the actuator harness from the fuel shutoff valve solenoid.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the supply voltage at the fuel shutoff valve solenoid. • Measure the voltage from the fuel shutoff control wire connectors on the harness side to engine block ground.	**OK** **More than (+) 6 VDC**	1D
	NOT OK Does **not** meet specifications.	1C-1



19400723

STEP 1C-1: Check the actuator harness and the ECM connector pins.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:
- Turn keyswitch OFF.
- Disconnect the actuator harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check the actuator harness and the ECM connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	1C-2
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using the electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	2A

STEP 1C-2: Check for an open circuit.

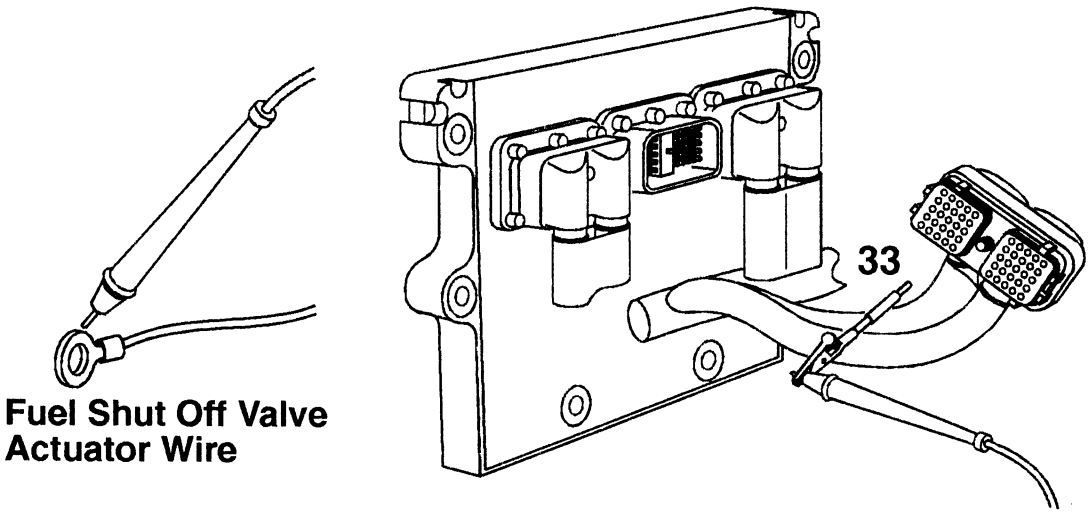
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness from the fuel shutoff valve solenoid.
- Disconnect the actuator harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for an open circuit. • Measure the resistance from pin 33 of the actuator harness to the fuel shutoff control wire.	**OK** **Less than 10 ohms**	1C-3
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	2A



STEP 1C-3: Check for a short circuit from pin to pin.

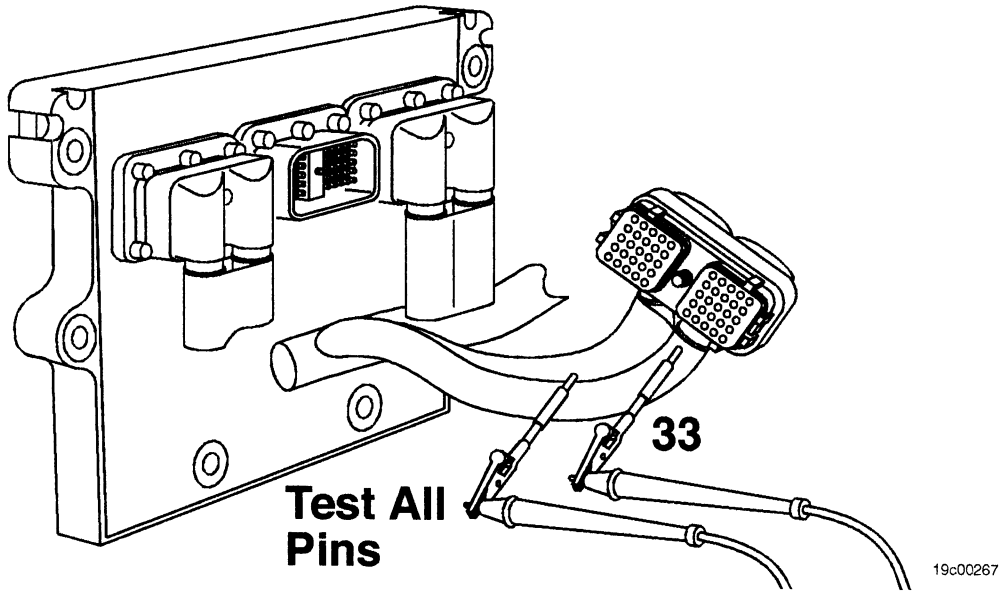
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness from the fuel shutoff valve solenoid.
- Disconnect the actuator harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pin 33 of the actuator harness connector to all other pins in the connector.	**OK** **More than 100k ohms**	1C-4
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	2A



STEP 1C-4: Measure the voltage from the ECM.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

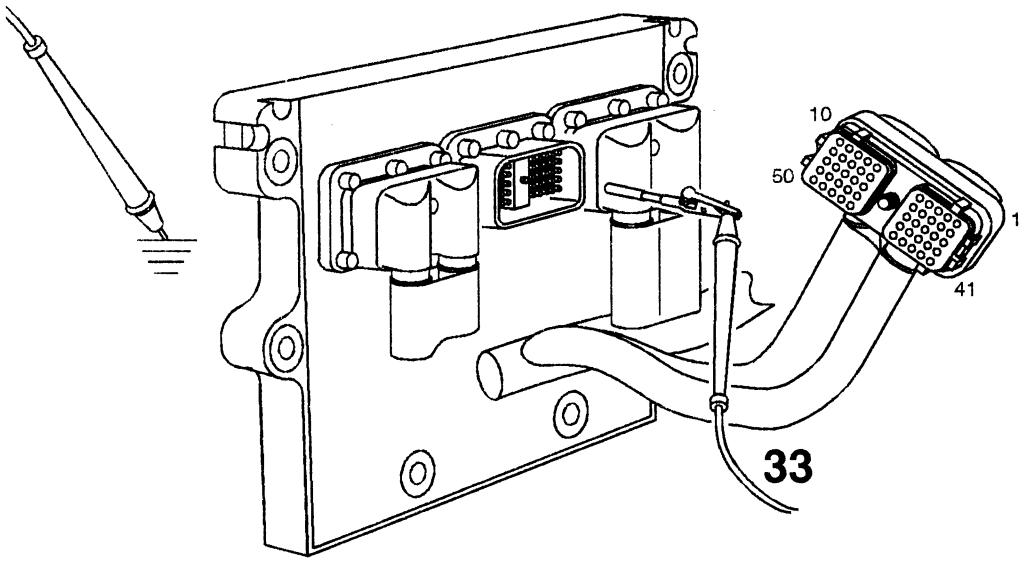
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

Condition:

- Disconnect the actuator harness connector from the ECM.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Measure the voltage from the ECM. • Measure the voltage at the ECM from pin 33 of the actuator harness connector port to engine block ground.	**OK** **More than (+) 6 VDC** **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	2A
	NOT OK **Replace the ECM** Refer to Procedure 019-031.	2A



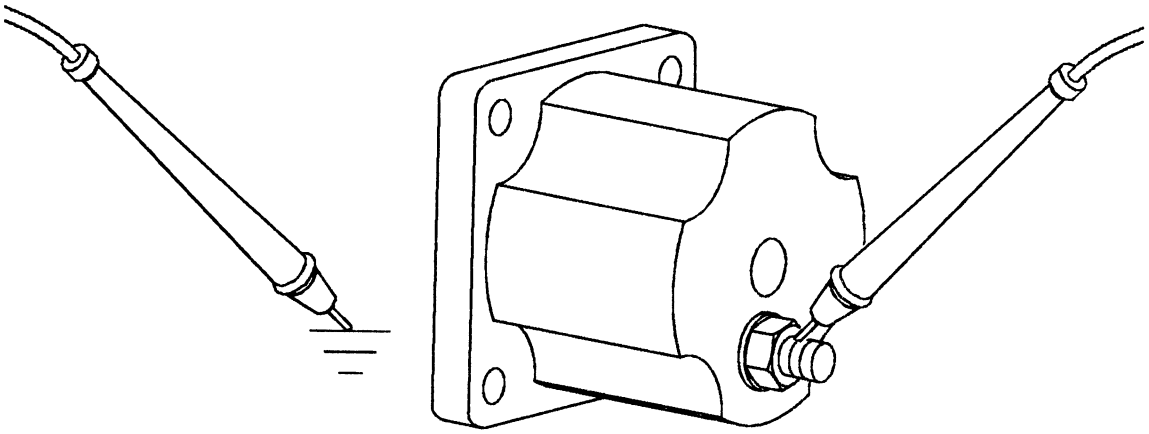
STEP 1D: Check the fuel shutoff valve solenoid resistance.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:
- Turn keyswitch OFF.
- Disconnect the actuator harness from the fuel shutoff valve solenoid.

Action	Specifications/Repair	Next Step
Check the fuel shutoff valve solenoid resistance. • Measure the resistance from the fuel shutoff valve solenoid to engine block ground.	**OK** **7 to 8 ohms for (+) 12-VDC solenoids** **28 to 32 ohms for (+) 24-VDC solenoids**	2A
	NOT OK **Replace the fuel shutoff valve solenoid** Refer to Procedure 019-050.	2A



19c00453

STEP 2: Clear the fault codes.

STEP 2A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it idle for 1 minute. • Using INSITE™, verify Fault Code 254 is inactive.	**OK** **Fault Code 254 inactive**	2B
	NOT OK Return to the troubleshooting steps or contact your local Cummins Authorized Repair Location if all the steps have been completed and checked again.	1A

STEP 2B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

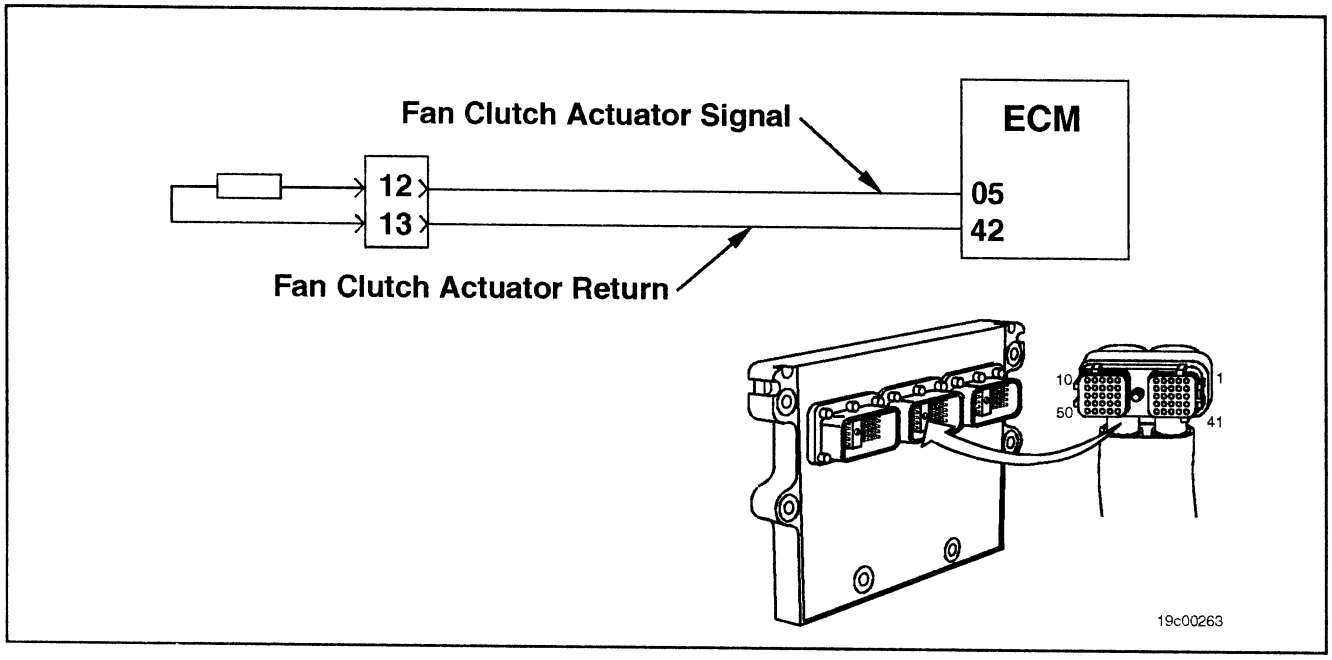
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 245

Engine Fan Clutch Supply Circuit

CODES	REASON	EFFECT
Fault Code: 245 PID(P), SID(S): S033 SPN: 647 FMI: 4/4 Lamp: Yellow	Less than 6 VDC detected at fan clutch when on. Indicates an excessive current draw from the electronic control module (ECM) or a faulty ECM output circuit.	The fan can stay on all the time.

Engine Fan Clutch Supply Circuit



Circuit Description:

The fan clutch solenoid is a device used by the ECM to control the engine fan by sending a signal to open or close the fan clutch solenoid.

Component Location:

Refer to an OEM diagram for the location of the fan clutch solenoid.

Shop Talk:

Possible cause for this fault code:

- ECM fan clutch supply has a short circuit to ground.

TROUBLESHOOTING SUMMARY

⚠ CAUTION ⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead
Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the actuator harness.		
STEP 1A: Inspect the harness and the fan clutch connector pins.	No damaged pins	
STEP 1B: Check for an open circuit in the engine harness.	Less than 10 ohms	
STEP 1C: Check for a short circuit to ground.	More than 100k ohms	
STEP 1D: Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 2: Check the OEM harness.		
STEP 2A: Inspect the 31-pin Deutsch connector pins.	No damaged pins	
STEP 2B: Check for an open circuit in the OEM harness.	Less than 10 ohms	
STEP 2C: Check for a short circuit to ground in the OEM harness.	More than 100k ohms	
STEP 2D: Check for a short circuit from pin to pin in the OEM harness.	More than 100k ohms	
STEP 3: Clear the fault codes.		
STEP 3A: Disable the fault code.	Fault Code 245 inactive	
STEP 3B: Clear the inactive fault codes.	All fault codes cleared	

TROUBLESHOOTING STEP

STEP 1: Check the actuator harness.

STEP 1A: Inspect the harness and the fan clutch connector pins.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness connector from the ECM.

Action	Specifications/Repair	Next Step
Inspect the harness and the ECM connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on connector the pins.	**OK** **No damaged pins**	1B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-250. • Replace engine harness. Refer to Procedure 019-043. • Replace ECM. Refer to Procedure 019-031.	3A

STEP 1B: Check for an open circuit in the engine harness.

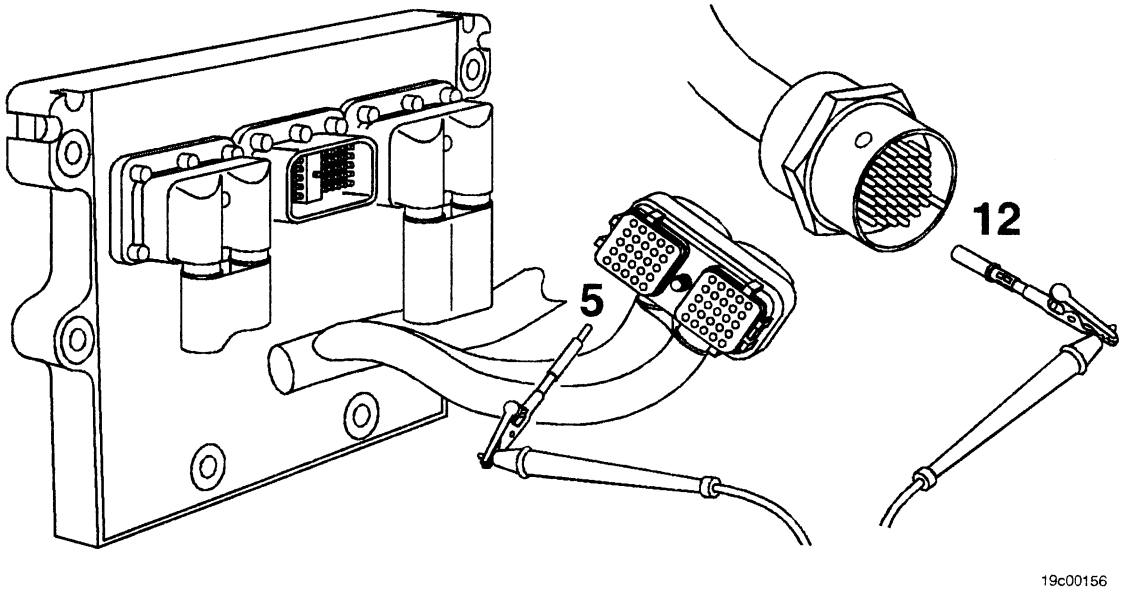
⚠CAUTION⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead
Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the OEM 31-pin connector.
- Disconnect the actuator harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for an open circuit in the engine harness. • Measure the resistance from pin 12 of the OEM 31-pin connector, engine harness side, to pin 5 of the actuator harness connector.	**OK** **Less than 10 ohms**	1C
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-231 or 019-250. • Replace the engine harness. Refer to Procedure 019-043.	3A



19c00156

STEP 1C: Check for a short circuit to ground.

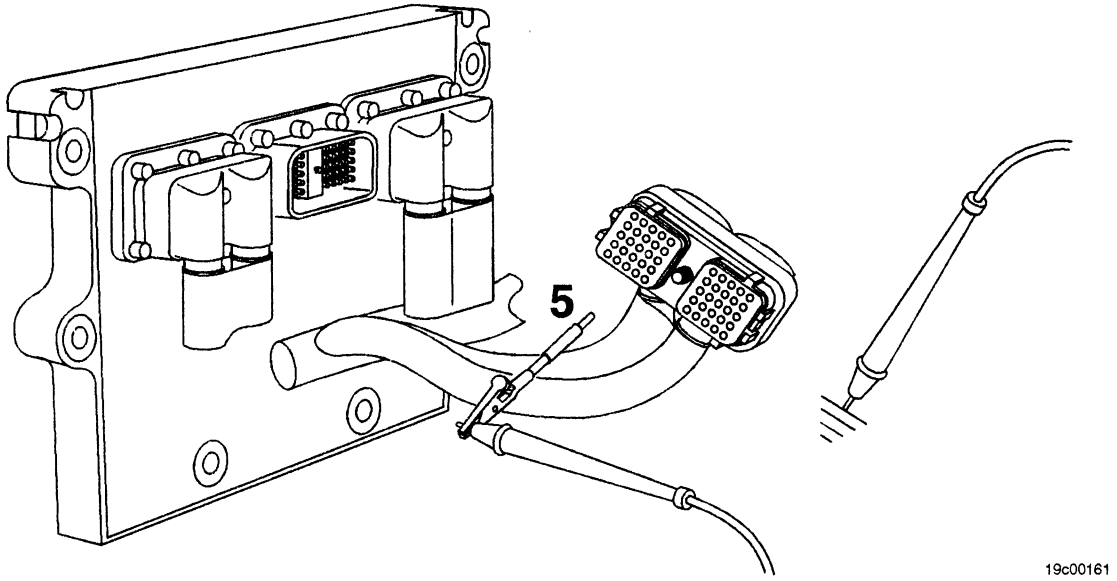
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness connector from the ECM.
- Disconnect the actuator harness from the OEM 31-pin connector.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground. • Measure the resistance from pin 5 in the actuator harness connector to engine block ground.	**OK** **More than 100k ohms**	1D
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	3A



STEP 1D: Check for a short circuit from pin to pin.

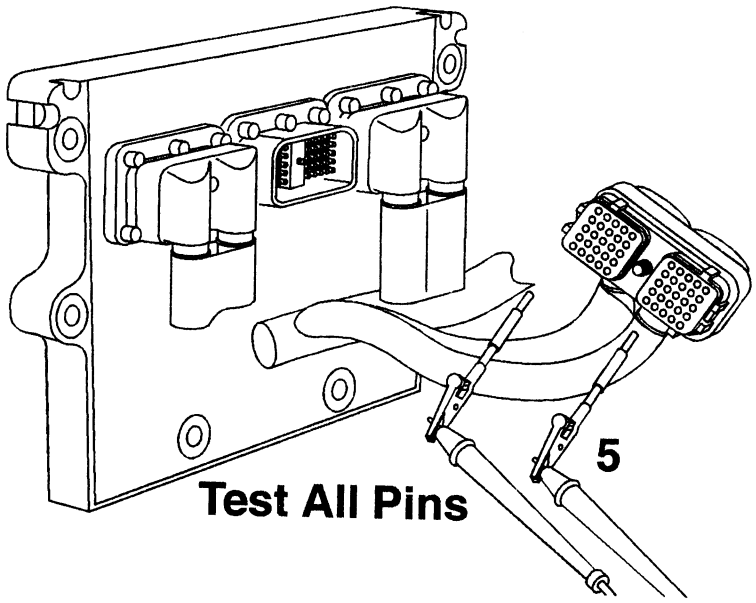
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Disconnect the OEM harness from the fan clutch solenoid.
- Disconnect the actuator harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pin 5 in the actuator harness connector to all other pins in the connector.	**OK** **More than 100k ohms**	2A
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	3A



STEP 2: Check the OEM harness.

STEP 2A: Inspect the 31-pin Deutsch connector pins.

Condition:

- Turn keyswitch OFF.
- Disconnect the OEM harness from the 31-pin Deutsch connector.
- Disconnect the actuator harness from the 31-pin Deutsch connector.

Action	Specifications/Repair	Next Step
Inspect the 31-pin Deutsch connector for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	2B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness or the OEM harness, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Repair the OEM harness. Refer to Procedure 019-231. • Replace the OEM harness. Refer to Procedure 019-071.	3A

STEP 2B: Check for an open circuit in the OEM harness.

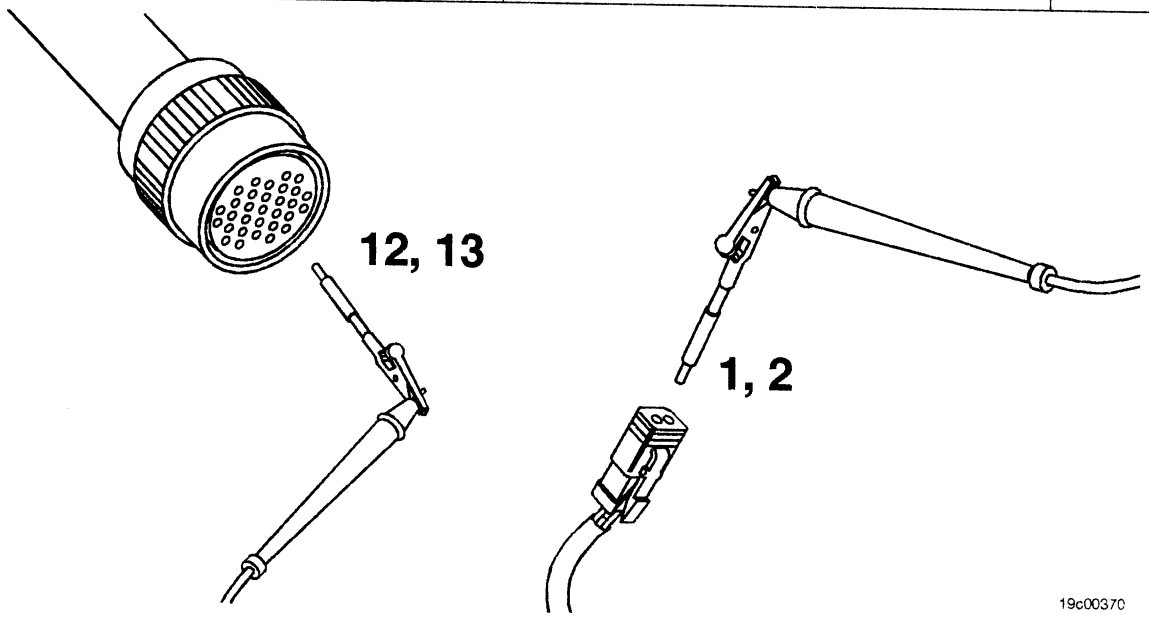
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness from the OEM 31-pin connector.
- Disconnect the OEM harness connector from the fan clutch solenoid.

Action	Specifications/Repair	Next Step
Check for an open circuit. • Measure the resistance from pin 12 of the OEM 31-pin connector to pin A (or 1) of the fan clutch solenoid connector. • Measure the resistance from pin 13 of the OEM 31-pin connector to pin B (or 2) of the fan clutch solenoid connector.	**OK** **Less than 10 ohms**	2C
	NOT OK **Repair or replace the OEM harness** • Repair the OEM harness. Refer to Procedure 019-202 or 019-231. • Replace the OEM harness. Refer to Procedure 019-071.	3A



STEP 2C: Check for a short circuit to ground in the OEM harness.

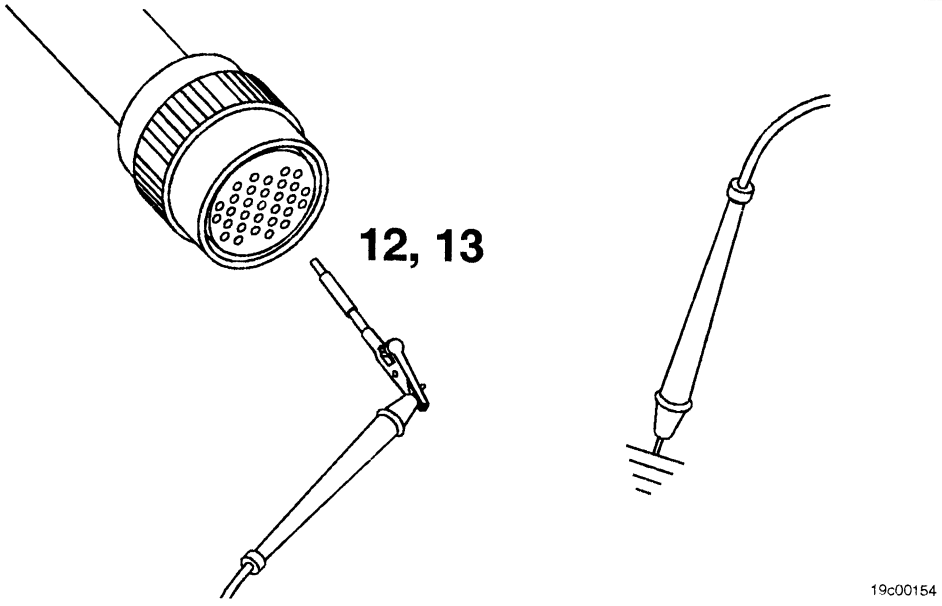
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the OEM harness from the fan clutch solenoid.
- Disconnect the actuator harness from the 31-pin connector.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground. • Measure the resistance from pin 12 of the 31-pin connector, OEM harness side, to engine block ground. • Measure the resistance from pin 13 of the 31-pin connector, OEM harness side, to engine block ground.	**OK** **More than 100k ohms**	2D
	NOT OK **Repair or replace the OEM harness** • Repair the OEM harness. Refer to Procedure 019-231. • Replace the OEM harness. Refer to Procedure 019-071.	3A



STEP 2D: Check for a short circuit from pin to pin in the OEM harness.

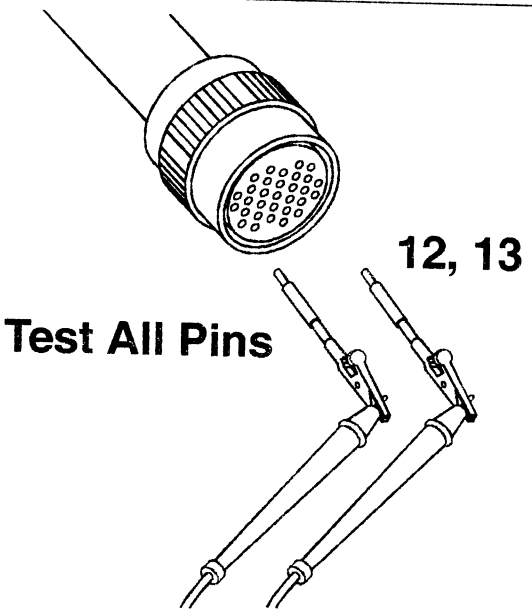
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the OEM harness from the fan clutch solenoid.
- Disconnect the actuator harness from the 31-pin connector.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin in the OEM harness. • Measure the resistance from pin 12 of the 31-pin connector, OEM harness side, to all other pins in the connector. • Measure the resistance from pin 13 of the 31-pin connector, OEM harness side, to all other pins in the connector.	**OK** **More than 100k ohms**	3A
	NOT OK **Repair or replace the OEM harness** • Repair the OEM harness. Refer to Procedure 019-231. • Replace the OEM harness. Refer to Procedure 019-071.	3A



STEP 3: Clear the fault codes.

STEP 3A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it idle for 1 minute. • Using INSITE™, verify Fault Code 245 is inactive.	**OK** **Fault Code 245 inactive**	3B
	NOT OK Return to the troubleshooting steps or contact your local Cummins Authorized Repair Location if all the steps have been completed and checked again.	1A

STEP 3B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

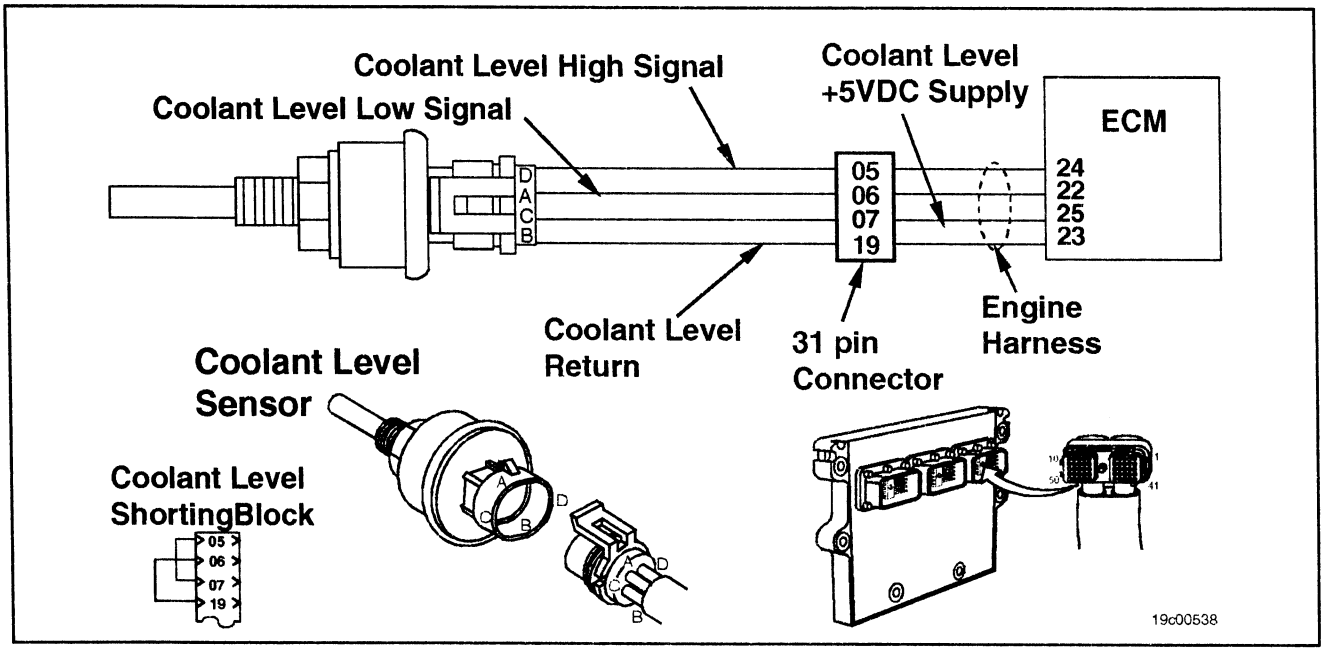
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 235

Engine Coolant Level - Engine Protection

CODES	REASON	EFFECT
Fault Code: 235 PID(P), SID(S): P111 SPN: 111 FMI: 1/1 Lamp: Red	Coolant level signal at pin 22 of the sensor harness connector indicates coolant level is below the normal range.	Progressive power and speed derate with increasing time after alert. If engine protection shutdown is enabled, engine will shut down 30 seconds after the engine protection lamp starts flashing.

Engine Coolant Level - Engine Protection



Circuit Description:

The coolant level sensor monitors the coolant level within the coolant system and passes information to the electronic control module (ECM) through the engine harness. Because this sensor is complex, do **not** use a multimeter to check it. If the radiator coolant level drops below a certain level, a progressive power and/or speed derate will occur. Engine can shut down if the engine protection shutdown feature is enabled.

Component Location:

The coolant level sensor is located in the radiator top tank or surge tank.

Shop Talk:

This is an OEM-supplied component and can vary in location.

- If a shorting plug is used in the coolant level circuit, verify that it is wired correctly.
- Inspect the wiring harness between the Weather-Pack four-way connector and the coolant level sensor for damage.
- Make sure the coolant level sensor is located in the middle of the tank rather than off to one side where the coolant level can change when the vehicle turns a corner.

TROUBLESHOOTING SUMMARY

⚠ WARNING ⚠

Do not remove the pressure cap from a hot engine. Wait until the coolant temperature is below 50°C [122°F] before removing the pressure cap. Heated coolant spray or steam can cause personal injury.

⚠ CAUTION ⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

Do not add cold coolant to a hot engine. Castings can be damaged. Allow engine to cool to below 50°C [122°F] before adding coolant.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead
Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Verify the coolant level.		
STEP 1A: Check the coolant level.	Coolant level is normal	
STEP 2: Check the coolant level sensor.		
STEP 2A: Confirm the fault is still active with the engine running.	Fault Code 235 still active	
STEP 3: Check engine harness.		
STEP 3A: Inspect the engine harness, 31-pin OEM connector, and ECM connector.	No damaged pins	
STEP 3B: Check sensor supply voltage.	(+) 4.5 to 5.5 VDC	
STEP 3B-1: Measure voltage from the ECM.	(+) 4.5 to 5.5 VDC	
STEP 3C: Check for an open circuit.	Less than 10 ohms	
STEP 4: Check the OEM harness.		
STEP 4A: Inspect the OEM harness, coolant level sensor, and the ECM connector.	No damaged pins	
STEP 4B: Check the sensor supply voltage.	(+) 4.5 to 5.5 VDC	
STEP 4C: Check for an open circuit.	Less than 10 ohms	
STEP 5: Clear the fault codes.		
STEP 5A: Disable the fault code.	Fault Code 235 inactive	
STEP 5B: Clear the inactive fault codes.	All fault codes cleared	

TROUBLESHOOTING STEP

STEP 1: Verify the coolant level.

STEP 1A: Check the coolant level.

⚠WARNING⚠

Do not remove the pressure cap from a hot engine. Wait until the coolant temperature is below 50°C [122°F] before removing the pressure cap. Heated coolant spray or steam can cause personal injury.

⚠CAUTION⚠

Do not add cold coolant to a hot engine. Castings can be damaged. Allow engine to cool to below 50°C [122°F] before adding coolant.

Condition:

- Allow engine to cool. See CAUTION statement above.

Action	Specifications/Repair	Next Step
Check coolant level. • Remove the radiator cap and inspect coolant level.	**OK** **Coolant level is normal**	2A
	NOT OK **Add coolant to the radiator** **NOTE:** Make sure the coolant has the proper ratio of antifreeze and water.	5A

STEP 2: Check the coolant level sensor.

STEP 2A: Confirm the fault is still active with the engine running.

Condition:

- Turn the keyswitch ON.

Action	Specifications/Repair	Next Step
Confirm the fault is still active with the engine running. • Start the engine and let it idle for at least 1 minute. • Read the fault codes using INSITE™.	**OK** **Fault Code 235 still active**	3A
	NOT OK Fault Code 235 inactive.	5A

STEP 3: Check engine harness.

STEP 3A: Inspect the engine harness, 31-pin OEM connector, and ECM connector.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn the keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.
- Disconnect the engine harness from the 31-pin OEM connector.

Action	Specifications/Repair	Next Step
Inspect the engine harness, 31-pin connector, and ECM connector for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	3B
	NOT OK **Repair damaged pins** Repair or replace the engine harness, or replace the coolant level sensor or the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-231 or 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the coolant level sensor. Refer to Procedure 019-017. • Replace the ECM. Refer to Procedure 019-031.	5A

STEP 3B: Check sensor supply voltage.

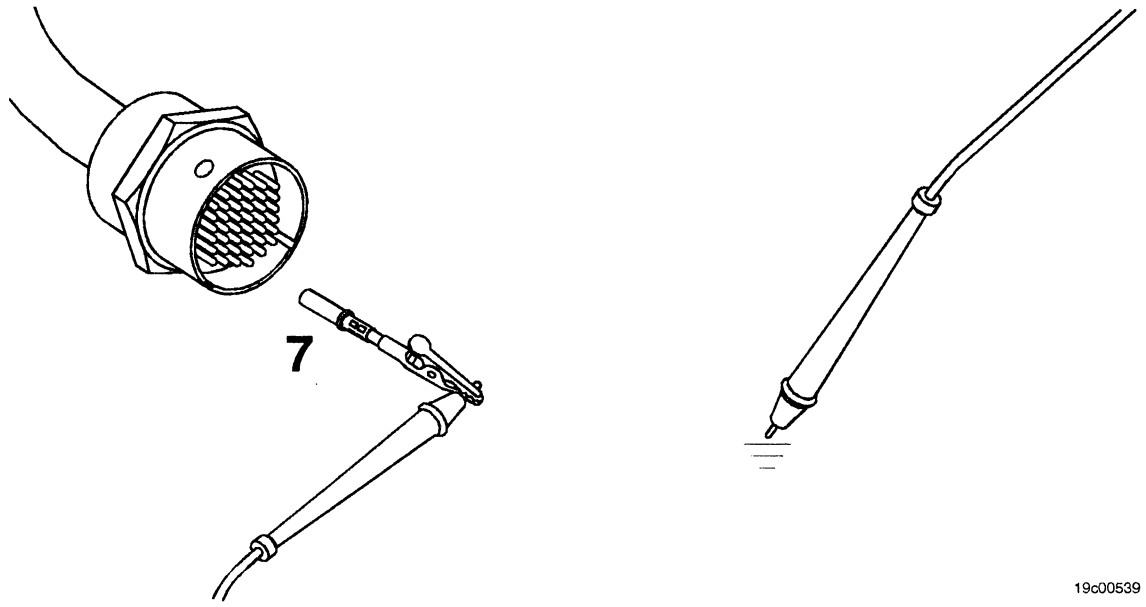
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822917 -female Deutsch/AMP/Metri-Pack test lead.

Condition:

- Disconnect the engine harness from the 31-pin OEM connector.
- Connect the sensor harness connector to the ECM.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check sensor supply voltage. • Measure the voltage from pin 7 of the 31-pin OEM connector, engine harness side, to engine block ground.	**OK** **(+) 4.5 to 5.5 VDC**	3C
	NOT OK Does **not** meet specifications.	3B-1



STEP 3B-1: Measure voltage from the ECM.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

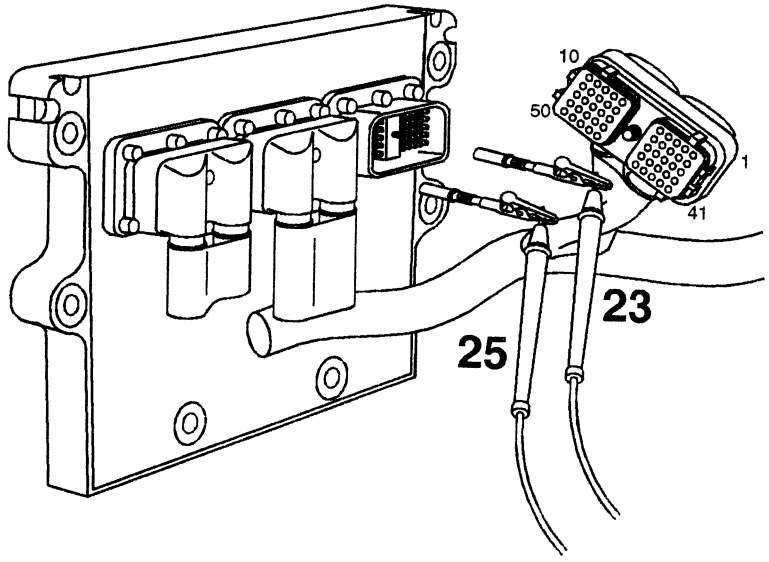
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

Condition:

- Disconnect the sensor from the 31-pin OEM connector.
- Disconnect the sensor connector from the ECM.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Measure voltage from the ECM. • Measure the voltage from pin 25 to pin 23 of the ECM sensor port.	**OK** **(+) 4.5 to 5.5 VDC** **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	5A
	NOT OK **Replace the ECM** Refer to Procedure 019-031.	5A



19c00861

STEP 3C: Check for an open circuit.

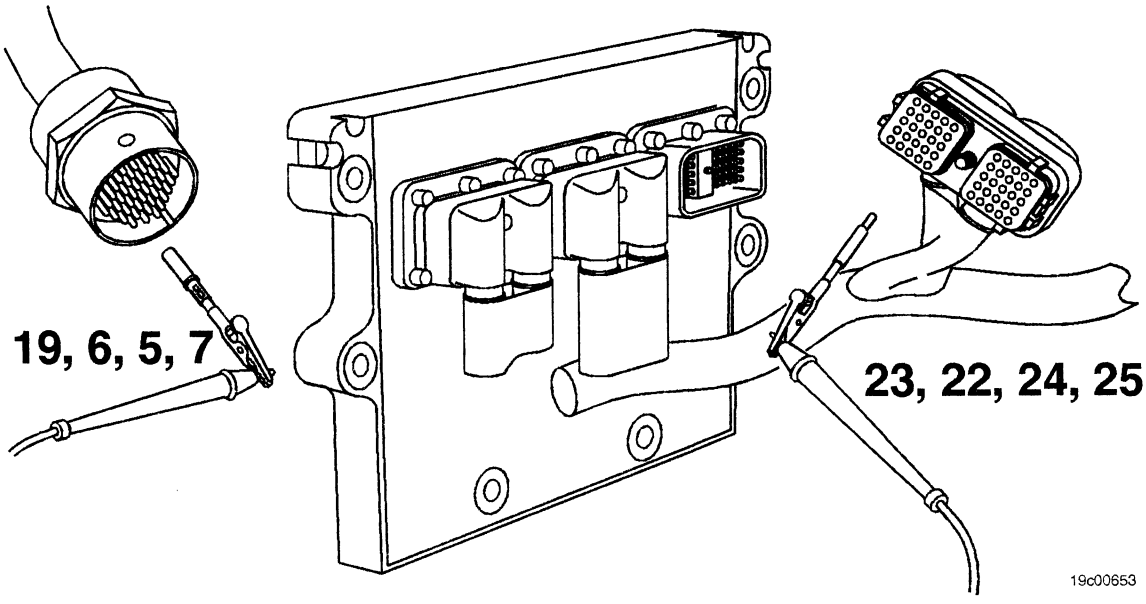
⚠CAUTION⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead
Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.
- Disconnect the sensor harness from the 31-pin OEM connector at the engine harness.

Action	Specifications/Repair	Next Step
Check for open circuit in the coolant level sensor circuit. • Measure the resistance from pin 19 on the sensor harness side of the 31-pin OEM connector to pin 23 of the sensor harness connector at the ECM. • Measure the resistance from pin 6 on the sensor harness side of the 31-pin OEM connector to pin 22 of the sensor harness connector at the ECM. • Measure the resistance from pin 5 on the sensor harness side of the 31-pin OEM connector to pin 24 of the sensor harness connector at the ECM. • Measure the resistance from pin 7 on the sensor harness side of the 31-pin OEM connector to pin 25 of the sensor harness connector at the ECM.	**OK** **Less than 10 ohms**	4A
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250 or 019-231. • Replace the engine harness. Refer to Procedure 019-043.	5A



STEP 4: Check the OEM harness.

STEP 4A: Inspect the OEM harness, coolant level sensor, and the ECM connector.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch OFF.
- Disconnect the engine harness from the 31-pin OEM connector.
- Disconnect the OEM harness from the coolant level sensor.

Action	Specifications/Repair	Next Step
Inspect the OEM harness, coolant level sensor, and ECM connector for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	4B
	NOT OK **Repair the damaged pins** Repair or replace the OEM harness, or replace the coolant level sensor or the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the OEM harness. Refer to Procedure 019-204 or 019-250. • Replace the OEM harness. Refer to Procedure 019-071. • Replace the coolant level sensor. Refer to Procedure 019-017. • Replace the ECM. Refer to Procedure 019-031.	5A

STEP 4B: Check the sensor supply voltage.

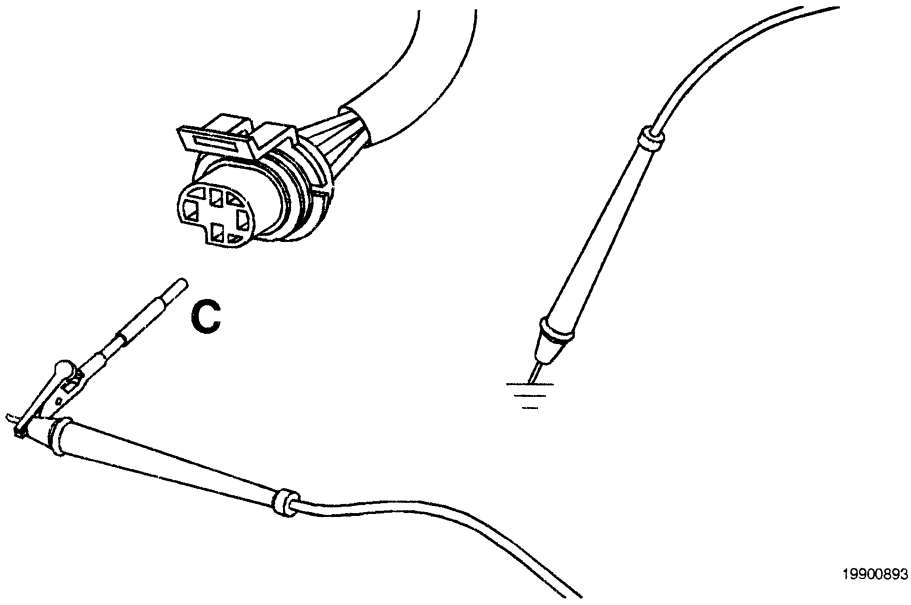
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Disconnect the OEM harness from the coolant level sensor.
- Connect the engine harness to the 31-pin OEM connector.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the sensor supply voltage. • Measure the voltage from supply, pin C (or 3) of the sensor connector, engine harness side to engine block ground.	**OK** **(+) 4.5 to 5.5 VDC**	4C
	NOT OK **Repair or replace the OEM harness** • Repair the OEM harness. Refer to Procedure 019-204. • Replace the OEM harness. Refer to Procedure 019-071.	5A



19900893

STEP 4C: Check for an open circuit.

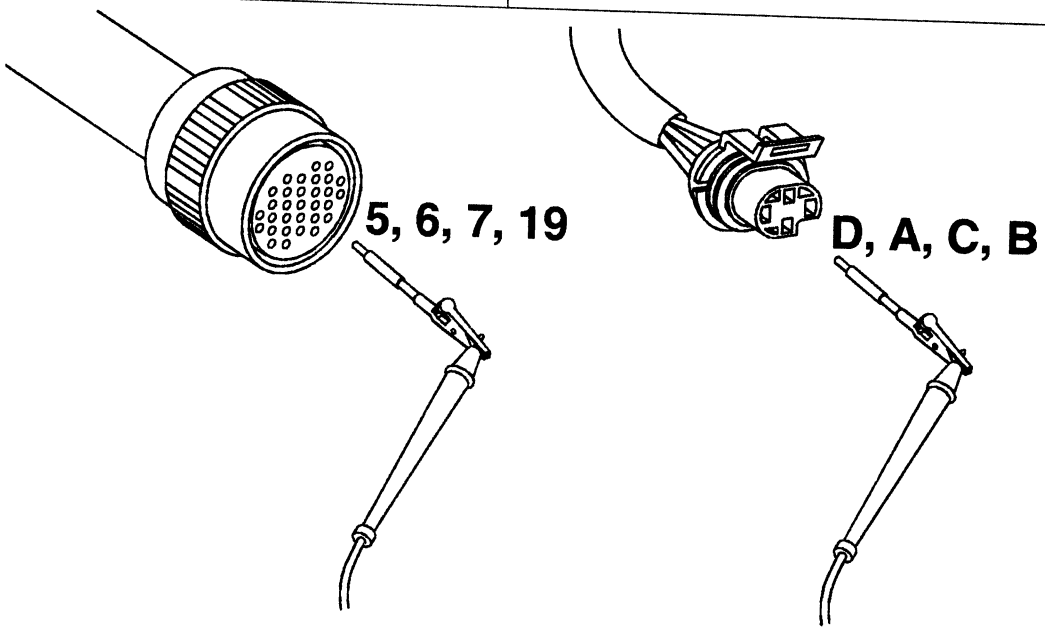
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the engine harness from the 31-pin OEM connector.
- Disconnect the OEM harness from the coolant level sensor.

Action	Specifications/Repair	Next Step
Check for an open circuit in the coolant level sensor circuit. • Measure the resistance from pin D (or 4) on the OEM harness side of the coolant level sensor connector to pin 5 of the OEM 31-pin connector, OEM harness side. • Measure the resistance from pin A (or 1) on the OEM harness side of the coolant level sensor connector to pin 6 of the OEM 31-pin connector, OEM harness side. • Measure the resistance from pin C (or 3) on the OEM harness side of the coolant level sensor connector to pin 7 of the OEM 31-pin connector, OEM harness side. • Measure the resistance from pin B (or 2) on the OEM harness side of the coolant level sensor connector to pin 19 of the OEM 31-pin connector, OEM harness side.	**OK** **Less than 10 ohms** **Replace the coolant level sensor** Refer to Procedure 019-017.	5A
	NOT OK **Repair or replace the OEM harness** • Repair the OEM harness. Refer to Procedure 019-204 or 019-231. • Replace the OEM harness. Refer to Procedure 019-071.	5A



STEP 5: Clear the fault codes.

STEP 5A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine, and let it idle for 1 minute. • Using INSITE™, verify Fault Code 235 is inactive.	**OK** **Fault Code 235 inactive**	5B
	NOT OK Return to the troubleshooting steps, or contact your local Cummins Authorized Repair Location if all the steps have been completed and checked again.	1A

STEP 5B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

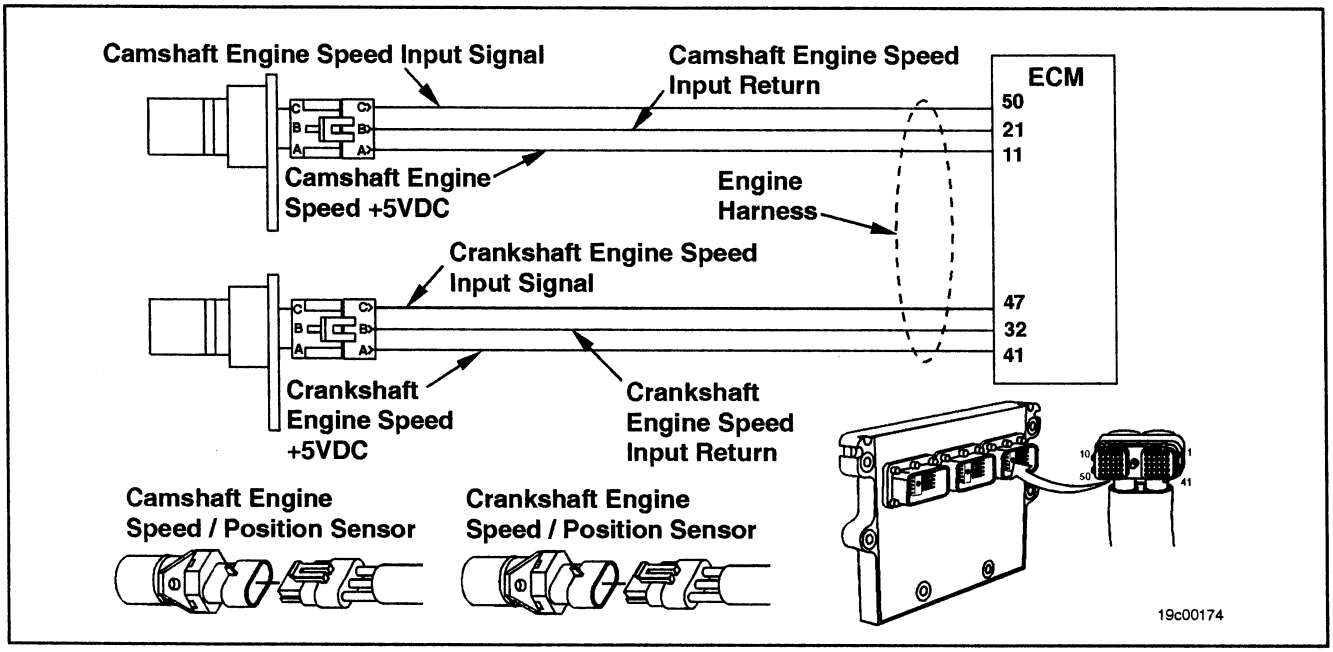
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault code using INSITE™.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting chart

Fault Code 234

Engine Overspeed

CODES	REASON	EFFECT
Fault Code: 234 PID(P), SID(S): P190 SPN: 190 FMI: 0/0 Lamp: Red	Engine speed signal indicated engine speed is greater than 2650 rpm.	Fuel shutoff valve closed until the engine speed falls to 2000 rpm.

Engine Overspeed Circuit



Circuit Description:

The crankshaft and camshaft engine speed/position sensor provides engine speed and position information to the electronic control module (ECM) through the engine harness.

Component Location:

The crankshaft engine speed/position sensor is located in the front cover on the intake side of the engine.
The camshaft engine speed/position sensor is located on the intake side of the cylinder head.

Shop Talk:

Possible causes of this fault code include external fuel sources drawn into the intake air passage, reverse powering (motoring) of the engine, and tampering of the engine speed/position sensors.
Inspect the intake manifold for sources of flammable vapors. Check the turbocharger seals to verify that there are no oil leaks.

- Inspect the engine speed/position sensors for damage or tampering.

TROUBLESHOOTING SUMMARY

⚠ WARNING ⚠

To avoid personal injury and property damage, the engine must be shut off immediately if the engine speed stays above 2650 rpm.

⚠ CAUTION ⚠

To avoid damaging the new ECM, all other active fault codes must be investigated prior to replacing the ECM.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Identify the reason for the overspeed.		
STEP 1A: Check for proper operating conditions.	Not motoring downhill	
STEP 1B: Check for an alternate fuel source.	No alternate fuel source	
STEP 1C: Check the engine rpm with the monitor mode.	Correct rpm reading	
STEP 1D: Check the injector overhead settings.	Correct injector overhead settings	
STEP 1E: Check for an active fault at low engine rpm.	Inactive fault at low rpm	
STEP 1F: Test vehicle.	Inactive fault	
STEP 2: Clear the fault code.		
STEP 2A: Disable the fault code.	Fault Code 234 inactive	
STEP 2B: Clear the inactive fault codes.	All faults cleared	

TROUBLESHOOTING STEP

STEP 1: Identify the reason for the overspeed.

STEP 1A: Check for proper operating conditions.

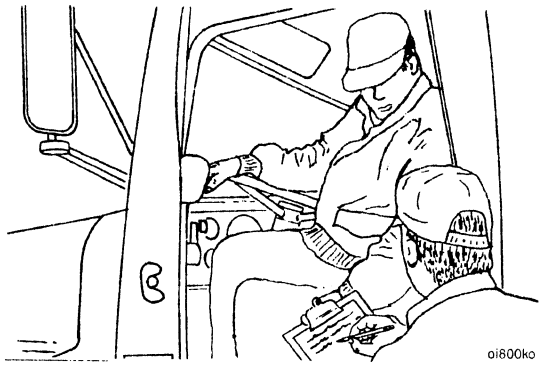
Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Check for proper operating conditions. • Check if the engine was motoring downhill when the fault was logged.	**OK** **Not motoring downhill**	1B
	NOT OK **Check the engine for damage** • Electronics are OK. • Check the base engine for damage due to overspeed condition.	2A

STEP 1B: Check for an alternate fuel source.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Check for an alternate fuel source. • Check if the driver reported a fuel-controlled event where the engine rapidly accelerated to or past 2650 rpm, followed by moderate deceleration to 2000 rpm.	**OK** **No alternate fuel source**	1C
	NOT OK **Locate the alternative fuel source** Locate any alternate fuel sources, such as operating the engine near flammable vapors, blown turbocharger seals, etc.	2A



STEP 1C: Check the engine rpm with the monitor mode.

⚠WARNING⚠

To avoid personal injury and property damage, the engine must be shut off immediately if the engine speed stays above 2650 rpm.

