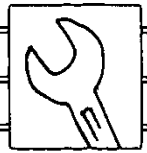
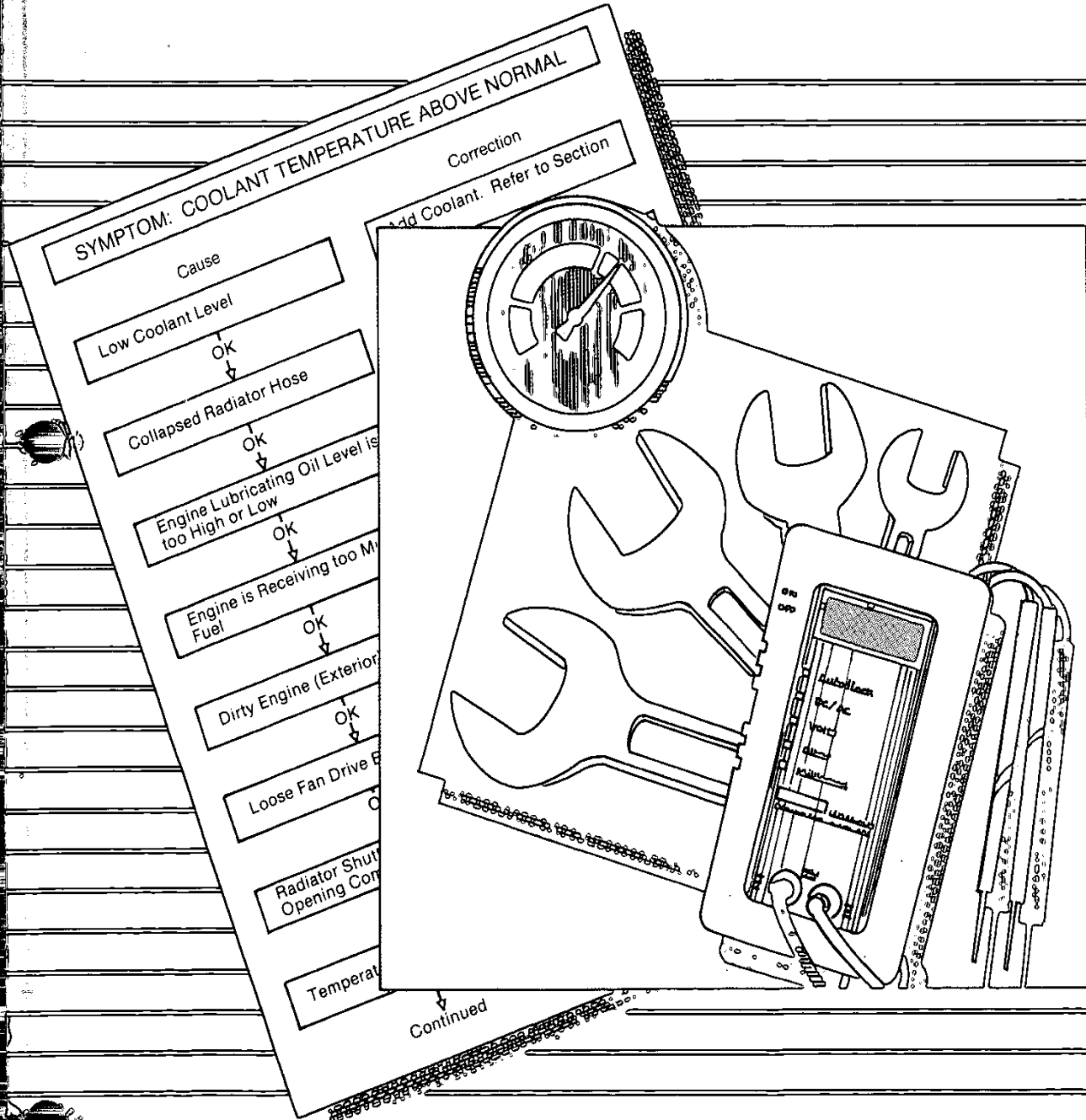


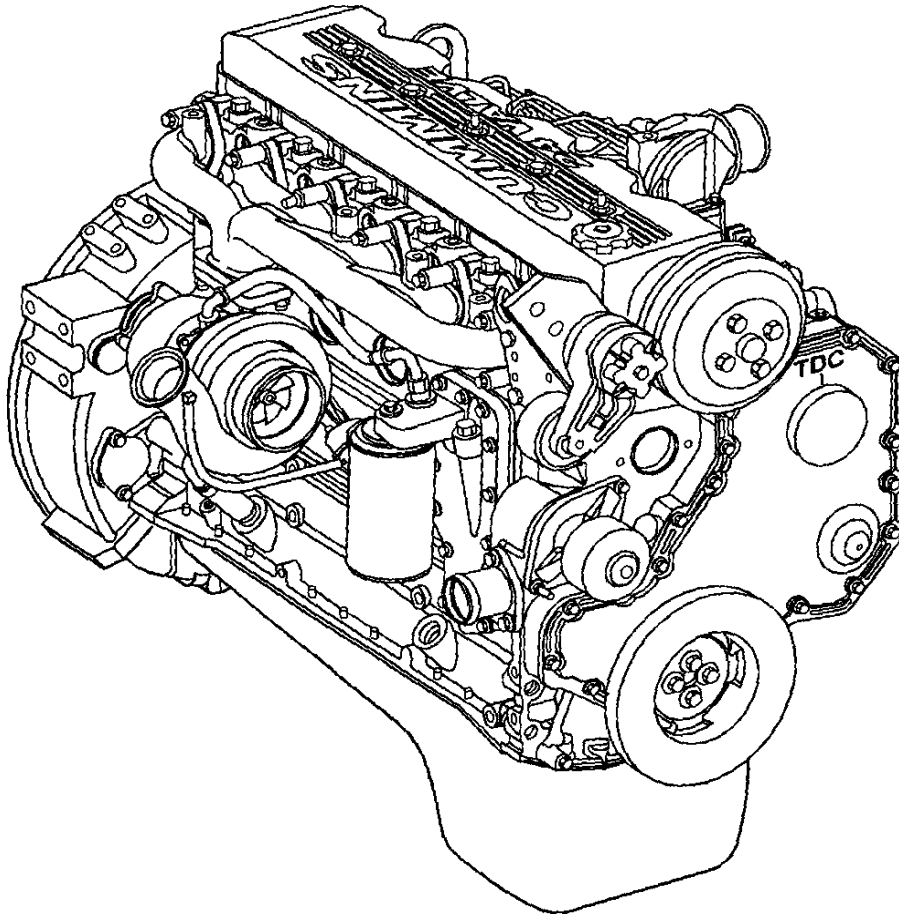


Troubleshooting and Repair Manual Electronic Control System ISB and QSB5.9 Engines Volume II





Troubleshooting and Repair Manual Electronic Control System ISB and QSB5.9 Engines Volume II



00900395

Foreword

This manual provides instructions for troubleshooting and repairing this engine in the chassis. Component and assembly rebuild procedures are provided in the engine shop manual. Refer to Section i - Introduction for instructions on how to use this manual.

Read and follow all safety instructions. Refer to the WARNING in the General Safety Instructions in Section i - Introduction.

The manual is organized to guide a service technician through the logical steps of identifying and correcting problems related to the engine. This manual does not cover vehicle or equipment problems. Consult the vehicle or equipment manufacturer for repair procedures.

A series of specific service manuals (for example: Shop, Specifications, and Alternative Repair) are available and can be ordered by filling out and mailing the Literature Order Form located in Section L - Service Literature.

The repair procedures used in this manual are recommended by Cummins Engine Co., Inc. Some service procedures require the use of special service tools. Use the correct tools as described.

Cummins Engine Company, Inc. encourages the user of this manual to report errors, omissions, and recommendations for improvement. Please use the postage paid, pre-addressed Literature Survey Form in the back of this manual for communicating your comments.

The specifications and rebuild information in this manual are based on the information in effect at the time of printing. Cummins Engine Company, Inc. reserves the right to make any changes at any time without obligation. If differences are found between your engine and the information in this manual, contact a Cummins Authorized Repair Location or call 1-800-DIESELS (1-800-343-7357) toll free in the U.S. and Canada.

The latest technology and the highest quality components are used to manufacture Cummins engines. When replacement parts are needed, we recommend using only genuine Cummins or ReCon® exchange parts. These parts can be identified by the following trademarks:



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Section i - Introduction

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General Safety Instructions

Important Safety Notice



Improper practices or carelessness can cause burns, cuts, mutilation, asphyxiation or other bodily injury or death.

Read and understand all of the safety precautions and warnings before performing any repair. This list contains the general safety precautions that **must** be followed to provide personal safety. Special safety precautions are included in the procedures when they apply.

- Make sure the work area surrounding the product is dry, well lit, ventilated, free from clutter, loose tools, parts, ignition sources and hazardous substances. Be aware of hazardous conditions that can exist.
- **Always** wear protective glasses and protective shoes when working.
- Rotating parts can cause cuts, mutilation or strangulation.
- Do **not** wear loose-fitting or torn clothing. Remove all jewelry when working.
- Disconnect the battery (negative [-] cable first) and discharge any capacitors before beginning any repair work. Disconnect the air starting motor if equipped to prevent accidental engine starting. Put a "Do Not Operate" tag in the operator's compartment or on the controls.
- Use **ONLY** the proper engine barring techniques for manually rotating the engine. Do **not** attempt to rotate the crankshaft by pulling or prying on the fan. This practice can cause serious personal injury, property damage, or damage to the fan blade(s) causing premature fan failure.
- If an engine has been operating and the coolant is hot, allow the engine to cool before you slowly loosen the filler cap and relieve the pressure from the cooling system.
- Do **not** work on anything that is supported **ONLY** by lifting jacks or a hoist. **Always** use blocks or proper stands to support the product before performing any service work.
- Relieve all pressure in the air, oil, fuel and the cooling systems before any lines, fittings, or related items are removed or disconnected. Be alert for possible pressure when disconnecting any device from a system that utilizes pressure. Do **not** check for pressure leaks with your hand. High pressure oil or fuel can cause personal injury.
- To prevent suffocation and frostbite, wear protective clothing and **ONLY** disconnect fuel and liquid refrigerant (freon) lines in a well ventilated area. To protect the environment, liquid refrigerant systems **must** be properly emptied and filled using equipment that prevents the release of refrigerant gas (fluorocarbons) into the atmosphere. Federal law requires capturing and recycling refrigerant.
- To avoid personal injury, use a hoist or get assistance when lifting components that weigh 23 kg [50 lb] or more. Make sure all lifting devices such as chains, hooks, or slings are in good condition and are of the correct capacity. Make sure hooks are positioned correctly. **Always** use a spreader bar when necessary. The lifting hooks **must not** be side-loaded.
- Corrosion inhibitor, a component of SCA and lubricating oil, contains alkali. Do **not** get the substance in your eyes. Avoid prolonged or repeated contact with skin. Do **not** swallow internally. In case of contact, immediately wash skin with soap and water. In case of contact, immediately flood eyes with large amounts of water for a minimum of 15 minutes. IMMEDIATELY CALL A PHYSICIAN. KEEP OUT OF REACH OF CHILDREN.
- Naptha and Methyl Ethyl Ketone (MEK) are flammable materials and **must** be used with caution. Follow the manufacturer's instructions to provide complete safety when using these materials. KEEP OUT OF REACH OF CHILDREN.
- To avoid burns, be alert for hot parts on products that have just been turned off, and hot fluids in lines, tubes, and compartments.
- **Always** use tools that are in good condition. Make sure you understand how to use them before performing any service work. Use **ONLY** genuine Cummins or Cummins ReCon® replacement parts.
- **Always** use the same fastener part number (or equivalent) when replacing fasteners. Do **not** use a fastener of lesser quality if replacements are necessary.
- Do **not** perform any repair when fatigued or after consuming alcohol or drugs that can impair your functioning.
- Some state and federal agencies in the United States of America have determined that used engine oil can be carcinogenic and can cause reproductive toxicity. Avoid inhalation of vapors, ingestion, and prolonged contact with used engine oil.

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Information Fault Codes

NOTE: - Information Fault Codes have simple, corrective actions and no fault code troubleshooting tree.
- SRT 00-394 applies to all of the Information Fault Codes listed below.
- After correcting the condition that caused the fault, let the engine warm up, then let the engine run for 1 minute to inactivate the fault code. Then, use INSITE™ to clear the fault code.

Fault Code 211

Lamp: None

SRT:

Reason: This fault indicates that the vehicle's electronic control unit (VECU), provided by the OEM, detected an active fault in the vehicle's control system.

Effect: None on performance.

Corrective Action: Refer to the OEM for proper repair procedure. Clear inactive fault code using INSITE™ after OEM problem is corrected.

Fault Code 287

Lamp: Yellow

SRT: SID; S091, SPN; 91, FMI; 2/19

Reason: The OEM vehicle electronic control unit (VECU) detected a fault with its accelerator pedal.

Effect: The engine will only idle.

Corrective Action: Refer to the OEM troubleshooting and repair manual. Troubleshoot the accelerator pedal connected to the OEM supplied vehicle electronic control unit (VECU).

Fault Code 288

Lamp: Yellow

SRT: SID; S029, SPN; 29, FMI; 2/19

Reason: The OEM vehicle electronic control unit (VECU) detected a fault with its remote throttle.

Effect: The engine will only idle.

Corrective Action: Refer to the OEM troubleshooting and repair manual. Troubleshoot the remote throttle pedal connected to the OEM supplied vehicle electronic control unit (VECU).

Fault Code 319

Lamp: Maintenance or none

SRT:

Reason: Real-time clock lost power. Unswitched battery power to the ECM has been interrupted.

Effect: None on performance. Data in the ECM will not have accurate time and date information.

Corrective Action: Set real-time clock using RoadRelay™ (if equipped) or by using INSITE™.

Fault Code 599

Lamp: Red

SRT:

Reason: The dual-output feature in this customer-specialized calibration has initiated an engine shutdown based on operating conditions, engine sensor values, or OEM inputs to the ECM.

Effect: Engine will shut down.

Corrective Action: The dual-output feature is contained only in customer-specialized calibrations. The feature can be set up to shut down the engine based on operating conditions, engine sensor values, or OEM inputs to the ECM. The two OEM inputs are OEM switch input and OEM pressure input. The technician must contact Cummins Engine Company to determine the dual-output feature's configuration to understand which parameters and what parameter value(s) are causing the engine to shut down.

Fault Code 611

Lamp: None

SRT:

Reason: The engine was shut down with the keyswitch before proper engine cooldown.

Effect: No action is taken by the ECM.

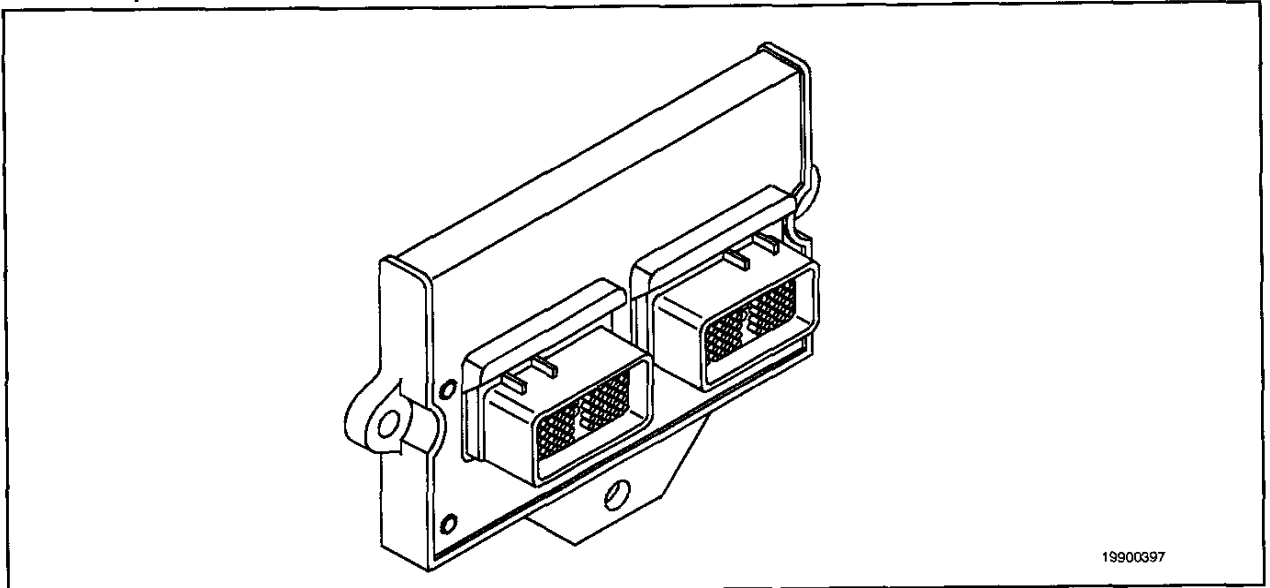
Corrective Action: Hot shutdowns damage engine components and shorten engine life. Refer to the engine operation and maintenance manual for proper cooldown techniques.

Fault Code 111

Electronic Control Module (ECM) Microprocessor

CODES	REASON	EFFECT
Fault Code: 111 PID(P), SID(S): S254 SPN: 629 FMI: 12 Lamp: Yellow	ECM internal hardware error.	Possible no effect or engine may run rough or not start.

ECM Microprocessor



Circuit Description:

The ECM is a computer that is responsible for engine control, diagnostics, and user features.

Component Location:

The ECM is located on the left side of the engine block, behind the fuel filter.

Shop Talk:

This fault code can be caused **only** by an internal ECM problem. Repairs are **not** possible for the ECM.

TROUBLESHOOTING SUMMARY



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 fault codes.

STEP 1A: Read the fault codes.

STEP 1B: Check the inactive counts of Fault Code 111.

Fault Code 111 inactive
Fault is inactive and no performance-related complaints are associated with this fault

STEP 2: Clear the fault codes.

STEP 2A: Disable the fault code.

STEP 2B: Clear the inactive fault codes.

Fault Code 111 inactive
All faults cleared

TROUBLESHOOTING STEP

STEP 1: Check the fault codes.

STEP 1A: Read the fault codes.



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 to the ON position.

Action	Specifications/Repair	Next Step
Read the fault codes. • Read the fault codes using INSITE™.	OK Fault Code 111 inactive	1B
	NOT OK Replace the ECM Refer to Procedure 019-031.	2A

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:		
<ul style="list-style-type: none"> • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Check the inactive counts of Fault Code 111. <ul style="list-style-type: none"> • Read the inactive counts of Fault Code 111 using INSITE™. 	OK Fault is inactive and no performance-related complaints are associated with this fault.	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:		
<ul style="list-style-type: none"> • Connect all components. 		
Action	Specifications/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> • Start the engine, and let idle for 1 minute. • 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.

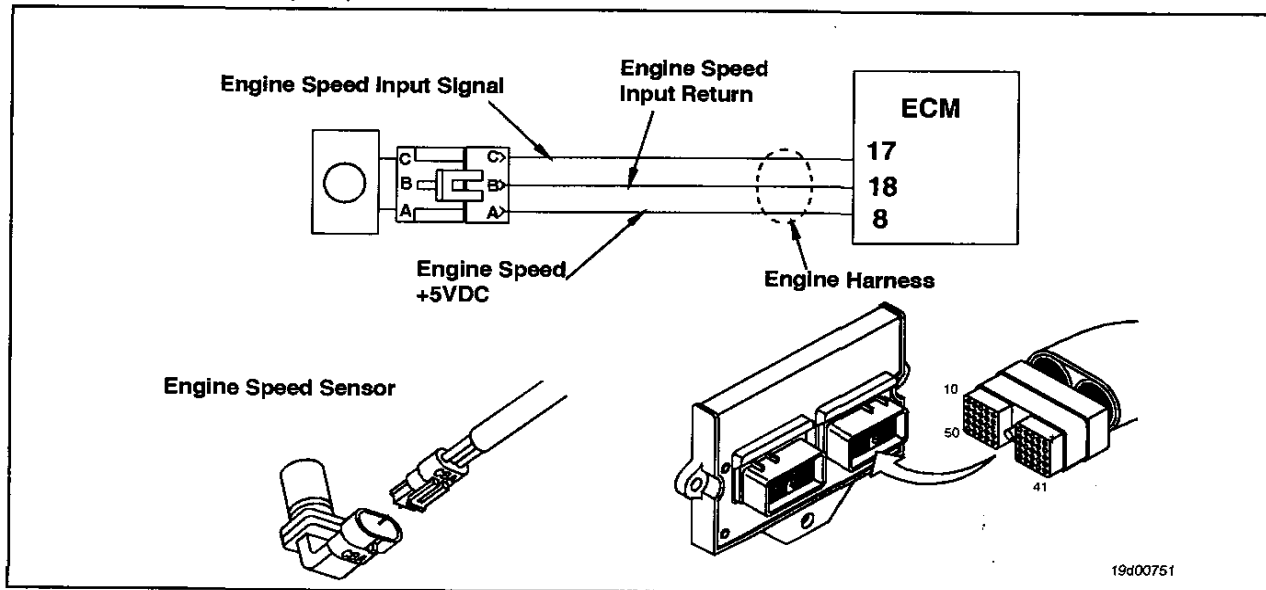
Condition:		
<ul style="list-style-type: none"> • Connect all components. • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> • Erase the inactive fault code using INSITE™. 	OK All faults cleared	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting chart

Fault Code 115

Engine Speed Sensor (ESS) Circuit

CODES	REASON	EFFECT
Fault Code: 115 PID(P), SID(S): P190 SPN: 190 FMI: 2 Lamp: Yellow	No engine speed signal detected at pin 17 of the engine harness.	Engine power derate. Possible white smoke.

Engine Speed Sensor (ESS) Circuit



Circuit Description:

The engine speed sensor provides engine speed information to the electronic control module (ECM). The sensor **must** be powered up by (+) 5 VDC to operate. The sensor generates its signals by sensing the movement of target teeth machined into a tone wheel that is mounted to the crankshaft. The tone wheel has 35 teeth and a gap where the 36th tooth would be placed. This missing tooth indicates that cylinder 1 (and 6) is at top dead center.

Component Location:

The engine speed sensor is located on the intake side of the engine block, at crankshaft level, between cylinders 4 and 5.

Shop Talk:

This fault code will also cause a fuel derate. This could be the cause of a low-power complaint. Also, this fault code can cause starting problems in cold weather.

TROUBLESHOOTING SUMMARY



To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.



To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack test lead.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check for multiple fault codes. <u>STEP 1A:</u> Read faults.		
	Fault Code 283 or 284 inactive	
STEP 2: Check the engine harness. <u>STEP 2A:</u> Inspect the engine harness and the ECM connectors. <u>STEP 2B:</u> Check for an open circuit. <u>STEP 2C:</u> Check for a short circuit to ground. <u>STEP 2D:</u> Check for a short circuit from pin to pin.	No damaged pins Less than 10 ohms More than 100k ohms More than 100k ohms	
STEP 3: Check the ESS. <u>STEP 3A:</u> Inspect the ESS and engine harness connectors. <u>STEP 3B:</u> Check ESS supply voltage. <u>STEP 3C:</u> Check for signal from the ESS. <u>STEP 3D:</u> Inspect the nose of the sensor.	No damaged pins 4.75 to 5.25 VDC Signal present No damage found	
STEP 4: Clear the fault codes. <u>STEP 4A:</u> Disable the fault codes. <u>STEP 4B:</u> Clear the inactive fault codes.	Fault Code 115 inactive All fault codes cleared	

TROUBLESHOOTING STEP

STEP 1: Check for multiple fault codes.
STEP 1A: Read the fault codes.

Condition: • Turn keyswitch to the ON position.		
Action	Specifications/Repair	Next Step
Read the fault codes. • Read the fault codes using INSITE™.	OK Fault Code 283 or 284 inactive	2A
	NOT OK Fault Code 283 or 284 active	Refer to Fault Code 283 or 284

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 to the OFF position.
- Disconnect the engine harness from the ECM.

Action	Specifications/Repair	Next Step
Inspect the engine harness and the ECM connector pins for the following: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	OK No damaged pins	2B
	NOT OK Repair the damaged pins Repair or replace the engine harness or ECM, whichever has the damaged pins. <ul style="list-style-type: none"> • Repair the engine harness. Refer to Procedure 019-250. • Replace engine harness. Refer to Procedure 019-043. • Replace ECM. Refer to Procedure 019-031. 	4A

STEP 2B: Check for an open circuit.

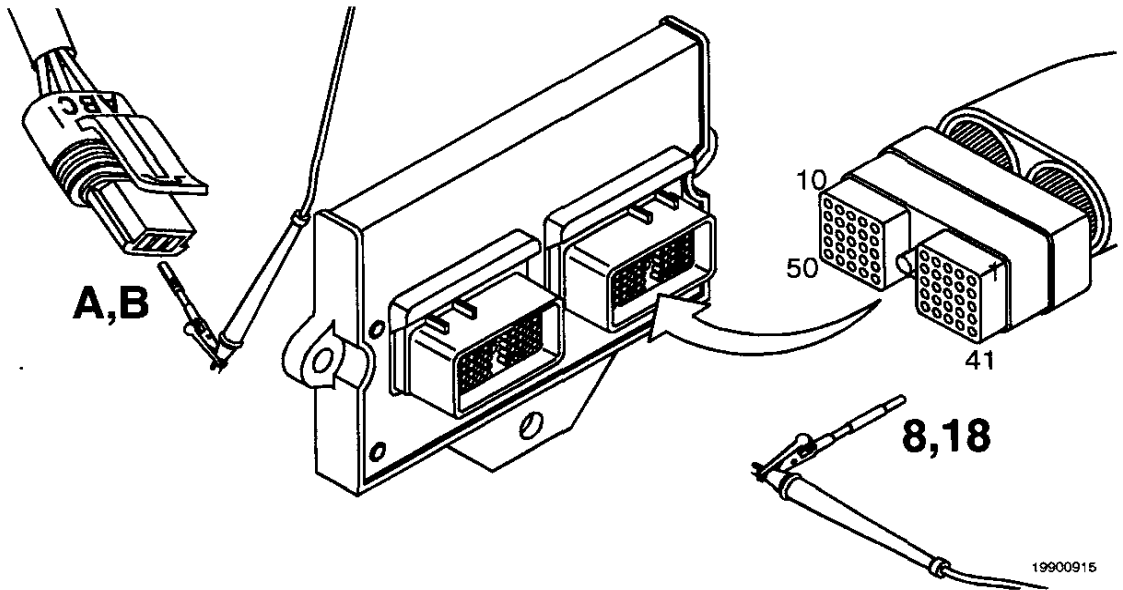
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the ECM.
- Disconnect the engine harness from the ESS.

Action	Specifications/Repair	Next Step
Check for an open circuit in the +5-VDC supply wire and the signal wire. <ul style="list-style-type: none"> • Measure the resistance from pin 8 of the engine harness connector to pin A on the harness side of the ESS connector. • Measure the resistance from pin 18 of the engine harness connector to pin B on the harness side of the ESS connector. • Measure the resistance from pin 17 of the engine harness connector to pin C on the harness side of the ESS connector. 	OK Less than 10 ohms	2C
	NOT OK Replace the engine harness Refer to Procedure 019-043.	4A



STEP 2C: Check for a short circuit to ground.

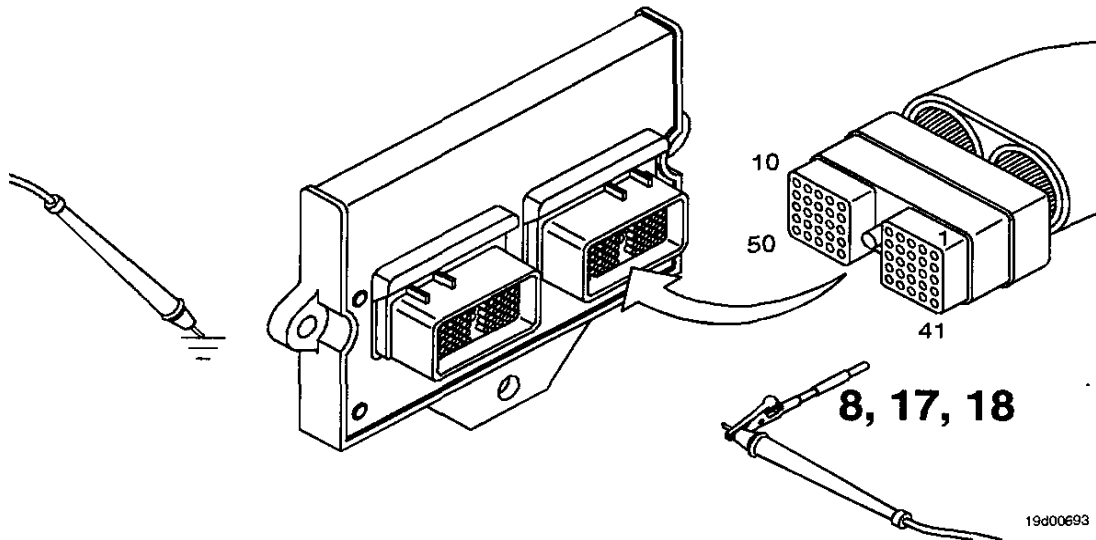
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the ECM.
- Disconnect the engine harness from the ESS.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground. <ul style="list-style-type: none"> • Measure the resistance from pin 8 of the engine harness connector to the engine block ground. 	OK More than 100k ohms	2D
<ul style="list-style-type: none"> • Measure the resistance from pin 18 of the engine harness connector to the engine block ground. • Measure the resistance from pin 17 of the engine harness connector to the engine block ground. 	NOT OK Replace the engine harness Refer to Procedure 019-043.	4A



STEP 2D: Check for a short circuit from pin to pin.

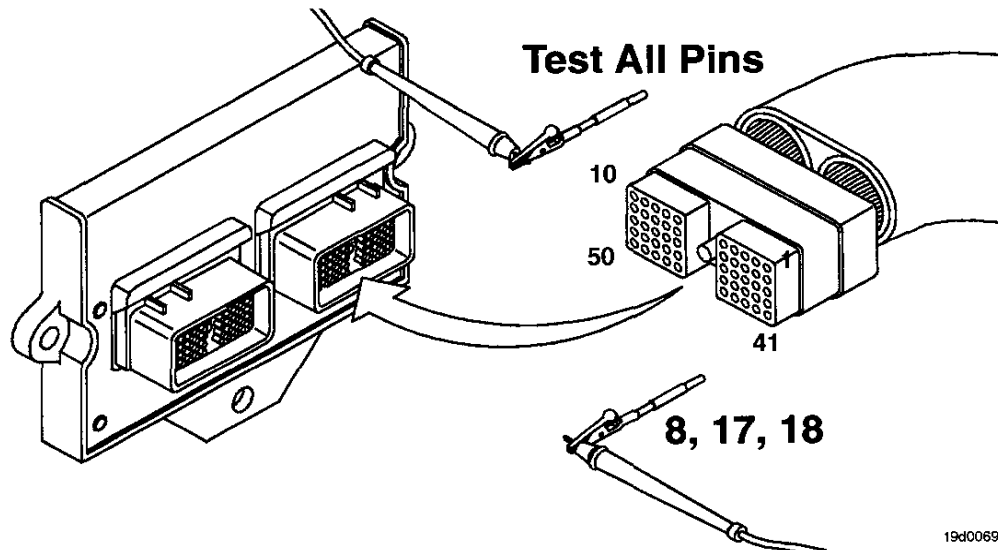
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the ECM.
- Disconnect the engine harness from the ESS.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure resistance from pins 8, 17, and 18 of the engine harness connector to all other pins in the connector.	OK More than 100k ohms	3A
	NOT OK Replace the engine harness Refer to Procedure 019-043.	4A



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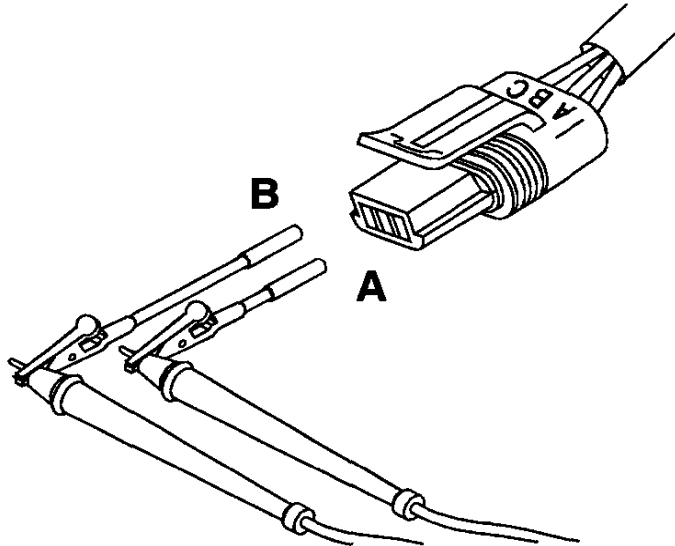
STEP 3: Check the ESS.

STEP 3A: Inspect the ESS and the engine harness connectors.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the ESS.
- Connect the engine harness to the ECM.

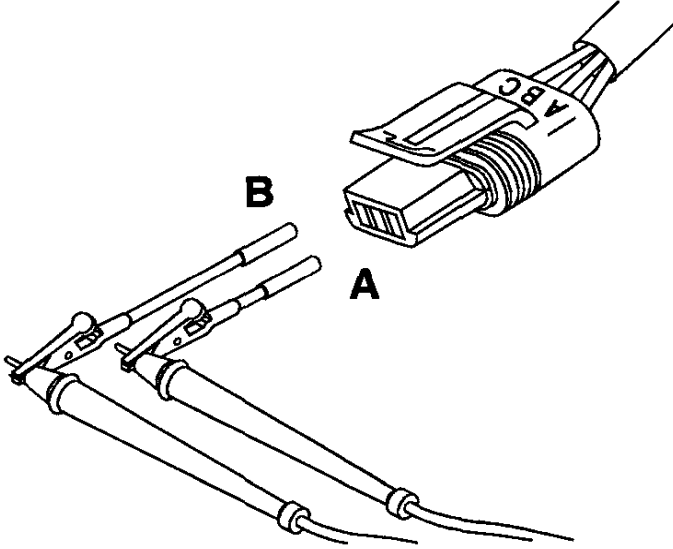
Action	Specifications/Repair	Next Step
Inspect the ESS and the engine harness connector pins for the following: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	OK No damaged pins	3B
	NOT OK Repair the damaged pins Repair or replace the engine harness or sensor, whichever has the damaged pins. <ul style="list-style-type: none"> • Repair the engine harness. Refer to Procedure 019-203. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ESS. Refer to Procedure 019-042. 	4A



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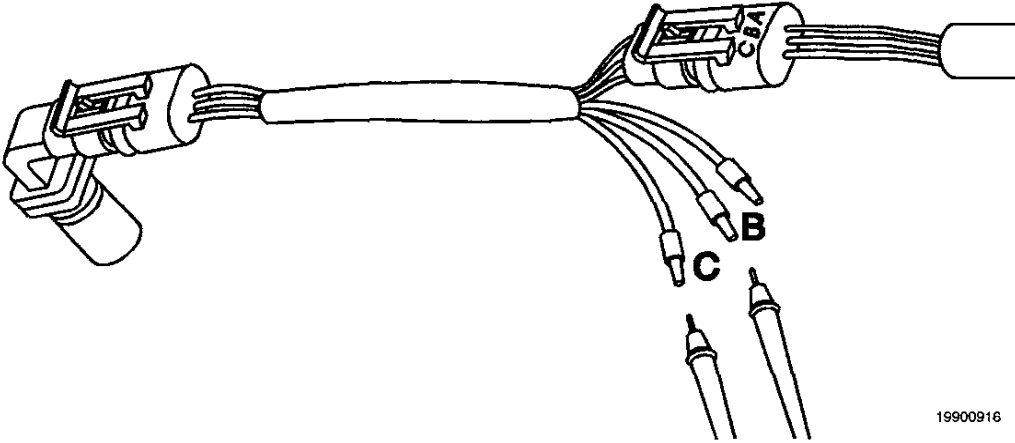
STEP 3B: Check ESS supply voltage.

Action	Specifications/Repair	Next Step
<p>Condition:</p> <ul style="list-style-type: none">• Turn keyswitch to the ON position.• Disconnect the engine harness from the ESS. <p>Check ESS supply voltage.</p> <ul style="list-style-type: none">• Measure the voltage from pin A to pin B on the harness side of the ESS connector.	<p>OK (+) 4.75 to 5.25 VDC</p>	3C
	<p>NOT OK Replace the ECM Refer to Procedure 019-031.</p>	4A



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STEP 3C: Check for a signal from the ESS.

<p>Condition:</p> <ul style="list-style-type: none"> • Turn keyswitch to the ON position. • Install breakout cable, Part No. 3824775, between the ESS and the engine harness. 		
Action	Specifications/Repair	Next Step
<p>Check for a signal from the ESS.</p> <ul style="list-style-type: none"> • Measure the voltage from pin C to pin B on the breakout cable while barring the engine over. If the signal is present, the voltage will fluctuate between less than (+) 0.5 VDC and greater than (+) 4.5 VDC as the engine is barred over slowly. <p>NOTE: Negative (-) lead of multimeter should be connected to pin B and the positive (+) lead to pin C.</p>	<p>OK Signal present</p>	3D
	<p>NOT OK Replace the ESS Refer to Procedure 019-042.</p>	4A
 <p>19900916</p>		

STEP 3D: Inspect the nose of the sensor.

<p>Condition:</p> <ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Remove sensor from engine. Refer to Procedure 019-042. 		
Action	Specifications/Repair	Next Step
<p>Inspect the nose of the sensor for damage or debris.</p> <ul style="list-style-type: none"> • Inspect for metal debris on sensor tip. • Inspect for damage on the sensor caused by crankshaft tone wheel gear. • Inspect for sensor swelling. • Check for properly installed tone wheel. 	<p>OK No damage found</p>	4A
	<p>NOT OK Replace the engine speed sensor Refer to Procedure 019-042.</p>	4A

STEP 4: Clear the fault codes.
STEP 4A: Disable the fault codes.

Condition: <ul style="list-style-type: none"> • Connect all components. • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Disable the fault codes. <ul style="list-style-type: none"> • Start the engine, and let idle for 1 minute. • Verify Fault Code 115 is inactive. 	OK Fault Code 115 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.	2A

STEP 4B: Clear the inactive fault codes.

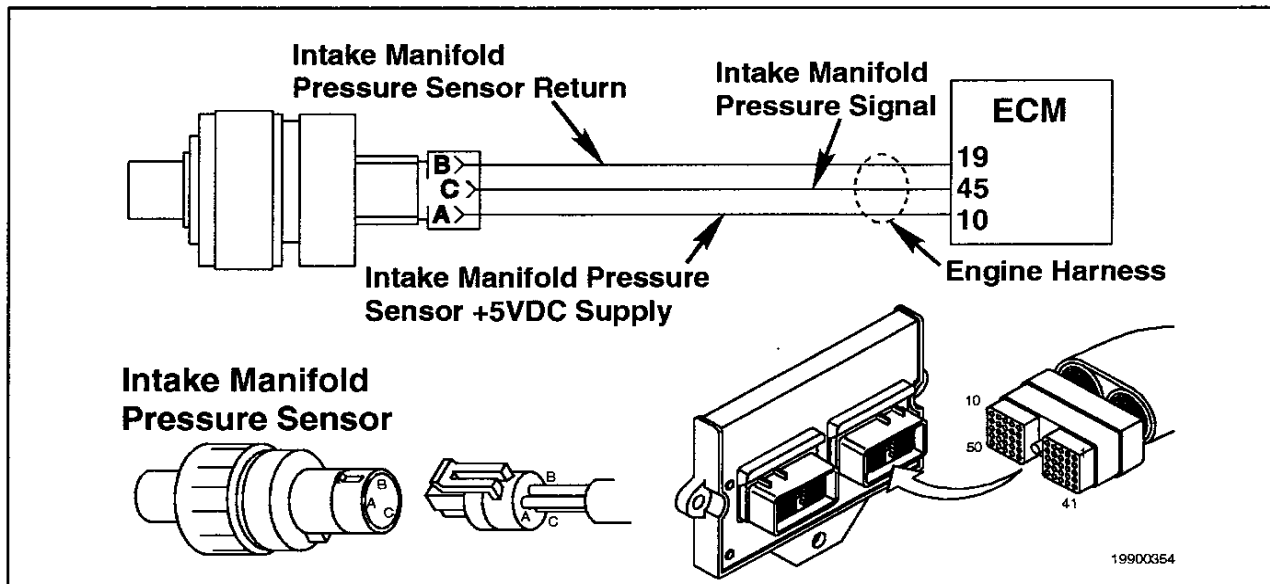
Condition: <ul style="list-style-type: none"> • Connect all components. • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> • Erase the inactive fault codes using INSITE™. 	OK All fault codes cleared	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 122 or 123

Intake Manifold Pressure Sensor Circuit

CODES	REASON	EFFECT
Fault Code: 122 or 123 PID(P), SID(S): P102 SPN: 102 FMI: 3 or 4 Lamp: Yellow	FC 122: High voltage detected at the boost pressure sensor signal pin 45 of the engine harness. FC 123: Low voltage detected at the boost pressure sensor signal pin 45 of the engine harness.	Engine will derate to no-boost fueling.

Intake Manifold Pressure Sensor Circuit



Circuit Description:

The intake manifold pressure 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 sensor is located on the rear of the intake air manifold in the second port on the side of the head to the right of the fuel filter.

Shop Talk:

- Determine if engine is being overfueled.
- Confirm that the correct intake manifold pressure 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 sensor circuit for signs of tampering. Remove any extra wires from the circuit.
- Check for high restriction in the intake air manifold due to a shutdown device in the manifold (if the vehicle is equipped with one). Do **not** remove this device. If the engine is operated in a flammable atmosphere, the device is an essential safety feature.

TROUBLESHOOTING SUMMARY



To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack test lead.



To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

STEPS	SPECIFICATIONS	SRT CODE
<u>STEP 1:</u> Check for multiple fault codes.		
<u>STEP 1A:</u> Read the fault codes.	Fault Codes 352 and 386 are not active	
<u>STEP 2:</u> Check for mechanical failure.		
<u>STEP 2A:</u> Verify proper turbocharger operation.	Positive intake manifold pressure from turbocharger and wastegate not stuck closed	
<u>STEP 3:</u> Check the engine harness.		
<u>STEP 3A:</u> Inspect the engine harness and the ECM connector pins.	No damaged pins	
<u>STEP 3B:</u> Check for an open circuit.	Less than 10 ohms	
<u>STEP 3C:</u> Check for a short circuit to ground.	More than 100k ohms	
<u>STEP 3D:</u> Check for a short circuit from pin to pin.	More than 100k ohms	
<u>STEP 4:</u> Check the intake manifold pressure sensor.		
<u>STEP 4A:</u> Inspect the intake manifold pressure sensor and engine harness connector pins.	No damaged pins	
<u>STEP 4B:</u> Check the intake manifold pressure supply voltage.	(+) 4.75 to 5.25 VDC	
<u>STEP 4C:</u> Check the intake manifold pressure signal voltage.	(+) 0.42 to 0.58 VDC	
<u>STEP 5:</u> Clear the fault codes.		
<u>STEP 5A:</u> Disable the fault code.	Fault Code 122 or 123 inactive	
<u>STEP 5B:</u> Clear the inactive fault codes.	All faults codes cleared	

TROUBLESHOOTING STEP

STEP 1: Check for multiple fault codes.

STEP 1A: Read the fault codes.

Condition: <ul style="list-style-type: none"> • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Read the fault codes. <ul style="list-style-type: none"> • Read fault codes using INSITE™. NOTE: If multiple temperature or pressure fault codes exist, this procedure should not be followed.	OK Fault Codes 352 and 386 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: Verify proper turbocharger operation.

Condition: <ul style="list-style-type: none"> • Turn keyswitch to the OFF position. 		
Action	Specifications/Repair	Next Step
Verify proper turbocharger operation. Check for positive intake manifold pressure using a mechanical gauge.	OK Positive intake manifold pressure from turbocharger and wastegate not stuck-closed	3A
	NOT OK Low intake manifold pressure Correct the base engine malfunction causing low intake manifold pressure. Refer to the Troubleshooting and Repair Manual, ISB Engines, Bulletin No. 3666193.	5A

STEP 3: Check the engine harness.

STEP 3A: 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 to the OFF position.
- Disconnect the engine harness from the ECM.

Action	Specifications/Repair	Next Step
Inspect the engine harness and the ECM connector pins for the following: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	OK No damaged pins	3B
	NOT OK Repair the damaged pins Repair or replace the engine harness or ECM, whichever has the damaged pins. <ul style="list-style-type: none"> • 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: Check for an open circuit.

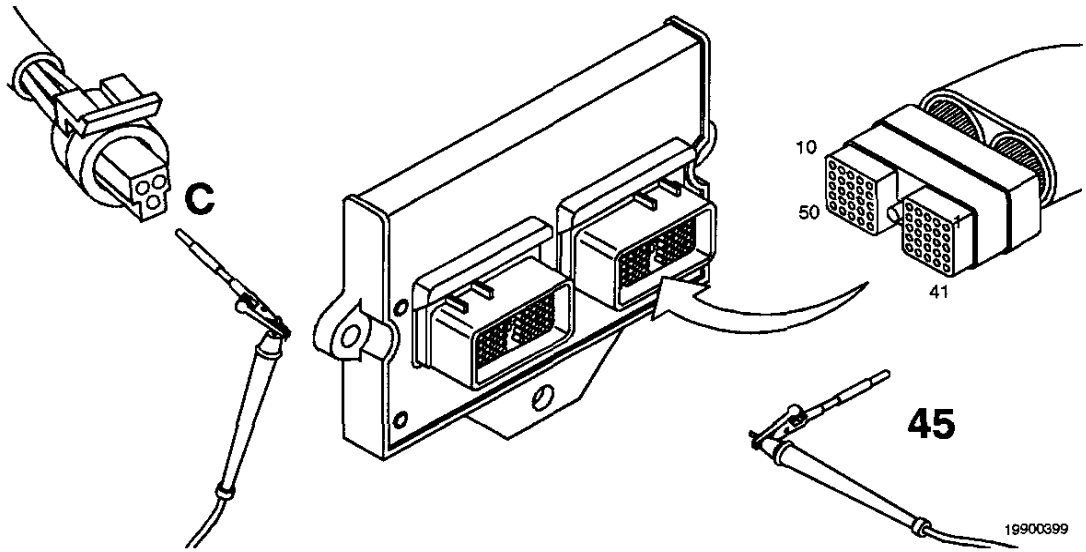


To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack/Deutsch test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the intake manifold pressure sensor from the engine harness.
- Disconnect the engine harness from the ECM.

Action	Specifications/Repair	Next Step
Check for an open circuit. • Measure the resistance from pin 45 on the engine harness connector to pin C on the harness side of the intake manifold pressure sensor connector.	OK Less than 10 ohms	3C
	NOT OK Replace the engine harness Refer to Procedure 019-043.	5A



STEP 3C: Check for a short circuit to ground.

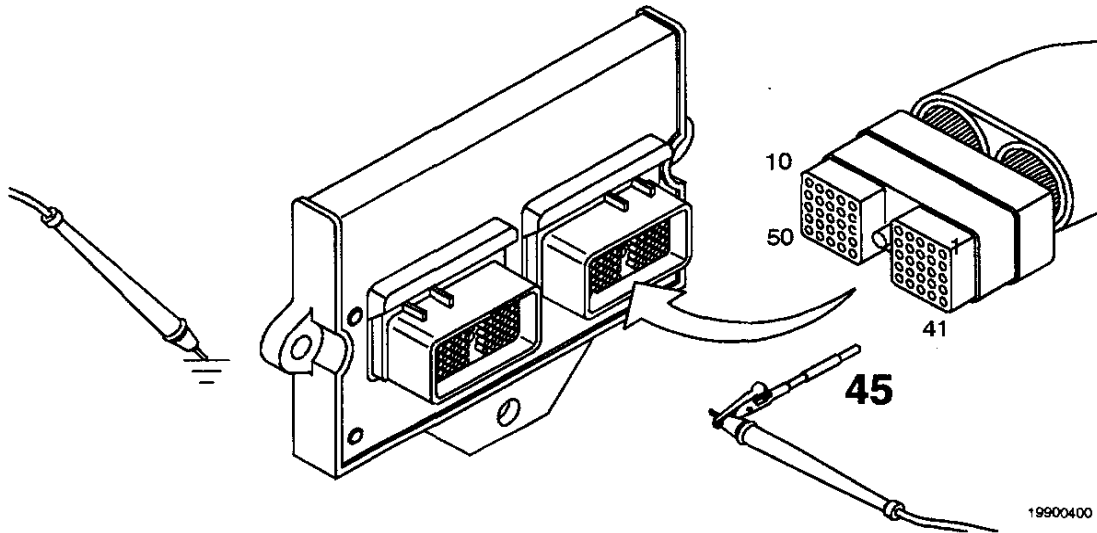
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack/Deutsch test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the intake manifold pressure sensor from the engine harness.
- Disconnect the engine harness from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground. • Measure the resistance from pin 45 on the harness side of the engine harness connector to engine block ground.	OK More than 100k ohms	3D
	NOT OK Replace the engine harness Refer to Procedure 019-043.	5A



STEP 3D: Check for a short circuit from pin to pin.

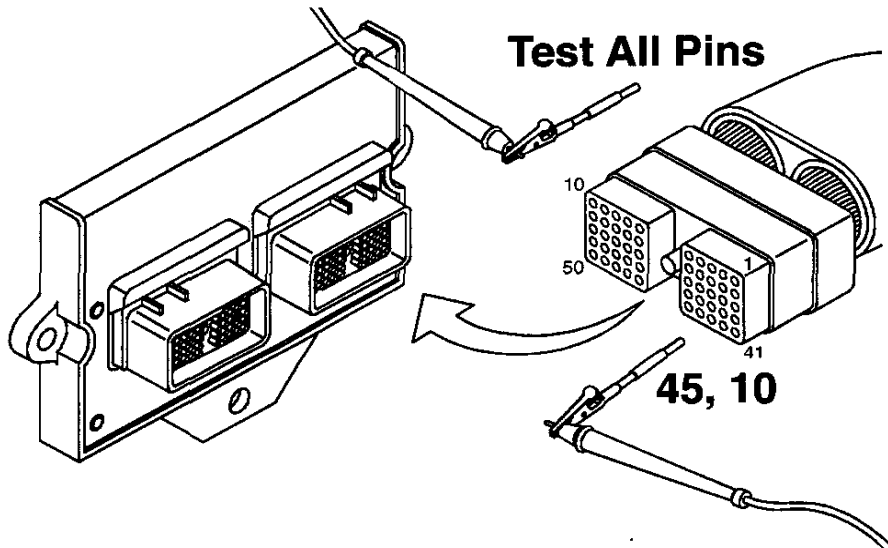
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the intake manifold pressure sensor.
- Disconnect the engine harness from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pins 45 and 10 on the harness side of the engine harness connector to all other pins in the engine harness.	OK More than 100k ohms	4A
	NOT OK Replace the engine harness Refer to Procedure 019-043.	5A



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STEP 4: Check the intake manifold pressure sensor.

STEP 4A: Inspect the intake manifold pressure sensor and engine harness connector pins.

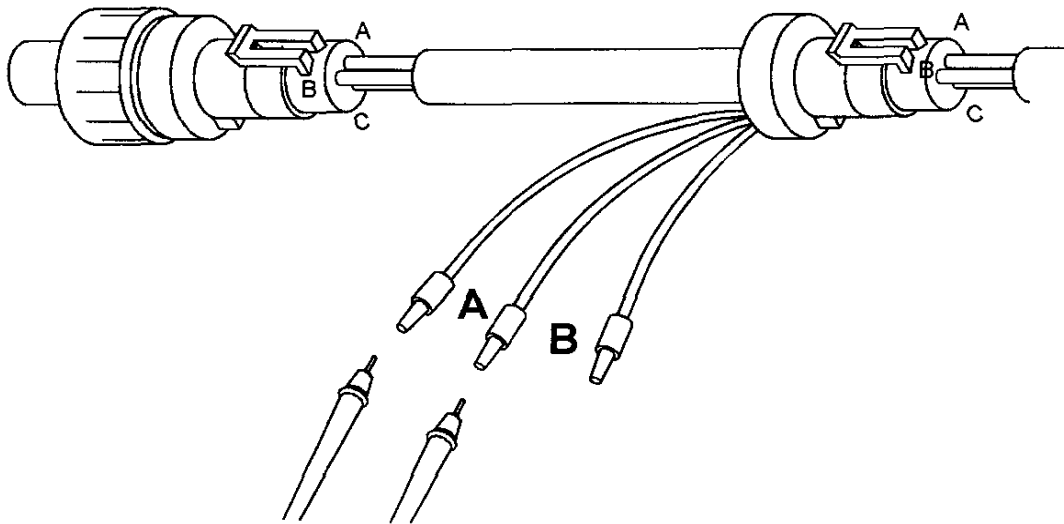
Condition:		
<ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the engine harness from the intake manifold pressure sensor. 		
Action	Specifications/Repair	Next Step
Inspect the engine harness and the sensor connector for the following: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	OK No damaged pins	4B
	NOT OK Repair the damaged pins Repair or replace the intake manifold pressure sensor or the engine harness, whichever has damaged pins. <ul style="list-style-type: none"> • Repair the engine harness. Refer to Procedure 019-203. • Replace the engine harness. Refer to Procedure 019-043. • Replace the intake manifold pressure sensor. Refer to Procedure 019-061. 	5A

STEP 4B: Check the intake manifold pressure supply voltage.

Condition:

- Turn keyswitch to the ON position.
- Connect the intake manifold pressure sensor breakout cable, Part No. 3824775, between the sensor and the engine harness.

Action	Specifications/Repair	Next Step
Check the intake manifold pressure supply voltage.	OK (+) 4.75 to 5.25 VDC	4C
• Measure the voltage from pin A to pin B of the intake manifold pressure sensor circuit.	NOT OK Replace the engine harness Refer to Procedure 019-043.	5A

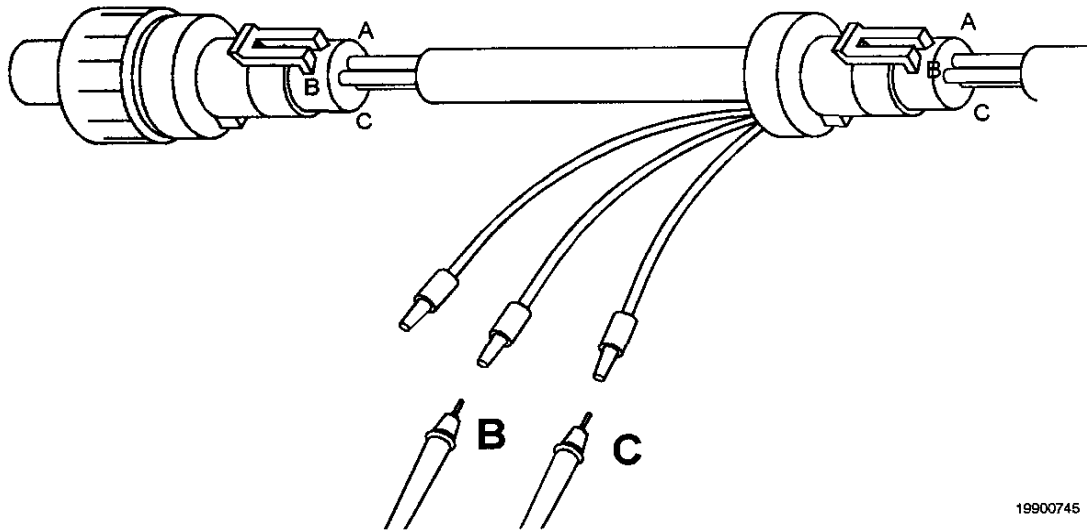


STEP 4C: Check the intake manifold pressure signal voltage.

Condition:

- Turn keyswitch to the ON position.
- Connect the intake manifold pressure sensor breakout cable, Part No. 3824775, between the sensor and the engine harness.

Action	Specifications/Repair	Next Step
Check the intake manifold pressure signal voltage. • Measure the voltage from pin B to pin C of the intake manifold pressure sensor circuit.	OK (+) 0.42 to 0.58 VDC	5A
	NOT OK Replace the intake manifold pressure sensor Refer to Procedure 019-061.	5A



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STEP 5: Clear the fault codes.

STEP 5A: Disable the fault code.

Condition:

- Connect all components.
- Turn keyswitch to the ON position.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine, and let idle for 1 minute. • Verify that Fault Code 122 or 123 is inactive.	OK Fault Code 122 or 123 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.

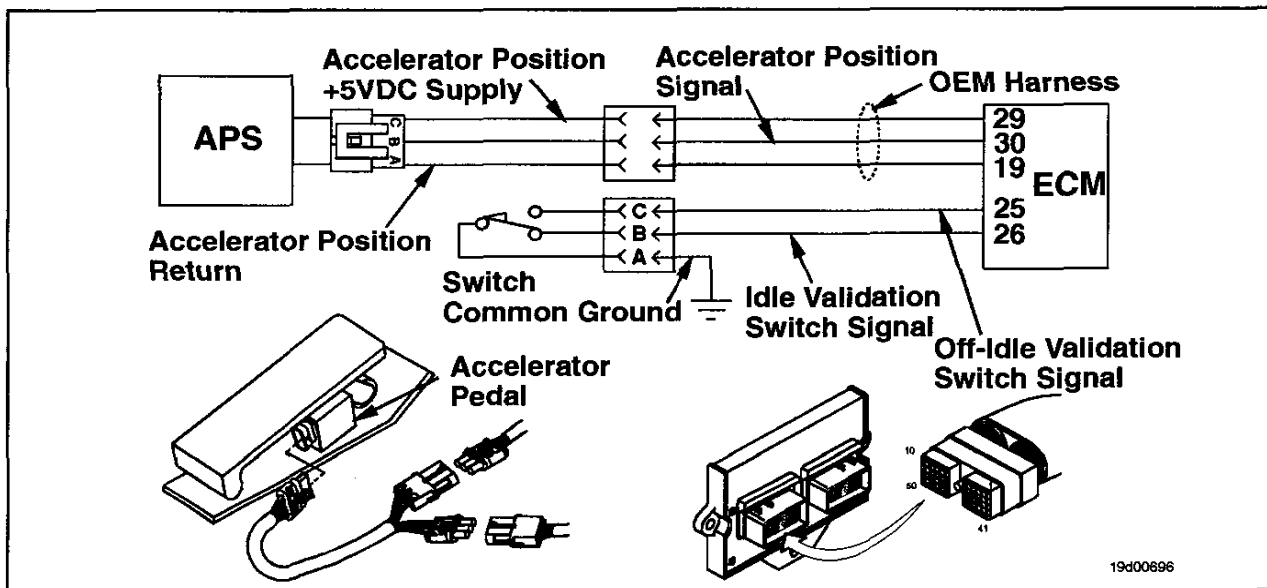
Condition:		
<ul style="list-style-type: none">• Connect all components.• Turn keyswitch to the ON position.		
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none">• Erase the inactive fault codes using INSITE™.	OK All faults codes cleared	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 131 or 132

Accelerator Position Sensor Circuit

CODES	REASON	EFFECT
Fault Code: 131 or 132 PID(P), SID(S): P091 SPN: 091 FMI: 3 or 4 Lamp: Yellow	FC 131: High voltage detected at accelerator position signal pin 30 of the OEM harness. FC 132: Low voltage detected at accelerator position signal pin 30 of the OEM harness.	Engine idles when idle validation switch indicates idle and ramps up to at a default set speed when the idle validation switch indicates off-idle.

Accelerator Position Sensor Circuit



Circuit Description:

The accelerator position sensor is attached to the accelerator pedal. The accelerator position sensor sends a signal to the electronic control module (ECM) when the driver pushes on the accelerator pedal. The accelerator position circuit contains three wires: a +5-VDC supply wire (pin 29), a return ground (pin 19), and a signal wire (pin 30).

NOTE: The connector pin letters shown for the accelerator pedal wiring in these troubleshooting steps are examples of representative sensors. The connector pin assignments can vary with equipment manufacturer, but the base troubleshooting logic will still apply.

Component Location:

The accelerator position sensor is located on the accelerator pedal.

Shop Talk:

If all wiring and sensor checks look in good order then replace the accelerator position sensor and the idle validation switch circuit wires between the accelerator pedal and the ECM with new wires. Run the wires through, or around, the bulkhead without using the bulkhead connector. Test the truck with the test wires in place. If the fault goes away, replace the OEM harness. Seal the openings in the bulkhead around the connector and wires to prevent toxic and noxious fumes from entering the operator area.

NOTE: The three wires in the accelerator position sensor circuit **must** be twisted together. The same applies for the three wires in the idle validation switch circuit.

NOTE: If pin 19 (return) and pin 30 (signal) are reversed, throttle position will **only** read 50 percent.

TROUBLESHOOTING SUMMARY



To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/Metri-Pack test lead
Part No. 3823995 - male Weather-Pack test lead
Part No. 3823996 - female Weather-Pack test lead.



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 accelerator position sensor.		
STEP 1A: Inspect the OEM harness and the accelerator position sensor connector pins.	No damaged pins	
STEP 1B: Check the accelerator position sensor resistance.	2000 to 3000 ohms	
STEP 1C: Check the resistance between sensor pins. NOTE: Measure when the pedal is depressed and released.	Released: 1500 to 3000 ohms Depressed: 200 to 1500 ohms NOTE: Released resistance must be at least 1000 ohms more than depressed resistance	
STEP 1D: Check for a short circuit to ground in the sensor +5-VDC supply.	More than 100k ohms	
STEP 1E: Check for a short circuit to ground in the sensor signal wire.	More than 100k ohms	
STEP 2: Check the OEM harness.		
STEP 2A: Inspect the harness and the ECM connector pins.	No damaged pins	
STEP 2B: Check for an open circuit in the supply, signal, and return wires of the OEM harness.	Less than 10 ohms	
STEP 2C: Check for a short circuit between the +5-VDC supply wire and any other wire in the OEM harness.	More than 100k ohms	
STEP 2D: Check for a short circuit between the accelerator position signal wire and any other wire in the OEM harness.	More than 100k ohms	
STEP 2E: Check for a short circuit between the +5-VDC supply and return wires (Fault Code 132 only).	More than 100k ohms	
STEP 2F: Check for a short circuit to ground in the accelerator position sensor signal circuit (Fault Code 132 only).	More than 100k ohms	

STEP 3: Check the ECM.

STEP 3A: Check the accelerator position supply voltage. (+) 4.75 to 5.25 VDC

STEP 4: Clear the fault code.

STEP 4A: Disable the fault code. Fault Code 131 or 132 inactive
STEP 4B: Clear the inactive fault codes. All faults cleared

TROUBLESHOOTING STEP

STEP 1: Check the accelerator position sensor.

STEP 1A: Inspect the OEM harness and the accelerator position sensor connector pins.

Condition:		
<ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the OEM harness from the accelerator position sensor. 		
Action	Specifications/Repair	Next Step
Inspect the OEM harness and the accelerator position sensor connector pins for the following: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	OK No damaged pins	1B
	NOT OK Repair the damaged pins Repair or replace the OEM harness or sensor, whichever has the damaged pins. <ul style="list-style-type: none"> • Repair the OEM harness. Refer to Procedure 019-203 or 019-206. • Replace the OEM harness. Refer to Procedure 019-071. • Replace the accelerator position sensor. Refer to OEM troubleshooting and repair manual. 	4A

STEP 1B: Check the accelerator position sensor resistance.

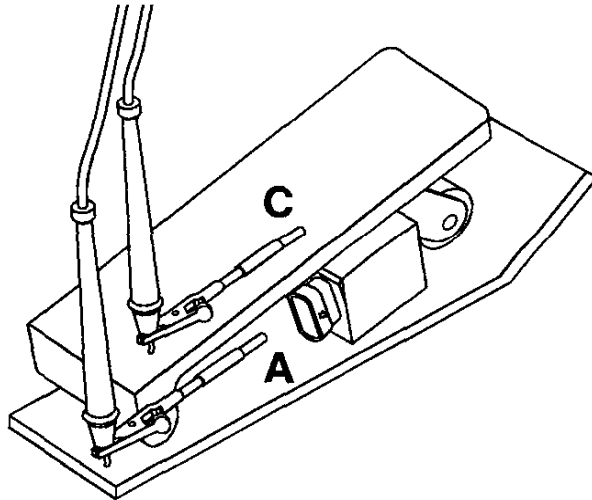
⚠ CAUTION ⚠

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 to the OFF position.
- Disconnect the OEM harness from the accelerator position sensor.

Action	Specifications/Repair	Next Step
Check for an open or short circuit between pins in the acclerator position sensor. • Measure the resistance from pin C (pin A) to pin A (pin C) on the sensor side of the accelerator position sensor when the accelerator pedal is released and when it is depressed.	OK 2000 to 3000 ohms	1C
NOTE: Install the 6-pin, Part No. 3824892, or the 3-pin, Part No. 3823255, repair connector onto the accelerator position sensor. NOTE: The pin letters shown above are for the integrated sensor switch (ISS) and letters shown in brackets are for pedals with separate idle validation and accelerator sensors.	NOT OK Replace the accelerator position sensor Refer to the OEM troubleshooting and repair manual.	4A



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STEP 1C: Check the resistance between sensor pins.

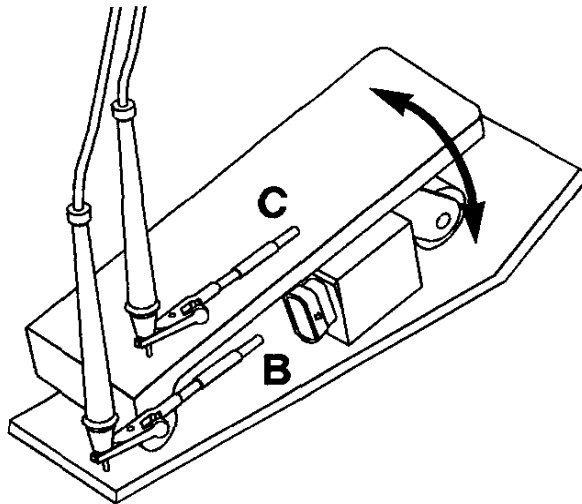


To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3823996 - female Weather-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the accelerator position sensor.

Action	Specifications/Repair	Next Step
<p>Check the resistance between sensor pins. NOTE: Measure when the pedal is depressed and released.</p> <ul style="list-style-type: none"> • Measure the resistance from pin C (pin A) to pin B (pin C) on the sensor side of the accelerator position sensor. <p>NOTE: Install the 6-pin, Part No. 3824892, or the 3-pin repair connector, Part No. 3823255, repair connector into accelerator position sensor.</p>	<p>OK Released: 1500 to 3000 ohms Depressed: 250 to 1500 ohms</p> <p>NOTE: Released resistance must be at least 1000 ohms more than depressed resistance.</p>	<p>1D</p>
<p>NOTE: The pin letters shown above are for the integrated sensor switch (ISS) and the letters shown in brackets are for pedals with separate idle validation and accelerator sensors.</p>	<p>NOT OK Replace the accelerator position sensor Refer to the OEM troubleshooting and repair manual.</p>	<p>4A</p>



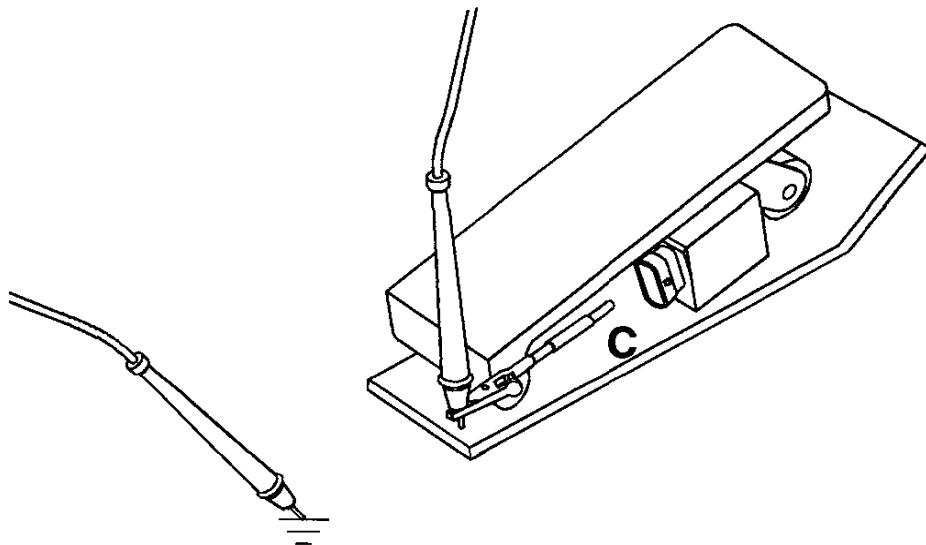
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STEP 1D: Check for a short circuit to ground in the sensor +5 VDC supply.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the accelerator position sensor.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground in the sensor +5-VDC supply. • Measure the resistance from pin C (pin A) on the sensor side of the accelerator position sensor to engine block ground.	OK More than 100k ohms	1E
NOTE: Install the 6-pin, Part No. 3824892, or the 3-pin, Part No. 3823255, repair connector into the accelerator position sensor. NOTE: The pin letters shown above are for the integrated sensor switch (ISS) and the letters shown in brackets are for pedals with separate idle validation and accelerator sensors.	NOT OK Replace the accelerator position sensor Refer to the OEM troubleshooting and repair manual.	4A



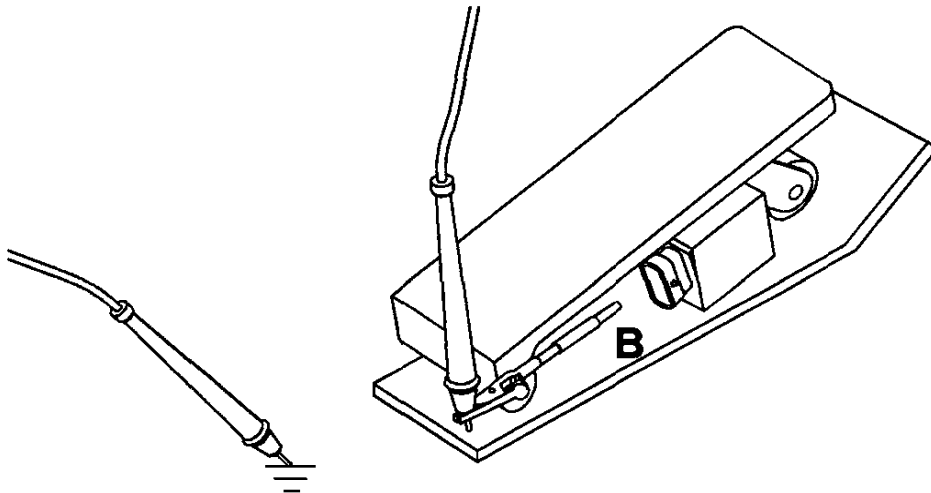
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STEP 1E: Check for a short circuit to ground in the sensor signal wire.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the accelerator position sensor.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground in the signal wire. <ul style="list-style-type: none"> • Measure the resistance from pin B (pin B) on the sensor side of the accelerator position sensor to engine block ground. 	OK More than 100k ohms	2A
<p>NOTE: Install the 6-pin, Part No. 3824892, or the 3-pin, Part No. 3823255, repair connector into the accelerator position sensor.</p> <p>NOTE: The pin letters shown above are for the integrated sensor switch (ISS) and letters shown in brackets are for pedals with separate idle validation and accelerator sensors.</p>	NOT OK Replace the accelerator position sensor Refer to the OEM troubleshooting and repair manual.	4A



STEP 2: Check the OEM harness.

STEP 2A: Inspect the OEM harness and the ECM connector pins.

Condition:		
<ul style="list-style-type: none">• Turn keyswitch to the OFF position.• Disconnect the OEM harness from the ECM.		
Action	Specifications/Repair	Next Step
Inspect the harness and the ECM connector pins for the following: <ul style="list-style-type: none">• Bent or broken pins• Pushed back or expanded pins• Corroded pins• Moisture in or on the connector• Missing or damaged seals.	OK No damaged pins	2B
	NOT OK Repair the damaged pins Repair or replace the OEM harness or ECM, whichever has damaged pins. <ul style="list-style-type: none">• Repair the OEM harness. Refer to Procedure 019-250.• Replace the OEM harness. Refer to Procedure 019-071.• Replace the ECM. Refer to Procedure 019-031.	4A

STEP 2B: Check for an open circuit in the supply, signal, and return wires of the OEM harness.

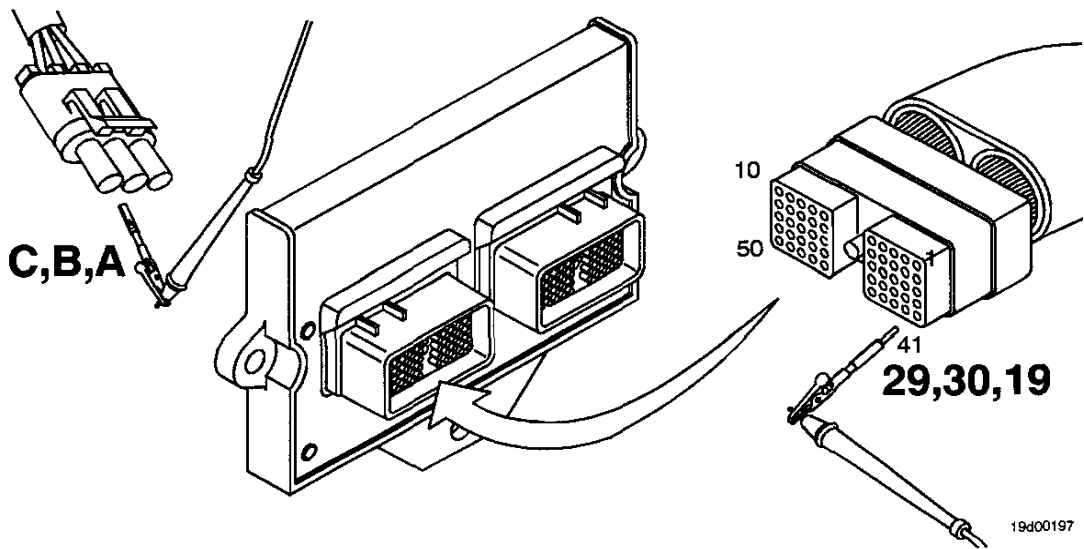
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/Metri-Pack test lead
Part No. 3823995 - male Weather-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the accelerator position sensor.
- Disconnect the OEM harness from the ECM.

Action	Specifications/Repair	Next Step
Check for an open circuit in the supply, signal, and return wires of the OEM harness. <ul style="list-style-type: none"> • Measure the resistance from pin 29 of the OEM harness connector to pin C (pin A) on the harness side of the accelerator position sensor. • Measure the resistance from pin 30 of the OEM harness connector to pin B (pin B) on the harness side of the accelerator position sensor. • Measure the resistance from pin 19 of the OEM harness connector to pin A (pin C) on the harness side of the accelerator position sensor. 	OK Less than 10 ohms	2C
<p>NOTE: The pin letters shown above are for the integrated sensor switch (ISS), and letters shown in brackets are for pedals with separate idle validation and accelerator sensors.</p>	NOT OK Replace the OEM harness Refer to Procedure 019-071.	4A



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STEP 2C: Check for a short circuit between +5-VDC supply wire and any other wire in the OEM harness.

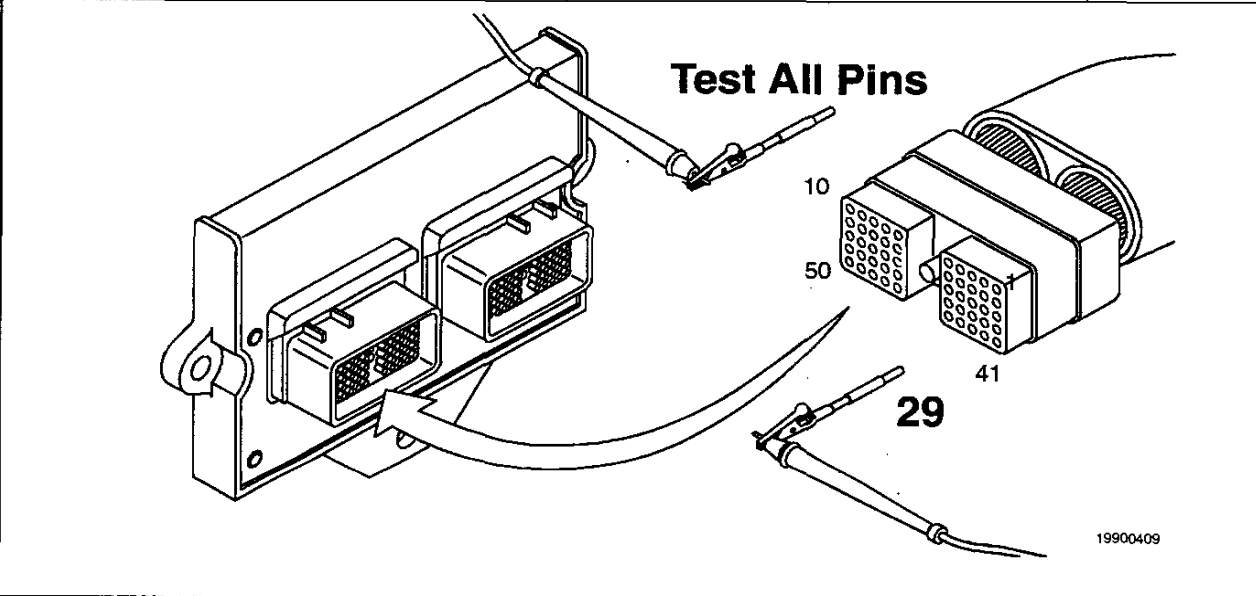
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male Deutsch/Metri-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the accelerator position sensor.
- Disconnect the OEM harness from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit from the +5-VDC supply wire to any other wire in the OEM harness. • Measure the resistance from pin 29 to all other pins in the OEM harness connector.	OK More than 100k ohms	2D
	NOT OK Replace the OEM harness Refer to Procedure 019-071.	4A



STEP 2D: Check for a short circuit between accelerator position signal wire and any other wire in the OEM harness.

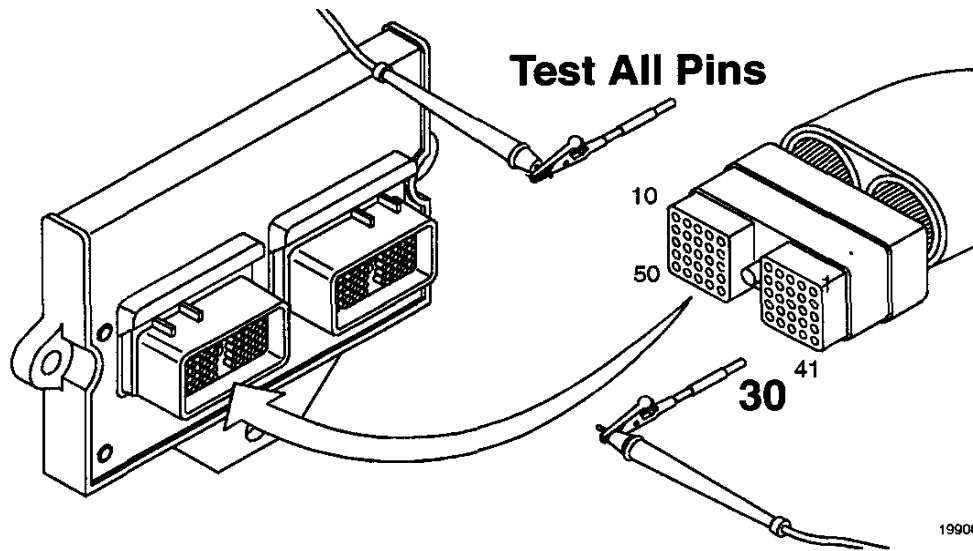
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male Deutsch/Metri-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the accelerator position sensor.
- Disconnect the OEM harness from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit between the accelerator position signal wire and any other signal in the OEM harness. • Measure the resistance from pin 30 to all other pins in OEM harness connector.	OK More than 100k ohms	2E
	NOT OK Replace the OEM harness Refer to Procedure 019-071.	4A



STEP 2E: Check for a short circuit between the +5-VDC supply and return wires (Fault Code 132 only).

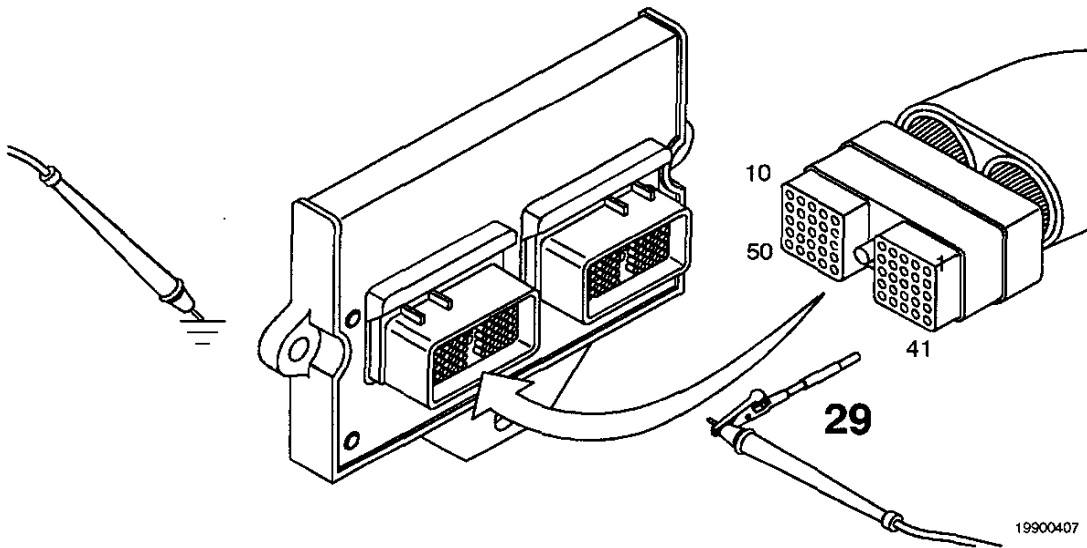
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male Deutsch/Metri-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the accelerator position sensor.
- Disconnect the OEM harness from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit between the +5-VDC supply and return wires. • Measure the resistance from pin 29 of the OEM harness connector to engine block ground.	OK More than 100k ohms	2F
	NOT OK Replace the OEM harness Refer to Procedure 019-071.	4A



STEP 2F: Check for a short circuit to ground of the accelerator position sensor signal (Fault Code 132 only).

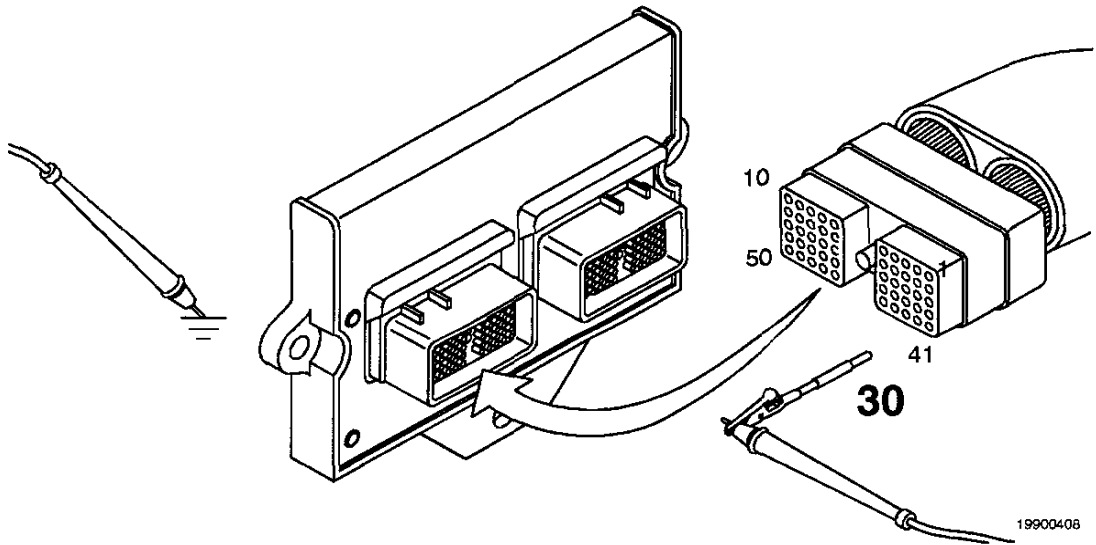
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male Deutsch/Metri-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the accelerator position sensor.
- Disconnect the OEM harness from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground of the accelerator position sensor signal circuit. <ul style="list-style-type: none">• Measure the resistance from pin 30 of the OEM harness connector to engine block ground.	OK More than 100k ohms	2G
	NOT OK Replace the OEM harness Refer to Procedure 019-071.	4A



STEP 3: Check the ECM.

STEP 3A: Check the accelerator position supply voltage.

⚠ CAUTION ⚠		
To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.		
Condition:		
<ul style="list-style-type: none"> • Connect the OEM harness to the accelerator position sensor. • Disconnect the OEM harness from the ECM. • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Check the accelerator position supply voltage. <ul style="list-style-type: none"> • Measure the voltage from pin 19 to pin 29 in the OEM port of the ECM. 	OK (+) 4.75 to 5.25 VDC	4A
	NOT OK Replace the ECM Refer to Procedure 019-031.	4A

STEP 4: Clear the fault code.

STEP 4A: Disable the fault code.

Condition:		
<ul style="list-style-type: none"> • Connect all components. 		
Action	Specifications/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> • Turn the keyswitch to the ON position, and depress the accelerator pedal to full position. Release the pedal, and turn the keyswitch to the OFF position. • Verify that Fault Code 131 or 132 is inactive. 	OK Fault Code 131 or 132 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.

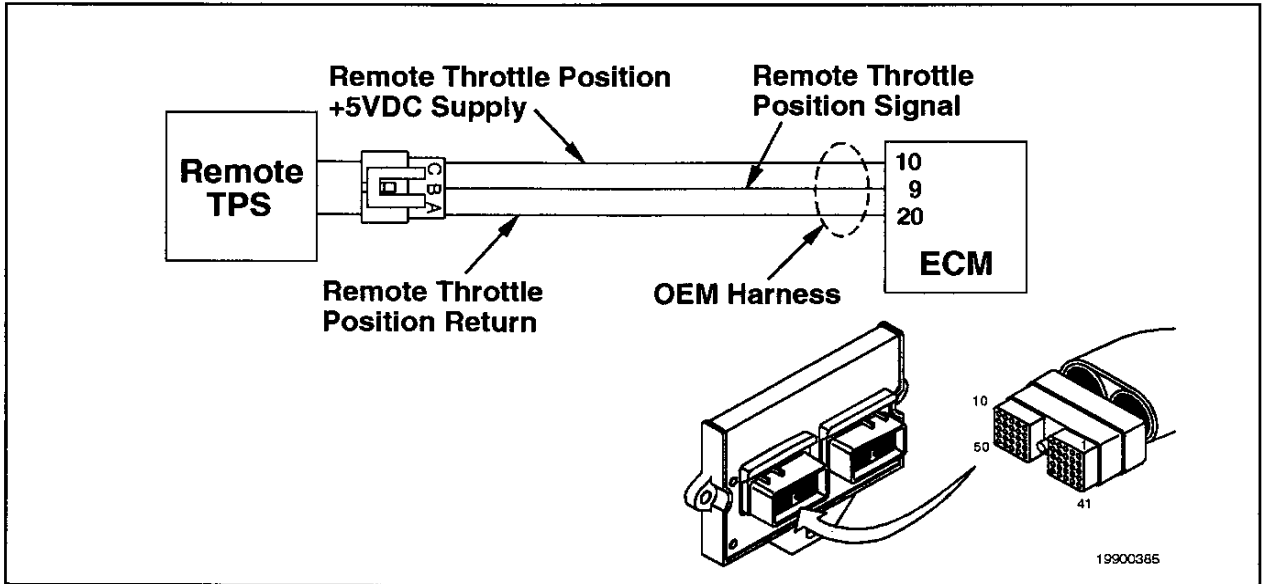
Condition:		
<ul style="list-style-type: none"> • Connect all components. • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> • Erase the inactive fault codes using INSITE™. 	OK All faults cleared	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting chart

Fault Code 133

Remote Throttle Position Sensor

CODES	REASON	EFFECT
Fault Code: 133 PID(P), SID(S): P029 SPN: 29 FMI: 3 Lamp: Red	High voltage detected at the remote throttle position signal circuit.	Engine will not respond to remote throttle input.