Condition:
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the engine rpm with the monitor mode. • Monitor the engine rpm using INSITE™.	**OK** **Correct rpm reading**	1D
	NOT OK **Inspect the engine position sensor** Check the engine position sensor as outlined for Fault Codes 115 and 121.	Fault Codes 115 and 121

STEP 1D: Check the injector overhead settings.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Check the injector overhead settings. • Check for correct injector overhead settings. Refer to Procedure 003-006 in theTroubleshooting and Repair Manual, Signature, ISX and QSX15 Engines, Bulletin No. 3666239.	**OK** **Correct injector overhead settings**	1E
	NOT OK **Reset the overhead** Reset the overhead using the outer base circle method. Inspect the base engine for damage due to overspeed condition.	2A

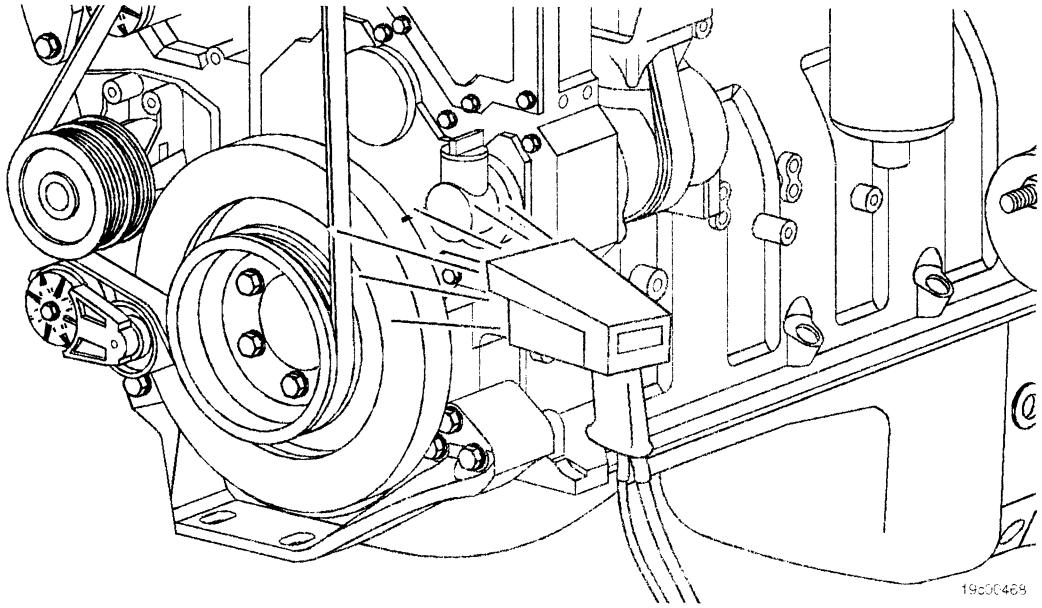
STEP 1E: Check for an active fault at low engine rpm.

⚠CAUTION⚠

To avoid damaging the new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check for an active fault at low engine rpm. • Check for active Fault Code 234 when the engine is **not** running above 2650 rpm.	**OK** **Inactive fault at the low rpm**	1F
	NOT OK **Replace the ECM** Refer to Procedure 019-031.	2A



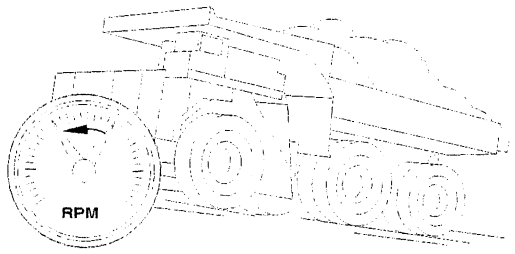
STEP 1F: Test the vehicle.

⚠WARNING⚠

To avoid personal injury and property damage, the engine must be shut off immediately if the engine speed stays above 2650 rpm.

Condition:
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Test the vehicle. • Check if the overspeed condition is still present.	**OK** **Inactive fault**	2A
	NOT OK Return to the troubleshooting steps or contact your local Cummins Authorized Repair Location if all the steps have been completed and check again.	1A



cent423

STEP 2: Clear the fault code.

STEP 2A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable fault code. • Start the engine and let it idle for 1 minute. • Using INSITE™, verify Fault Code 234 is inactive.	**OK** **Fault Code 234 inactive**	2B
	NOT OK Return to the troubleshooting steps or contact your local Cummins Authorized Repair Location if all the steps have been completed and checked again.	1A

STEP 2B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

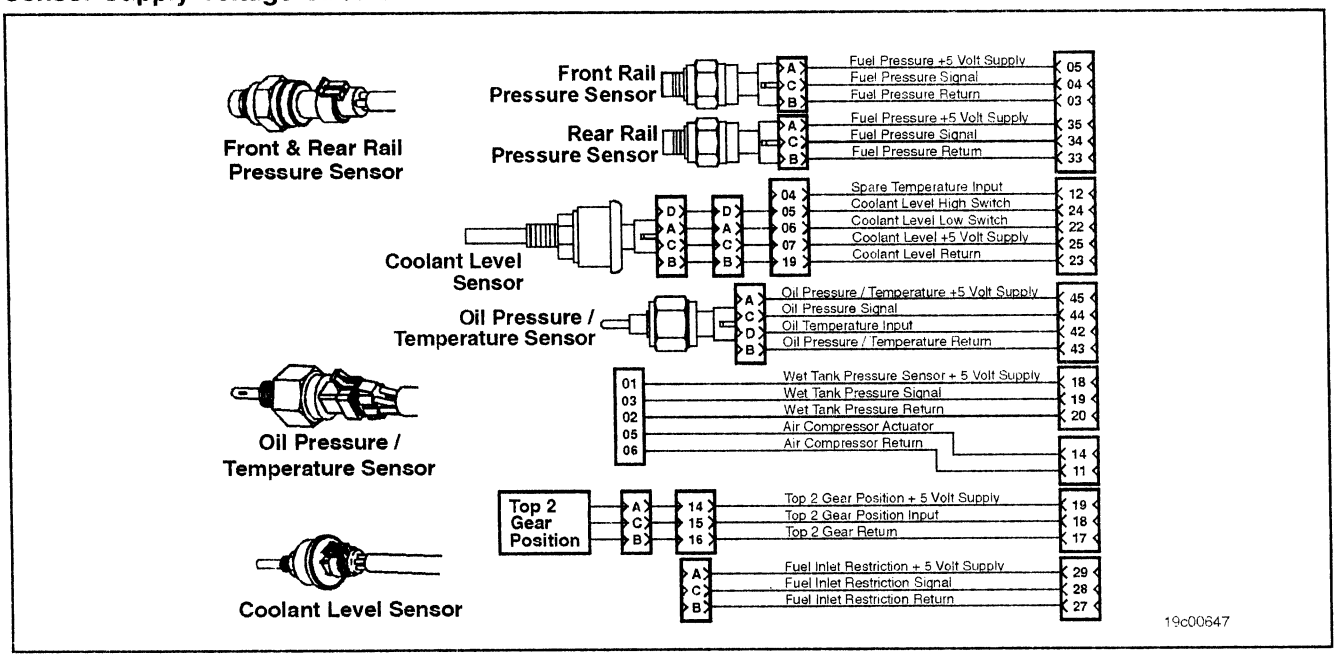
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes with INSITE™.	**OK** **All faults cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 227

Sensor Voltage Supply

CODES	REASON	EFFECT
Fault Code: 227 PID(P), SID(S): S232 SPN: 620 FMI: 3/3 Lamp: Yellow	High voltage detected on the ECM voltage supply line to some sensors.	Engine will run derated. No engine protection for oil pressure or coolant level.

Sensor Supply Voltage Circuit



Circuit Description:

The ECM supplies each of these sensors with (+) 5 VDC. If the supply wire to any sensor is damaged, the sensor will **not** work correctly.

NOTE: In the above picture, the circuits for the wet tank pressure sensor/air compressor and Top 2 Gear Position wires are labeled differently on the industrial wiring diagram. The equivalent differences in the industrial labels are as follows:

Wet Tank Pressure Sensor + 5-Volt Supply = OEM Pressure Supply (Pins 1 to 18)
Wet Tank Pressure Signal = OEM Pressure Signal (Pins 3 to 19)
Wet Tank Pressure Return = OEM Pressure Return (Pins 2 to 20)
Air Compressor Actuator = Switched Output A (Pins 5 to 14)
Air Compressor Return = Spare (Pins 6 to 11)
Top 2 Gear Position + 5-Volt Supply = Spare (Pins 14 to 19)
Top 2 Gear Position Input = Spare (Pins 15 to 18)
Top 2 Gear Position Return = Spare (Pins 16 to 17)

Component Location:

1. Front rail pressure sensor is located on the fuel delivery housing.
2. Rear rail pressure sensor is located on the fuel delivery housing.
3. Fuel inlet restriction sensor is located on the fuel delivery housing.
4. Oil pressure/temperature sensor is located below the air compressor (automotive **only**).

5. Wet tank pressure sensor is located on the air compressor (automotive **only**).
6. Coolant level sensor. Refer to the OEM troubleshooting and repair manual for proper location.
7. Top 2 transmission position sensor - located on the transmission if vehicle has a Spicer™ Top 2 transmission. Refer to the OEM troubleshooting and repair manual for proper location (automotive **only**).

Shop Talk:

High voltage on the sensor (+) 5 VDC supply line will be caused by a short circuit to battery in the supply wire or a short circuit between an actuator wire and the supply wire.

TROUBLESHOOTING SUMMARY

⚠ CAUTION ⚠

To avoid damaging the new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead
Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the sensor and actuator harness.		
STEP 1A: Inspect the harness and the ECM connector pins.	No damaged pins	
STEP 1B: Check the supply voltage from the ECM.	(+) 4.75 to 5.25 VDC	
STEP 1C: Check for a short circuit to battery in the sensor supply lines.	More than 100k ohms	
STEP 1D: Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 2: Clear the fault codes.		
STEP 2A: Disable the fault code.	Fault Code 227 inactive	
STEP 2B: Clear the inactive fault codes.	All fault codes cleared	

TROUBLESHOOTING STEP

STEP 1: Check the sensor and actuator harness.

STEP 1A: Inspect harness and the ECM connector pins.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness connector from the ECM.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Inspect the sensor and actuator harness and the ECM connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	1B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using the electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	2A

STEP 1B: Check the supply voltage from the ECM.

⚠CAUTION⚠

To avoid damaging the new ECM, all other active fault codes must be investigated prior to replacing the ECM.

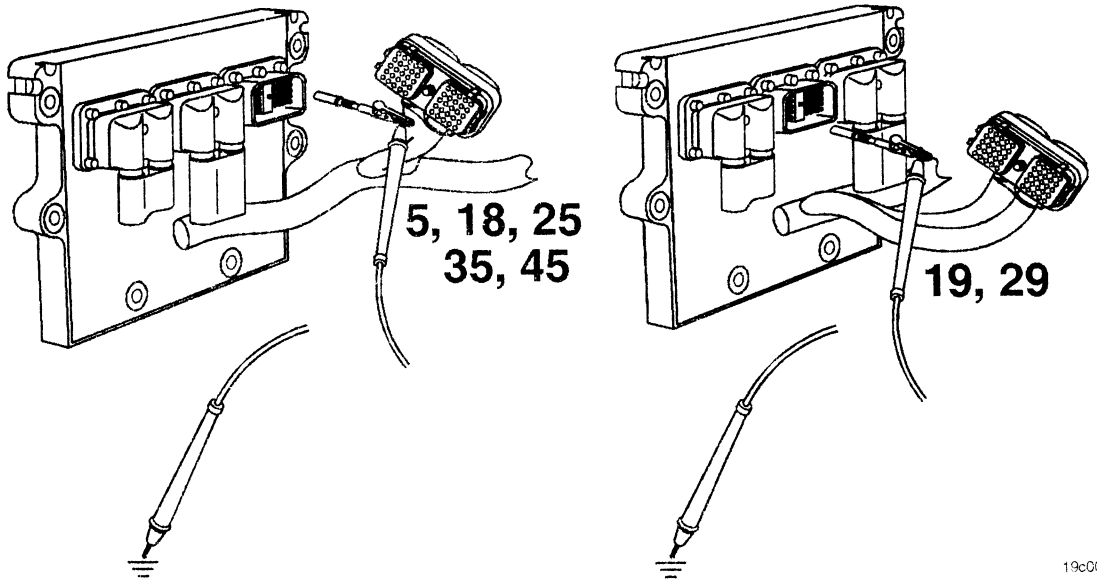
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

Condition:

- Disconnect the actuator harness connector from the ECM.
- Disconnect the sensor harness connector from the ECM.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the supply voltage from the ECM. • Measure the supply voltage out of the ECM sensor harness port from pins 5, 25, 35, 18, and 45 to ground. • Measure the supply voltage out of the ECM actuator harness port from pins 19 and 29 to ground.	**OK** **(+) 4.75 to 5.25 VDC**	1C
	NOT OK **Replace the ECM** Refer to Procedure 019-031.	2A



STEP 1C: Check for a short circuit to battery in the sensor supply lines.

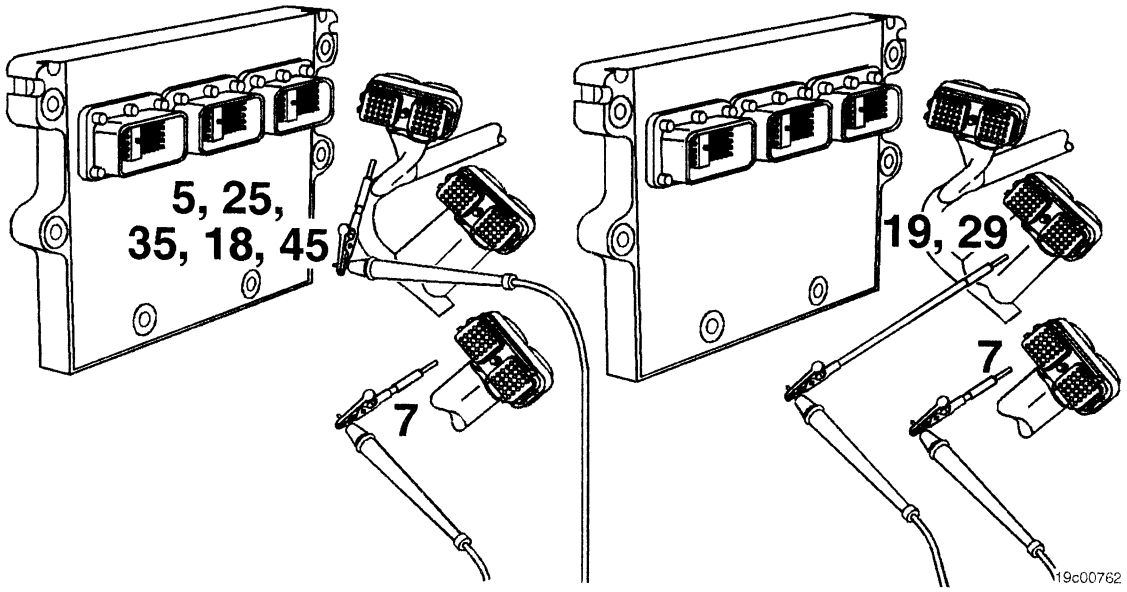
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness connector from the ECM.
- Disconnect the sensor harness connector from the ECM.
- Disconnect the OEM harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit to battery in the sensor supply lines. • Measure the resistance from pins 5, 25, 35, 18, and 45 in the sensor harness connector to pin 7 in the OEM harness connector. • Measure the resistance from pins 19 and 29 in the actuator harness connector to pin 7 in the OEM harness connector.	**OK** **More than 100k ohms**	1D
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	2A



STEP 1D: Check for a short circuit from pin to pin.

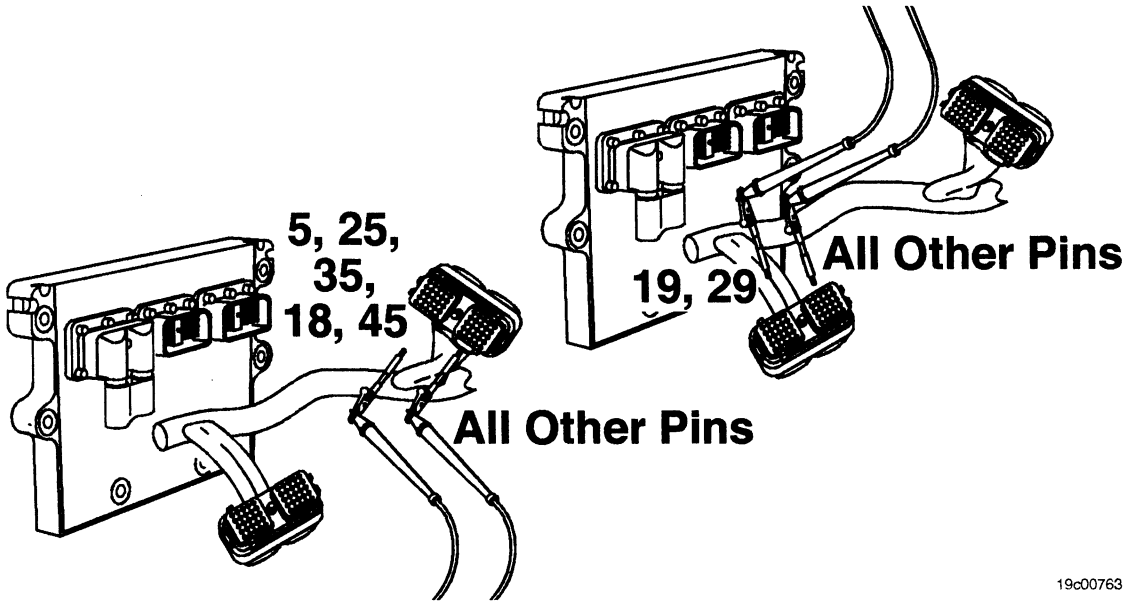
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness connector from the ECM.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pins 5, 25, 35, 18, and 45 in the sensor harness connector to all other pins in the connector. • Measure the resistance from pins 19 and 29 in the actuator connector to all other pins in the connector.	**OK** **More than 100k ohms**	2A
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	2A



STEP 2: Clear the fault codes.

STEP 2A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it idle for 1 minute. • Using INSITE™, verify Fault Code 227 is inactive.	**OK** **Fault Code 227 inactive**	2B
	NOT OK Return to the troubleshooting steps or contact your local Cummins Authorized Repair Location if all the steps have been completed and checked again.	1A

STEP 2B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

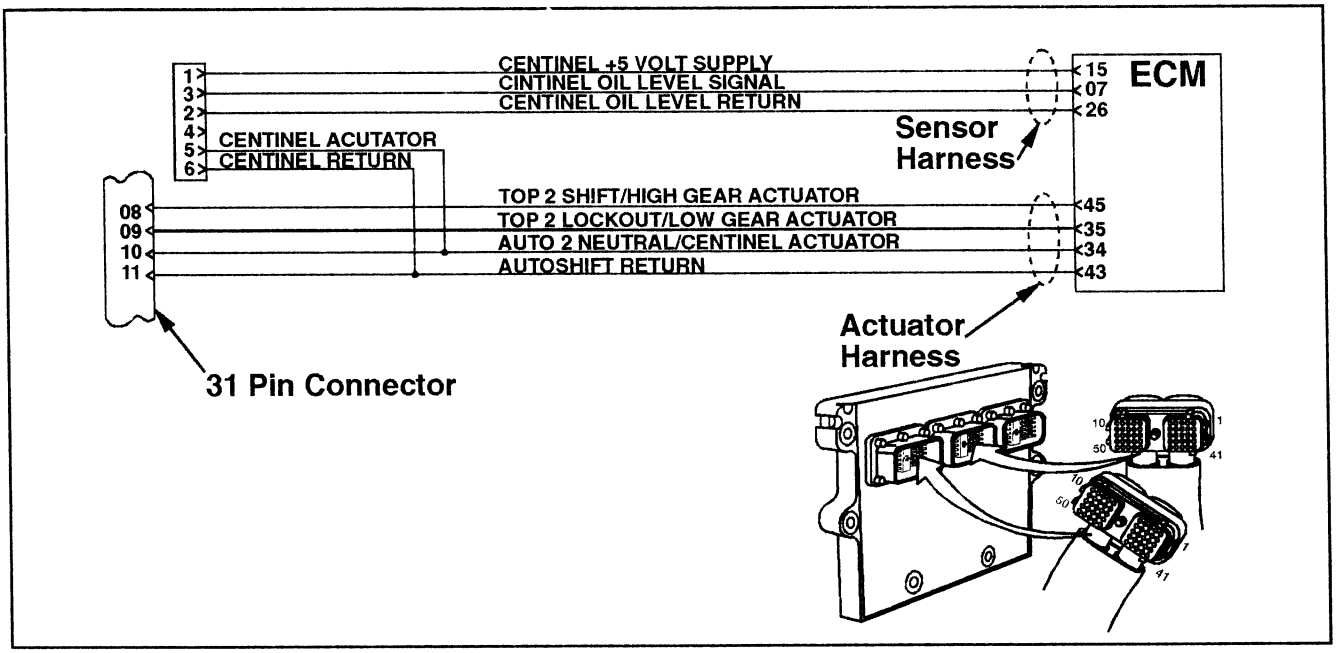
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 223

Burn Valve Solenoid

CODES	REASON	EFFECT
Fault Code: 223 PID(P), SID(S): S085 SPN: 1265 FMI: 4/4 Lamp: Yellow	Incorrect voltage detected at the Centinel™ actuator circuit by the ECM.	None on performance. Centinel™ deactivated.

Burn Valve Solenoid



Circuit Description:

The burn valve solenoid controls the flow of oil into the fuel drainline during the burn cycle.

Component Location:

The burn valve solenoid is on top of the oil control valve. The oil control valve is on the left side of the engine below the fuel delivery housing.

TROUBLESHOOTING SUMMARY

⚠ CAUTION ⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking measurements: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the burn valve solenoid.		
STEP 1A: Verify the burn valve solenoid is connected to the engine harness.	Solenoid is connected	
STEP 1B: Inspect the burn valve solenoid and the solenoid connector on the engine harness.	No damaged pins	
STEP 1C: Check the burn valve solenoid for an open circuit.	Less than 120 ohms	
STEP 1D: Check the burn valve solenoid for a short circuit.	More than 80 ohms	
STEP 2: Check the engine harness.		
STEP 2A: Inspect the engine harness and the ECM connectors.	No damaged pins	
STEP 2B: Check for an open circuit.	Less than 10 ohms	
STEP 2B-1: Check for an open circuit in the Centinel™ jumper harness.	Less than 10 ohms	
STEP 2C: Check for a short circuit to ground.	More than 100k ohms	
STEP 2C-1: Check for a short circuit to ground in the Centinel™ jumper harness.	More than 100k ohms	
STEP 2D: Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 3: Clear the fault codes.		
STEP 3A: Disable the fault code.	Fault Code 223 inactive	
STEP 3B: Clear the inactive fault codes.	All fault codes cleared	

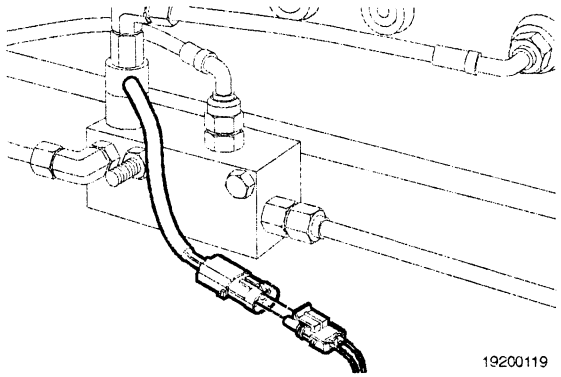
TROUBLESHOOTING STEP

STEP 1: Check the burn valve solenoid.

STEP 1A: Verify the burn valve solenoid is connected to the engine harness.

Condition:
- Turn keyswitch OFF.

Action	Specifications/Repair	Next Step
Verify the burn valve solenoid is connected to the engine harness.	**OK** **Solenoid is connected**	1B
	NOT OK Connect the solenoid to the engine harness.	3A



STEP 1B: Inspect the burn valve solenoid and the solenoid connector on the engine harness.

Condition:
- Turn keyswitch OFF.
- Disconnect the engine harness from the burn valve solenoid.

Action	Specifications/Repair	Next Step
Inspect the burn valve solenoid and the engine harness connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	1C
	NOT OK **Repair the damaged pins** Repair or replace the engine harness or replace the burn valve solenoid, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-202. • Replace the engine harness. Refer to Procedure 019-043. • Replace the burn valve solenoid. Refer to the Centinel™ Master Repair Manual, Bulletin No. 3666231.	3A

STEP 1C: Check the burn valve solenoid for an open circuit.

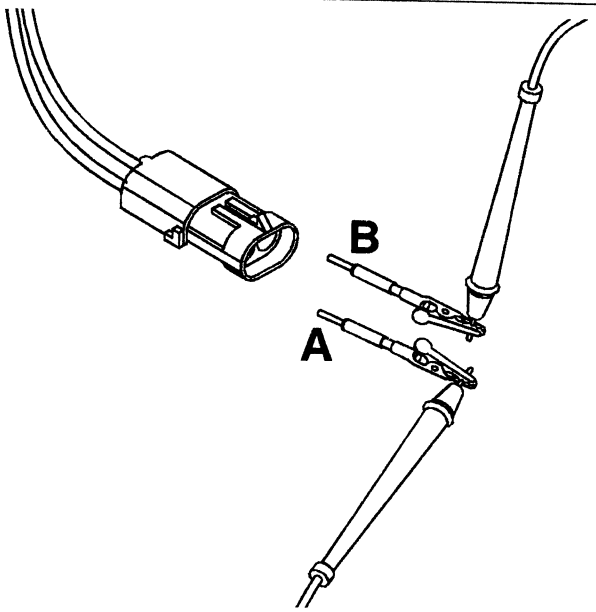
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking measurements: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the burn valve solenoid from the engine harness.

Action	Specifications/Repair	Next Step
Check the burn valve solenoid for an open circuit. • Measure the resistance from pin A (or 1) to pin B (or 2) of the burn valve solenoid connector.	**OK** **Less than 120 ohms**	1D
	NOT OK **Replace the burn valve solenoid** Refer to the Centinel™ Master Repair Manual, Bulletin No. 3666231.	3A



19c00759

STEP 1D: Check the burn valve solenoid for a short circuit.

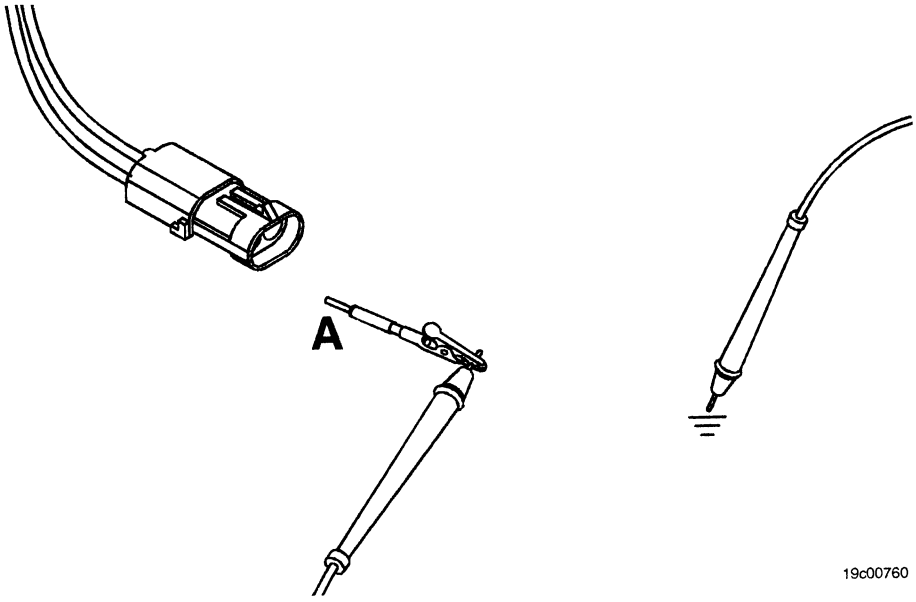
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking measurements: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Disconnect the engine harness from the burn valve solenoid.

Action	Specifications/Repair	Next Step
Check the burn valve solenoid for a short circuit to ground. • Measure the resistance from pin A (or 1) of the burn valve solenoid to engine block ground.	**OK** **More than 80 ohms**	2A
	NOT OK **Replace the burn valve solenoid** Refer to the Centinel™ Master Repair Manual, Bulletin No. 3666231.	3A



STEP 2: Check the engine harness.

STEP 2A: Inspect the engine harness and ECM connectors.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch OFF.
- Disconnect the engine harness connector from the ECM.

Action	Specifications/Repair	Next Step
Inspect the engine harness and ECM connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	2B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	3A

STEP 2B: Check for an open circuit.

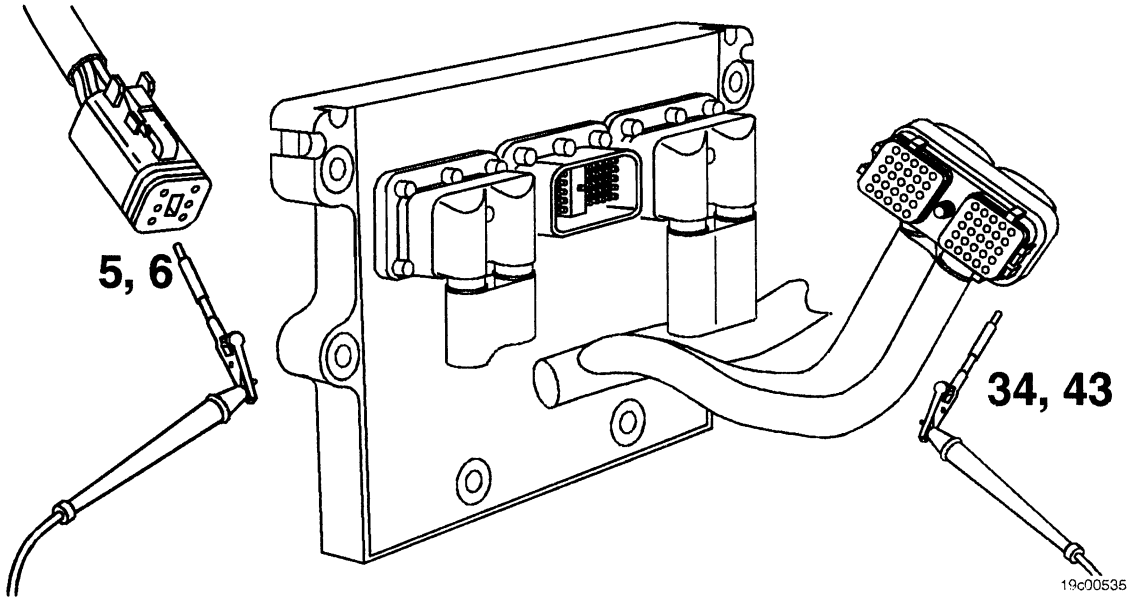
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking measurements: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the burn valve solenoid from the engine harness.
- Disconnect the actuator harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for an open circuit in the burn valve solenoid circuit. • Measure the resistance from pin 34 of the actuator harness connector to pin 5 of the burn valve solenoid, harness side. • Measure the resistance from pin 43 of the actuator harness connector to pin 6 of the burn valve solenoid, harness side.	**OK** **Less than 10 ohms**	2B-1
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-206 or 019-250. • Replace the engine harness. Refer to Procedure 019-043.	3A



STEP 2B-1: Check for an open circuit in the Centinel™ jumper harness.

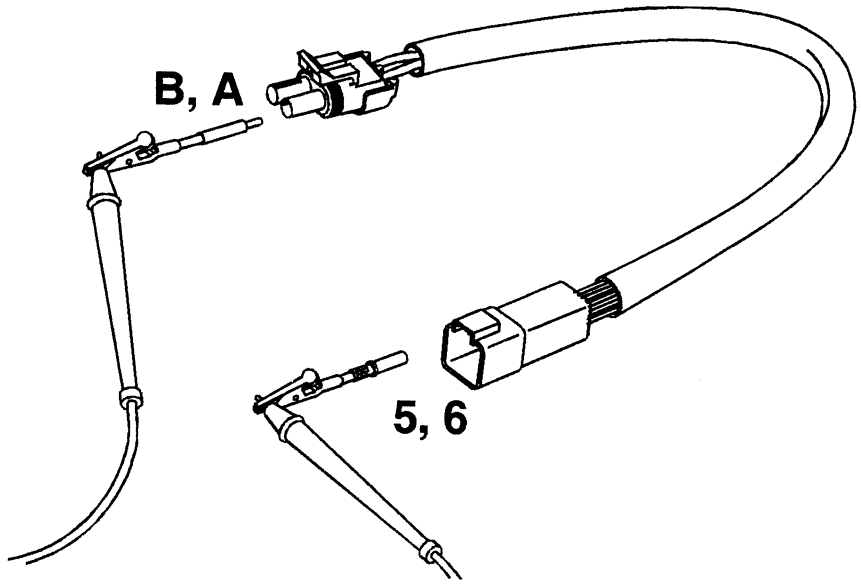
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking measurements: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the jumper harness from the burn valve solenoid.
- Disconnect the jumper harness from the engine harness.

Action	Specifications/Repair	Next Step
Check for an open circuit in the Centinel™ jumper harness.. • Measure the resistance from the signal pin of the 2-pin connector end of the Centinel™ jumper harness to pin 5 of the 6-pin connnector end of the harness. • Measure the resistance from the return pin of the 2-pin connector end of the Centinel™ jumper harness to pin 6 of the 6-pin connnector end of the harness.	**OK** **Less than 10 ohms**	2C
	NOT OK **Repair or replace the Centinel™ jumper harness** Refer to the Centinel™ Master Repair Manual, Bulletin No. 3666231.	3A



19c00867

STEP 2C: Check for a short circuit to ground.

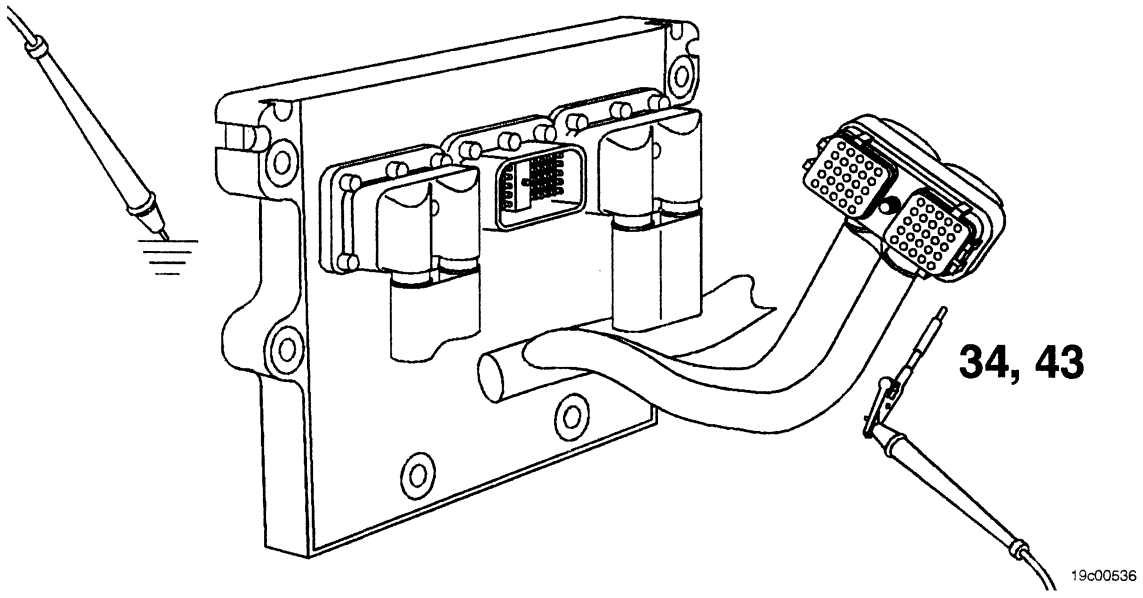
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking measurements: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the burn valve solenoid from the engine harness.
- Disconnect the actuator harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground. • Measure the resistance from pin 34 of the actuator harness connector to engine block ground. • Measure the resistance from pin 43 of the actuator harness connector to engine block ground.	**OK** **More than 100k ohms**	2C-1
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	3A



STEP 2C-1: Check for a short circuit to ground in the Centinel™ jumper harness.

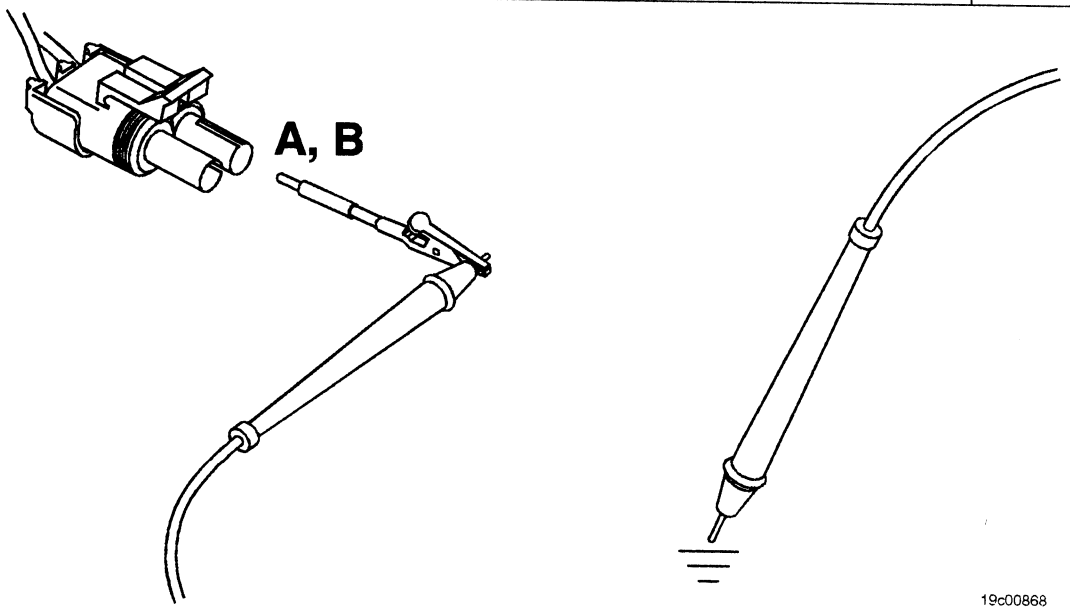
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking measurements: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the jumper harness from the burn valve solenoid.
- Disconnect the jumper harness from the engine harness.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground in the Centinel™ jumper harness. • Measure the resistance from pin A (or 1) of the 2-pin jumper harness connector to engine block ground. • Measure the resistance from pin B (or 2) of the 2-pin jumper harness connector to engine block ground.	**OK** **More than 100k ohms**	2D
	NOT OK **Repair or replace the Centinel™ jumper harness** Refer to the Centinel™ Master Repair Manual, Bulletin No. 3666231.	3A



STEP 2D: Check for a short circuit from pin to pin.

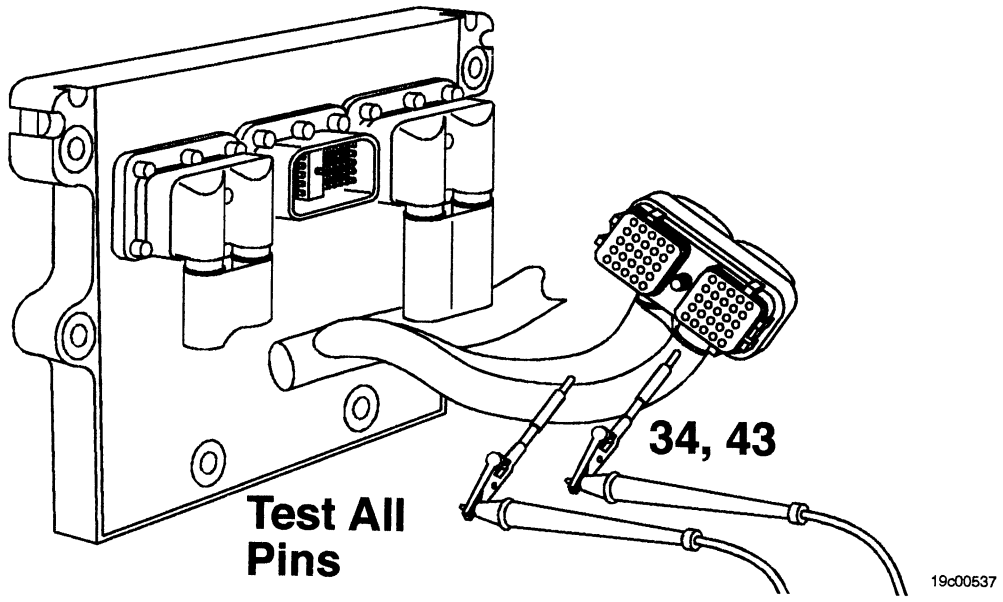
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking measurements: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the engine harness from the burn valve solenoid.
- Disconnect the actuator harness connector from the ECM.
- Disconnect the 31-pin OEM connector.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pin 34 of the actuator harness connector to all other pins in the connector. • Measure the resistance from pin 43 of the actuator harness connector to all other pins in the connector.	**OK** **More than 100k ohms**	3A
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	3A



STEP 3: Clear the fault codes.

STEP 3A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it idle for 1 minute. • Verify that Fault Code 223 is inactive.	**OK** **Fault Code 223 inactive**	3B
	NOT OK Return to troubleshooting steps or contact your local Cummins Authorized Repair Location if all the steps have been completed and checked again.	1A

STEP 3B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

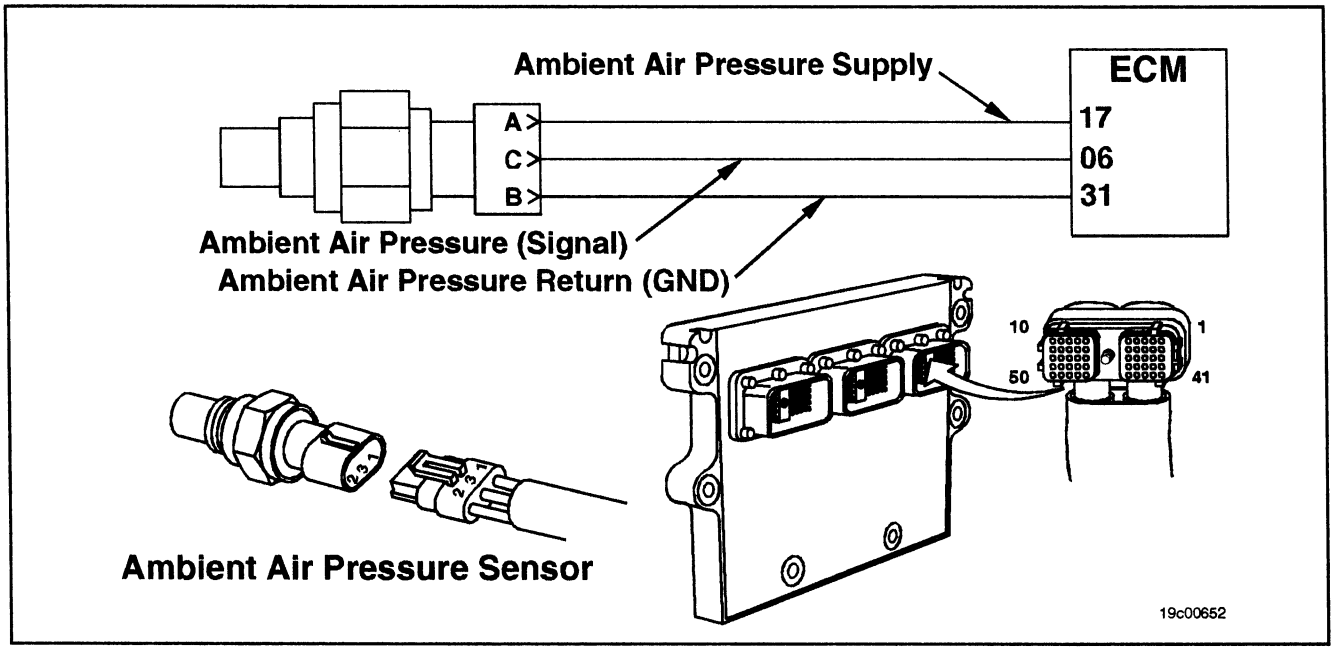
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 222

Ambient Air Pressure Sensor Circuit

CODES	REASON	EFFECT
Fault Code: 222 PID(P), SID(S): P108 SPN: 108 FMI: 4/4 Lamp: Yellow	Low voltage detected at the ambient air pressure circuit.	Derate in power output of engine.

Ambient Air Pressure Sensor Circuit



Circuit Description:

The ambient air pressure sensor monitors atmospheric pressure and passes information to the electronic control module (ECM) through the sensor harness.

Component Location:

The ambient air pressure sensor is located below the ECM.

Shop Talk:

Monitor the ambient air pressure reading with a service tool to confirm that the pressure reading matches the actual air pressure.

TROUBLESHOOTING SUMMARY

⚠ CAUTION ⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.
Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead
Part No. 3824774 - breakout cable.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check for multiple fault codes.		
STEP 1A: Read the fault codes.	Fault Code 123 inactive	
STEP 2: Check the ambient air pressure sensor.		
STEP 2A: Inspect the ambient air pressure sensor and sensor harness connector pins.	No damaged pins	
STEP 2B: Read the fault codes.	Fault Code 222 inactive	
STEP 2C: Check the ECM ambient air pressure supply voltage.	(+) 4.75 to 5.25 VDC	
STEP 2C-1: Measure the voltage from the ECM.	(+) 4.75 to 5.25 VDC	
STEP 2D: Check the ECM ambient air pressure signal voltage.	Altitude (ft) Voltage (VDC) 0 (sea level) - (+) 3.40 to 4.50 3000 - (+) 2.80 to 3.80 6000 - 2.20 to 3.25 9000 - (+) 1.70 to 2.70 12000 - (+) 1.20 to 2.20	
STEP 2D-1: Check for a short circuit to ground.	More than 100k ohms	
STEP 2D-2: Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 3: Check the sensor harness.		
STEP 3A: Inspect the sensor harness and the ECM connector for damaged pins.	No damaged pins	
STEP 3B: Read the fault codes.	Fault Code 222 inactive	
STEP 3C: Check for an open circuit.	Less than 10 ohms	
STEP 4: Check for an ECM response.		
STEP 4A: Check for the appropriate ECM response.	Fault Code 222 inactive and Fault Code 221 active	
STEP 5: Clear the fault codes.		
STEP 5A: Disable the fault code.	Fault Code 222 inactive	
STEP 5B: Clear the inactive fault codes.	All faults cleared	

TROUBLESHOOTING STEP

STEP 1: Check for multiple fault codes.

STEP 1A: Read the fault codes.

Condition:
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Read the fault codes using INSITE™.	**OK** **Fault Code 123 inactive**	2A
	NOT OK	Fault Code 352

STEP 2: Check the ambient air pressure sensor.

STEP 2A: Inspect the ambient air pressure sensor and sensor harness connector pins.

Condition:
- Turn keyswitch OFF.
- Disconnect the engine harness from the ambient air pressure sensor.

Action	Specifications/Repair	Next Step
Inspect the ambient air pressure sensor and sensor harness connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	2B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the sensor, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using the electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-203. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ambient air pressure sensor. Refer to Procedure 019-004.	5A

STEP 2B: Read the fault codes.

Condition:
- Turn keyswitch OFF.
- Connect all components.

Action	Specifications/Repair	Next Step
Read the fault codes. • Start the engine and let it idle for 1 minute. • Read the fault codes using INSITE™.	**OK** **Fault Code 222 inactive**	2C
	NOT OK Repair complete.	5B

STEP 2C: Check the ECM ambient air pressure supply voltage.

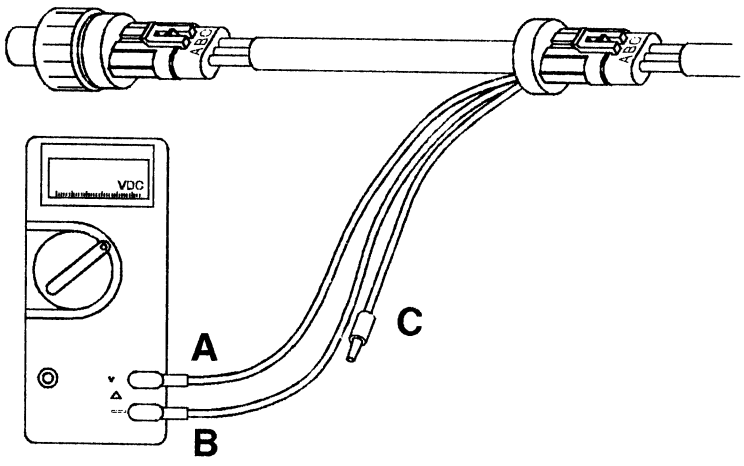
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3824774 - breakout cable.

Condition:

- Install the breakout cable, Part No. 3824774, between the sensor and the engine harness connector.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the ECM ambient air pressure supply voltage. • Using a multimeter, measure the supply voltage from pin A (or RED) to pin B (or BLACK) of the breakout cable.	**OK** **(+) 4.75 to 5.25 VDC**	2D
	NOT OK Does **not** meet specifications.	2C-1



19c00094

STEP 2C-1: Measure the voltage from the ECM.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

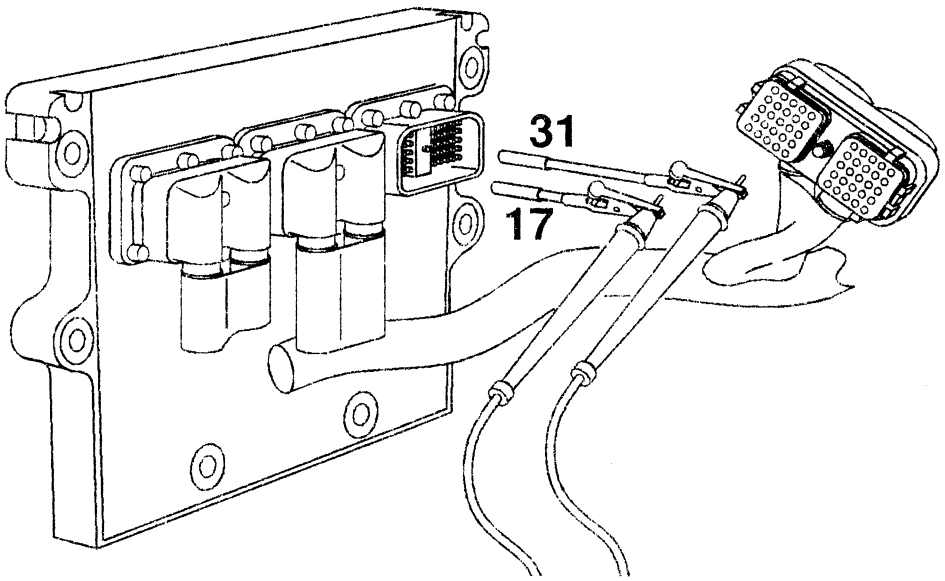
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822917 - female Deustch/AMP/Metri-Pack test lead.

Condition:

- Disconnect the sensor harness connector from the ECM.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Measure the voltage out of the ECM. • Measure the voltage at the ECM from pin 17 to pin 31 of the ECM sensor port.	**OK** **(+) 4.75 to 5.25 VDC** **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	5A
	NOT OK **Replace the ECM** Refer to Procedure 019-031.	5A



19c00125

STEP 2D: Check the ECM ambient air pressure signal voltage.

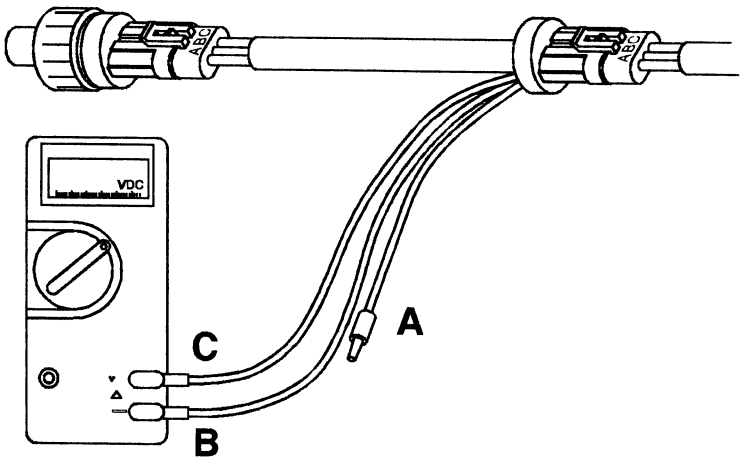
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3824774 - breakout cable.

Condition:

- Install the breakout cable, Part No. 3824774, between the sensor and the engine harness connector.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the ECM ambient air pressure signal voltage. • Measure the signal voltage from pin B (or BLACK) to pin C (or YELLOW) of the breakout cable.	**OK** **Altitude (ft) - Voltage (VDC)** **0 (sea level) - (+) 3.40 to 4.50** **3000 - (+) 2.80 to 3.80** **6000 - (+) 2.20 to 3.25** **9000 - (+) 1.70 to 2.70** **12000 - (+) 1.20 to 3.40**	2D-1
	NOT OK	3A



19c00095

STEP 2D-1: Check for a short circuit to ground.

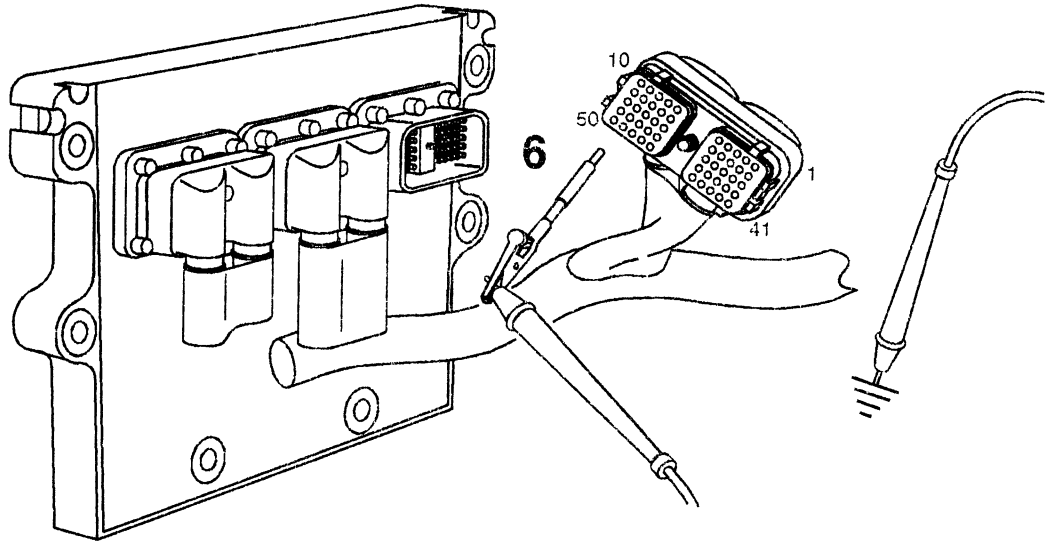
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the ambient air pressure sensor from the engine harness.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground. • Measure the resistance from sensor harness connector pin 6 to the chassis ground.	**OK** **More than 100k ohms**	2D-2
	NOT OK **Replace the engine harness** Replace the engine harness. Refer to Procedure 019-043.	5A



19c00068

STEP 2D-2: Check for a short circuit from pin to pin.

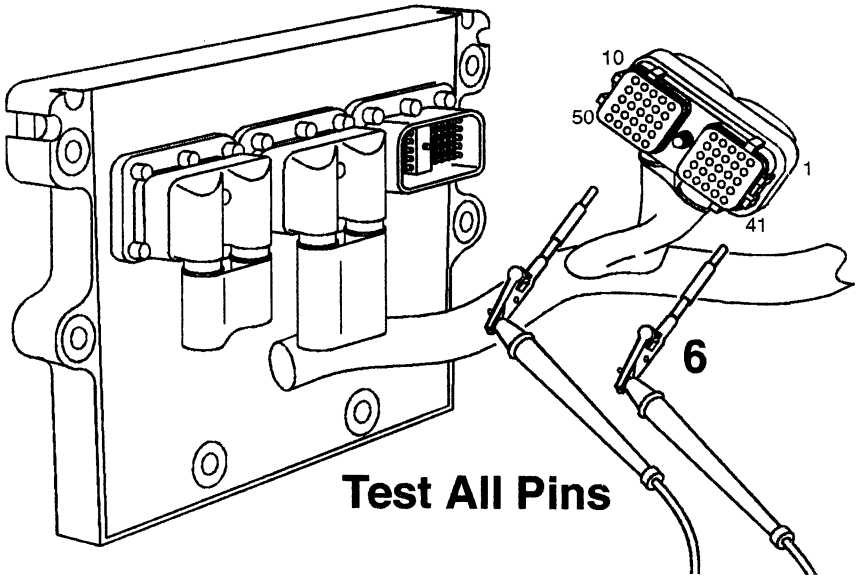
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the engine harness from the ambient air pressure sensor.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pin 6 of the sensor harness connector to all other pins in the connector.	**OK** **More than 100k ohms** **Replace the ambient air temperature sensor** Refer to Procedure 019-004.	5A
	NOT OK **Replace the engine harness** Replace the engine harness. Refer to Procedure 019-043.	5A



STEP 3: Check the sensor harness.

STEP 3A: Inspect the sensor harness and the ECM connector for damaged pins.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:
- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Inspect the sensor harness and the ECM connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	3B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	5A

STEP 3B: Read the fault codes.

Condition:
- Turn keyswitch OFF.
- Connect all components.

Action	Specifications/Repair	Next Step
Read the fault codes. • Start the engine and let it idle for 1 minute. • Read the fault codes using INSITE™.	**OK** **Fault Code 222 inactive**	3C
	NOT OK Repair complete.	5B

STEP 3C: Check for an open circuit.