Remote Throttle Position Sensor Circuit



Circuit Description:

The remote throttle pedal provides the driver's throttle command to the electronic control module (ECM) through the OEM harness and the original equipment manufacturer's (OEM) interface harness. The ECM uses this signal to determine the fueling command.

Component Location:

The remote throttle pedal location varies with each OEM. Refer to the OEM manual.

Shop Talk:

The throttle position sensor is a potentiometer. The resistance specifications of the throttle position sensor is as follows:

- Between supply and return = 2000 to 3000 ohms
- Between supply and signal: Released = 1500 to 3000 ohms; depressed = 200 to 1500 ohms

Note: If the throttle or throttle position sensor is changed, or after a calibration download, cycle the throttle pedal (keyswitch in the ON position) through its complete travel three times. This procedure calibrates the new throttle with the ECM.

- The remote throttle enable switch **must** be turned on for the remote throttle to operate.
- Possible causes of this fault code include an open circuit in the return wire, short circuit to + 5 VDC or 12 VDC, defective remote throttle position sensor or a failed ECM power supply.

TROUBLESHOOTING SUMMARY



To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3823996 - female Weather-Pack test lead
Part No. 3822758 - male Deutsch/Cannon/Metri-Pack test lead.



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: Isolate the remote throttle position sensor circuit.		
STEP 1A: Inspect the OEM harness and sensor connector pins.	No damaged pins	
STEP 1B: Check for active fault codes.	Fault Code 131 inactive	
STEP 1C: Disconnect the remote throttle connector; check if fault code deactivates.	Fault Code 133 inactive	
STEP 2: Check the remote throttle position sensor.		
STEP 2A: Inspect the harness and the remote throttle position sensor connector pins.	No damaged pins	
STEP 2B: Check the remote throttle position resistance.	250 to 3000 ohms	
STEP 2C: Check the resistance between sensor pins.	Released: 1500 to 3000 ohms Depressed: 250 to 1500 ohms Released resistance must be at least 1000 ohms more than depressed resistance	
STEP 3: Check the OEM harness.		
STEP 3A: Inspect the harness and the ECM connector pins.	No damaged pins	
STEP 3B: Check for a short circuit between the +5-VDC supply and return wires.	250 to 3000 ohms	
STEP 3C: Check for an open circuit in the return wire.	Less than 10 ohms	
STEP 3D: Check the resistance in the +5-VDC supply wire and signal wire circuit.	More than 100k ohms	
STEP 3E: Check for a short circuit between the remote throttle position signal wire and the supply wire in the OEM harness.	More than 100k ohms	
STEP 3F: Check for a short circuit between the remote throttle position signal and another signal wire or the switch supply wire.	More than 100k ohms	

STEP 4: Clear the fault code.

STEP 4A: Disable the fault code.

Fault Code 133 inactive

STEP 4B: Clear the inactive fault codes.

All faults cleared

TROUBLESHOOTING STEP

STEP 1: Isolate the remote throttle position sensor circuit.

STEP 1A: Inspect the OEM harness and sensor connector pins.

Condition: <ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the OEM harness from the remote throttle position sensor. 		
Action	Specifications/Repair	Next Step
Inspect the OEM harness and the remote throttle position sensor connector pins for: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	OK No damaged pins	1B
	NOT OK Repair the damaged pins Repair or replace the OEM harness or sensor, whichever has the damaged pins. <ul style="list-style-type: none"> • Repair the OEM harness. Refer to Procedure 019-203. • Replace the OEM harness. Refer to Procedure 019-071. • Replace the remote throttle position sensor. Refer to OEM troubleshooting and repair manual. 	4A

STEP 1B: Check for active fault codes.

Condition: <ul style="list-style-type: none"> • Connect all the components. • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Check for active fault codes. <ul style="list-style-type: none"> • Check for active fault codes using INSITE™. 	OK Fault Codes 131, 132, and 352 are active	1C
	NOT OK Fault Code 131 inactive	4A

STEP 1C: Disconnect the remote throttle connector; check if fault code deactivates.

Condition: <ul style="list-style-type: none"> • Disconnect the remote throttle connector. 		
Action	Specifications/Repair	Next Step
Check for fault code deactivates. <ul style="list-style-type: none"> • Check for inactive fault codes using INSITE™. 	OK Fault Code 133 active	2A
	NOT OK Go to Fault Code 131 Replace the remote throttle position sensor. Refer to OEM troubleshooting and repair manual.	Go to Fault Code 131

STEP 2: Check the remote throttle position sensor.

STEP 2A: Inspect the harness and the remote throttle position sensor connector pins.

Condition:		
<ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the OEM harness from the remote throttle position sensor. 		
Action	Specifications/Repair	Next Step
Inspect the harness and the remote throttle position sensor connector pins for: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	OK No damaged pins	2B
	NOT OK Repair the damaged pins Repair or replace the OEM harness or sensor, whichever has the damaged pins. <ul style="list-style-type: none"> • <i>Repair the OEM harness. Refer to Procedure 019-203.</i> • <i>Replace the OEM harness. Refer to Procedure 019-071.</i> • <i>Replace the remote throttle position sensor. Refer to OEM troubleshooting and repair manual.</i> 	4A

STEP 2B: Check the remote throttle position resistance.

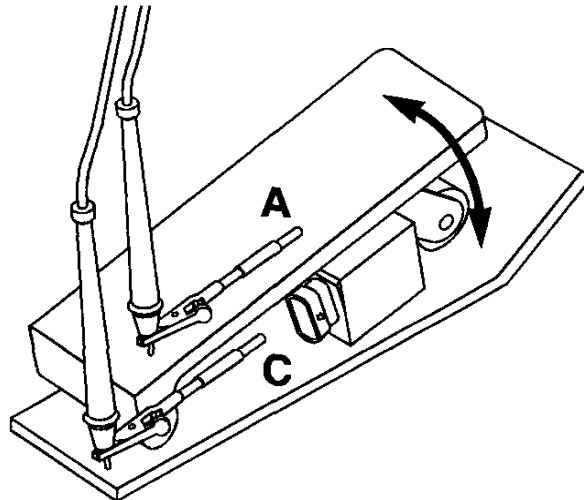
⚠ CAUTION ⚠

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 to the OFF position.
- Disconnect the OEM harness from the remote throttle position sensor.

Action	Specifications/Repair	Next Step
Check for an open or short circuit between pins in the remote throttle position sensor.	OK 250 to 3000 ohms	2C
<ul style="list-style-type: none"> • Measure the resistance between the +5-VDC supply and the remote throttle position sensor return on the sensor side of the remote throttle position sensor when the remote throttle is released and when it is depressed. 	NOT OK Replace the remote throttle position sensor Refer to the OEM troubleshooting and repair manual.	4A



STEP 2C: Check the resistance between sensor pins.

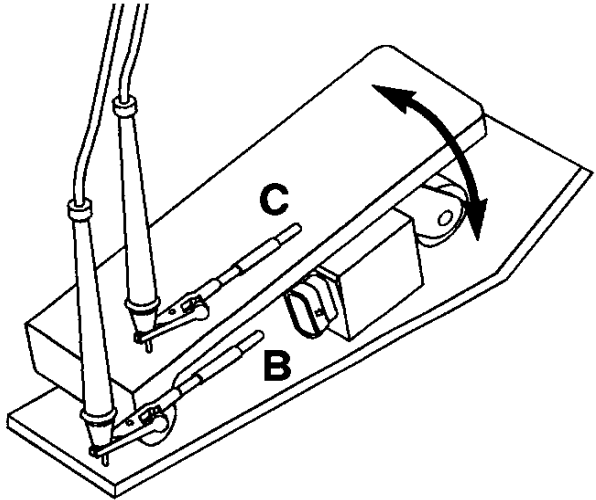


To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3823996 - female Weather-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the remote throttle position sensor.

Action	Specifications/Repair	Next Step
Check the resistance between sensor pins. NOTE: Measure when the pedal is depressed and released. • Measure the resistance between the +5-VDC supply and the signal wire on the sensor side of the remote throttle position sensor.	OK Released: 1500 to 3000 ohms Depressed: 250 to 1500 ohms Released resistance must be at least 1000 ohms more than depressed resistance.	3A
	NOT OK Replace the remote throttle position sensor Refer to the OEM troubleshooting and repair manual.	4A



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STEP 3: Check the OEM harness.

STEP 3A: Inspect the harness and the ECM connector pins.



To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the ECM.
- Disconnect the OEM harness from the remote throttle.

Action	Specifications/Repair	Next Step
Inspect the harness and the ECM connector pins for: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	OK No damaged pins	3B
	NOT OK Repair the damaged pins Repair or replace the OEM harness or ECM, whichever has the damaged pins. <ul style="list-style-type: none"> • Repair the OEM harness. Refer to Procedure 019-250. • Replace the OEM harness. Refer to Procedure 019-071. • Replace the ECM. Refer to Procedure 019-031. 	4A

STEP 3B: Check for a short circuit between the +5-VDC supply and return wires.

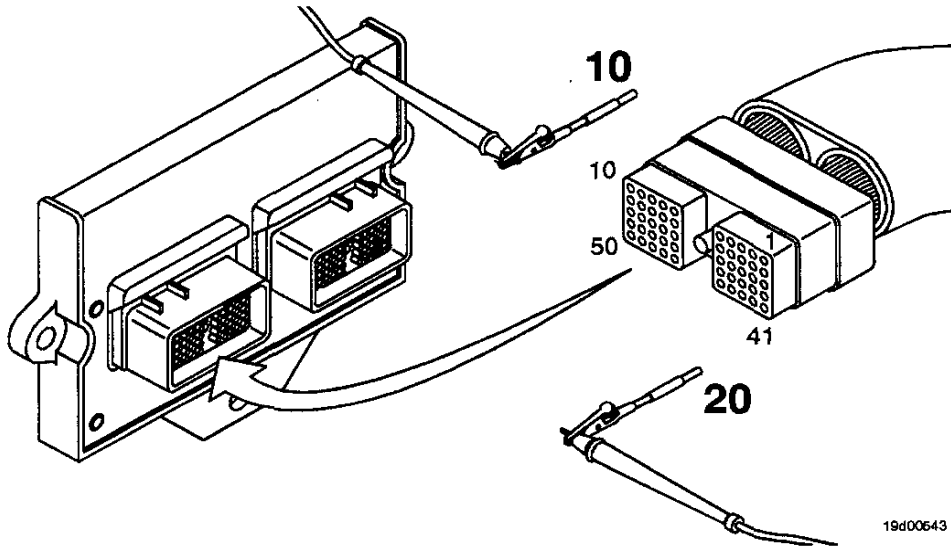
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male Deutsch/Cannon/Metri-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Connect the OEM harness to the remote throttle position sensor.
- Connect the OEM harness to the bulkhead connector.
- Disconnect the OEM harness from the ECM.

Action	Specifications/Repair	Next Step
Check the resistance between the +5-VDC supply and return wires. • Measure the resistance between pin 10 and pin 20 in the OEM harness when the remote throttle pedal is up or down.	OK 2000 to 3000 ohms	3C
	NOT OK Repair or replace the OEM harness Refer to the OEM troubleshooting and repair manual.	4A



STEP 3C: Check for an open circuit in the return wire.

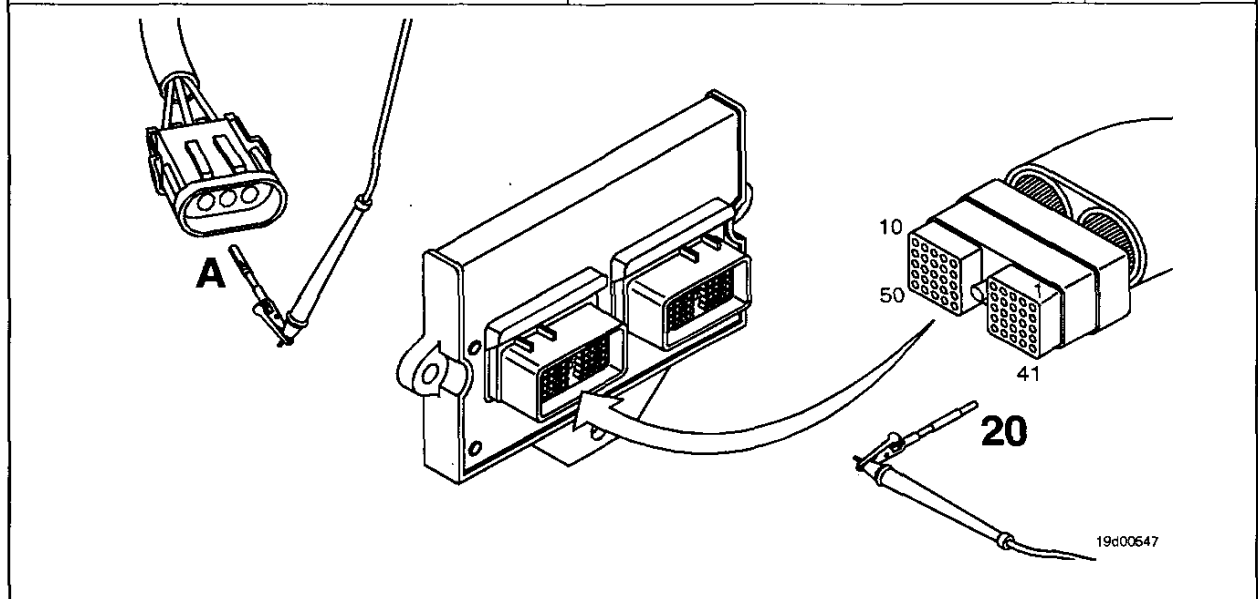
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male Deutsch/Cannon/Metri-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the remote throttle position sensor.
- Disconnect the OEM harness from the ECM.

Action	Specifications/Repair	Next Step
Check for an open circuit in the return wire. • Measure the resistance from pin 20 of the OEM harness connector to pin A of the remote throttle position sensor connector.	OK Less than 10 ohms	3D
	NOT OK Repair or replace the OEM harness Refer to the OEM troubleshooting and repair manual.	4A



STEP 3D: Check the resistance in the +5-VDC supply wire and the signal wire circuit.

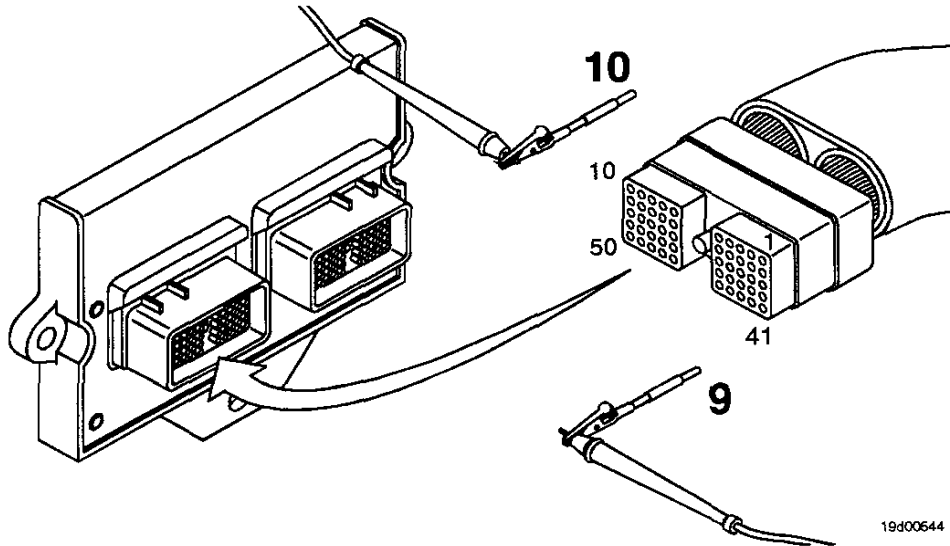


To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male Deutsch/Cannon/Metri-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Connect the OEM harness to the remote throttle position sensor.
- Connect the OEM harness to the bulkhead connector.
- Disconnect the OEM harness from the ECM.

Action	Specifications/Repair	Next Step
Check the resistance in the +5-VDC supply wire and the signal wire circuit. • Measure the resistance between pin 10 and pin 9 when the remote throttle is released and when it is depressed.	OK Released: 1500 to 3000 ohms Depressed: 250 to 1500 ohms	3E
	NOT OK Repair or replace OEM harness Refer to the OEM troubleshooting and repair manual.	4A



STEP 3E: Check for a short circuit between the remote throttle position signal wire and the supply wire in the OEM harness.

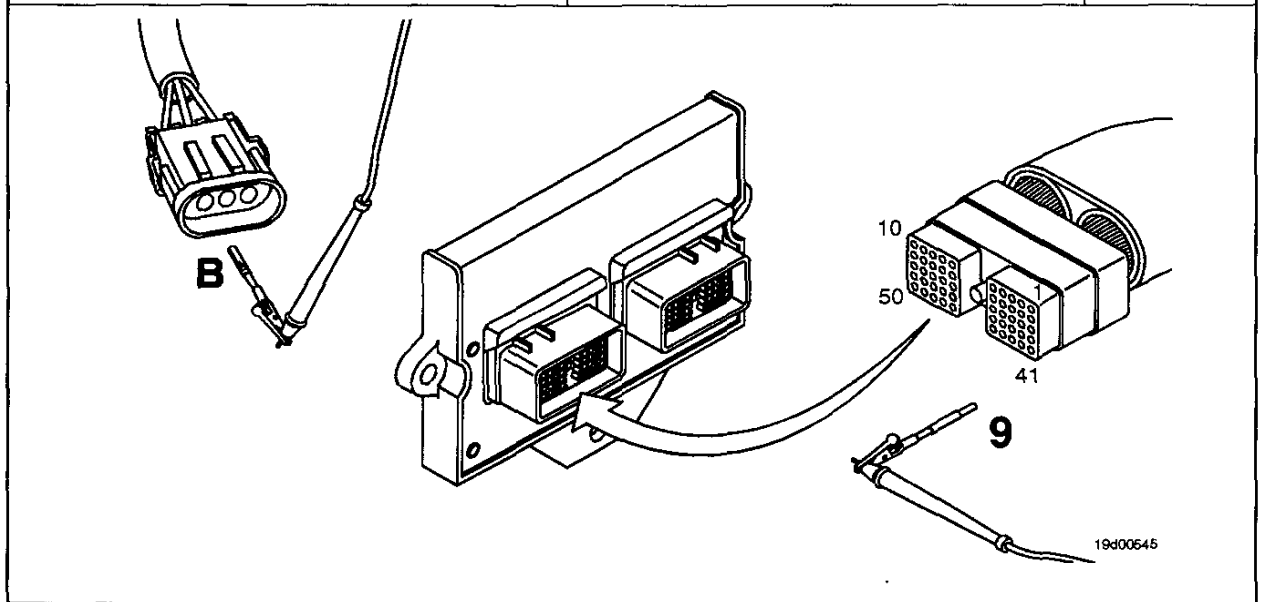
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male Deutsch/Cannon/Metri-Pack test lead.

Condition:

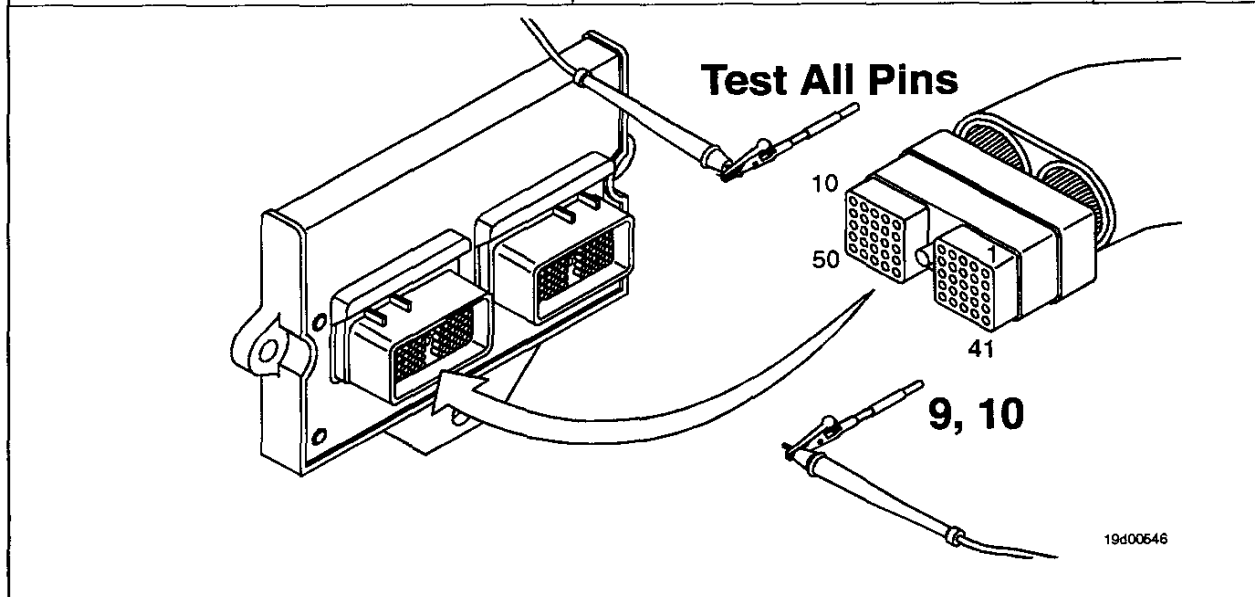
- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the remote throttle position sensor.
- Disconnect the OEM harness from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit between the remote throttle position signal wire and the supply wire in the OEM harness. • Measure the resistance from pin 9 of the OEM harness connector to pin B of the remote throttle position sensor connector.	OK More than 100k ohms	3F
	NOT OK Repair or replace the OEM harness Refer to the OEM troubleshooting and repair manual.	4A



STEP 3F: Check for a short circuit between the remote throttle position signal and supply wire to all other wires in the OEM harness connector.

Condition:		
<ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the OEM harness from the remote throttle position sensor. • Disconnect the OEM harness from the ECM. • Disconnect the negative (-) battery terminal. 		
Action	Specifications/Repair	Next Step
Check for a short circuit between the remote throttle position signal and supply wire to all other wires in the OEM harness connector. <ul style="list-style-type: none"> • Measure the resistance from pin 9 and pin 10 of the OEM harness connector to all other pins in the OEM harness connector. 	OK More than 100k ohms	4A
	NOT OK Repair or replace the OEM harness Refer to the OEM troubleshooting and repair manual.	4A



STEP 4: Clear the fault codes.

STEP 4A: Disable the fault code.

Condition:		
<ul style="list-style-type: none"> • Connect all the components. • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> • Turn the keyswitch to the ON position and depress the remote throttle to full position three times. Release the remote throttle and turn the keyswitch to the OFF position. • Start the engine, and let it idle for 1 minute. • Using INSITE™, verify that the Fault Code 133 is inactive. 	OK Fault Code 133 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.

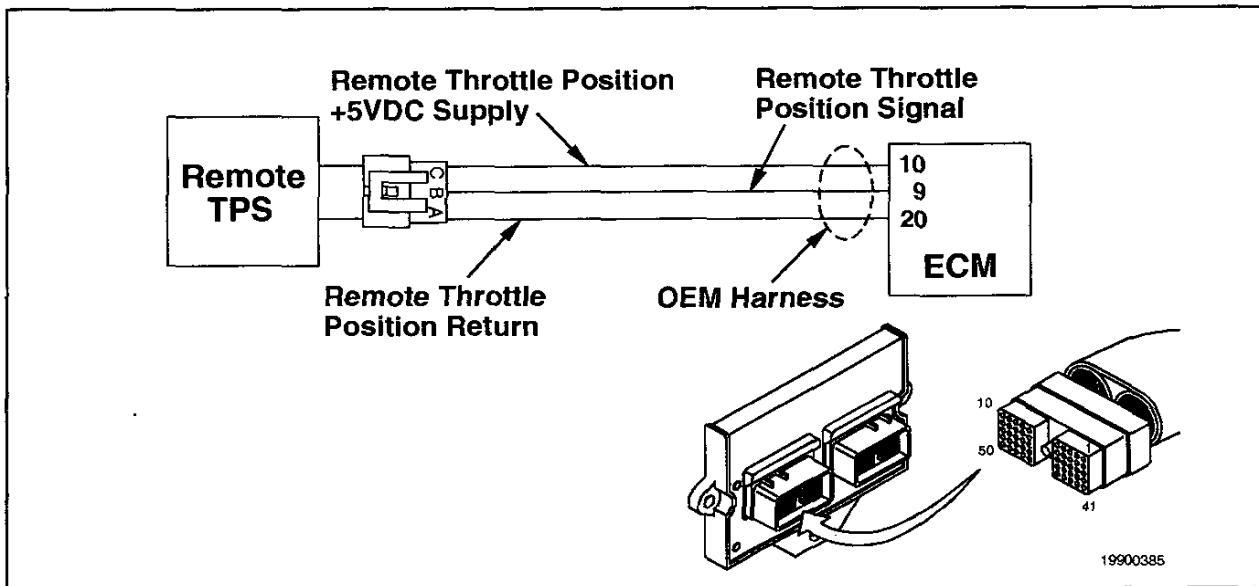
Condition:		
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	OK All faults cleared	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting chart

Fault Code 134

Remote Throttle Position Sensor

CODES	REASON	EFFECT
Fault Code: 134 PID(P), SID(S): P029 SPN: 29 FMI: 4 Lamp: Red	Low voltage detected at the remote throttle position signal circuit.	Engine will not respond to remote throttle input.

Remote Throttle Position Sensor Circuit



Circuit Description:

The remote throttle pedal provides the driver's throttle command to the electronic control module (ECM) through the original equipment manufacturer's (OEM) harness and the OEM interface harness. The ECM uses this signal to determine the fueling command.

Component Location:

The remote throttle pedal location varies with each OEM. Refer to the OEM manual.

Shop Talk:

The remote throttle position sensor is a potentiometer. The resistance specifications of the throttle position sensor is as follows:

- Between supply and return = 2000 to 3000 ohms
 - Between supply and signal: Released = 1500 to 3000 ohms; depressed = 200 to 1500 ohms
- NOTE:** If the remote throttle position sensor is changed, or after a calibration download, cycle the throttle pedal (keyswitch in the ON position) through its complete travel three times. This procedure calibrates the new remote throttle with the ECM.
- The remote throttle enable switch **must** be turned on for the remote throttle to operate.
 - Possible causes of this fault code include an open circuit in the supply wire, short circuit to ground in the supply or signal wires, defective remote throttle position sensor, or a failed ECM power supply.

TROUBLESHOOTING SUMMARY



To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/Cannon/Metri-Pack test lead
Part No. 3823996 - female Weather-Pack test lead.



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: Isolate the remote throttle position sensor circuit.		
STEP 1A: Inspect the OEM harness and sensor connector pins.	No damaged pins	
STEP 1B: Check for active fault codes.	Fault Code 132 inactive	
STEP 1C: Disconnect the remote throttle connector; check if fault code deactivates.	Fault Code 134 inactive	
STEP 2: Check the remote throttle position sensor.		
STEP 2A: Inspect the harness and the remote throttle position sensor connector pins.	No damaged pins	
STEP 2B: Check the remote throttle position resistance.	2000 to 3000 ohms	
STEP 2C: Check for short circuit to ground on the remote throttle sensor +5-VDC supply wire.	More than 100k ohms	
STEP 2D: Check for a short circuit to ground on the remote throttle sensor signal wire.	More than 100k ohms	
STEP 3: Check the OEM harness.		
STEP 3A: Inspect the harness and the ECM connector pins.	No damaged pins	
STEP 3B: Check for an open circuit in the supply or signal wires of the OEM harness.	Less than 10 ohms	
STEP 3C: Check for a short circuit to ground of the remote throttle position sensor +5-VDC supply circuit.	More than 100k ohms	
STEP 3D: Check for a short circuit to ground of the remote throttle position sensor signal circuit.	More than 100k ohms	
STEP 3E: Check for a short circuit between the remote throttle position +5-VDC signal wire and any other wire in the OEM harness.	More than 100k ohms	

STEP 3F: Check for a short circuit between the remote throttle position signal wire and the other signal wire in the OEM harness.

More than 100k ohms

STEP 4: Clear the fault codes.

STEP 4A: Disable the fault code.

Fault Code 134 inactive

STEP 4B: Clear the inactive fault codes.

All faults cleared

TROUBLESHOOTING STEP

STEP 1: Isolate the remote throttle position sensor circuit.

STEP 1A: Inspect the OEM harness and sensor connector pins.

Condition: <ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the OEM harness from the remote throttle position sensor. 		
Action	Specifications/Repair	Next Step
Inspect the OEM harness and the remote throttle position sensor connector pins for: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	OK No damaged pins	1B
	NOT OK Repair the damaged pins Repair or replace the OEM harness or sensor, whichever has the damaged pins. <ul style="list-style-type: none"> • Repair the OEM harness. Refer to Procedure 019-203. • Replace the OEM harness. Refer to Procedure 019-071. • Replace the remote throttle position sensor. Refer to OEM troubleshooting and repair manual. 	4A

STEP 1B: Check for active fault codes.

Condition: <ul style="list-style-type: none"> • Connect all the components. • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Check for active fault codes. <ul style="list-style-type: none"> • Check for active fault codes using INSITE™. 	OK Fault Code 132 active	1C
	NOT OK Fault Code 132 inactive	4A

STEP 1C: Disconnect the remote throttle connector; check if fault code deactivates.

Condition: <ul style="list-style-type: none"> Disconnect the remote throttle connector. 		
Action	Specifications/Repair	Next Step
Check for fault code deactivates. <ul style="list-style-type: none"> Check for inactive fault codes using INSITE™. 	OK Fault Code 134 active	2A
	NOT OK Fault Code 134 inactive Replace the remote throttle position sensor. Refer to OEM troubleshooting and repair manual.	4A

STEP 2: Check the remote throttle position sensor.

STEP 2A: Inspect the harness and the remote throttle position sensor connector pins.

Condition: <ul style="list-style-type: none"> Turn keyswitch to the OFF position. Disconnect the OEM harness from the remote throttle position sensor. 		
Action	Specifications/Repair	Next Step
Inspect the harness and the remote throttle position sensor connector pins for: <ul style="list-style-type: none"> Bent or broken pins Pushed back or expanded pins Corroded pins Moisture in or on the connector Missing or damaged seals. 	OK No damaged pins	2B
	NOT OK Repair the damaged pins Repair or replace the OEM harness or sensor, whichever has the damaged pins. <ul style="list-style-type: none"> Repair the OEM harness. Refer to Procedure 019-203. Replace the OEM harness. Refer to Procedure 019-071. Replace the remote throttle position sensor. Refer to OEM troubleshooting and repair manual. 	4A

STEP 2B: Check the remote throttle position resistance.

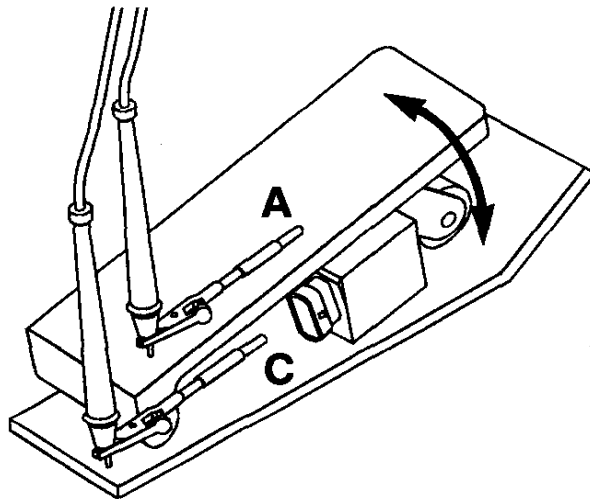
⚠ CAUTION ⚠

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 to the OFF position.
- Disconnect the OEM harness from the remote throttle position sensor.

Action	Specifications/Repair	Next Step
Check for an open or short circuit between pins in the remote throttle position sensor.	OK 2000 to 3000 ohms	2C
<ul style="list-style-type: none">• Measure the resistance between the +5-VDC supply and the remote throttle position sensor return on the sensor side of the remote throttle position sensor when the remote throttle is released and when it is depressed.	NOT OK Replace the remote throttle position sensor Refer to the OEM troubleshooting and repair manual.	4A



STEP 2C: Check for short circuit to ground on the remote throttle sensor +5-VDC supply wire.

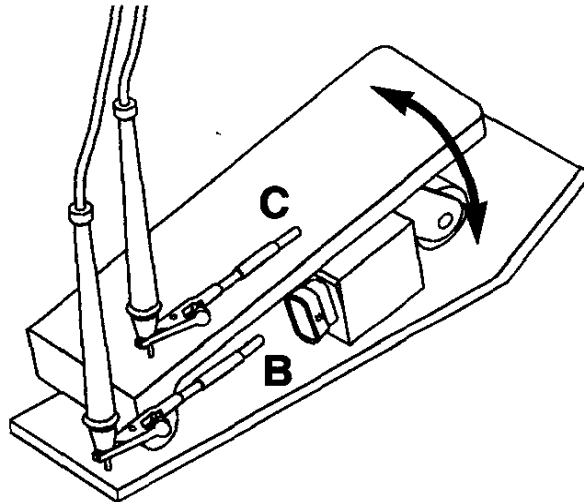
⚠ CAUTION ⚠

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 to the OFF position.
- Disconnect the OEM harness from the remote throttle position sensor.

Action	Specifications/Repair	Next Step
Check for short circuit to ground on the remote throttle sensor +5-VDC supply.	OK More than 100k ohms	2D
<ul style="list-style-type: none"> • Measure the resistance between the +5-VDC supply on the sensor side of the remote throttle position sensor and the chassis ground. 	NOT OK Replace the remote throttle position sensor Refer to the OEM troubleshooting and repair manual.	4A



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STEP 2D: Check for a short circuit to ground of the sensor signal wire.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male Deutsch/Cannon/Metri-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the remote throttle position sensor.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground of the sensor signal wire.	OK More than 100k ohms	3A
<ul style="list-style-type: none"> • Measure the resistance between the signal wire on the sensor side of the remote throttle position sensor and the chassis ground. 	NOT OK Replace the remote throttle position sensor Refer to the OEM troubleshooting and repair manual.	4A

STEP 3: Check the OEM harness.

STEP 3A: Inspect the harness, bulkhead connector, 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 to the OFF position.
- Disconnect the OEM harness from the ECM.
- Disconnect the OEM harness from the remote throttle position sensor.

Action	Specifications/Repair	Next Step
Inspect the harness and the ECM connector pins for:	OK No damaged pins	3B
<ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	NOT OK Repair the damaged pins Repair or replace the OEM harness or ECM, whichever has the damaged pins. <ul style="list-style-type: none"> • Repair the OEM harness. Refer to Procedure 019-250. • Replace the OEM harness. Refer to Procedure 019-071. • Replace the ECM. Refer to Procedure 019-031. 	4A

STEP 3B: Check for an open circuit in the supply or signal wires of the OEM harness.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male Deutsch/Cannon/Metri-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness to the remote throttle position sensor.
- Disconnect the OEM harness from the ECM.

Action	Specifications/Repair	Next Step
Check for an open circuit in the supply or signal wires of the OEM harness.	OK Less than 10 ohms	3C
<ul style="list-style-type: none"> • Measure the resistance between pin 10 of the OEM harness and the +5-VDC supply on the harness side of the remote throttle position sensor. • Measure the resistance between pin 9 of the OEM harness and the signal wire on the harness side of the remote throttle position sensor. 	NOT OK Repair or replace the OEM harness Refer to the OEM troubleshooting and repair manual.	4A

STEP 3C: Check for a short circuit to ground in the remote throttle position sensor +5-VDC supply circuit.

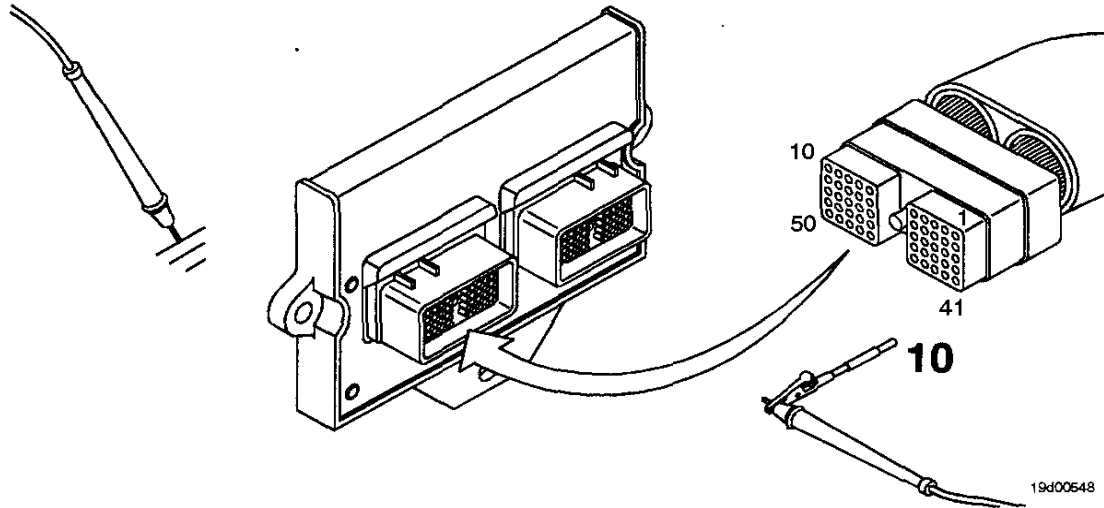
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male Deutsch/Cannon/Metri-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness to the remote throttle position sensor.
- Disconnect the OEM harness from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground in the remote throttle position sensor +5-VDC supply circuit. • Measure the resistance between the pin 10 of the OEM harness and the chassis ground.	OK More than 100k ohms	3D
	NOT OK Repair or replace the OEM harness Refer to the OEM troubleshooting and repair manual.	4A



STEP 3D: Check for a short circuit to ground of the remote throttle position sensor signal circuit.

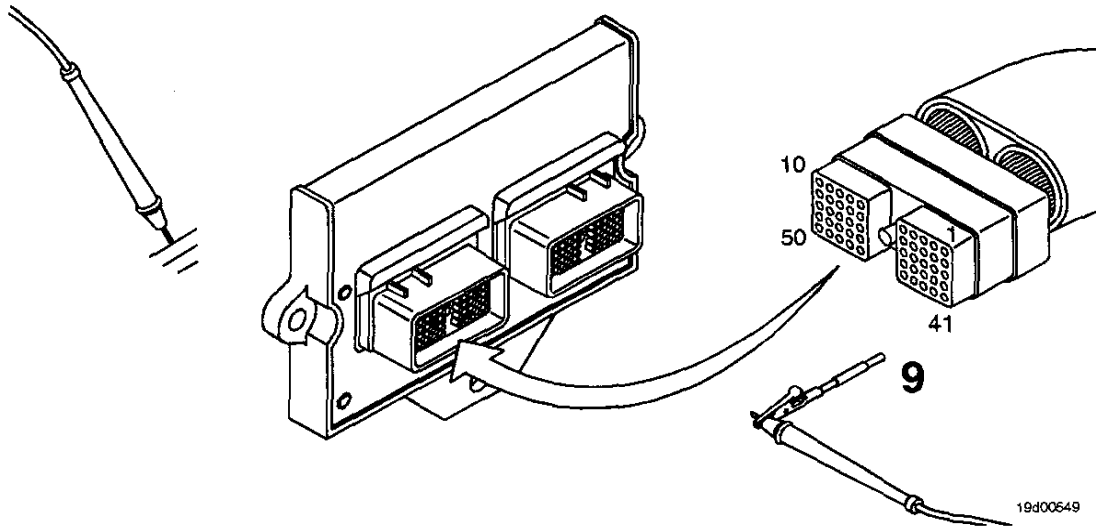
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male Deutsch/Cannon/Metri-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness to the remote throttle position sensor.
- Disconnect the OEM harness from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground in the remote throttle position sensor signal circuit. <ul style="list-style-type: none">• Measure the resistance between pin 9 of the OEM harness and the chassis ground.	OK More than 100k ohms	3E
	NOT OK Repair or replace the OEM harness Refer to the OEM troubleshooting and repair manual.	4A



STEP 3E: Check for a short circuit between +5-VDC supply wire and any other wire in the OEM harness.

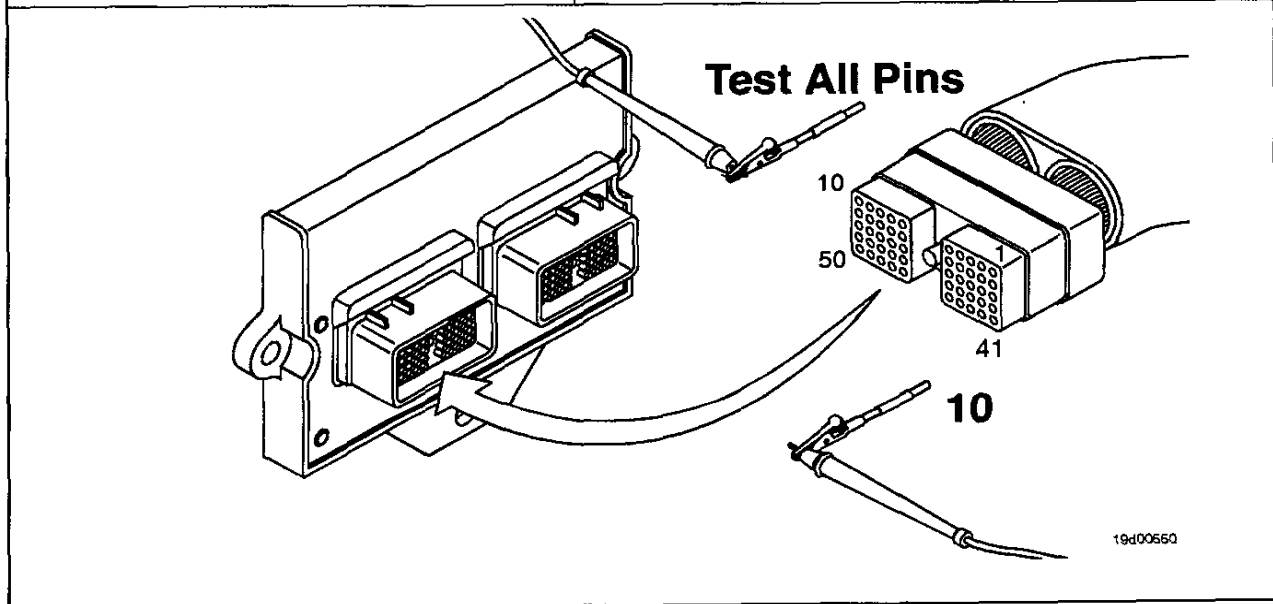
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male Deutsch/Cannon/Metri-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the remote throttle position sensor.
- Disconnect the OEM harness from the ECM.
- Disconnect the OEM negative (-) battery terminal.

Action	Specifications/Repair	Next Step
Check for a short circuit between +5 VDC supply wire and any other wire in the OEM harness. • Measure the resistance between the pin 10 and all other pins in the OEM harness connector.	OK More than 100k ohms	3F
	NOT OK Repair or replace the OEM harness Refer to the OEM troubleshooting and repair manual.	4A



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STEP 3F: Check for a short circuit between remote throttle position signal wire and any other wire in the OEM harness.

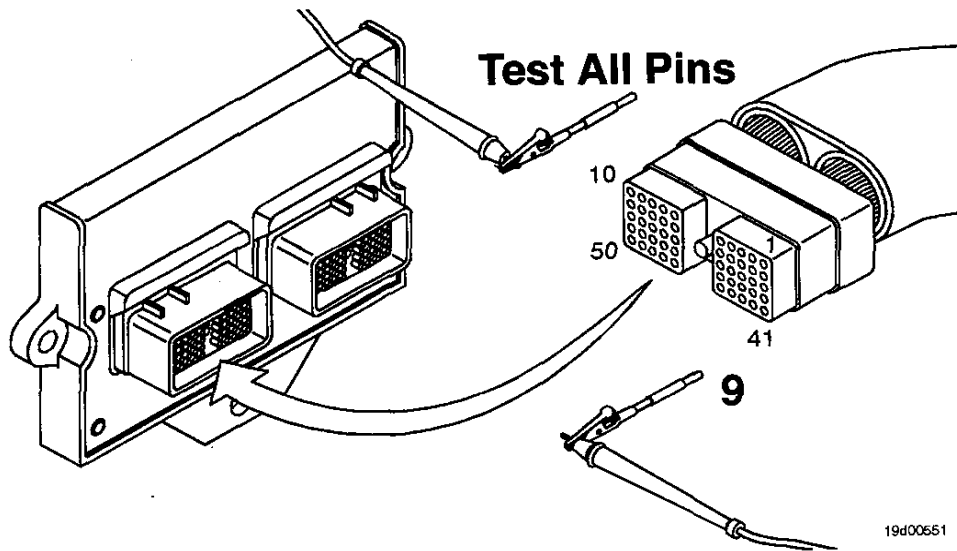
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male Deutsch/Cannon/Metri-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the remote throttle position sensor.
- Disconnect the OEM harness from the ECM.
- Disconnect the OEM negative (-) battery terminal.

Action	Specifications/Repair	Next Step
Check for a short circuit between remote throttle position signal wire and any other wire in the OEM harness.	OK More than 100k ohms	4A
<ul style="list-style-type: none"> • Measure the resistance between pin 9 and all other pins in the OEM harness connector. 	NOT OK Repair or replace the OEM harness Refer to the OEM troubleshooting and repair manual.	4A



19d00651

STEP 4: Clear the fault code.
STEP 4A: Disable the fault code.

Condition:		
<ul style="list-style-type: none"> • Connect all the components. • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> • Turn the keyswitch to the ON position, and depress the remote throttle to full position three times. Release the remote throttle, and turn the keyswitch to the OFF position. • Start the engine, and let it idle for 1 minute. • Using INSITE™, verify that the Fault Code 134 is inactive. 	OK Fault Code 134 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.

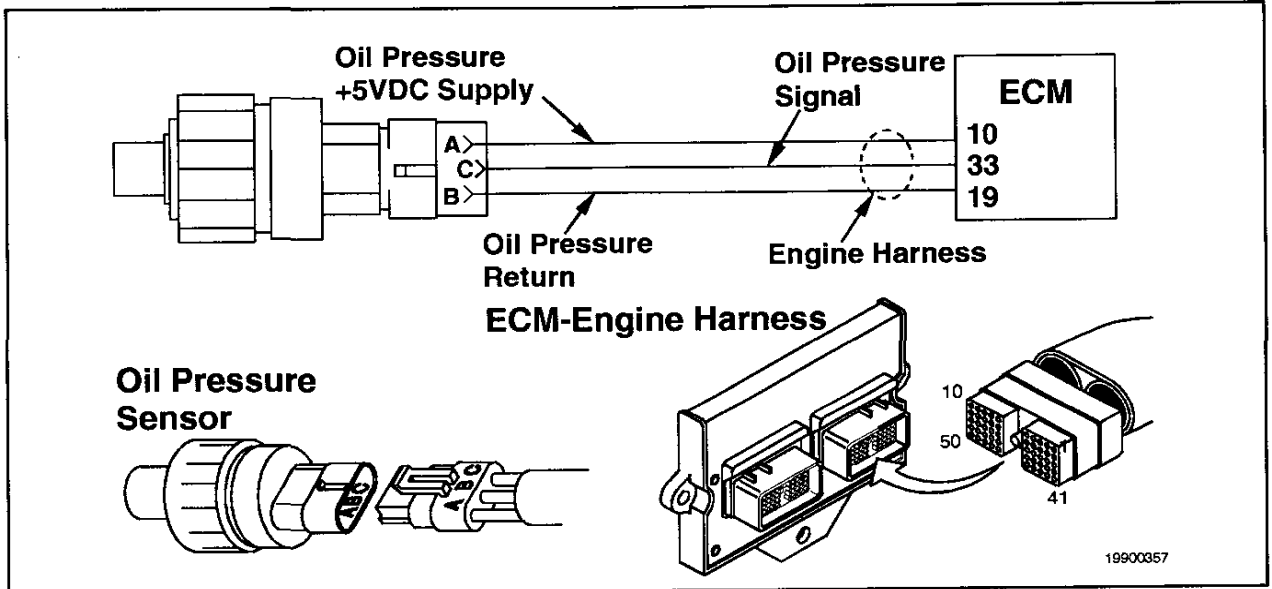
Condition:		
<ul style="list-style-type: none"> • Connect all the components. • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> • Erase the inactive fault codes using INSITE™. 	OK All faults cleared	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting chart

Fault Code 135 or 141

Oil Pressure Sensor Circuit

CODES	REASON	EFFECT
Fault Code: 135 or 141 PID(P), SID(S): P100 SPN: 100 FMI: 3 or 4 Lamp: Yellow	FC 135: High voltage detected at oil pressure sensor signal pin 33 of the engine harness. FC 141: Low voltage detected at oil pressure sensor signal pin 33 of the engine harness.	Default value used for oil pressure. No engine protection for oil pressure.

Oil Pressure Sensor Circuit



Circuit Description:

The oil pressure 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 sensor is located on the engine block, below and to the right of the ECM.

Shop Talk:

- If Fault Code 143 or 415 is **not** present, the problem is **not** related to the engine lubrication system.
- INSITE™ can be used to monitor the oil pressure signal voltage going into the ECM.

TROUBLESHOOTING SUMMARY



To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack test lead.



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 for multiple fault codes.

STEP 1A: Read the fault codes.

Fault Codes 352 and 386 inactive

STEP 2: Check the oil pressure sensor.

STEP 2A: Inspect the engine harness and oil pressure sensor connector pins.

No damaged pins

STEP 2B: Check the oil pressure sensor supply voltage.

(+) 4.75 to 5.25 VDC

STEP 2C: Check the oil pressure sensor signal voltage.

(+) 0.40 to 0.60 VDC

STEP 3: Check the engine harness.

STEP 3A: Inspect 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 ground.

More than 100k ohms

STEP 3D: Check for a short circuit from pin to pin.

More than 100k ohms

STEP 4: Clear fault codes.

STEP 4A: Disable the fault code.

Fault Code 135 or 141 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: <ul style="list-style-type: none"> • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Read the fault codes. <ul style="list-style-type: none"> • Read the fault codes using INSITE™. NOTE: If multiple temperature or pressure fault codes exist, this procedure should not be followed.	OK Fault Codes 352 and 386 inactive	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 352

STEP 2: Check the oil pressure sensor.

STEP 2A: Inspect the engine harness and the oil pressure sensor connector pins.

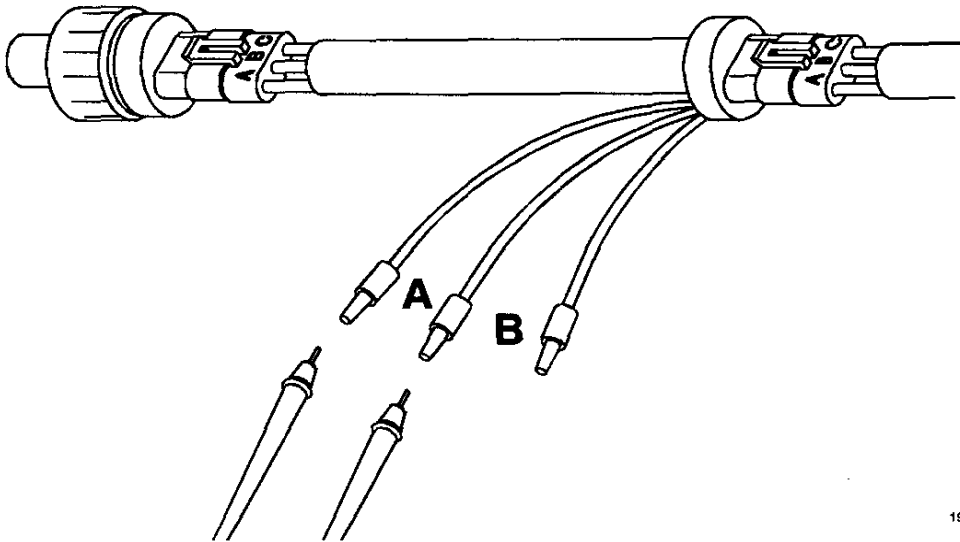
Condition: <ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the engine harness from the oil pressure sensor. 		
Action	Specifications/Repair	Next Step
Inspect the oil pressure sensor and the engine harness connector pins for the following: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	OK No damaged pins	2B
	NOT OK Repair the damaged pins Repair or replace the oil pressure sensor or the engine harness, whichever has damaged pins. <ul style="list-style-type: none"> • Repair the engine harness. Refer to Procedure 019-203. • Replace the engine harness. Refer to Procedure 019-043. • Replace the oil pressure sensor. Refer to Procedure 019-066. 	4A

STEP 2B: Check the oil pressure sensor supply voltage.

Condition:

- Turn keyswitch to the ON position.
- Disconnect the engine harness from the oil pressure sensor.
- Install oil pressure sensor breakout cable, Part No. 3824775.

Action	Specifications/Repair	Next Step
Check the oil pressure sensor supply voltage. • Measure the voltage from pin A to pin B on the harness side of the oil pressure sensor connector. NOTE: Pressure sensor breakout cable kit, Part No. 3824775 of kit 3824773, is available to assist with this step.	OK (+) 4.75 to 5.25 VDC	2C
	NOT OK	3A



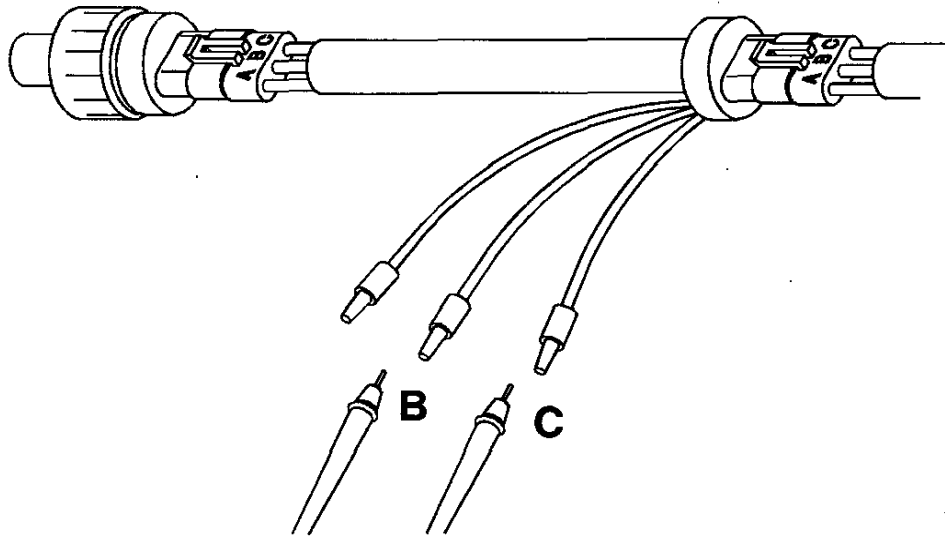
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STEP 2C: Check the oil pressure sensor signal voltage.

Condition:

- Turn keyswitch to the ON position; engine **not** running.
- Install oil pressure sensor breakout cable, Part No. 3824775.

Action	Specifications/Repair	Next Step
Check the oil pressure sensor signal voltage. • Measure the voltage from pin C to pin B of the breakout cable.	OK (+) 0.40 to 0.60 VDC	3A
	NOT OK Replace the oil pressure sensor Refer to Procedure 019-066.	4A



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STEP 3: Check the engine harness.

STEP 3A: Inspect the engine harness and the ECM connector pins.



To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the ECM.

Action	Specifications/Repair	Next Step
Inspect the engine harness and the ECM connector pins for the following: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	OK No damaged pins	3B
	NOT OK Repair the damaged pins Repair or replace the engine harness or ECM, whichever has the damaged pins. <ul style="list-style-type: none"> • 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.

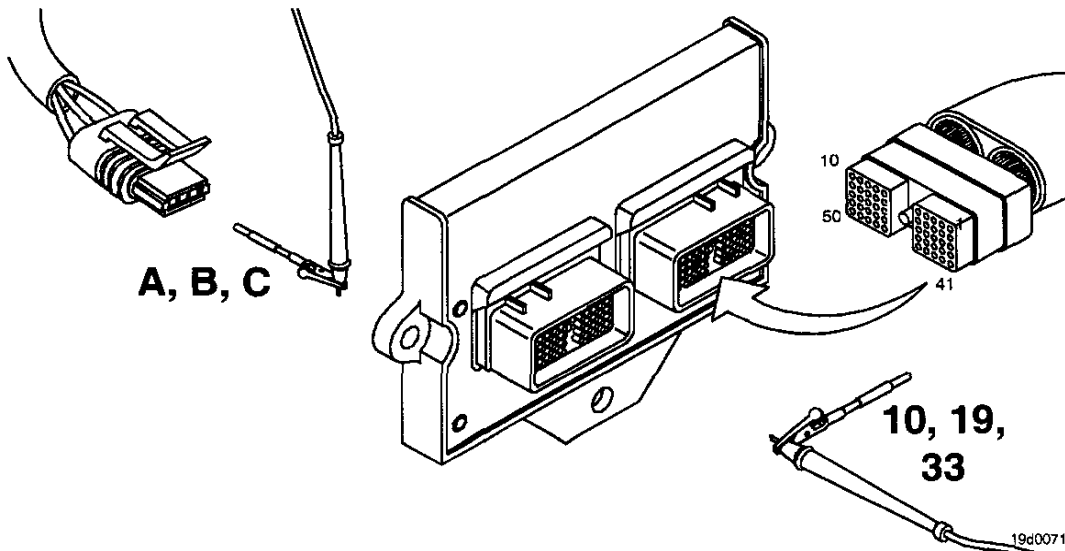
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the oil pressure sensor.
- Disconnect the engine harness from the ECM.

Action	Specifications/Repair	Next Step
Check for an open circuit. <ul style="list-style-type: none"> • Measure the resistance from pin 33 of the engine harness connector to pin C on the harness side of the oil pressure sensor connector. • Measure the resistance from pin 10 of the engine harness connector to pin A on the harness side of the oil pressure sensor connector. 	OK Less than 10 ohms	3C
<ul style="list-style-type: none"> • Measure the resistance from pin 19 of the engine harness connector to pin B on the harness side of the oil pressure sensor connector. 	NOT OK Replace the engine harness Refer to Procedure 019-043.	4A



STEP 3C: Check for a short circuit to ground.

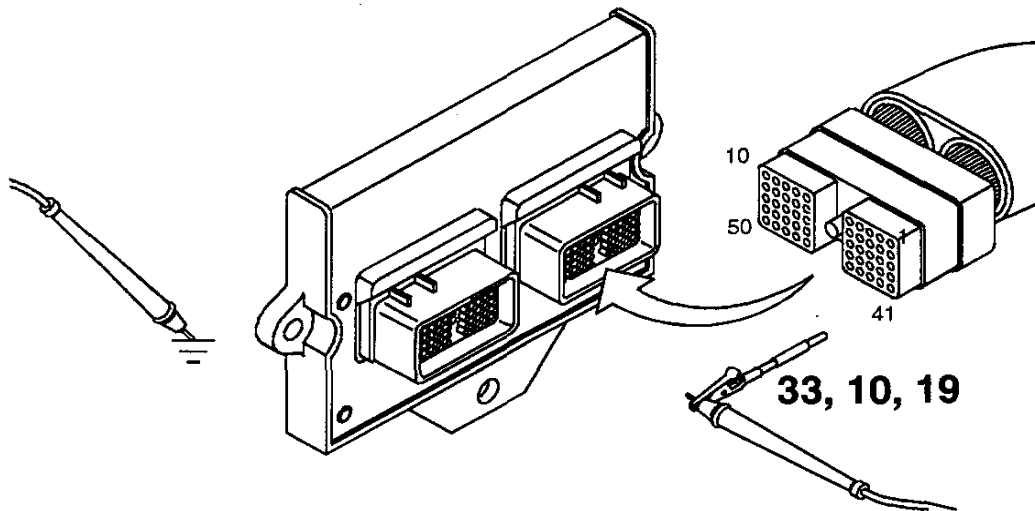
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the oil pressure sensor.
- Disconnect the engine harness from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground. • Measure the resistance from pin 33 of the engine harness connector to engine block ground. • Measure the resistance from pin 10 of the engine harness connector to engine block ground.	OK More than 100k ohms	3D
• Measure the resistance from pin 19 of the engine harness connector to engine block ground.	NOT OK Replace the engine harness Refer to Procedure 019-043.	4A



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STEP 3D: Check for a short circuit from pin to pin.

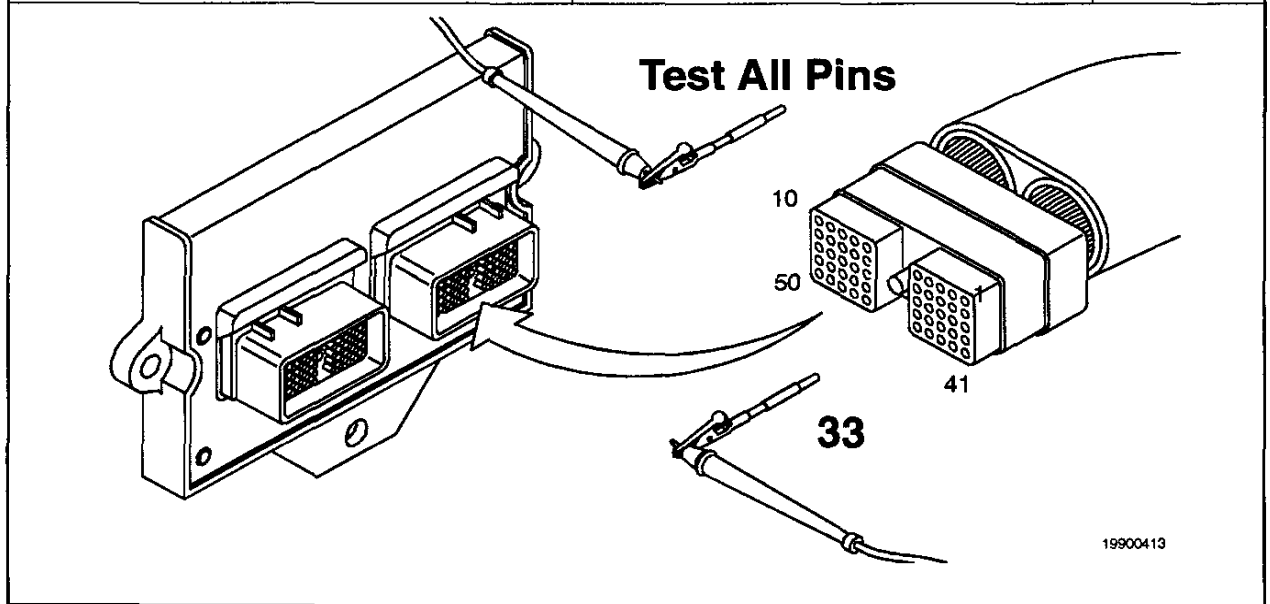
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male Deutsch/Cannon/Metri-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness 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 33 of the engine harness connector to all other pins in the engine harness connector.	OK More than 100k ohms Replace the ECM. Refer to Procedure 019-031.	4A
	NOT OK Replace the engine harness Refer to Procedure 019-043.	4A



STEP 4: Clear the fault codes.

STEP 4A: Disable the fault code.

Condition: <ul style="list-style-type: none"> • Connect all components. • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> • Start the engine, and let idle for 1 minute. • Verify that Fault Code 141 is inactive and did not reoccur. • Turn keyswitch to the ON position. 	OK Fault Code 135 or 141 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.

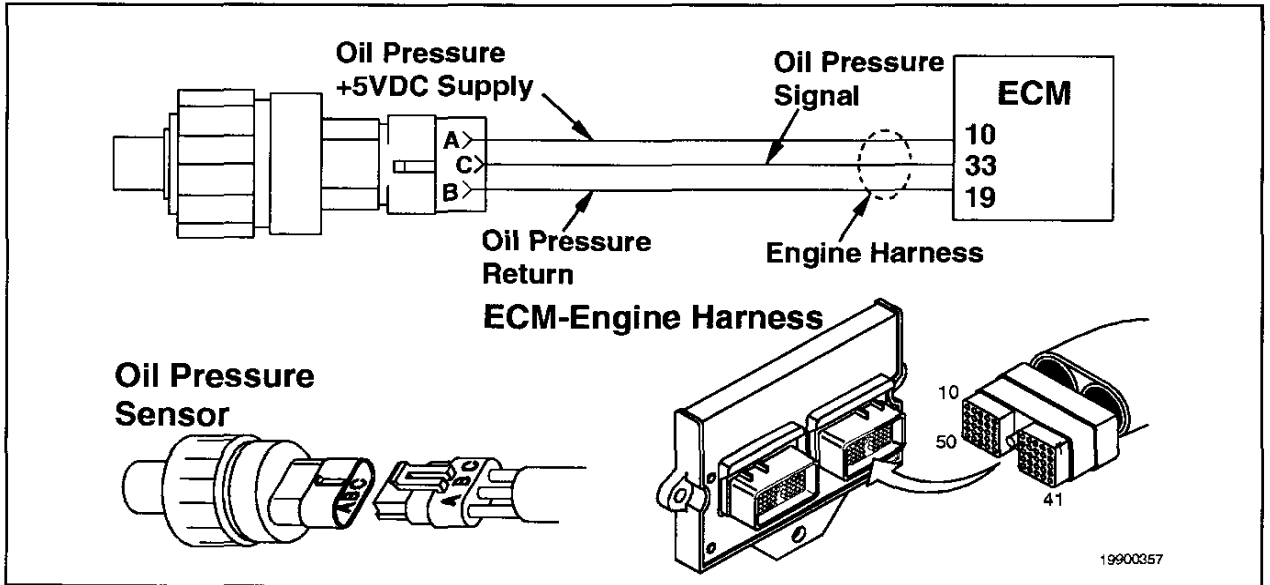
Condition: <ul style="list-style-type: none"> • Connect all the components. • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> • Erase the inactive fault code using INSITE™. 	OK All fault codes cleared	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 143

Oil Pressure - Engine Protection

CODES	REASON	EFFECT
Fault Code: 143 PID(P), SID(S): P100 SPN: 100 FMI: 1 Lamp: Yellow	Oil pressure signal indicates oil pressure below the low engine protection limit.	Power and/or speed derate and possible engine shutdown if engine protection shutdown feature enabled.

Oil Pressure Sensor Circuit



Circuit Description:

The oil pressure 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 sensor is located on the engine block, below and to the right of the ECM.

Shop Talk:

- Confirm that the oil pressure sensor supply voltage is between (+) 4.5 and 5.25 VDC at the sensor.
- Verify, with the driver, the engine speed at which the fault occurs. If the engine is being operated at too low of a speed under load, the oil pressure can drop below the engine protection limits.

TROUBLESHOOTING SUMMARY

STEPS

SPECIFICATIONS

SRT CODE

STEP 1: Check the sensor accuracy.

STEP 1A: Verify the sensor accuracy with a mechanical gauge.

Sensor reading is correct

STEP 2: Clear the fault code.

STEP 2A: Disable the fault code.

Fault Code 143 inactive

STEP 2B: Clear the inactive fault codes.

All faults cleared

TROUBLESHOOTING STEP

STEP 1: Check the sensor accuracy.

STEP 1A: Verify the sensor accuracy with a mechanical gauge.

Condition:		
<ul style="list-style-type: none"> Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Verify the sensor accuracy with a mechanical gauge. <ul style="list-style-type: none"> Connect a mechanical oil pressure gauge to the engine. Connect INSITE™ to vehicle datalink. Start the engine, and compare the oil pressure reading on the service tool monitor screen to the reading on the mechanical oil pressure gauge. NOTE: If necessary, rev the engine up to make it easier to see differences in the readings.	OK The sensor reading is correct Refer to the Troubleshooting and Repair Manual, ISB Engines, Bulletin No. 3666193.	2A
	NOT OK Fault Code 141 active	Fault Code 141

STEP 2: Clear the fault code

STEP 2A: Disable the fault code

Condition:		
<ul style="list-style-type: none"> Connect all the components. Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> Start the engine, and let it idle for 1 minute. Verify Fault Code 143 is inactive. NOTE: If the fault was at a particular speed, run the engine at that speed to verify the problem has been corrected.	OK Fault Code 143 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.

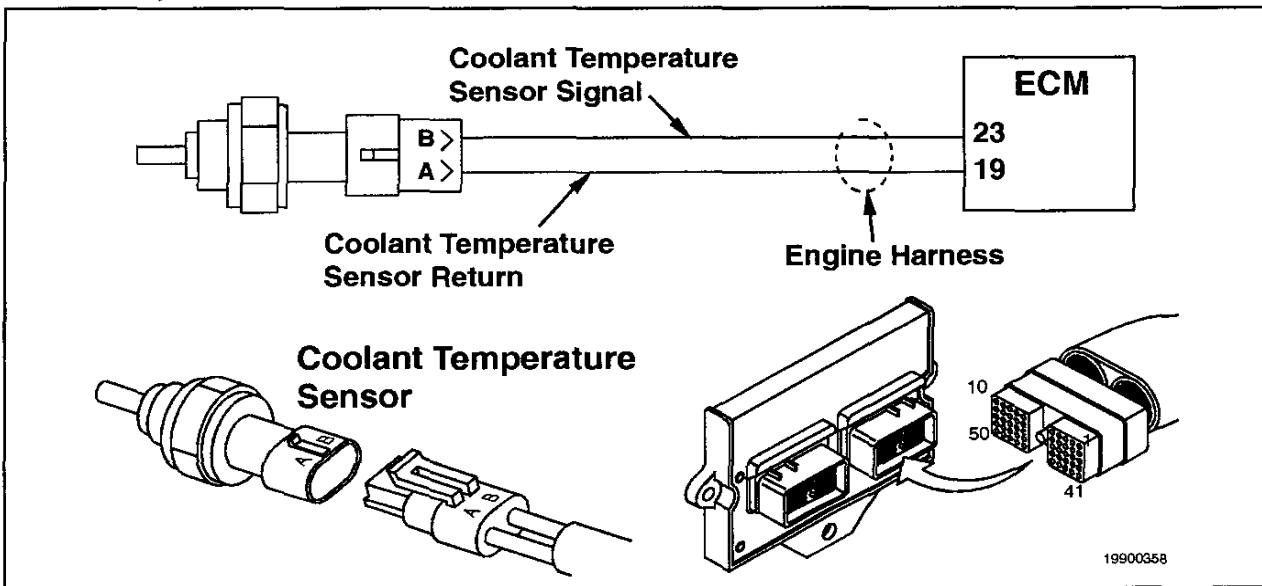
Condition:		
<ul style="list-style-type: none">• Connect all the components.• Turn keyswitch to the ON position.		
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none">• Erase the inactive fault code using INSITE™.	OK All faults cleared	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting chart

Fault Code 144 or 145

Coolant Temperature Sensor Circuit

CODES	REASON	EFFECT
Fault Code: 144 or 145 PID(P), SID(S): P110 SPN: 110 FMI: 3 or 4 Lamp: Yellow	FC 144: High voltage detected at the coolant temperature signal pin 23 of the engine harness. FC 145: Low voltage detected at the coolant temperature signal pin 23 of the engine harness.	Default value used for engine coolant temperature. 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 to the front of the thermostat housing.

Shop Talk:

The sensor reading will match to the following table if the sensor is functioning properly.

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

Wait until the coolant temperature is below 50° C [120°F] before removing the coolant system pressure cap or the coolant temperature sensor. Failure to do so can cause personal injury from heated coolant spray.

CAUTION

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack test lead
Part No. 3823256 - female Metri-Pack test lead.

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 fault codes.		
<u>STEP 1A:</u> Read the fault codes.	Fault Codes 352 and 386 are inactive	
STEP 2: Check the coolant temperature sensor.		
<u>STEP 2A:</u> Inspect the engine harness and coolant temperature sensor connector pins.	No damaged pins	
<u>STEP 2B:</u> Check the resistance of the coolant temperature sensor.	175 to 244k ohms	
<u>STEP 2C:</u> Check for a short circuit to ground in coolant temperature sensor.	More than 100k ohms	
STEP 3: Check the engine harness.		
<u>STEP 3A:</u> Inspect the harness and the ECM connector.	No damaged pins	
<u>STEP 3B:</u> Check for an open circuit.	Less than 10 ohms	
<u>STEP 3C:</u> Check for a short circuit to ground.	More than 100k ohms	
<u>STEP 3D:</u> Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 4: Clear the fault codes.		
<u>STEP 4A:</u> Disable the fault code.	Fault Code 144 or 145 inactive	
<u>STEP 4B:</u> Clear the inactive fault codes.	All faults cleared	

TROUBLESHOOTING STEP

STEP 1: Check for multiple fault codes.
STEP 1A: Read the fault codes.

Condition:		
<ul style="list-style-type: none"> • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Read the fault codes. <ul style="list-style-type: none"> • Read the fault codes using INSITE™. 	OK Fault Codes 352 and 386 inactive	2A
	NOT OK Possible sensor failure, short circuit to ground in the sensor +5-VDC common supply, or a short circuit from pin to pin, or an open circuit in the sensor common ground.	Refer to Fault Codes 352 and 386

STEP 2: Check the coolant temperature sensor.
STEP 2A: Inspect the engine harness and coolant temperature sensor connector pins.

Condition:		
<ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the engine harness from the coolant temperature sensor. 		
Action	Specifications/Repair	Next Step
Inspect the harness and the sensor connector pins for the following: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	OK No damaged pins	2B
	NOT OK Repair the damaged pins Repair or replace the engine harness or the coolant temperature sensor, whichever has the damaged pins. <ul style="list-style-type: none"> • Repair the engine harness. Refer to Procedure 019-202. • Replace the engine harness. Refer to Procedure 019-043. • Replace the coolant temperature sensor. Refer to Procedure 019-019. • Install the appropriate connector seal if damaged or missing. Refer to Procedure 019-202. 	4A

STEP 2B: Check the resistance of the coolant temperature sensor.

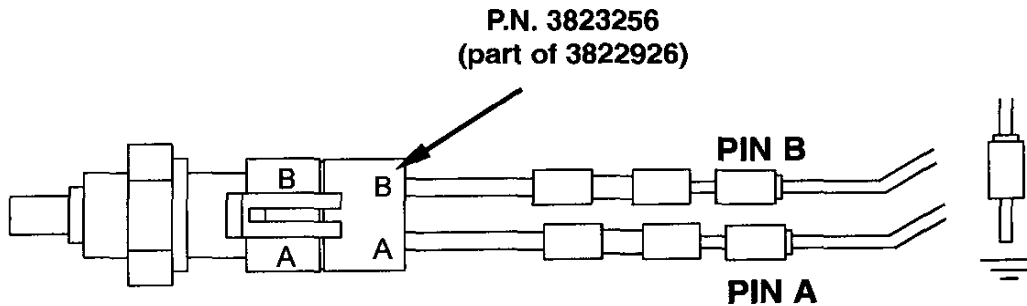
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3823256 - female Metri-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- 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 to pin B of the coolant temperature sensor.	OK 175 to 244k ohms NOT OK Replace the coolant temperature sensor Refer to Procedure 019-019.	2C 4A



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STEP 2C: Check for a short circuit to ground in the coolant temperature sensor.

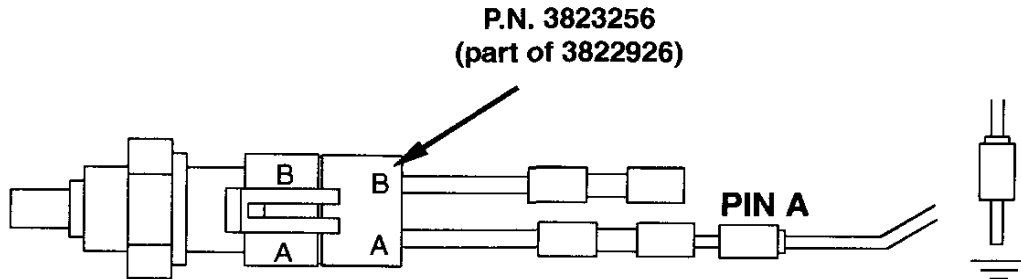
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3823256 - female Metri-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- 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 of the coolant temperature sensor to engine block ground.	OK More than 100k ohms	3A
	NOT OK Replace the coolant temperature sensor Refer to Procedure 019-019.	4A



19800122

STEP 3: Check the engine harness.

STEP 3A: 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 to the OFF position.
- Disconnect the engine harness from the ECM.

Action	Specifications/Repair	Next Step
Inspect the engine harness and the ECM connector pins for the following: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	OK No damaged pins	3B
	NOT OK Repair the damaged pins Repair or replace the engine harness or ECM, whichever has the damaged pins. <ul style="list-style-type: none"> • 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.

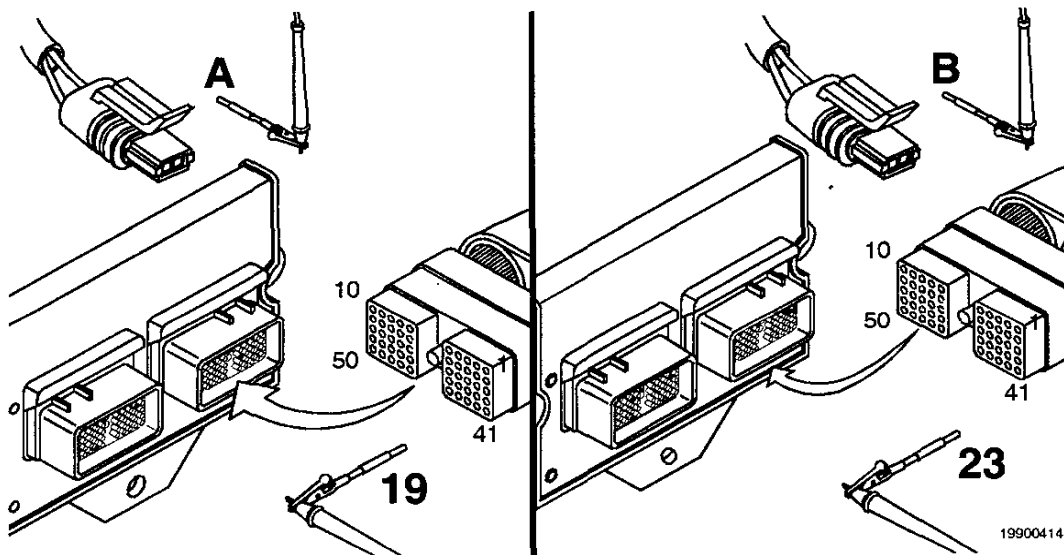


To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the coolant temperature sensor.
- Disconnect the engine harness from the ECM.

Action	Specifications/Repair	Next Step
Check for an open circuit. <ul style="list-style-type: none"> • Measure the resistance from pin 19 of the engine harness to pin A on the harness side of the coolant temperature sensor connector. 	OK Less than 10 ohms	3C
<ul style="list-style-type: none"> • Measure the resistance from pin 23 of the engine harness to pin B on the harness side of the coolant temperature sensor. 	NOT OK Replace the engine harness Refer to Procedure 019-043.	4A



19900414

STEP 3C: Check for a short circuit to ground.

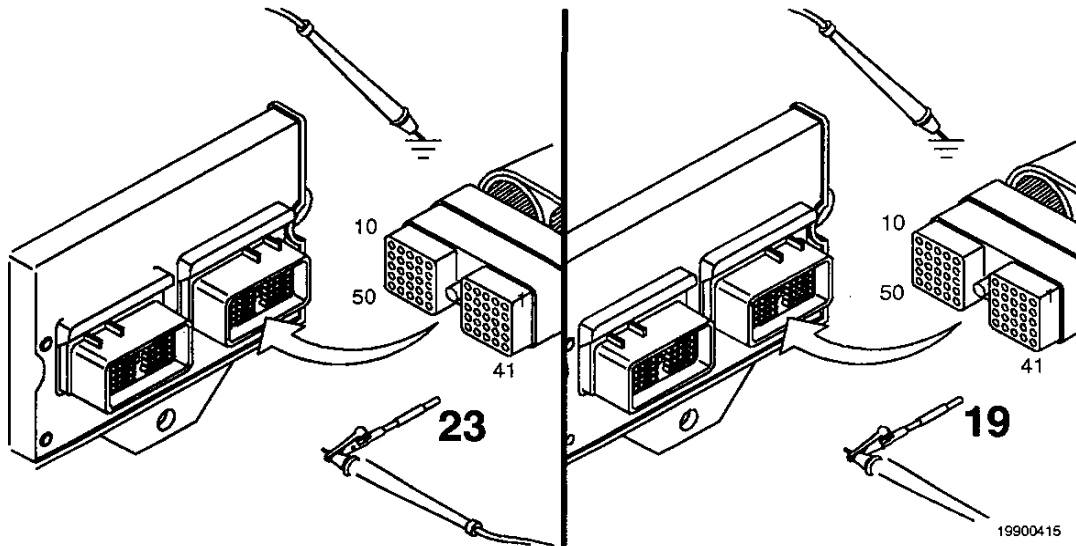
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the coolant temperature sensor.
- Disconnect the engine harness from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground. • Measure the resistance from pin 23 of the engine harness to engine block ground. • Measure the resistance from pin 19 of the engine harness to engine block ground.	OK More than 100k ohms	3D
	NOT OK Replace the engine harness Refer to Procedure 019-043.	4A



STEP 3D: Check for a short circuit from pin to pin.

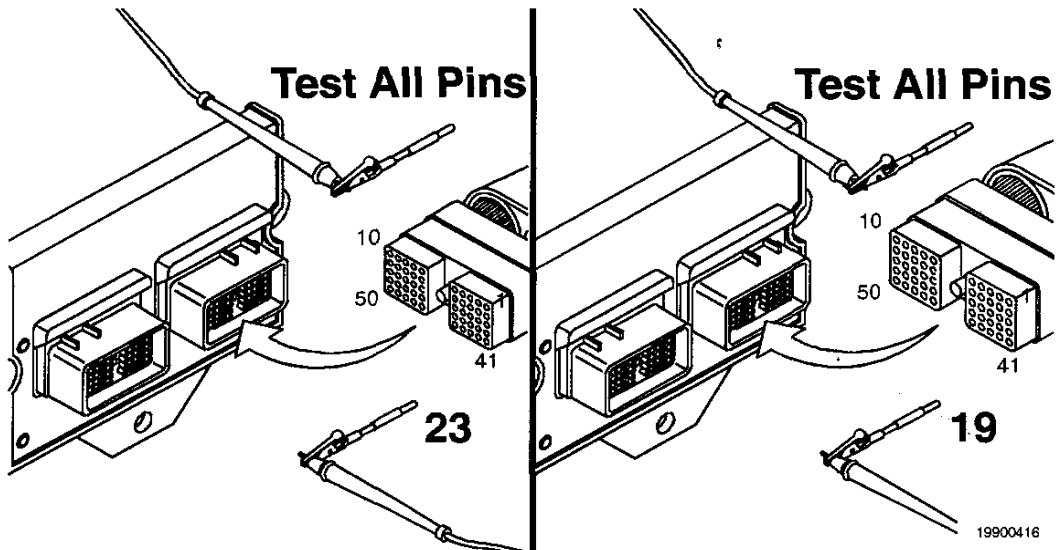
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the coolant temperature sensor.
- Disconnect the engine harness from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pin 23 of the engine harness to all other pins in the engine harness. • Measure the resistance from pin 19 of the engine harness to all other pins in the engine harness.	OK More than 100k ohms	4A
	NOT OK Replace the engine harness Refer to Procedure 019-043.	4A



STEP 4: Clear the fault code.

STEP 4A: Disable the fault code.

Condition: <ul style="list-style-type: none"> • Connect all components. • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> • Start the engine, and let idle for 1 minute. • Verify that Fault Code 144 or 145 is inactive. 	OK Fault Code 144 or 145 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.

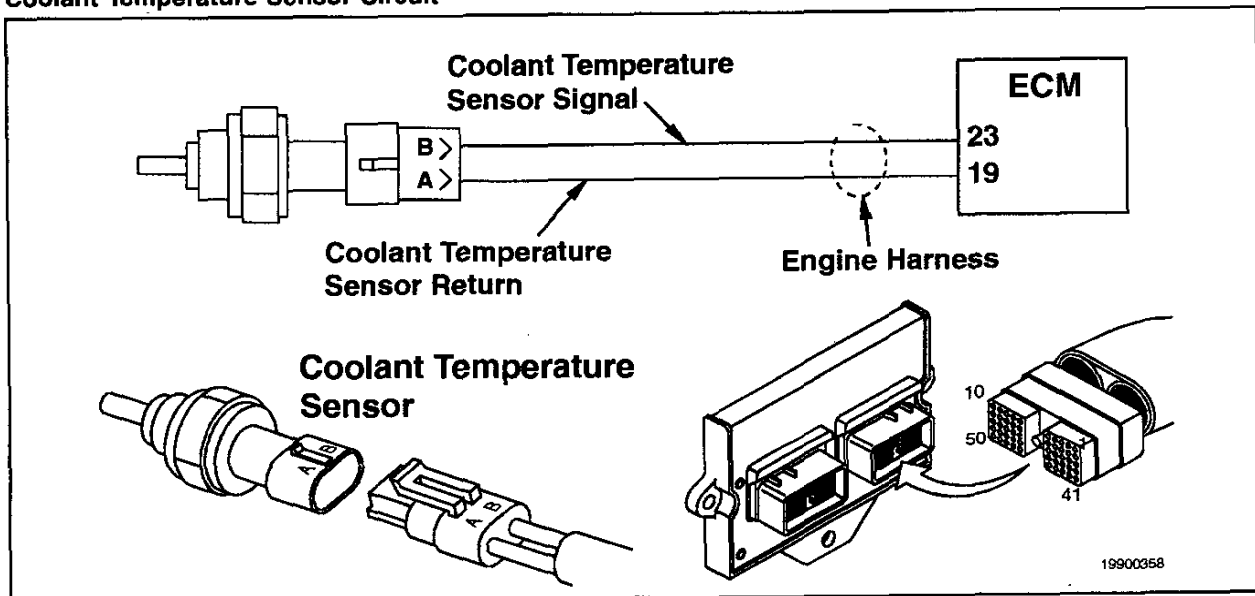
Condition: <ul style="list-style-type: none"> • Connect all the components. • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> • Erase the inactive fault code using INSITE™. 	OK All faults cleared	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting chart

Fault Code 146

Coolant Temperature - Engine Protection

CODES	REASON	EFFECT
Fault Code: 146 PID(P), SID(S): P110 SPN: 110 FMI: 0 Lamp: Yellow	Coolant temperature signal indicates coolant temperature has exceeded the minimum engine protection limit.	Power derate and possible engine shut-down if engine protection shutdown feature is enabled.

Coolant Temperature Sensor Circuit



Circuit Description:

The coolant temperature sensor (CTS) is used by the electronic control module (ECM) to monitor the temperature of the engine coolant. The coolant temperature is used by the ECM for the engine protection system and the timing and fueling control.

Component Location:

The coolant temperature sensor is located on top of the thermostat housing.

Shop Talk:

Make sure the airflow through the radiator is **not** obstructed.

TROUBLESHOOTING SUMMARY

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the sensor accuracy.		
STEP 1A: Verify the sensor accuracy with a thermocouple or similar temperature probe.	Sensor reading is correct	
STEP 2: Clear the fault codes.		
STEP 2A: Disable the fault code.	Fault Code 146 inactive	
STEP 2B: Clear the inactive fault codes.	All faults cleared	

TROUBLESHOOTING STEP

STEP 1: Check the sensor accuracy.
STEP 1A: Verify the sensor accuracy with a thermocouple or similar temperature probe.

Condition:		
<ul style="list-style-type: none"> Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Verify the sensor accuracy with a thermocouple or similar temperature probe. <ul style="list-style-type: none"> Connect the temperature probe to the engine near the coolant temperature sensor. Connect INSITE™ to the vehicle datalink. Compare the coolant temperature reading on the service tool monitor screen to the reading from the temperature probe. NOTE: If a temperature measuring device is not available, answer "OK" to this step.	OK Sensor reading is correct Refer to the Troubleshooting and Repair Manual, ISB Engines, Bulletin No. 3666193.	2A
	NOT OK Sensor reading incorrect Replace the coolant temperature sensor. Refer to Procedure 019-019.	2A

STEP 2: Clear the fault codes.
STEP 2A: Disable the fault code.