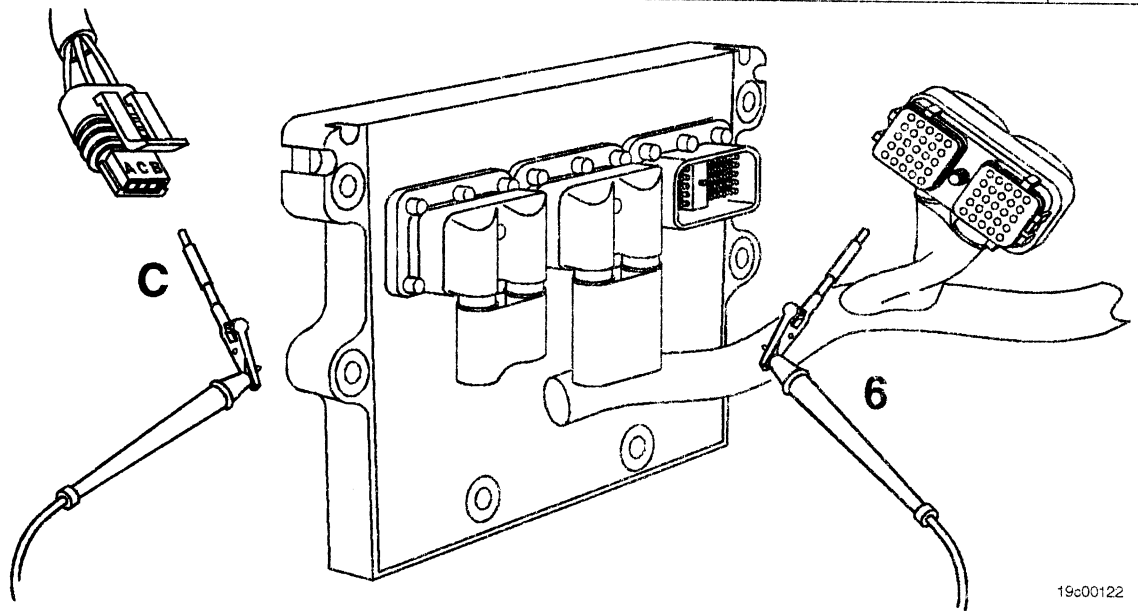
⚠CAUTION⚠

To avoid pin and harness damage, use the following test leads when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the ambient air pressure sensor from the engine harness.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for an open circuit in the ambient air pressure signal wire. • Measure the resistance from sensor harness connector pin 6 to the ambient air pressure sensor signal pin C (or 3).	**OK** **Less than 10 ohms**	4A
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-203 or 019-250. • Replace the engine harness. Refer to Procedure 019-043.	5A



STEP 4: Check for an ECM response.

STEP 4A: Check for the appropriate ECM response.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

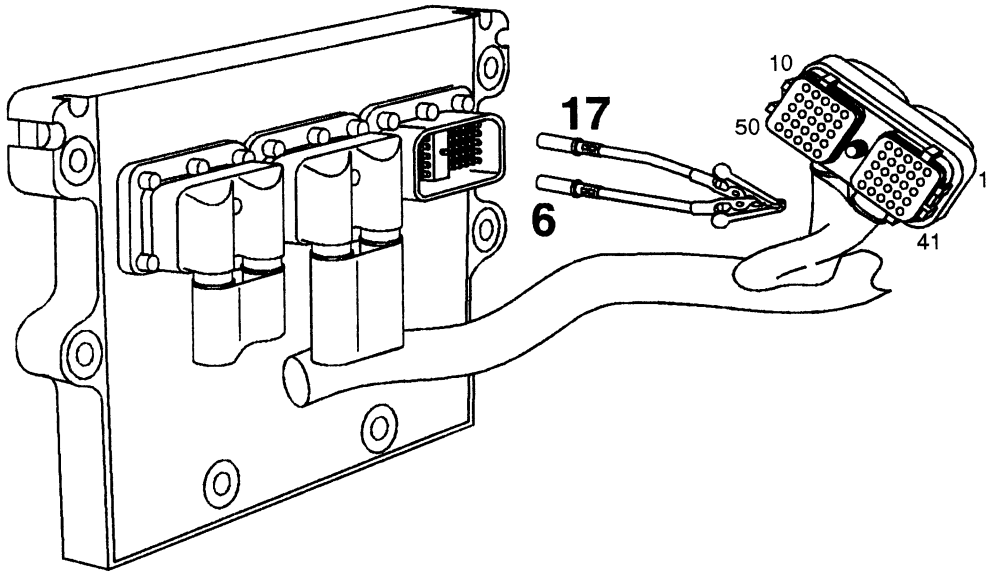
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

Condition:

- Disconnect the sensor harness connector from the ECM.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check for the appropriate ECM response. • Install a jumper wire between ECM sensor port pin 6 and pin 17. • Read the fault codes using INSITE™.	**OK** **Fault Code 222 inactive** **Fault Code 221 active**	5A
	NOT OK **Replace the ECM** Refer to Procedure 019-031.	5A



STEP 5: Clear the fault codes.

STEP 5A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it idle for 1 minute. • Using INSITE™, verify that Fault Code 222 is inactive.	**OK** **Fault Code 222 inactive**	5B
	NOT OK Return to troubleshooting steps or contact your local Cummins Authorized Repair Location if all the steps have been completed and checked again.	1A

STEP 5B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

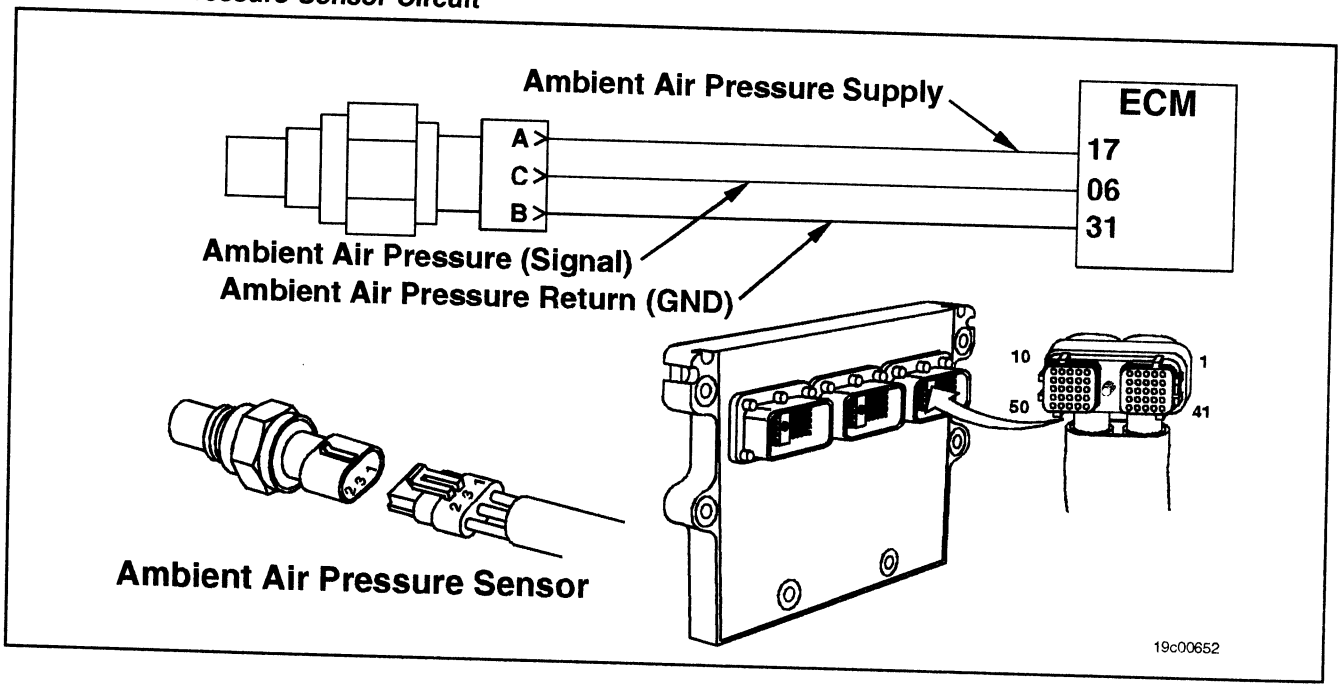
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All faults cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 221

Ambient Air Pressure Sensor Circuit

CODES	REASON	EFFECT
Fault Code: 221 PID(P), SID(S): P108 SPN: 108 FMI: 3/3 Lamp: Yellow	High voltage detected at the ambient air pressure sensor circuit.	Derate in power output of engine.

Ambient Air Pressure Sensor Circuit



Circuit Description:

The ambient air pressure sensor monitors atmospheric pressure and passes the information to the electronic control module (ECM) through the engine harness.

Component Location:

The ambient air pressure sensor is located below ECM.

Shop Talk:

Monitor the ambient air pressure reading with a service tool to confirm that the pressure reading matches the actual air pressure.

TROUBLESHOOTING SUMMARY

⚠ CAUTION ⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead
Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead
Part No. 3824774 - breakout cable.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the ambient air pressure sensor.		
STEP 1A: Inspect the ambient air pressure sensor and engine harness connector pins.	No damaged pins	
STEP 1B: Read the fault codes.	Fault Code 221 inactive	
STEP 1C: Check the ECM ambient air pressure sensor supply voltage.	(+) 4.75 to 5.25 VDC	
STEP 1C-1: Measure the voltage from the ECM.	(+) 4.75 to 5.25 VDC	
STEP 1D: Check the ECM ambient air pressure sensor signal voltage.	Altitude (ft) Voltage (VDC) 0 (sea level) - (+) 3.40 to 4.50 3000 - (+) 2.80 to 3.80 6000 - (+) 2.20 to 3.25 9000 - (+) 1.70 to 2.70 12000 - (+) 1.20 to 2.20	
STEP 2: Check the sensor harness.		
STEP 2A: Inspect the sensor harness and the ECM connector for damaged pins.	No damaged pins	
STEP 2B: Read the fault codes.	Fault Code 221 inactive	
STEP 2C: Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 2D: Check for an open circuit in the return wire.	Less than 10 ohms	
STEP 3: Check for an ECM response.		
STEP 3A: Check for the appropriate ECM response.	Fault Code 221 inactive Fault Code 222 active	
STEP 4: Clear the fault codes.		
STEP 4A: Disable the fault code.	Fault Code 221 inactive	
STEP 4B: Clear the inactive fault codes.	All faults cleared	

TROUBLESHOOTING STEP

STEP 1: Check the ambient air pressure sensor.

STEP 1A: Inspect the ambient air pressure sensor and engine harness connector pins.

Condition:
- Turn keyswitch OFF.
- Disconnect the engine harness from the ambient air pressure sensor.

Action	Specifications/Repair	Next Step
Inspect the ambient air pressure sensor and sensor harness connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	1B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the sensor, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using the electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-203. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ambient air pressure sensor. Refer to Procedure 019-004.	4A

STEP 1B: Read the fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Start the engine and let it idle for 1 minute. • Read the fault codes using INSITE™.	**OK** **Fault Code 221 inactive**	4B
	NOT OK Fault Code 221 active.	1C

STEP 1C: Check the ECM ambient air pressure sensor supply voltage.

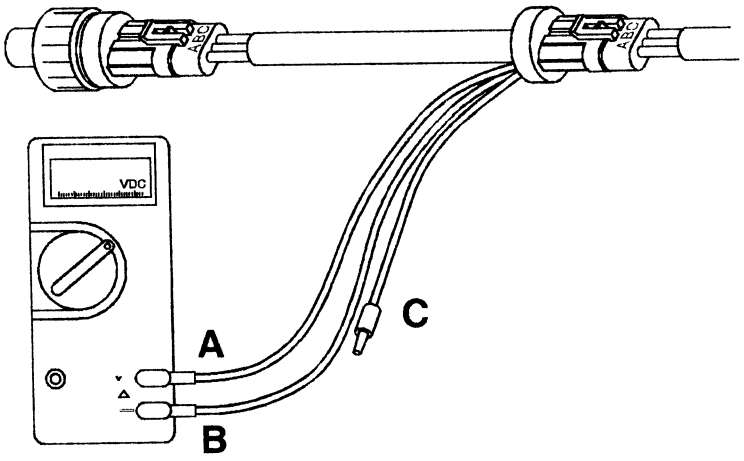
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking measurements: Part No. 3824774 - breakout cable.

Condition:

- Install breakout cable, Part No. 3824774, between the sensor and the sensor harness connector.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the ECM ambient air pressure sensor supply voltage. • Measure the supply voltage from pin A (or RED) to pin B (or BLACK) of the breakout cable.	**OK** **(+) 4.75 to 5.25 VDC**	1D
	NOT OK Does **not** meet specifications.	1C-1



19c00094

STEP 1C-1: Measure the voltage from the ECM.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

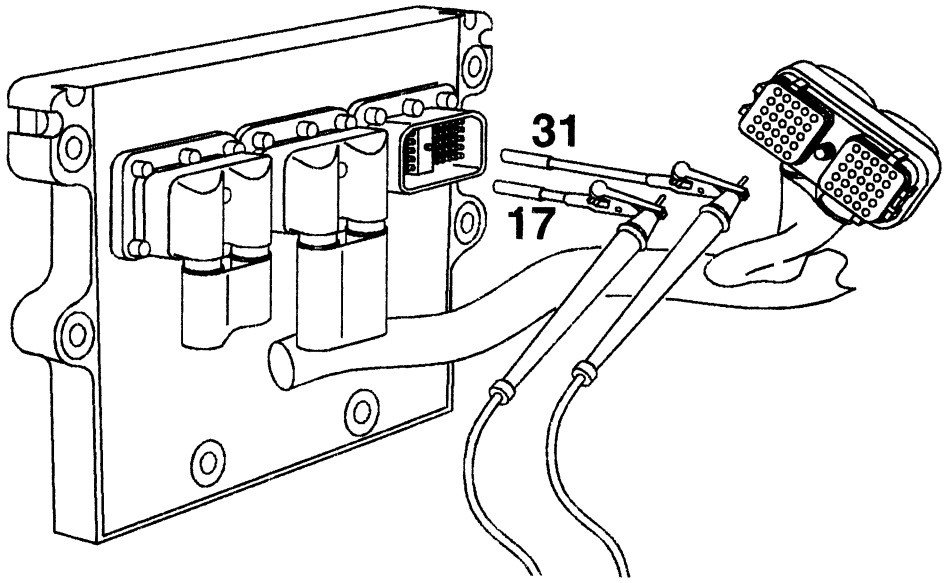
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

Condition:

- Disconnect the sensor harness connector from the ECM.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Measure the voltage out of the ECM. • Measure the voltage at the ECM from pin 17 to pin 31 of the ECM sensor port.	**OK** **(+) 4.75 to 5.25 VDC** **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	4A
	NOT OK **Replace the ECM** Refer to Procedure 019-031.	4A



19c00125

STEP 1D: Check the ECM ambient air pressure sensor signal voltage.

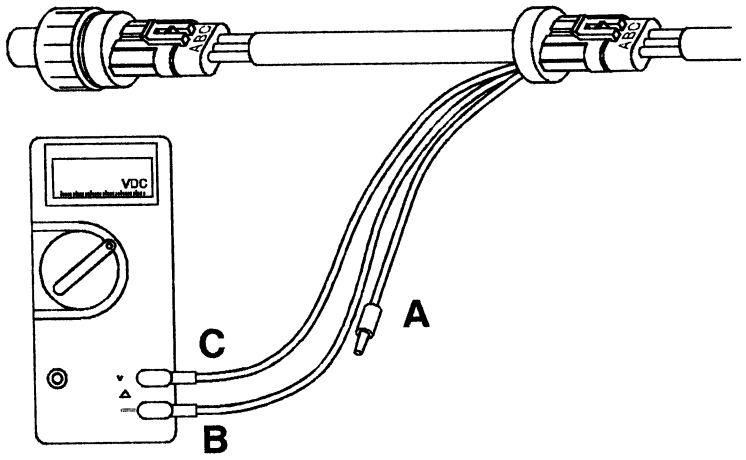
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking measurements: Part No. 3824774 - breakout cable.

Condition:

- Install the breakout cable, Part No. 3824774, between the sensor and the sensor harness connector.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the ECM ambient air pressure signal voltage. • Measure the signal voltage from pin C (or YELLOW) to pin B (or BLACK) of the breakout cable.	**OK** **Altitude (ft) Voltage (VDC)** **0 (sea level) - (+) 3.40 to 4.50** **3000 - (+) 2.80 to 3.80** **6000 - (+) 2.20 to 3.25** **9000 - (+) 1.70 to 2.70** **12000 - (+) 1.20 to 2.20**	3A
	NOT OK	2A



19c00095

STEP 2: Check the sensor harness.

STEP 2A: Inspect the sensor harness and the ECM connector for damaged pins.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:
- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Inspect the sensor harness and the ECM connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	2B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	4A

STEP 2B: Read the fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Start the engine and let it idle for 1 minute. • Read the fault codes using INSITE™.	**OK** **Fault Code 221 inactive**	4B
	NOT OK Fault Code 221 active.	2C

STEP 2C: Check for a short circuit from pin to pin.

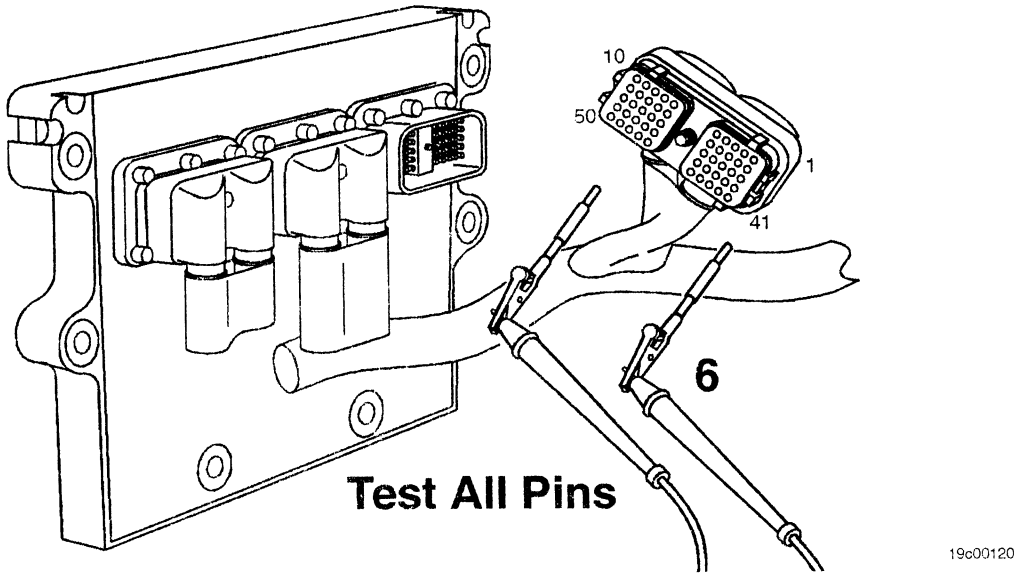
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pin 6 of the sensor harness connector to all other pins in the connector.	**OK** **More than 100k ohms**	2D
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043	4A



STEP 2D: Check for an open circuit in the return wire.

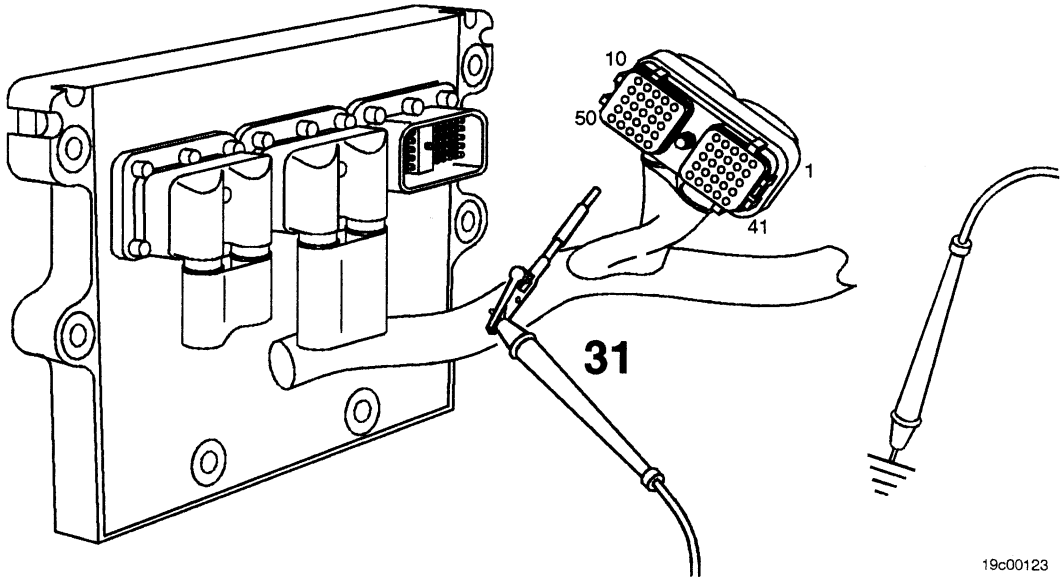
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.
- Disconnect the engine harness from the ambient air pressure sensor.

Action	Specifications/Repair	Next Step
Check for an open circuit in the return wire. • Measure the resistance from pin 31 of the sensor harness connector to the engine block ground.	**OK** **Less than 10 ohms** **Replace the ambient air pressure sensor** Refer to Procedure 019-004.	3A
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043	4A



STEP 3: Check for an ECM response.

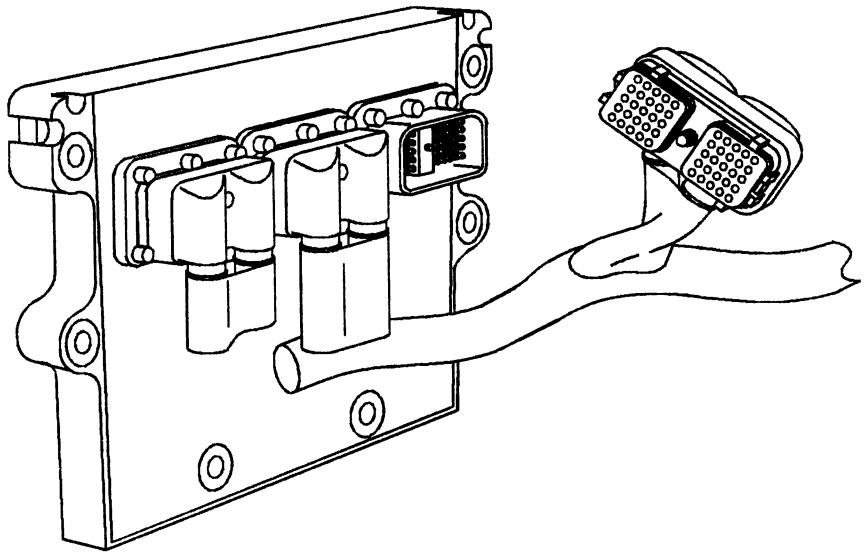
STEP 3A: Check for the appropriate ECM response.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:
- Disconnect the sensor harness connector from the ECM.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check for the appropriate ECM response. • Disconnect the sensor harness connector from the ECM. • Read the fault codes using INSITE™.	**OK** **Fault Code 221 inactive** **Fault Code 222 active**	4A
	NOT OK **Replace the ECM** Refer to Procedure 019-031.	4A



19600008

STEP 4: Clear the fault codes.

STEP 4A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it idle for 1 minute. • Using INSITE™, verify that Fault Code 221 is inactive.	**OK** **Fault Code 221 inactive**	4B
	NOT OK Return to troubleshooting steps or contact your local Cummins Authorized Repair Location if all steps have been completed and checked again.	1A

STEP 4B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

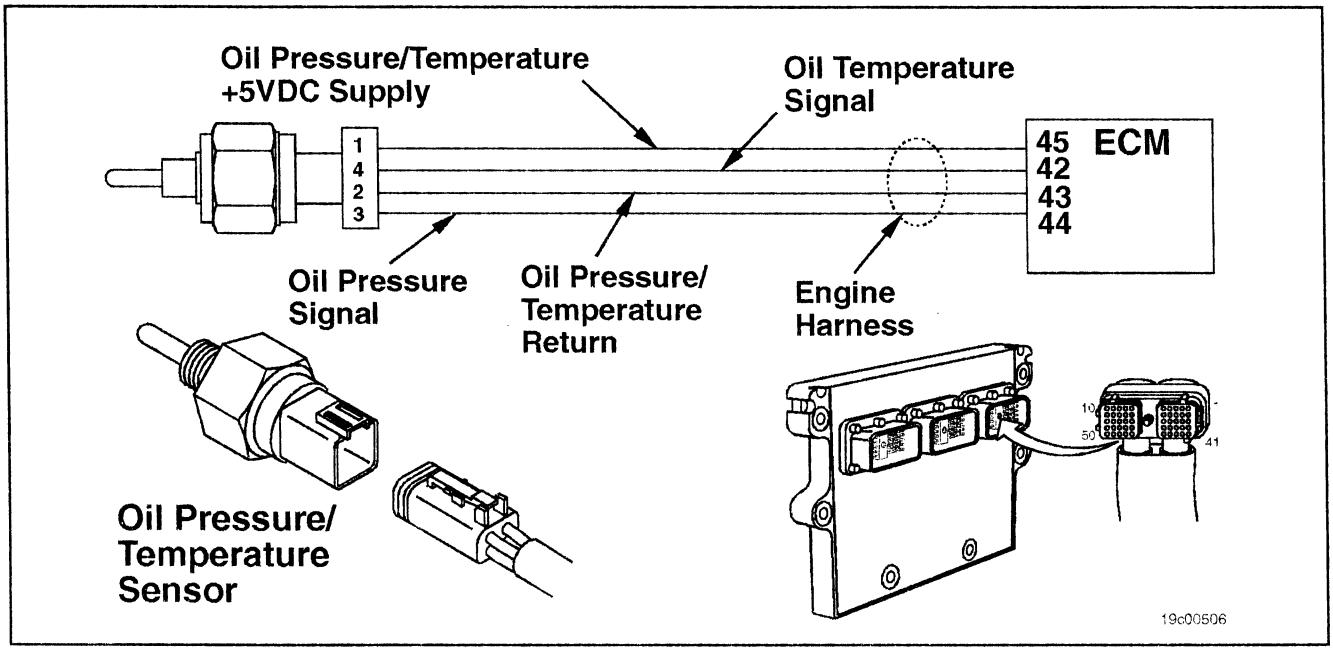
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All faults cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 141

Oil Pressure Sensor Circuit

CODES	REASON	EFFECT
Fault Code: 141 PID(P), SID(S): P100 SPN: 100 FMI: 4/4 Lamp: Yellow	Low voltage detected at the oil pressure circuit.	No engine protection for oil pressure.

Oil Pressure Sensor Circuit



Circuit Description:

The oil pressure/temperature sensor is used by the electronic control module (ECM) to monitor the lubricating oil pressure. The ECM monitors the voltage on the signal pin and converts this to a pressure value. The oil pressure value is used by the ECM for the engine protection system.

Component Location:

The oil pressure/temperature sensor is located on the engine block to the left of the fuel filter, behind the air compressor.

Shop Talk:

If Fault Code 143 or 415 is present, the problem is probably base engine related.

TROUBLESHOOTING SUMMARY

⚠ CAUTION ⚠

To avoid damaging the new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead
Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead
Part No. 3162898 - breakout cable.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check for multiple fault codes.		
STEP 1A: Read the fault codes.	Fault Codes 187, 452, and 484 are not active	
STEP 2: Check the oil pressure/temperature sensor.		
STEP 2A: Inspect the oil pressure/temperature sensor and engine harness connector pins.	No damaged pins	
STEP 2B: Read the fault codes.	Fault Code 141 inactive	
STEP 2C: Check the oil pressure/temperature sensor supply voltage.	(+) 4.75 to 5.25 VDC	
STEP 2C-1: Check the voltage from the ECM.	(+) 4.75 to 5.25 VDC	
STEP 2D: Check the oil pressure/temperature sensor signal voltage.	(+) 0.50 to 1.40 VDC	
STEP 2D-1: Check for a short circuit to ground.	More than 100k ohms	
STEP 2D-2: Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 3: Check the engine harness.		
STEP 3A: Inspect the engine harness and ECM connector for damaged pins.	No damaged pins	
STEP 3B: Read the fault codes.	Fault Code 141 inactive	
STEP 3C: Check for an open circuit.	Less than 10 ohms	
STEP 4: Check for an ECM response.		
STEP 4A: Check for the appropriate ECM response.	Fault Code 141 inactive Fault Code 135 active	
STEP 5: Clear the fault codes.		
STEP 5A: Disable the fault code.	Fault Code 141 inactive	
STEP 5B: Clear the inactive fault codes.	All fault codes cleared	

TROUBLESHOOTING STEP

STEP 1: Check for multiple fault codes.

STEP 1A: Read the fault codes.

Condition:
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Read the fault codes using INSITE™.	**OK** **Fault Codes 187, 452, and 484 are not active**	2A
	NOT OK Possible sensor failure, a short circuit to ground in the sensor (+) 5-VDC common supply, or a short circuit from pin to pin.	Fault Code 187

STEP 2: Check the oil pressure/temperature sensor.

STEP 2A: Inspect the oil pressure/temperature sensor and engine harness connector pins.

Condition:
- Turn keyswitch OFF.
- Disconnect the engine harness from the oil pressure/temperature sensor.

Action	Specifications/Repair	Next Step
Inspect the oil pressure/temperature sensor and engine harness connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	2B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the oil pressure/temperature sensor, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using the electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-204. • Replace the engine harness. Refer to Procedure 019-043. • Replace the oil pressure sensor. Refer to Procedure 019-155.	5A

STEP 2B: Read the fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Start the engine and let it idle for 1 minute. • Read the fault codes using INSITE™.	**OK** **Fault Code 141 inactive**	5B
	NOT OK Fault Code 141 active.	2C

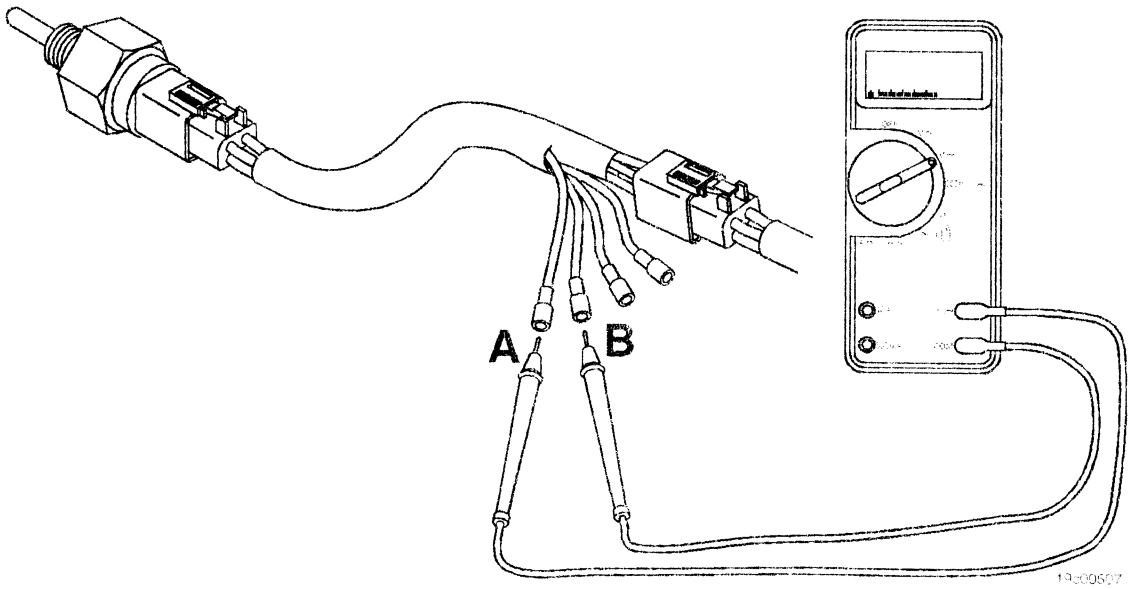
STEP 2C: Check the oil pressure/temperature sensor supply voltage.

△CAUTION△

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3162898 - breakout cable.

Condition:
- Disconnect the engine harness from the oil pressure sensor.
- Install the breakout cable, Part No. 3162898, between the sensor and the engine harness connector.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the oil pressure/temperature sensor supply voltage. • Measure the supply voltage from pin A (or RED) to pin B (or BLACK) on the harness side of the oil pressure sensor.	**OK** **(+) 4.75 to 5.25 VDC**	2D
	NOT OK Does **not** meet specifications.	2C-1



⚠CAUTION⚠

To avoid damaging the new ECM, all other active fault codes must be investigated prior to repla ECM.

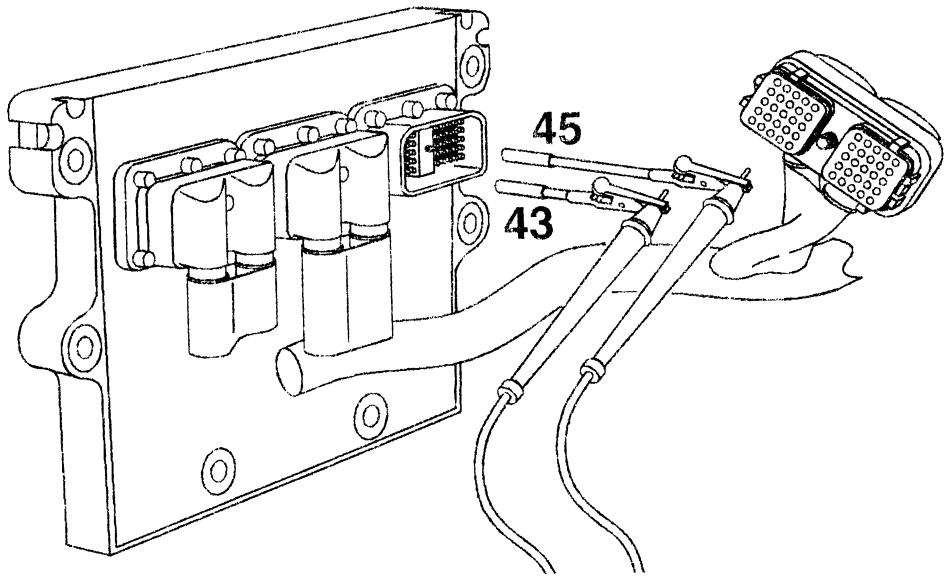
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

Condition:

- Disconnect the sensor harness connector from the ECM.
- Set the multimeter to the voltage function and connect the two test leads to the multimeter.
- Turn keyswitch ON.

Action	Specifications/Repair	N
Measure the voltage from the ECM. • Measure the voltage from pin 45 to pin 43 of the ECM sensor port.	**OK** **(+) 4.75 to 5.25 VDC**	5/
	NOT OK **Replace the ECM** Refer to Procedure 019-031.	5/



19

STEP 2D: Check the oil pressure/temperature sensor signal voltage.

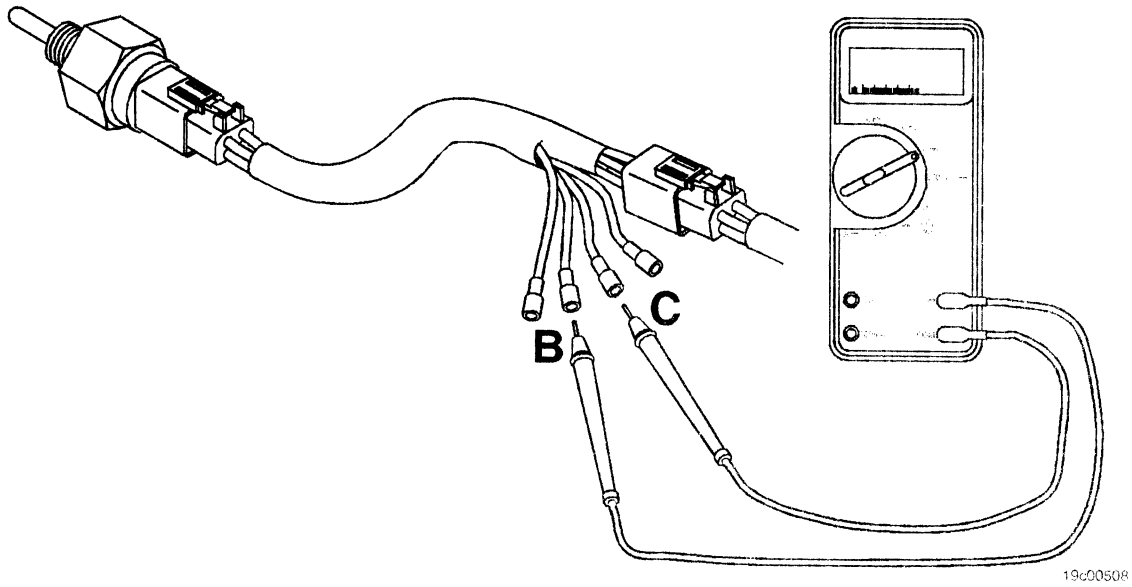
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3162898 - breakout cable.

Condition:

- Disconnect the oil pressure/temperature sensor from the engine harness.
- Install the breakout cable, Part No. 3162898, between the sensor and the engine harness.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the oil pressure/temperature sensor signal voltage. • Measure the voltage from pin C (or YELLOW) to pin B (or BLACK) of the breakout cable.	**OK** **(+) 0.50 to 1.40 VDC**	2D-1
	NOT OK Does **not** meet specifications.	3A



STEP 2D-1: Check for a short circuit to ground.

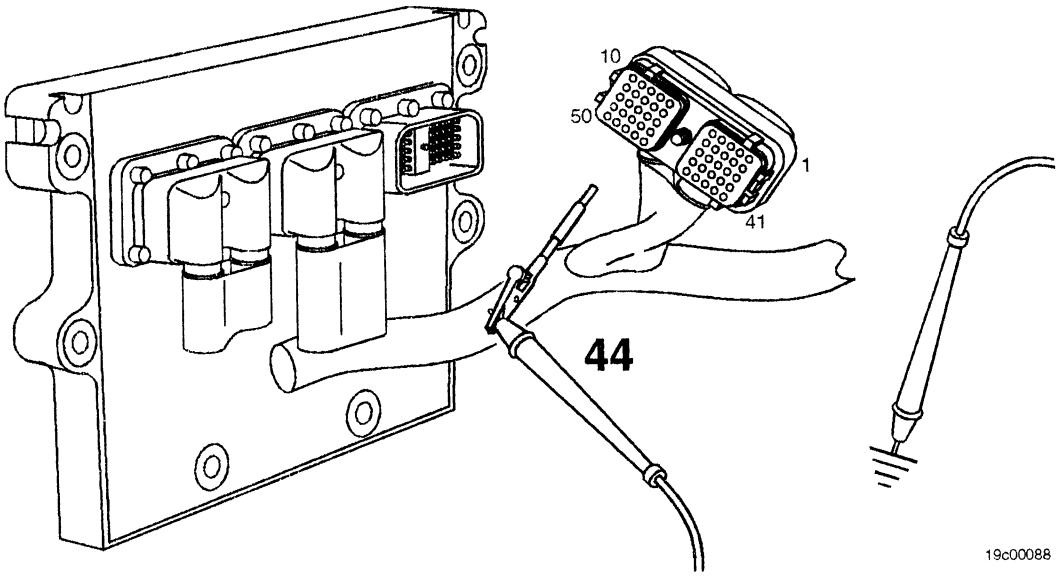
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the engine harness from the oil pressure sensor.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground. • Measure the resistance from pin 44 (or pressure signal) of the sensor harness connector to chassis ground.	**OK** **More than 100k ohms**	2D-2
	NOT OK **Replace the engine harness** Replace the engine harness. Refer to Procedure 019-043.	5A



STEP 2D-2: Check for a short circuit from pin to pin.

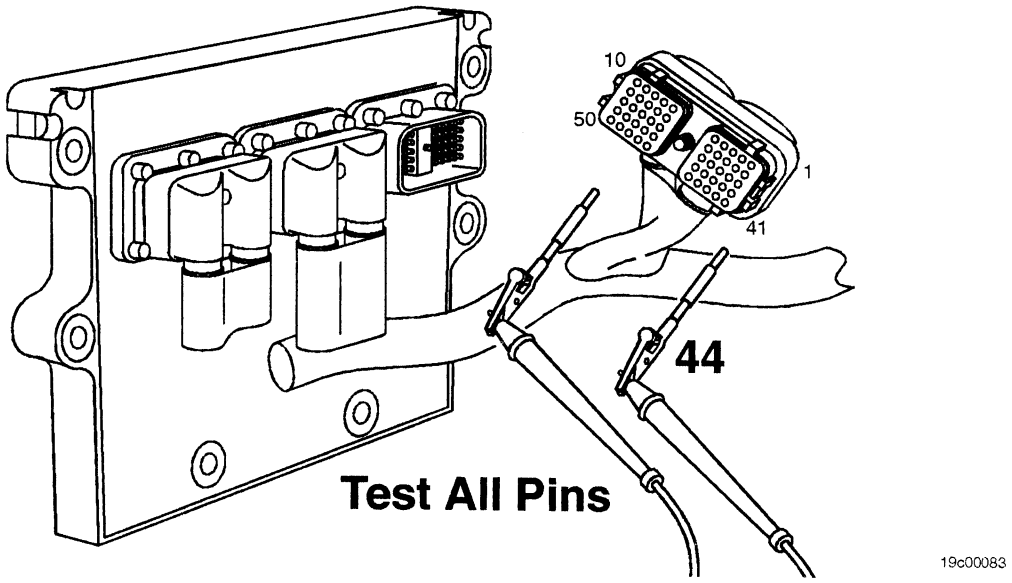
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.
- Disconnect the engine harness from the oil pressure sensor.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pin 44 (or pressure signal) of the sensor harness connector to all other pins in the connector.	**OK** **More than 100k ohms** **Replace the oil pressure sensor** Refer to Procedure 019-155.	5A
	NOT OK **Replace the engine harness** Refer to Procedure 019-043.	5A



STEP 3: Check the engine harness.

STEP 3A: Inspect the engine harness and ECM connector for damaged pins.

⚠CAUTION⚠

To avoid damaging the new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:
- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Inspect the engine harness and ECM connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	3B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using the electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-204 or 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	5A

STEP 3B: Read the fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Start the engine and let it idle for 1 minute. • Read the fault codes using INSITE™.	**OK** **Fault Code 141 inactive**	5B
	NOT OK Fault Code 141 active	3C

STEP 3C: Check for an open circuit.

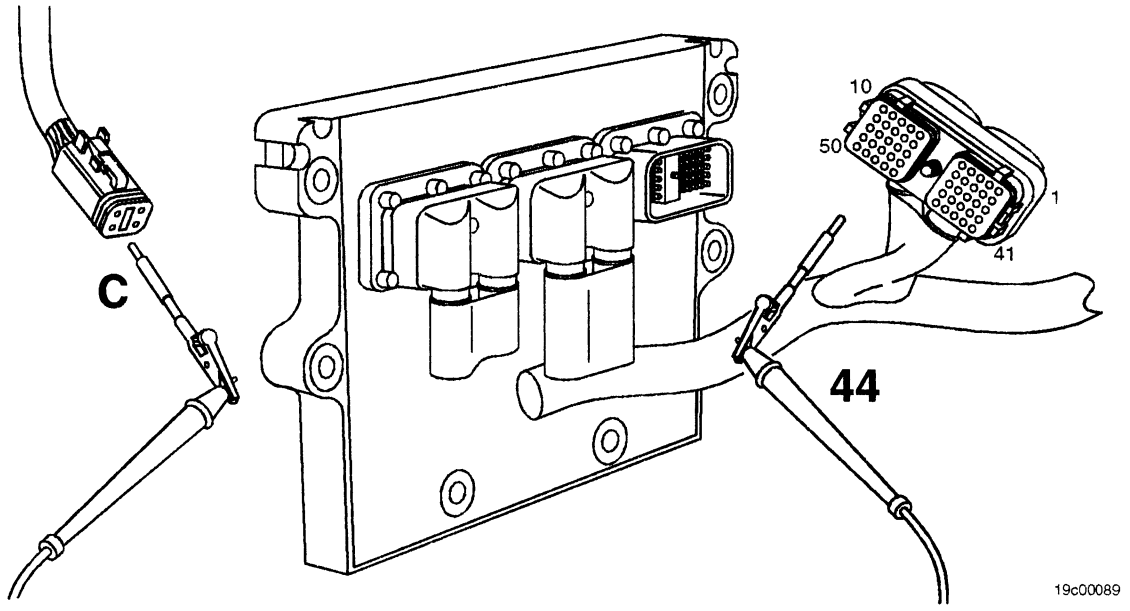
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the engine harness from the oil pressure sensor.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for an open circuit. • Measure the resistance from pin 44 (or pressure signal) of the sensor harness connector to pin C (or 3) of the oil pressure sensor connector, harness side.	**OK** **Less than 10 ohms**	4A
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-204 or 019-250. • Replace the engine harness. Refer to Procedure 019-043.	5A



STEP 4: Check for an ECM response.

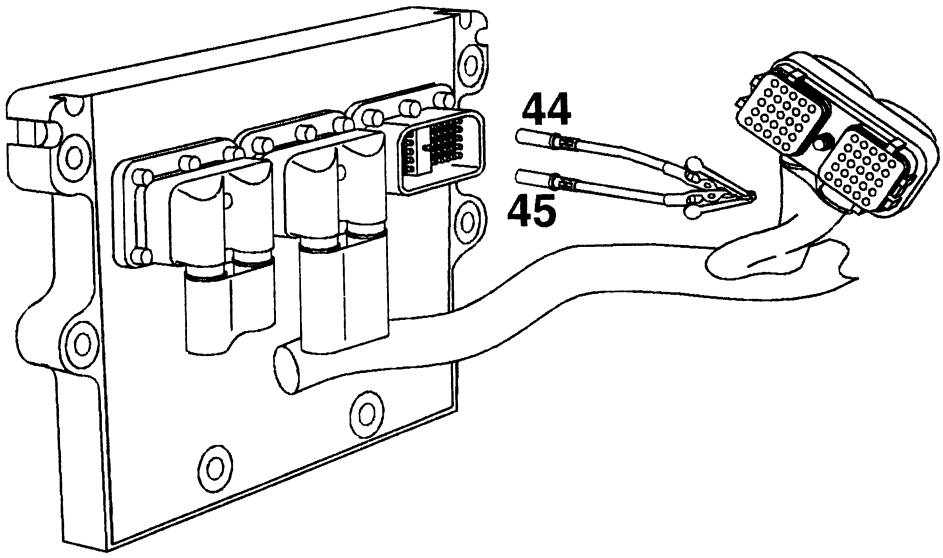
STEP 4A: Check for the appropriate ECM response.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:
- Disconnect the sensor harness connector from the ECM.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check for the appropriate ECM response. • Install a jumper wire between the ECM sensor port pin 44, the pressure signal and pin 45, the (+) 5-VDC supply.	**OK** **Fault Code 141 inactive** **Fault Code 135 active**	5A
	NOT OK **Replace the ECM** Refer to Procedure 019-031.	5A



19c00509

STEP 5: Clear the fault codes.

STEP 5A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it idle for 1 minute. • Using INSITE™, verify Fault Code 141 is inactive and did **not** reoccur.	**OK** **Fault Code 141 inactive**	5B
	NOT OK Return to the troubleshooting steps or contact your local Cummins Authorized Repair Location if all the steps have been completed and checked again.	1A

STEP 5B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

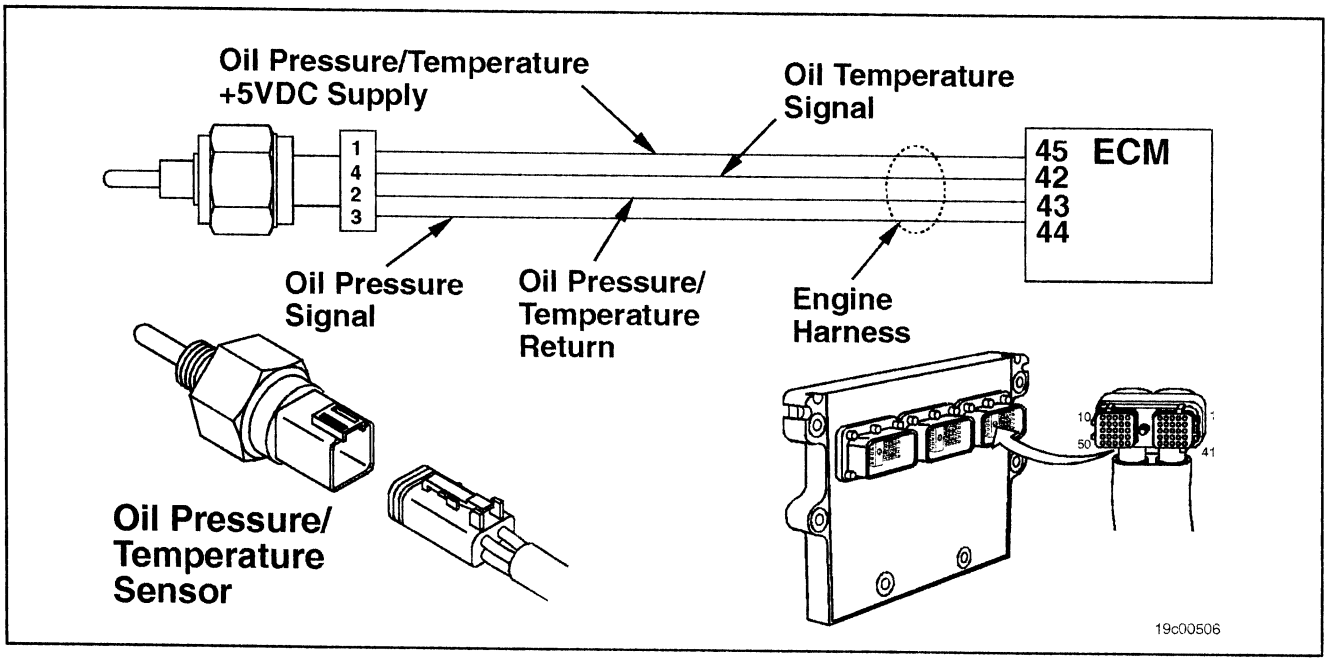
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 135

Oil Pressure Sensor Circuit

CODES	REASON	EFFECT
Fault Code: 135 PID(P), SID(S): P100 SPN: 100 FMI: 3/3 Lamp: Yellow	High voltage detected at the oil pressure circuit.	No engine protection for oil pressure.

Oil Pressure Sensor Circuit



Circuit Description:

The oil pressure/temperature sensor is used by the electronic control module (ECM) to monitor the lubricating oil pressure. The ECM monitors the voltage on the signal pin and converts this to a pressure value. The oil pressure value is used by the ECM for the engine protection system.

Component Location:

The oil pressure/temperature sensor is located on the engine block to the left of the fuel filter, behind the air compressor.

Shop Talk:

Does the fault occur **only** in cold weather? If so, allow the oil to warm up and see if the fault goes inactive.

TROUBLESHOOTING SUMMARY

⚠ CAUTION ⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead
Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead
Part No. 3162898 - breakout cable.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the oil pressure/temperature sensor.		
STEP 1A: Inspect the oil pressure/temperature sensor and the engine harness connector pins.	No damaged pins	
STEP 1B: Read the fault codes.	Fault Code 135 inactive	
STEP 1C: Check the oil pressure/temperature sensor supply voltage.	(+) 4.75 to 5.25 VDC	
STEP 1C-1: Measure the voltage from the ECM.	(+) 4.75 to 5.25 VDC	
STEP 1D: Check the oil pressure/temperature sensor signal voltage.	(+) 0.50 to 1.40 VDC	
STEP 2: Check the engine harness.		
STEP 2A: Inspect the engine harness and ECM connector pins.	No damaged pins	
STEP 2B: Read the fault codes.	Fault Code 135 inactive	
STEP 2C: Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 2D: Check for an open circuit in the return wire.	Less than 10 ohms	
STEP 3: Check for an ECM response.		
STEP 3A: Check for the appropriate ECM response.	Fault Code 135 inactive Fault Code 141 active	
STEP 4: Clear the fault codes.		
STEP 4A: Disable the fault code.	Fault Code 135 inactive	
STEP 4B: Clear the inactive fault codes.	All fault codes cleared	

TROUBLESHOOTING STEP

STEP 1: Check the oil pressure/temperature sensor.

STEP 1A: Inspect the oil pressure/temperature sensor and the engine harness connector pins.

Condition:
- Turn keyswitch OFF.
- Disconnect the engine harness from the oil pressure/temperature sensor.

Action	Specifications/Repair	Next Step
Inspect the oil pressure/temperature sensor and the engine harness connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	1B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the oil pressure/temperature sensor, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using the electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-204. • Replace the engine harness. Refer to Procedure 019-043. • Replace the oil pressure/temperature sensor. Refer to Procedure 019-155.	4A

STEP 1B: Read the fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Start the engine and let it idle for 1 minute. • Read the fault codes using INSITE™.	**OK** **Fault Code 135 inactive**	4B
	NOT OK Fault Code 135 active.	1C

STEP 1C: Check the oil pressure/temperature sensor supply voltage.

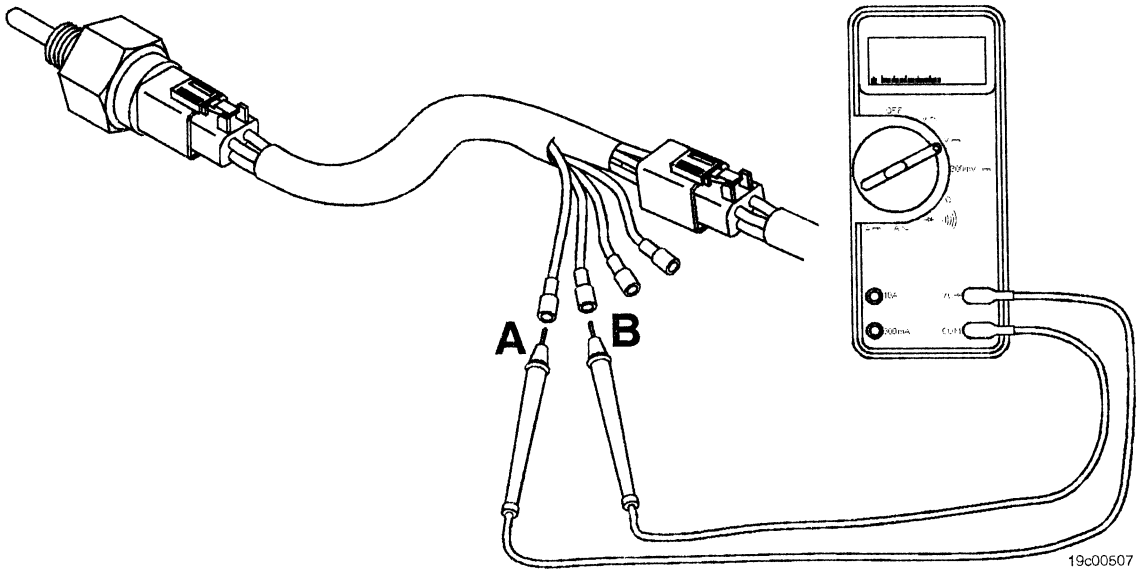
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3162898 - breakout cable.

Condition:

- Install breakout cable, Part No. 3162898, between the sensor and the engine harness connector.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the oil pressure/temperature sensor supply voltage. • Measure the supply voltage from pin A (or RED) to pin B (or BLACK) of the breakout cable.	**OK** **(+) 4.75 to 5.25 VDC**	1D
	NOT OK Does **not** meet specifications.	1C-1



STEP 1C-1: Measure the voltage from the ECM.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

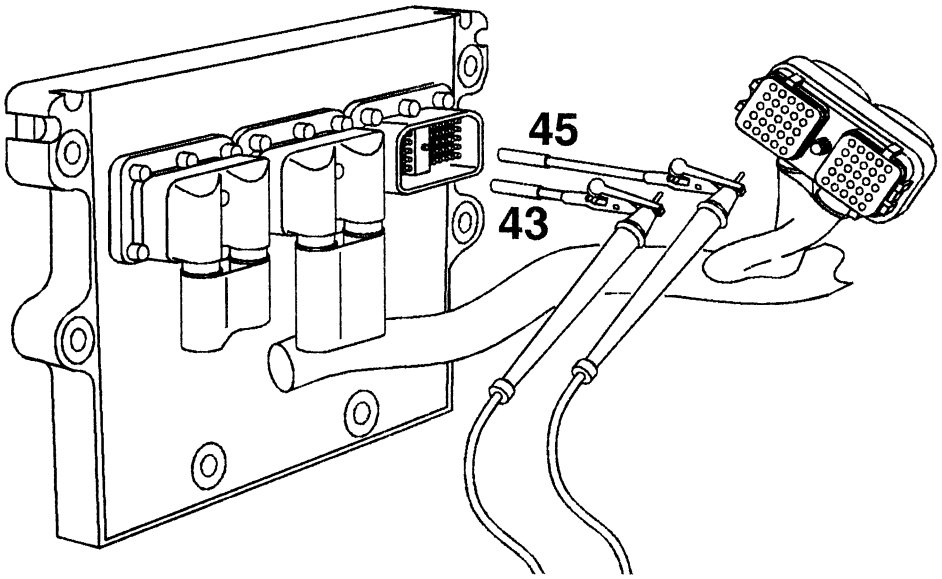
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

Condition:

- Disconnect the sensor harness connector from the ECM.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Measure the voltage from the ECM. • Measure the voltage at the ECM from pin 45 to pin 43 of the ECM sensor port.	**OK** **(+) 4.75 to 5.25 VDC** **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	4A
	NOT OK **Replace the ECM** Refer to Procedure 019-031.	4A



19c00254

STEP 1D: Check the oil pressure/temperature sensor signal voltage.

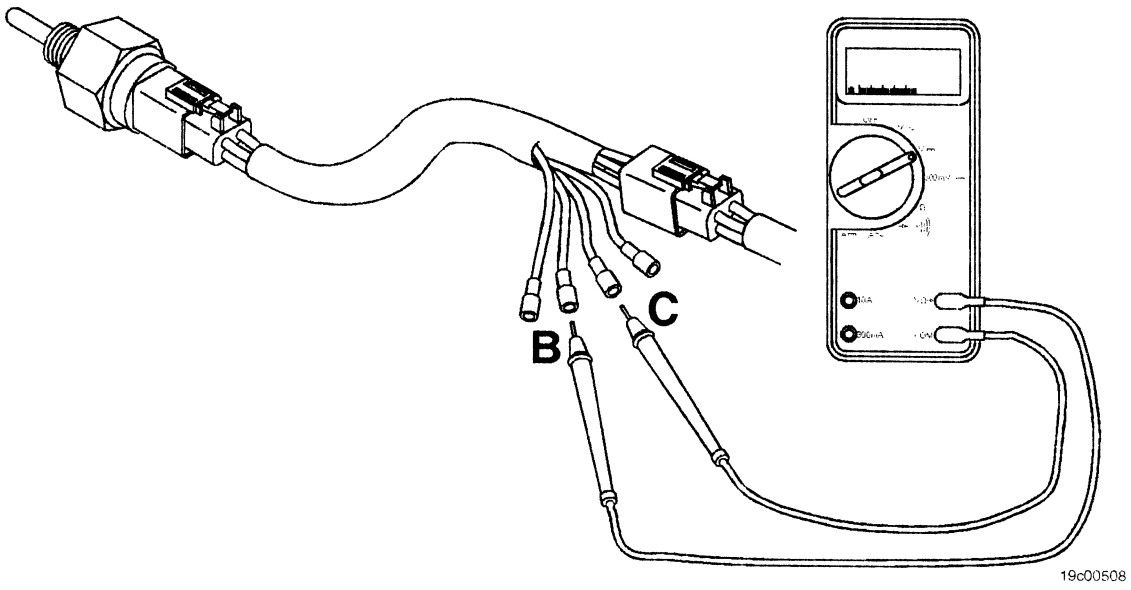
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3162898 - breakout cable.

Condition:

- Install breakout cable, Part No. 3162898, between the sensor and the engine harness connector.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the oil pressure/temperature sensor signal voltage. • Measure the signal voltage from pin C (or YELLOW) to pin B (or BLACK) of the breakout cable.	**OK** **0.50 to 1.40 VDC**	3A
	NOT OK Does **not** meet specifications.	2A



STEP 2: Check the engine harness.

STEP 2A: Inspect the engine harness and ECM connector pins.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:
- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Inspect the engine harness and ECM connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	2B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the ECM, whichever has damaged pins. • Flush the dirt, debris, or moisture from the connector pins using the electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	4A

STEP 2B: Read the fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Start the engine and let it idle for 1 minute. • Read the fault codes using INSITE™.	**OK** **Fault Code 135 inactive**	4B
	NOT OK Fault Code 135 active.	2C

STEP 2C: Check for a short circuit from pin to pin.

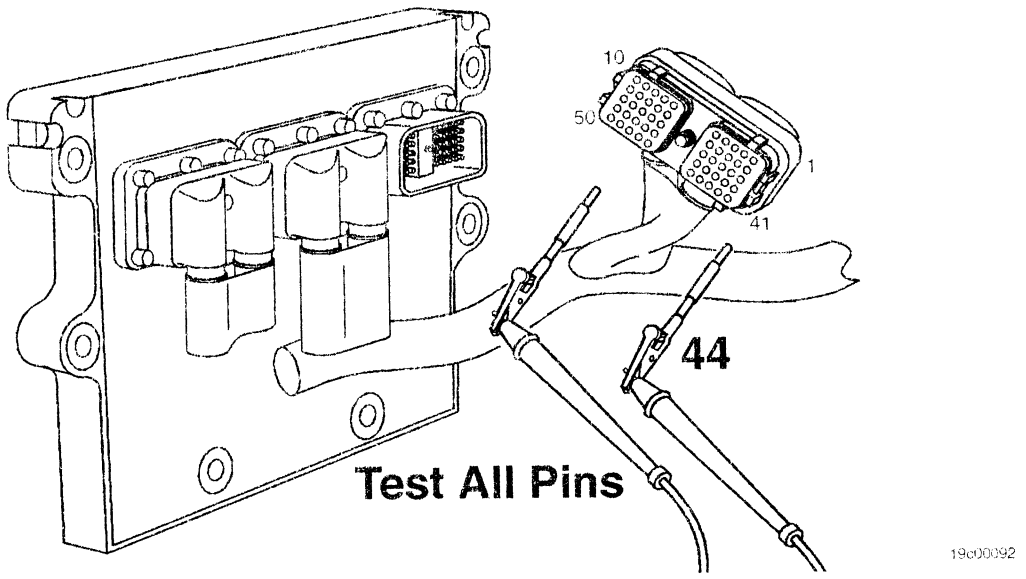
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin from pin. • Measure the resistance from pin 44 of the sensor harness connector to all other pins in the connector.	OK **More than 100k ohms**	2D
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	4A



STEP 2D: Check for an open circuit in the return wire.

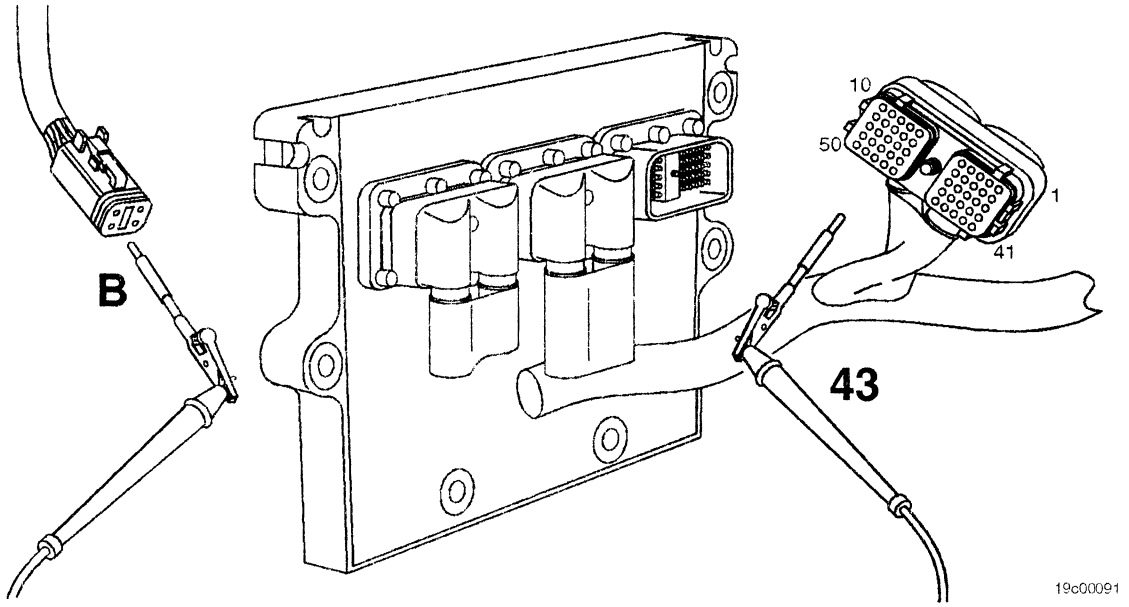
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.
- Disconnect the engine harness from the oil pressure/temperature sensor.

Action	Specifications/Repair	Next Step
Check for an open circuit. • Measure the resistance from pin 43 of the sensor harness connector to pin B (or 2) on the harness side of the oil pressure/ temperature sensor connector.	**OK** **Less than 10 ohms** **Replace the oil pressure/temperature sensor** Refer to Procedure 019-155.	4A
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-204 or 019-250. • Replace the engine harness. Refer to Procedure 019-043.	4A



STEP 3: Check for an ECM response.

STEP 3A: Check for the appropriate ECM response.

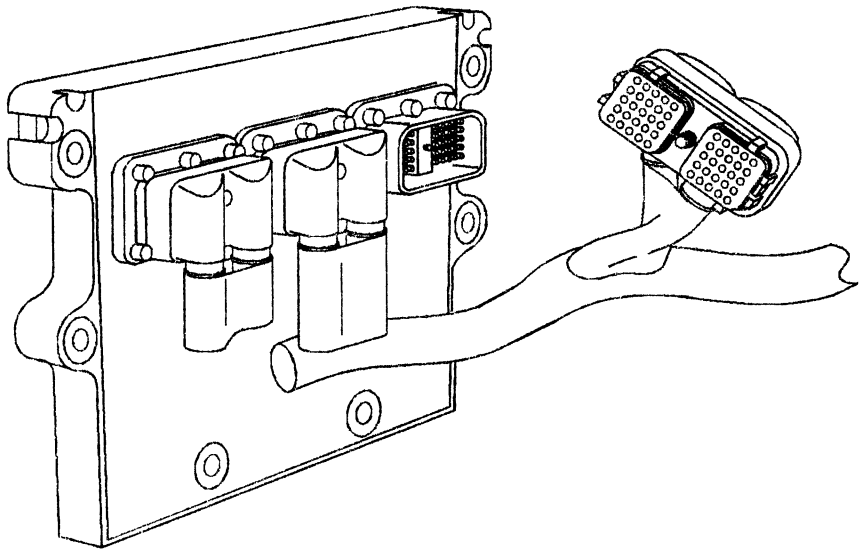
⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Disconnect the sensor harness connector from the ECM.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check for the appropriate ECM response. • Disconnect the sensor harness connector from the ECM. • Using INSITE™, check for the appropriate ECM response.	**OK** **Fault Code 135 inactive** **Fault Code 141 active**	4A
	NOT OK **Replace the ECM** Refer to Procedure 019-031.	4A



19600008

STEP 4: Clear the fault codes.

STEP 4A: Disable the fault code.

Condition:

- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it idle for 1 minute. • Using INSITE™, verify Fault Code 135 is inactive.	**OK** **Fault Code 135 inactive**	4B
	NOT OK Return to the troubleshooting steps or contact your local Cummins Authorized Repair Location if all the steps have been completed and checked again.	1A

STEP 4B: Clear the inactive fault codes.

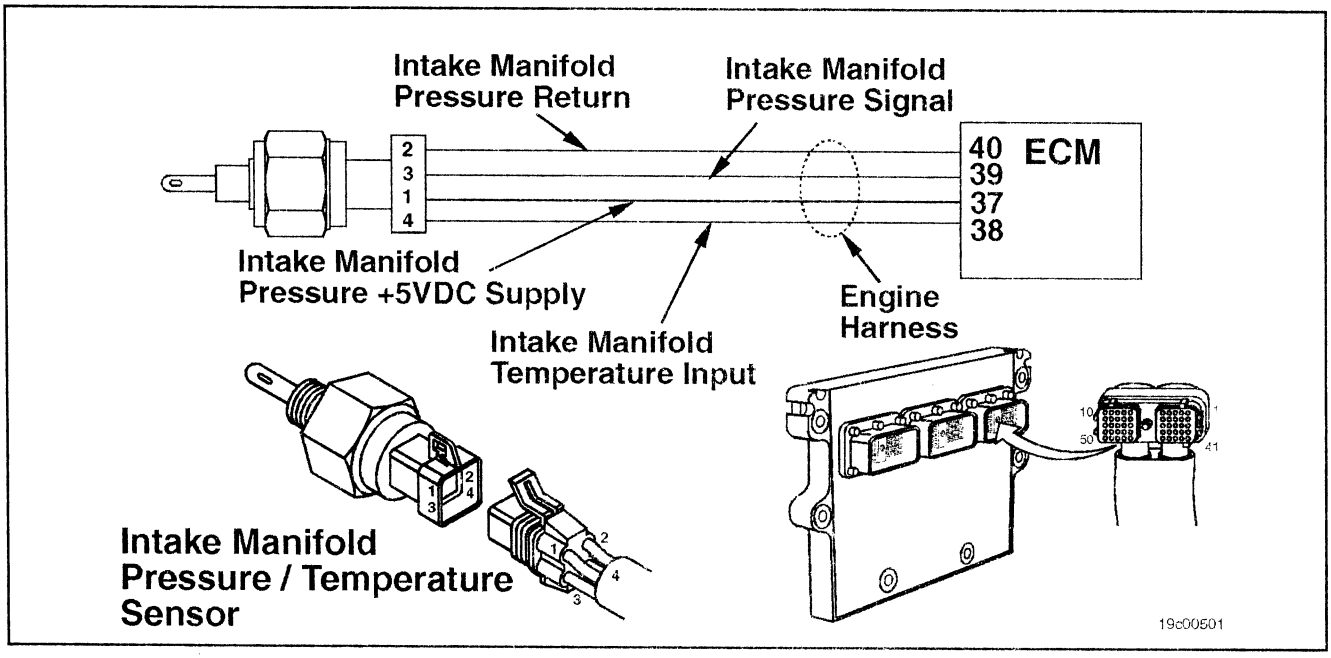
Condition: • Connect all components. • Turn keyswitch ON.		
Action	**Specifications/Repair**	**Next Step**
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 123

Intake Manifold Pressure Sensor Circuit

CODES	REASON	EFFECT
Fault Code: 123 PID(P), SID(S): P102 SPN: 102 FMI: 4/4 Lamp: Yellow	Low voltage detected on the intake manifold pressure/temperature sensor.	Derate in power output of the engine.

Intake Manifold Pressure Sensor Circuit



Circuit Description:

The intake manifold pressure/temperature sensor monitors intake manifold pressure and passes information to the electronic control module (ECM) through the engine harness. If intake manifold pressure becomes too high, it will cause a derate condition.

Component Location:

The intake manifold pressure/temperature sensor is located in the intake air manifold toward the front of the engine.

Shop Talk:

- Check for high restriction in the intake air manifold due to a shutdown device in the manifold if the vehicle is equipped with a shutdown device. Do **not** remove this device. If the engine is operated in a flammable atmosphere, the device is an essential safety feature. Removing it could cause severe personal injury or death.
- Check for installation of a torque limiting device (TLD) breakout wiring harness. Temporarily remove the TLD from the engine harness, and install the intake manifold pressure/temperature sensor directly to the engine harness. If Fault Code 123 becomes inactive, inspect the TLD.

TROUBLESHOOTING SUMMARY

⚠ CAUTION ⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead
Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead
Part No. 3162898 - breakout cable.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check for multiple fault codes.		
STEP 1A: Read the fault codes.	Fault Codes 222, 352, and 452 are not active	
STEP 2: Check for mechanical failure.		
STEP 2A: Check for proper operation of the turbocharger.	Positive intake manifold pressure from the turbocharger	
STEP 3: Check the intake manifold pressure/temperature sensor.		
STEP 3A: Inspect the intake manifold pressure/temperature sensor and engine harness connector pins.	No damaged pins	
STEP 3B: Read the fault codes.	Fault Code 123 inactive	
STEP 3C: Check the ECM intake manifold pressure/temperature sensor supply voltage.	(+) 4.75 to 5.25 VDC	
STEP 3C-1: Measure the voltage from the ECM.	(+) 4.75 to 5.25 VDC	
STEP 3D: Check the ECM intake manifold pressure/temperature sensor signal voltage.	(+) 0.42 to 0.58 VDC	
STEP 3D-1: Check for a short circuit to ground.	More than 100k ohms	
STEP 3D-2: Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 4: Check the engine harness.		
STEP 4A: Inspect the engine harness and the ECM connector for damaged pins.	No damaged pins	
STEP 4B: Read the fault codes.	Fault Code 123 inactive	
STEP 4C: Check for an open circuit.	Less than 10 ohms	
STEP 5: Check for an ECM response.		
STEP 5A: Check for the appropriate ECM response.	Fault Code 123 inactive and Fault Code 122 active	

STEP 6: Clear the fault codes.

STEP 6A: Disable the fault code. — **Fault Code 123 inactive**

STEP 6B: Clear the inactive fault codes. — **All faults cleared**

TROUBLESHOOTING STEP

STEP 1: Check for multiple fault codes.

STEP 1A: Read the fault codes.

Condition:
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Read the fault codes using INSITE™.	**OK** **Fault Codes 222, 352, and 452 are not active**	2A
	NOT OK Possible sensor failure, short circuit to ground in sensor (+) 5-VDC common supply, or short circuit from pin to pin.	Fault Code 352

STEP 2: Check for mechanical failure.

STEP 2A: Check for proper operation of the turbocharger.

Condition:
- Turn keyswitch OFF.
- Disconnect the engine harness from the intake manifold pressure/temperature sensor.

Action	Specifications/Repair	Next Step
Check for proper operation of the turbocharger. • Check for positive intake manifold pressure.	**OK** **Positive intake manifold pressure from the turbocharger**	3A
	NOT OK **Low intake manifold pressure** Correct the base engine malfunction causing low intake manifold pressure. Refer to the Signature, ISX and QSX15 Engines Troubleshooting and Repair Manual, Bulletin No. 3666239.	6A

STEP 3: Check the intake manifold pressure/temperature sensor.

STEP 3A: Inspect the intake manifold pressure/temperature sensor and engine harness connector pins.

Condition:
- Turn keyswitch OFF.
- Disconnect the engine harness from the intake manifold pressure/temperature sensor.

Action	Specifications/Repair	Next Step
Inspect the engine harness and the sensor connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	3B
	NOT OK **Repair the damaged pins.** Repair or replace the engine harness, or replace the intake manifold pressure/temperature sensor, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using the electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-204. • Replace the engine harness. Refer to Procedure 019-043. • Replace the intake manifold pressure/temperature sensor. Refer to Procedure 019-059.	6A

STEP 3B: Read the fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Start the engine and let it idle for 1 minute. • Read the fault codes using INSITE™.	**OK** **Fault Code 123 inactive**	6B
	NOT OK Fault Code 123 active.	3C

STEP 3C: Check the ECM intake manifold pressure/temperature sensor supply voltage.

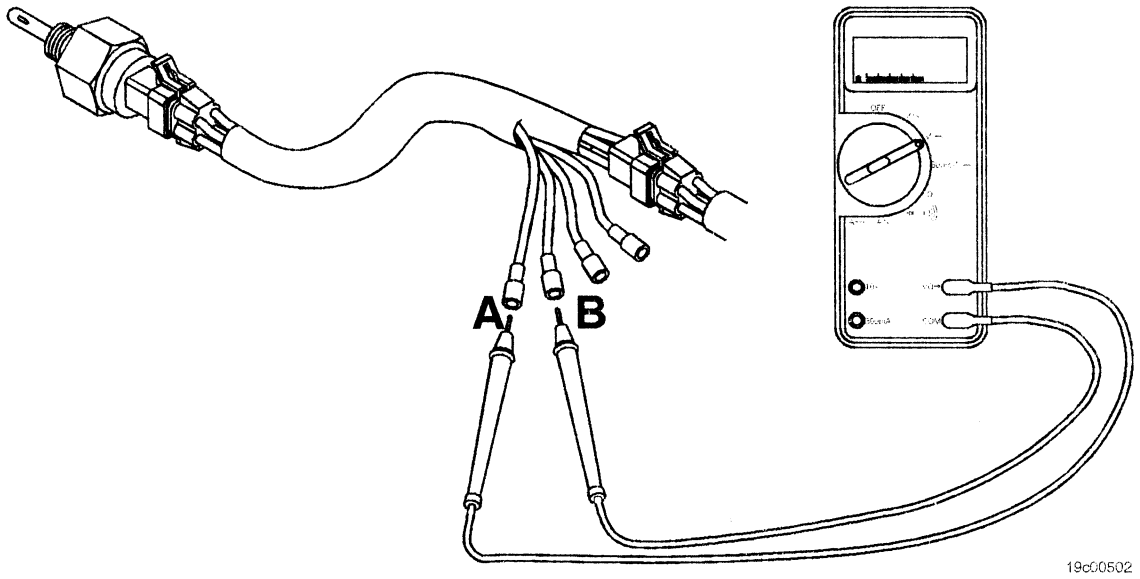
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 31262898 - breakout cable.

Condition:

- Install the intake manifold pressure/temperature sensor breakout cable, Part No. 31262898, between the sensor and the engine harness connector.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the intake manifold pressure/temperature sensor supply voltage. • Measure the supply voltage from pin A (or RED) to pin B (or BLACK) of the breakout cable.	**OK** **(+) 4.75 to 5.25 VDC**	3D
	NOT OK Does **not** meet specifications.	3C-1



STEP 3C-1: Measure the voltage from the ECM.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

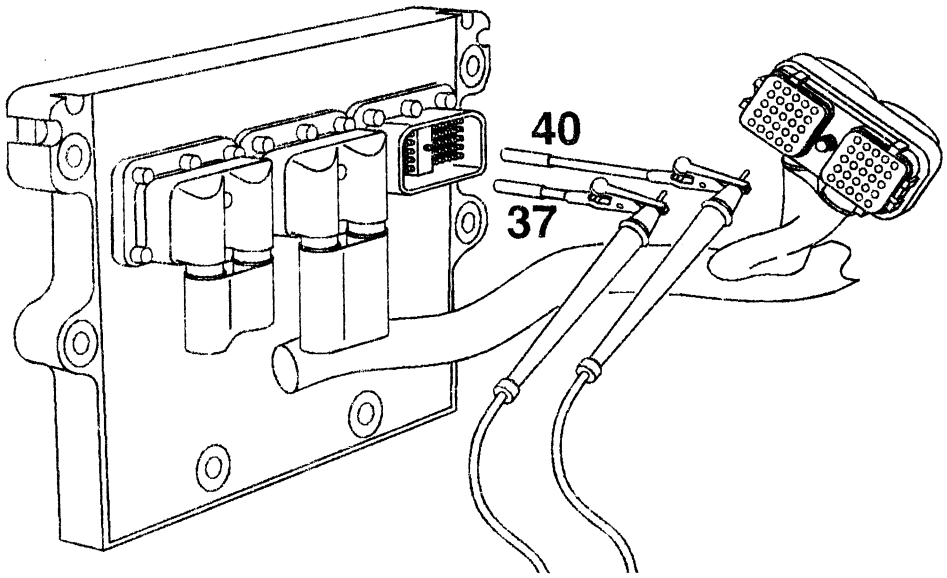
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

Condition:

- Disconnect the sensor harness connector from the ECM.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Measure the voltage out of the ECM. • Measure the voltage at the ECM from pin 37 to pin 40 of the ECM sensor port.	**OK** **(+) 4.75 to 5.25 VDC** **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	6A
	NOT OK **Replace the ECM** Refer to Procedure 019-031.	6A



STEP 3D: Check the ECM intake manifold pressure/temperature sensor signal voltage.

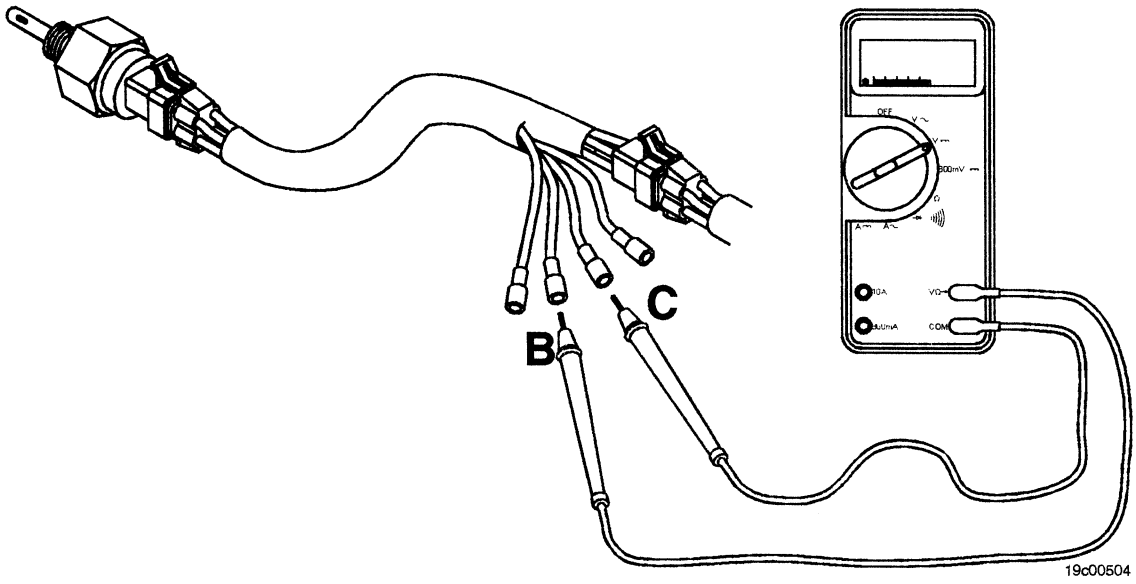
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 31262898 - breakout cable.

Condition:

- Install the breakout cable, Part No. 3162898, between the intake manifold pressure/temperature sensor and the engine harness connector.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the intake manifold pressure/temperature sensor signal voltage. • Measure the signal voltage from pin B (or BLACK) to pin C (or YELLOW) of the breakout cable.	**OK** **(+) 0.42 to 0.58 VDC**	3D-1
	NOT OK Does **not** meet specifications.	4A



STEP 3D-1: Check for a short circuit to ground.

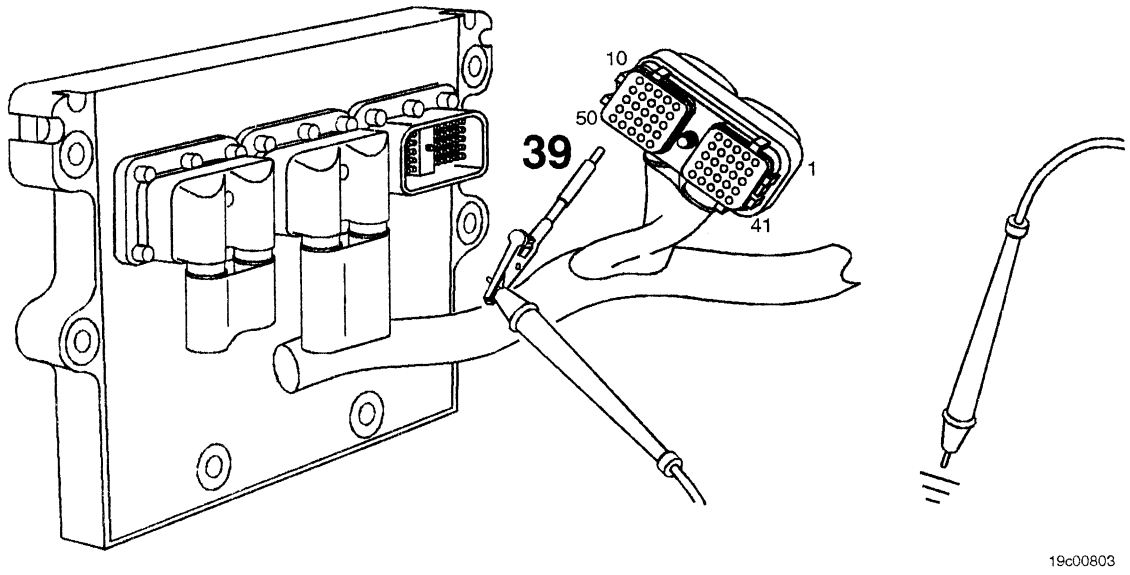
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the intake manifold pressure/temperature sensor from the engine harness.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground. • Measure the resistance from pin 39 of the sensor harness connector to chassis ground.	**OK** **More than 100k ohms**	3D-2
	NOT OK **Replace the engine harness** Refer to Procedure 019-043.	6A



STEP 3D-2: Check for a short circuit from pin to pin.

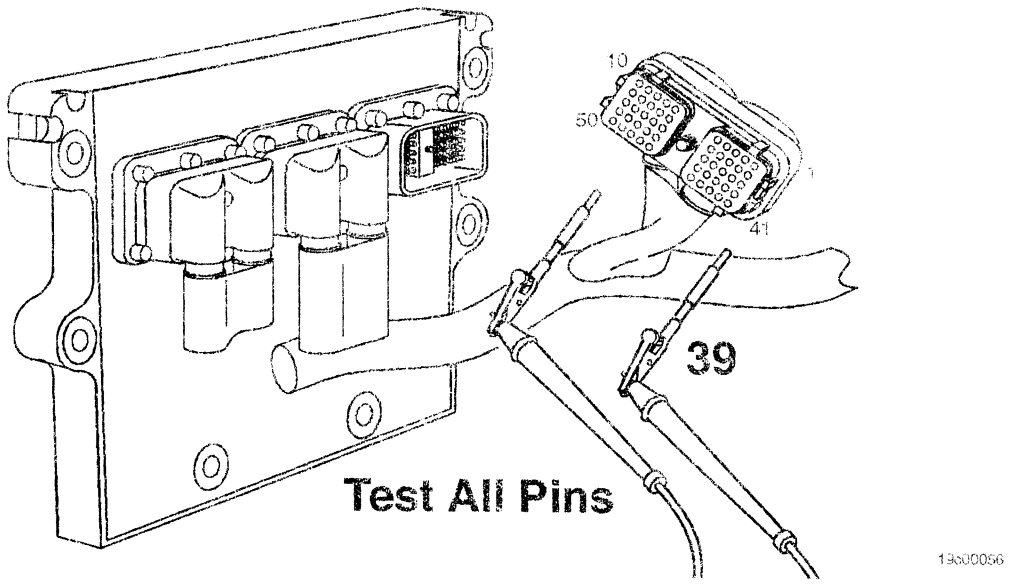
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.
- Disconnect the engine harness from the intake manifold pressure/temperature sensor.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pin 39 of the sensor harness connector to all other pins in the connector.	OK **More than 100k ohms** **Replace the intake manifold pressure/ temperature sensor** Refer to Procedure 019-059.	6A
	NOT OK **Replace the engine harness** Refer to Procedure 019-043.	6A



STEP 4: Check the engine harness.

STEP 4A: Inspect the engine harness and the ECM connector for damaged pins.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:
- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Inspect the engine harness and the ECM connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	4B
	NOT OK **Repair the damaged pins.** Repair or replace the engine harness, or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using the electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	6A

STEP 4B: Read the fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Start the engine and let it idle for 1 minute. • Read the fault codes using INSITE™.	**OK** **Fault Code 123 inactive**	6B
	NOT OK Fault Code 123 active.	4C

STEP 4C: Check for an open circuit.

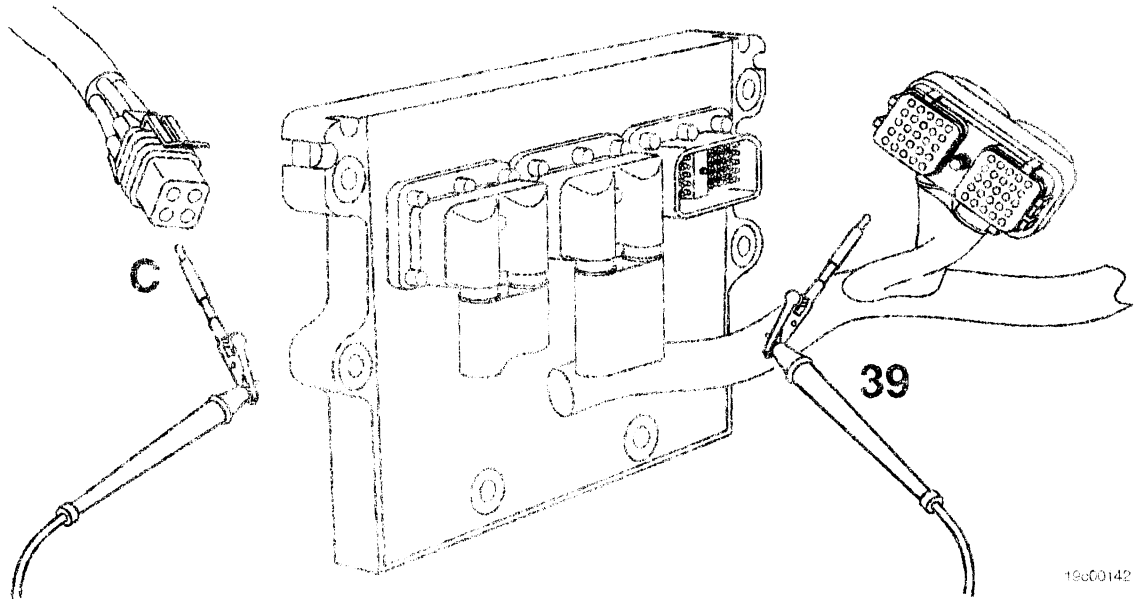
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the intake manifold pressure/temperature sensor from the engine harness.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for an open circuit. • Measure the resistance from pin 39 of the sensor harness connector to pin C for 39 of the intake manifold pressure/temperature sensor connector, harness side.	OK Less than 10 ohms	5A
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-204 or 019-250. • Replace the engine harness. Refer to Procedure 019-043.	6A



STEP 5: Check for an ECM response.

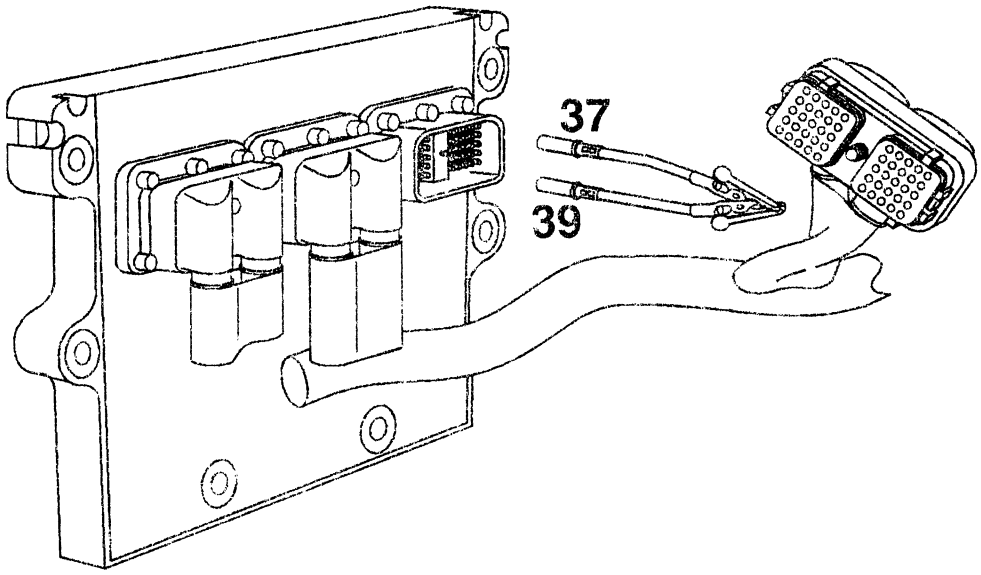
STEP 5A: Check for the appropriate ECM response.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:
- Disconnect the sensor harness connector from the ECM.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check for the appropriate ECM response. • Install a jumper wire between ECM sensor port pin 37 and pin 39.	**OK** **Fault Code 123 inactive and Fault Code 122 active**	6A
	NOT OK **Replace the ECM** Refer to Procedure 019-031.	6A



STEP 6: Clear the fault codes.

STEP 6A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it idle for 1 minute. • Using INSITE™, verify that Fault Code 123 is inactive.	**OK** **Fault Code 123 inactive**	6B
	NOT OK Return to the troubleshooting steps or contact your local Cummins Authorized Repair Location if all the steps have been completed and checked again.	1A

STEP 6B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

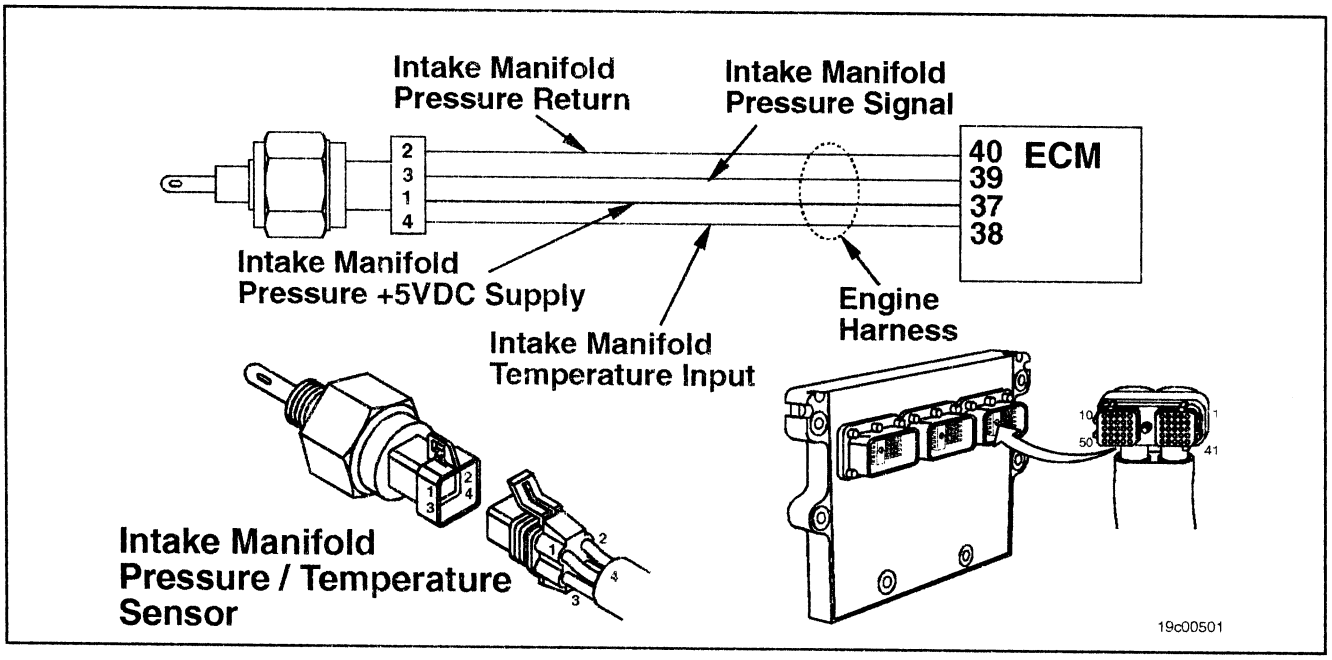
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase inactive fault codes using INSITE™.	**OK** **All faults cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 122

Intake Manifold Pressure Sensor Circuit

CODES	REASON	EFFECT
Fault Code: 122 PID(P), SID(S): P102 SPN: 102 FMI: 3/3 Lamp: Yellow	High voltage detected at the intake manifold pressure sensor circuit.	Derate in power output of the engine.

Intake Manifold Pressure Sensor Circuit



Circuit Description:

The intake manifold pressure/temperature sensor monitors intake manifold pressure and passes information to the electronic control module (ECM) through the engine harness. If the intake manifold pressure becomes too high, it will cause a derate condition.

Component Location:

The intake manifold pressure/temperature sensor is located in the air intake manifold toward the front of the engine.

Shop Talk:

- Determine if engine is being overfueled.
- Confirm that the correct intake manifold pressure/temperature sensor part number is being used.
- Confirm that the correct turbocharger is being used.
- If it is suspected that cold intake air is the cause of the high intake manifold pressure, test the engine with warm intake air.
- Inspect the intake manifold pressure/temperature sensor circuit for signs of tampering. Remove any extra wires from the circuit.

TROUBLESHOOTING SUMMARY

⚠ CAUTION ⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead
Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead
Part No. 3162898 - breakout cable.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the intake manifold pressure/temperature sensor.		
STEP 1A: Inspect the intake manifold pressure/temperature sensor and engine harness connector pins.	No damaged pins	
STEP 1B: Read the fault codes.	Fault Code 122 inactive	
STEP 1C: Check the intake manifold pressure/temperature sensor supply voltage.	(+) 4.75 to 5.25 VDC	
STEP 1C-1: Measure the voltage from the ECM.	(+) 4.75 to 5.25 VDC	
STEP 1D: Check the intake manifold pressure/temperature sensor signal voltage.	(+) 0.42 to 0.58 VDC	
STEP 2: Check the engine harness and the ECM.		
STEP 2A: Inspect the engine harness and the ECM connector pins.	No damaged pins	
STEP 2B: Read the fault codes.	Fault Code 122 inactive	
STEP 2C: Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 2D: Check for an open circuit in the return wire.	Less than 10 ohms	
STEP 3: Check for an ECM response.		
STEP 3A: Check for the appropriate ECM response.	Fault Code 122 inactive Fault Code 123 active	
STEP 4: Clear the fault codes.		
STEP 4A: Disable the fault code.	Fault Code 122 inactive	
STEP 4B: Clear the inactive fault codes.	All faults cleared	

TROUBLESHOOTING STEP

STEP 1: Check the intake manifold pressure/temperature sensor.

STEP 1A: Inspect the intake manifold pressure/temperature sensor and engine harness connector pins.

Condition:
- Turn keyswitch OFF.
- Disconnect the engine harness from the intake manifold pressure/temperature sensor.
- Flush and clean the connector pins using electronic contact cleaner, Part No. 3824510.

Action	Specifications/Repair	Next Step
Inspect the engine harness and sensor connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	1B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the intake manifold pressure/temperature sensor, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. Refer to Procedure 019-203. • Repair the engine harness. Refer to Procedure 019-204. • Replace the engine harness. Refer to Procedure 019-043. • Replace the intake manifold pressure/temperature sensor. Refer to Procedure 019-061.	4A

STEP 1B: Read the fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Start the engine and let it idle for 1 minute. • Read the fault codes using INSITE™.	**OK** **Fault Code 122 inactive**	4B
	NOT OK Fault Code 122 active.	1C

STEP 1C: Check the intake manifold pressure/temperature sensor supply voltage.

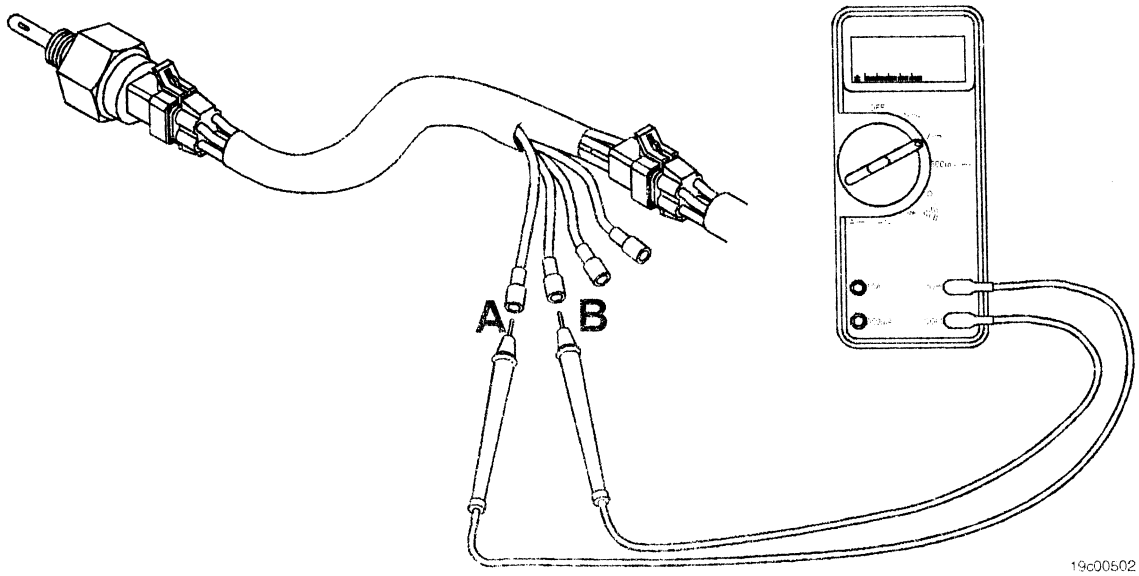
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3162898 - breakout cable.

Condition:

- Install the breakout cable, Part No. 3162898, between the sensor and the engine harness connector.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the intake manifold pressure/temperature sensor supply voltage. • Using a multimeter, measure the supply voltage from pin A (or RED) to pin B (or BLACK) of the breakout cable.	**OK** **(+) 4.75 to 5.25 VDC**	1D
	NOT OK Does **not** meet specifications.	1C-1



STEP 1C-1: Measure the voltage from the ECM.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

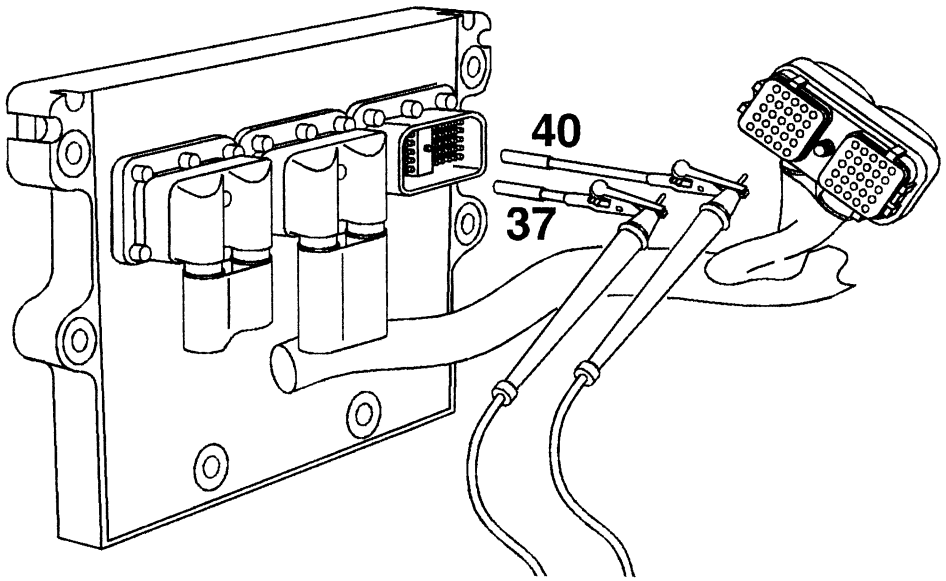
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

Condition:

- Disconnect the sensor harness connector from the ECM.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Verify ECM output voltage. • Measure the voltage out of the ECM from pin 40 to pin 37 at the ECM sensor port.	**OK** **(+) 4.75 to 5.25 VDC** **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	4A
	NOT OK **Replace the ECM** Refer to Procedure 019-031.	4A



19c00001

STEP 1D: Check the intake manifold pressure/temperature sensor signal voltage.

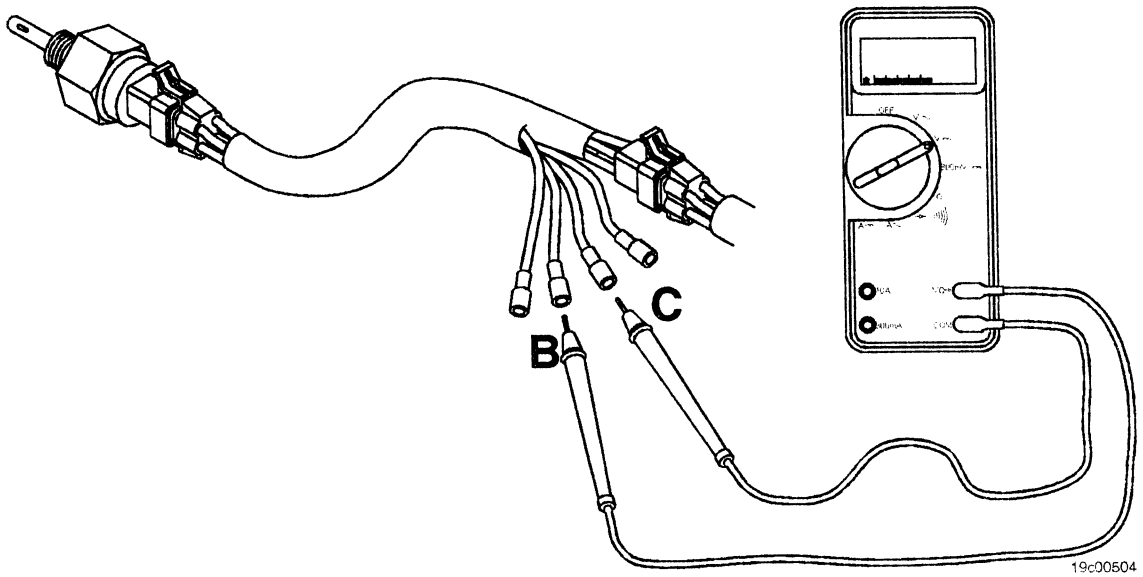
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3162898 - breakout cable.

Condition:

- Install the breakout cable, Part No. 3162898, between the sensor and the engine harness connector.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the intake manifold pressure/temperature sensor signal voltage. • Measure the signal voltage from pin C (or YELLOW) to pin B (or BLACK) of the breakout cable.	**OK** **(+) 0.42 to 0.58 VDC**	3A
	NOT OK Does **not** meet specifications.	2A



STEP 2: Check the engine harness and the ECM.

STEP 2A: Inspect the engine harness and the ECM connector pins.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:
- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.
- Flush and clean the connector pins using electrical contact cleaner, Part No. 3824510.

Action	Specifications/Repair	Next Step
Inspect the engine harness and the ECM connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	2B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	4A

STEP 2B: Read the fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Start the engine and let it idle for 1 minute. • Read the fault codes using INSITE™.	**OK** **Fault Code 122 inactive**	4B
	NOT OK Fault Code 122 active.	2C

STEP 2C: Check for a short circuit from pin to pin.

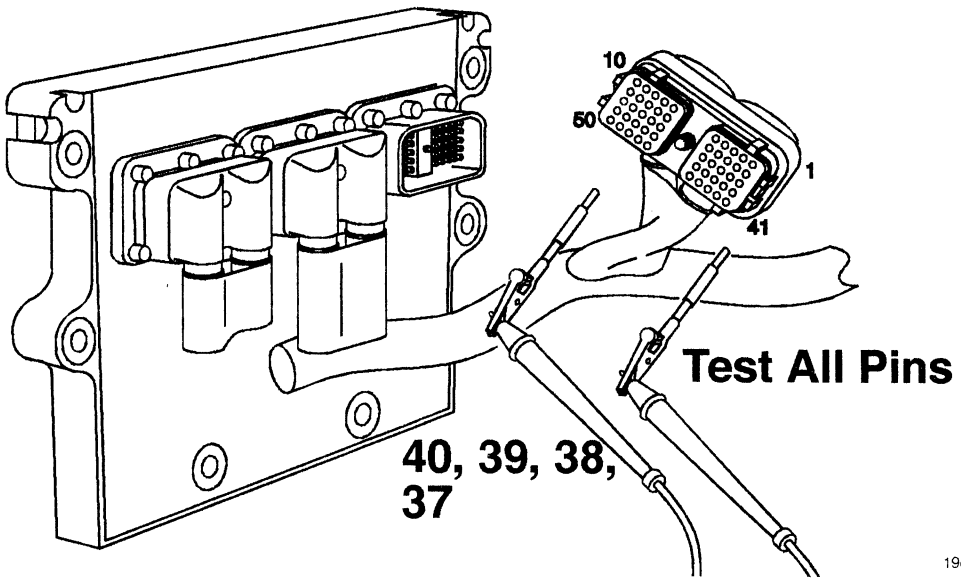
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pin 40 of the sensor harness connector to all other pins in the connector. • Measure the resistance from pin 39 of the sensor harness connector to all other pins in the connector. • Measure the resistance from pin 38 of the sensor harness connector to all other pins in the connector. • Measure the resistance from pin 37 of the sensor harness connector to all other pins in the connector.	**OK** **More than 100k ohms**	2D
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	4A



STEP 2D: Check for an open circuit in the return wire.

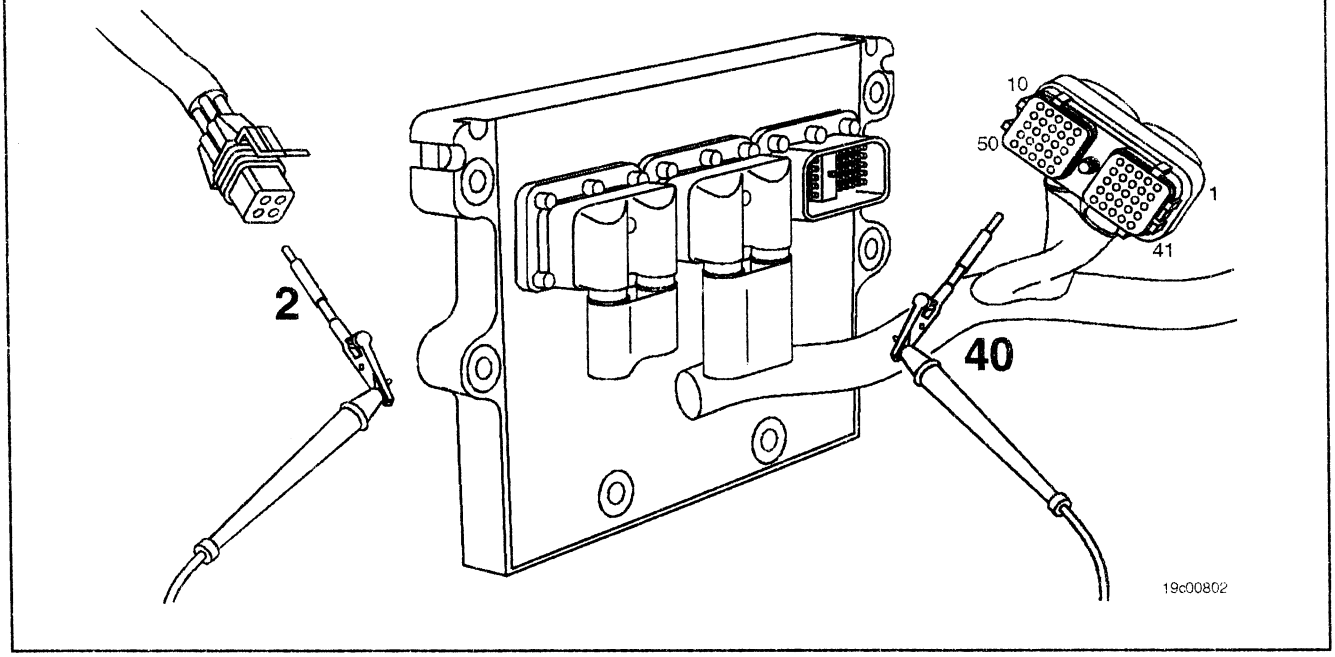
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect sensor harness connector from ECM.
- Disconnect intake manifold pressure/temperature sensor from sensor harness.

Action	Specifications/Repair	Next Step
Check for an open circuit in the return wire. • Measure the resistance from pin 40 of the sensor harness connector at the ECM to pin 2 (or B) of the sensor harness connector, at the sensor end of the harness.	**OK** **Less than 10 ohms** **Replace the intake manifold pressure/ temperature sensor** Refer to Procedure 019-159.	4A
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-204 or 019-250. • Replace the engine harness. Refer to Procedure 019-043.	4A



STEP 3: Check for an ECM response.

STEP 3A: Check for the appropriate ECM response.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:
- Disconnect the sensor harness connector from the ECM.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check for the appropriate ECM response. • Read the fault codes using INSITE™.	**OK** **Fault Code 122 inactive** **Fault Code 123 active**	4A
	NOT OK **Fault Code 122 active** **Replace the ECM** Refer to Procedure 019-031.	4A

STEP 4: Clear the fault codes.

STEP 4A: Disable the fault code.

Condition:
- Connect all components.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it idle for 1 minute. • Verify that Fault Code 122 is inactive.	**OK** **Fault Code 122 inactive**	4B
	NOT OK Return to troubleshooting steps or contact your local Cummins Authorized Repair Location if all steps have been completed and checked again.	1A

STEP 4B: Clear the inactive fault codes.

Condition:
- Connect all components.

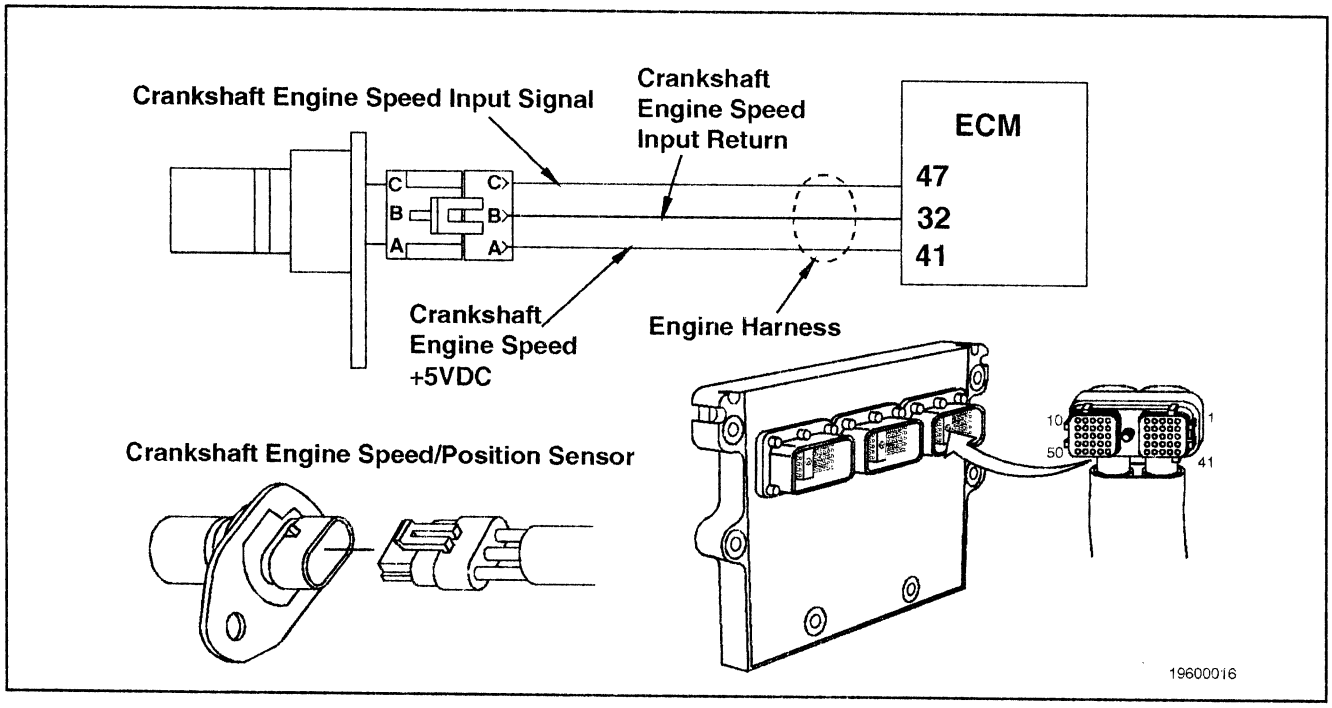
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All faults cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 121

Crankshaft Engine Position Sensor Circuit

CODES	REASON	EFFECT
Fault Code: 121 PID(P), SID(S): P190 SPN: 190 FMI: 10/10 Lamp: Yellow	No engine speed signal detected from the crankshaft engine position sensor.	Hard starting, low power, rough idle, or possible white smoke.