Condition:		
<ul style="list-style-type: none"> Connect all the components. Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> Start the engine, and let idle for 1 minute. Using INSITE™, verify Fault Code 146 is inactive. 	OK Fault Code 146 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 the components.
- Turn keyswitch to the ON position.

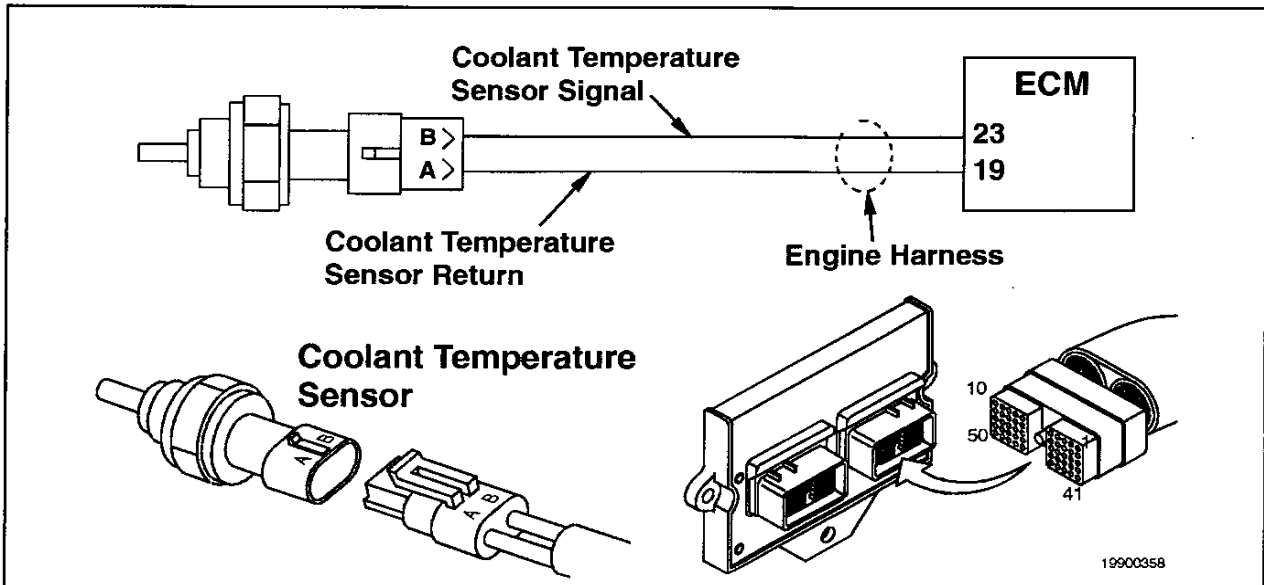
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault code using INSITE™.	OK All fault codes cleared	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting chart

Fault Code 151

Coolant Temperature - Engine Protection

CODES	REASON	EFFECT
Fault Code: 151 PID(P), SID(S): FMI: Lamp: Red	Coolant engine temperature signal indicates coolant temperature has exceeded the engine protection limit.	Power and/or speed derate and possible engine shutdown if engine protection shutdown feature is enabled.

Coolant Temperature Sensor Circuit



Circuit Description:

The coolant temperature sensor is used by the electronic control module (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 on the engine in the thermostat housing area.

Shop Talk:

Make sure the airflow through the radiator is **not** obstructed.

TROUBLESHOOTING SUMMARY

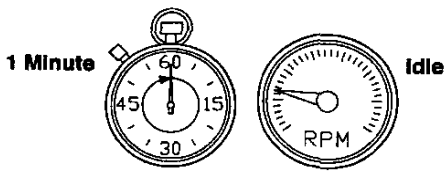


STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the sensor accuracy. <u>STEP 1A:</u> Verify the sensor accuracy with a thermocouple or similar temperature probe.	Sensor reading is correct	
STEP 2: Clear the fault code. <u>STEP 2A:</u> Disable the fault code. <u>STEP 2B:</u> Clear the inactive fault codes.	Fault Code 151 not active All faults cleared	

TROUBLESHOOTING STEP

STEP 1: Check the sensor accuracy.
STEP 1A: Verify the sensor accuracy with a thermocouple or similar temperature probe.

Condition:		
<ul style="list-style-type: none"> Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Verify the sensor accuracy with a thermocouple or similar temperature probe. <ul style="list-style-type: none"> Connect the temperature probe to the engine near the coolant temperature sensor. Connect INSITE™ to the vehicle datalink. Compare the coolant temperature reading on the service tool monitor screen to the reading from the temperature probe. NOTE: If temperature measuring device is not available, answer "OK" to this step.	OK Sensor reading is correct Refer to the Troubleshooting and Repair Manual, ISB Engines, Bulletin No. 3666193.	2A
	NOT OK Refer to Fault Code 145.	Fault Code 145

STEP 2: Clear the fault code.
STEP 2A: Disable the fault code.

Condition:		
<ul style="list-style-type: none"> • Connect all the components. 		
Action	Specifications/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> • Start the engine, and let idle for 1 minute. • Verify Fault Code 151 is inactive. 	OK Fault Code 151 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
 <p>1 Minute   idle</p>		
19400011		

STEP 2B: Clear the inactive fault codes.

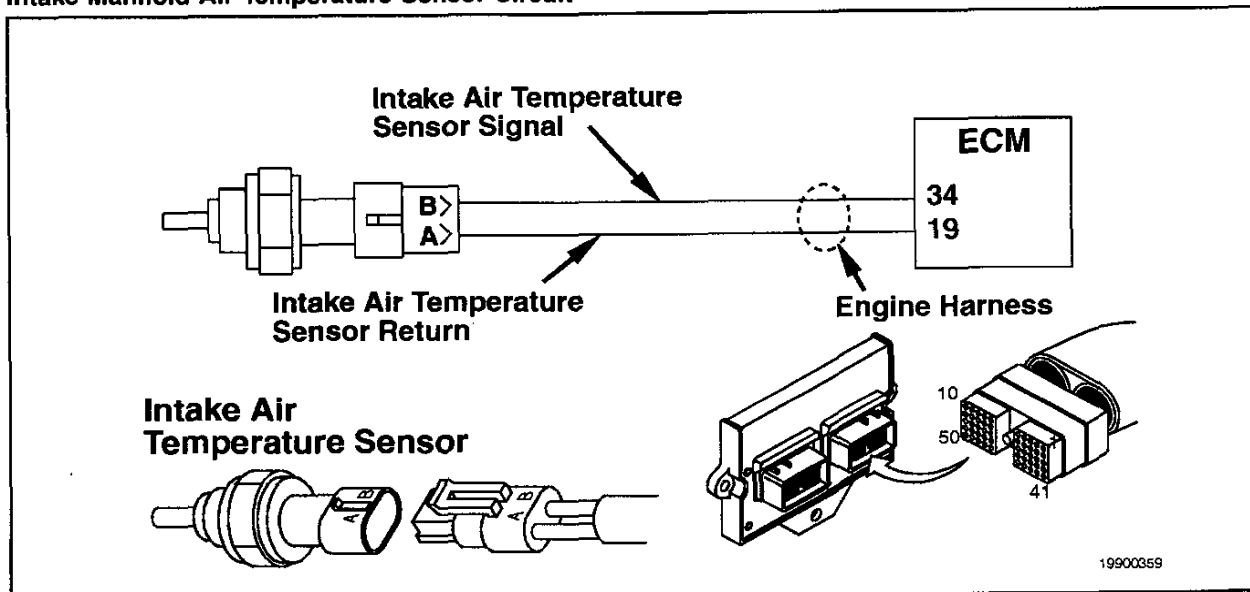
Condition:		
<ul style="list-style-type: none"> • Connect all the components. 		
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> • Erase the inactive fault codes using INSITE™. 	OK All fault codes cleared	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting chart

Fault Code 153 or 154

Intake Manifold Air Temperature Sensor Circuit

CODES	REASON	EFFECT
Fault Code: 153 or 154 PID(P), SID(S): P105 SPN: 105 FMI: 3 or 4 Lamp: Yellow	FC 153: High voltage detected at intake manifold temperature signal pin 34 of the engine harness. FC 154: Low voltage detected at intake manifold temperature signal pin 34 of the engine harness.	Default value used for intake manifold temperature. No engine protection for intake manifold temperature.

Intake Manifold Air Temperature Sensor Circuit



Circuit Description:

The intake manifold air temperature sensor is used by the ECM to monitor the engine intake air temperature. The intake manifold air temperature signal is used by the ECM for engine protection system, cold start aid, timing, and fueling control.

Component Location:

The intake manifold air temperature sensor is located on the side of the intake manifold at the rear of the head.

Shop Talk:

If the sensor is functioning properly, compare the reading to the following 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



To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3823256 - female Metri-Pack test lead
Part No. 3822758 - male Deutsch-Pack test lead.



To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

STEPS	SPECIFICATIONS	SRT CODE
<u>STEP 1:</u> Check for multiple fault codes.		
<u>STEP 1A:</u> Check for active fault codes.	Fault Codes 352 and 386 inactive	
<u>STEP 2:</u> Check the intake manifold temperature sensor.		
<u>STEP 2A:</u> Inspect intake manifold temperature sensor and engine harness connector pins.	No damaged pins	
<u>STEP 2B:</u> Check the sensor resistance.	175 to 244k ohms	
<u>STEP 2C:</u> Check for a short circuit to ground.	More than 100k ohms	
<u>STEP 3:</u> Check engine harness.		
<u>STEP 3A:</u> Inspect harness and ECM connector.	No damaged pins	
<u>STEP 3B:</u> Check for an open circuit.	Less than 10 ohms	
<u>STEP 3C:</u> Check for a short circuit to ground.	More than 100k ohms	
<u>STEP 3D:</u> Check for a short circuit from pin to pin.	More than 100k ohms	
<u>STEP 4:</u> Clear fault codes.		
<u>STEP 4A:</u> Disable the fault code.	Fault Code 153 or 154 inactive	
<u>STEP 4B:</u> Clear the inactive fault codes.	All faults cleared	

TROUBLESHOOTING STEP

STEP 1: Check for multiple fault codes.

STEP 1A: Check for active fault codes.

Condition:		
<ul style="list-style-type: none"> • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Check for active fault codes. <ul style="list-style-type: none"> • Read the fault codes using INSITE™. 	OK Fault Codes 352 and 386 inactive	2A
	NOT OK Possible sensor failure, a short circuit to ground in the sensor +5-VDC common supply, a short circuit from pin to pin, or an open circuit on the sensor common ground.	Refer to Fault Code 352 or 386

STEP 2: Check the intake manifold temperature sensor.

STEP 2A: Inspect the intake manifold temperature sensor and the engine harness connector pins.

Condition:		
<ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the engine harness from the intake manifold temperature sensor. 		
Action	Specifications/Repair	Next Step
Inspect the intake manifold temperature sensor and the engine harness connector pins for the following: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	OK No damaged pins	2B
	NOT OK Repair the damaged pins Repair or replace the intake manifold temperature sensor or the engine harness, whichever has the damaged pins. <ul style="list-style-type: none"> • Repair the engine harness. Refer to Procedure 019-202. • Replace the engine harness. Refer to Procedure 019-043. • Replace the intake manifold temperature sensor. Refer to Procedure 019-059. 	4A

STEP 2B: Check the sensor resistance.

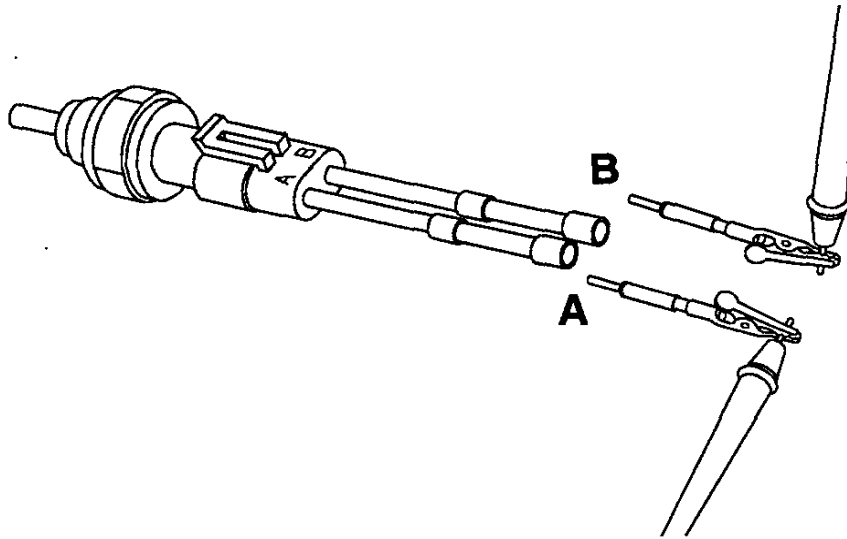
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch-Pack test lead
Part No. 3823256 - 2-pin Metri-Pack repair terminal.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the intake manifold air temperature sensor.

Action	Specifications/Repair	Next Step
Check the resistance of the intake manifold air temperature sensor. • Measure the resistance from pin A to pin B of the intake manifold air temperature sensor.	OK 175 ohms to 244k ohms	2C
	NOT OK Replace the intake manifold temperature sensor Refer to Procedure 019-059.	4A



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STEP 2C: Check for a short circuit to ground.

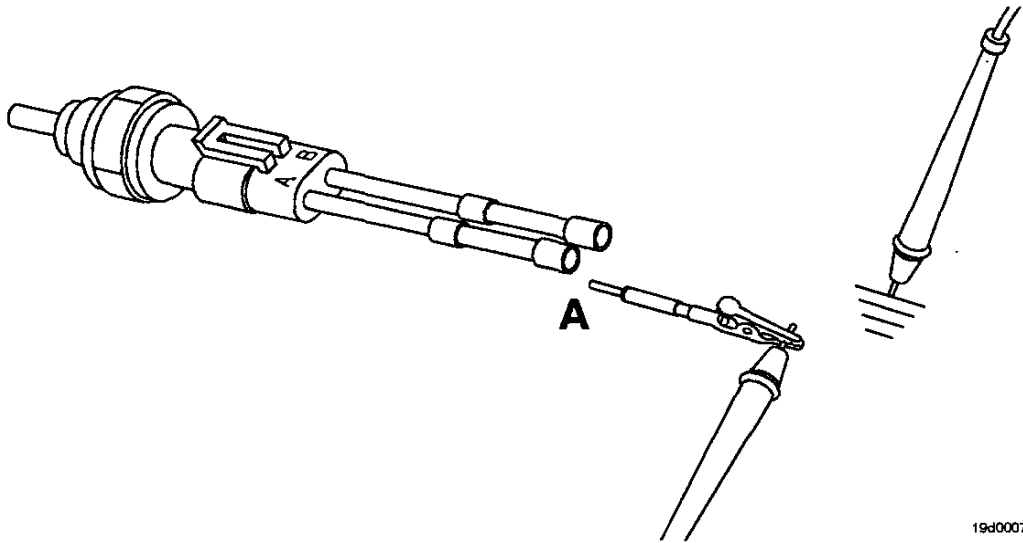
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch-Pack test lead
Part No. 3823256 - 2-pin Metri-Pack repair terminal.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the intake manifold air temperature sensor.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground. • Measure the resistance from pin A of the intake manifold temperature sensor to engine block ground.	OK More than 100k ohms	3A
	NOT OK Replace the intake manifold temperature sensor Refer to Procedure 019-059.	4A



19d00077

STEP 3: Check the engine harness.

STEP 3A: Inspect the engine harness and the ECM connector pins.

⚠ CAUTION ⚠		
<p>To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.</p>		
<p>Condition:</p> <ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the engine harness from the ECM. 		
Action	Specifications/Repair	Next Step
<p>Inspect the engine harness and the ECM connector pins for the following:</p> <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	<p>OK No damaged pins</p>	3B
	<p>NOT OK Repair the damaged pins Repair or replace the engine harness or ECM, whichever has the damaged pins.</p> <ul style="list-style-type: none"> • 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.

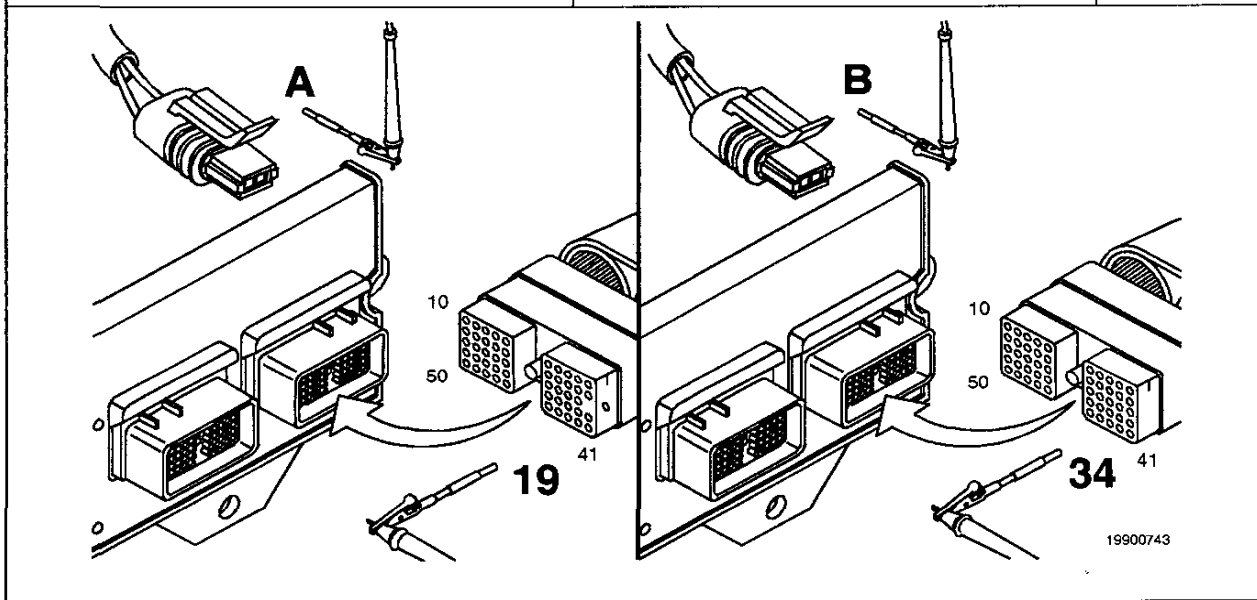
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male Deutsch-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the intake manifold air temperature sensor.
- Disconnect the engine harness from the ECM.

Action	Specifications/Repair	Next Step
Check for an open circuit. • Measure the resistance from pin 19 of the engine harness to pin A on the harness side of the intake manifold air temperature sensor connector.	OK Less than 10 ohms	3C
• Measure the resistance from pin 34 of the engine harness to pin B on the harness side of the intake manifold air temperature sensor connector.	NOT OK Replace the engine harness Refer to Procedure 019-043.	4A



STEP 3C: Check for a short circuit to the ground.

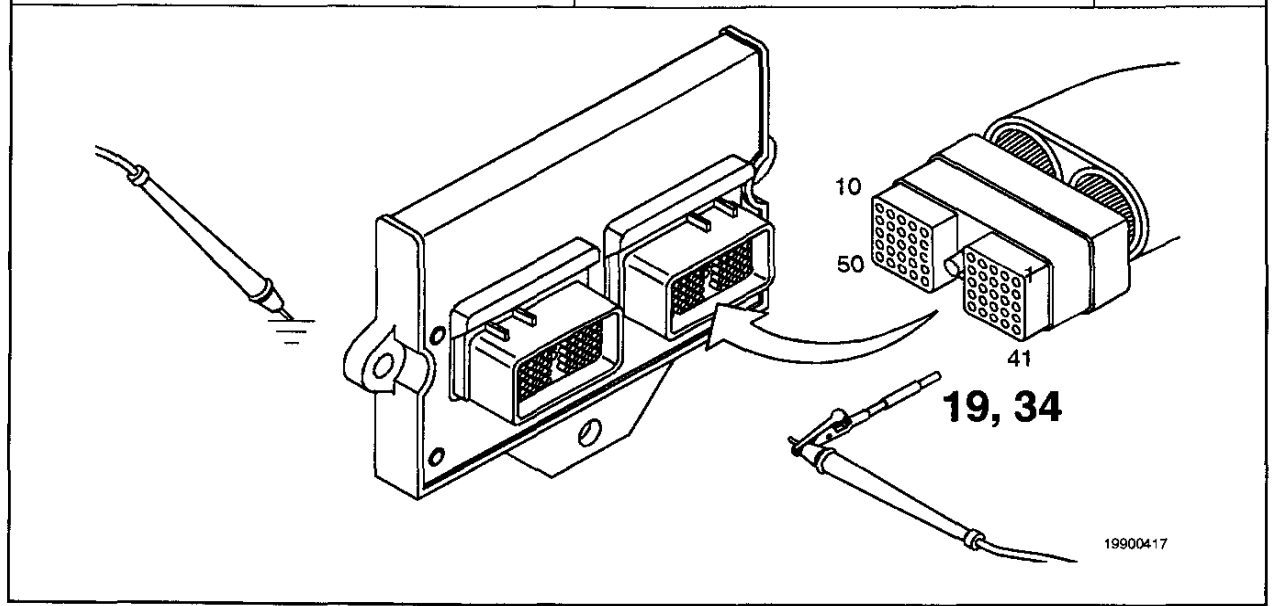
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male Deutsch-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the intake manifold air temperature sensor.
- Disconnect the engine harness from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground. • Measure the resistance from pin 19 of the engine harness connector to engine block ground. • Measure the resistance from pin 34 of the engine harness connector to engine block ground.	OK More than 100k ohms	3D
	NOT OK Replace the engine harness Refer to Procedure 019-043.	4A



STEP 3D: Check for a short circuit from pin to pin.

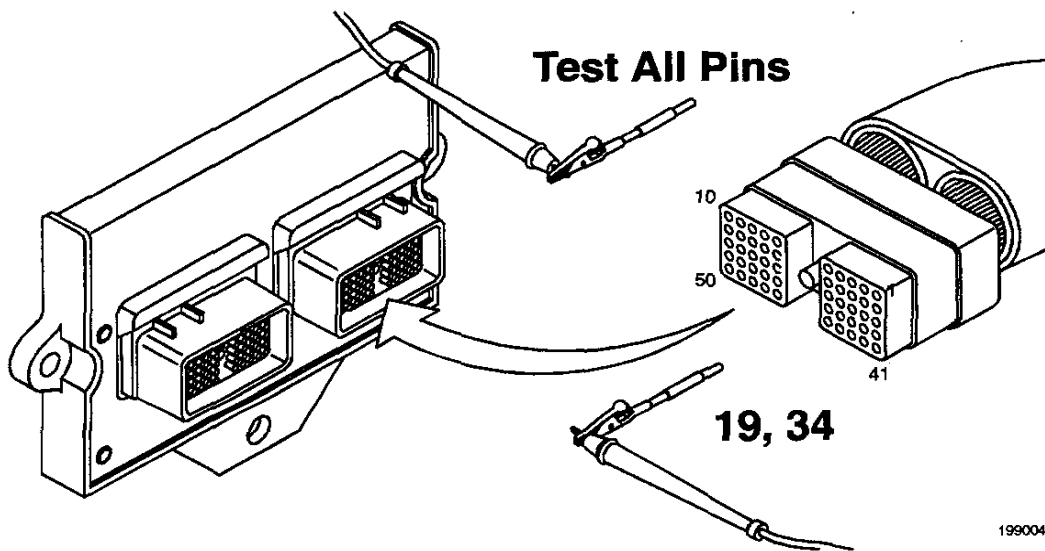


To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male Deutsch-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the intake manifold air temperature sensor.
- Disconnect the engine harness from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pin 19 of the engine harness to all other pins in the engine harness. • Measure the resistance from pin 34 of the engine harness to all other pins in the engine harness.	OK More than 100k ohms	4A
	NOT OK Replace the engine harness Refer to Procedure 019-043.	4A



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STEP 4: Clear the fault code.

STEP 4A: Disable the fault code.

Condition: <ul style="list-style-type: none"> • Connect all components. • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> • Start the engine, and let idle for 1 minute. • Verify that Fault Code 153 or 154 is inactive. 	OK Fault Code 153 or 154 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.

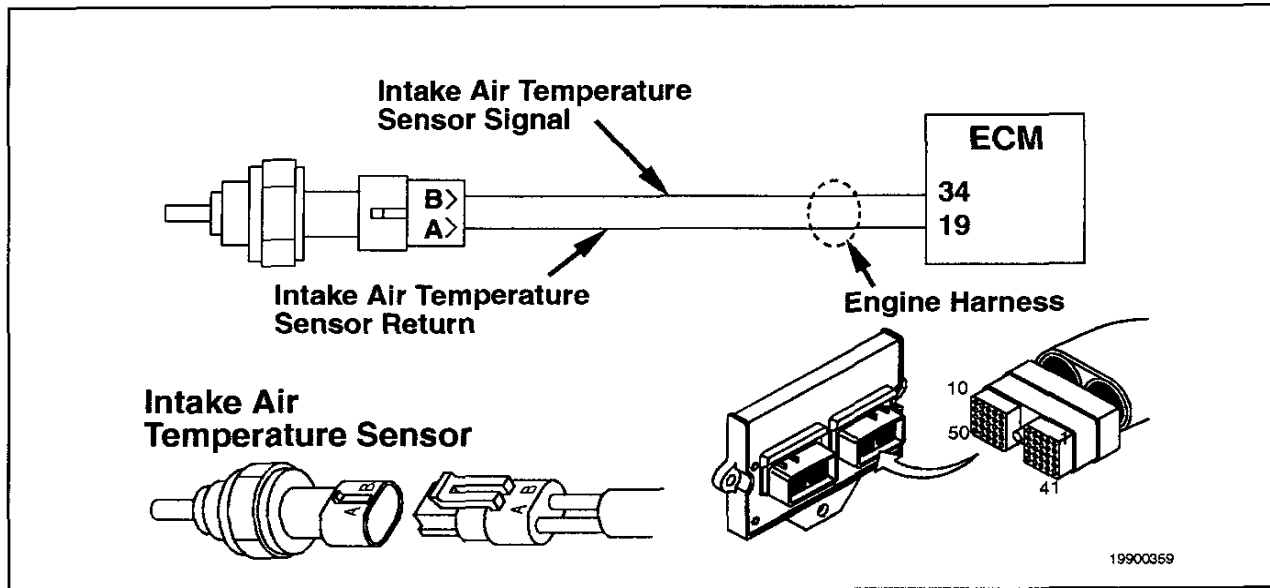
Condition: <ul style="list-style-type: none"> • Connect all components. • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> • Erase the inactive fault code using INSITE™. 	OK All the faults cleared	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting chart

Fault Code 155

Intake Manifold Air Temperature Sensor - Engine Protection Circuit

CODES	REASON	EFFECT
Fault Code: 155 PID(P), SID(S): P105 SPN: 105 FMI: 0 Lamp: Red	Intake manifold air temperature signal indicates the intake manifold air temperature is above the engine protection limit.	Speed derate and possible engine shut-down if engine protection shutdown feature is enabled.

Intake Manifold Air Temperature Sensor Circuit



Circuit Description:

The intake manifold air temperature sensor is used by the electronic control module (ECM) to monitor the temperature of the engine intake air. The intake air temperature is used by the ECM for the engine protection system, cold start aids, and the timing and fueling control.

Component Location:

The intake manifold temperature sensor is located on the side of the intake manifold toward the rear of the cylinder head.

Shop Talk:

- Make sure the engine compartment temperature does **not** get too high (above 93.3°C [200°F]).
- Make sure the intake manifold temperature sensor is **not** located near any extreme heat sources.
- Possible causes:
 - clogged, dirty, inadequate capacity air cleaner element. Refer to Procedures 010-060 through 010-063 in the Troubleshooting and Repair Manual, ISB Engines, Bulletin No. 3666193.
 - intake restriction. Refer to Procedure 010-059 in the Troubleshooting and Repair Manual, ISB Engines, Bulletin No. 3666193.

TROUBLESHOOTING SUMMARY

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the sensor accuracy.		
STEP 1A: Verify the sensor accuracy with a thermocouple or similar temperature probe.	Sensor reading is correct	
STEP 2: Clear the fault code.		
STEP 2A: Disable the fault code.	Fault Code 155 inactive	
STEP 2B: Clear the inactive fault codes.	All faults cleared	

TROUBLESHOOTING STEP

STEP 1: Check the sensor accuracy.
STEP 1A: Verify the sensor accuracy with a thermocouple or similar temperature probe.

Condition:		
Action	Specifications/Repair	Next Step
• Turn keyswitch to the ON position. Verify the sensor accuracy with a thermocouple or similar temperature probe. • Connect the temperature probe to the engine near the intake manifold air temperature sensor. • Connect INSITE™ to the datalink. • Run the engine, and compare the intake manifold temperature sensor reading on INSITE™ monitor screen to the reading from the temperature probe. NOTE: If a temperature measuring device is not available, answer "OK" to this step. NOTE: Readings may need to be checked while engine is operating at normal temperature conditions (180°F coolant).	OK Sensor reading is correct within 5°F Locate and repair the cause of high intake manifold air temperature (refer to the Shop Talk section of this fault code for the correct procedure).	2A
	NOT OK Sensor reading incorrect	Fault Code 154

STEP 2: Clear the fault code.

STEP 2A: Disable the fault code.

Condition:		
<ul style="list-style-type: none"> • Connect all the components. • Turn keyswitch to the <i>ON</i> position. 		
Action	Specifications/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> • Start the engine, and let idle for 1 minute. • Load and operate engine to typical operating temperature (180°F coolant). • Verify Fault Code 155 is inactive and did not reoccur. 	OK Fault code 155 inactive and did not reoccur.	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.

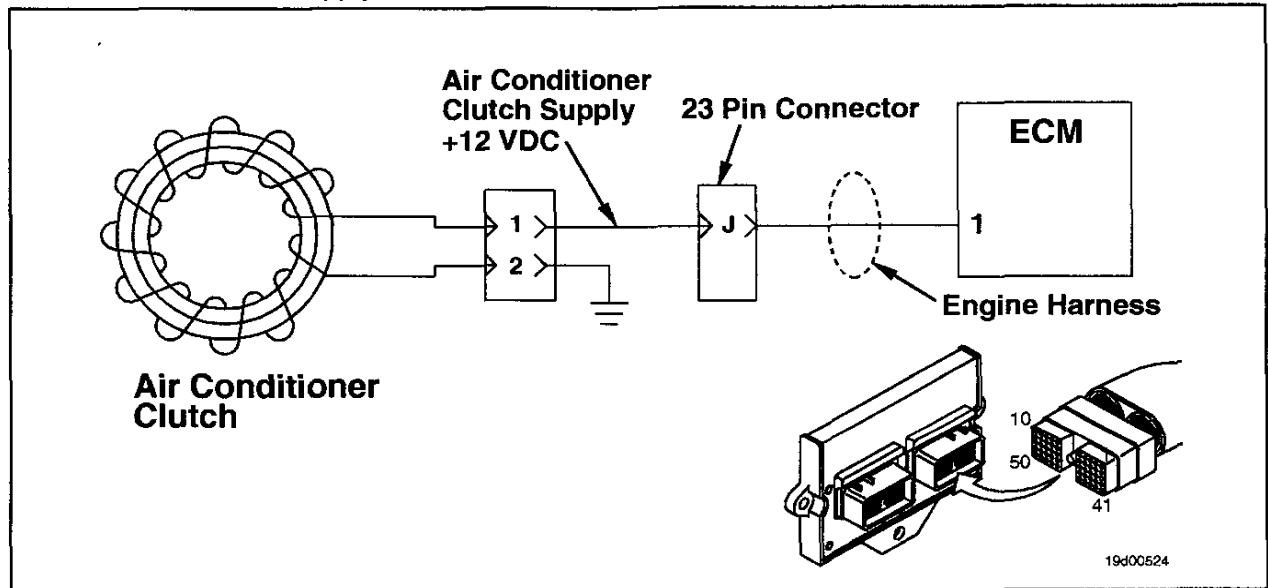
Condition:		
<ul style="list-style-type: none"> • Connect all the components. • Turn keyswitch to the <i>ON</i> position. 		
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> • Erase the inactive fault code using INSITE™. 	OK All faults cleared	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting chart

Fault Code 191

Air Conditioner Clutch Supply Circuit

CODES	REASON	EFFECT
Fault Code: 191 PID(P), SID(S): P050 SPN: 876 FMI: 11 Lamp:	Air conditioner clutch signal indicates a short to ground when commanded on.	Can not turn on air conditioner.

Air Conditioner Clutch Supply Circuit



Circuit Description:

The air conditioner clutch solenoid is a device used by the electronic control module (ECM) to control the air conditioner by sending a signal to open or close the air conditioner clutch solenoid.

Component Location:

Refer to an original equipment manufacturer's (OEM) diagram for the location of the air conditioner clutch solenoid.

Shop Talk:

Air conditioner clutch solenoid could be malfunctioning due to a failed engine harness or a bad ground on the air conditioner clutch connector.

TROUBLESHOOTING SUMMARY



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. 3823993 - male Deutsch test lead
Part No. 3823994 - female Deutsch test lead.



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 air conditioner clutch.

STEP 1A: Inspect and test the air conditioner clutch and air conditioner clutch relay (if equipped).

Air conditioner clutch and relay within specifications

STEP 2: Check the engine harness.

STEP 2A: Inspect the engine harness, air conditioner clutch relay, 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: Check the OEM harness.

STEP 3A: Inspect the engine harness and OEM harness connectors.

No damaged pins

STEP 3B: Check for an open circuit.

Less than 10 ohms

STEP 3C: Check for a short circuit to 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 191 inactive

STEP 4B: Clear the inactive fault codes.

All faults cleared

TROUBLESHOOTING STEP

STEP 1: Check the air conditioner clutch.

STEP 1A: Check the air conditioner clutch and air conditioner clutch relay (if equipped).

Condition:		
<ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the OEM harness from the air conditioner clutch or air conditioner clutch relay. 		
Action	Specifications/Repair	Next Step
Check the air conditioner clutch for: <ul style="list-style-type: none"> • Damaged pins • Open or short circuits • Excessive current draw (power air conditioner clutch directly from battery) • Perform this test in accordance with the OEM instructions. 	OK Air conditioner clutch within specifications	2A
	NOT OK Repair or replace the air conditioner clutch Refer to the OEM troubleshooting and repair manual.	4A

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:		
<ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the engine harness from the ECM. • Disconnect the engine harness from the 23-pin OEM harness connector. 		
Action	Specifications/Repair	Next Step
Inspect the engine harness and the ECM connectors for: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	OK No damaged pins	2B
	NOT OK Repair the damaged pins Repair or replace the engine harness, or ECM, whichever has the damaged pins. <ul style="list-style-type: none"> • Repair the engine harness. Refer to Procedures 019-250 and 019-223. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031. 	4A

STEP 2B: Check for an open circuit.

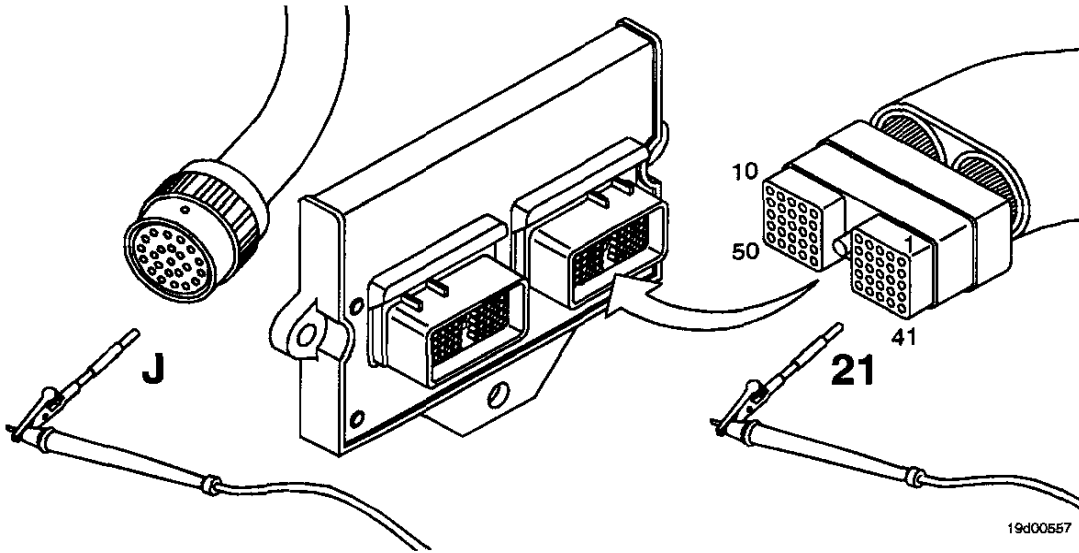
⚠ CAUTION ⚠

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. 3823994 - female Deutsch lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the ECM.
- Disconnect the engine harness from the 23-pin OEM harness connector.

Action	Specifications/Repair	Next Step
Check for an open circuit. • Measure the resistance from pin 21 of the engine harness connector to pin J of the 23-pin OEM harness connector.	OK Less than 10 ohms	2C
	NOT OK Replace the engine harness Refer to Procedure 019-043.	4A



STEP 2C: Check for a short circuit to ground.

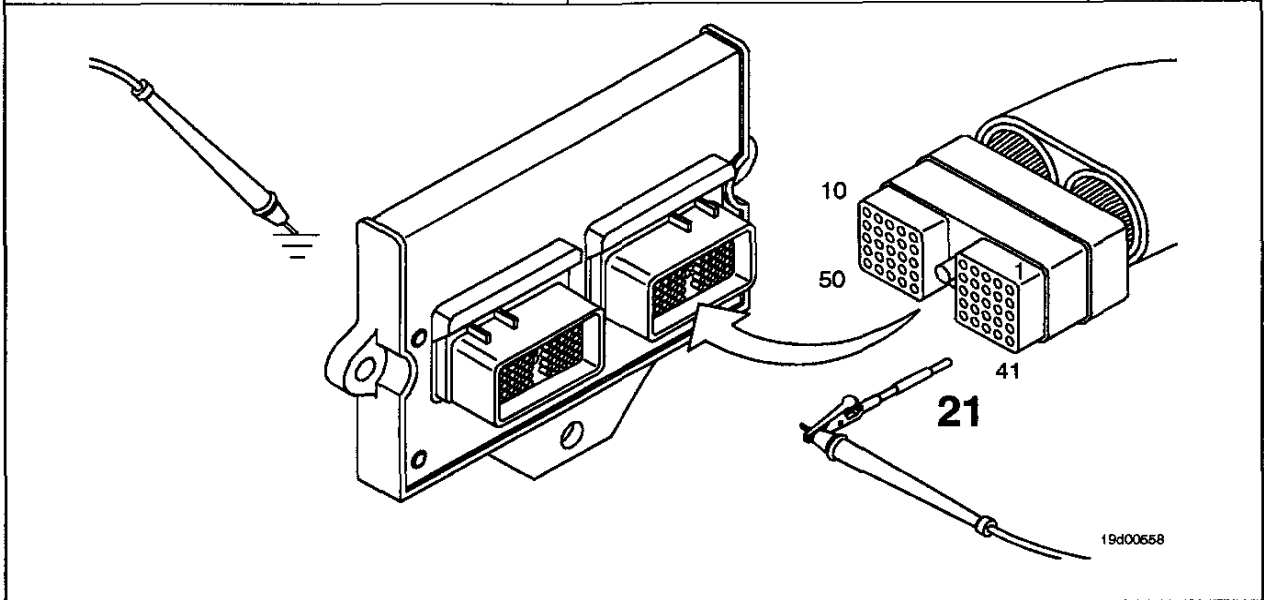
⚠ CAUTION ⚠

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 to the OFF position.
- Disconnect the engine harness from the ECM.
- Disconnect the engine harness from the 23-pin OEM harness connector.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground. • Measure the resistance from pin 21 in the engine harness to engine block ground.	OK More than 100k ohms	2D
	NOT OK Replace the engine harness Refer to Procedure 019-043.	4A



STEP 2D: Check for a short circuit from pin to pin.

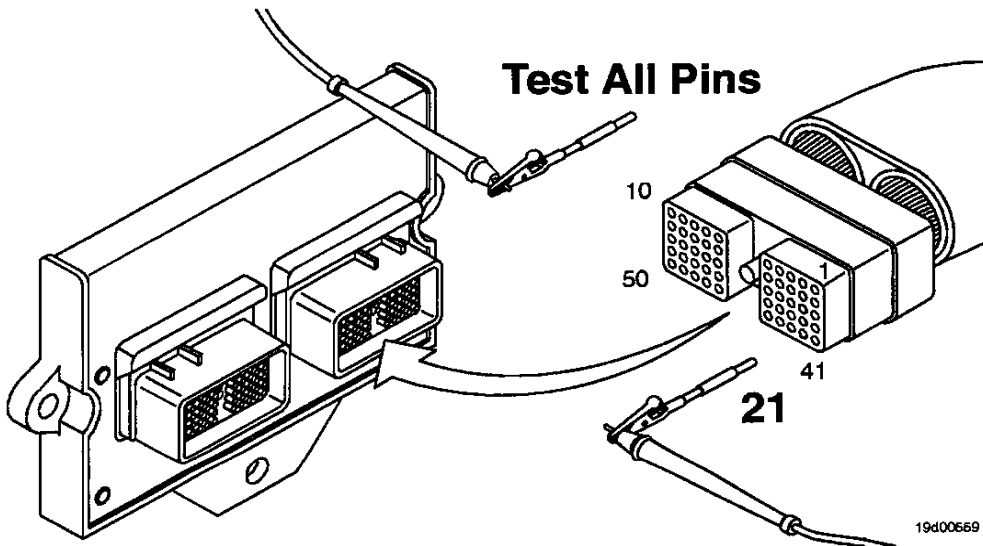
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male AMP/Cannon/Deutsch/Metri-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the ECM.
- Disconnect the engine harness from the 23-pin OEM harness connector.

Action	Specifications/Repair	Next Step
Check for a short circuit between pins. • Measure the resistance from pin 21 to all other pins in the connector.	OK More than 100k ohms	3A
	NOT OK Replace the engine harness Refer to Procedure 019-043.	4A



STEP 3: Check the OEM harness.

STEP 3A: Inspect the OEM harness.

<p>Condition:</p> <ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the OEM harness from the air conditioner clutch solenoid or relay. • Disconnect the engine harness from the 23-pin OEM harness connector. 		
Action	Specifications/Repair	Next Step
<p>Inspect the OEM harness and 23-pin connector for:</p> <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	<p>OK No damaged pins</p>	3B
	<p>NOT OK Repair the damaged pins Repair or replace the OEM harness or air conditioner clutch relay, whichever has damaged pins.</p> <ul style="list-style-type: none"> • Repair the OEM harness. Refer to Procedure 019-223 or 019-202. • Replace the OEM harness. Refer to Procedure 019-071. • Replace the air conditioner clutch relay. Refer to the OEM troubleshooting and repair manual. 	4A

STEP 3B: Check for an open circuit.

<p>⚠ CAUTION ⚠</p>		
<p>To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3823993 - male Deutsch test lead.</p>		
<p>Condition:</p> <ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the OEM harness from the air conditioner clutch solenoid or relay. • Disconnect the engine harness from the 23-pin OEM harness connector. 		
Action	Specifications/Repair	Next Step
<p>Check for an open circuit.</p> <ul style="list-style-type: none"> • Measure the resistance from pin J of the 23-pin connector on the OEM side to the air conditioner clutch solenoid or relay. 	<p>OK Less than 10 ohms</p>	3C
	<p>NOT OK Replace the OEM harness Refer to Procedure 019-071.</p>	4A

STEP 3C: Check for a short circuit to ground in the OEM harness.