Crankshaft Engine Position Sensor Circuit



Circuit Description:

The crankshaft engine position sensor provides engine speed and position information to the electronic control module (ECM). The sensor **must** be powered up by (+) 5 VDC to operate. The sensor generates the signal by sensing the movement of target teeth machined into a tone wheel that is mounted to the crankshaft.

Component Location:

The crankshaft engine position sensor is located on the side of the front cover on the intake side of the engine.

Shop Talk:

Possible causes of this fault code include a damaged crankshaft engine position sensor, an open or a short circuit, or power supply voltage failure.

TROUBLESHOOTING SUMMARY

⚠ CAUTION ⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead
Part No. 3823995 - male Weather-Pack test lead
Part No. 3824775 - breakout cable.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the crankshaft engine position sensor.		
STEP 1A: Inspect the crankshaft engine position sensor and engine harness connectors.	No damaged pins	
STEP 1B: Check for signal from the crankshaft engine position sensor.	Signal present	
STEP 1B-1: Check crankshaft engine position sensor supply voltage.	(+) 4.75 to 5.25 VDC	
STEP 2: Check the engine harness.		
STEP 2A: Inspect the engine harness and the ECM connectors.	No damaged pins	
STEP 2B: Check for an open circuit.	Less than 10 ohms	
STEP 2C: Check for a short circuit to ground.	More than 100k ohms	
STEP 2D: Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 3: Clear the fault codes.		
STEP 3A: Disable the fault code.	Fault Code 121 inactive	
STEP 3B: Clear the inactive fault codes.	All fault codes cleared	

TROUBLESHOOTING STEP

STEP 1: Check the crankshaft engine position sensor.

STEP 1A: Inspect the crankshaft engine position sensor and the engine harness connectors.

Condition:
- Turn keyswitch OFF.
- Disconnect the engine harness from the crankshaft engine position sensor.
- Connect the sensor harness connector to the ECM.

Action	Specifications/Repair	Next Step
Inspect the crankshaft engine position sensor and the engine harness connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	1B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the sensor, whichever has the damaged pins • Flush the dirt, debris, or moisture from the connector pins using the electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-203. • Replace the engine harness. Refer to Procedure 019-043. • Replace the crankshaft engine position sensor. Refer to Procedure 019-042.	3A

STEP 1B: Check for signal from the crankshaft engine position sensor.

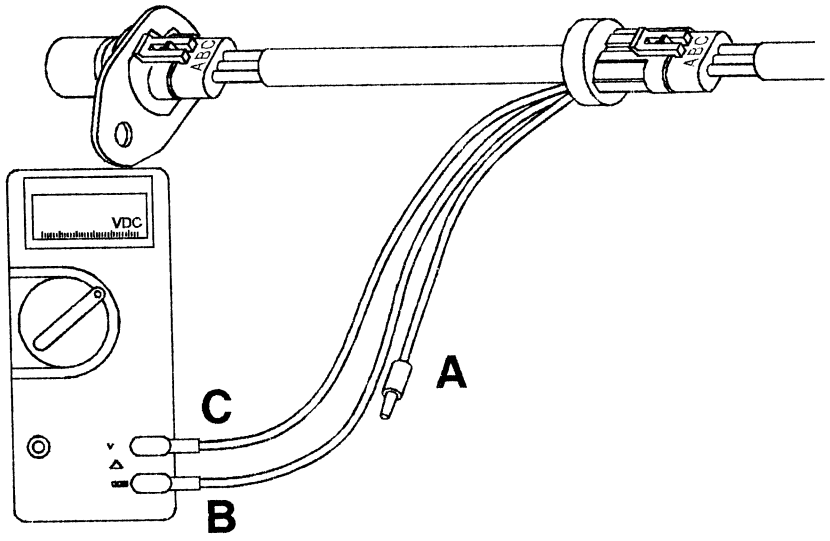
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3824775 - breakout cable

Condition:

- Install breakout cable, Part No. 3824775, between the crankshaft engine position sensor and the engine harness.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check for signal from the crankshaft engine position sensor. • Measure the voltage from pin C (or YELLOW) to pin B (or BLACK) on the breakout cable while barring the engine over.	**OK** **Signal present;** **signal should change from** **(+) 4 - 5 VDC to 0.5 - 2.3 VDC** **and back about every 60° of crankshaft rotation**	2A
	NOT OK Does **not** meet specifications.	1B-1



19c00765

STEP 1B-1: Check crankshaft engine position sensor supply voltage.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

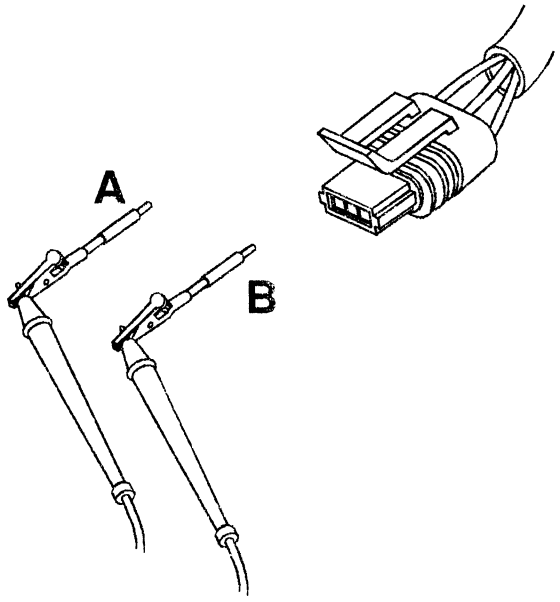
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3823995 - male Weather-Pack test lead.

Condition:

- Disconnect the engine harness from the crankshaft engine position sensor.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check crankshaft engine position sensor supply voltage. • Measure the voltage from pin A (or 1) to pin B (or 2) on the harness side of the crankshaft engine position sensor connector.	**OK** **(+) 4.75 to 5.25 VDC** **Replace the crankshaft engine position sensor** Refer to Procedure 019-042.	3A
	NOT OK **Replace the ECM** Refer to Procedure 019-031.	3A



19200191

STEP 2: Check the engine harness.

STEP 2A: Inspect the engine harness and the ECM connectors.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Inspect the engine harness and the ECM connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	2B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the ECM, whichever has the damaged pins • Flush the dirt, debris, or moisture from the connector pins using the electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	3A

STEP 2B: Check for an open circuit.

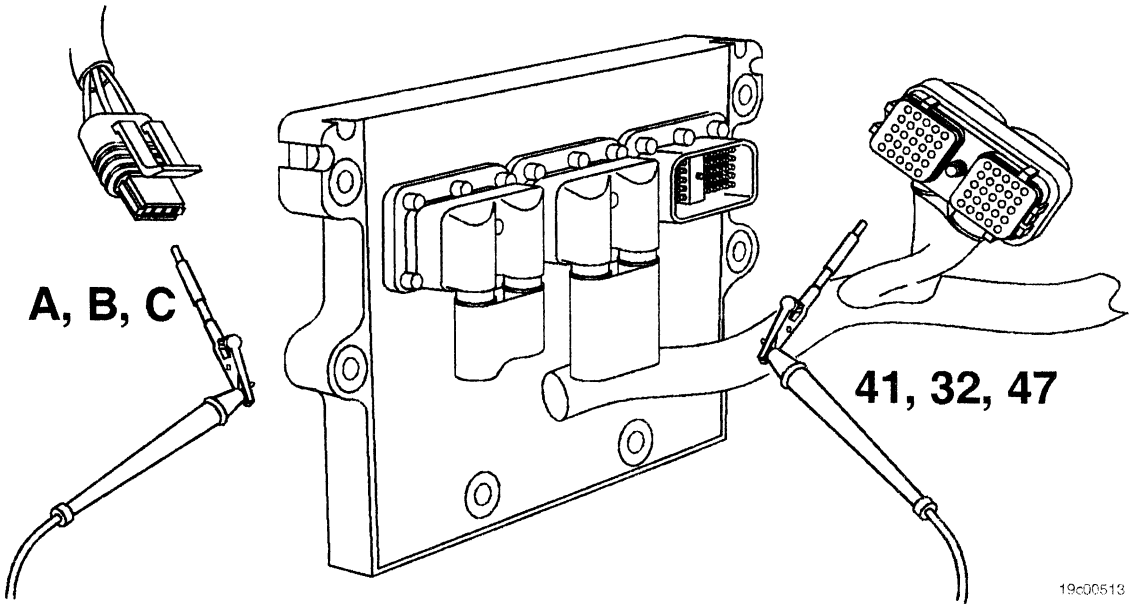
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.
- Disconnect the sensor harness from the crankshaft engine position sensor.

Action	Specifications/Repair	Next Step
Check for an open circuit. • Measure the resistance from pin 41 of the sensor harness connector to pin A (or 1) on the harness side of the crankshaft engine position sensor connector. • Measure the resistance from pin 32 of the sensor harness connector to pin B (or 2) on the harness side of the crankshaft engine position sensor connector. • Measure the resistance from pin 47 of the sensor harness connector to pin C (or 3) on the harness side of the crankshaft engine position sensor connector.	**OK** **Less than 10 ohms**	2C
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-203 or 019-250. • Replace the engine harness. Refer to Procedure 019-043.	3A



STEP 2C: Check for a short circuit to ground.

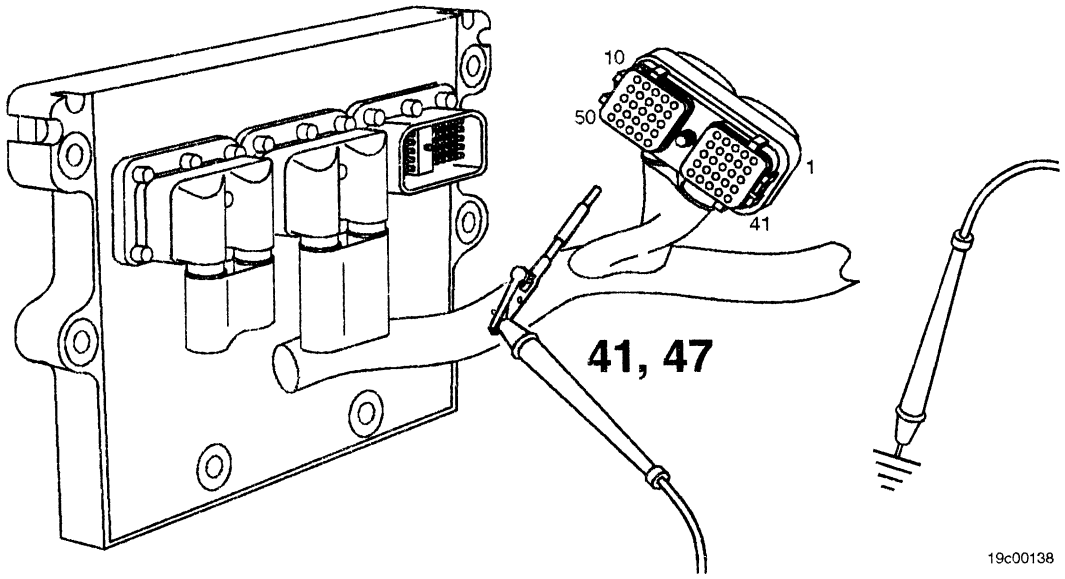
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.
- Disconnect the engine harness from the crankshaft engine position sensor.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground. • Measure the resistance from pin 41 of the sensor harness connector to engine block ground. • Measure the resistance from pin 47 of the sensor harness connector to engine block ground.	**OK** **More than 100k ohms**	2D
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	3A



STEP 2D: Check for a short circuit from pin to pin.

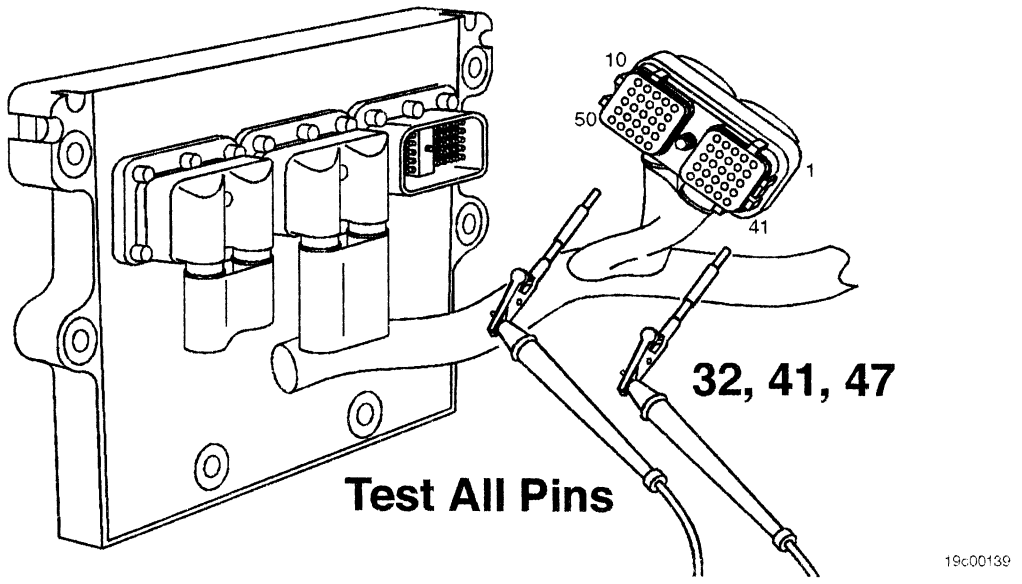
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.
- Disconnect the engine harness from the crankshaft engine position sensor.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin in the (+) 5-VDC supply wire and the signal wire. • Measure resistance from pin 32 of the sensor harness connector to all other pins in the connector. • Measure resistance from pin 41 of the sensor harness connector to all other pins in the connector. • Measure resistance from pin 47 of the sensor harness connector to all other pins in the connector.	**OK** **More than 100k ohms**	3A
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	3A



STEP 3: Clear the fault codes.

STEP 3A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it idle for 1 minute. • Using INSITE™, verify Fault Code 121 is inactive.	**OK** **Fault Code 121 inactive**	3B
	NOT OK Return to the troubleshooting steps or contact your local Cummins Authorized Repair Location if all the steps have been completed and checked again.	1A

STEP 3B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

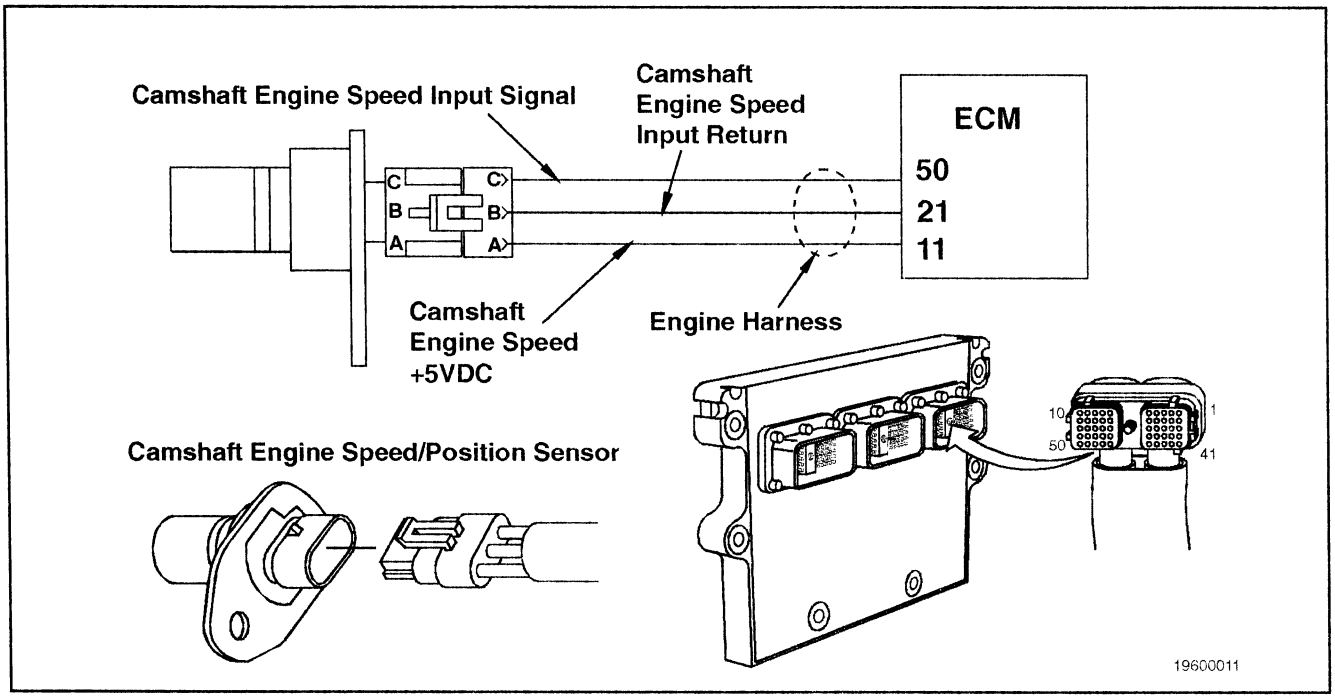
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 115

Camshaft Engine Position Sensor Circuit

CODES	REASON	EFFECT
Fault Code: 115 PID(P), SID(S): P190 SPN: 190 FMI: 2/2 Lamp: Red	No engine speed signal detected from the camshaft engine position sensor.	Engine may take longer to start.

Camshaft Engine Position Sensor Circuit



Circuit Description:

The camshaft engine position sensor provides engine speed and position information to the electronic control module (ECM). The sensor **must** be powered up by (+) 5 VDC to operate. The sensor generates the signal from an extra lobe on the camshaft.

Component Location:

The camshaft engine position sensor is located on the intake side of the engine block on the cylinder head to the right of the ECM.

Shop Talk:

Possible causes of this fault code include a damaged camshaft engine position sensor, an open or a short circuit, or power supply voltage failure.

TROUBLESHOOTING SUMMARY

⚠ CAUTION ⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead
Part No. 3823995 - male Weather-Pack test lead
Part No. 3824775 - breakout cable.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the camshaft engine position sensor.		
STEP 1A: Inspect the camshaft engine position sensor and engine harness connectors.	No damaged pins	
STEP 1B: Check for a signal from the camshaft engine position sensor.	Signal present	
STEP 1B-1: Check the camshaft engine position sensor supply voltage.	(+) 4.75 to 5.25 VDC	
STEP 2: Check the engine harness.		
STEP 2A: Inspect the engine harness and the ECM connectors.	No damaged pins	
STEP 2B: Check for an open circuit.	Less than 10 ohms	
STEP 2C: Check for a short circuit to ground.	More than 100k ohms	
STEP 2D: Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 3: Clear the fault codes.		
STEP 3A: Disable the fault code.	Fault Code 115 inactive	
STEP 3B: Clear the inactive fault codes.	All fault codes cleared	

STEP 1C: Check the intake manifold pressure/temperature sensor supply voltage.

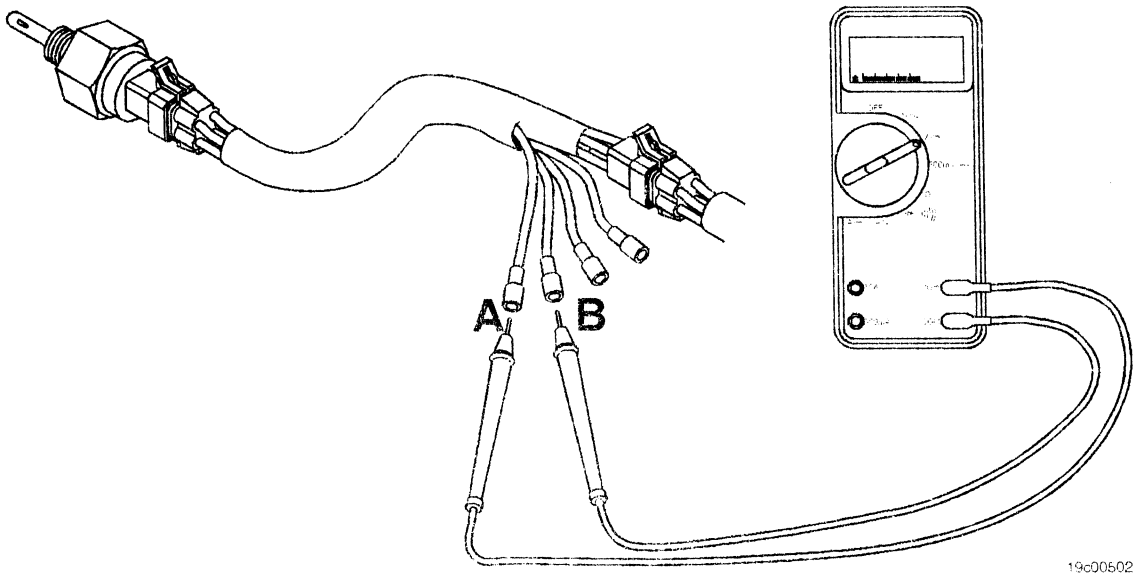
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3162898 - breakout cable.

Condition:

- Install the breakout cable, Part No. 3162898, between the sensor and the engine harness connector.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the intake manifold pressure/temperature sensor supply voltage. • Using a multimeter, measure the supply voltage from pin A (or RED) to pin B (or BLACK) of the breakout cable.	**OK** **(+) 4.75 to 5.25 VDC**	1D
	NOT OK Does **not** meet specifications.	1C-1



STEP 1C-1: Measure the voltage from the ECM.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

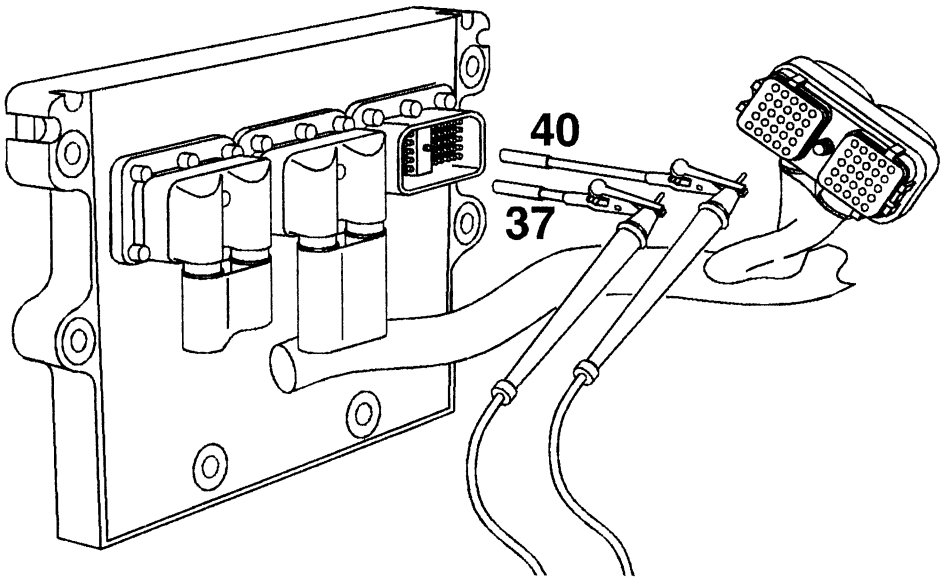
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

Condition:

- Disconnect the sensor harness connector from the ECM.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Verify ECM output voltage. • Measure the voltage out of the ECM from pin 40 to pin 37 at the ECM sensor port.	**OK** **(+) 4.75 to 5.25 VDC** **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	4A
	NOT OK **Replace the ECM** Refer to Procedure 019-031.	4A



STEP 1D: Check the intake manifold pressure/temperature sensor signal voltage.

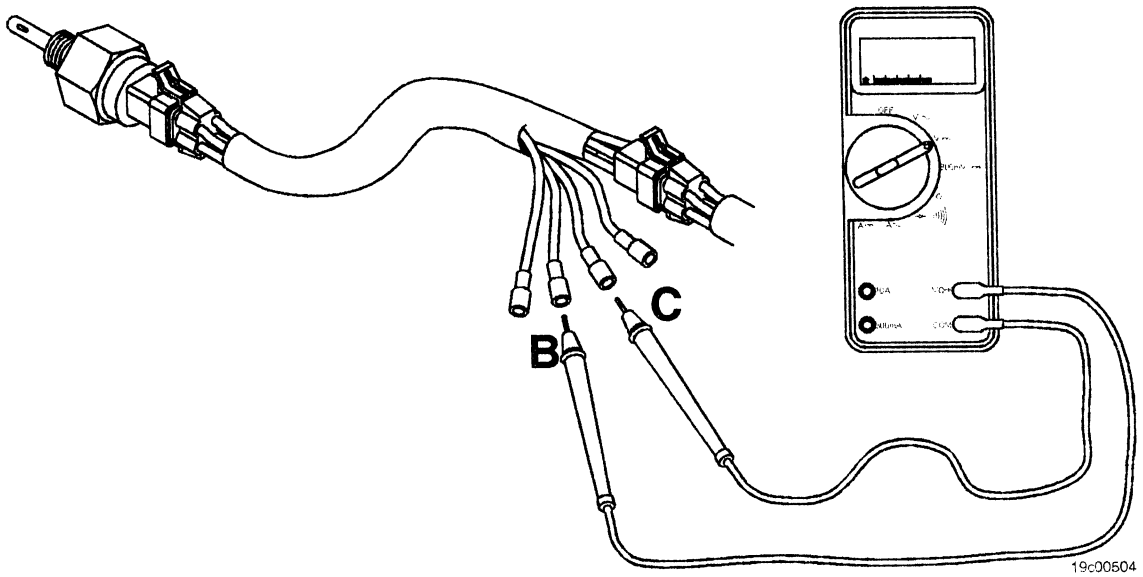
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3162898 - breakout cable.

Condition:

- Install the breakout cable, Part No. 3162898, between the sensor and the engine harness connector.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the intake manifold pressure/temperature sensor signal voltage. • Measure the signal voltage from pin C (or YELLOW) to pin B (or BLACK) of the breakout cable.	**OK** **(+) 0.42 to 0.58 VDC**	3A
	NOT OK Does **not** meet specifications.	2A



STEP 2: Check the engine harness and the ECM.

STEP 2A: Inspect the engine harness and the ECM connector pins.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:
- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.
- Flush and clean the connector pins using electrical contact cleaner, Part No. 3824510.

Action	Specifications/Repair	Next Step
Inspect the engine harness and the ECM connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	2B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	4A

STEP 2B: Read the fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Start the engine and let it idle for 1 minute. • Read the fault codes using INSITE™.	**OK** **Fault Code 122 inactive**	4B
	NOT OK Fault Code 122 active.	2C

STEP 2C: Check for a short circuit from pin to pin.

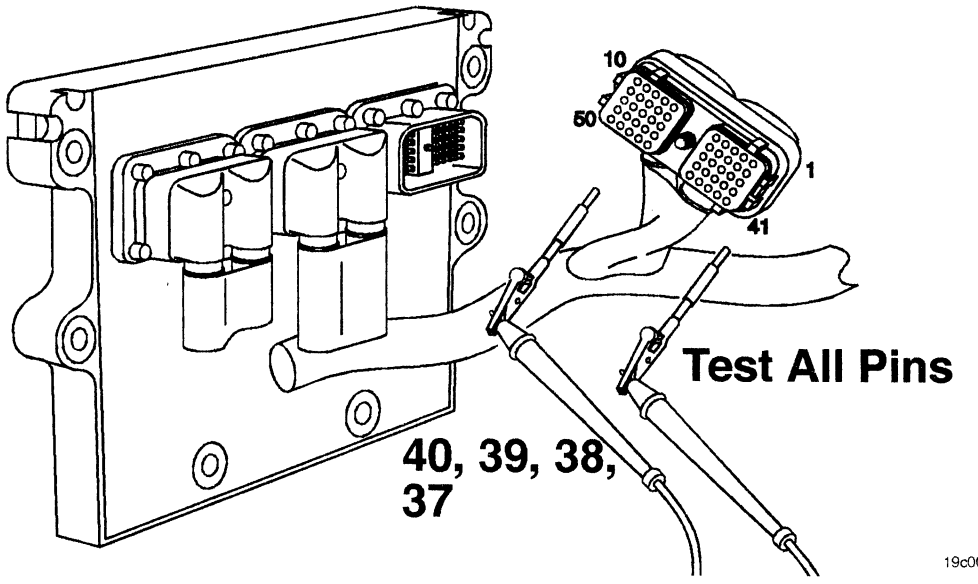
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pin 40 of the sensor harness connector to all other pins in the connector. • Measure the resistance from pin 39 of the sensor harness connector to all other pins in the connector. • Measure the resistance from pin 38 of the sensor harness connector to all other pins in the connector. • Measure the resistance from pin 37 of the sensor harness connector to all other pins in the connector.	**OK** **More than 100k ohms**	2D
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	4A



STEP 2D: Check for an open circuit in the return wire.

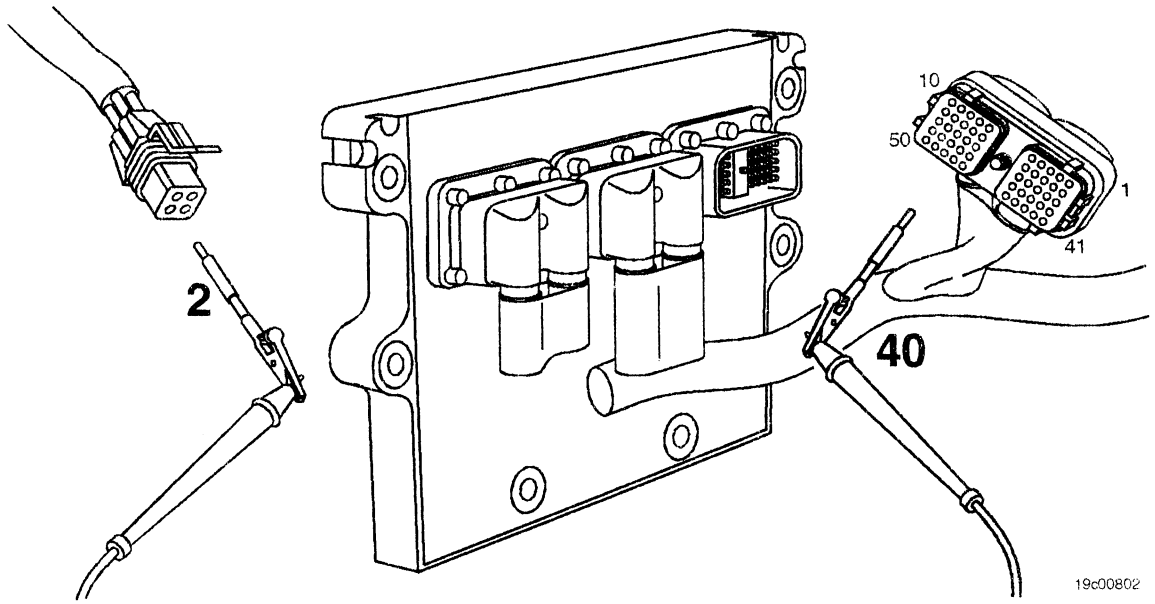
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect sensor harness connector from ECM.
- Disconnect intake manifold pressure/temperature sensor from sensor harness.

Action	Specifications/Repair	Next Step
Check for an open circuit in the return wire. • Measure the resistance from pin 40 of the sensor harness connector at the ECM to pin 2 (or B) of the sensor harness connector, at the sensor end of the harness.	**OK** **Less than 10 ohms** **Replace the intake manifold pressure/ temperature sensor** Refer to Procedure 019-159.	4A
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-204 or 019-250. • Replace the engine harness. Refer to Procedure 019-043.	4A



STEP 3: Check for an ECM response.

STEP 3A: Check for the appropriate ECM response.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:
- Disconnect the sensor harness connector from the ECM.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check for the appropriate ECM response. • Read the fault codes using INSITE™.	**OK** **Fault Code 122 inactive** **Fault Code 123 active**	4A
	NOT OK **Fault Code 122 active** **Replace the ECM** Refer to Procedure 019-031.	4A

STEP 4: Clear the fault codes.

STEP 4A: Disable the fault code.

Condition:
- Connect all components.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it idle for 1 minute. • Verify that Fault Code 122 is inactive.	**OK** **Fault Code 122 inactive**	4B
	NOT OK Return to troubleshooting steps or contact your local Cummins Authorized Repair Location if all steps have been completed and checked again.	1A

STEP 4B: Clear the inactive fault codes.

Condition:
- Connect all components.

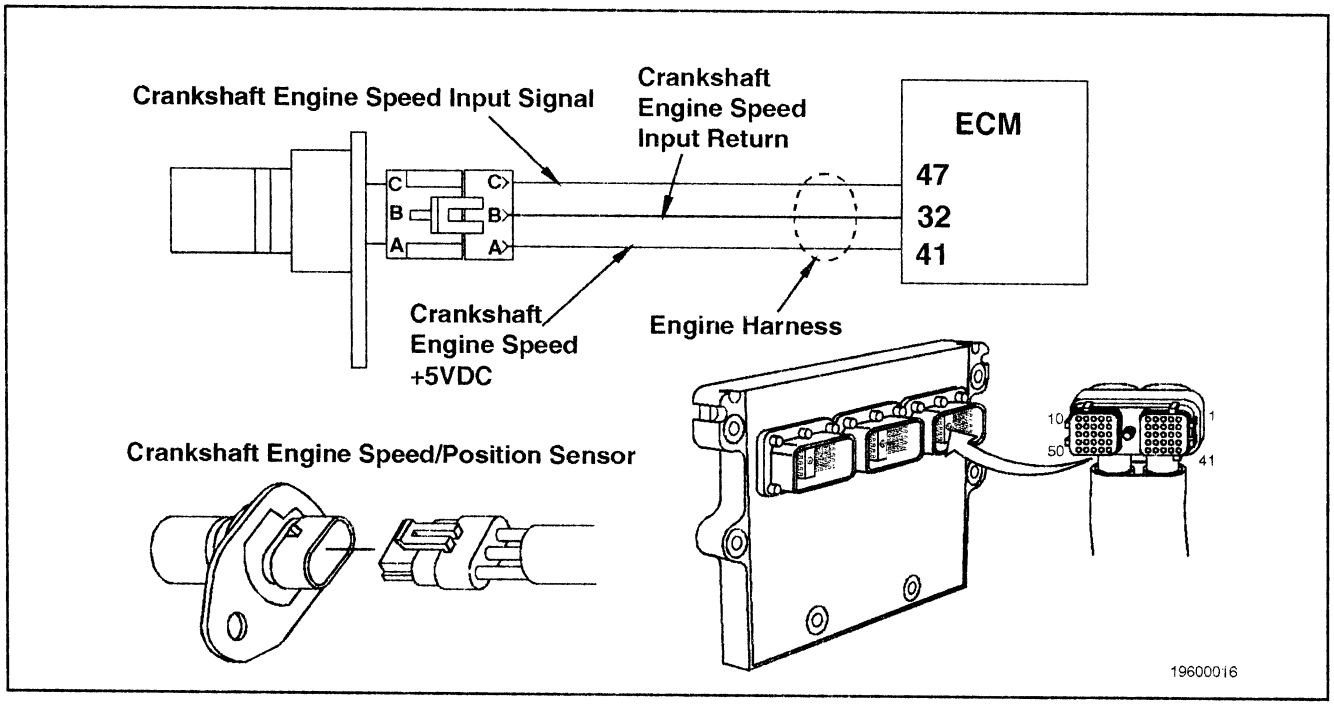
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All faults cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 121

Crankshaft Engine Position Sensor Circuit

CODES	REASON	EFFECT
Fault Code: 121 PID(P), SID(S): P190 SPN: 190 FMI: 10/10 Lamp: Yellow	No engine speed signal detected from the crankshaft engine position sensor.	Hard starting, low power, rough idle, or possible white smoke.

Crankshaft Engine Position Sensor Circuit



Circuit Description:

The crankshaft engine position sensor provides engine speed and position information to the electronic control module (ECM). The sensor **must** be powered up by (+) 5 VDC to operate. The sensor generates the signal by sensing the movement of target teeth machined into a tone wheel that is mounted to the crankshaft.

Component Location:

The crankshaft engine position sensor is located on the side of the front cover on the intake side of the engine.

Shop Talk:

Possible causes of this fault code include a damaged crankshaft engine position sensor, an open or a short circuit, or power supply voltage failure.

TROUBLESHOOTING SUMMARY

⚠ CAUTION ⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead
Part No. 3823995 - male Weather-Pack test lead
Part No. 3824775 - breakout cable.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the crankshaft engine position sensor.		
STEP 1A: Inspect the crankshaft engine position sensor and engine harness connectors.	No damaged pins	
STEP 1B: Check for signal from the crankshaft engine position sensor.	Signal present	
STEP 1B-1: Check crankshaft engine position sensor supply voltage.	(+) 4.75 to 5.25 VDC	
STEP 2: Check the engine harness.		
STEP 2A: Inspect the engine harness and the ECM connectors.	No damaged pins	
STEP 2B: Check for an open circuit.	Less than 10 ohms	
STEP 2C: Check for a short circuit to ground.	More than 100k ohms	
STEP 2D: Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 3: Clear the fault codes.		
STEP 3A: Disable the fault code.	Fault Code 121 inactive	
STEP 3B: Clear the inactive fault codes.	All fault codes cleared	

TROUBLESHOOTING STEP

STEP 1: Check the crankshaft engine position sensor.

STEP 1A: Inspect the crankshaft engine position sensor and the engine harness connectors.

Condition:
- Turn keyswitch OFF.
- Disconnect the engine harness from the crankshaft engine position sensor.
- Connect the sensor harness connector to the ECM.

Action	Specifications/Repair	Next Step
Inspect the crankshaft engine position sensor and the engine harness connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	1B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the sensor, whichever has the damaged pins • Flush the dirt, debris, or moisture from the connector pins using the electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-203. • Replace the engine harness. Refer to Procedure 019-043. • Replace the crankshaft engine position sensor. Refer to Procedure 019-042.	3A

STEP 1B: Check for signal from the crankshaft engine position sensor.

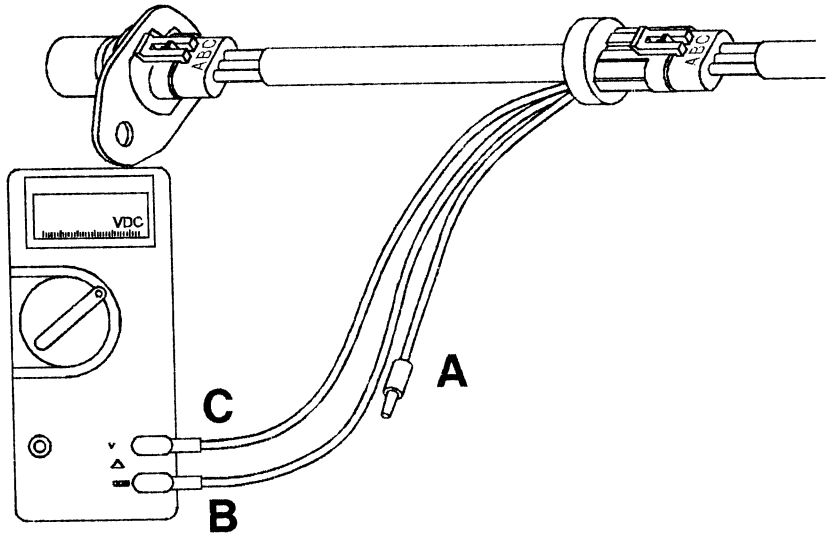
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3824775 - breakout cable

Condition:

- Install breakout cable, Part No. 3824775, between the crankshaft engine position sensor and the engine harness.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check for signal from the crankshaft engine position sensor. • Measure the voltage from pin C (or YELLOW) to pin B (or BLACK) on the breakout cable while barring the engine over.	**OK** **Signal present;** **signal should change from** **(+) 4 - 5 VDC to 0.5 - 2.3 VDC** **and back about every 60° of crankshaft rotation**	2A
	NOT OK Does **not** meet specifications.	1B-1



19c00765

STEP 1B-1: Check crankshaft engine position sensor supply voltage.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

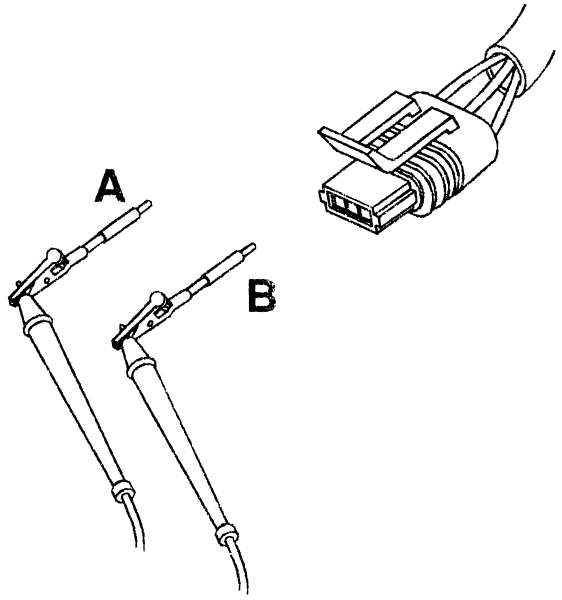
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3823995 - male Weather-Pack test lead.

Condition:

- Disconnect the engine harness from the crankshaft engine position sensor.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check crankshaft engine position sensor supply voltage. • Measure the voltage from pin A (or 1) to pin B (or 2) on the harness side of the crankshaft engine position sensor connector.	**OK** **(+) 4.75 to 5.25 VDC** **Replace the crankshaft engine position sensor** Refer to Procedure 019-042.	3A
	NOT OK **Replace the ECM** Refer to Procedure 019-031.	3A



19200191

STEP 1C: Check the intake manifold pressure/temperature sensor supply voltage.

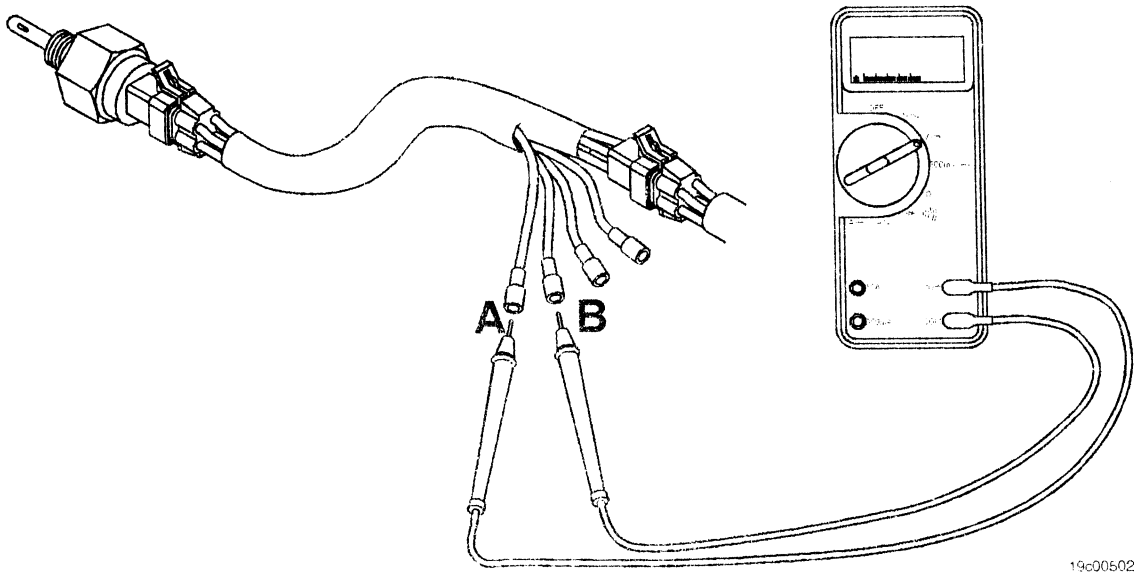
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3162898 - breakout cable.

Condition:

- Install the breakout cable, Part No. 3162898, between the sensor and the engine harness connector.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the intake manifold pressure/temperature sensor supply voltage. • Using a multimeter, measure the supply voltage from pin A (or RED) to pin B (or BLACK) of the breakout cable.	**OK** **(+) 4.75 to 5.25 VDC**	1D
	NOT OK Does **not** meet specifications.	1C-1



STEP 1C-1: Measure the voltage from the ECM.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

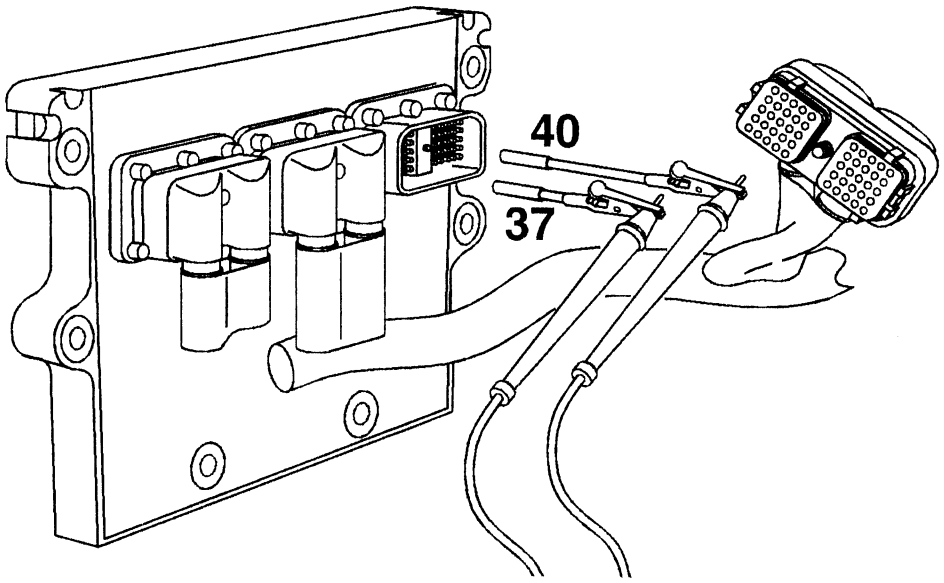
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

Condition:

- Disconnect the sensor harness connector from the ECM.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Verify ECM output voltage. • Measure the voltage out of the ECM from pin 40 to pin 37 at the ECM sensor port.	**OK** **(+) 4.75 to 5.25 VDC** **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	4A
	NOT OK **Replace the ECM** Refer to Procedure 019-031.	4A



STEP 1D: Check the intake manifold pressure/temperature sensor signal voltage.

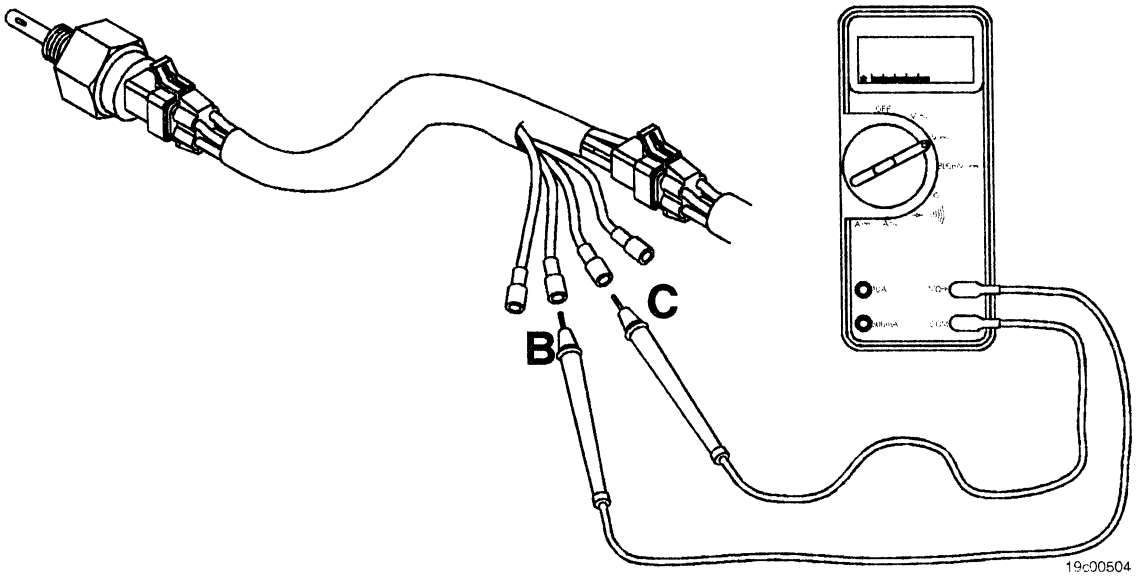
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3162898 - breakout cable.

Condition:

- Install the breakout cable, Part No. 3162898, between the sensor and the engine harness connector.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the intake manifold pressure/temperature sensor signal voltage. • Measure the signal voltage from pin C (or YELLOW) to pin B (or BLACK) of the breakout cable.	**OK** **(+) 0.42 to 0.58 VDC**	3A
	NOT OK Does **not** meet specifications.	2A



STEP 2: Check the engine harness and the ECM.

STEP 2A: Inspect the engine harness and the ECM connector pins.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:
- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.
- Flush and clean the connector pins using electrical contact cleaner, Part No. 3824510.

Action	Specifications/Repair	Next Step
Inspect the engine harness and the ECM connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	2B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	4A

STEP 2B: Read the fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Start the engine and let it idle for 1 minute. • Read the fault codes using INSITE™.	**OK** **Fault Code 122 inactive**	4B
	NOT OK Fault Code 122 active.	2C

STEP 2C: Check for a short circuit from pin to pin.

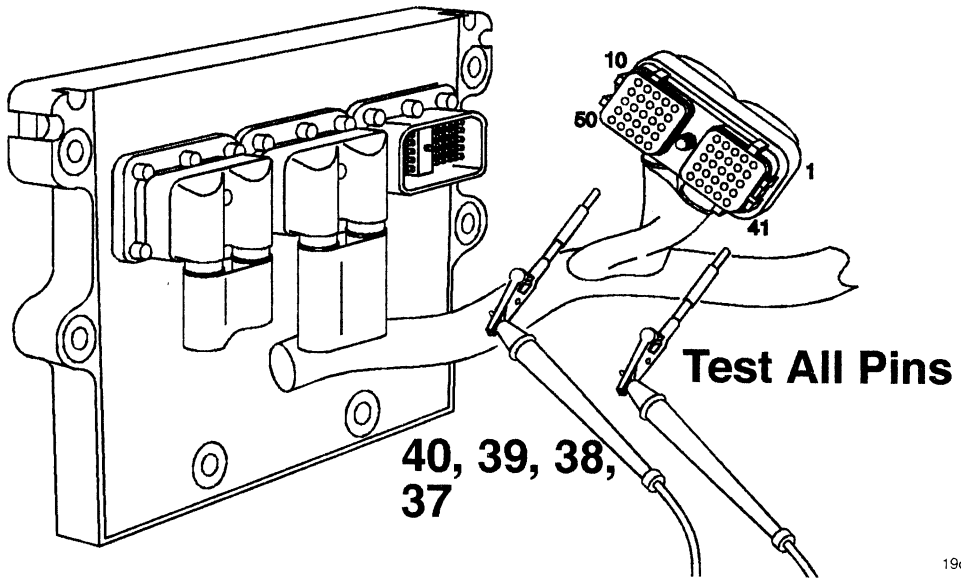
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pin 40 of the sensor harness connector to all other pins in the connector. • Measure the resistance from pin 39 of the sensor harness connector to all other pins in the connector. • Measure the resistance from pin 38 of the sensor harness connector to all other pins in the connector. • Measure the resistance from pin 37 of the sensor harness connector to all other pins in the connector.	**OK** **More than 100k ohms**	2D
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	4A



STEP 2D: Check for an open circuit in the return wire.

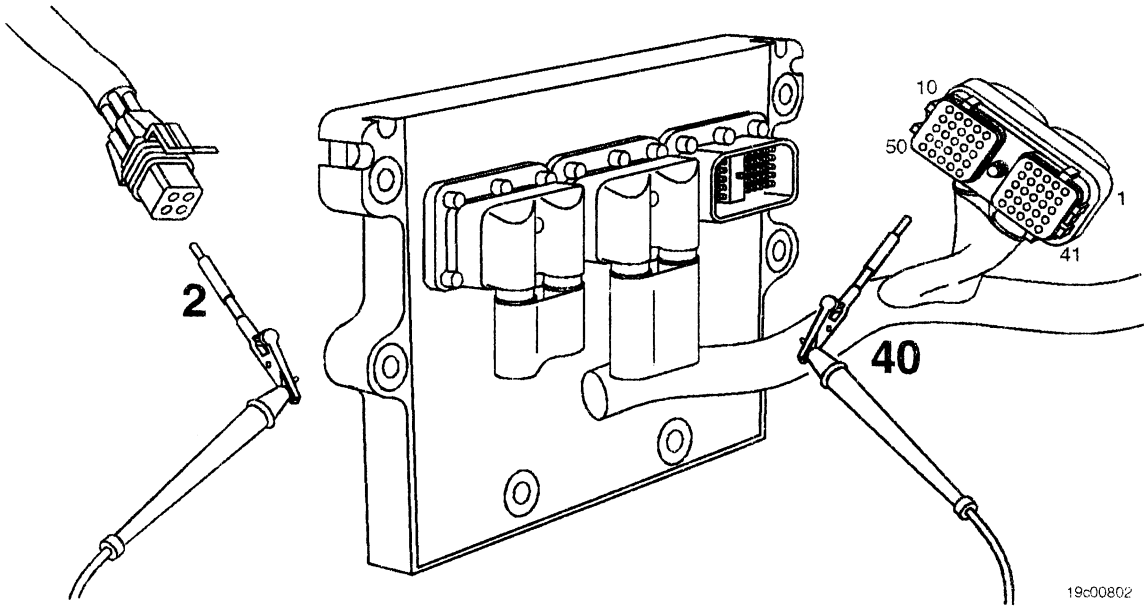
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect sensor harness connector from ECM.
- Disconnect intake manifold pressure/temperature sensor from sensor harness.

Action	Specifications/Repair	Next Step
Check for an open circuit in the return wire. • Measure the resistance from pin 40 of the sensor harness connector at the ECM to pin 2 (or B) of the sensor harness connector, at the sensor end of the harness.	**OK** **Less than 10 ohms** **Replace the intake manifold pressure/ temperature sensor** Refer to Procedure 019-159.	4A
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-204 or 019-250. • Replace the engine harness. Refer to Procedure 019-043.	4A



STEP 3: Check for an ECM response.

STEP 3A: Check for the appropriate ECM response.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:
- Disconnect the sensor harness connector from the ECM.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check for the appropriate ECM response. • Read the fault codes using INSITE™.	**OK** **Fault Code 122 inactive** **Fault Code 123 active**	4A
	NOT OK **Fault Code 122 active** **Replace the ECM** Refer to Procedure 019-031.	4A

STEP 4: Clear the fault codes.

STEP 4A: Disable the fault code.

Condition:
- Connect all components.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it idle for 1 minute. • Verify that Fault Code 122 is inactive.	**OK** **Fault Code 122 inactive**	4B
	NOT OK Return to troubleshooting steps or contact your local Cummins Authorized Repair Location if all steps have been completed and checked again.	1A

STEP 4B: Clear the inactive fault codes.

Condition:
- Connect all components.

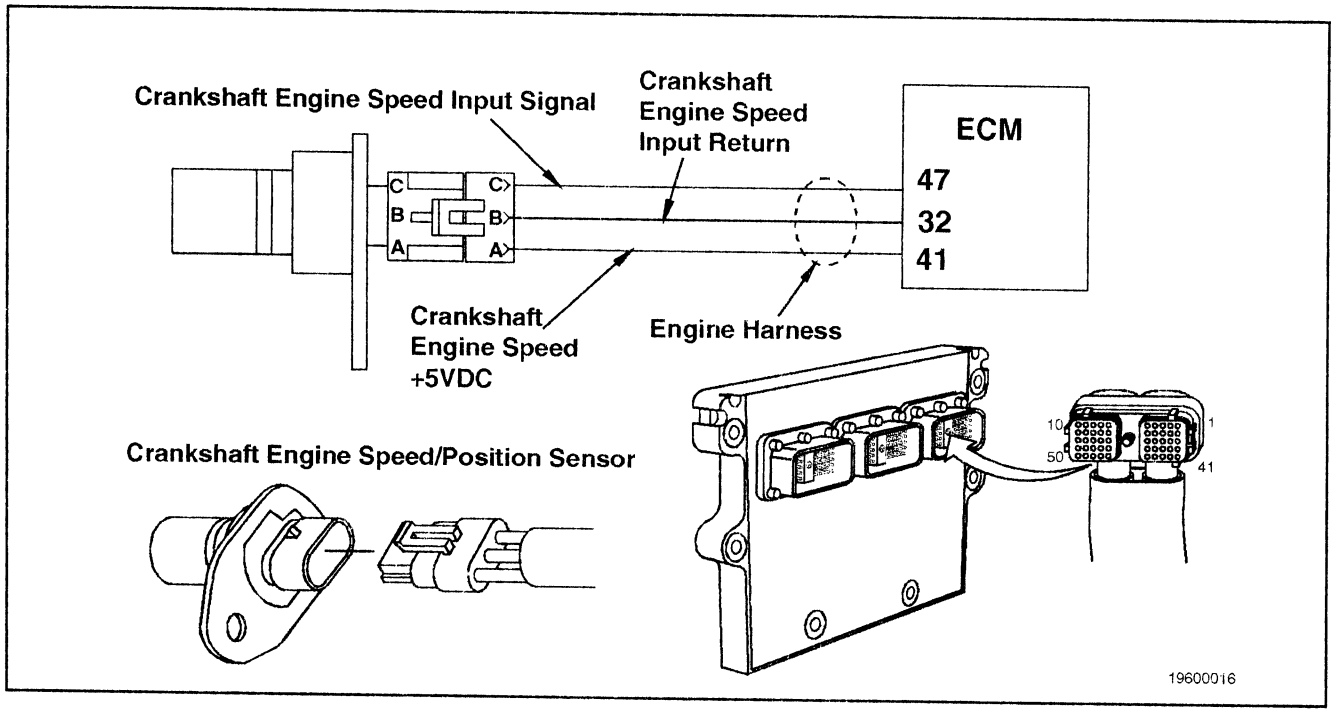
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All faults cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 121

Crankshaft Engine Position Sensor Circuit

CODES	REASON	EFFECT
Fault Code: 121 PID(P), SID(S): P190 SPN: 190 FMI: 10/10 Lamp: Yellow	No engine speed signal detected from the crankshaft engine position sensor.	Hard starting, low power, rough idle, or possible white smoke.

Crankshaft Engine Position Sensor Circuit



Circuit Description:

The crankshaft engine position sensor provides engine speed and position information to the electronic control module (ECM). The sensor **must** be powered up by (+) 5 VDC to operate. The sensor generates the signal by sensing the movement of target teeth machined into a tone wheel that is mounted to the crankshaft.

Component Location:

The crankshaft engine position sensor is located on the side of the front cover on the intake side of the engine.

Shop Talk:

Possible causes of this fault code include a damaged crankshaft engine position sensor, an open or a short circuit, or power supply voltage failure.

TROUBLESHOOTING SUMMARY

⚠ CAUTION ⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead
Part No. 3823995 - male Weather-Pack test lead
Part No. 3824775 - breakout cable.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the crankshaft engine position sensor.		
STEP 1A: Inspect the crankshaft engine position sensor and engine harness connectors.	No damaged pins	
STEP 1B: Check for signal from the crankshaft engine position sensor.	Signal present	
STEP 1B-1: Check crankshaft engine position sensor supply voltage.	(+) 4.75 to 5.25 VDC	
STEP 2: Check the engine harness.		
STEP 2A: Inspect the engine harness and the ECM connectors.	No damaged pins	
STEP 2B: Check for an open circuit.	Less than 10 ohms	
STEP 2C: Check for a short circuit to ground.	More than 100k ohms	
STEP 2D: Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 3: Clear the fault codes.		
STEP 3A: Disable the fault code.	Fault Code 121 inactive	
STEP 3B: Clear the inactive fault codes.	All fault codes cleared	

TROUBLESHOOTING STEP

STEP 1: Check the crankshaft engine position sensor.

STEP 1A: Inspect the crankshaft engine position sensor and the engine harness connectors.

Condition:
- Turn keyswitch OFF.
- Disconnect the engine harness from the crankshaft engine position sensor.
- Connect the sensor harness connector to the ECM.

Action	Specifications/Repair	Next Step
Inspect the crankshaft engine position sensor and the engine harness connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	1B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the sensor, whichever has the damaged pins • Flush the dirt, debris, or moisture from the connector pins using the electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-203. • Replace the engine harness. Refer to Procedure 019-043. • Replace the crankshaft engine position sensor. Refer to Procedure 019-042.	3A

STEP 1B: Check for signal from the crankshaft engine position sensor.

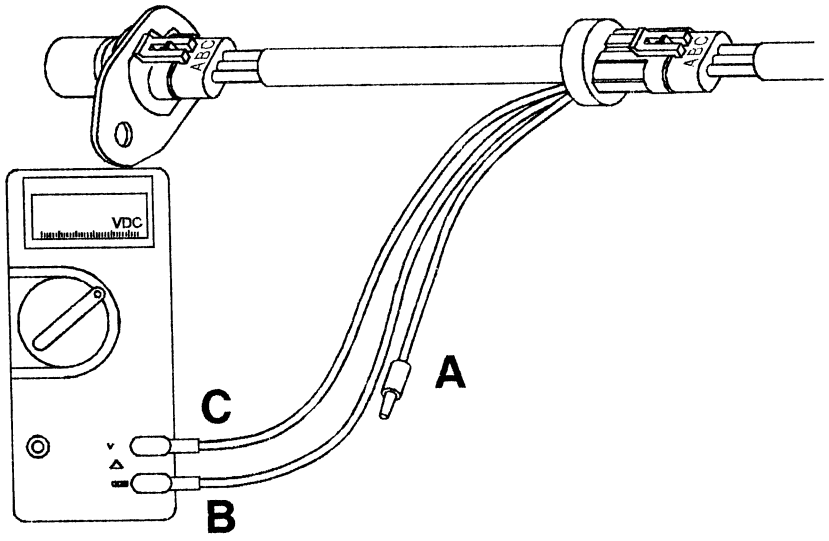
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3824775 - breakout cable

Condition:

- Install breakout cable, Part No. 3824775, between the crankshaft engine position sensor and the engine harness.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check for signal from the crankshaft engine position sensor. • Measure the voltage from pin C (or YELLOW) to pin B (or BLACK) on the breakout cable while barring the engine over.	**OK** **Signal present;** **signal should change from** **(+) 4 - 5 VDC to 0.5 - 2.3 VDC** **and back about every 60° of crankshaft rotation**	2A
	NOT OK Does **not** meet specifications.	1B-1



19c00765

STEP 1B-1: Check crankshaft engine position sensor supply voltage.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

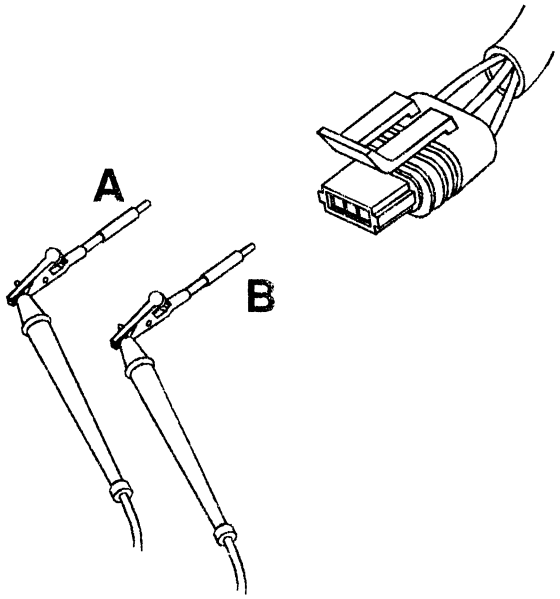
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3823995 - male Weather-Pack test lead.

Condition:

- Disconnect the engine harness from the crankshaft engine position sensor.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check crankshaft engine position sensor supply voltage. • Measure the voltage from pin A (or 1) to pin B (or 2) on the harness side of the crankshaft engine position sensor connector.	**OK** **(+) 4.75 to 5.25 VDC** **Replace the crankshaft engine position sensor** Refer to Procedure 019-042.	3A
	NOT OK **Replace the ECM** Refer to Procedure 019-031.	3A



19200191

STEP 2: Check the engine harness.

STEP 2A: Inspect the engine harness and the ECM connectors.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Inspect the engine harness and the ECM connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	2B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the ECM, whichever has the damaged pins • Flush the dirt, debris, or moisture from the connector pins using the electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	3A

STEP 2B: Check for an open circuit.

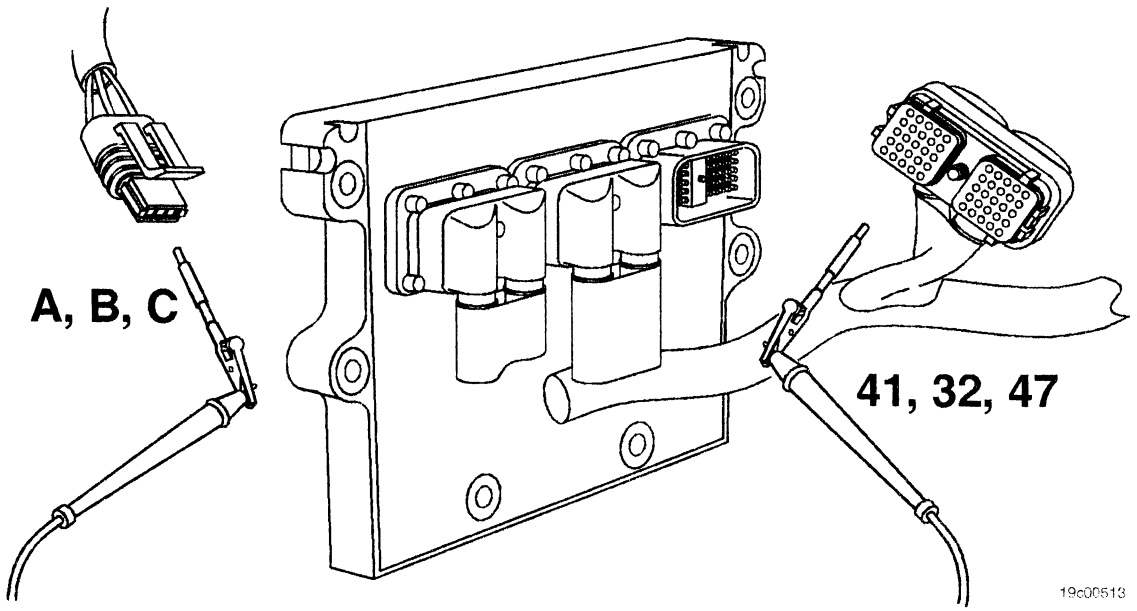
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.
- Disconnect the sensor harness from the crankshaft engine position sensor.

Action	Specifications/Repair	Next Step
Check for an open circuit. • Measure the resistance from pin 41 of the sensor harness connector to pin A (or 1) on the harness side of the crankshaft engine position sensor connector. • Measure the resistance from pin 32 of the sensor harness connector to pin B (or 2) on the harness side of the crankshaft engine position sensor connector. • Measure the resistance from pin 47 of the sensor harness connector to pin C (or 3) on the harness side of the crankshaft engine position sensor connector.	**OK** **Less than 10 ohms**	2C
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-203 or 019-250. • Replace the engine harness. Refer to Procedure 019-043.	3A



STEP 2C: Check for a short circuit to ground.

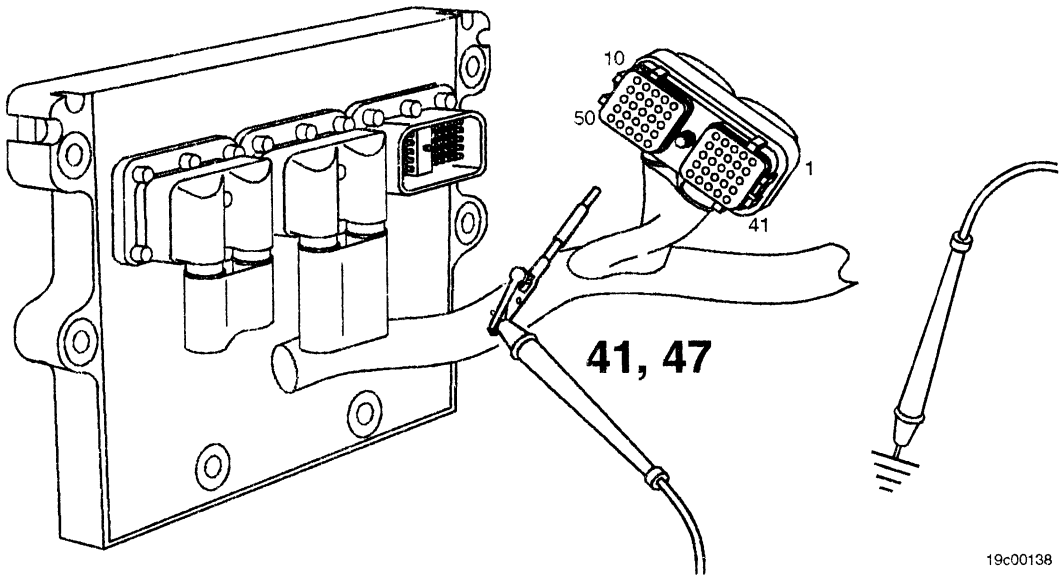
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.
- Disconnect the engine harness from the crankshaft engine position sensor.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground. • Measure the resistance from pin 41 of the sensor harness connector to engine block ground. • Measure the resistance from pin 47 of the sensor harness connector to engine block ground.	**OK** **More than 100k ohms**	2D
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	3A



STEP 2D: Check for a short circuit from pin to pin.

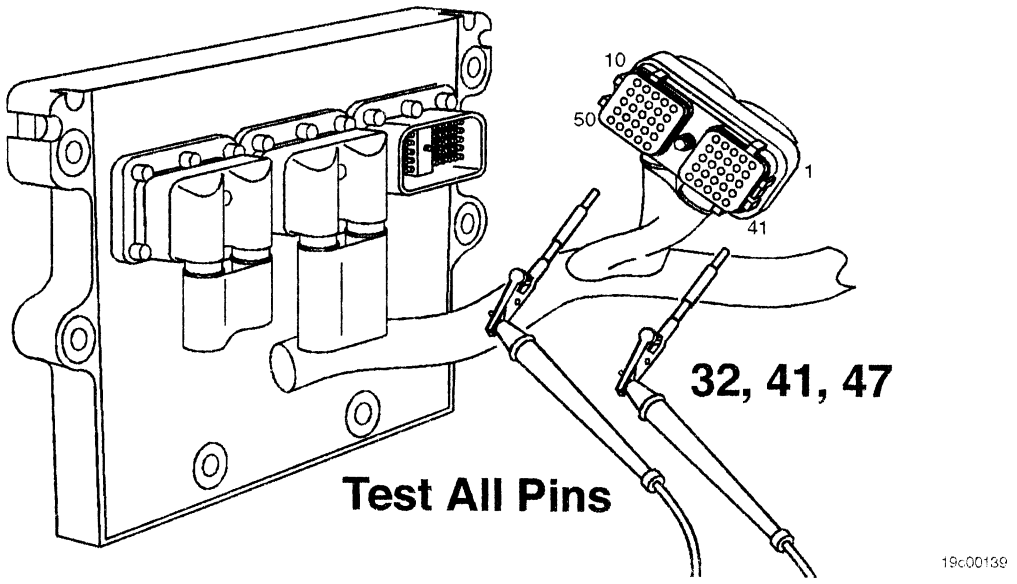
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.
- Disconnect the engine harness from the crankshaft engine position sensor.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin in the (+) 5-VDC supply wire and the signal wire. • Measure resistance from pin 32 of the sensor harness connector to all other pins in the connector. • Measure resistance from pin 41 of the sensor harness connector to all other pins in the connector. • Measure resistance from pin 47 of the sensor harness connector to all other pins in the connector.	**OK** **More than 100k ohms**	3A
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	3A



STEP 3: Clear the fault codes.

STEP 3A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it idle for 1 minute. • Using INSITE™, verify Fault Code 121 is inactive.	**OK** **Fault Code 121 inactive**	3B
	NOT OK Return to the troubleshooting steps or contact your local Cummins Authorized Repair Location if all the steps have been completed and checked again.	1A

STEP 3B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

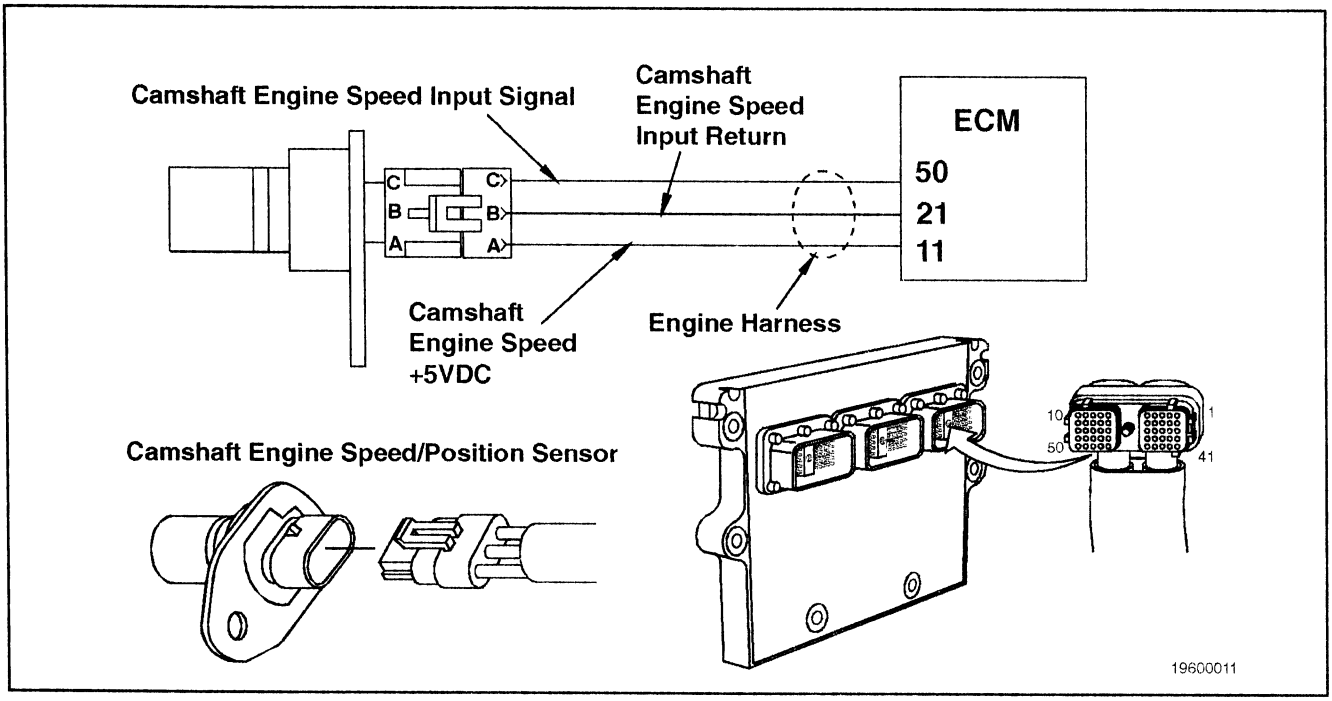
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 115

Camshaft Engine Position Sensor Circuit

CODES	REASON	EFFECT
Fault Code: 115 PID(P), SID(S): P190 SPN: 190 FMI: 2/2 Lamp: Red	No engine speed signal detected from the camshaft engine position sensor.	Engine may take longer to start.

Camshaft Engine Position Sensor Circuit



Circuit Description:

The camshaft engine position sensor provides engine speed and position information to the electronic control module (ECM). The sensor **must** be powered up by (+) 5 VDC to operate. The sensor generates the signal from an extra lobe on the camshaft.

Component Location:

The camshaft engine position sensor is located on the intake side of the engine block on the cylinder head to the right of the ECM.

Shop Talk:

Possible causes of this fault code include a damaged camshaft engine position sensor, an open or a short circuit, or power supply voltage failure.

TROUBLESHOOTING SUMMARY

⚠ CAUTION ⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead
Part No. 3823995 - male Weather-Pack test lead
Part No. 3824775 - breakout cable.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the camshaft engine position sensor.		
STEP 1A: Inspect the camshaft engine position sensor and engine harness connectors.	No damaged pins	
STEP 1B: Check for a signal from the camshaft engine position sensor.	Signal present	
STEP 1B-1: Check the camshaft engine position sensor supply voltage.	(+) 4.75 to 5.25 VDC	
STEP 2: Check the engine harness.		
STEP 2A: Inspect the engine harness and the ECM connectors.	No damaged pins	
STEP 2B: Check for an open circuit.	Less than 10 ohms	
STEP 2C: Check for a short circuit to ground.	More than 100k ohms	
STEP 2D: Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 3: Clear the fault codes.		
STEP 3A: Disable the fault code.	Fault Code 115 inactive	
STEP 3B: Clear the inactive fault codes.	All fault codes cleared	

TROUBLESHOOTING STEP

STEP 1: Check the camshaft engine position sensor.

STEP 1A: Inspect the camshaft engine position sensor and the engine harness connectors.

Condition:
- Turn keyswitch OFF.
- Disconnect the engine harness from the camshaft engine speed sensor.
- Connect the engine harness to the ECM.

Action	Specifications/Repair	Next Step
Inspect the camshaft engine position sensor and the engine harness connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	1B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the sensor, whichever has the damaged pins • Flush the dirt, debris, or moisture from the connector pins using the electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-203 or 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the camshaft engine position sensor. Refer to Procedure 019-038.	3A

STEP 1B: Check for a signal from the camshaft engine position sensor.

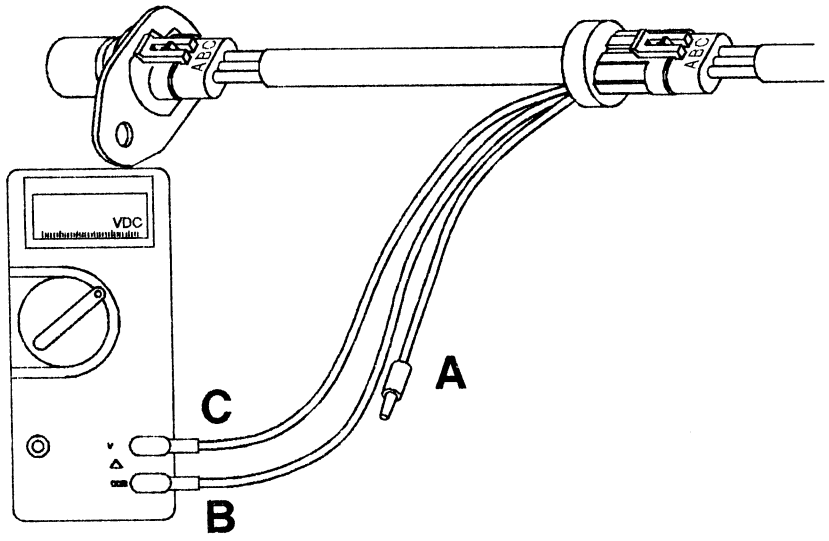
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3824775 - breakout cable.

Condition:

- Install breakout cable, Part No. 3824775, between the camshaft engine position sensor and the engine harness.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check for a signal from the camshaft engine position sensor. • Measure the voltage from pin C (or YELLOW) to pin B (or BLACK) on the breakout cable while barring the engine over.	**OK** **Signal present;** **signal should change from (+) 4.0-5.0 VDC to 0.5-2.3 VDC and back again about every 360° of crankshaft rotation**	3A
	NOT OK Does **not** meet specifications.	1B-1



19c00765

STEP 1B-1: Check the camshaft engine position sensor supply voltage.

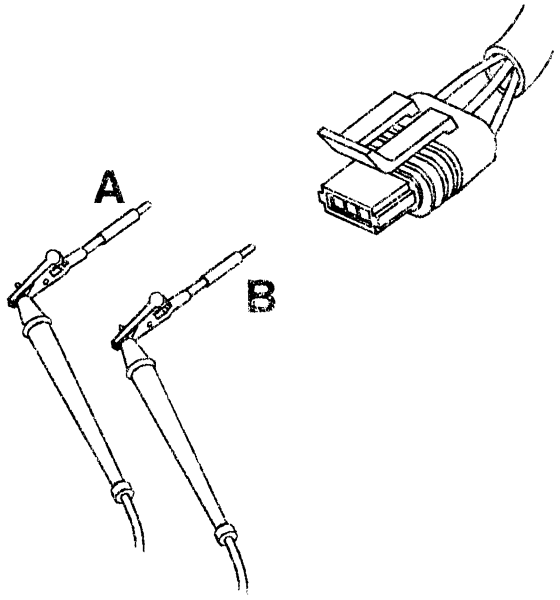
△CAUTION△

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3823995 - male Weather-Pack test lead.

Condition:

- Disconnect the engine harness from the camshaft engine position sensor.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the engine position sensor supply voltage. • Measure the voltage from pin A (or 1) to pin B (or 2) on the harness side of the camshaft engine position sensor connector.	**OK** **(+) 4.75 to 5.25 VDC** **Replace the camshaft engine position sensor** Refer to Procedure 019-038.	3A
	NOT OK Does **not** meet specifications.	2A



19200191

STEP 2: Check the engine harness.

STEP 2A: Inspect the engine harness and the ECM connectors.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Inspect the engine harness and the ECM connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	2B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using the electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-250. • Replace engine harness. Refer to Procedure 019-043. • Replace ECM. Refer to Procedure 019-031.	3A

STEP 2B: Check for an open circuit.

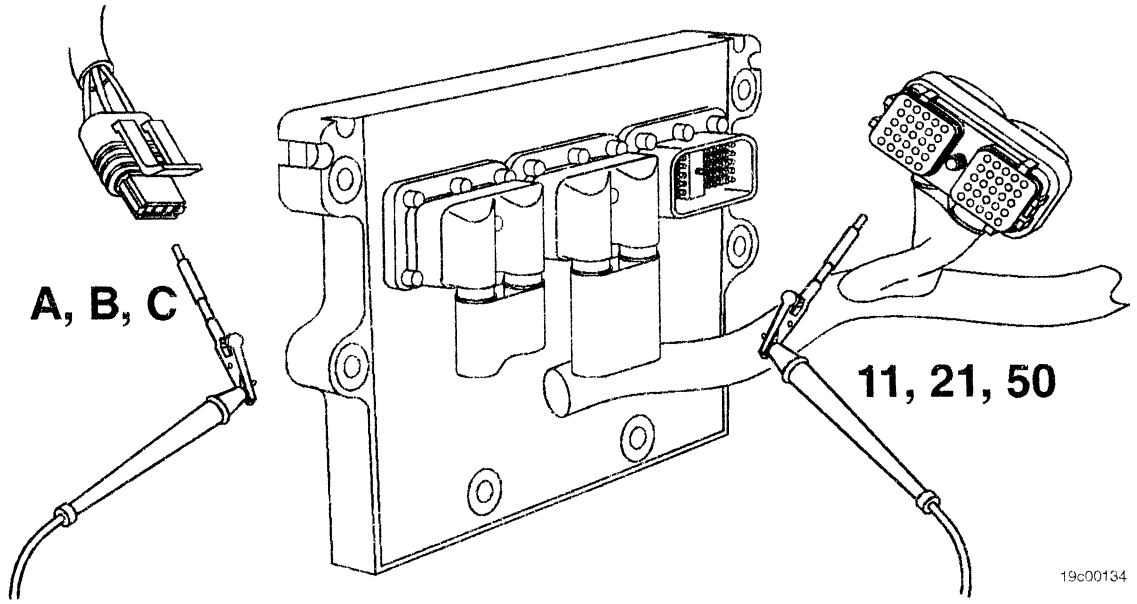
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.
- Disconnect the engine harness from the camshaft engine position sensor.

Action	Specifications/Repair	Next Step
Check for an open circuit. • Measure the resistance from pin 11 of the sensor harness connector to pin A (or 1) on the harness side of the camshaft engine position sensor connector. • Measure the resistance from pin 21 of the sensor harness connector to pin B (or 2) on the harness side of the camshaft engine position sensor connector. • Measure the resistance from pin 50 of the sensor harness connector to pin C (or 3) on the harness side of the camshaft engine position sensor connector.	**OK** **Less than 10 ohms**	2C
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-203 or 019-250. • Replace the engine harness. Refer to Procedure 019-043.	3A



STEP 2C: Check for a short circuit to ground.

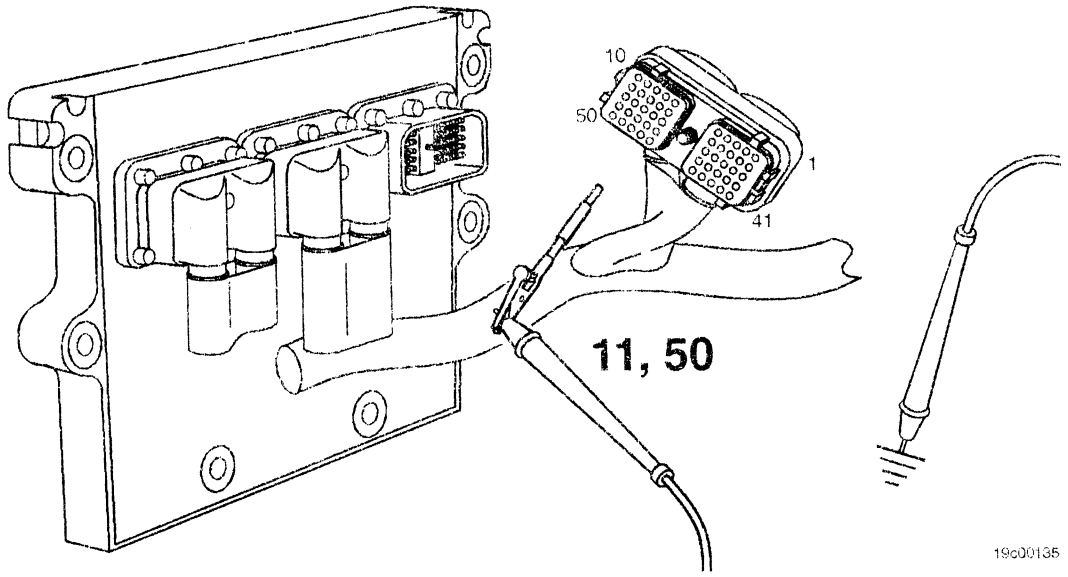
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.
- Disconnect the engine harness from the camshaft engine position sensor.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground. • Measure the resistance from pin 11 of the sensor harness connector to engine block ground. • Measure the resistance from pin 50 of the sensor harness connector to engine block ground.	OK **More than 100k ohms**	2D
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	3A



STEP 2D: Check for a short circuit from pin to pin.

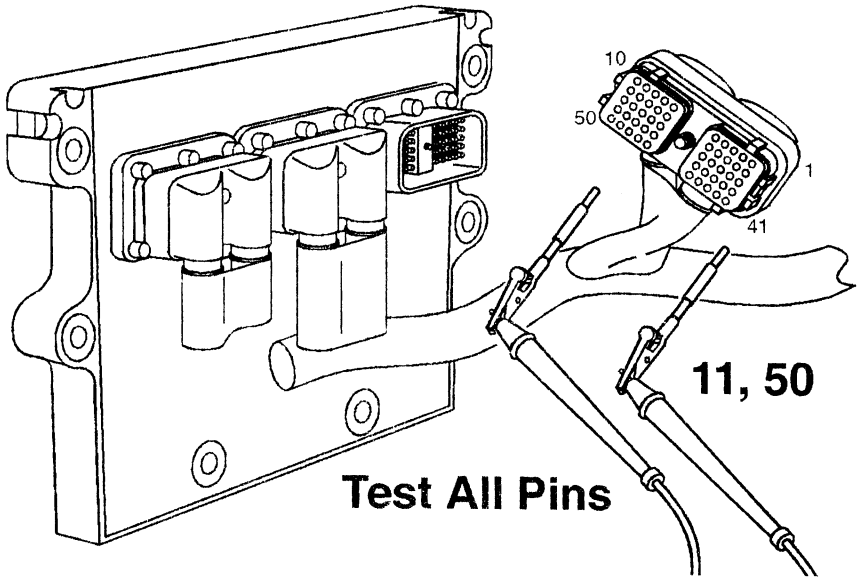
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.
- Disconnect the engine harness from the camshaft engine position sensor.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pin 11 of the sensor harness connector to all other pins in the connector. • Measure the resistance from pin 50 of the sensor harness connector to all other pins in the connector.	**OK** **More than 100k ohms**	3A
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	3A



STEP 3: Clear the fault codes.

STEP 3A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let idle for one 1 minute. • Using INSITE™, verify Fault Code 115 is inactive.	**OK** **Fault Code 115 inactive**	3B
	NOT OK Return to the troubleshooting steps or contact your local Cummins Authorized Repair Location if all the steps have been completed and checked again.	1A

STEP 3B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

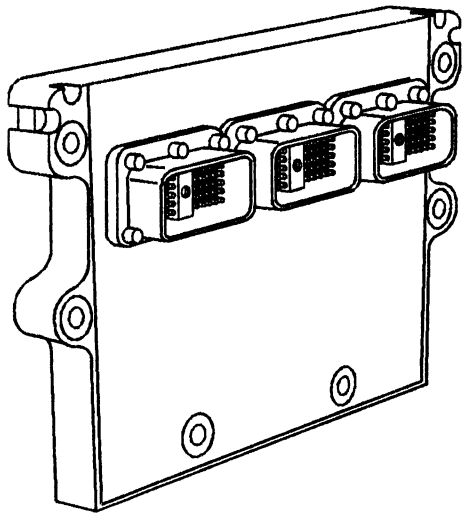
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 111

Electronic Control Module (ECM) Microprocessor

CODES	REASON	EFFECT
Fault Code: 111 PID(P), SID(S): S254 SPN: 629 FMI: 12/12 Lamp: Red	Error internal to the ECM related to the memory hardware failures or internal ECM voltage supply circuits.	Engine will **not** start.

ECM Microprocessor



19c00010

Circuit Description:

The ECM is a computer that is responsible for engine control, diagnostics, and user features.

Component Location:

The ECM is bolted to the intake side of the engine between the air horn and the front of the engine.

Shop Talk:

This fault code can **only** be caused by an internal ECM problem. Repairs are **not** possible for the ECM.

STEP 1B: Check the inactive counts of Fault Code 111.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the inactive counts of Fault Code 111. • Read the inactive counts of Fault Code 111 using INSITE™.	**OK** **Less than 3 counts**	2B
	NOT OK **Replace the ECM** Refer to Procedure 019-031.	2A

STEP 2: Clear the fault codes.

STEP 2A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it idle for at least 1 minute. • Using INSITE™, verify that Fault Code 111 is inactive.	**OK** **Fault Code 111 inactive**	2B
	NOT OK Return to the troubleshooting steps or contact your local Cummins Authorized Repair Location if all the steps have been completed and checked again.	1A

STEP 2B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All faults cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

TROUBLESHOOTING SUMMARY

⚠ CAUTION ⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the ECM.		
STEP 1A: Check the ECM.	Fault Code 111 inactive	
STEP 1B: Check the inactive counts of Fault Code 111.	Less than 3 counts	
STEP 2: Clear the fault codes.		
STEP 2A: Disable the fault code.	Fault Code 111 inactive	
STEP 2B: Clear the inactive fault codes.	All faults cleared	

TROUBLESHOOTING STEP

STEP 1: Check the ECM.

STEP 1A: Check the ECM.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:
- Connect all the components.

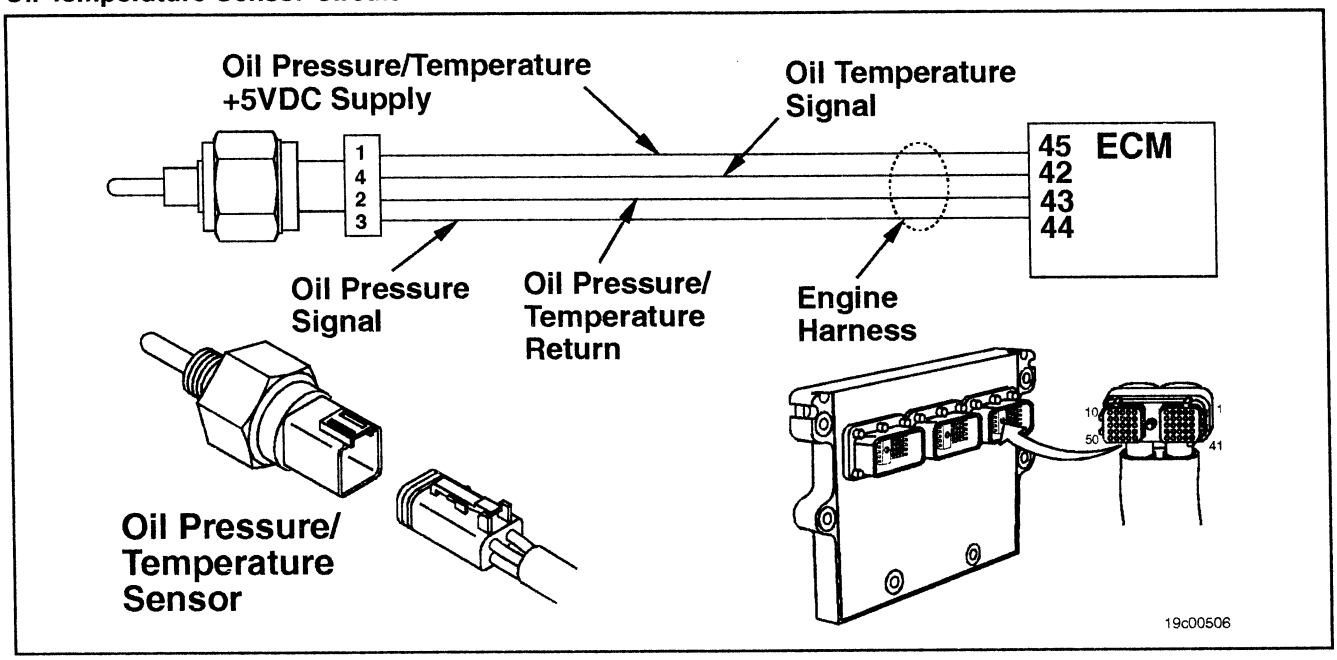
Action	Specifications/Repair	Next Step
Check the ECM. • Turn keyswitch OFF and wait 5 seconds. • Start the engine and let it idle for 1 minute.	**OK** **Fault Code 111 inactive**	1B
	NOT OK **Replace the ECM** Refer to Procedure 019-031.	2A

Fault Code 213

Oil Temperature Sensor Circuit

CODES	REASON	EFFECT
Fault Code: 213 PID(P), SID(S): P175 SPN: 175 FMI: 4/4 Lamp: Yellow	Low voltage detected at the oil temperature circuit.	No engine protection for oil temperature.

Oil Temperature Sensor Circuit



Circuit Description:

The oil pressure/temperature sensor is used by the electronic control module (ECM) to monitor the temperature of the engine oil. If the oil temperature becomes too high and engine protection is enabled, a derate condition could be incurred, possibly leading to shutdown.

Component Location:

The oil pressure/temperature sensor is located on the engine block to the left of the fuel filter, behind the air compressor.

Shop Talk:

The resistance of the sensor varies with the temperature. Compare your readings with this table:

Temperature (°C)	Temperature [°F]	Resistance (ohms)
0	32	30k to 36k
25	77	9k to 11k
50	122	3k to 4k
75	167	1350 to 1500
100	212	600 to 675

TROUBLESHOOTING SUMMARY

⚠ CAUTION ⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead
Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check for multiple fault codes.		
STEP 1A: Read the fault codes.	Fault Codes 145 and 154 are not active	
STEP 2: Check the oil pressure/temperature sensor.		
STEP 2A: Inspect the oil pressure/temperature sensor and the sensor harness connector pins.	No damaged pins	
STEP 2B: Read the fault codes.	Fault Code 213 inactive	
STEP 2C: Check the resistance of the oil pressure/temperature sensor.	300 ohms to 90k ohms	
STEP 2D: Check for a short circuit to ground.	More than 100k ohms	
STEP 3: Check the sensor harness.		
STEP 3A: Inspect the harness and the ECM connector pins.	No damaged pins	
STEP 3B: Read the fault codes.	Fault Code 213 inactive	
STEP 3C: Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 3D: Check for a short circuit to ground.	More than 100k ohms	
STEP 4: Clear the fault code.		
STEP 4A: Disable the fault code.	Fault Code 213 inactive	
STEP 4B: Clear the inactive fault codes.	All faults cleared	

TROUBLESHOOTING STEP

STEP 1: Check for multiple fault codes.

STEP 1A: Read the fault codes.

Condition:
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Read the fault codes using INSITE™.	**OK** **Fault Codes 145 and 154 and are not active**	2A
	NOT OK	Fault Code 187

STEP 2: Check the oil pressure/temperature sensor.

STEP 2A: Inspect the oil pressure/temperature sensor and the sensor harness connector pins.

Condition:
- Turn keyswitch OFF.
- Disconnect the engine harness from the oil pressure/temperature sensor.

Action	Specifications/Repair	Next Step
Inspect the harness and the sensor connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	2B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the sensor, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using the electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-204. • Replace the engine harness. Refer to Procedure 019-043. • Replace the oil pressure/temperature sensor. Refer to Procedure 019-155.	4A

STEP 2B: Read the fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Start the engine and let it idle for 1 minute. • Read the fault codes using INSITE™.	**OK** **Fault Code 213 inactive**	4B
	NOT OK Fault Code 213 active	2C

STEP 2C: Check the resistance of the oil pressure/temperature sensor.

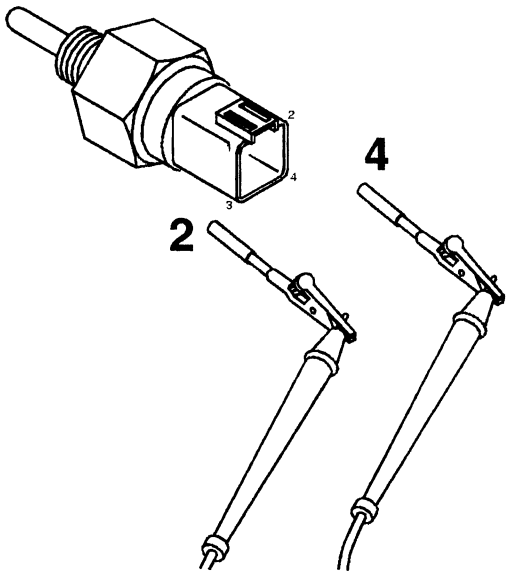
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the engine harness from the oil pressure/temperature sensor.

Action	Specifications/Repair	Next Step
Check the resistance of the oil pressure/ temperature sensor. • Measure the resistance from pin 4 (or D) to pin 2 (or B) of the oil pressure/temperature sensor.	**OK** **300 ohms to 90k ohms**	2D
	NOT OK **Replace the oil pressure/temperature sensor** Refer to Procedure 019-155.	4A



STEP 2D: Check for a short circuit to ground.

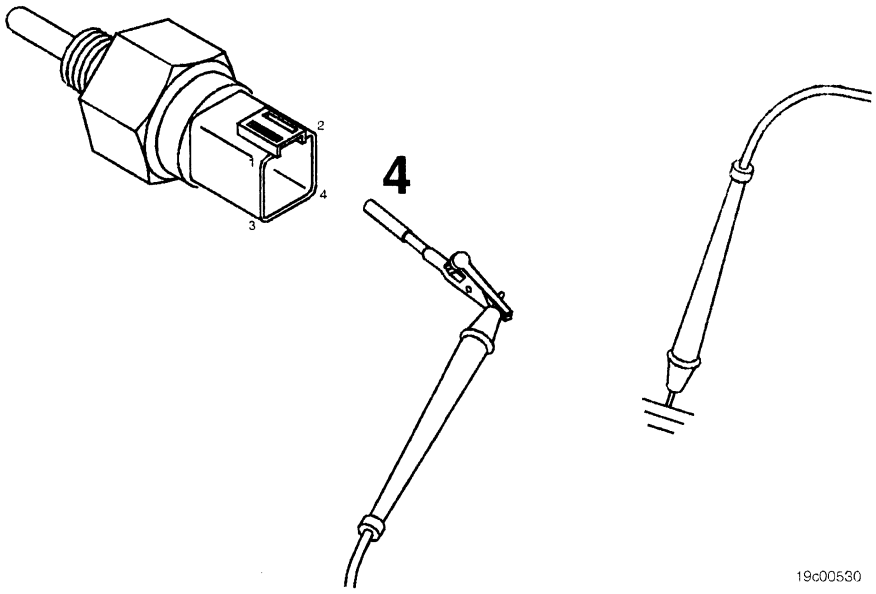
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the engine harness from the oil pressure/temperature sensor.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground. • Measure the resistance from pin 4 (or D) of the oil pressure/temperature sensor to the engine block ground.	**OK** **More than 100k ohms**	3A
	NOT OK **Replace the oil pressure/temperature sensor** Refer to Procedure 019-155.	4A



STEP 3: Check the sensor harness.

STEP 3A: Inspect the harness and the ECM connector pins.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:
- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Inspect the harness and the ECM connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	3B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using the electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	4A

STEP 3B: Read the fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Start the engine and let it idle for 1 minute. • Read the fault codes using INSITE™.	**OK** **Fault Code 213 inactive**	4B
	NOT OK Fault Code 213 active.	3C

STEP 3C: Check for a short circuit from pin to pin.

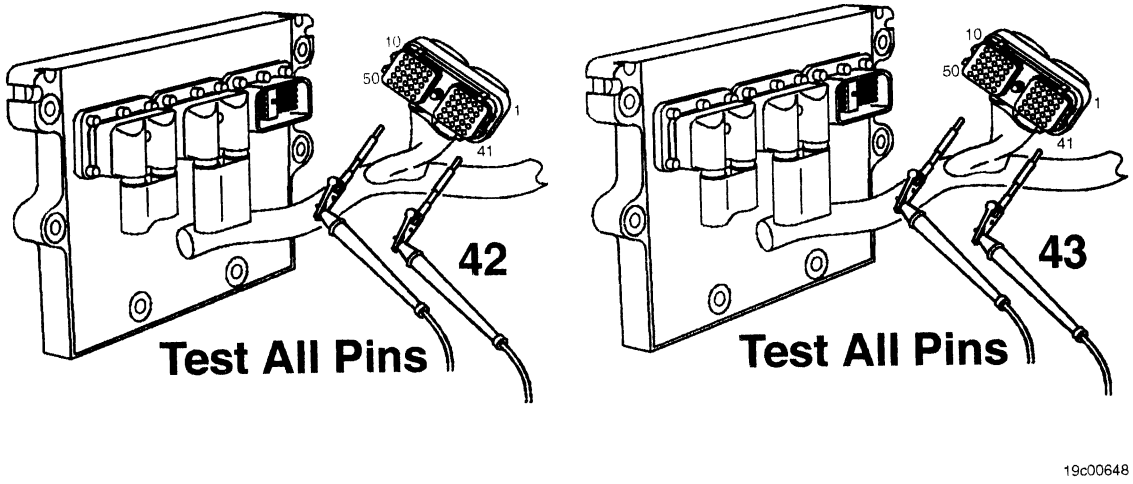
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the engine harness from the oil pressure/temperature sensor.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pin 42 of the sensor harness connector to all other pins in the connector. • Measure the resistance from pin 43 of the sensor harness connector to all other pins in the connector.	**OK** **More than 100k ohms**	3D
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	4A



STEP 3D: Check for a short circuit to ground.

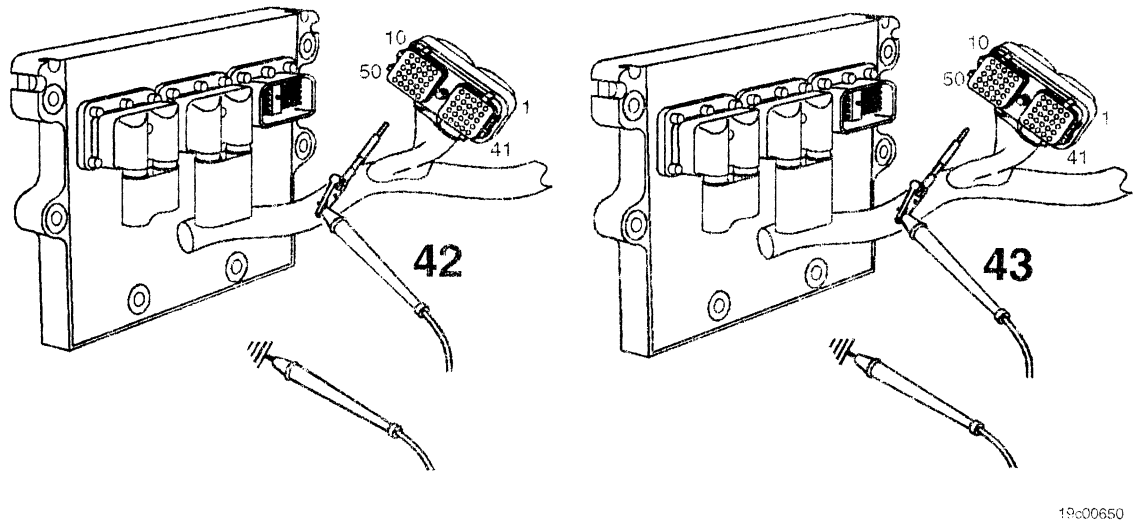
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the engine harness from the oil pressure/temperature sensor.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground. • Measure the resistance from pin 42 of the sensor harness connector to the engine block ground. • Measure the resistance from pin 43 of the sensor harness connector to the engine block ground.	**OK** **More than 100k ohms**	4A
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	4A



STEP 4: Clear the fault code.

STEP 4A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it idle for 1 minute. • Using INSITE™, verify that Fault Code 213 is inactive.	**OK** **Fault Code 213 inactive**	4B
	NOT OK Return to troubleshooting steps or contact your local Cummins Authorized Repair Location if all steps have been completed and checked again.	1A

STEP 4B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

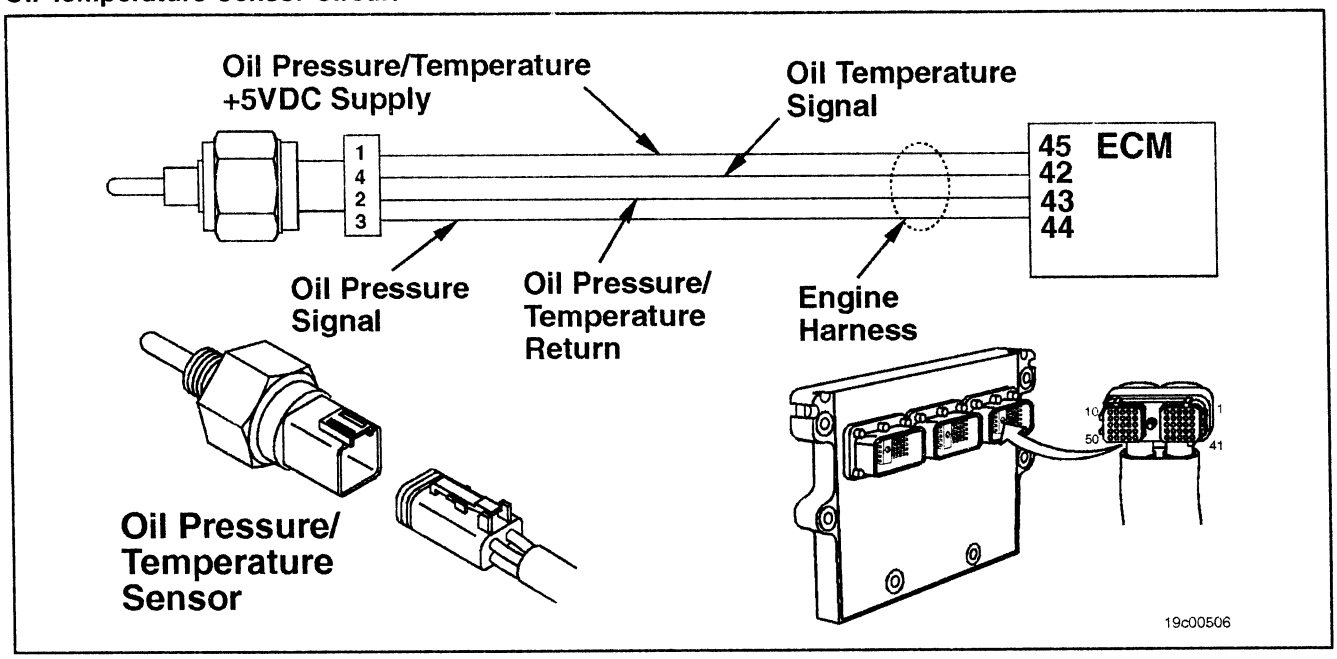
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All faults cleared**	Repair complete
	NOT OK Troubleshooting any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 212

Oil Temperature Sensor Circuit

CODES	REASON	EFFECT
Fault Code: 212 PID(P), SID(S): P175 SPN: 175 FMI: 3/3 Lamp: Yellow	High voltage detected at the oil temperature circuit.	No engine protection for oil temperature.

Oil Temperature Sensor Circuit



Circuit Description:

The oil pressure/temperature sensor is used by the electronic control module (ECM) to monitor the temperature of the engine oil. If the oil temperature becomes too high and the engine protection is enabled, a derate condition can be incurred, possibly leading to shutdown.

Component Location:

The oil pressure/temperature sensor is located on the engine block to the left of the fuel filter, behind the air compressor.

Shop Talk:

Sensor resistance varies with temperature. Compare your reading to this table:

Temperature (°C)	Temperature [°F]	Resistance (ohms)
0	32	30k to 36k
25	77	9k to 11k
50	122	3k to 4k
75	167	1350 to 1500
100	212	600 to 675

TROUBLESHOOTING SUMMARY

⚠ CAUTION ⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead
Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the oil pressure/temperature sensor.		
STEP 1A: Inspect the oil pressure/temperature sensor and sensor harness connector pins.	No damaged pins	
STEP 1B: Read the fault codes.	Fault Code 212 inactive	
STEP 1C: Check the resistance of the oil pressure/temperature sensor.	300 ohms to 90k ohms	
STEP 2: Check the sensor harness.		
STEP 2A: Inspect the sensor harness and the ECM connector pins.	No damaged pins	
STEP 2B: Read the fault codes.	Fault Code 212 inactive	
STEP 2C: Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 2D: Check for an open circuit.	Less than 10 ohms	
STEP 3: Clear the fault codes.		
STEP 3A: Disable the fault codes.	Fault Code 212 inactive	
STEP 3B: Clear the inactive fault codes.	All faults cleared	

TROUBLESHOOTING STEP

STEP 1: Check the oil pressure/temperature sensor.

STEP 1A: Inspect the oil pressure/temperature sensor and sensor harness connector pins.

Condition:
- Turn keyswitch OFF.
- Disconnect the engine harness from the oil pressure/temperature sensor.

Action	Specifications/Repair	Next Step
Inspect the oil pressure/temperature sensor and sensor harness connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector.	**OK** **No damaged pins**	1B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the oil pressure/temperature sensor, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using the electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-204. • Replace the engine harness. Refer to Procedure 019-043. • Replace the sensor. Refer to Procedure 019-155.	3A

STEP 1B: Read the fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Start the engine and let it idle for 1 minute. • Read the fault codes using INSITE™.	**OK** **Fault Code 212 inactive**	3B
	NOT OK Fault Code 212 active.	1C

STEP 1C: Check the resistance of the oil pressure/temperature sensor.

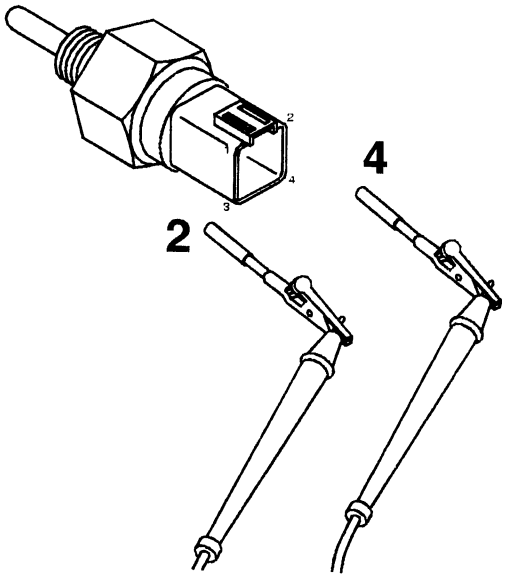
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the engine harness from the oil pressure/temperature sensor.

Action	Specifications/Repair	Next Step
Check the resistance of the oil pressure/ temperature sensor. • Measure the resistance from pin 4 (or D) to pin 2 (or B) of the oil pressure/temperature sensor.	**OK** **300 ohms to 90k ohms**	2A
	NOT OK **Replace the oil pressure/temperature sensor** Refer to Procedure 019-155.	3A



STEP 2: Check the sensor harness.

STEP 2A: Inspect the sensor harness and the ECM connector pins.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:
- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Inspect the sensor harness and the ECM connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	2B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using the electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	3A

STEP 2B: Read the fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Start the engine and let it idle for 1 minute. • Read the fault codes using INSITE™.	**OK** **Fault Code 212 inactive**	3B
	NOT OK Fault Code 212 active.	2C

STEP 2C: Check for a short circuit from pin to pin.