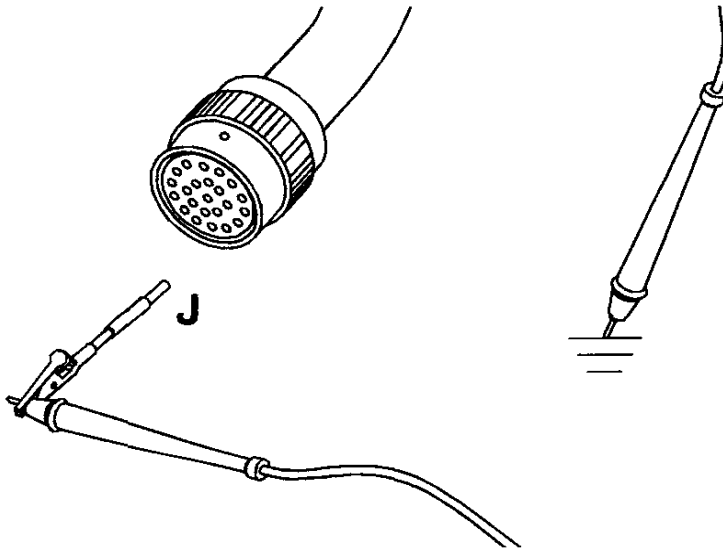
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3823993 - male Deutsch test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the air conditioner clutch solenoid or relay.
- Disconnect the engine harness from the 23-pin OEM harness connector.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground in the OEM harness. • Measure resistance from pin J of the 23-pin OEM harness connector to ground.	OK More than 100k ohms	3D
	NOT OK Replace the OEM harness Refer to Procedure 019-071.	4A



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STEP 3D: Check for a short circuit from pin to pin.

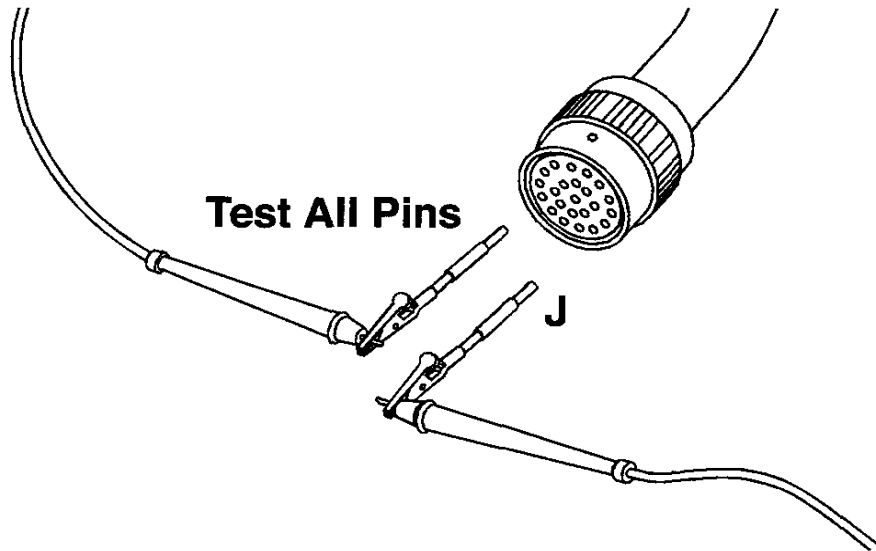
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3823993 - male Deutsch test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the air conditioner clutch solenoid or relay.
- Disconnect the engine harness from the 23-pin OEM harness connector.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin in the OEM harness. • Measure resistance from pin J of the 23-pin OEM harness connector to all other pins in the 23-pin connector.	OK More than 100k ohms	4A
	NOT OK Replace the OEM harness Refer to Procedure 019-071.	4A



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STEP 4: Clear the fault codes.

STEP 4A: Disable the fault code.

Condition:

- Connect all the components.
- Turn keyswitch to the ON position.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine, and let idle for 1 minute. • Using INSITE™, verify Fault Code 191 is inactive.	OK Fault Code 191 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.

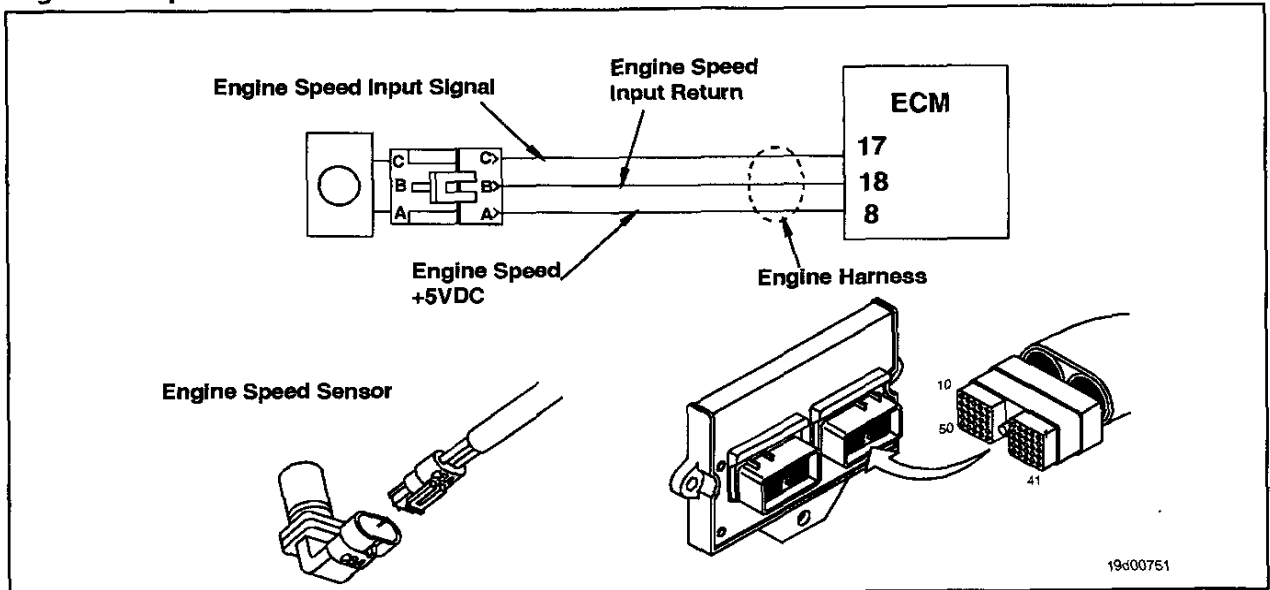
Condition:		
<ul style="list-style-type: none">• Connect all the components.• Turn keyswitch to the ON position.		
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none">• Erase the inactive fault codes using INSITE™.	OK All faults cleared	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting chart

Fault Code 234

Engine Overspeed Circuit

CODES	REASON	EFFECT
Fault Code: 234 PID(P), SID(S): P190 SPN: 190 FMI: 0 Lamp: Red	Engine speed signal indicates engine speed has exceeded the overspeed limit.	Fuel to the injectors disabled until the engine speed falls below the overspeed limit.

Engine Overspeed Circuit



Circuit Description:

The engine speed sensor provides engine speed information to the electronic control module (ECM). The sensor **must** be powered up by + 5 VDC to operate. The sensor generates its signals by sensing the movement of target teeth cast into a tone wheel that is mounted to the crankshaft. The tone wheel has 35 teeth and a gap where the 36th tooth would be placed. This missing tooth indicates that cylinder No. 1 (and No. 6) is at top dead center.

Component Location:

The engine speed sensor is located on the intake side of the engine block, at crankshaft level, between cylinders No. 4 and No. 5.

TROUBLESHOOTING SUMMARY



WARNING

If flammable vapors are detected, shut down the engine, ventilate the area, and do not restart the engine until the source of the vapors is located and repaired.



CAUTION

If the engine speed stays above 3700 rpm, the engine must be shut off immediately.



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: Identify the reason for overspeed.		
<u>STEP 1A:</u> Check for proper operating conditions.	Not motoring downhill	
<u>STEP 1B:</u> Check for an alternate fuel source.	No alternate fuel source	
<u>STEP 1C:</u> Check the rpm with INSITE™ service tool monitor mode.	Correct rpm reading	
<u>STEP 1D:</u> Check for an active fault at low rpm.	Inactive fault at low rpm	
STEP 2: Clear the fault code.		
<u>STEP 2A:</u> Disable the fault code.	Fault Code 234 inactive	
<u>STEP 2B:</u> Clear the inactive fault codes.	All faults cleared	

TROUBLESHOOTING STEP

STEP 1: Identify the reason for overspeed.
STEP 1A: Check for proper operating conditions.

Condition:		
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 engine for damage due to overspeed condition.	2A

STEP 1B: Check for an alternate fuel source.

▲WARNING▲		
<p>If flammable vapors are detected, shut down the engine, ventilate the area, and do not restart the engine until the source of the vapors is located and repaired.</p>		
<p>Condition:</p> <ul style="list-style-type: none"> • Turn keyswitch to the OFF position. 		
Action	Specifications/Repair	Next Step
<p>Check for an alternate fuel source.</p> <ul style="list-style-type: none"> • Check if the driver reported a fuel-controlled event where the engine rapidly accelerated to or past overspeed limit without accelerator input to cause speed increase, then followed by a sharp engine cutout. • Check the intake manifold for sources of flammable vapors, and check the turbo-charger seals to verify there are no oil leaks. 	<p>OK No alternate fuel source</p>	1C
	<p>NOT OK Locate the alternate fuel source</p> <ul style="list-style-type: none"> • Locate any alternate fuel sources, such as operating the engine near flammable vapors, blown turbocharger seals, and so forth. • Inspect the base engine for damage due to the overspeed condition. 	2A

STEP 1C: Check the rpm with the INSITE™ service tool monitor mode.

▲CAUTION▲		
<p>If the engine speed stays above 3700 rpm, the engine must be shut off immediately.</p>		
<p>Condition:</p> <ul style="list-style-type: none"> • Run the engine. • Connect service tool to the vehicle datalink. 		
Action	Specifications/Repair	Next Step
<p>Check the rpm with the monitor mode.</p> <ul style="list-style-type: none"> • Monitor the engine using INSITE™. <p>NOTE: Compare the engine speed reading on INSITE™ to a mechanical tachometer or the dash tachometer.</p>	<p>OK Correct rpm reading</p>	1D
	<p>NOT OK Inspect the engine speed sensor</p> <p>Check the engine speed sensor as outlined for Fault Code 115. Inspect the engine for damage due to the overspeed condition.</p>	2A

STEP 1D: Check for an active fault at low rpm.

⚠ CAUTION ⚠		
To avoid damaging the new ECM, all other active fault codes must be investigated prior to replacing the ECM.		
Condition:		
<ul style="list-style-type: none"> Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Check for an active fault code at low rpm. Check for active Fault Code 234 when the engine is not running above 3700 rpm.	OK Inactive fault code at low rpm	2A
	NOT OK Replace the ECM <ul style="list-style-type: none"> Refer to Procedure 019-031. 	2A

STEP 2: Clear the fault code.

STEP 2A: Disable the fault code.

Condition:		
<ul style="list-style-type: none"> Connect all the components. Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> Start the engine, and operate in the condition that previously exhibited the overspeed condition. 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.

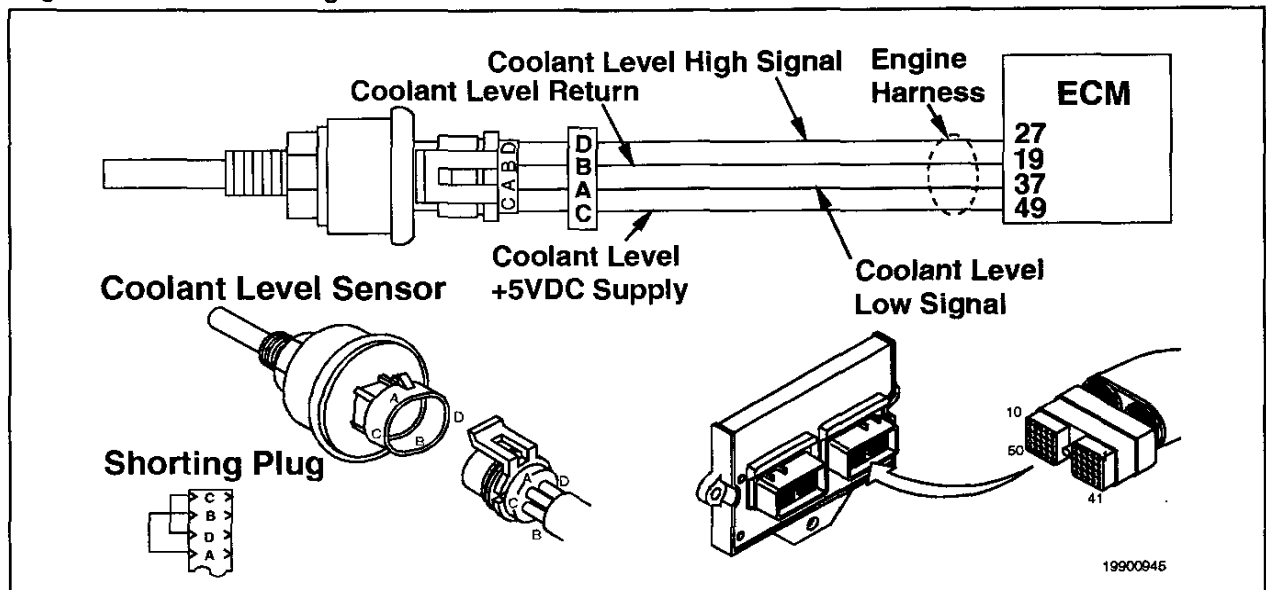
Condition:		
<ul style="list-style-type: none"> Connect all the components. Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> Erase the inactive fault code using INSITE™. 	OK All faults cleared	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting chart

Fault Code 235

Engine Coolant Level - Engine Protection

CODES	REASON	EFFECT
Fault Code: 235 PID(P), SID(S): P111 SPN: 111 FMI: 1 Lamp: Maintenance	Coolant level signal at pin 37 of the engine harness indicates coolant level is low.	Power and/or speed derate and possible engine shutdown if engine protection shutdown feature is enabled.

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 so 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, perhaps, shut down if 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.
- 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 toward a corner.
- Make sure the correct ECM code is in the ECM. Calibrating the ECM with the incorrect DO option can cause Fault Code 235 to be active since some OEMs use different sensors that require special calibrations.
- Sterling Trucks utilize ECM pin A22 for coolant level sensing through a 2-pin sensor; refer to SPT 98T19-46.

TROUBLESHOOTING SUMMARY



Wait until the coolant temperature is below 50°C [120°F] before removing the coolant system pressure cap or the coolant temperature sensor. Failure to do so can cause personal injury from heated coolant spray.



Do not add cold coolant to a hot engine. Castings can be damaged. Allow engine to cool to below 50°C [120°F] before adding coolant.



To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.



To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3823758 - male Deutsch/AMP/Metri-Pack test lead
Part No. 3823993 - male Deutsch test lead
Part No. 3823995 - male Weather-Pack test lead.

STEPS	SPECIFICATIONS	SRT CODE
<u>STEP 1:</u> Verify the coolant level.		
<u>STEP 1A:</u> Check the coolant level.	Coolant level normal	
<u>STEP 2:</u> Check the coolant level sensor.		
<u>STEP 2A:</u> Confirm the fault is still active with the engine running.	Fault still active	
<u>STEP 3:</u> Check for multiple fault codes.		
<u>STEP 3A:</u> Read fault codes.	Fault Code 385 or 444 inactive	
<u>STEP 4:</u> Check OEM pigtail harness.		
<u>STEP 4A:</u> Inspect the coolant level sensor, OEM pigtail harness, and engine harness connector.	No damaged pins	
<u>STEP 4B:</u> Check for open circuits.	Less than 10 ohms	
<u>STEP 4C:</u> Check for short circuits to ground.	More than 100k ohms	
<u>STEP 4D:</u> Check for short circuits from pin to pin.	More than 100k ohms	
<u>STEP 5:</u> Check engine harness.		
<u>STEP 5A:</u> Inspect the engine harness and ECM connectors.	No damaged pins	
<u>STEP 5B:</u> Check for short circuits to ground.	More than 100k ohms	
<u>STEP 5C:</u> Check for short circuits from pin to pin.	More than 100k ohms	

STEP 5D: Check for open circuit.
STEP 5E: Check sensor supply voltage.

Less than 10 ohms
(+) 4.75 to 5.25 VDC

STEP 6: Clear the fault code.

STEP 6A: Disable the fault code.
STEP 6B: Clear the inactive fault codes.

Fault Code 235 inactive
All faults cleared

TROUBLESHOOTING STEP

STEP 1: Verify the coolant level.

STEP 1A: Check the coolant level.

▲WARNING▲		
Wait until the coolant temperature is below 50°C [120°F] before removing the coolant system pressure cap or the coolant temperature sensor. Failure to do so can cause personal injury from heated coolant spray.		
▲CAUTION▲		
Do not add cold coolant to a hot engine: Castings can be damaged. Allow engine to cool to below 50°C [120°F] before adding coolant.		
Condition:		
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.	6A

STEP 2: Check the coolant level sensor.

STEP 2A: Confirm the fault is still active with the engine running.

Condition:		
• Turn keyswitch to the ON position.		
Action	Specifications/Repair	Next Step
Confirm the fault is still active with the engine running. • Start the engine, and let idle for at least 1 minute. • Read the fault codes using INSITE™.	OK Fault code still active	3A
	NOT OK Fault Code 235 inactive	6A

STEP 3: Check for multiple fault codes.

STEP 3A: Read fault codes.

Condition: • Turn keyswitch to the ON position.		
Action	Specifications/Repair	Next Step
Read the fault codes. • Read the fault codes using INSITE™.	OK Fault Code 385 or 444 inactive	4A
	NOT OK Fault Code 385 or 444 active	Refer to Fault Code 385 or 444

STEP 4: Check OEM pigtail harness.

STEP 4A: Inspect the coolant level sensor, OEM pigtail harness, and engine harness connectors.

Condition: • Turn keyswitch to the OFF position. • Disconnect the coolant level sensor, OEM pigtail harness, and engine harness.		
Action	Specifications/Repair	Next Step
Inspect the coolant level sensor, OEM pigtail harness, and engine harness connectors for: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • <i>Moisture in or on the connectors</i> • Missing or damaged seals. 	OK No damaged pins.	4B
	NOT OK Repair the damaged pins <ul style="list-style-type: none"> • Repair the coolant level sensor. Refer to the OEM troubleshooting and repair manual. • Repair the OEM pigtail harness. Refer to the OEM troubleshooting and repair manual. • Repair the engine harness. Refer to Procedure 019-043. 	6A

STEP 4B: Check for open circuits.

▲WARNING▲

Wait until the coolant temperature is below 50°C [120°F] before removing the coolant system pressure cap or the coolant temperature sensor. Failure to do so can cause personal injury from heated coolant spray.

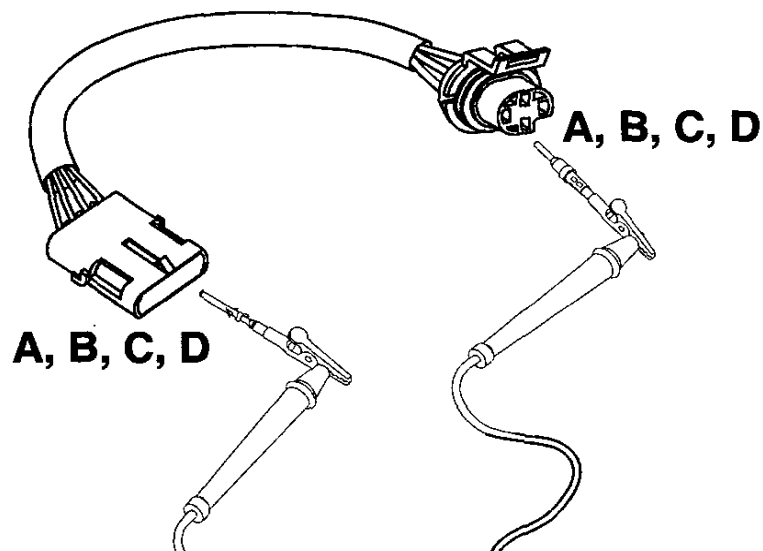
▲CAUTION▲

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3823993 - male Deutsch test lead
Part No. 3823995 - male Weather-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the coolant level sensor and OEM pigtail harness.

Action	Specifications/Repair	Next Step
Check for an open circuit. <ul style="list-style-type: none"> • Measure the resistance from pin C to pin C. • Measure the resistance from pin B to pin B. • Measure the resistance from pin D to pin D. • Measure the resistance from pin A to pin A. 	OK Less than 10 ohms	4C
	NOT OK Repair or replace the OEM pigtail harness Refer to the OEM troubleshooting and repair manual.	6A



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STEP 4C: Check for short circuits to ground.

▲WARNING▲

Wait until the coolant temperature is below 50°C [120°F] before removing the coolant system pressure cap or the coolant temperature sensor. Failure to do so can cause personal injury from heated coolant spray.

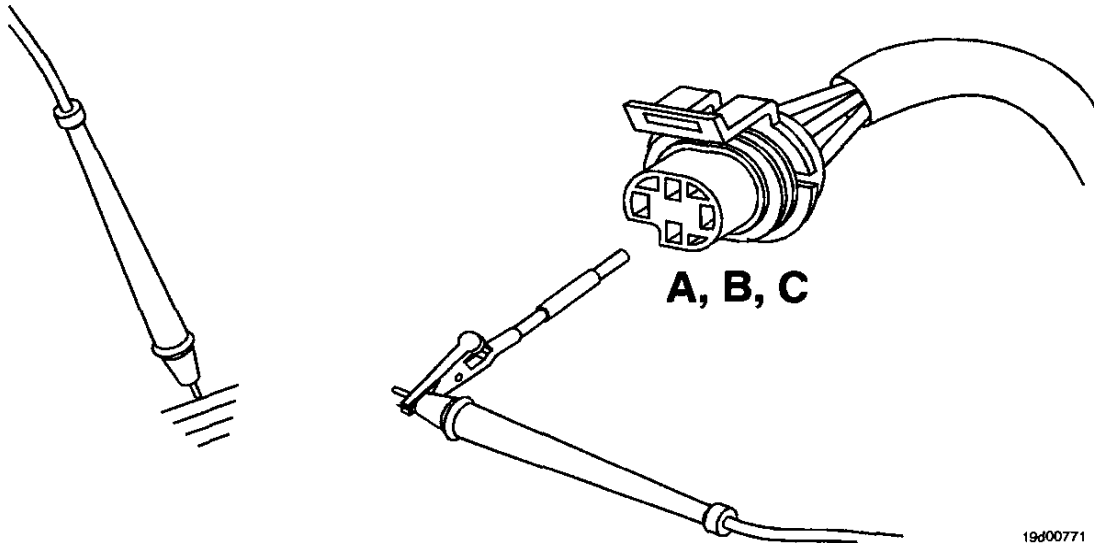
▲CAUTION▲

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3823993 - male Deutsch test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the coolant level sensor and OEM pigtail harness.

Action	Specifications/Repair	Next Step
Check for short circuits to ground. <ul style="list-style-type: none"> • Measure the resistance from pin A to ground. • Measure the resistance from pin B to ground. • Measure the resistance from pin C to ground. 	OK More than 100k ohms	4D
	NOT OK Repair or replace the OEM pigtail harness Refer to the OEM troubleshooting and repair manual.	6A



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STEP 4D: Check for short circuits from pin to pin.

▲WARNING▲

Wait until the coolant temperature is below 50°C [120°F] before removing the coolant system pressure cap or the coolant temperature sensor. Failure to do so can cause personal injury from heated coolant spray.

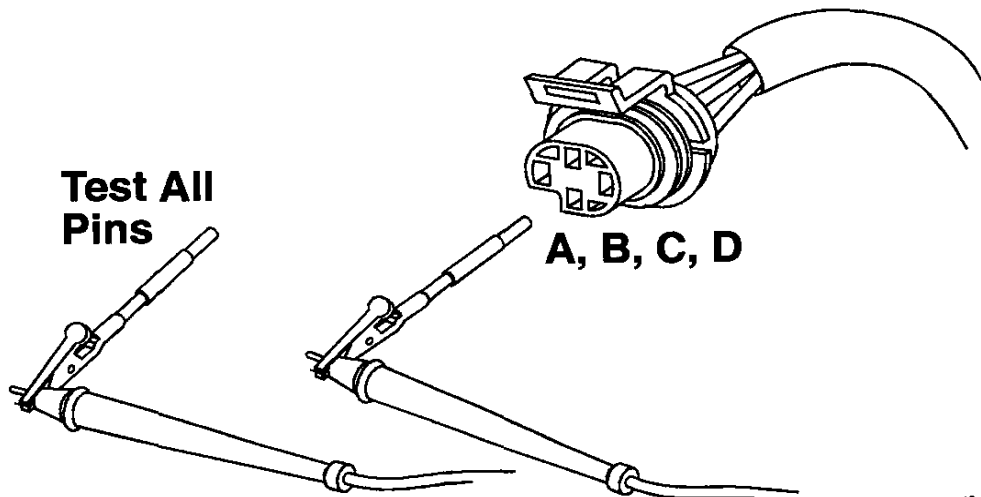
▲CAUTION▲

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3823993 - male Deutsch test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the coolant level sensor and OEM pigtail harness.

Action	Specifications/Repair	Next Step
Check for short circuits from pin to pin. <ul style="list-style-type: none"> • Measure the resistance from pin A to all other pins. • Measure the resistance from pin B to all other pins. • Measure the resistance from pin C to all other pins. • Measure the resistance from pin D to all other pins. 	OK More than 100k ohms	5A
	NOT OK Repair or replace the OEM pigtail harness Refer to the OEM troubleshooting and repair manual.	6A



STEP 5: Check engine harness.

STEP 5A: 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 to the OFF position.
- Disconnect the engine harness from the engine control module (ECM).
- Disconnect the engine harness from the OEM pigtail harness.

Action	Specifications/Repair	Next Step
Inspect the engine harness and ECM connectors for the following: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing connector seal. 	OK No damaged pins	5B
	NOT OK Repair damaged pins Repair or replace the engine harness, ECM, or coolant level sensor, whichever has the damaged pins. <ul style="list-style-type: none"> • Repair the engine harness. Refer to Procedures 019-204 and 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031. • Dry the connector using electrical contact cleaner, Part No. 3824510. 	6A

STEP 5B: Check for short circuits to ground.

⚠ WARNING ⚠

Wait until the coolant temperature is below 50°C [120°F] before removing the coolant system pressure cap or the coolant temperature sensor. Failure to do so can cause personal injury from heated coolant spray.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3823758 - male Deutsch/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the coolant level sensor and OEM pigtail harness.
- Disconnect the engine harness from the ECM.

Action	Specifications/Repair	Next Step
Check for short circuits to ground. <ul style="list-style-type: none"> • Measure the resistance from pin 49 to engine block ground. • Measure the resistance from pin 27 to engine block ground. • Measure the resistance from pin 37 to engine block ground. 	OK More than 100k ohms	5C
	NOT OK Repair or replace the engine harness Refer to Procedure 019-043.	6A

STEP 5C: Check for short circuits from pin to pin.

▲WARNING▲

Wait until the coolant temperature is below 50°C [120°F] before removing the coolant system pressure cap or the coolant temperature sensor. Failure to do so can cause personal injury from heated coolant spray.

▲CAUTION▲

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the coolant level sensor and OEM pigtail harness.
- Disconnect the engine harness from the ECM.

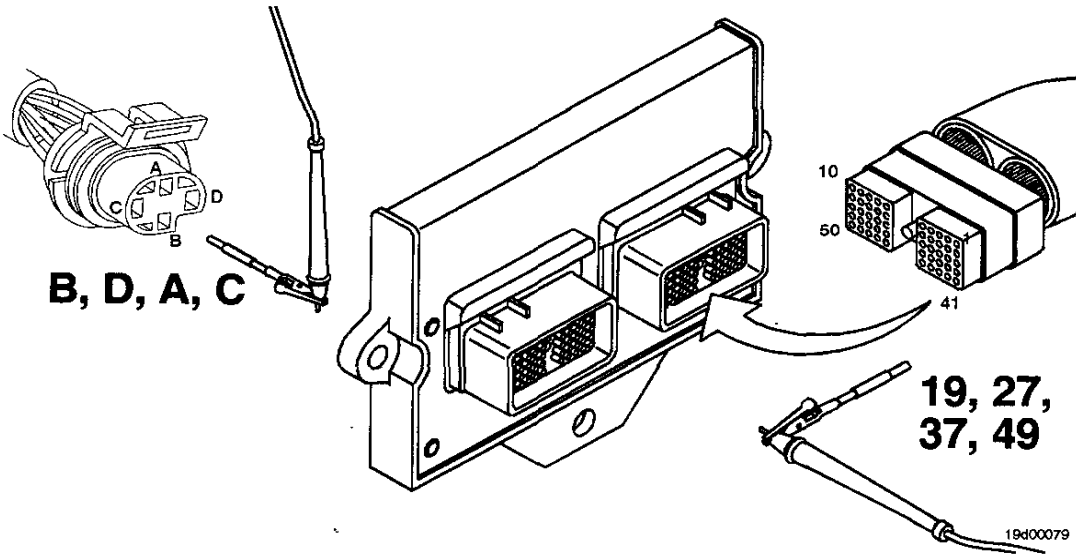
Action	Specifications/Repair	Next Step
Check for short circuits from pin to pin. <ul style="list-style-type: none"> • Measure the resistance from pin 49 to all other pins. • Measure the resistance from pin 27 to all other pins. 	OK More than 100k ohms	5D
<ul style="list-style-type: none"> • Measure the resistance from pin 37 to all other pins. • Measure the resistance from pin 19 to all other pins. 	NOT OK Repair or replace the engine harness Refer to Procedure 019-043.	6A

STEP 5D: Check for open circuit.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the ECM.
- Disconnect the engine harness from the coolant level sensor.

Action	Specifications/Repair	Next Step
<p>Check for open circuit in the coolant level sensor circuit.</p> <ul style="list-style-type: none"> • Measure the resistance from pin B on the harness side of the coolant level sensor circuit to pin 19 of the engine harness connector. • Measure the resistance from pin D on the harness side of the coolant level sensor circuit to pin 27 of the engine harness connector. 	<p>OK Less than 10 ohms</p>	<p>5E</p>
<ul style="list-style-type: none"> • Measure the resistance from pin A on the harness side of the coolant level sensor circuit to pin 37 of the engine harness connector. • Measure the resistance from pin C on the harness side of the coolant level sensor circuit to pin 49 of the engine harness connector. 	<p>NOT OK Replace the engine harness Refer to Procedure 019-043.</p>	<p>6A</p>



STEP 5E: Check sensor supply voltage.

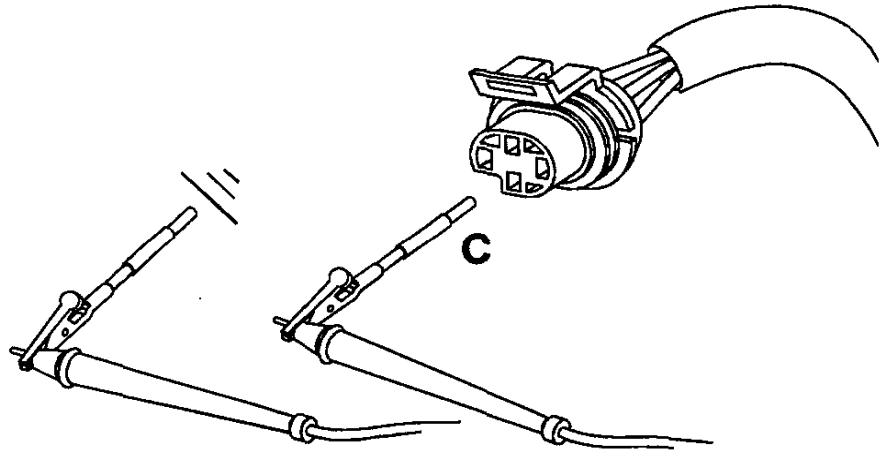
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch to the ON position.
- Disconnect the engine harness from the coolant level sensor.
- Connect the engine harness to the ECM.

Action	Specifications/Repair	Next Step
Check sensor supply voltage. • Measure the voltage from pin C of the sensor connector, harness side, to engine block ground.	OK (+) 4.75 to 5.25 VDC Replace coolant level sensor. Refer to Procedure 019-017.	6A
	NOT OK Replace the ECM Refer to Procedure 019-031.	6A



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STEP 6: Clear the fault code.

STEP 6A: Disable the fault code.

Condition: <ul style="list-style-type: none"> • Connect all the components. • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> • Start the engine, and let it idle for 1 minute. • Verify Fault Code 235 is inactive. 	OK Fault code 235 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.

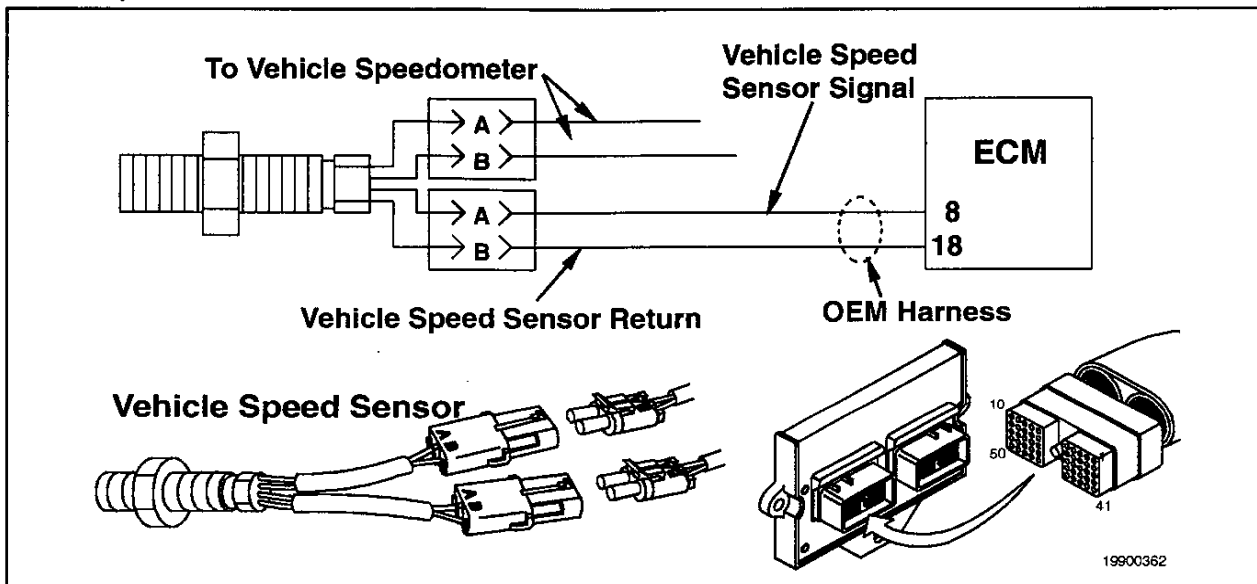
Condition: <ul style="list-style-type: none"> • Connect all the components. • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> • Erase the inactive fault code using INSITE™. 	OK All faults cleared	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting chart

Fault Code 241

Vehicle Speed Sensor Circuit

CODES	REASON	EFFECT
Fault Code: 241 PID(P), SID(S): P084 SPN: 084 FMI: 2 Lamp: Yellow	Vehicle speed signal on pins 8 and 18 of the original equipment manufacturer's (OEM) harness has been lost.	Engine speed limited to "Max. Engine Speed without Vehicle Speed Sensor." Cruise control, gear-down protection and road speed governor will not work. Trip information data that are based on mileage will be incorrect.

Vehicle Speed Sensor Circuit



Circuit Description:

The vehicle speed sensor (VSS) uses two separate coils of wire (some applications use a single-coil sensor) to count gear teeth as they pass in front of the sensor. One coil is used by the electronic control module (ECM) to sense vehicle speed. The other coil is sometimes used by the OEM to send a vehicle speed signal to the speedometer.

Component Location:

The VSS is most commonly installed in the rear of the transmission.

Shop Talk:

- Disconnect the vehicle speed sensor connector that connects to the OEM speedometer, or trip recorder, and move the truck. If the fault goes inactive, there is probably electrical noise being fed into the vehicle speed sensor circuit from the OEM device.
- Verify the vehicle speed sensor wires in the OEM harness are twisted-pairs.
- Check brake switch operation with INSITE™. Fault could be caused by rear-wheel lockup without brake indication to ECM.
- Verify the speed sensor is installed properly and its locking nut has **not** vibrated loose.

TROUBLESHOOTING SUMMARY



To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack/Deutsch test lead
Part No. 3823996 - female Weather-Pack test lead.



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 VSS.		
STEP 1A: Inspect the OEM harness and the sensor connectors.	No damaged pins	
STEP 1B: Check for proper adjustment (if adjustable).	1/2 to 3/4 turn out from gear for threaded type of sensor	
STEP 1C: Check for the correct sensor resistance.	750 to 1500 ohms	
STEP 1D: Check for a short circuit to ground.	More than 10M ohms	
STEP 1E: Check for a short circuit between coils (if two coils exist).	More than 10M ohms	
STEP 2: Check the OEM harness.		
STEP 2A: Inspect the harness and the ECM connectors.	No damaged pins	
STEP 2B: Check for correct circuit resistance.	750 to 1500 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: Check the OEM components.		
STEP 3A: Check for an external recording device.	No external device	
STEP 3B: Check for a transmission tailshaft gear slipping on the shaft.	Gear attached properly	
STEP 3C: Check for interference on the OEM harness.	Fault Code 241 inactive	
STEP 3C-1: Disable the fault code.	Fault Code 241 inactive	
STEP 4: Clear the fault code.		
STEP 4A: Disable the fault code.	Fault Code 241 inactive	
STEP 4B: Clear the inactive fault codes.	All faults cleared	

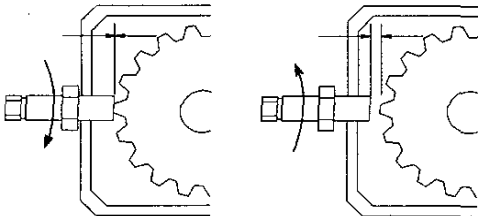
TROUBLESHOOTING STEP

STEP 1: Check the VSS.

STEP 1A: inspect the OEM harness and the sensor connectors.

Condition: <ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the OEM harness from the VSS. 		
Action	Specifications/Repair	Next Step
Inspect the OEM harness and the sensor connectors for the following: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	OK No damaged pins	1B
	NOT OK Repair the damaged pins Repair or replace the OEM harness or sensor, whichever has the damaged pins. <ul style="list-style-type: none"> • Repair the OEM harness. Refer to Procedure 019-202. • Replace the OEM harness. Refer to Procedure 019-071. • Replace the VSS. Refer to Procedure 019-090 or 019-091. 	4A

STEP 1B: Check the VSS for the proper adjustment (if adjustable).

Condition: <ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the OEM harness from the VSS. 		
Action	Specifications/Repair	Next Step
Check the VSS for the proper adjustment (if adjustable).	OK 1/2 to 3/4 of a turn out from the gear	1C
	NOT OK Adjust the VSS Refer to Procedure 019-090 or 019-091.	4A
		
19800250		

STEP 1C: Check for the correct sensor resistance.

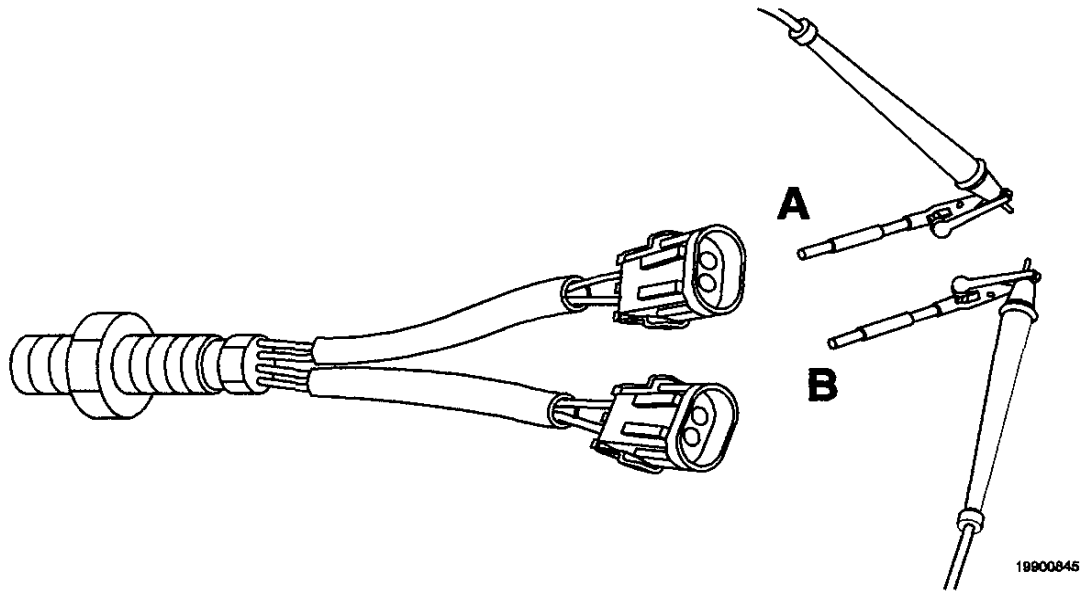
⚠ CAUTION ⚠

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 to the OFF position.
- Disconnect the OEM harness from the VSS.

Action	Specifications/Repair	Next Step
Check the vehicle speed sensor for the correct resistance. • Measure the resistance from pin A to pin B for each VSS connector on the sensor side.	OK 750 to 1500 ohms	1D
	NOT OK Replace the VSS Refer to Procedure 019-090 or 019-091.	4A



STEP 1D: Check for a short circuit to ground.

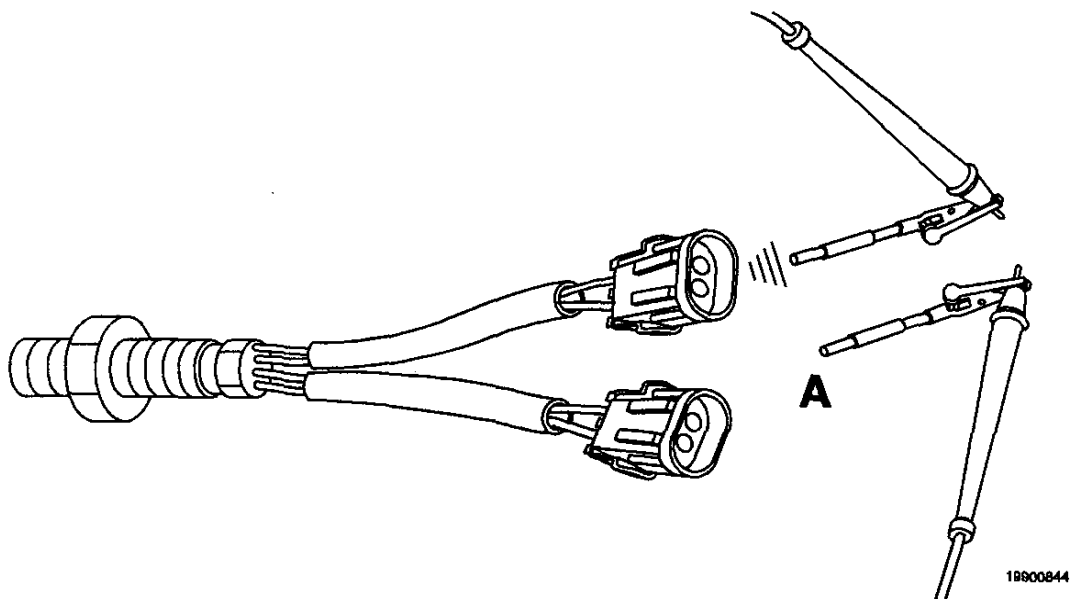
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3823996 - female Weather-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the vehicle speed sensor.

Action	Specifications/Repair	Next Step
Check the VSS for a short circuit to ground. • Measure the resistance from pin A on the sensor side of one of the VSS connectors to engine block ground. • Measure the resistance from pin A on the sensor side of the other VSS connector to engine block ground.	OK More than 10M ohms	1E
	NOT OK Replace the VSS Refer to Procedure 019-090 or 019-091.	4A



STEP 1E: Check for a short circuit between coils (if two coils exist).

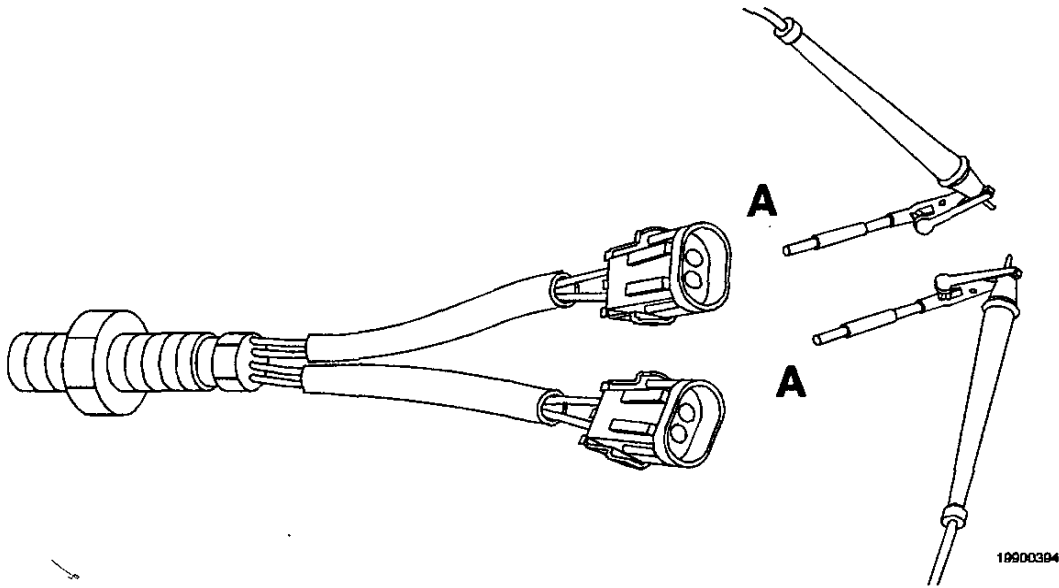
⚠ CAUTION ⚠

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 to the OFF position.
- Disconnect the OEM harness from the VSS.

Action	Specifications/Repair	Next Step
Check the VSS for a short circuit between coils. • Measure the resistance from pin A on the sensor side of one of the VSS connectors to pin A of the other connector.	OK More than 10M ohms	2A
	NOT OK Replace the VSS Refer to Procedure 019-090 or 019-091.	4A



STEP 2: Check the OEM harness.

STEP 2A: Inspect the harness and the ECM connectors.

Condition:		
<ul style="list-style-type: none">• Turn keyswitch to the OFF position.• Disconnect the OEM harness from the ECM.		
Action	Specifications/Repair	Next Step
Inspect the harness and the ECM connectors for the following: <ul style="list-style-type: none">• Bent or broken pins• Pushed back or expanded pins• Corroded pins• Moisture in or on the connector• Missing or damaged seals.	OK No damaged pins	2B
	NOT OK Repair the damaged pins Repair or replace the OEM harness or ECM, whichever has the damaged pins. <ul style="list-style-type: none">• Repair the OEM harness. Refer to Procedure 019-250.• Replace the OEM harness. Refer to Procedure 019-071.• Replace the ECM. Refer to Procedure 019-031.	4A

STEP 2B: Check for the correct circuit resistance.

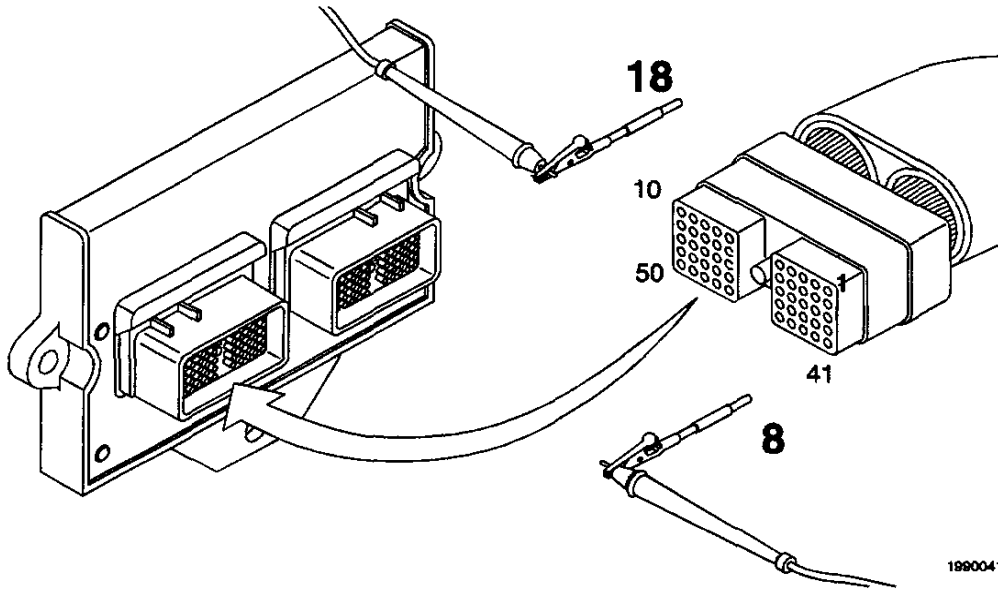
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the ECM.
- Connect the OEM harness to the VSS.

Action	Specifications/Repair	Next Step
Check for the correct circuit resistance. • Check the OEM harness for the proper resistance between pin 8 and pin 18 of the OEM harness connector.	OK 750 to 1500 ohms	2C
	NOT OK Replace the OEM harness Refer to Procedure 019-071.	4A



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STEP 2C: Check for a short circuit to ground.

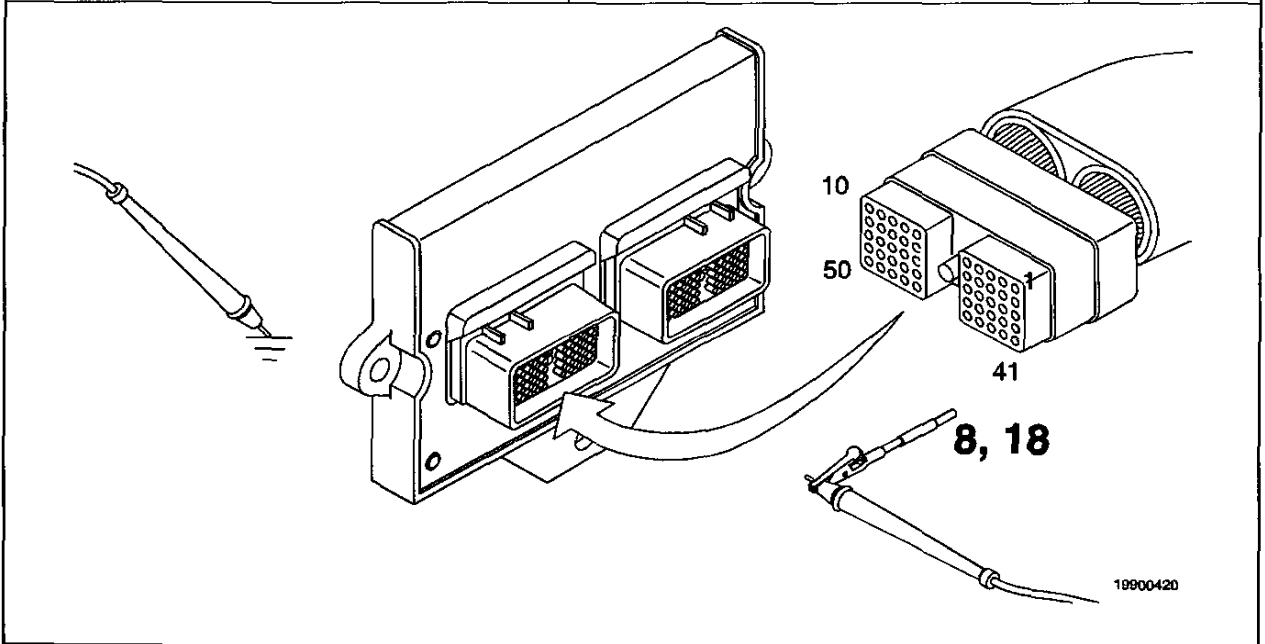
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack/Deutsch test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the VSS.
- Disconnect the OEM harness from the ECM.

Action	Specifications/Repair	Next Step
Check the harness for a short circuit to ground. • Measure the resistance from pin 8 of the OEM harness connector to engine block ground.	OK More than 100k ohms	2D
• Measure the resistance from pin 18 of the OEM harness connector to engine block ground.	NOT OK Replace the OEM harness Refer to Procedure 019-071.	4A



STEP 2D: Check for a short circuit from pin to pin.

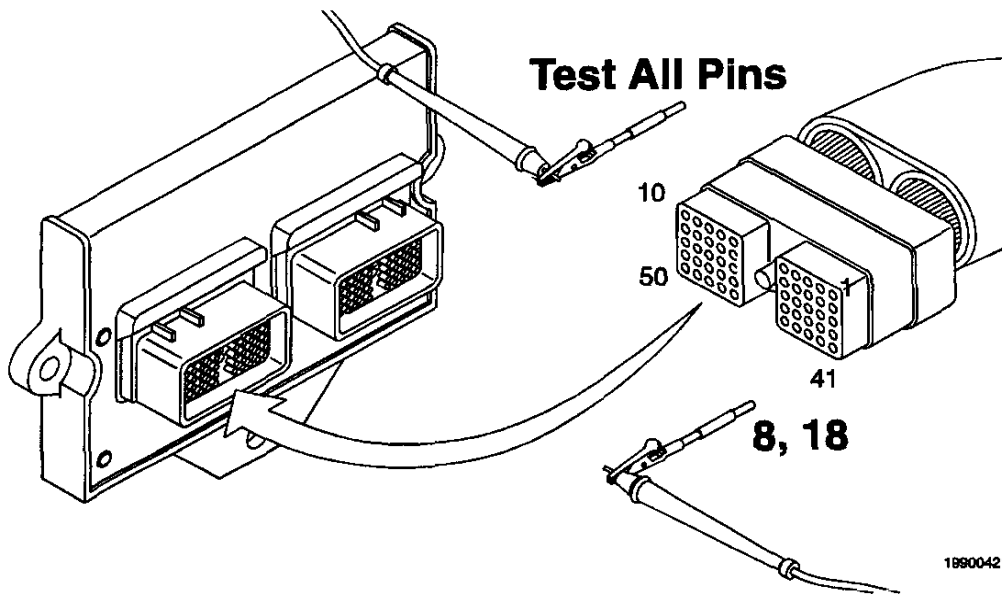


To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the VSS.
- Disconnect the OEM harness from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pins 8 and 18 to all other pins in the OEM harness connector.	OK More than 100k ohms	3A
	NOT OK Replace the OEM harness. Refer to Procedure 019-071.	4A



STEP 3: Check OEM components.

STEP 3A: Check for an external recording device.

Condition:

- Turn keyswitch to the OFF position.

Action	Specifications/Repair	Next Step
Check for an external recording device or similar devices attached to the vehicle speed sensor circuit.	OK No external device	3B
	NOT OK Disconnect device from circuit	4A

STEP 3B: Check for the transmission tailshaft gear slipping on its shaft.

Condition: <ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • VSS removed. 		
Action	Specifications/Repair	Next Step
Check for the transmission tailshaft gear slipping on its shaft. <ul style="list-style-type: none"> • Check to make sure the transmission gear inside the sensor mounting is not slipping on the shaft. Do this by trying to spin the gear with a standard screwdriver. 	OK Gear attached properly	3C
	NOT OK Repair transmission gear Refer to the OEM troubleshooting and repair manual.	4A

STEP 3C: Check for interference on the OEM harness.

Condition: <ul style="list-style-type: none"> • Connect all the components. 		
Action	Specifications/Repair	Next Step
Check for interference on the OEM harness. <ul style="list-style-type: none"> • Install a pair of twisted jumper wires from the VSS to the ECM. Connect the wires from pin A on the harness side of the VSS connector to pin 8 on the OEM harness connector, and from pin B on the harness side of the VSS connector to pin 18 of the OEM harness connector. • Disconnect the speedometer connector at the VSS. • Drive the vehicle. The vehicle speed must exceed 10 mph. 	OK Fault Code 241 inactive There is an interference on the OEM harness. Locate and remove the source of interference.	4A
	NOT OK Replace the VSS Refer to Procedure 019-090 or 019-091.	3C-1

STEP 3C-1: Disable the fault code.

⚠ CAUTION ⚠		
To avoid damaging a new ECM, all other fault codes must be investigated prior to replacing the ECM.		
Condition: <ul style="list-style-type: none"> • Connect all the components. 		
Action	Specifications/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> • Drive the vehicle. The vehicle speed must exceed 16 kph [10 mph]. • Verify Fault Code 241 is inactive. 	OK Fault Code 241 inactive	4A
	NOT OK Replace the ECM Refer to Procedure 019-031.	4A

STEP 4: Clear the fault code.

STEP 4A: Disable the fault code.

Condition:		
<ul style="list-style-type: none"> • Connect all the components. • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> • Drive the vehicle. The vehicle speed must exceed 16 kph [10 mph]. 	OK Fault Code 241 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.

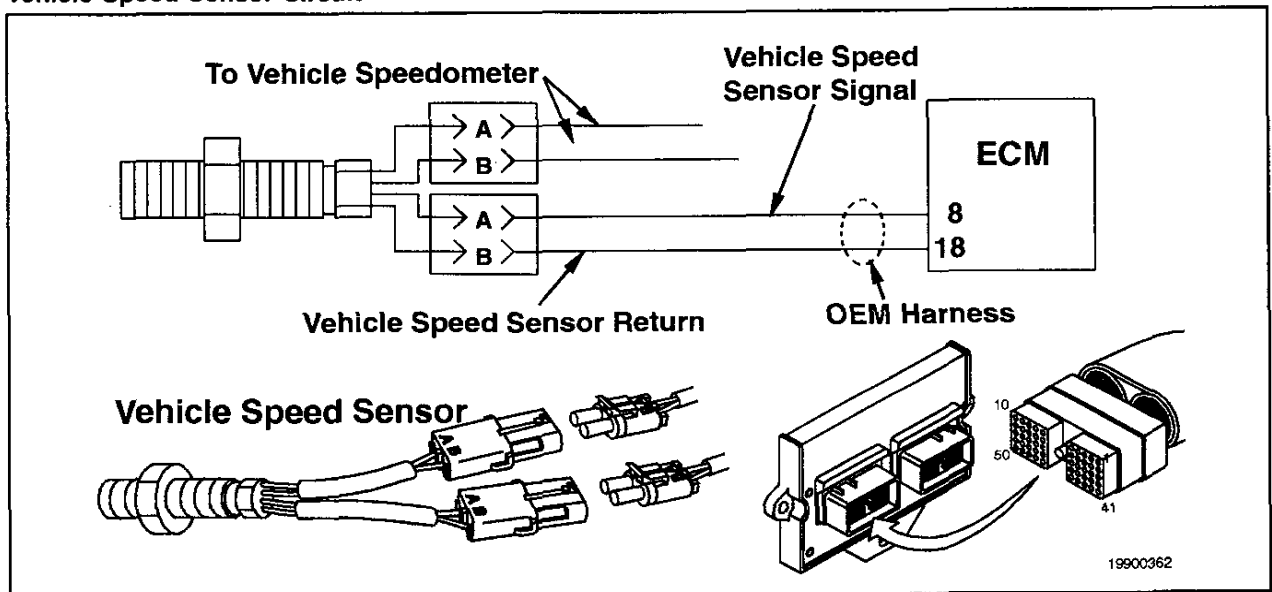
Condition:		
<ul style="list-style-type: none"> • Connect all the components. • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> • Erase the inactive fault code using INSITE™. 	OK All faults cleared	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting chart

Fault Code 242

Vehicle Speed Sensor (VSS) Circuit

CODES	REASON	EFFECT
Fault Code: 242 PID(P), SID(S): P084 SPN: 084 FMI: 10 Lamp: Yellow	Invalid or inappropriate vehicle speed signal detected on pins 8 and 18 of the original equipment manufacturer's (OEM) harness indicating an intermittent connection or possible tampering.	Engine speed limited to "Maximum Engine Speed without Vehicle Speed Sensor" for the duration of the invalid signal. Cruise control, gear-down protection, and the road speed governor will not work. Trip information data that is based on mileage will be incorrect.

Vehicle Speed Sensor Circuit



Circuit Description:

The vehicle speed sensor (VSS) uses two separate coils of wire (some applications use a single-coil sensor) to count gear teeth as they pass in front of the sensor. One coil is used by the electronic control module (ECM) to sense vehicle speed. The other coil is sometimes used by the OEM to send a vehicle speed signal to the speedometer.

Component Location:

The VSS is most commonly installed in the rear of the transmission.

Shop Talk:

- Verify that the feature settings for VSS antitampering (Fault Code 242), application type and automatic transmission are set correctly. If any of these are set incorrectly, Fault Code 242 could occur erroneously.
- NOTE:** Driving techniques, such as driving for extended periods of time in lower gears, could log Fault Code 242.
- Fault Code 242 can be logged if the driver attempts to defeat the road speed governor by repeatedly cycling the keyswitch.
 - Interview the driver to discover what occurred when the fault code was logged. Explain the driver actions that can cause Fault Code 242 to be logged.
 - When deactivating the fault, verify that the vehicle is stopped and the engine is shut down.
 - Verify that the keyswitch has been cycled and has remained in the ON position for 30 seconds after the invalid signal has been corrected. This fault will remain active until the keyswitch is cycled and the ECM sees zero vehicle speed and zero engine speed for 30 seconds.

TROUBLESHOOTING SUMMARY

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Verify that the feature settings are set correctly.		
STEP 1A: Verify that the customer wants VSS antitampering (Fault Code 242) enabled.	Customer wants VSS antitampering (Fault Code 242) enabled	
STEP 1B: Verify that automatic transmission is set correctly for application.	Automatic transmission set correctly	
STEP 1C: Verify that application type is set correctly for application.	Application type set correctly	
STEP 2: Look for signs of tampering.		
STEP 2A: Inspect the VSS.	No signs of tampering detected	
STEP 2B: Inspect OEM VSS circuit.	No signs of tampering detected	
STEP 2C: Monitor vehicle speed.	Electronic service tool displays correct speed	
STEP 2C-1: Verify the vehicle speed.	Vehicle speed accurate for present gear	
STEP 3: Clear the fault code.		
STEP 3A: Disable the fault code.	Fault Code 242 inactive	
STEP 3B: Clear the inactive fault codes.	All faults cleared	

TROUBLESHOOTING STEP

STEP 1: Verify that the feature settings are set correctly.

STEP 1A: Verify that the customer wants VSS antitampering (Fault Code 242) enabled.

Condition: • Turn keyswitch to the OFF position.		
Action	Specifications/Repair	Next Step
Verify that the customer wants VSS antitampering (Fault Code 242) enabled. Talk to the owner of the vehicle to see if this feature is required for the application of this vehicle.	OK Customer wants VSS antitampering (Fault Code 242) enabled	1B
	NOT OK Adjust the feature setting to its correct value using INSITE™.	3A

STEP 1B: Verify that automatic transmission is set correctly for application.

Condition:		
Action	Specifications/Repair	Next Step
Verify that automatic transmission is set correctly for application. • Verify that this feature is activated if an automatic transmission is used, or deactivated if a manual transmission is used, using INSITE™.	OK Automatic transmission set correctly	1C
	NOT OK Adjust the feature setting to its correct value using INSITE™.	3A

STEP 1C: Verify that application type is set correctly for application.

Condition:		
Action	Specifications/Repair	Next Step
Verify that application type is set correctly for application. • Verify that this feature setting is set correctly for the application in which this vehicle is used, using INSITE™. NOTE: Driving for extended periods in lower gears is considered an on/off highway application.	OK Application type set correctly	2A
	NOT OK Adjust the feature setting to its correct value using INSITE™.	3A

STEP 2: Look for signs of tampering.

STEP 2A: Inspect the VSS.

Condition:		
Action	Specifications/Repair	Next Step
Inspect the VSS for: • Improper mounting of the VSS • VSS improperly connected to OEM harness • Other external device connected in place of VSS • Any evidence that tampering with the VSS has taken place.	OK No signs of tampering detected at or with the vehicle speed sensor	2B
	NOT OK VSS is improperly installed, connected, or has been tampered with • Correctly install and connect the VSS to the OEM harness. Refer to Procedure 019-090 or 019-091. • Remove any tampering device.	3A

STEP 2B: Inspect the OEM VSS circuit.

Condition:		
Action	Specifications/Repair	Next Step
Inspect the OEM VSS circuit for: <ul style="list-style-type: none"> • Broken, cut, or incorrect routing of the VSS wires • Any devices connected in series or parallel with the VSS • Any other wires added to the VSS circuit • Any evidence that tampering with the VSS circuit has taken place. 	OK No signs of tampering detected with the VSS leads or the OEM harness	2C
	NOT OK Repair or replace the OEM harness Refer to Procedure 019-071.	3A

STEP 2C: Monitor the vehicle speed.

Condition:		
Action	Specifications/Repair	Next Step
Monitor vehicle speed: To check the vehicle speed, use INSITE™. <ul style="list-style-type: none"> • Verify that the vehicle speed is zero when the vehicle is stationary and the engine is running. • Drive the vehicle, or run on a chassis dynamometer. Compare the vehicle speed read by the electronic service tool to the speedometer on the dash. <p>NOTE: If the dash is an electronic dash that uses the ECM to obtain vehicle speed, perform a road test, and use a stopwatch and road mile markers to determine the true vehicle speed.</p>	OK Electronic service tool displays correct speed	2C-1
	NOT OK Electronic service tool and speedometer do not match. Verify the VSS parameters are adjusted correctly in the ECM. Check the VSS and the OEM harness in Steps 2A and 2B above. Repair any problems found.	3A

STEP 2C-1: Verify the vehicle speed.

Condition:		
Action	Specifications/Repair	Next Step
Verify that the speed reported by the electronic service tool is accurate or reasonable for the PRESENT gear. (i.e., 40 mph in top gear is probably inaccurate.)	OK Vehicle speed accurate for present gear	Fault Code 241
	NOT OK Vehicle speed read by electronic service tool is inaccurate Verify VSS parameters are adjusted correctly in the ECM. Check VSS and OEM harness in Steps 2A and 2B above. Repair any problems found.	3A

STEP 3: Clear the fault code.
STEP 3A: Disable the fault code.

Condition: • Connect all the components.		
Action	Specifications/Repair	Next Step
Disable the fault code. • Turn the keyswitch to the OFF position. • Turn the keyswitch to the ON position (do not start engine). NOTE: Vehicle speed and engine speed must be zero for at least 30 seconds to disable the fault code.	OK Fault Code 242 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.

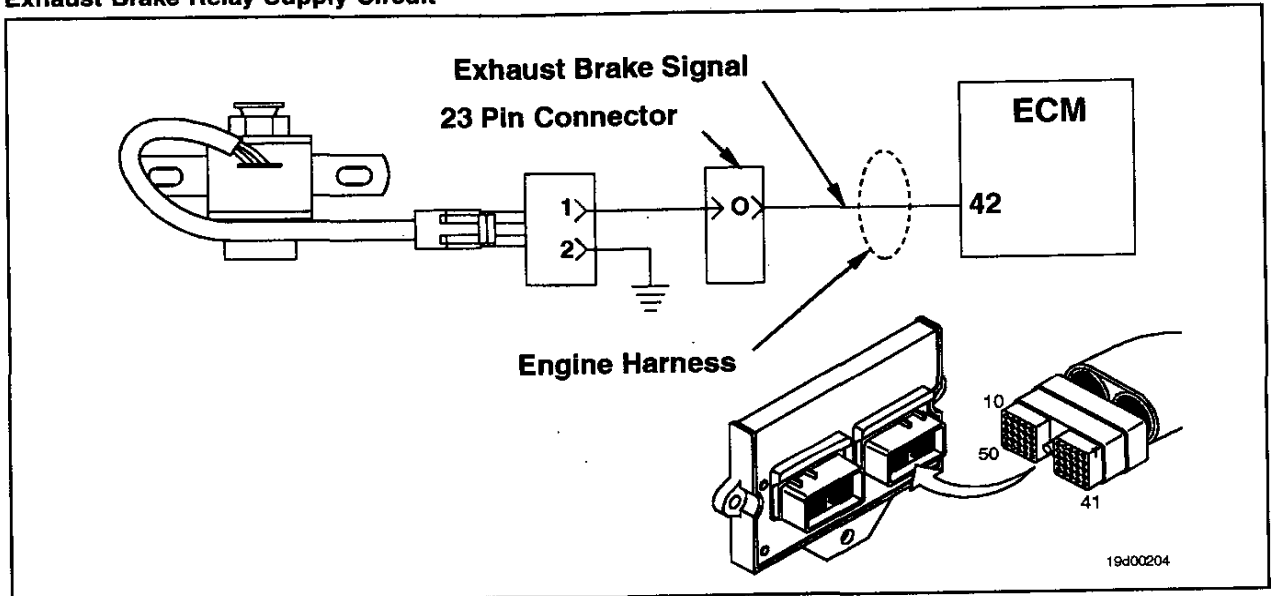
Condition: • Connect all the components. • Turn keyswitch to the ON position.		
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	OK All faults cleared	Repair complete
	NOT OK Troubleshooting any remaining active fault codes.	Appropriate troubleshooting chart

Fault Code 243

Exhaust Brake Supply Circuit

CODES	REASON	EFFECT
Fault Code: 243 PID(P), SID(S): P121 SPN: 513 FMI: 4 Lamp:	Error detected in exhaust brake relay enable circuit at pin 42 of the engine harness.	Exhaust brake will not work.

Exhaust Brake Relay Supply Circuit



Circuit Description:

The electronic control module (ECM) enables the exhaust brake by sending a signal to the relay that controls the exhaust brake under certain conditions.

Component Location:

Refer to the original equipment manufacturer's (OEM) diagram for the location of the engine brake.

TROUBLESHOOTING SUMMARY



To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male Deutsch/Cannon/Metri-Pack test lead
Part No. 3823994 - female Deutsch test lead
Part No. 3823993 - male Deutsch test lead.



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 engine harness.

STEP 1A: Inspect the engine harness, exhaust brake, and ECM connectors.

No damaged pins

STEP 1B: Check for an open circuit.

Less than 10 ohms

STEP 1C: Check for an 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 engine harness and OEM harness 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 codes.

Fault Code 243 inactive

STEP 3B: Clear the inactive fault codes.

All faults cleared

TROUBLESHOOTING STEP

STEP 1: Check the engine harness.

STEP 1A: Inspect the engine harness and ECM connectors.

⚠ CAUTION ⚠

To avoid damaging the ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the ECM.
- Disconnect the engine harness from the OEM 23-pin connector.

Action	Specifications/Repair	Next Step
Inspect the engine harness and the ECM connectors for: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	OK No damaged pins	1B
	NOT OK Repair the damaged pins Repair or replace the engine harness or ECM, whichever has the damaged pins. <ul style="list-style-type: none"> • Repair the engine harness. Refer to Procedures 019-250 and 019-223. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031. 	3A

STEP 1B: Check for an open circuit.

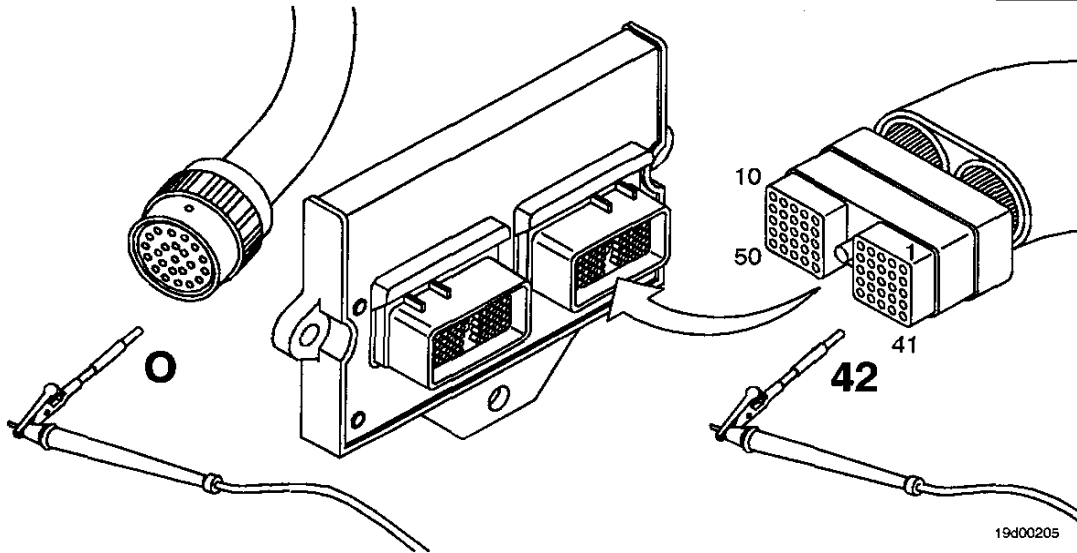
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/Cannon/Metri-Pack test lead
Part No. 3823994 - female Deutsch test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the ECM.
- Disconnect the engine harness from the OEM 23-pin connector.

Action	Specifications/Repair	Next Step
Check for an open circuit. • Measure the resistance from pin 42 of the ECM connector to pin O of the 23-pin OEM harness connector.	OK Less than 10 ohms	1C
	NOT OK 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/Cannon/AMP/Metri-Pack test lead.

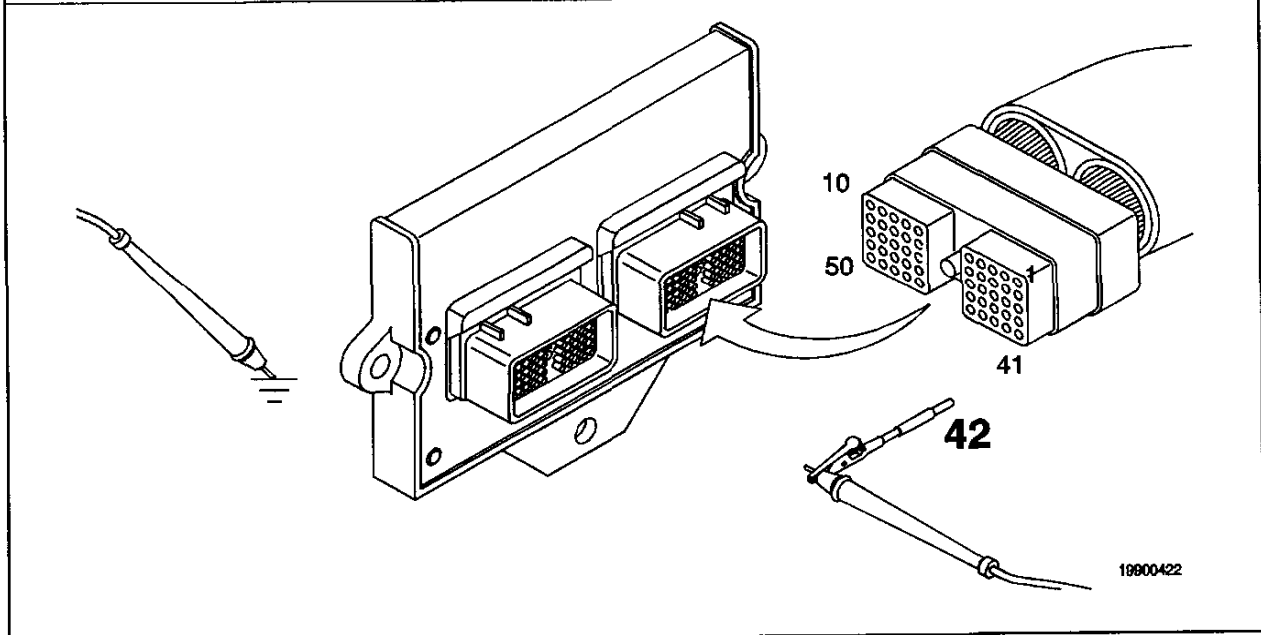
⚠ CAUTION ⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the ECM.
- Disconnect the engine harness from the OEM 23-pin connector.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground. • Measure the resistance from pin 42 in the engine harness to engine block ground.	OK More than 100k ohms	1D
	NOT OK Replace the engine harness Refer to Procedure 019-043.	3A



STEP 1D: Check for a short circuit between pins.

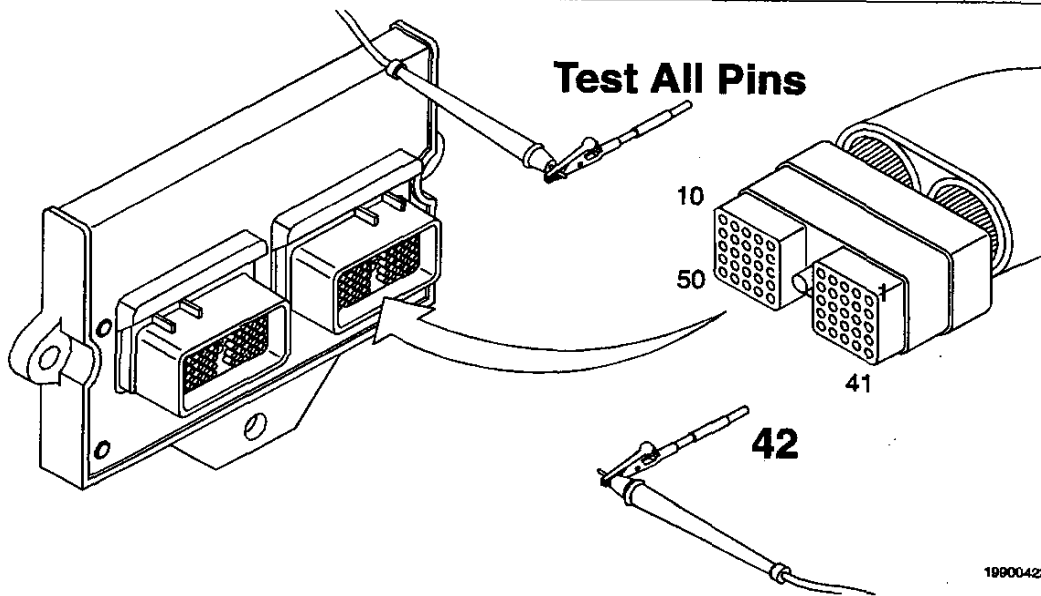
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male Deutsch/Cannon/Metri-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the ECM.
- Disconnect the engine harness from the OEM 23-pin connector.

Action	Specifications/Repair	Next Step
Check for a short circuit between pins. • Measure the resistance from pin 42 to all other pins in the ECM connector.	OK More than 100k ohms	2A
	NOT OK Replace the engine harness Refer to Procedure 019-043.	3A



STEP 2: Check the OEM harness.

STEP 2A: Inspect the engine harness and OEM harness connectors.

<p>Condition:</p> <ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the OEM harness from the engine harness at the 23-pin connector. • Disconnect the OEM harness from the exhaust brake. 		
Action	Specifications/Repair	Next Step
<p>Inspect the OEM harness, 23-pin connector, and the exhaust brake connector for:</p> <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	<p>OK No damaged pins</p>	2B
	<p>NOT OK Repair the damaged pins Repair or replace the OEM harness or exhaust brake connectors, whichever have damaged pins.</p> <ul style="list-style-type: none"> • Repair the OEM harness. Refer to Procedures 019-223 and 019-202. • Replace the OEM harness. Refer to Procedure 019-071. • Repair the exhaust brake connector. Refer to the OEM troubleshooting and repair manual. 	3A

STEP 2B: Check for an open circuit.

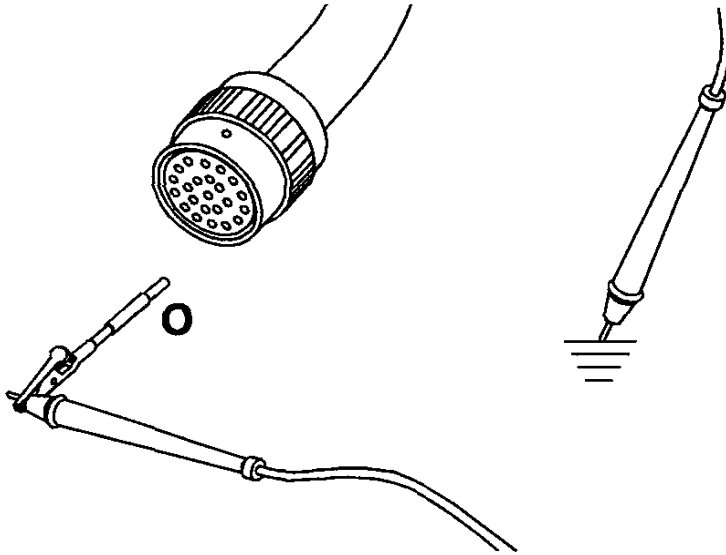
<p>⚠ CAUTION ⚠</p>		
<p>To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3823993 - male Deutsch test lead.</p>		
<p>Condition:</p> <ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the OEM harness from the engine harness at the 23-pin connector. • Disconnect the OEM harness from the exhaust brake. 		
Action	Specifications/Repair	Next Step
<p>Check for an open circuit.</p> <ul style="list-style-type: none"> • Measure the resistance from pin O of the 23-pin OEM connector on the OEM side to pin 1 of the exhaust brake connector. 	<p>OK Less than 10 ohms</p>	2C
	<p>NOT OK Replace the OEM harness Refer to Procedure 019-071.</p>	3A

STEP 2C: Check for a short circuit to ground.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the engine harness at the 23-pin connector.
- Disconnect the OEM harness from the exhaust brake.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground. • Measure the resistance from pin O of the 23-pin connector to the engine block ground.	OK More than 100k ohms	2D
	NOT OK Replace the OEM harness Refer to Procedure 019-071.	3A



19d00206

STEP 2D: Check for a short circuit from pin to pin.

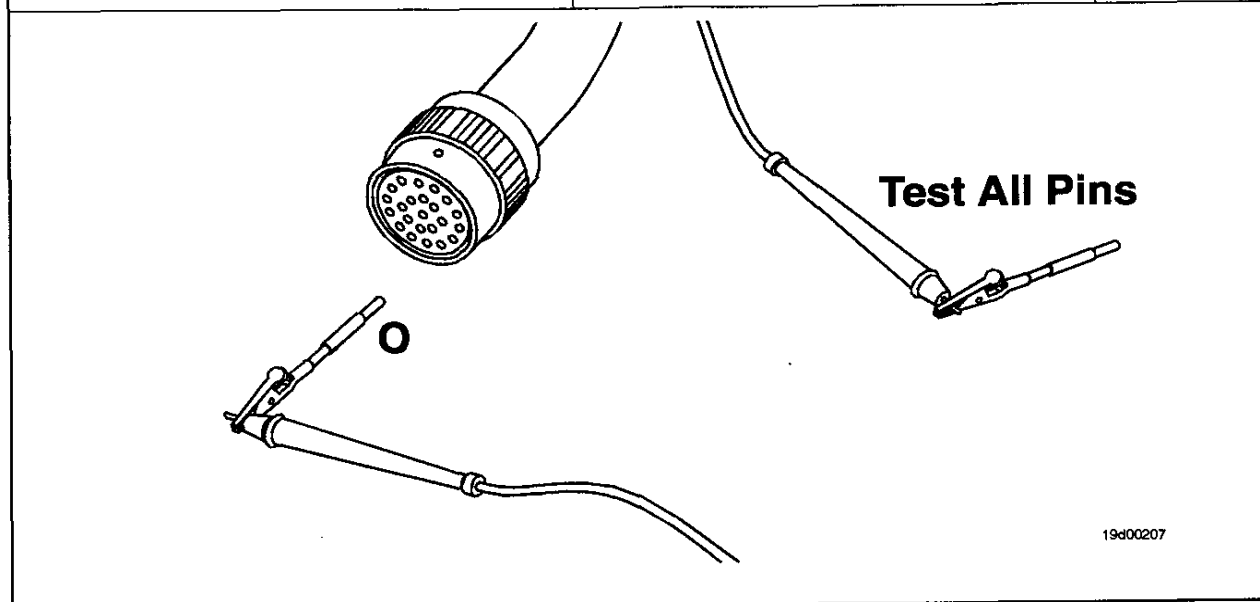


To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3823993 - male Deutsch test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the engine harness at the 23-pin connector.
- Disconnect the OEM harness from the exhaust brake.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pin O of the 23-pin OEM connector to all other pins in the connector.	OK More than 100k ohms	3A
	NOT OK Replace the OEM harness Refer to Procedure 019-071.	3A



STEP 3: Clear the fault codes.

STEP 3A: Disable the fault codes.

Condition:

- Connect all the components.
- Turn keyswitch to the ON position.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine, and let idle for 1 minute. • Using INSITE™, verify Fault Code 243 is inactive.	OK Fault Code 243 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.

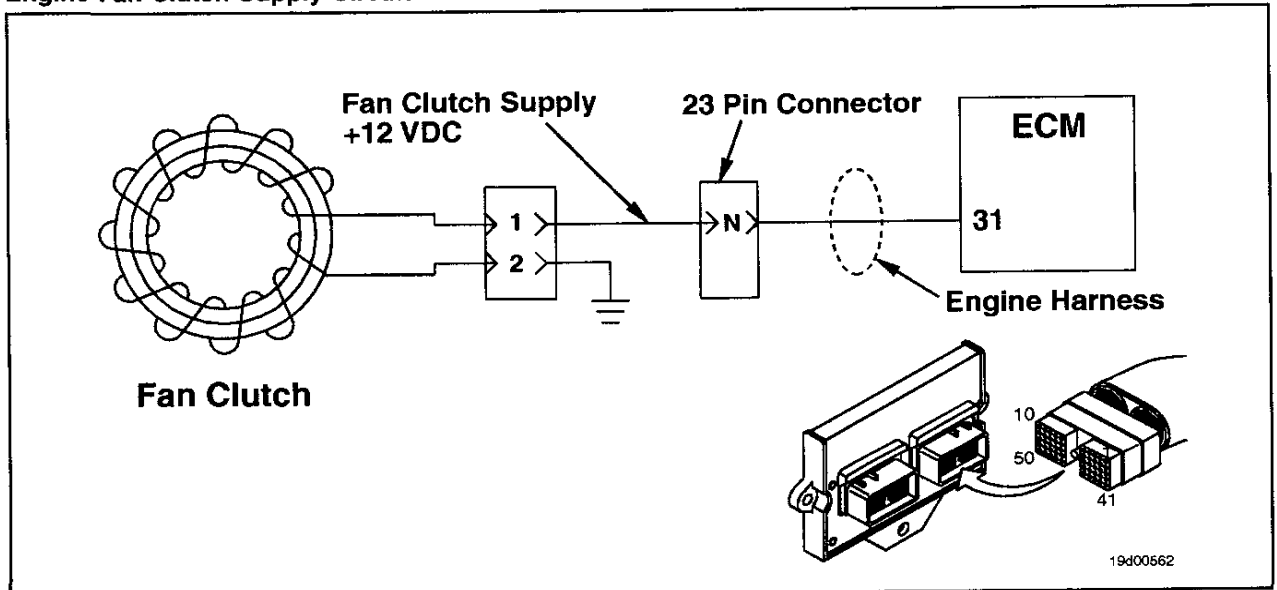
Condition:		
<ul style="list-style-type: none">• Connect all the components.• Turn keyswitch to the ON position.		
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none">• Erase the inactive fault codes using INSITE™.	OK All faults cleared	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting chart

Fault Code 245

Engine Fan Clutch Supply Circuit

CODES	REASON	EFFECT
Fault Code: 245 PID(P), SID(S): S033 SPN: 647 FMI: 4 Lamp:	Error detected in fan clutch relay enable circuit at pin 31 of the engine harness.	Electronic control module (ECM) can not control the engine cooling fan. Fan will remain either on or off.

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 original equipment manufacturer's (OEM) diagram for the location of the fan clutch solenoid.

Shop Talk:

- Fan clutch solenoid could be malfunctioning due to a failed engine harness or a bad ground on the fan clutch connector.
- Use INSITE™ to make sure that on/off fan feature is enabled and the right ON voltage is chosen.

TROUBLESHOOTING SUMMARY



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. 3823993 - male Deutsch test lead
Part No. 3823994 - female Deutsch test lead.



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 fan clutch.

STEP 1A: Inspect and test the fan clutch and fan clutch relay (if equipped).

Fan clutch and relay within specifications

STEP 2: Check the engine harness.

STEP 2A: Inspect the engine harness, fan clutch relay, and 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: Check the OEM harness.

STEP 3A: Inspect the engine harness and OEM harness connectors.

No damaged pins

STEP 3B: Check for an open circuit.