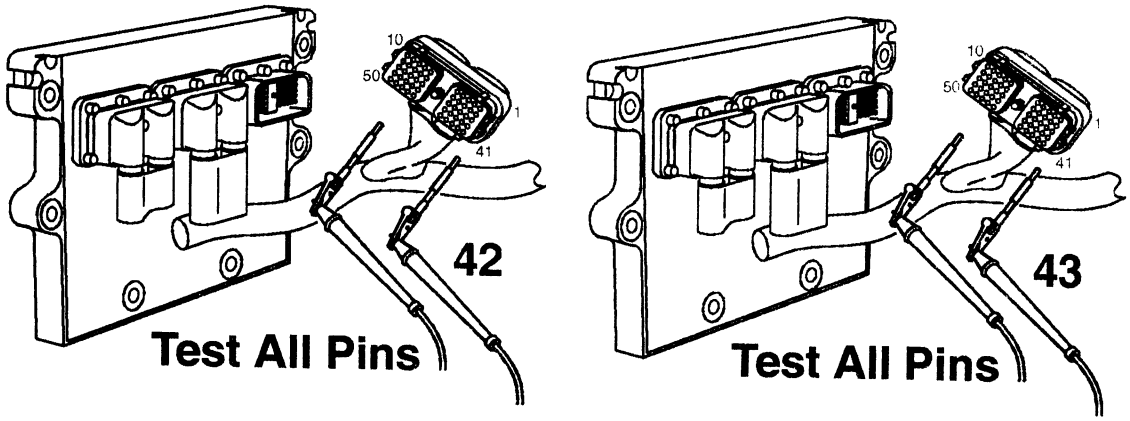
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the engine harness from the oil pressure/temperature sensor.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pin 42 of the sensor harness connector to all other pins in the connector. • Measure the resistance from pin 43 of the sensor harness connector to all other pins in the connector.	**OK** **More than 100k ohms**	2D
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	3A



STEP 2D: Check for an open circuit.

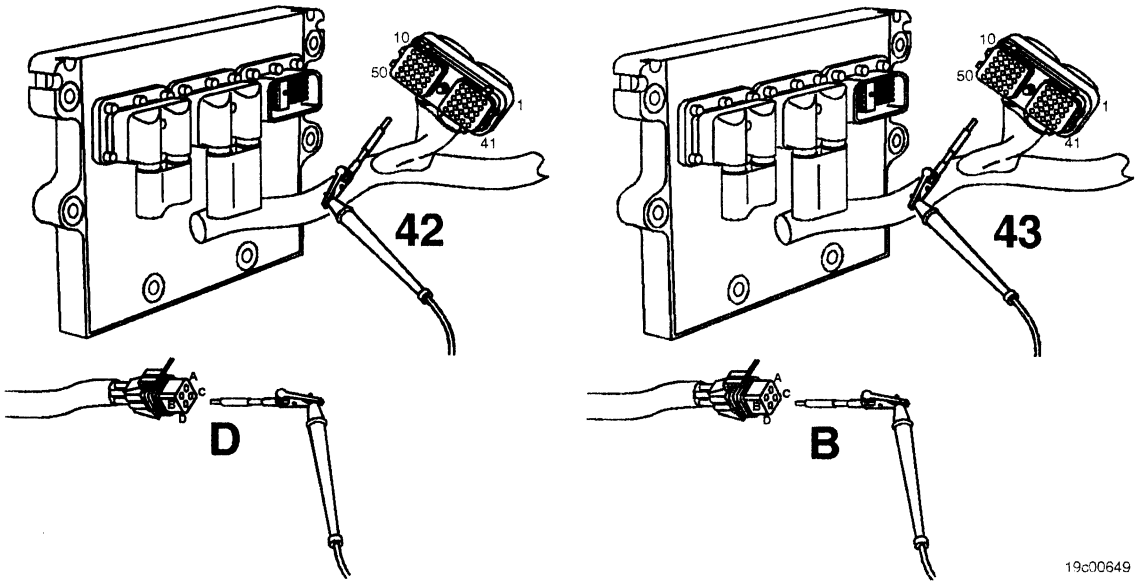
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the engine harness from the oil pressure/temperature sensor.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for an open circuit. • Measure the resistance from pin 42 of the sensor harness connector to pin 4 (or D) of the oil pressure/temperature sensor. • Measure the resistance from pin 43 of the sensor harness connector to pin 2 (or B) of the oil pressure/temperature sensor.	**OK** **Less than 10 ohms**	3A
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-204 or 019-250. • Replace the engine harness. Refer to Procedure 019-043.	3A



STEP 3: Clear the fault code.

STEP 3A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it idle for 1 minute. • Using INSITE™, verify that Fault Code 212 is inactive.	**OK** **Fault Code 212 inactive**	3B
	NOT OK Return to troubleshooting steps or contact your local Cummins Authorized Repair Location if all the steps have been completed and checked again.	1A

STEP 3B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

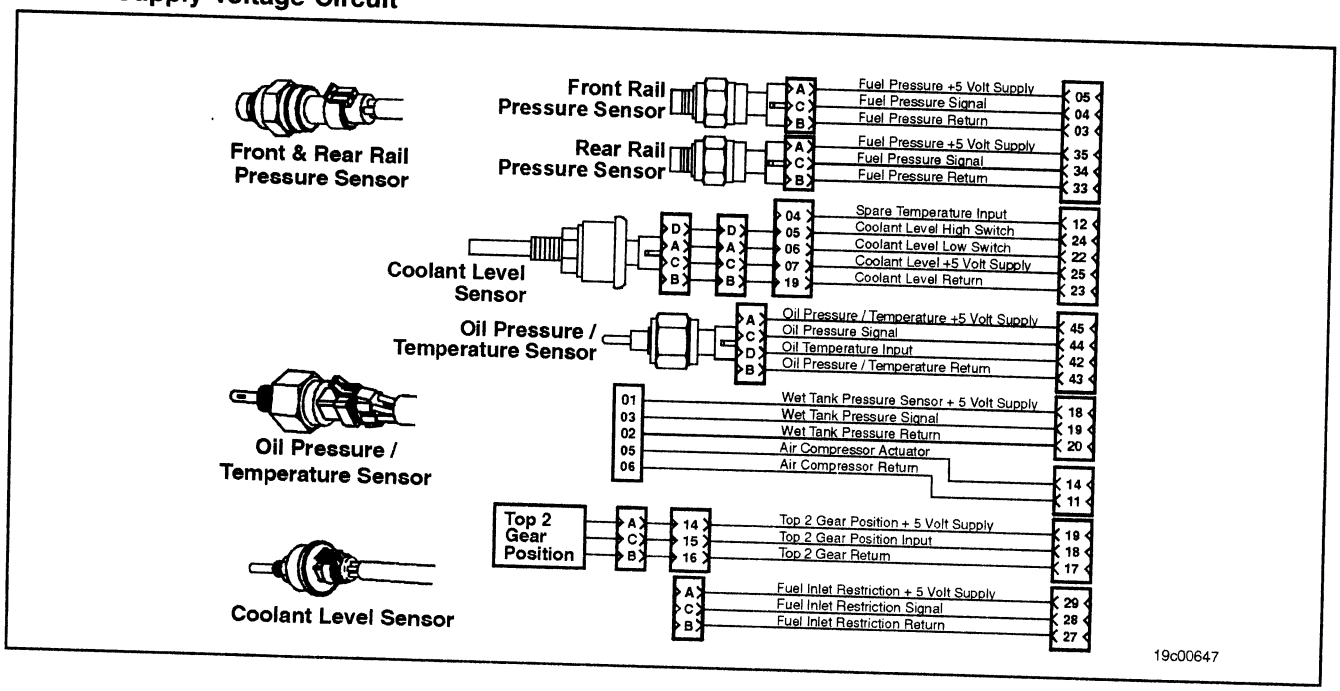
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All faults cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 187

Sensor Voltage Supply

CODES	REASON	EFFECT
Fault Code: 187 PID(P), SID(S): S232 SPN: 620 FMI: 4/4 Lamp: Yellow	Low voltage detected on the ECM voltage supply line to some sensors (VSEN2 supply).	Engine will run derated. No engine protection for oil pressure or coolant level.

Sensor Supply Voltage Circuit



Circuit Description:

The ECM supplies each of these sensors with (+) 5 VDC. If the supply line to any sensor is damaged, the sensor will **not** work correctly.

Component Location:

1. Front fuel rail pressure sensor is located on the fuel delivery housing.
2. Rear fuel rail pressure sensor is located on the fuel delivery housing.
3. Fuel inlet restriction sensor is located on the fuel delivery housing.
4. Oil pressure/temperature sensor is located below the air compressor.
5. Wet tank pressure sensor is located on the air compressor.
6. Coolant level sensor. Refer to the OEM troubleshooting and repair manual for proper location.
7. Top 2 transmission position sensor; located on the transmission if vehicle has a Spicer™ Top 2 Automate transmission. Refer to the OEM troubleshooting and repair manual for proper location.

Shop Talk:

Low voltage on the sensor (+) 5-VDC supply line will be caused by a short circuit to ground in a supply line, a short circuit between a supply line or a return line, a failed sensor, or a failed ECM power supply.

TROUBLESHOOTING SUMMARY

⚠ CAUTION ⚠

To avoid damaging the new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead
Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check for the failed sensors.		
STEP 1A: Check the oil pressure/temperature sensor.	Less than (+) 4.5 VDC	
STEP 1B: Check the front fuel rail pressure sensor.	Less than (+) 4.5 VDC	
STEP 1C: Check the rear fuel rail pressure sensor.	Less than (+) 4.5 VDC	
STEP 1D: Check the fuel inlet restriction sensor.	Less than (+) 4.5 VDC	
STEP 1E: Check the wet tank pressure sensor.	Less than (+) 4.5 VDC	
STEP 1F: Check coolant level sensor.	Less than (+) 4.5 VDC	
STEP 1G: Check Top 2 transmission position sensor.	Less than (+) 4.5 VDC	
STEP 2: Check the sensor harness.		
STEP 2A: Inspect the sensor harness and the ECM connector pins.	No damaged pins	
STEP 2B: Check the supply voltage from the ECM.	(+) 4.75 to 5.25 VDC	
STEP 2C: Check for a short circuit to ground in the sensor supply lines.	More than 100k ohms	
STEP 2D: Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 3: Clear the fault codes.		
STEP 3A: Disable the fault code.	Fault Code 187 inactive	
STEP 3B: Clear the inactive fault codes.	All fault codes cleared	

TROUBLESHOOTING STEP

STEP 1: Check for the failed sensors.

STEP 1A: Check the oil pressure/temperature sensor.

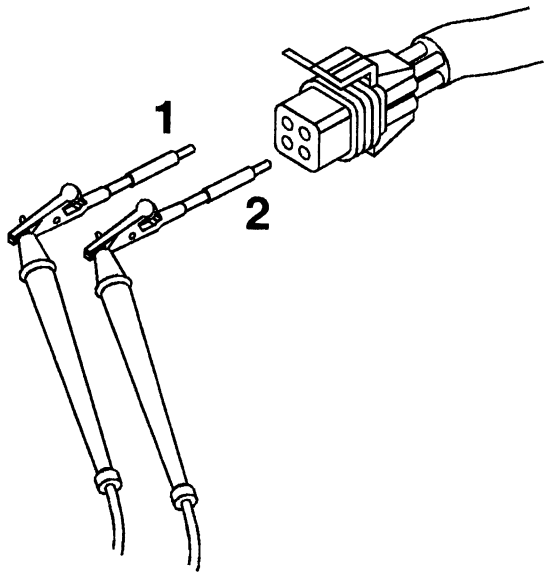
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Disconnect the engine harness from the oil pressure/temperature sensor.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the oil pressure/temperature sensor. • Measure the voltage from pin 1 (or A) to pin 2 (or B) on the oil pressure/temperature sensor connector.	**OK** **Less than (+) 4.5 VDC**	1B
	NOT OK **Replace the oil pressure/temperature sensor** Refer to Procedure 019-155.	3A



19c00081

STEP 1B: Check the front fuel rail pressure sensor.

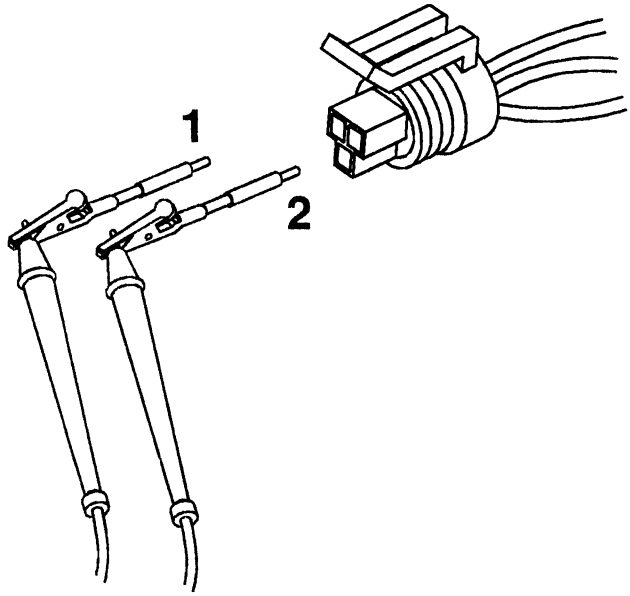
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Disconnect the engine harness from the front fuel rail pressure sensor.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the front fuel rail pressure sensor. • Measure the voltage from pin 1 (or A) to pin 2 (or B) on the front fuel rail pressure sensor connector.	**OK** **Less than (+) 4.5 VDC**	1C
	NOT OK **Replace the front fuel rail pressure sensor** Refer to Procedure 019-115.	3A



19c00810

STEP 1C: Check the rear fuel rail pressure sensor.

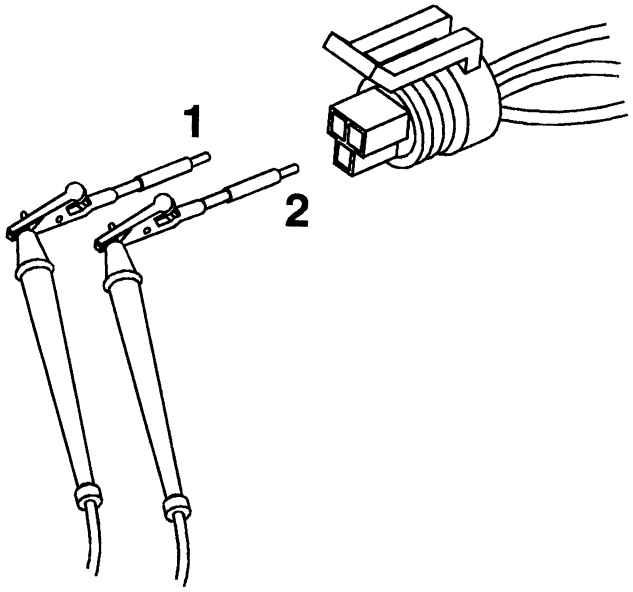
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Disconnect the engine harness from the rear fuel rail pressure sensor.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the rear fuel rail pressure sensor. • Measure the voltage from pin 1 (or A) to pin 2 (or B) on the rear fuel rail pressure sensor connector.	**OK** **Less than (+) 4.5 VDC**	1D
	NOT OK **Replace the rear fuel rail pressure sensor** Refer to Procedure 019-115.	3A



19c00810

STEP 1D: Check the fuel inlet restriction sensor.

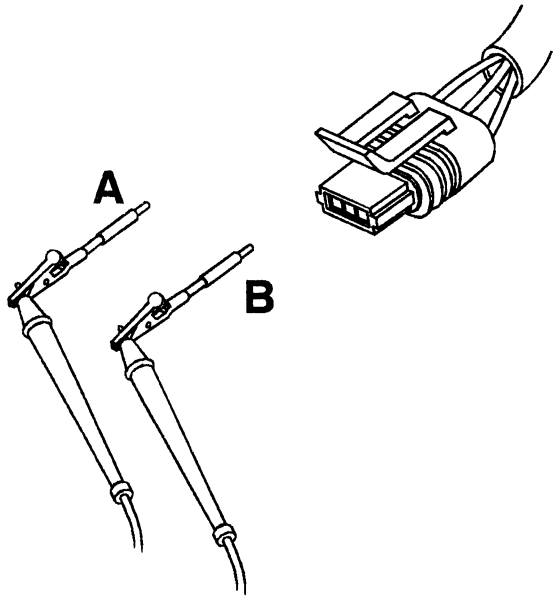
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- OPTIONAL EQUIPMENT; check vehicle to see if so equipped.
- If **not** equipped, go to Step 1E.
- Disconnect the engine harness from the fuel inlet restriction sensor.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the fuel inlet restriction sensor. • Measure the voltage from pin 1 (or A) to pin 2 (or B) on the fuel inlet restriction sensor connector.	**OK** **Less than (+) 4.5 VDC**	1E
	NOT OK **Replace the fuel inlet restriction sensor** Refer to Procedure 019-128.	3A



19200191

STEP 1E: Check the wet tank pressure sensor.

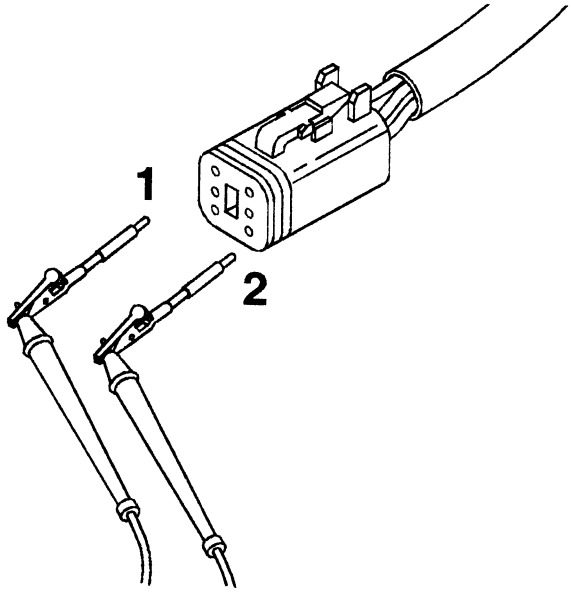
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- OPTIONAL EQUIPMENT; check vehicle to see if so equipped.
- If **not** equipped, go to Step 1F.
- Disconnect the engine harness from the wet tank pressure sensor.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the wet tank pressure sensor. • Measure the voltage from pin 1 (or A) to pin 2 (or B) on the wet tank pressure sensor connector.	**OK** **Less than (+) 4.5 VDC**	1F
	NOT OK **Replace the wet tank pressure sensor/ governor assembly** Refer to the OEM troubleshooting and repair manual.	3A



19c00526

STEP 1F: Check the coolant level sensor.

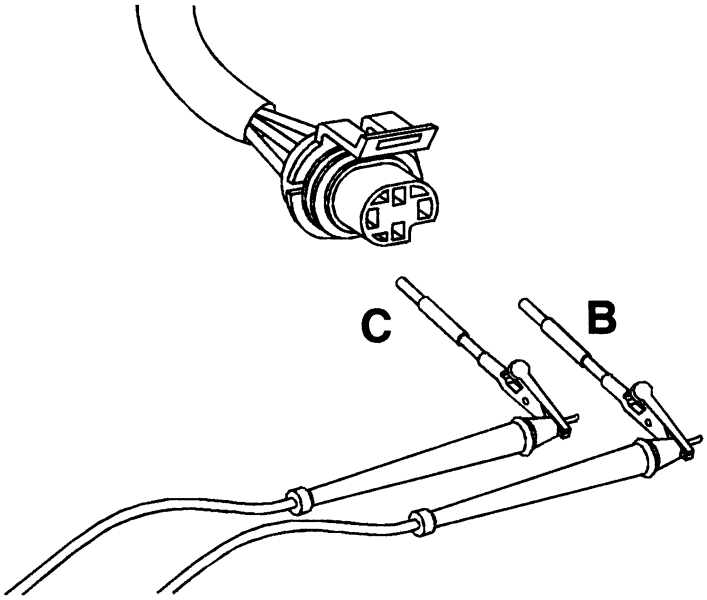
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Disconnect the engine harness from the coolant level sensor.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the coolant level sensor. • Measure the voltage from supply pin 3 (or C) to return pin 2 (or B) on the coolant level sensor connector.	**OK** **Less than (+) 4.5 VDC**	1G
	NOT OK **Replace the coolant level sensor** Refer to Procedure 019-017.	3A



STEP 1G: Check the Top 2 transmission position sensor.

⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- OPTIONAL EQUIPMENT; check vehicle to see if so equipped.
- Following step **only** applies if vehicle has Spicer Top 2 transmission.
- If **not** equipped, go to Step 2A.
- Disconnect the engine harness from the Top 2 transmission position sensor.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the Top 2 transmission position sensor. • Measure the voltage from pin 1 (or A) to pin 2 (or B) on the Top 2 transmission position connector.	**OK** **Less than (+) 4.5 VDC**	2A
	NOT OK **Replace the Top 2 transmission position sensor** Refer to the OEM troubleshooting and repair manual for proper procedure.	3A

STEP 2: Check the sensor harness.

STEP 2A: Inspect the sensor harness and the ECM connector pins.

⚠CAUTION⚠

To avoid damaging the new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Inspect the sensor harness and the ECM connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	2B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using the electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	3A

STEP 2B: Check the supply voltage from the ECM.

⚠CAUTION⚠

To avoid damaging the new ECM, all other active fault codes must be investigated prior to replacing the ECM.

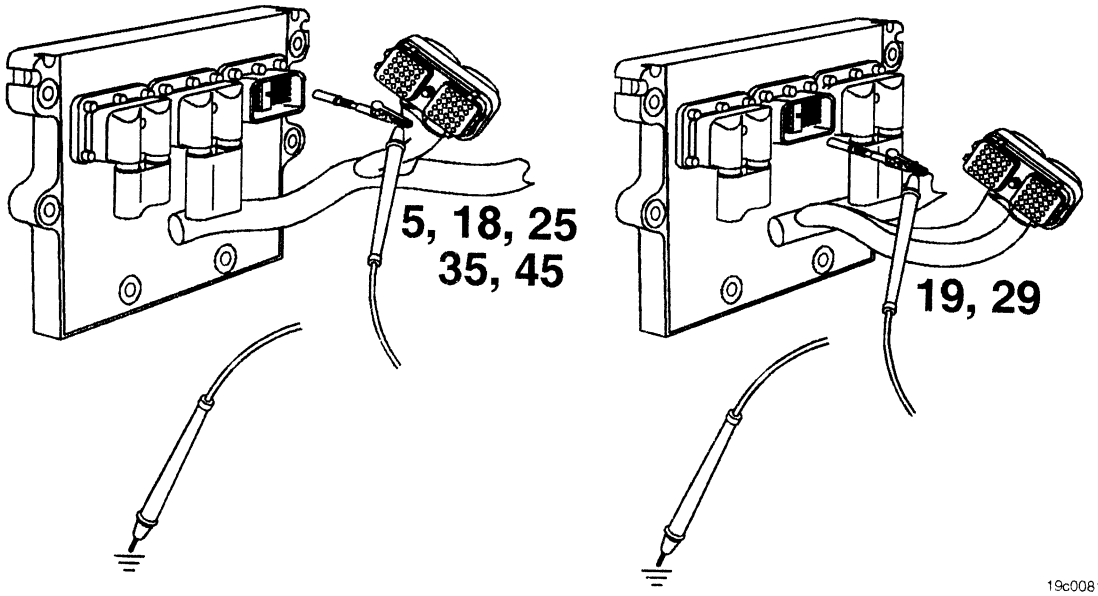
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

Condition:

- Disconnect the sensor harness connector from the ECM.
- Disconnect the actuator harness connector from the ECM.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Check the supply voltage from the ECM. • Measure the supply voltage out of the ECM sensor harness connector port from pins 5, 18, 25, 35, and 45 to ground. • Measure the supply voltage out of the ECM actuator harness connector port from pins 19 and 29 to ground.	**OK** **(+) 4.75 to 5.25 VDC**	2C
	NOT OK **Replace the ECM** Refer to Procedure 019-031.	3A



STEP 2C: Check for a short circuit to ground in the sensor supply lines.

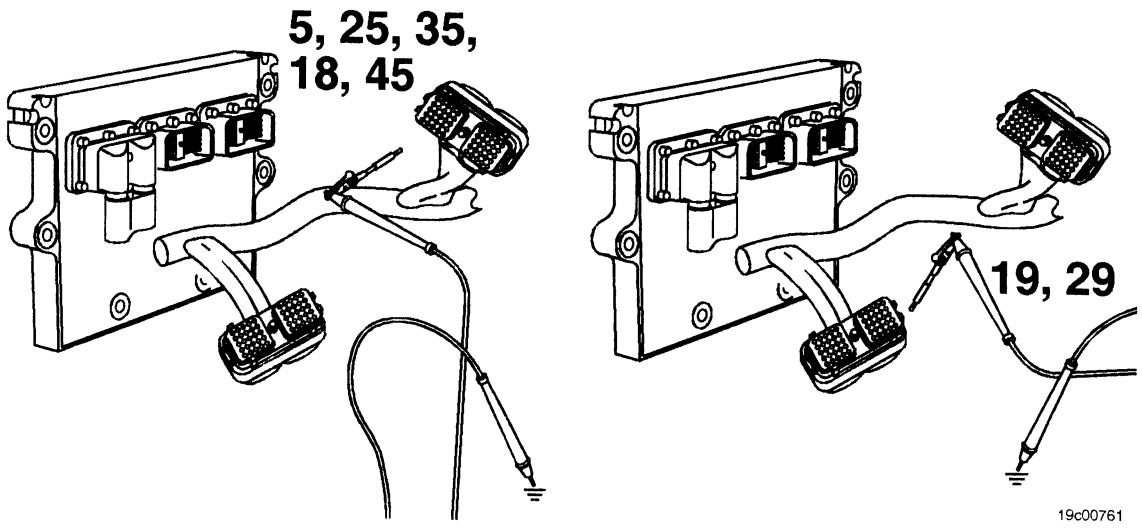
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.
- Disconnect the actuator harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground in the sensor supply lines. • Measure the resistance from pins 5, 18, 25, 35, and 45 in the sensor harness connector to engine block ground. • Measure the resistance from pins 19 and 29 in the actuator harness connector to engine block ground.	**OK** **More than 100k ohms**	2D
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	3A



STEP 2D: Check for a short circuit from pin to pin.

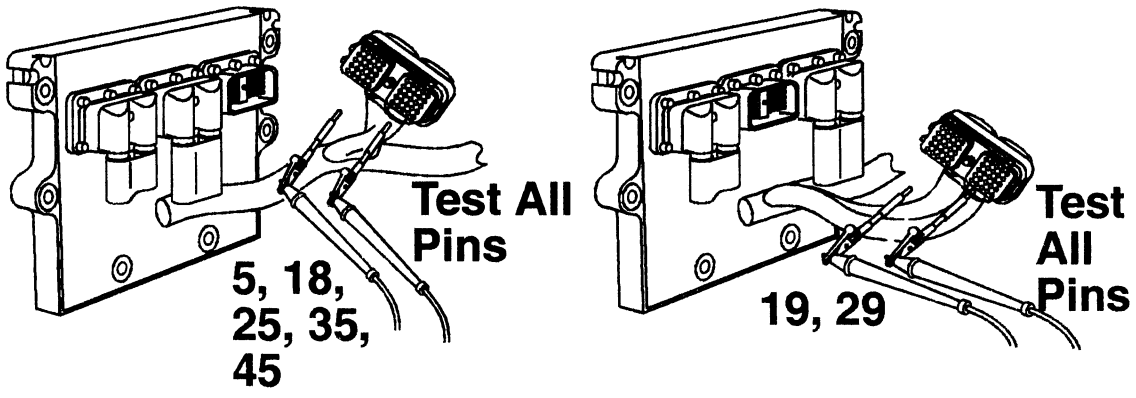
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the sensor harness and actuator harness connectors from the ECM.
- Disconnect the oil pressure/temperature sensor from the engine harness.
- Disconnect the front fuel rail pressure sensor from the engine harness.
- Disconnect the rear fuel rail pressure sensor from the engine harness.
- Disconnect the fuel inlet restriction sensor from the engine harness.
- Disconnect the wet tank pressure sensor from the engine harness.
- Disconnect the coolant level sensor from the engine harness.
- Disconnect the Top 2 transmission position sensor (if equipped) from the engine harness.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pin 5 to all other pins in the sensor harness connector. • Measure the resistance from pin 18 to all other pins in the sensor harness connector. • Measure the resistance from pin 25 to all other pins in the sensor harness connector. • Measure the resistance from pin 35 to all other pins in the sensor harness connector. • Measure the resistance from pin 45 to all other pins in the sensor harness connector. • Measure the resistance from pin 19 to all other pins in the actuator harness connector. • Measure the resistance from pin 29 to all other pins in the actuator harness connector.	**OK** **More than 100k ohms**	3A
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	3A



STEP 3: Clear the fault codes.

STEP 3A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it idle for 1 minute. • Using INSITE™, verify Fault Code 187 is inactive.	**OK** **Fault Code 187 inactive**	3B
	NOT OK Return to the troubleshooting steps or contact your local Cummins Authorized Repair Location if all the steps have been completed and checked again.	1A

STEP 3B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

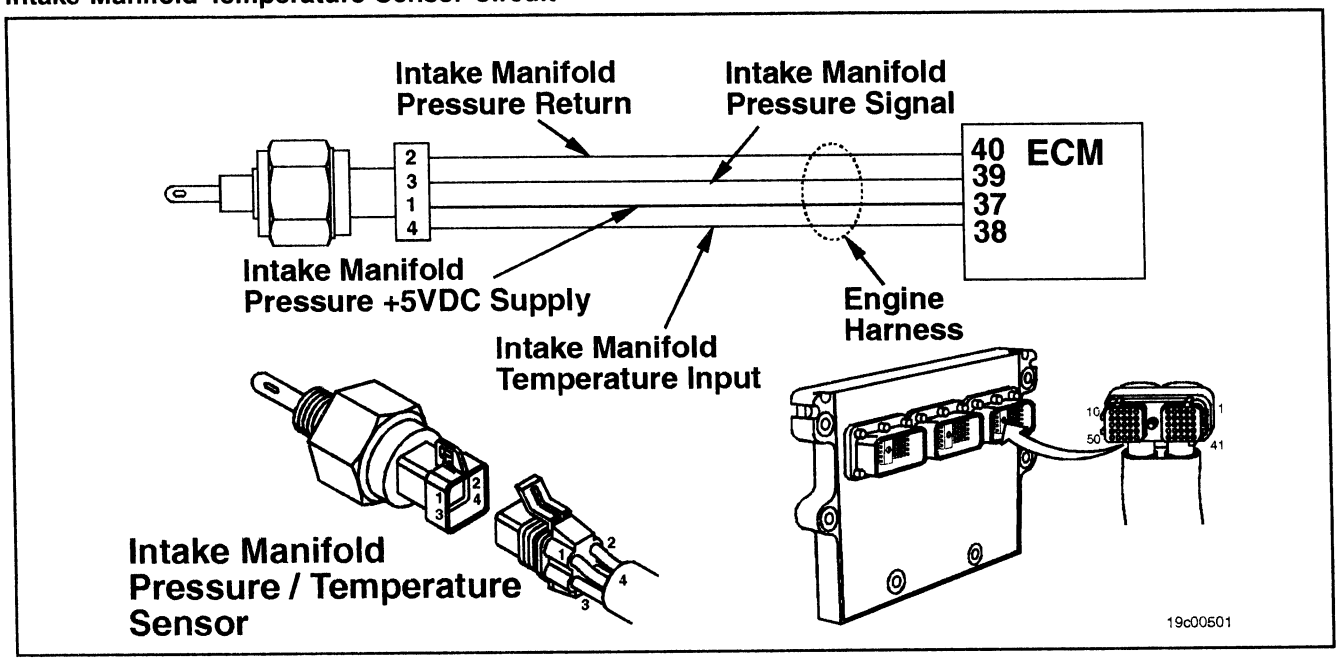
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 154

Intake Manifold Temperature Sensor Circuit

CODES	REASON	EFFECT
Fault Code: 154 PID(P), SID(S): P105 SPN: 105 FMI: 4/4 Lamp: Yellow	Low voltage detected at the intake manifold temperature circuit.	Possible white smoke. Fan will stay on if controlled by the electronic control module (ECM). No engine protection for coolant temperature.

Intake Manifold Temperature Sensor Circuit



Circuit Description:

The ECM uses the intake manifold pressure/temperature sensor to monitor the temperature of the engine intake air. The ECM uses the intake manifold temperature signal for the engine protection system, timing, and fueling control.

Component Location:

The intake manifold pressure/temperature sensor is on the side of the intake manifold in front of the air horn.

Shop Talk:

The sensor resistance varies with the temperature. Compare your reading to this table:

Temperature (°C)	Temperature [°F]	Resistance (ohms)
0	32	30k to 36k
25	77	9k to 11k
50	122	3k to 4k
75	167	1350 to 1500
100	212	600 to 675

TROUBLESHOOTING SUMMARY

⚠ CAUTION ⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead
Part No. 3823996 - female Weather-Pack test lead.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check for multiple fault codes.		
STEP 1A: Read the fault codes.	Fault Codes 145 and 213 are not active	
STEP 2: Check the intake manifold pressure/temperature sensor.		
STEP 2A: Inspect the intake manifold pressure/ temperature sensor and the sensor harness connector pins.	No damaged pins	
STEP 2B: Read the fault codes.	Fault Code 154 inactive	
STEP 2C: Check the resistance of the intake manifold pressure/temperature sensor.	300 ohms to 90k ohms	
STEP 2D: Check for a short circuit to ground.	More than 100k ohms	
STEP 3: Check the sensor harness.		
STEP 3A: Inspect the sensor harness and the ECM connector pins.	No damaged pins	
STEP 3B: Read the fault codes.	Fault Code 154 inactive	
STEP 3C: Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 3D: Check for a short circuit to ground.	More than 100k ohms	
STEP 4: Clear the fault code.		
STEP 4A: Disable the fault code.	Fault Code 154 inactive	
STEP 4B: Clear the inactive fault codes.	All faults cleared	

TROUBLESHOOTING STEP

STEP 1: Check for multiple fault codes.

STEP 1A: Read the fault codes.

Condition:
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Read the fault codes using INSITE™.	**OK** **Fault Codes 145 and 213 are not active**	2A
	NOT OK	Fault Code 352

STEP 2: Check the intake manifold pressure/temperature sensor.

STEP 2A: Inspect the intake manifold pressure/temperature sensor and the sensor harness connector pins.

Condition:
- Turn keyswitch OFF.
- Disconnect the engine harness from the intake manifold pressure/temperature sensor.

Action	Specifications/Repair	Next Step
Inspect the intake manifold pressure/ temperature sensor and the sensor harness connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	2B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the intake manifold pressure/ temperature sensor, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using the electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-204. • Replace the engine harness. Refer to Procedure 019-043. • Replace the intake manifold pressure/ temperature sensor. Refer to Procedure 019-159.	4A

STEP 2B: Read the fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Start the engine and let it idle for 1 minute. • Read the fault codes using INSITE™.	**OK** **Fault Code 154 inactive**	4B
	NOT OK Fault Code 154 active.	2C

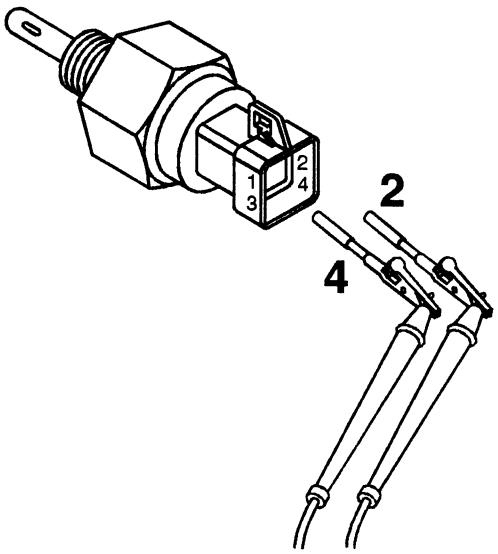
STEP 2C: Check the resistance of the intake manifold pressure/temperature sensor.

⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3823996 - female Weather-Pack test lead.

Condition:
- Turn keyswitch OFF.
- Disconnect the engine harness from the intake manifold pressure/temperature sensor.

Action	Specifications/Repair	Next Step
Check the resistance of the intake manifold pressure/temperature sensor. • Measure the resistance from pin 4 (or D) to pin 2 (or B) of the intake manifold pressure/temperature sensor.	**OK** **300 ohms to 90k ohms**	2D
	NOT OK **Replace the intake manifold pressure/temperature sensor** Refer to Procedure 019-159.	4A



19c00681

STEP 2D: Check for a short circuit to ground.

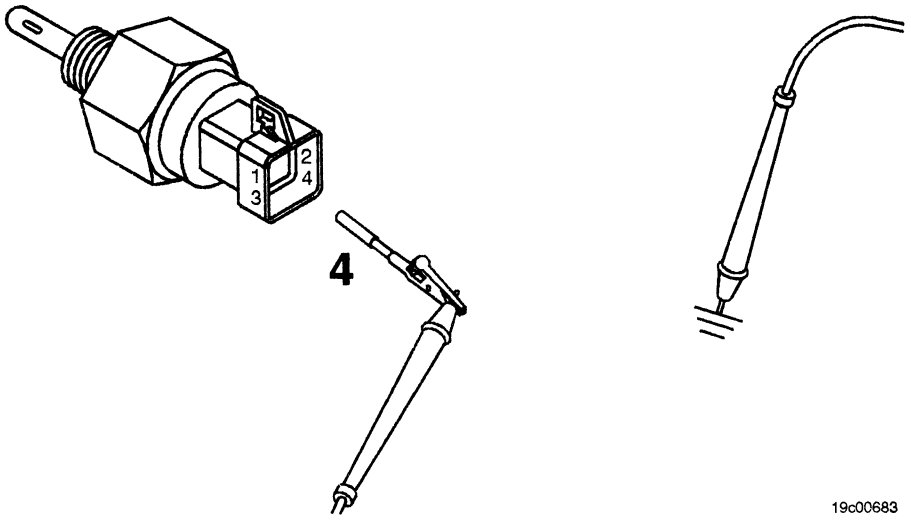
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3823996 - female Weatherpack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the engine harness from the intake manifold pressure/temperature sensor.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground. • Measure the resistance from pin 4 (or D) of the intake manifold pressure/temperature sensor to the engine block.	**OK** **More than 100k ohms**	3A
	NOT OK **Replace the intake manifold pressure/ temperature sensor** Refer to Procedure 019-159.	4A



19c00683

STEP 3: Check the sensor harness.

STEP 3A: Inspect the sensor harness and the ECM connector pins.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:
- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Inspect the sensor harness and the ECM connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	3B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using the electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	4A

STEP 3B: Read the fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Start the engine and let it idle for 1 minute. • Read the fault codes using INSITE™.	**OK** **Fault Code 154 inactive**	4B
	NOT OK Fault Code 154 active.	3C

STEP 3C: Check for a short circuit from pin to pin.

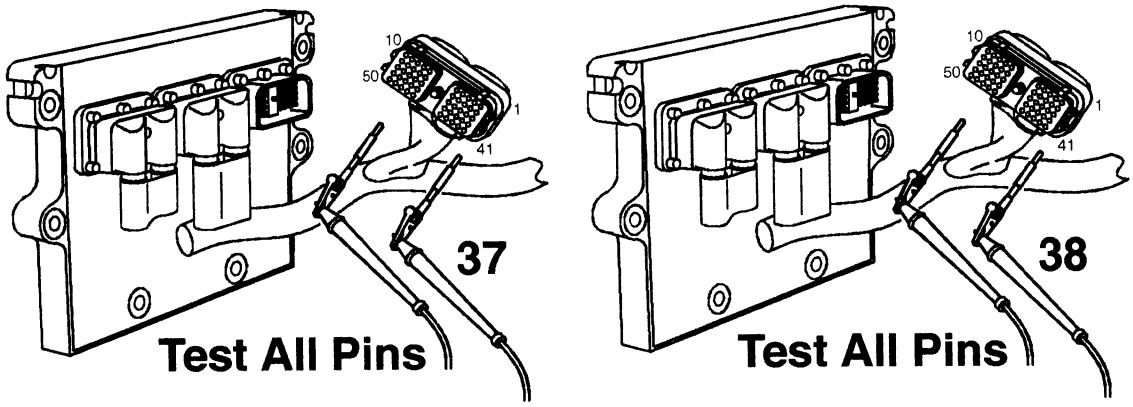
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the engine harness from the intake manifold pressure/temperature sensor.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pin 37 of the sensor harness connector to all other pins in the connector. • Measure the resistance from pin 38 of the sensor harness connector to all other pins in the connector.	**OK** **More than 100k ohms**	3D
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	4A



STEP 3D: Check for a short circuit to the ground.

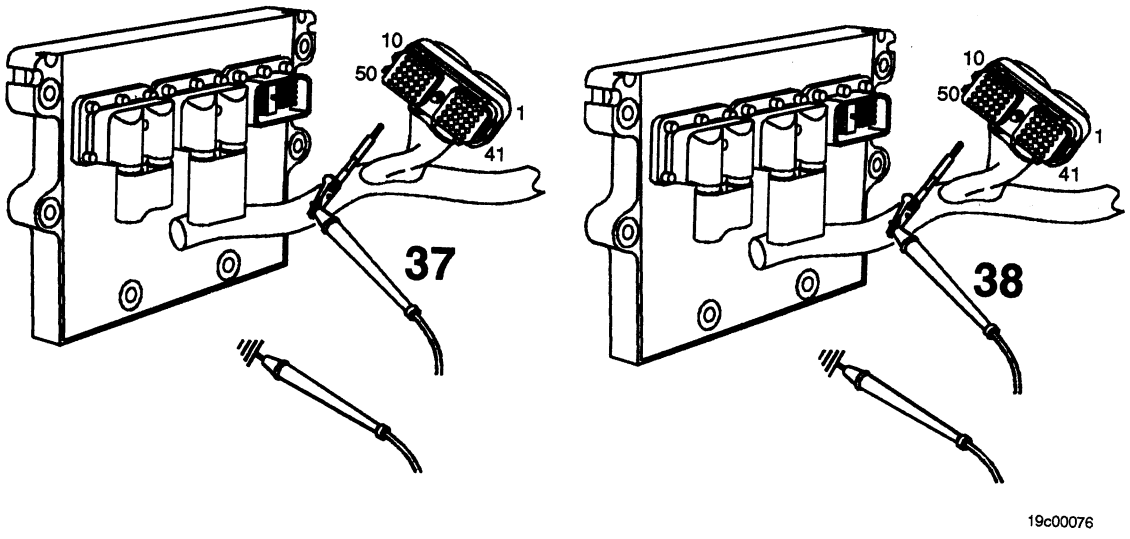
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the engine harness from the intake manifold pressure/temperature sensor.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground. • Measure the resistance from pin 37 of the sensor harness connector to the engine block ground. • Measure the resistance from pin 38 of the sensor harness connector to the engine block ground.	**OK** **More than 100k ohms**	4A
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	4A



STEP 4: Clear the fault code.

STEP 4A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it idle for 1 minute. • Using INSITE™, verify that Fault Code 154 is inactive.	**OK** **Fault Code 154 inactive**	4B
	NOT OK Return to troubleshooting steps or contact your local Cummins Authorized Repair Location if all steps have been completed and checked again.	1A

STEP 4B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

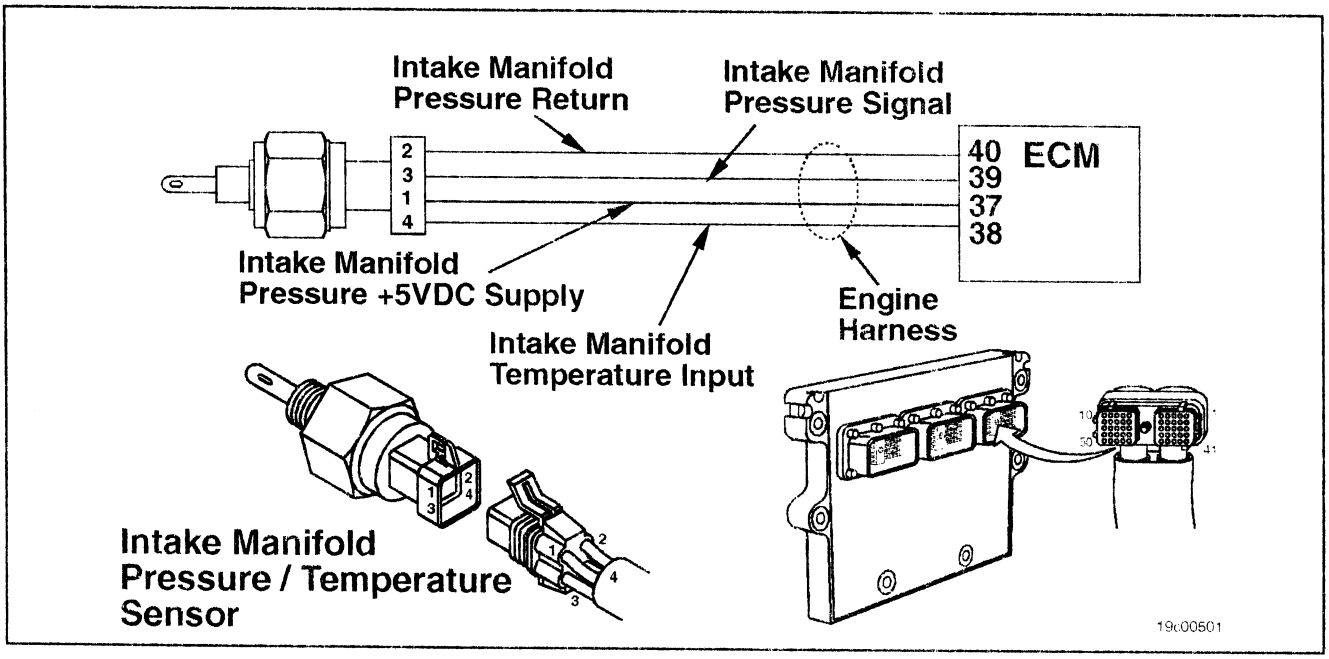
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All faults cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 153

Intake Manifold Temperature Sensor Circuit

CODES	REASON	EFFECT
Fault Code: 153 PID(P), SID(S): P105 SPN: 105 FMI: 3/3 Lamp: Yellow	High voltage detected at the intake manifold temperature circuit.	Possible white smoke. Fan will stay on if controlled by the electronic control module (ECM). No engine protection for coolant temperature.

Intake Manifold Temperature Sensor Circuit



Circuit Description:

The intake manifold pressure/temperature sensor is used by the ECM to monitor the temperature of the engine intake air. The ECM uses the intake manifold temperature signal for the engine protection system, timing, and fueling control.

Component Location:

The intake manifold pressure/temperature sensor is located on the side of the intake manifold in front of the air inlet horn.

Shop Talk:

Sensor resistance varies with the temperature. Compare your readings with this table:

Temperature (°C)	Temperature [°F]	Resistance (ohms)
0	32	30k to 36k
25	77	9k to 11k
50	122	3k to 4k
75	167	1350 to 1500
100	212	600 to 675

TROUBLESHOOTING SUMMARY

⚠ CAUTION ⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3823995 - male Weather-Pack test lead
Part No. 3823996 - female Weather-Pack test lead
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the intake manifold pressure/temperature sensor.		
STEP 1A: Inspect the intake manifold pressure/ temperature sensor and the sensor harness connector pins.	No damaged pins	
STEP 1B: Read the fault codes.	Fault Code 153 inactive	
STEP 1C: Check the resistance of the intake manifold pressure/temperature sensor.	300 ohms to 90k ohms	
STEP 2: Check the sensor harness.		
STEP 2A: Inspect the sensor harness and the ECM connector pins.	No damaged pins	
STEP 2B: Read the fault codes.	Fault Code 153 inactive	
STEP 2C: Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 2D: Check for an open circuit.	Less than 10 ohms	
STEP 3: Clear the fault code.		
STEP 3A: Disable the fault code.	Fault Code 153 inactive	
STEP 3B: Clear the inactive fault codes.	All faults cleared	

TROUBLESHOOTING STEP

STEP 1: Check the intake manifold pressure/temperature sensor.

STEP 1A: Inspect the intake manifold pressure/temperature sensor and the sensor harness connector pins.

Condition:
- Turn keyswitch OFF.
- Disconnect the engine harness from the intake manifold pressure/temperature sensor.

Action	Specifications/Repair	Next Step
Inspect the intake manifold pressure/ temperature sensor and the sensor harness connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	1B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the intake manifold pressure/ temperature sensor, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using the electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-204. • Replace the engine harness. Refer to Procedure 019-043. • Replace the intake manifold pressure/ temperature sensor. Refer to Procedure 019-159.	3A

STEP 1B: Read the fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Start the engine and let it idle for 1 minute. • Read the fault codes using INSITE™.	**OK** **Fault Code 153 inactive**	3B
	NOT OK Fault Code 153 active.	1C

STEP 1C: Check the resistance of the intake manifold pressure/temperature sensor.

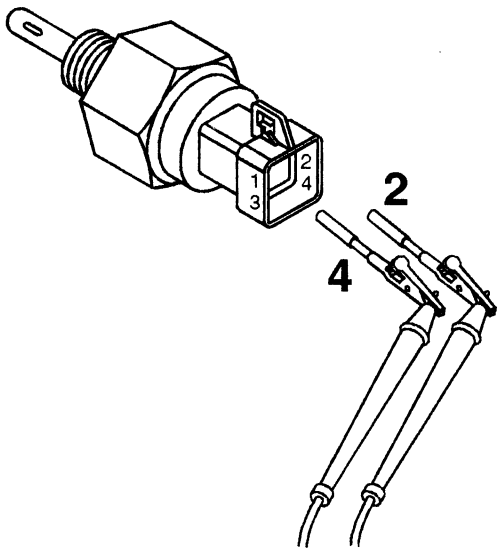
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3823996 - female Weather-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the engine harness from the intake manifold pressure/temperature sensor.

Action	Specifications/Repair	Next Step
Check the resistance of the intake manifold pressure/temperature sensor. • Measure the resistance from pin 4 (or D) to pin 2 (or B) of the intake manifold pressure/ temperature sensor.	**OK** **300 ohms to 90k ohms**	2A
	NOT OK **Replace the intake manifold pressure/ temperature sensor** Refer to Procedure 019-159.	3A



19c00681

STEP 2: Check the sensor harness.

STEP 2A: Inspect the sensor harness and the ECM connector pins.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:
- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Inspect the sensor harness and the ECM connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	2B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using the electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	3A

STEP 2B: Read the fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Start the engine and let it idle for 1 minute. • Read the fault codes using INSITE™.	**OK** **Fault Code 153 inactive**	3B
	NOT OK Fault Code 153 active.	2C

STEP 2C: Check for a short circuit from pin to pin.

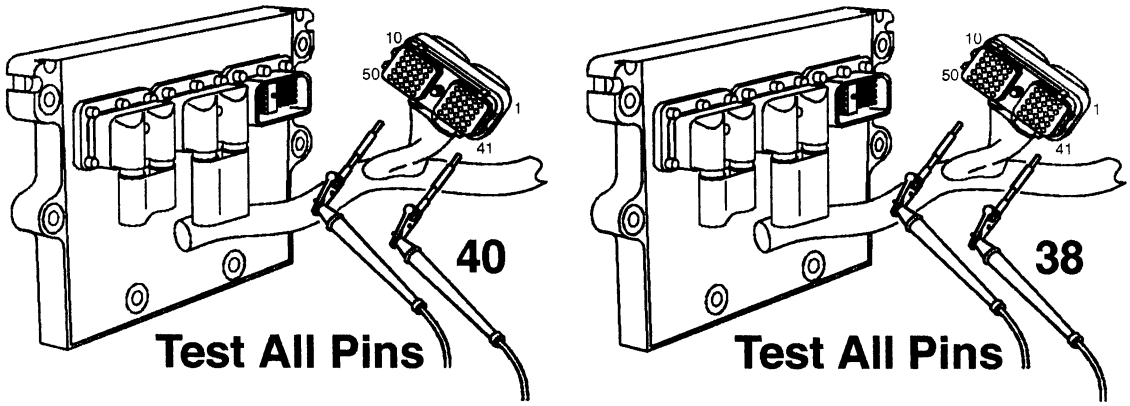
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the engine harness from the intake manifold pressure/temperature sensor.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pin 40 to all other pins in the sensor harness connector. • Measure the resistance from pin 38 to all other pins in the sensor harness connector.	**OK** **More than 100k ohms**	2D
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	3A



STEP 2D: Check for an open circuit.

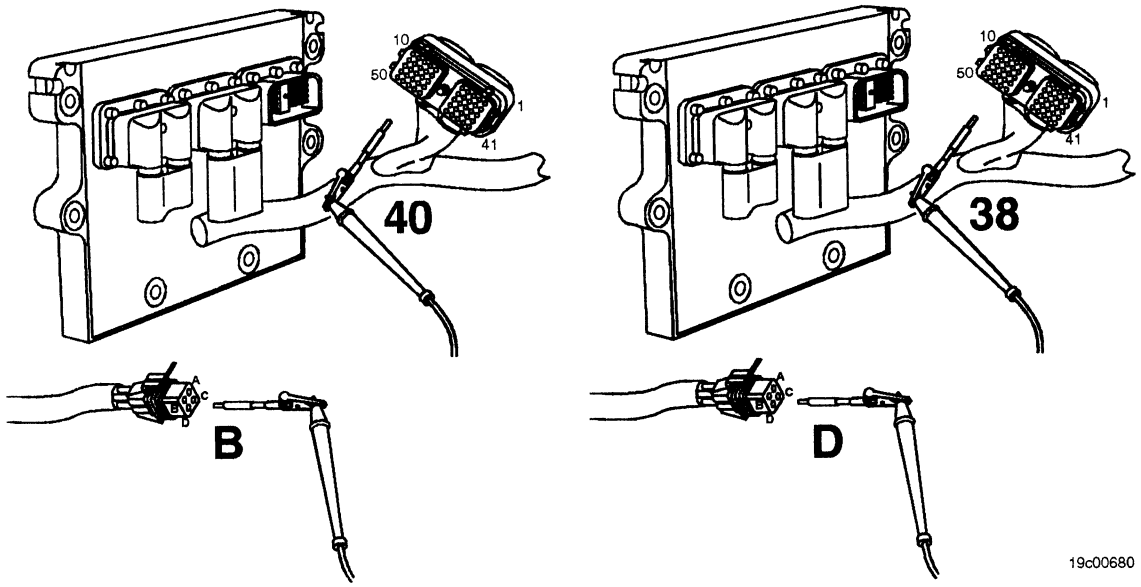
⚠CAUTION⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3823995 - male Weather-Pack test lead
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the engine harness from the intake manifold pressure/temperature sensor.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for an open circuit. • Measure the resistance from pin 40 of the sensor harness connector to pin 2 (or B) of the intake manifold pressure/temperature sensor connector, harness side. • Measure the resistance from pin 38 of the sensor harness connector to pin 4 (or D) of the intake manifold pressure/temperature sensor connector, harness side.	**OK** **Less than 10 ohms**	3A
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-204 or 019-250. • Replace the engine harness. Refer to Procedure 019-043.	3A



STEP 3: Clear the fault code.

STEP 3A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it idle for 1 minute. • Using INSITE™, verify that Fault Code 153 is inactive.	**OK** **Fault Code 153 inactive**	3B
	NOT OK Return to the troubleshooting steps or contact your local Cummins Authorized Repair Location if all steps have been completed and checked again.	1A

STEP 3B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

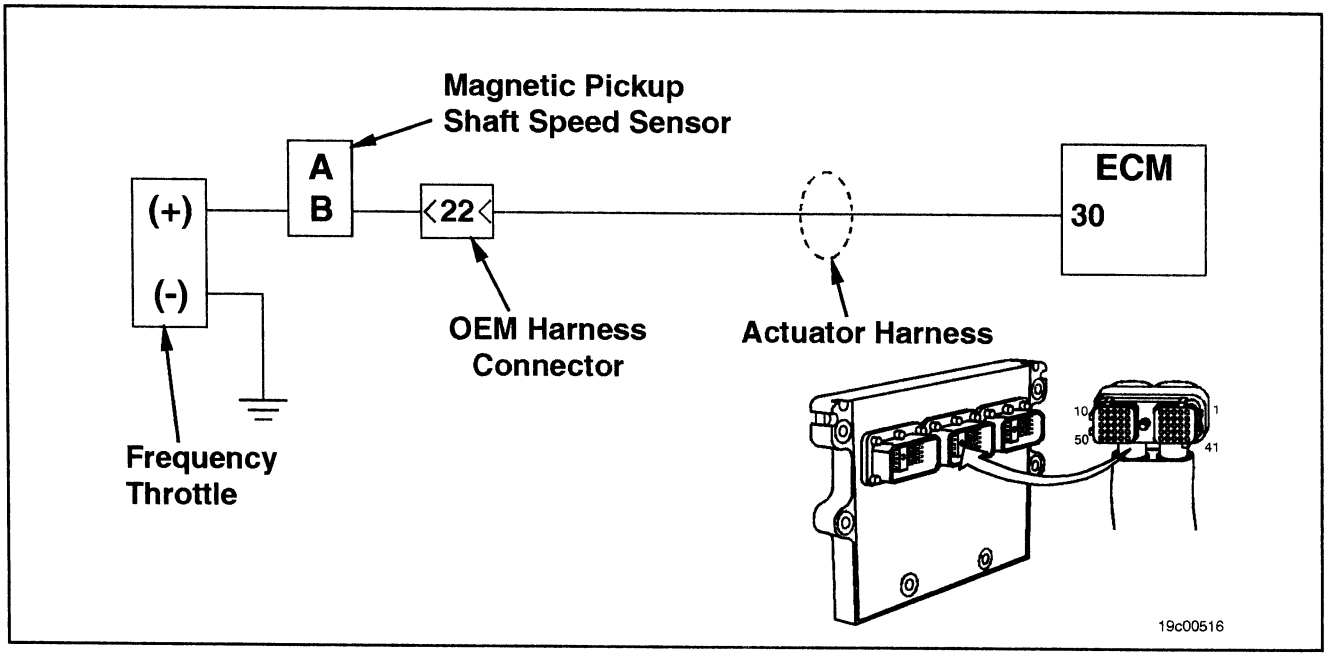
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All faults cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 147 (INDUSTRIAL)

Frequency Throttle Circuit

CODES	REASON	EFFECT
Fault Code: 147 PID(P), SID(S): P91 SPN: 091 FMI: 8/8 Lamp: Red	A frequency of less than 100 Hz was detected at frequency throttle signal pin of the actuator harness connector at the ECM.	Calibration-dependent power and speed derate.