Less than 10 ohms

STEP 3C: Check for a short circuit to 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 245 inactive

STEP 4B: Clear the inactive fault codes.

All faults cleared

TROUBLESHOOTING STEP


STEP 1: Check the fan clutch

STEP 1A: Check the fan clutch and fan clutch relay (if equipped).

Condition: <ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the OEM harness from the fan clutch or fan clutch relay. 		
Action	Specifications/Repair	Next Step
Check the fan clutch for: <ul style="list-style-type: none"> • Damaged pins • Open or short circuits • Excessive current draw (power fan clutch directly from battery) • Perform this test in accordance with the OEM instructions. 	OK Fan clutch within specifications	2A
	NOT OK Repair or replace the fan clutch Refer to OEM troubleshooting and repair manual.	4A

STEP 2: Check the engine harness.

STEP 2A: Inspect the engine harness and the ECM connectors.

		
To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.		
Condition: <ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the engine harness from the ECM. • Disconnect the engine harness from the 23-pin OEM harness connector. 		
Action	Specifications/Repair	Next Step
Inspect the engine harness and the ECM connectors for: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	OK No damaged pins	2B
	NOT OK Repair the damaged pins Repair or replace the engine harness, or ECM, whichever has the damaged pins. <ul style="list-style-type: none"> • Repair the engine harness. Refer to Procedures 019-250 and 019-223. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031. 	4A

STEP 2B: Check for an open circuit.

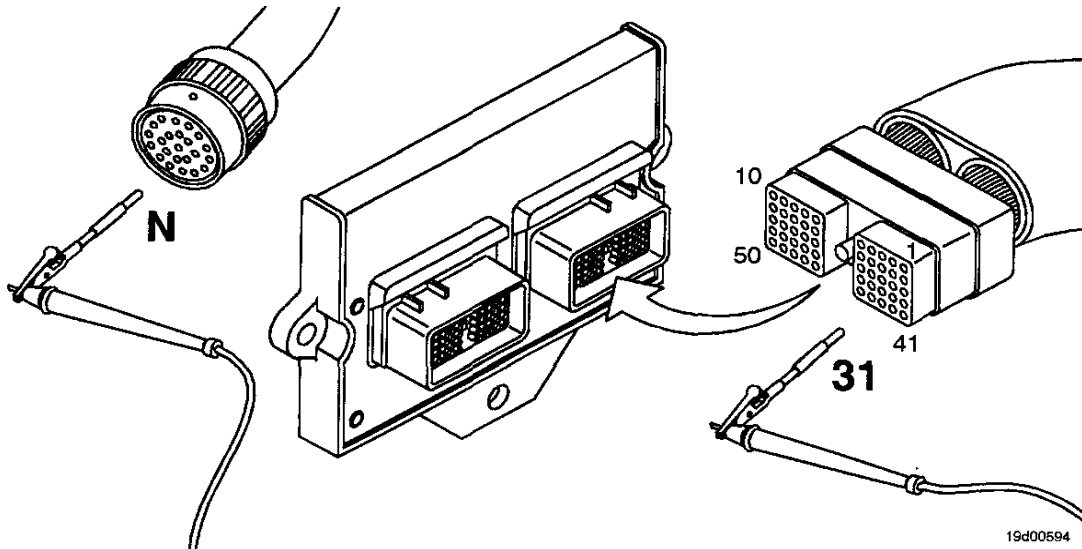


To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead
Part No. 3823994 - female Deutsch lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the ECM.
- Disconnect the engine harness from the 23-pin OEM harness connector.

Action	Specifications/Repair	Next Step
Check for an open circuit. • Measure the resistance from pin 31 of the engine harness connector to pin N of the 23-pin OEM harness connector.	OK Less than 10 ohms	2C
	NOT OK Replace the engine harness Refer to Procedure 019-043.	4A



STEP 2C: Check for a short circuit to ground.

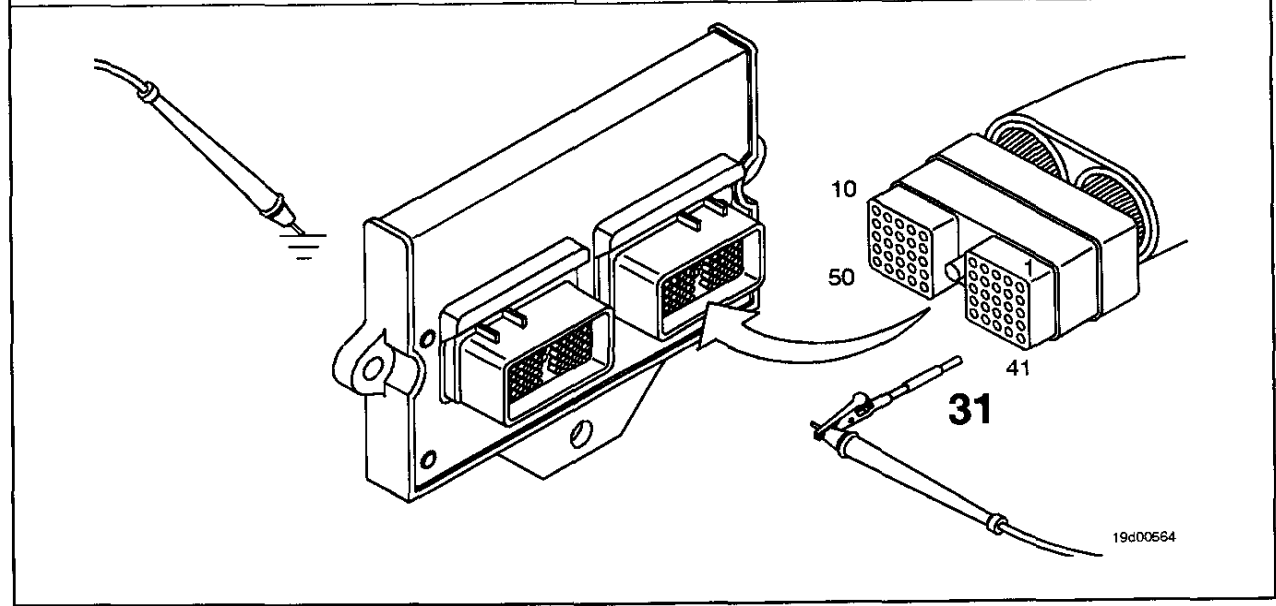
⚠ CAUTION ⚠

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 to the OFF position.
- Disconnect the engine harness from the ECM.
- Disconnect the engine harness from the 23-pin OEM harness connector.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground. • Measure the resistance from pin 31 in the engine harness to engine block ground.	OK More than 100k ohms	2D
	NOT OK Replace the engine harness Refer to Procedure 019-043.	4A



STEP 2D: Check for a short circuit from pin to pin.

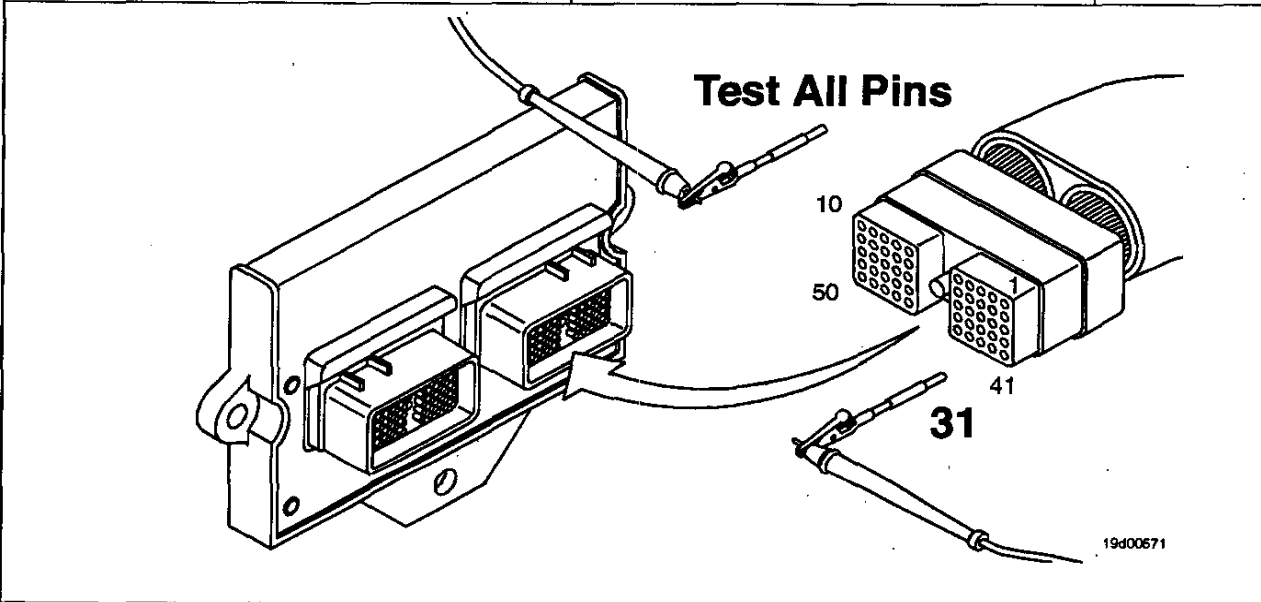
CAUTION

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male AMP/Cannon/Deutsch/Metri-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the ECM.
- Disconnect the engine harness from the 23-pin OEM harness connector.

Action	Specifications/Repair	Next Step
Check for a short circuit between pins. • Measure the resistance from pin 31 to all other pins in the connector.	OK More than 100k ohms	3A
	NOT OK Replace the engine harness Refer to Procedure 019-043.	4A



STEP 3: Check the OEM harness.

STEP 3A: inspect the OEM harness.

Condition:		
<ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the OEM harness from the fan clutch relay. • Disconnect the engine harness from the 23-pin OEM harness connector. 		
Action	Specifications/Repair	Next Step
Inspect the OEM harness and 23-pin connector for: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	OK No damaged pins	3B
	NOT OK Repair the damaged pins Repair or replace the OEM harness or fan clutch relay, whichever has damaged pins. <ul style="list-style-type: none"> • Repair the OEM harness. Refer to Procedure 019-223 or 019-202. • Replace the OEM harness. Refer to Procedure 019-071. • Replace the fan clutch relay. Refer to the OEM troubleshooting and repair manual. 	4A

STEP 3B: Check for an open circuit.

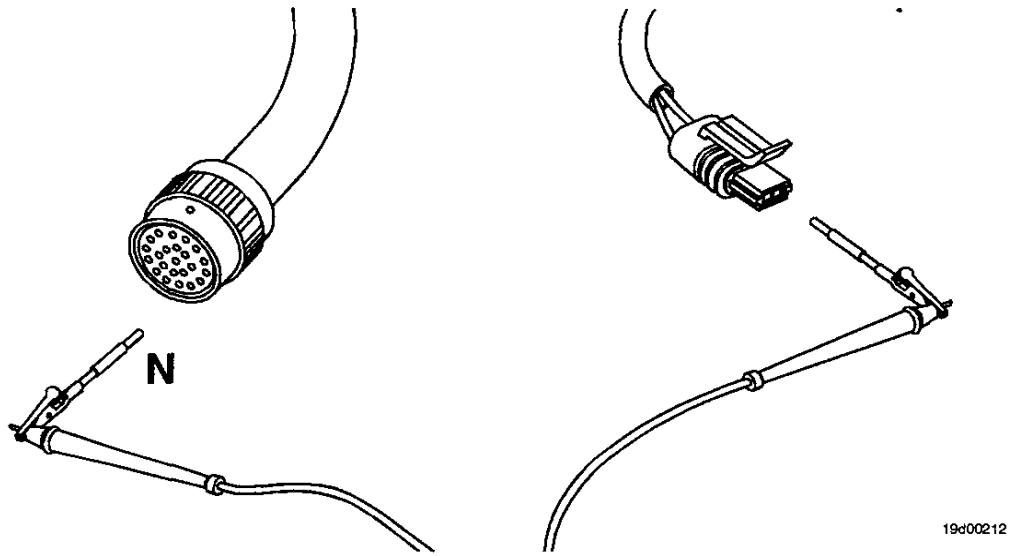
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3823993 - male Deutsch test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the fan clutch solenoid or relay.
- Disconnect the engine harness from the 23-pin OEM harness connector.

Action	Specifications/Repair	Next Step
Check for an open circuit. • Measure the resistance from pin N of the 23-pin OEM harness connector to the fan clutch solenoid or relay.	OK Less than 10 ohms	3C
	NOT OK Replace the OEM harness Refer to the Procedure 019-071.	4A



STEP 3C: Check for a short circuit to ground in the OEM harness.

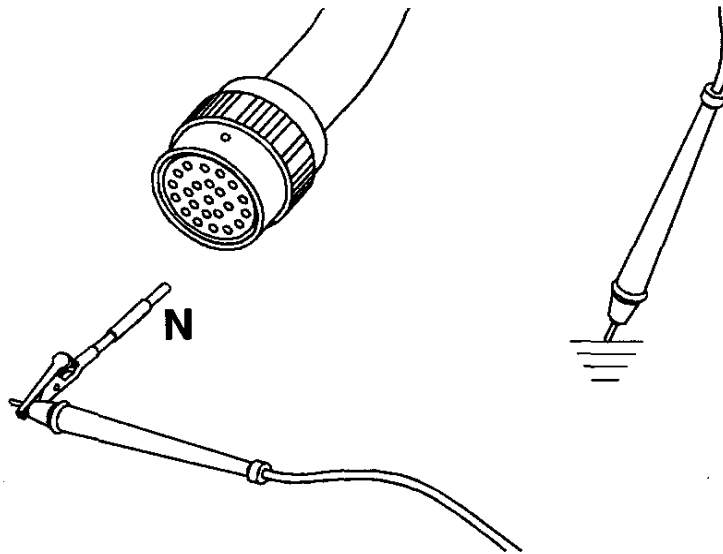
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3823993 - male Deutsch test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the fan clutch solenoid or relay.
- Disconnect the engine harness from the 23-pin OEM harness connector.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground in the OEM harness. • Measure resistance from pin N of the 23-pin OEM harness connector to ground.	OK More than 100k ohms	3D
	NOT OK Replace the OEM harness Refer to Procedure 019-071.	4A



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STEP 3D: Check for a short circuit from pin to pin.

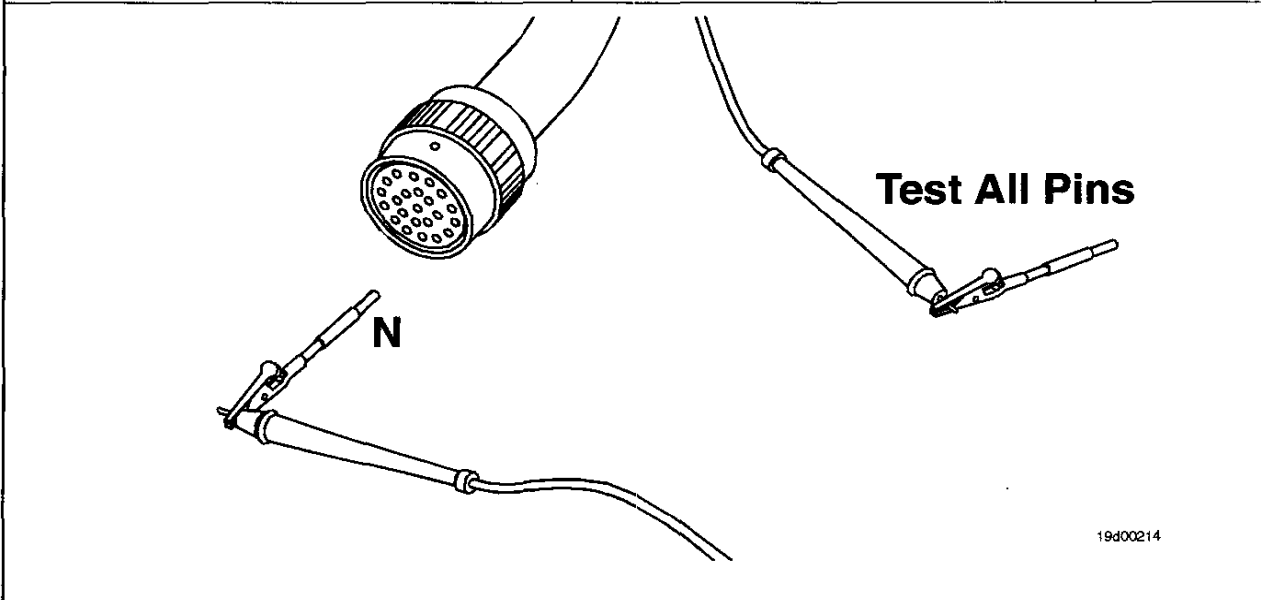
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3823993 - male Deutsch test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the fan clutch solenoid or relay.
- Disconnect the engine harness from the 23-pin OEM harness connector.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin in the OEM harness. • Measure resistance from pin N of the 23-pin OEM harness connector to all other pins in the 23-pin connector.	OK More than 100k ohms	4A
	NOT OK Replace the OEM harness Refer to Procedure 019-071.	4A



STEP 4: Clear the fault codes.

STEP 4A: Disable the fault code.

Condition:

- Connect all the components.
- Turn keyswitch to the ON position.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine, and let idle for 1 minute. • Using INSITE™, verify Fault Code 245 is inactive.	OK Fault Code 245 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.

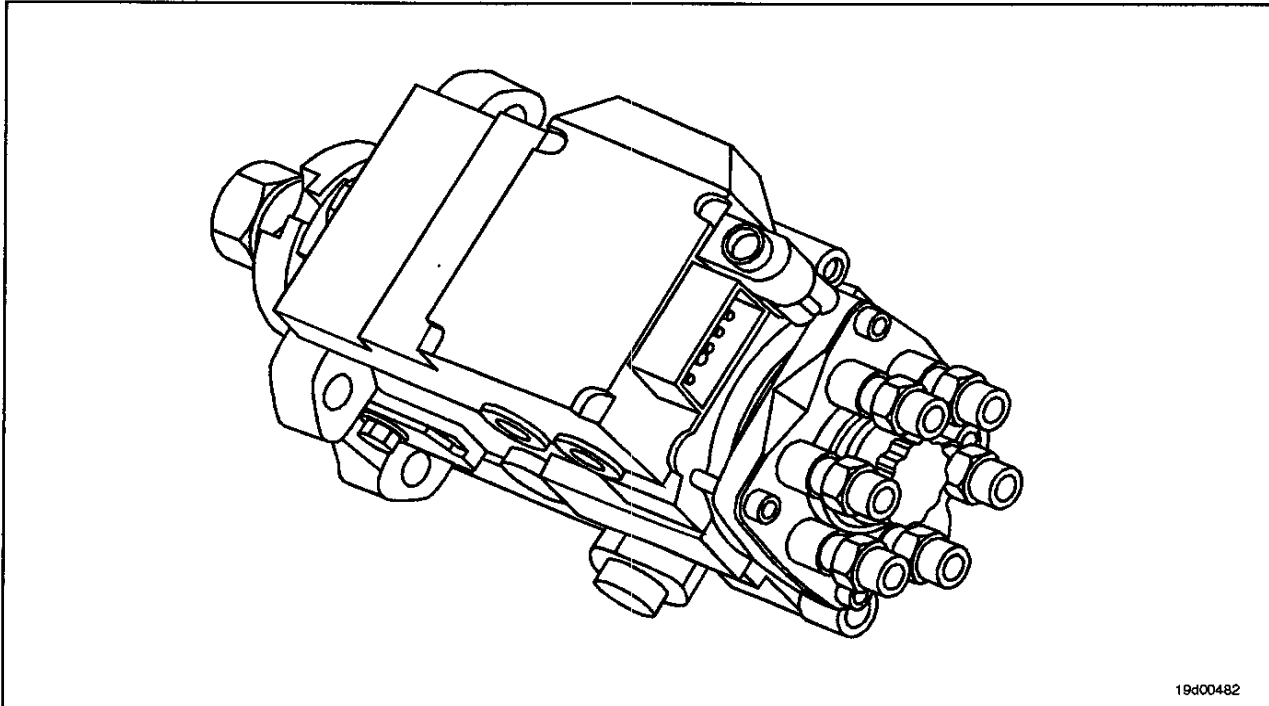
Condition:		
<ul style="list-style-type: none">• Connect all the components.• Turn keyswitch to the ON position.		
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none">• Erase the inactive fault codes using INSITE™.	OK All faults cleared	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting chart

Fault Code 261

Fuel Temperature Sensor Circuit

CODES	REASON	EFFECT
Fault Code: 261 PID(P), SID(S): P174 SPN: 174 FMI: 0 Lamp: Yellow	Fuel temperature signal indicates fuel temperature has exceeded the engine protection limit and/or pump protection limit.	Power derate.

VP44 Fuel Pump



Circuit Description:

The fuel temperature sensor is located in the VP44 fuel pump. Fuel temperature information is passed to the electronic control module (ECM) through the controller area network (CAN) datalink.

Component Location:

The fuel temperature sensor is located in the VP44 fuel pump.

TROUBLESHOOTING SUMMARY

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the sensor accuracy.		
STEP 1A: Verify the sensor accuracy with a thermocouple or similar temperature probe.	Sensor reading correct	
STEP 2: Clear the fault code.		
STEP 2A: Disable the fault code.	Fault Code 261 inactive	
STEP 2B: Clear the inactive fault codes.	All faults cleared	

TROUBLESHOOTING STEP

STEP 1: Check sensor accuracy.
STEP 1A: Verify the sensor accuracy with a thermocouple or similar temperature probe.

<p>Condition:</p> <ul style="list-style-type: none"> • Allow the engine to cold soak (for ≥ 2 hours, if possible). • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
<p>Verify the sensor accuracy with a thermocouple or similar temperature probe.</p> <ul style="list-style-type: none"> • Place a thermocouple or similar temperature probe (thermometer kit, Part No. 3822666, can be used) in the outlet tap of the fuel filter head. • Connect INSITE™ to the engine datalink. • Compare the fuel temperature sensor reading on the INSITE™ monitor screen to the reading from the temperature probe. • Load and operate the engine to typical operating temperature (180°F), and compare the fuel temperature sensor reading on the INSITE™ monitor screen to the reading from the temperature probe. <p>NOTE: Readings should vary no more than 25°F between INSITE™ and the temperature probe when the engine is warm or within 5°F when the engine is cold.</p> <p>NOTE: If a temperature measuring device is not available, answer "OK" to this step. Readings need to be checked while engine is operating at the conditions at which the fault occurred.</p>	<p>OK Sensor reading is correct Locate and repair the cause of high fuel temperature. Refer to the Troubleshooting and Repair Manual, ISB Engines, Bulletin No. 3666193.</p>	2A
	<p>NOT OK Replace the VP44 pump Refer to Procedure 005-014 in the Troubleshooting and Repair Manual, ISB Engines, Bulletin No. 3666193.</p>	2A

STEP 2: Clear the fault code.

STEP 2A: Disable the fault code.

Condition: <ul style="list-style-type: none"> • Connect all the components. • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> • Start the engine, and let idle for 1 minute. • Load and operate engine to typical operating temperature (180°F coolant). • Verify Fault Code 261 is inactive. 	OK Fault Code 261 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.

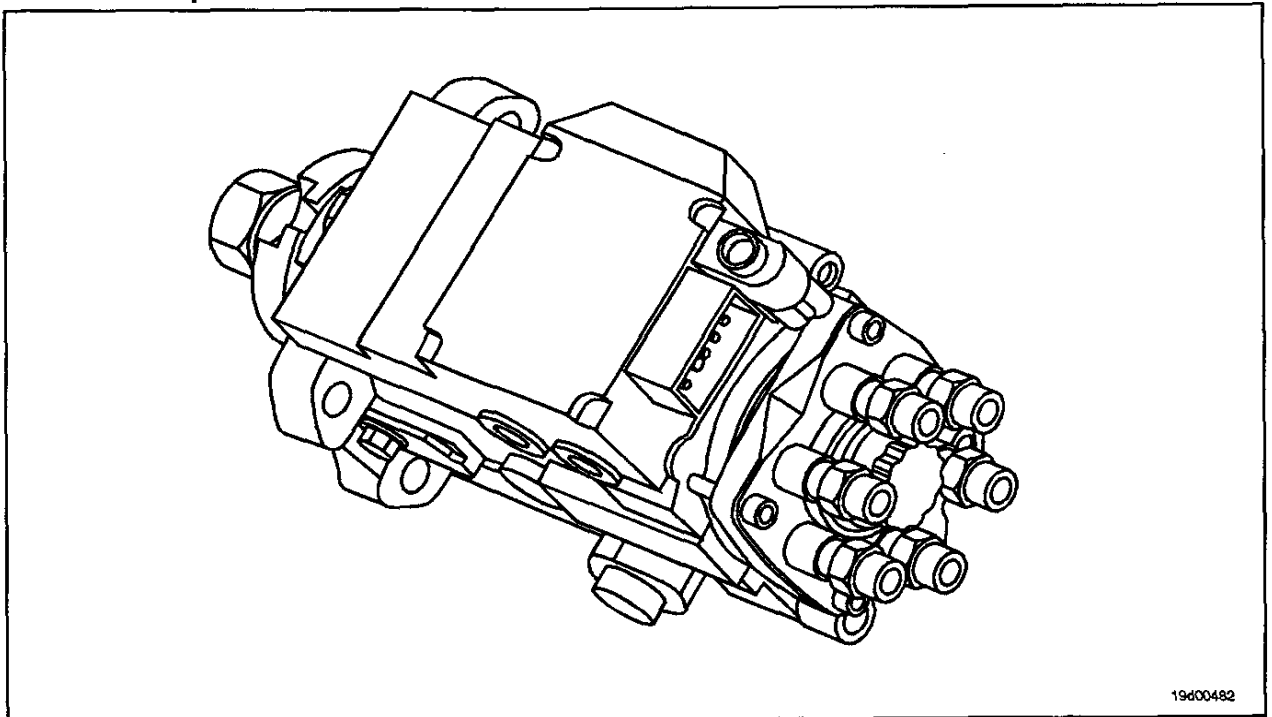
Condition: <ul style="list-style-type: none"> • Connect all the components. • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> • Erase the inactive fault code using INSITE™. 	OK All faults cleared	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting chart

Fault Code 264, 361, 366, 367, 374, 376, or 517

VP44 Internal Failure

CODES	REASON	EFFECT
Fault Code: 264, 361, 366, 367, 374, 376, or 517 PID(P), SID(S): S251, SPN: 174, 1076, 1077, or 1078 FMI: 2, 3, 11, 12, or 7 Lamp: Yellow	Bosch® VP44 internal failure.	Low power, engine power derate, or engine stops.

VP44 Fuel Pump



19d00482

Circuit Description:

These faults are due to a failure internal to the Bosch® VP44 fuel pump and requires Bosch® to service the pump.

Component Location:

The circuit for these fault codes is contained within the Bosch® fuel pump control module (FPCM).

Shop Talk:

The table below relates which actions are taken by the engine ECM or fuel pump control module when each fault code becomes active.

Fault Code	Action Taken By ECM or FPCM		
	No Action	Fueling Derate	Disable Injection
264		X	
361			X
366	X		
367			X
374	X	X	X
376			X
517			X

NOTE: An active pump fault code can result in deactivation of the fuel lift pump by the engine ECM. Correct the active fault codes before replacing the fuel lift pump.

TROUBLESHOOTING SUMMARY

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check fault codes. STEP 1A: Read fault codes.	Fault Code 264, 361, 366, 367, 374, 376, or 517 inactive	
STEP 2: Clear the fault codes. STEP 2A: Disable the fault code. STEP 2B: Clear the inactive fault codes.	Fault Code 264, 361, 366, 367, 374, 376, or 517 inactive All faults cleared	

TROUBLESHOOTING STEP

STEP 1: Check fault codes.
STEP 1A: Read fault codes.

Condition:		
<ul style="list-style-type: none"> Turn the keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Read the fault codes. <ul style="list-style-type: none"> Read the fault codes using INSITE™. 	OK Fault Code 264, 361, 366, 367, 374, 376, or 517 inactive	2A
	NOT OK Replace fuel pump Refer to Procedure 005-014 in the Troubleshooting and Repair Manual, ISB Engines, Bulletin No. 3666193.	2A

STEP 2: Clear the fault code.
STEP 2A: Disable the fault code.

Condition:		
<ul style="list-style-type: none"> Connect all the components. Turn the keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> Start the engine, and let idle for 1 minute. Verify that Fault Codes 264, 361, 366, 367, 374, 376, and 517 are inactive. 	OK Fault Codes 264, 361, 366, 367, 374, 376, and 517 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.

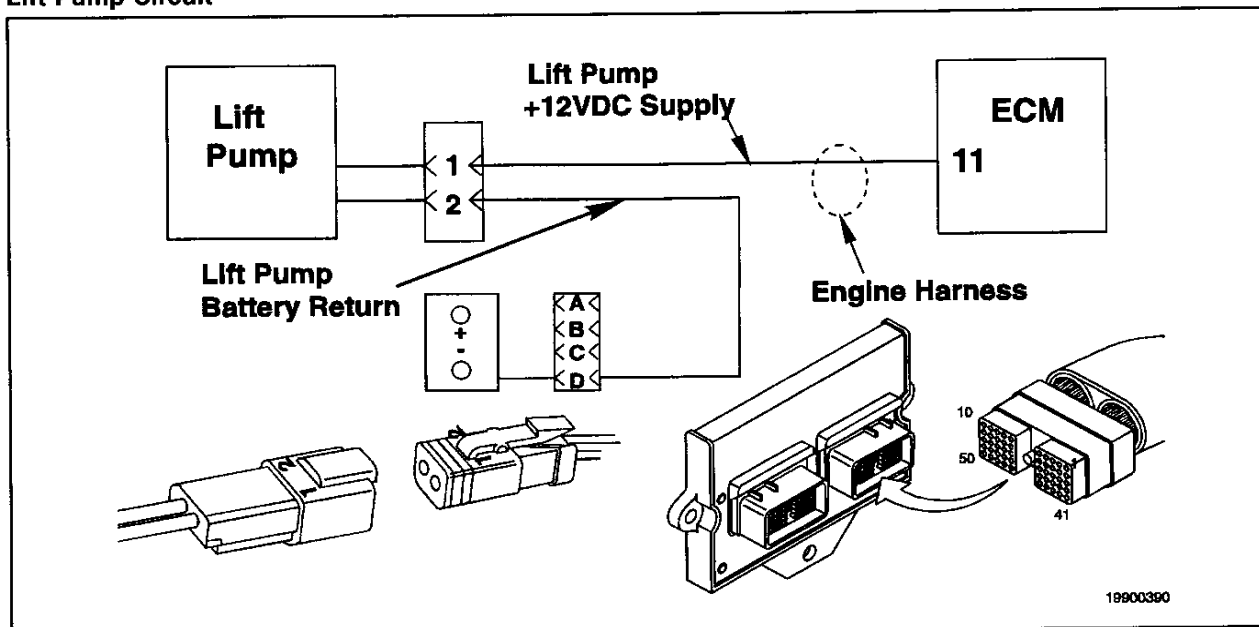
Condition:		
<ul style="list-style-type: none">• Connect all the components.• Turn the keyswitch to the ON position.		
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none">• Erase the inactive fault codes using INSITE™.	OK All faults cleared	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting chart

Fault Code 278

Lift Pump Circuit

CODES	REASON	EFFECT
Fault Code: 278 PID(P), SID(S): P073 SPN: 1075 FMI: 11 Lamp: Yellow	Error detected in lift pump circuit at pin 11 of the engine harness.	The engine possibly loses power, dies, or is difficult to start.

Lift Pump Circuit



Circuit Description:

The electronic control module (ECM) enables the lift pump by sending a signal directly to the lift pump. The ECM fast-duty cycles the lift pump on and off during cranking, and it enables the pump once the engine has started.

Component Location:

The lift pump is mounted to the engine block on the intake side, toward the rear of the engine.

Shop Talk:

- Lift pump is turned on for approximately 5 seconds when the keyswitch is first turned on. With the hood raised, it is possible to hear the lift pump running when the keyswitch is turned on.
- Loose battery connections can sometimes cause this fault code.

TROUBLESHOOTING SUMMARY



To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack/Deutsch test lead.



To avoid damaging a new ECM, all other fault codes must be investigated prior to replacing the ECM.

STEPS	SPECIFICATIONS	SRT CODE
<u>STEP 1:</u> Check the lift pump.		
<u>STEP 1A:</u> Inspect the engine harness and lift pump connectors.	No damaged pins	
<u>STEP 1B:</u> Check resistance of lift pump.	0.1 to 2.0 ohms (+) 12-VDC lift pump 0.1 to 4.0 ohms (+) 24-VDC lift pump	
<u>STEP 1C:</u> Check for a short circuit to ground.	More than 100k ohms	
<u>STEP 2:</u> Check engine harness.		
<u>STEP 2A:</u> Inspect engine harness and ECM connector pins.	No damaged pins	
<u>STEP 2B:</u> Check for an open circuit.	Less than 10 ohms	
<u>STEP 2B-1:</u> Check for an open circuit in OEM harness.	Less than 10 ohms	
<u>STEP 2C:</u> Check for a short circuit to ground.	More than 100k ohms	
<u>STEP 2D:</u> Check for a short circuit from pin to pin.	More than 100k ohms	
<u>STEP 2E:</u> Measure voltage at the lift pump.	(+) 11 to 13 VDC	
<u>STEP 3:</u> Clear the fault codes.		
<u>STEP 3A:</u> Disable the fault code.	Fault Code 278 inactive	
<u>STEP 3B:</u> Clear the inactive fault codes.	All faults cleared	

TROUBLESHOOTING STEP

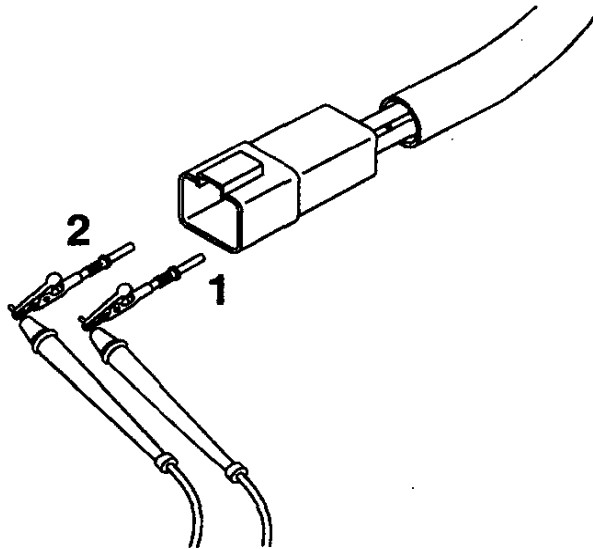
STEP 1: Check the lift pump.

STEP 1A: Inspect the engine harness and lift pump connectors.

Condition:		
<ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the engine harness from the lift pump. 		
Action	Specifications/Repair	Next Step
Inspect the engine harness and lift pump connectors for the following: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	OK No damaged pins	1B
	NOT OK Repair the damaged pins Repair or replace the engine harness or lift pump, whichever has damaged pins. <ul style="list-style-type: none"> • Repair the engine harness. Refer to Procedure 019-202. • Replace the engine harness. Refer to Procedure 019-043. • Repair or replace the lift pump. Refer to Procedure 005-014 in the Troubleshooting and Repair Manual, ISB Engines, Bulletin No. 3666193. 	3A

STEP 1B: Check resistance of the lift pump.

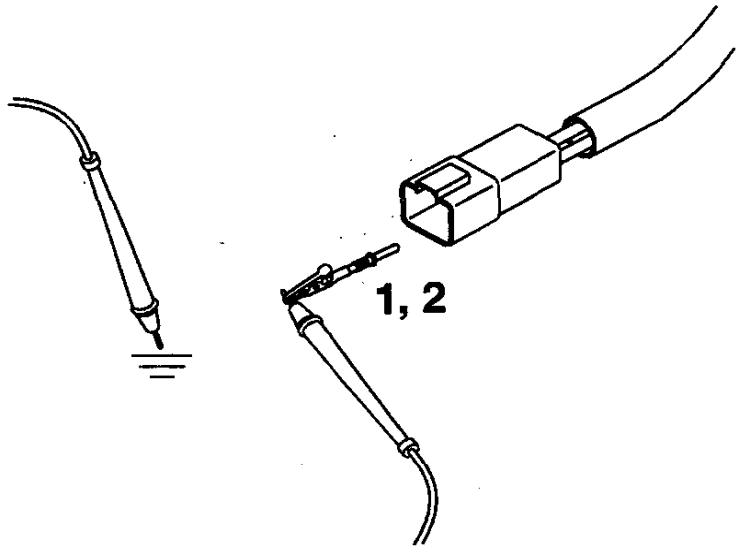
Action	Specifications/Repair	Next Step
<p>Condition:</p> <ul style="list-style-type: none">• Turn keyswitch to the OFF position.• Disconnect the engine harness from the lift pump. <p>Check resistance of lift pump.</p> <ul style="list-style-type: none">• Measure the resistance of the multimeter leads. Make sure this value is subtracted from the lift pump resistance measurement to obtain the true pump resistance.• Measure the resistance from pin 1 to pin 2 of the lift pump harness.	<p>OK 0.1 to 2.0 ohms (+) 12-VDC lift pump 0.1 to 4.0 ohms (+) 24-VDC lift pump</p>	1C
	<p>NOT OK Replace lift pump Refer to Procedure 005-045 in the Troubleshooting and Repair Manual, ISB Engines, Bulletin No. 3666193.</p>	3A



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STEP 1C: Check for a short circuit to ground.

Condition:		
<ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the engine harness from the lift pump. 		
Action	Specifications/Repair	Next Step
Check for a short to ground in the lift pump. • Measure the resistance from pins 1 and 2 of the lift pump connector, pump side, to engine block ground.	OK More than 100k ohms	2A
	NOT OK Replace the lift pump Refer to Procedure 005-045 in the Troubleshooting and Repair Manual, ISB Engines, Bulletin No. 3666193.	3A



19d00715

STEP 2: Check engine harness.

STEP 2A: Inspect engine harness and ECM connectors pins.



To avoid damaging a new ECM, all other fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the ECM.

Action	Specifications/Repair	Next Step
Inspect the engine harness and the ECM connector pins for the following: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	OK No damaged pins	2B
	NOT OK Repair the damaged pins Repair or replace the engine harness or ECM, whichever has damaged pins. <ul style="list-style-type: none"> • 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.

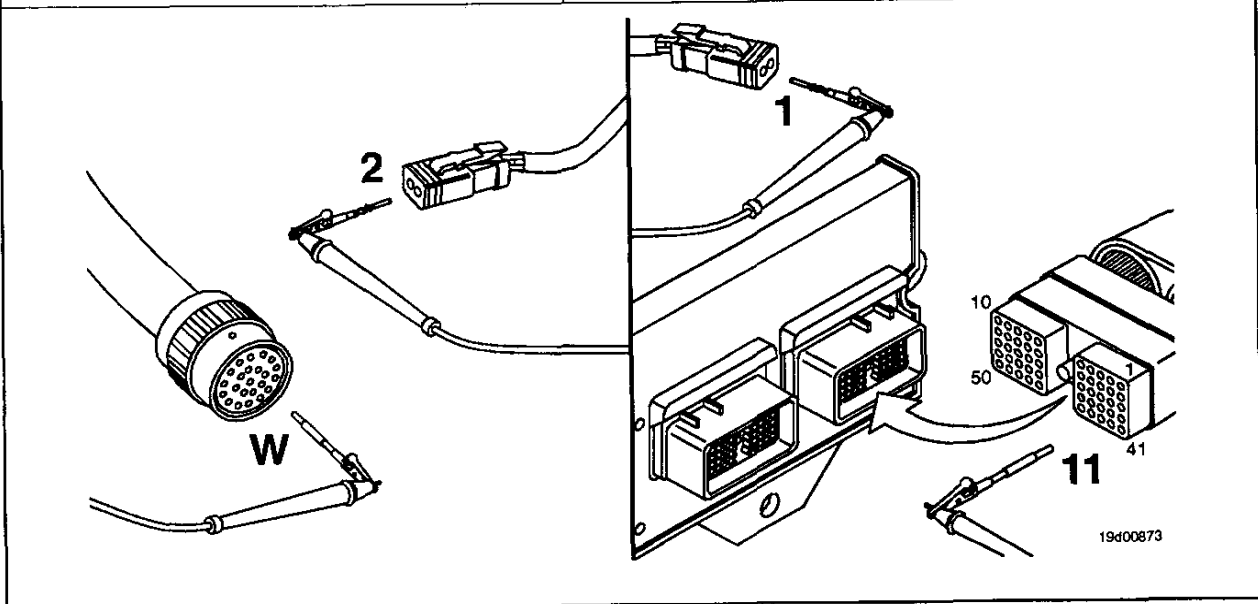
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack/Deutsch test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the ECM.
- Disconnect the lift pump connector from the engine harness.
- Disconnect the OEM harness from the 23-pin connector.

Action	Specifications/Repair	Next Step
Check for an open circuit in the lift pump supply pin.	OK Less than 10 ohms	2B-1
<ul style="list-style-type: none"> • Measure the resistance from pin 2 of the lift pump connector, harness side, and engine to pin W of the 23-pin connector. • Measure the resistance from pin 11 of the engine harness connector to pin 1 of the lift pump connector. 	NOT OK Replace the engine harness Refer to Procedure 019-043.	3A



STEP 2B-1: Check for an open circuit in OEM harness.

Condition:		
<ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the OEM harness from the 23-pin connector. • Disconnect the negative (-) battery terminal from the battery post. 		
Action	Specifications/Repair	Next Step
Check for an open circuit in the OEM harness. <ul style="list-style-type: none"> • Measure resistance from pin W of OEM 23-pin connector to negative (-) battery terminal. 	OK Less than 10 ohms	2C
	NOT OK Replace OEM harness Refer to OEM troubleshooting and repair manual.	3A

STEP 2C: Check for a short circuit to ground.

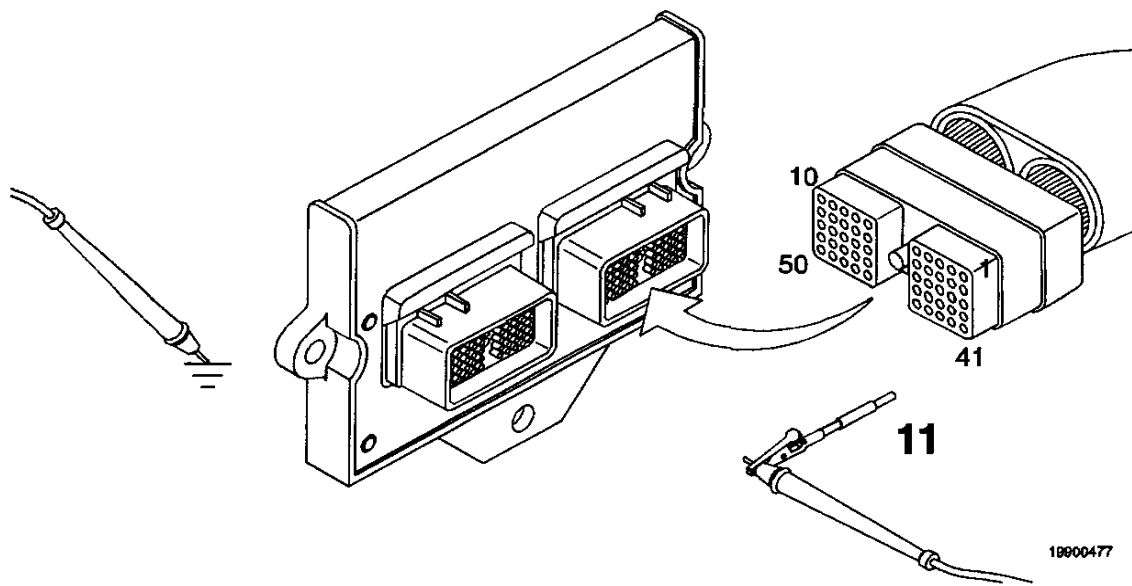


To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack/Deutsch test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the ECM.
- Disconnect the engine harness from the lift pump.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground. <ul style="list-style-type: none"> • Measure resistance from pin 11 of the engine harness to engine block ground 	OK More the 100k ohms	2D
	NOT OK Replace the engine harness Refer to Procedure 019-043.	3A



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STEP 2D: Check for a short from pin to pin.