Frequency Throttle Circuit



Circuit Description:

The frequency throttle provides the driver's throttle command to the electronic control module (ECM) through the actuator harness and the OEM engine harness. The ECM uses this signal to determine the fueling command.

Component Location:

Throttle location varies with each OEM. Refer to the OEM troubleshooting and repair manual.

Shop Talk:

The frequency throttle can either be used in conjunction with a voltage throttle or by itself.

TROUBLESHOOTING SUMMARY

⚠ CAUTION ⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead
Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

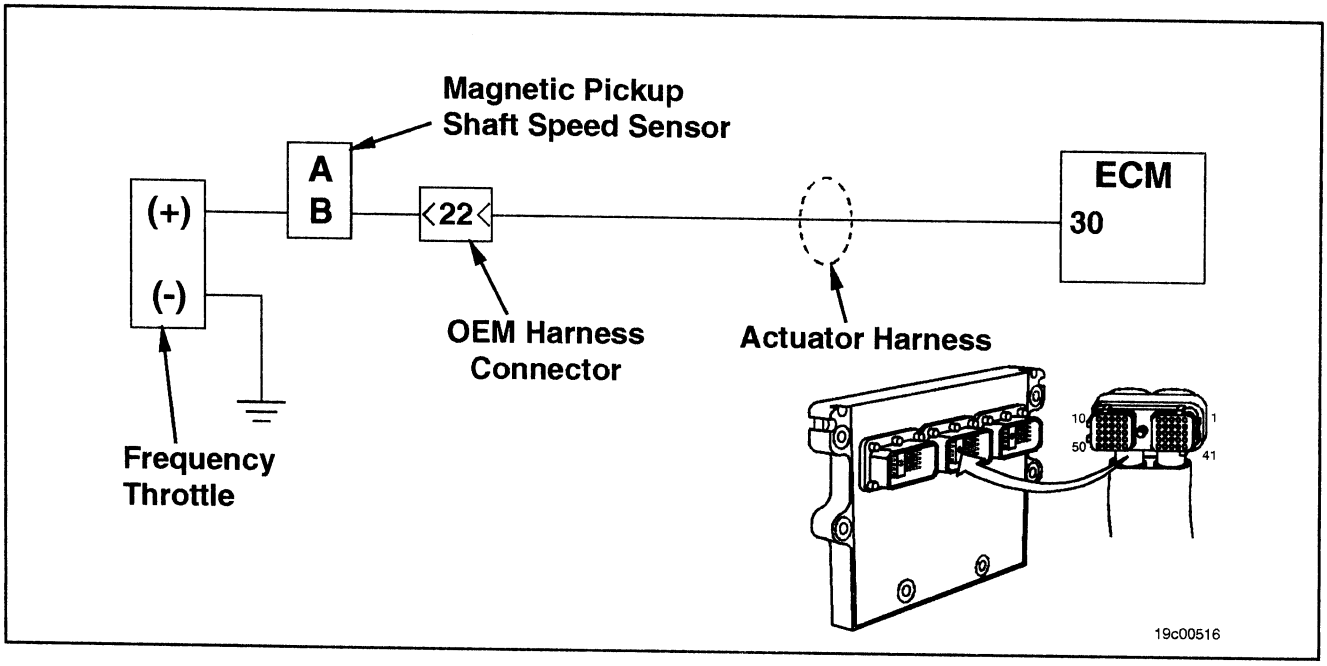
STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the OEM harness.		
STEP 1A: Inspect the OEM harness and the actuator harness connectors.	No damaged pins	
STEP 1B: Check for an open circuit.	Less than 10 ohms	
STEP 1C: Check for a short circuit to ground.	More than 100k ohms	
STEP 1D: Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 2: Check the actuator harness.		
STEP 2A: Inspect the actuator harness and the ECM connectors.	No damaged pins	
STEP 2B: Check for an open circuit.	Less than 10 ohms	
STEP 2C: Check for a short circuit to ground.	More than 100k ohms	
STEP 2D: Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 3: Clear the fault codes.		
STEP 3A: Disable the fault code.	Fault Code 147 inactive	
STEP 3B: Clear the inactive fault codes.	All fault codes cleared	

Fault Code 147 (INDUSTRIAL)

Frequency Throttle Circuit

CODES	REASON	EFFECT
Fault Code: 147 PID(P), SID(S): P91 SPN: 091 FMI: 8/8 Lamp: Red	A frequency of less than 100 Hz was detected at frequency throttle signal pin of the actuator harness connector at the ECM.	Calibration-dependent power and speed derate.

Frequency Throttle Circuit



Circuit Description:

The frequency throttle provides the driver's throttle command to the electronic control module (ECM) through the actuator harness and the OEM engine harness. The ECM uses this signal to determine the fueling command.

Component Location:

Throttle location varies with each OEM. Refer to the OEM troubleshooting and repair manual.

Shop Talk:

The frequency throttle can either be used in conjunction with a voltage throttle or by itself.

TROUBLESHOOTING SUMMARY

⚠ CAUTION ⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead
Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

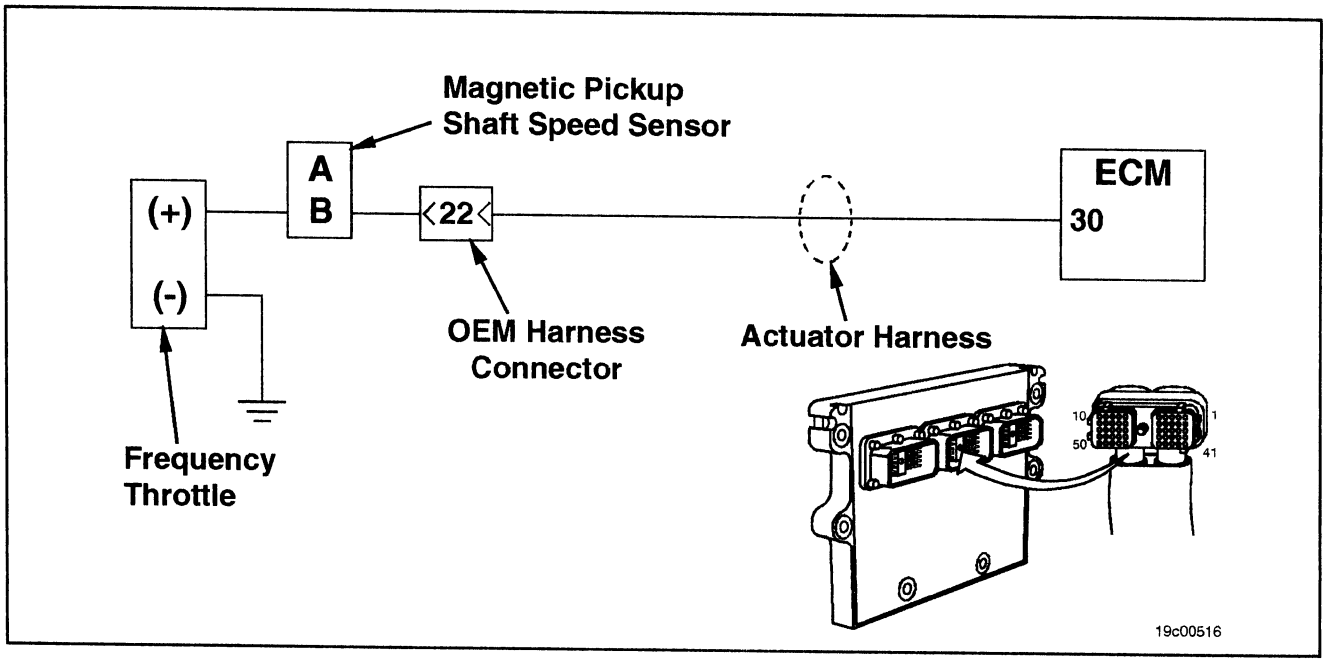
STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the OEM harness.		
STEP 1A: Inspect the OEM harness and the actuator harness connectors.	No damaged pins	
STEP 1B: Check for an open circuit.	Less than 10 ohms	
STEP 1C: Check for a short circuit to ground.	More than 100k ohms	
STEP 1D: Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 2: Check the actuator harness.		
STEP 2A: Inspect the actuator harness and the ECM connectors.	No damaged pins	
STEP 2B: Check for an open circuit.	Less than 10 ohms	
STEP 2C: Check for a short circuit to ground.	More than 100k ohms	
STEP 2D: Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 3: Clear the fault codes.		
STEP 3A: Disable the fault code.	Fault Code 147 inactive	
STEP 3B: Clear the inactive fault codes.	All fault codes cleared	

Fault Code 147 (INDUSTRIAL)

Frequency Throttle Circuit

CODES	REASON	EFFECT
Fault Code: 147 PID(P), SID(S): P91 SPN: 091 FMI: 8/8 Lamp: Red	A frequency of less than 100 Hz was detected at frequency throttle signal pin of the actuator harness connector at the ECM.	Calibration-dependent power and speed derate.

Frequency Throttle Circuit



Circuit Description:

The frequency throttle provides the driver's throttle command to the electronic control module (ECM) through the actuator harness and the OEM engine harness. The ECM uses this signal to determine the fueling command.

Component Location:

Throttle location varies with each OEM. Refer to the OEM troubleshooting and repair manual.

Shop Talk:

The frequency throttle can either be used in conjunction with a voltage throttle or by itself.

TROUBLESHOOTING SUMMARY

⚠ CAUTION ⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead
Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the OEM harness.		
STEP 1A: Inspect the OEM harness and the actuator harness connectors.	No damaged pins	
STEP 1B: Check for an open circuit.	Less than 10 ohms	
STEP 1C: Check for a short circuit to ground.	More than 100k ohms	
STEP 1D: Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 2: Check the actuator harness.		
STEP 2A: Inspect the actuator harness and the ECM connectors.	No damaged pins	
STEP 2B: Check for an open circuit.	Less than 10 ohms	
STEP 2C: Check for a short circuit to ground.	More than 100k ohms	
STEP 2D: Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 3: Clear the fault codes.		
STEP 3A: Disable the fault code.	Fault Code 147 inactive	
STEP 3B: Clear the inactive fault codes.	All fault codes cleared	

TROUBLESHOOTING SUMMARY

⚠ CAUTION ⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead
Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the OEM harness.		
STEP 1A: Inspect the OEM harness and the actuator harness connectors.	No damaged pins	
STEP 1B: Check for an open circuit.	Less than 10 ohms	
STEP 1C: Check for a short circuit to ground.	More than 100k ohms	
STEP 1D: Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 2: Check the actuator harness.		
STEP 2A: Inspect the actuator harness and the ECM connectors.	No damaged pins	
STEP 2B: Check for an open circuit.	Less than 10 ohms	
STEP 2C: Check for a short circuit to ground.	More than 100k ohms	
STEP 2D: Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 3: Clear the fault codes.		
STEP 3A: Disable the fault code.	Fault Code 147 inactive	
STEP 3B: Clear the inactive fault codes.	All fault codes cleared	

TROUBLESHOOTING STEP

STEP 1: Check the OEM harness.

STEP 1A: Inspect the OEM harness and the actuator harness connectors.

Condition:
- Turn keyswitch OFF.
- Disconnect the OEM harness from the actuator harness at the 31-pin connector.

Action	Specifications/Repair	Next Step
Inspect the OEM harness and the actuator harness connectors for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	1B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness or the OEM harness, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electronic contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-231. • Replace the engine harness. Refer to Procedure 019-043. • Repair the OEM harness. Refer to Procedure 019-231. • Replace the OEM harness. Refer to Procedure 019-071.	3A

STEP 1B: Check for an open circuit.

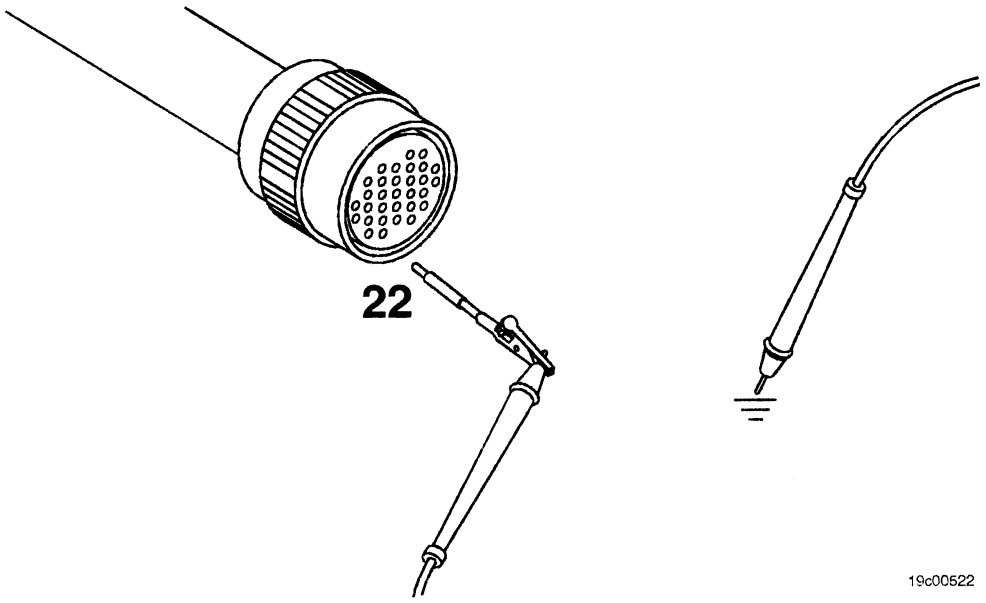
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the OEM engine harness from the actuator harness at the 31-pin connector.
- Connect the frequency throttle to the OEM harness.

Action	Specifications/Repair	Next Step
Check for an open circuit. • Measure the resistance from pin 22 of the OEM 31-pin connector to engine block ground.	**OK** **Less than 10 ohms**	1C
	NOT OK **Repair or replace the OEM harness** • Repair the OEM harness. Refer to Procedure 019-231. • Replace the OEM harness. Refer to Procedure 019-071.	3A



STEP 1C: Check for a short circuit to ground.

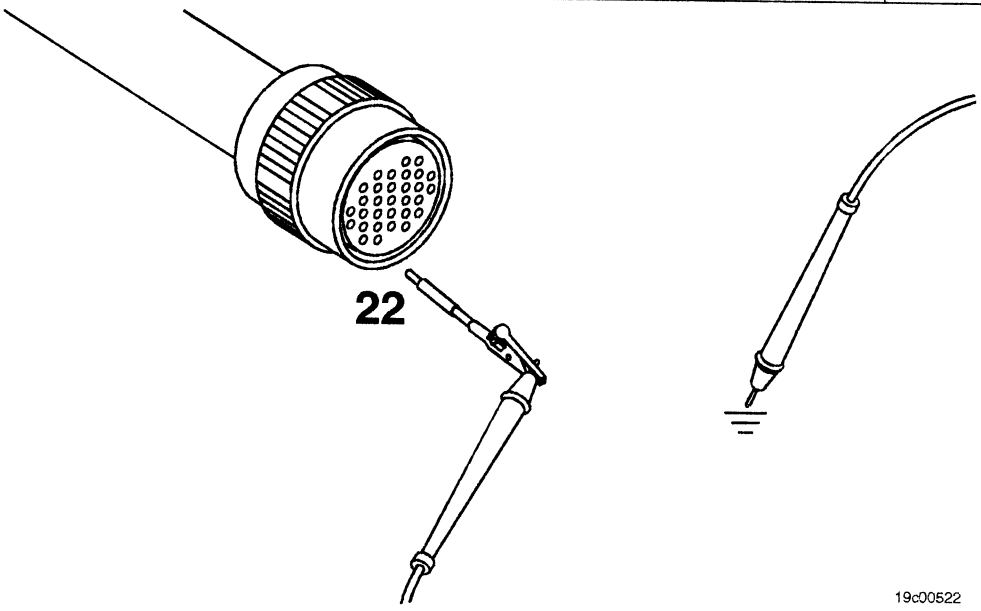
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the OEM engine harness from the actuator harness at the 31-pin connector.
- Disconnect the OEM engine harness from the frequency throttle.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground. • Measure the resistance from pin 22 of the OEM 31-pin connector to engine block ground.	**OK** **More than 100k ohms**	1D
	NOT OK **Repair or replace the OEM harness** • Repair the OEM harness. Refer to Procedure 019-231. • Replace the OEM harness. Refer to Procedure 019-071.	3A



STEP 1D: Check for a short circuit from pin to pin.

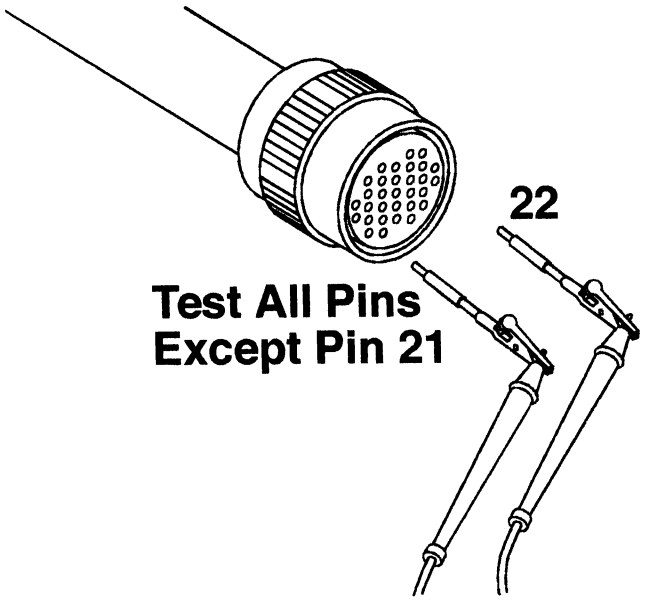
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the OEM engine harness from the actuator harness at the 31-pin connector.
- Disconnect the OEM engine harness from the frequency throttle.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pin 22 of the OEM engine harness 31-pin connector to all other pins in the connector, except pin 21.	**OK** **More than 100k ohms**	2A
	NOT OK **Repair or replace the OEM harness** • Repair the OEM harness. Refer to Procedure 019-231. • Replace the OEM harness. Refer to Procedure 019-071.	3A



STEP 2: Check the actuator harness.

STEP 2A: Inspect the actuator harness and the ECM connectors.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch OFF.
- Disconnect the actuator harness connector from the ECM.

Action	Specifications/Repair	Next Step
Inspect the actuator harness and the ECM connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	2B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using electronic contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-231. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	3A

STEP 2B: Check for an open circuit.

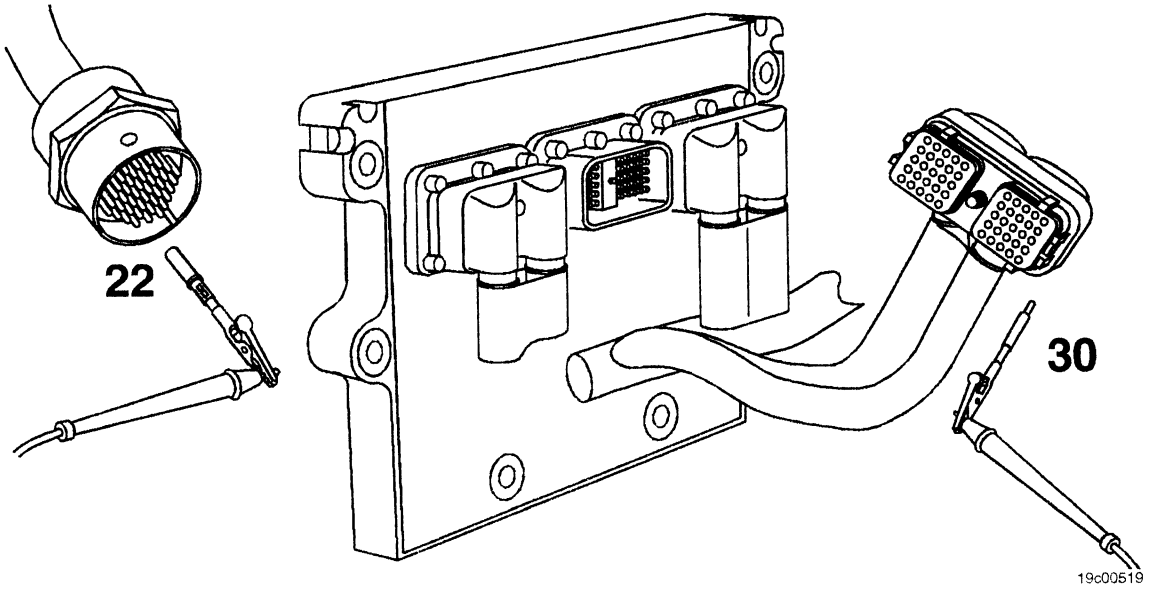
⚠CAUTION⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead
Part No. 3822917 - female Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the OEM engine harness from the actuator harness at the 31-pin connector.
- Disconnect the actuator harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for an open circuit. • Measure the resistance from pin 30 of the actuator harness connector to pin 22 of the engine harness 31-pin OEM connector.	**OK** **Less than 10 ohms**	2C
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-231 or 019-250. • Replace the engine harness. Refer to Procedure 019-043.	3A



STEP 2C: Check for a short circuit to ground.

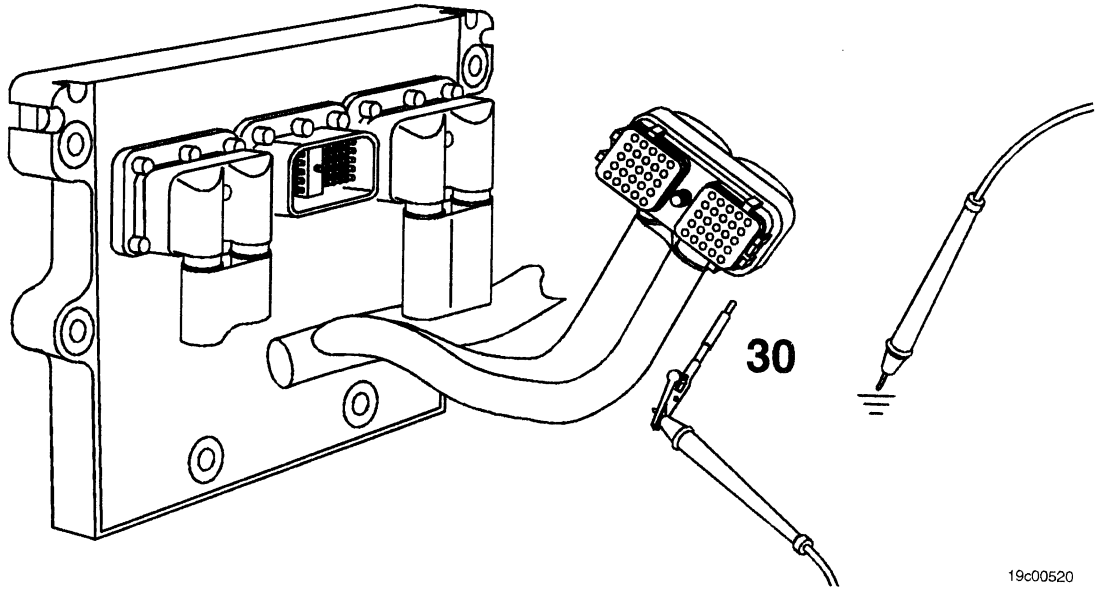
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the OEM engine harness from the actuator harness at the 31-pin connector.
- Disconnect the actuator harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground. • Measure the resistance from pin 30 of the actuator harness ECM connector to engine block ground.	**OK** **More than 100k ohms**	2D
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	3A



STEP 2D: Check for a short circuit from pin to pin.

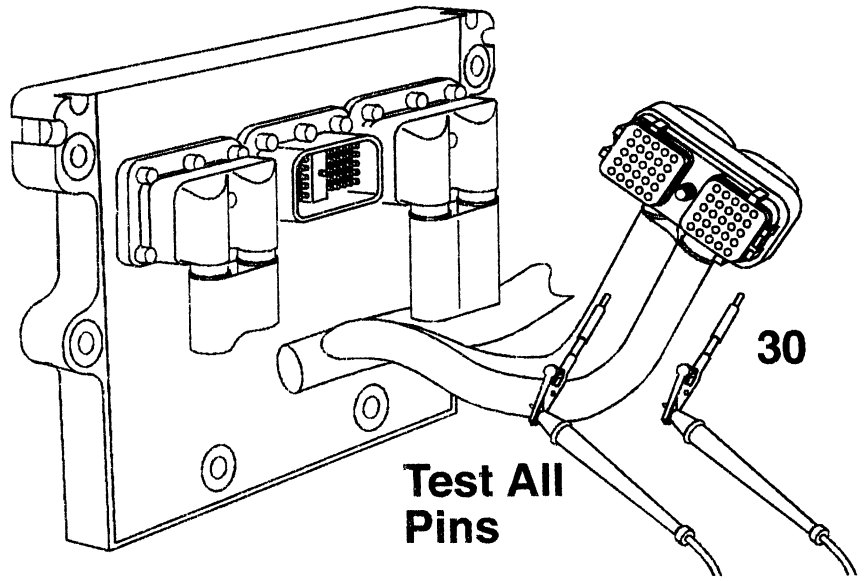
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the OEM engine harness from the actuator harness at the 31-pin connector.
- Disconnect the actuator harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pin 30 of the actuator harness ECM connector to all other pins in the connector.	**OK** **More than 100k ohms**	3A
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	3A



STEP 3: Clear the fault codes.

STEP 3A: Disable the fault code.

Condition:
- Connect all components.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it idle for 1 minute. • Verify that Fault Code 147 is inactive.	**OK** **Fault Code 147 inactive**	3B
	NOT OK Return to troubleshooting steps or contact your local Cummins Authorized Repair Location if all steps have been completed and checked again.	1A

STEP 3B: Clear the inactive fault codes.

Condition:
- Connect all components.

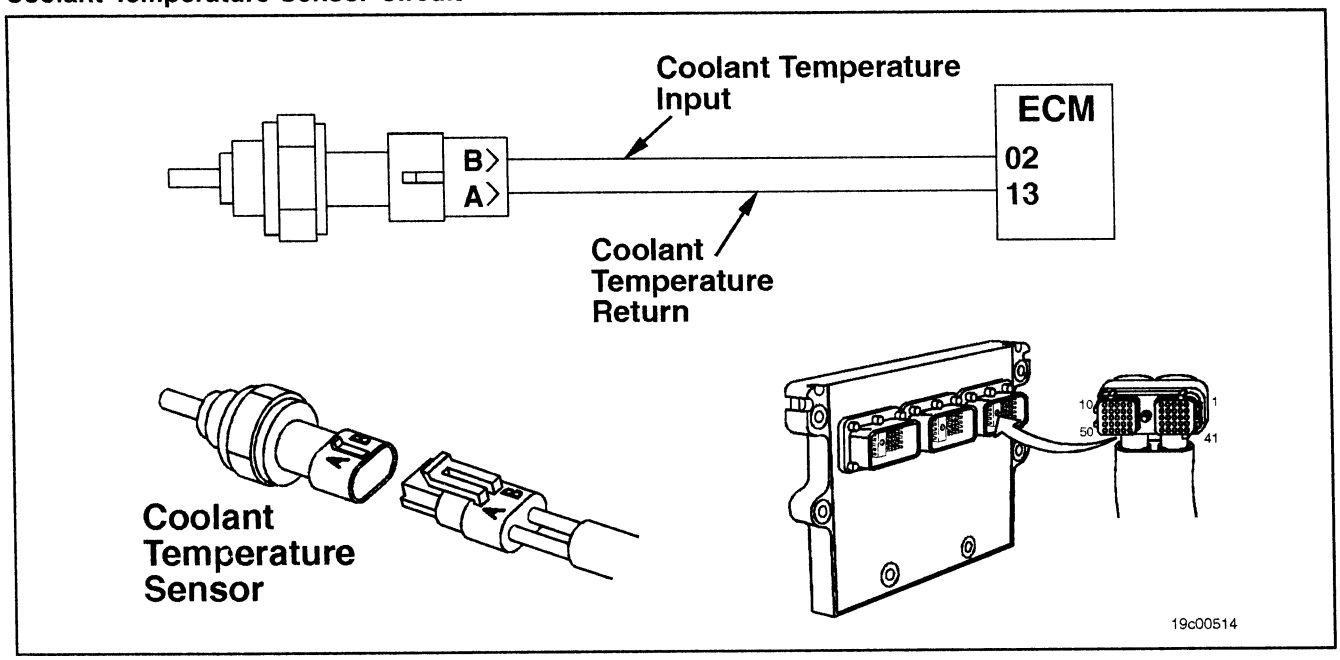
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 145

Coolant Temperature Sensor Circuit

CODES	REASON	EFFECT
Fault Code: 145 PID(P), SID(S): P110 SPN: 110 FMI: 4/4 Lamp: Yellow	Low voltage detected at the coolant temperature circuit.	Possible white smoke. Fan will stay on if controlled by the electronic control module (ECM). No engine protection for coolant temperature.

Coolant Temperature Sensor Circuit



Circuit Description:

The coolant temperature sensor is used by the ECM to monitor the temperature of the engine coolant. The coolant temperature is used by the ECM for the engine protection system, timing, and fueling control.

Component Location:

The coolant temperature sensor is located in front of the turbocharger.

Shop Talk:

The resistance of the sensor varies with the temperature. Compare your reading to this table:

Temperature (°C)	Temperature [°F]	Resistance (ohms)
0	32	30k to 36k
25	77	9k to 11k
50	122	3k to 4k
75	167	1350 to 1500
100	212	600 to 675

TROUBLESHOOTING SUMMARY

⚠ WARNING ⚠

Do not remove the pressure cap from a hot engine. Wait until the coolant temperature is below 50°C [122°F] before removing the pressure cap. Heated coolant spray or steam can cause personal injury.

⚠ CAUTION ⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead
Part No. 3823256 - 2-way Metri-Pack test lead.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the coolant temperature sensor.		
STEP 1A: Inspect the coolant temperature sensor and sensor harness connector pins.	No damaged pins	
STEP 1B: Read the fault codes.	Fault Code 145 inactive	
STEP 1C: Check the resistance of the coolant temperature sensor.	300 ohms to 90k ohms	
STEP 1D: Check for a short circuit to ground.	More than 100k ohms	
STEP 2: Check the sensor harness.		
STEP 2A: Inspect the sensor harness and the ECM connector pins.	No damaged pins	
STEP 2B: Read the fault codes.	Fault Code 145 inactive	
STEP 2C: Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 2D: Check for a short circuit to ground.	More than 100k ohms	
STEP 3: Clear the fault codes.		
STEP 3A: Disable the fault code.	Fault Code 145 inactive	
STEP 3B: Clear the inactive fault codes.	All fault codes cleared	

TROUBLESHOOTING STEP

STEP 1: Check the coolant temperature sensor.

STEP 1A: Inspect the coolant temperature sensor and sensor harness connector pins.

⚠WARNING⚠

Do not remove the pressure cap from a hot engine. Wait until the coolant temperature is below 50°C [122°F] before removing the pressure cap. Heated coolant spray or steam can cause personal injury.

Condition:
- Turn keyswitch OFF.
- Disconnect the sensor harness from the coolant temperature sensor.

Action	Specifications/Repair	Next Step
Inspect the harness and the sensor connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	1B
	NOT OK **Repair the damaged pins** Repair or replace the sensor harness, or replace the coolant temperature sensor, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using the electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the sensor harness. Refer to Procedure 019-202. • Replace the sensor harness. Refer to Procedure 019-043. • Replace the coolant temperature sensor. Refer to Procedure 019-019.	3A

STEP 1B: Read the fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Start the engine and let it idle for 1 minute. • Read the fault codes using INSITE™.	**OK** **Fault Code 145 inactive**	3B
	NOT OK Fault Code 145 active.	1C

STEP 1C: Check the resistance of the coolant temperature sensor.

⚠WARNING⚠

Do not remove the pressure cap from a hot engine. Wait until the coolant temperature is below 50°C [122°F] before removing the pressure cap. Heated coolant spray or steam can cause personal injury.

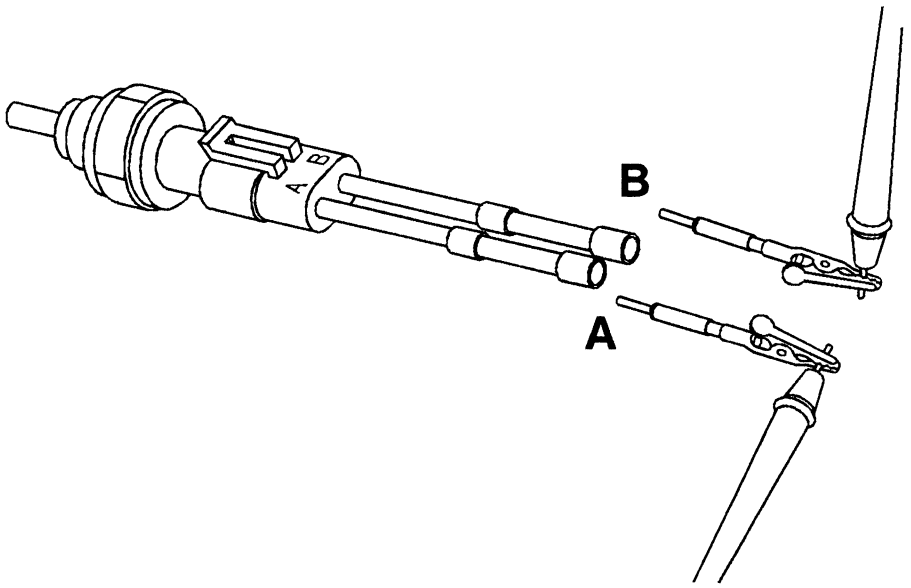
⚠CAUTION⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3823256 - 2-way Metri-Pack test lead
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the engine harness from the coolant temperature sensor.

Action	Specifications/Repair	Next Step
Check the resistance of the coolant temperature sensor. • Measure the resistance from pin A (or 1) to pin B (or 2) of the coolant temperature sensor.	**OK** **300 ohms to 90k ohms**	1D
	NOT OK **Replace the coolant temperature sensor** Refer to Procedure 019-019.	3A



STEP 1D: Check for a short circuit to ground.

⚠WARNING⚠

Do not remove the pressure cap from a hot engine. Wait until the coolant temperature is below 50°C [122°F] before removing the pressure cap. Heated coolant spray or steam can cause personal injury.

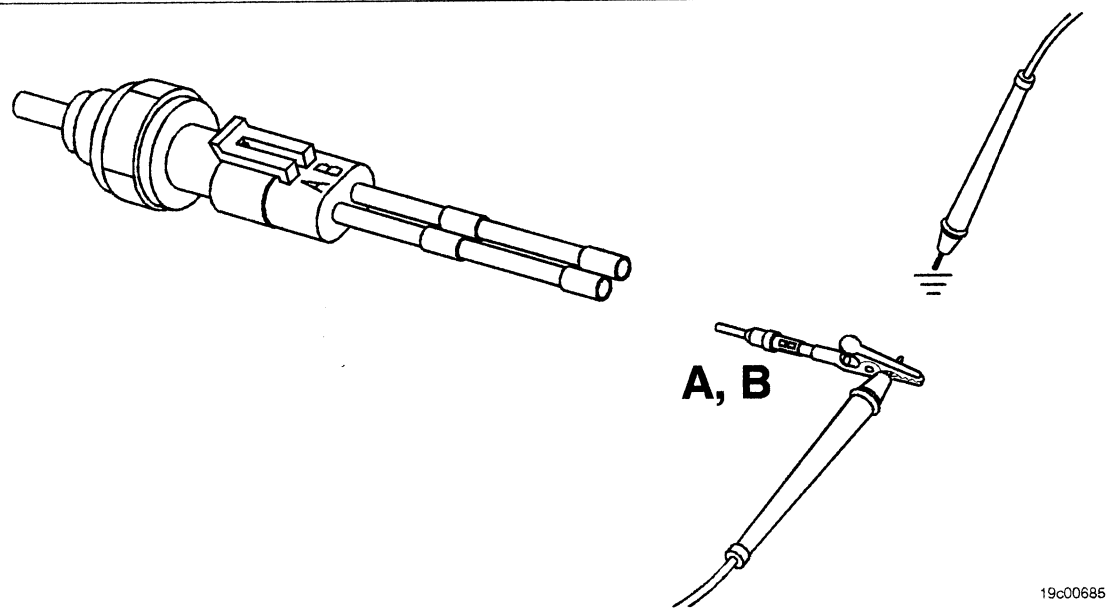
⚠CAUTION⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3823256 - 2-way Metri-Pack test lead
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the engine harness from the coolant temperature sensor.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground. • Measure the resistance from pin A (or 1) of the coolant temperature sensor to engine block ground. • Measure the resistance from pin B (or 2) of the coolant temperature sensor to engine block ground.	**OK** **More than 100k ohms**	2A
	NOT OK **Replace the coolant temperature sensor** Refer to Procedure 019-019.	3A



STEP 2: Check the sensor harness.

STEP 2A: Inspect the sensor harness and the ECM connector pins.

⚠WARNING⚠

Do not remove the pressure cap from a hot engine. Wait until the coolant temperature is below 50°C [122°F] before removing the pressure cap. Heated coolant spray or steam can cause personal injury.

△CAUTION△

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:
- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Inspect the sensor harness and the ECM connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	2B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using the electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	3A

STEP 2B: Read the fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Start the engine and let it idle for 1 minute. • Read the fault codes using INSITE™.	**OK** **Fault Code 145 inactive**	3B
	NOT OK Fault Code 145 active.	2C

STEP 2C: Check for a short circuit from pin to pin.

⚠WARNING⚠

Do not remove the pressure cap from a hot engine. Wait until the coolant temperature is below 50°C [122°F] before removing the pressure cap. Heated coolant spray or steam can cause personal injury.

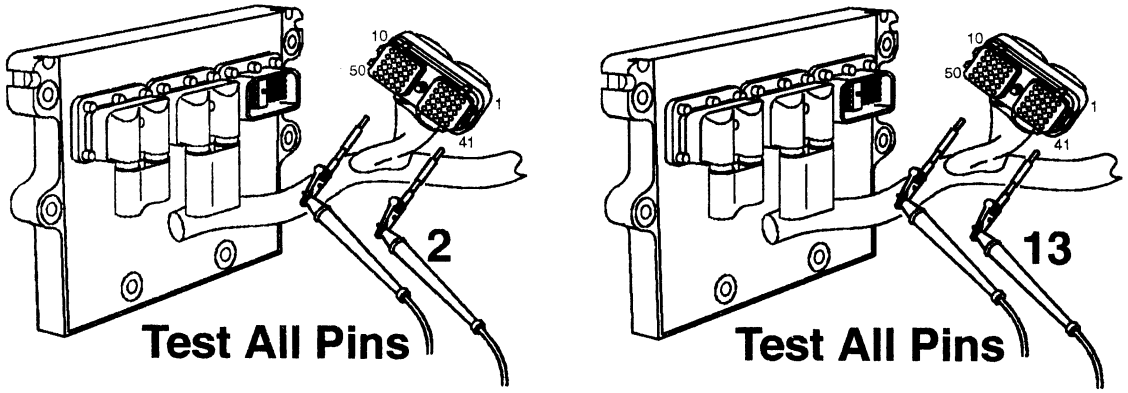
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the engine harness from the coolant temperature sensor.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pin 2 of the sensor harness connector to all other pins in the connector. • Measure the resistance from pin 13 of the sensor harness connector to all other pins in the connector.	**OK** **More than 100k ohms**	2D
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	3A



19c00512

STEP 2D: Check for a short circuit to ground.

⚠WARNING⚠

Do not remove the pressure cap from a hot engine. Wait until the coolant temperature is below 50°C [122°F] before removing the pressure cap. Heated coolant spray or steam can cause personal injury.

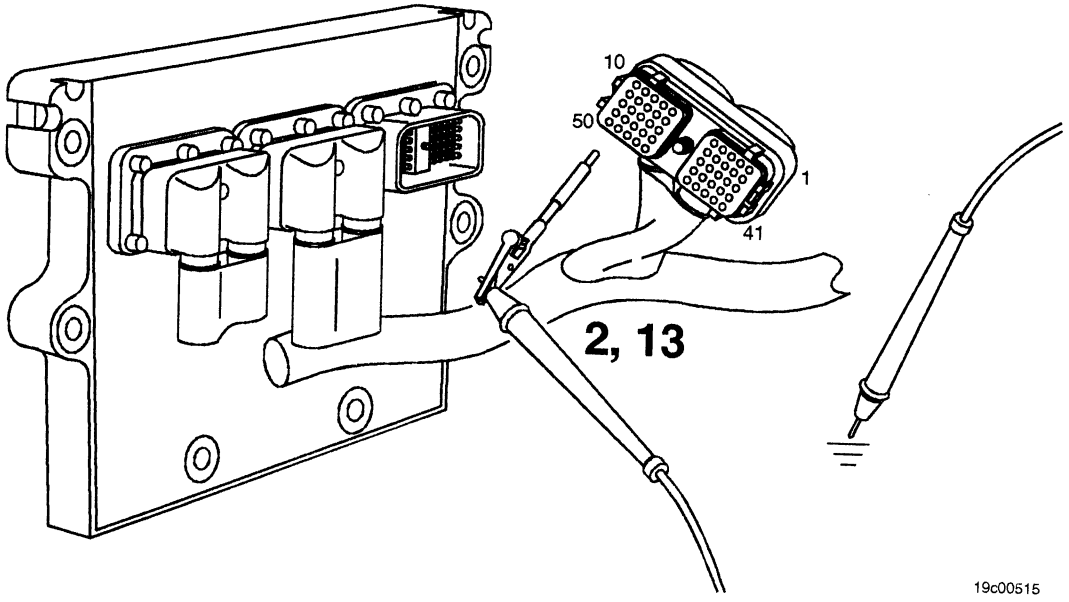
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the engine harness from the coolant temperature sensor.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground. • Measure the resistance from pin 2 of the sensor harness connector to the engine block ground. • Measure the resistance from pin 13 of the sensor harness connector to the engine block ground.	**OK** **More than 100k ohms**	3A
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	3A



STEP 3: Clear the fault codes.

STEP 3A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it idle for 1 minute. • Using INSITE™, verify Fault Code 145 is inactive.	**OK** **Fault Code 145 inactive**	3B
	NOT OK Return to the troubleshooting steps or contact your local Cummins Authorized Repair Location if all the steps have been completed and checked again.	1A

STEP 3B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

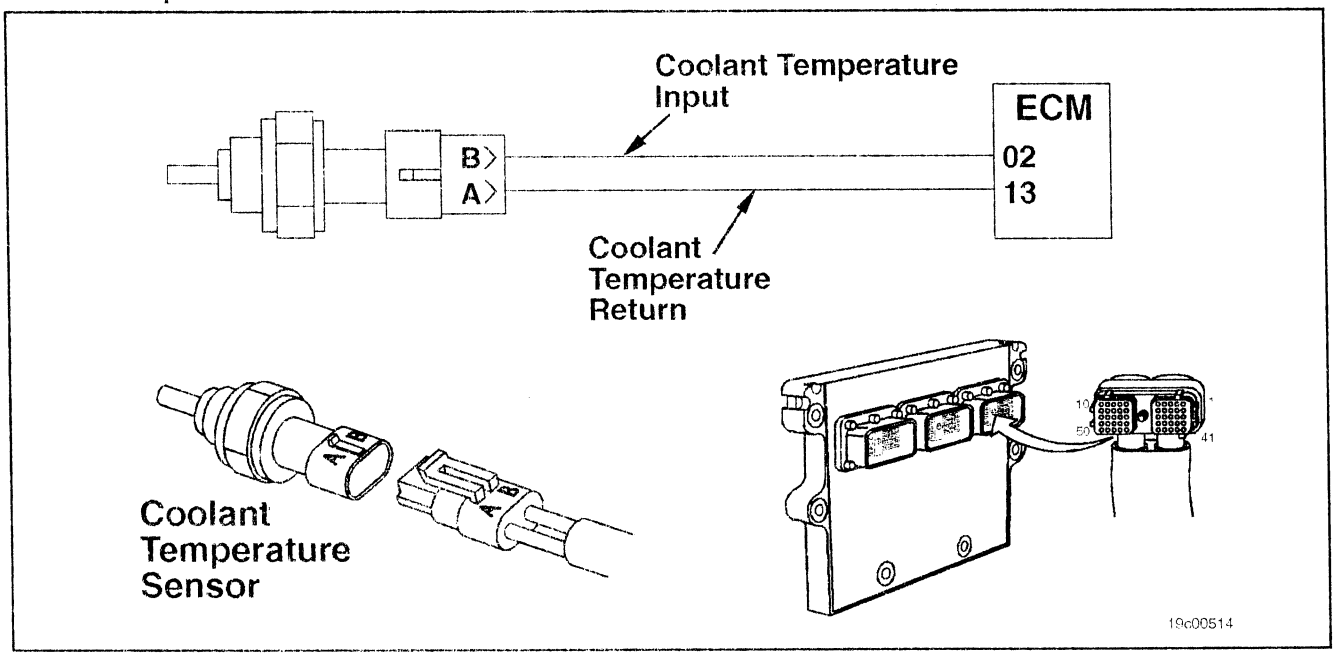
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 144

Coolant Temperature Sensor Circuit

CODES	REASON	EFFECT
Fault Code: 144 PID(P), SID(S): P110 SPN: 110 FMI: 3/3 Lamp: Yellow	High voltage detected at the coolant temperature circuit.	Possible white smoke. Fan will stay on if controlled by the electronic control module (ECM). No engine protection for coolant temperature.

Coolant Temperature Sensor Circuit



Circuit Description:

The coolant temperature sensor is used by the ECM to monitor the temperature of the engine coolant. The coolant temperature is used by the ECM for the engine protection system, timing, and fueling control.

Component Location:

The coolant temperature sensor is located in front of the turbocharger.

Shop Talk:

The resistance of the sensor varies with the temperature. Compare your reading to this table:

Temperature (°C)	Temperature [°F]	Resistance (ohms)
0	32	30k to 36k
25	77	9k to 11k
50	122	3k to 4k
75	167	1350 to 1500
100	212	600 to 675

TROUBLESHOOTING SUMMARY

⚠ WARNING ⚠

Do not remove the pressure cap from a hot engine. Wait until the coolant temperature is below 50°C [122°F] before removing the pressure cap. Heated coolant spray or steam can cause personal injury.

⚠ CAUTION ⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead
Part No. 3823256 - 2-way Metri-Pack test lead.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the coolant temperature sensor.		
STEP 1A: Inspect the coolant temperature sensor and sensor harness connector pins.	No damaged pins	
STEP 1B: Read the fault codes.	Fault Code 144 inactive	
STEP 1C: Check the resistance of the coolant temperature sensor.	300 ohms to 90k ohms	
STEP 2: Check the sensor harness.		
STEP 2A: Inspect the sensor harness and the ECM connector pins.	No damaged pins	
STEP 2B: Read the fault codes.	Fault Code 144 inactive	
STEP 2C: Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 2D: Check for an open circuit.	Less than 10 ohms	
STEP 3: Clear the fault codes.		
STEP 3A: Disable the fault code.	Fault Code 144 inactive	
STEP 3B: Clear the inactive fault codes.	All fault codes cleared	

TROUBLESHOOTING STEP

STEP 1: Check the coolant temperature sensor.

STEP 1A: Inspect the coolant temperature sensor and sensor harness connector pins.

⚠WARNING⚠

Do not remove the pressure cap from a hot engine. Wait until the coolant temperature is below 50°C [122°F] before removing the pressure cap. Heated coolant spray or steam can cause personal injury.

Condition:
- Turn keyswitch OFF.
- Disconnect the sensor harness from the coolant temperature sensor.

Action	Specifications/Repair	Next Step
Inspect the coolant temperature sensor and sensor harness connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	1B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the coolant temperature sensor, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using the electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-204. • Replace the engine harness. Refer to Procedure 019-043. • Replace the coolant temperature sensor. Refer to Procedure 019-019.	3A

STEP 1B: Read the fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Start the engine and let it idle for 1 minute. • Read the fault codes using INSITE™.	**OK** **Fault Code 144 inactive**	3B
	NOT OK Fault Code 144 active.	1C

STEP 1C: Check the resistance of the coolant temperature sensor.

⚠WARNING⚠

Do not remove the pressure cap from a hot engine. Wait until the coolant temperature is below 50°C [122°F] before removing the pressure cap. Heated coolant spray or steam can cause personal injury.

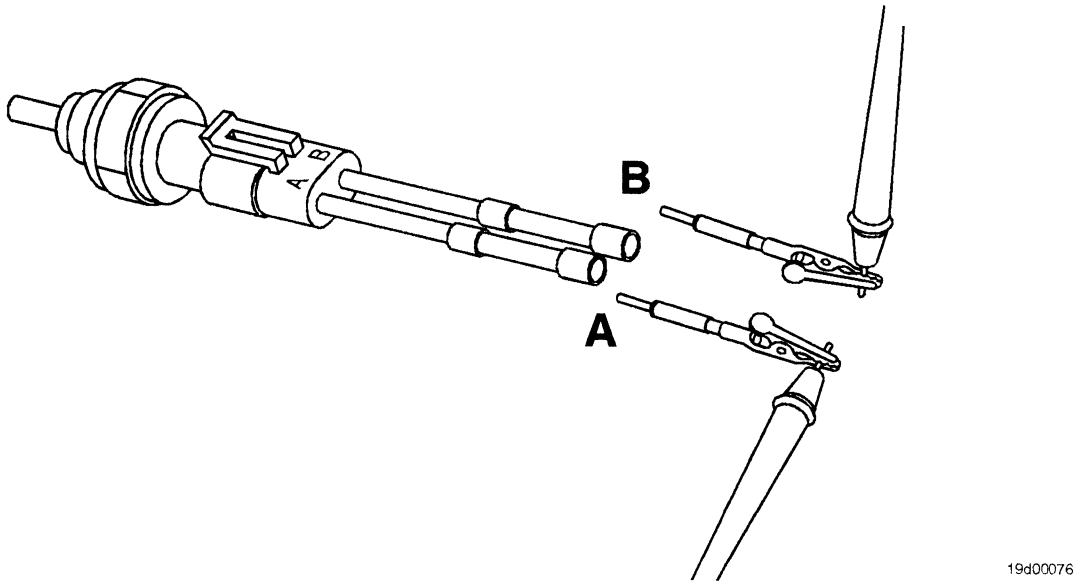
⚠CAUTION⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3823256 - 2-way Metri-Pack test lead
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the engine harness from the coolant temperature sensor.

Action	Specifications/Repair	Next Step
Check the resistance of the coolant temperature sensor. • Measure the resistance from pin A (or 1) to pin B (or 2) of the coolant temperature sensor.	**OK** **300 ohms to 90k ohms**	2A
	NOT OK **Replace the coolant temperature sensor** Refer to Procedure 019-019.	3A



STEP 2: Check the sensor harness.

STEP 2A: Inspect the sensor harness and the ECM connector pins.

⚠WARNING⚠

Do not remove the pressure cap from a hot engine. Wait until the coolant temperature is below 50°C [122°F] before removing the pressure cap. Heated coolant spray or steam can cause personal injury.

⚠CAUTION⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:
- Turn keyswitch OFF.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Inspect the sensor harness and the ECM connector pins for the following: • Corroded pins • Bent or broken pins • Pushed back or expanded pins • Moisture in or on the connector • Missing or damaged connector seals • Dirt or debris in or on the connector pins.	**OK** **No damaged pins**	2B
	NOT OK **Repair the damaged pins** Repair or replace the engine harness, or replace the ECM, whichever has the damaged pins. • Flush the dirt, debris, or moisture from the connector pins using the electrical contact cleaner, Part No. 3824510. • Install the appropriate connector seal if it is damaged or missing. • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031.	3A

STEP 2B: Read the fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Read the fault codes. • Start the engine and let it idle for 1 minute. • Read the fault codes using INSITE™.	**OK** **Fault Code 144 inactive**	3B
	NOT OK Fault Code 144 active.	2C

STEP 2C: Check for a short circuit from pin to pin.

⚠WARNING⚠

Do not remove the pressure cap from a hot engine. Wait until the coolant temperature is below 50°C [122°F] before removing the pressure cap. Heated coolant spray or steam can cause personal injury.

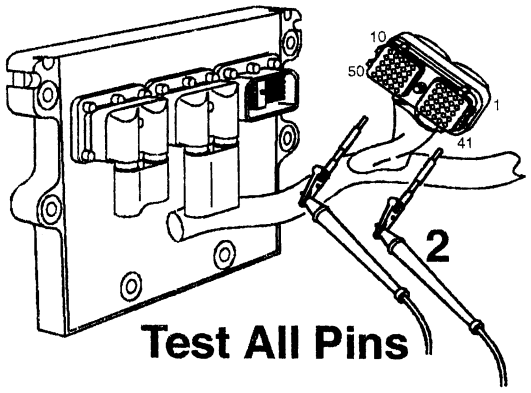
⚠CAUTION⚠

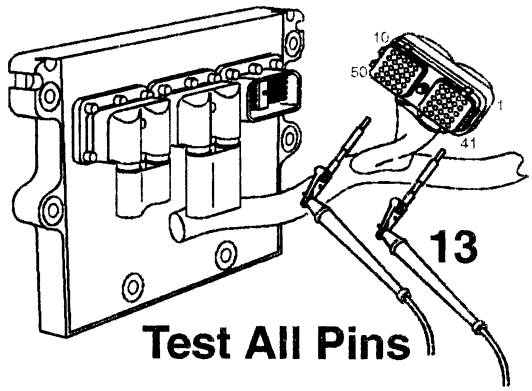
To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the engine harness from the coolant temperature sensor.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pin 2 of the sensor harness connector to all other pins. • Measure the resistance from pin 13 of the sensor harness connector to all other pins.	**OK** **More than 100k ohms**	2D
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043.	3A





19c00512

STEP 2D: Check for an open circuit.

⚠WARNING⚠

Do not remove the pressure cap from a hot engine. Wait until the coolant temperature is below 50°C [122°F] before removing the pressure cap. Heated coolant spray or steam can cause personal injury.

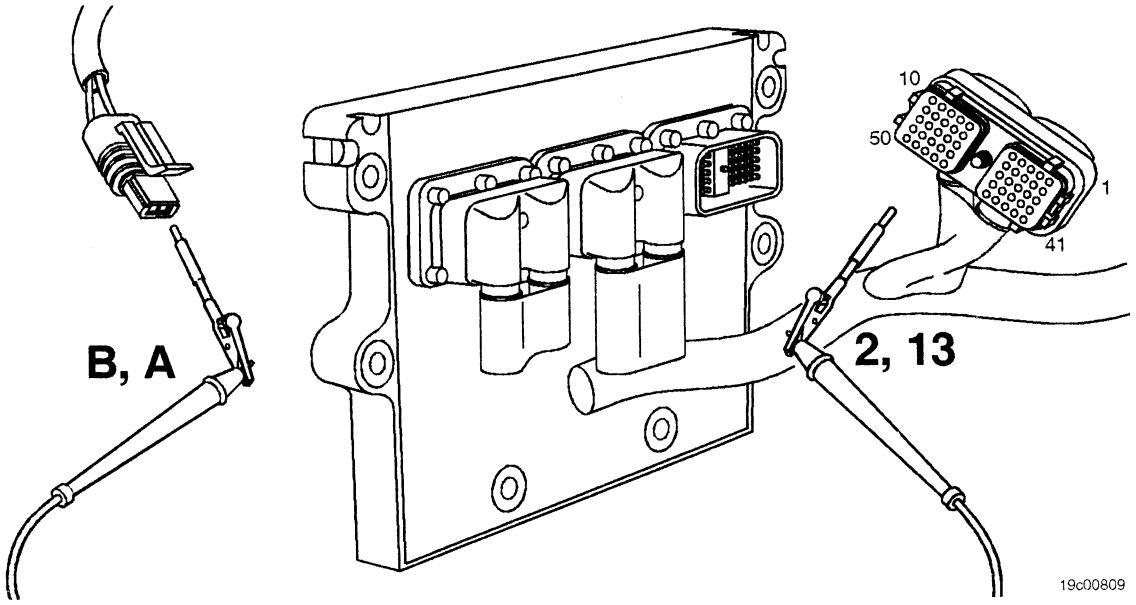
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch OFF.
- Disconnect the engine harness from the coolant temperature sensor.
- Disconnect the sensor harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for an open circuit. • Measure the resistance from pin 2 of the sensor harness connector to pin B (or 2) of the coolant temperature sensor connector. • Measure the resistance from pin 13 of the sensor harness connector to pin A (or 1) of the coolant temperature sensor connector.	**OK** **Less than 10 ohms**	3A
	NOT OK **Repair or replace the engine harness** • Repair the engine harness. Refer to Procedure 019-202 or 019-250. • Replace the engine harness. Refer to Procedure 019-043.	3A



STEP 3: Clear the fault codes.

STEP 3A: Disable the fault code.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine and let it idle for 1 minute. • Using INSITE™, verify that Fault Code 144 is inactive.	**OK** **Fault Code 144 inactive**	3B
	NOT OK Return to troubleshooting steps or contact your local Cummins Authorized Repair Location if all steps have been completed and checked again.	1A

STEP 3B: Clear the inactive fault codes.

Condition:
- Connect all components.
- Turn keyswitch ON.

Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	**OK** **All fault codes cleared**	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts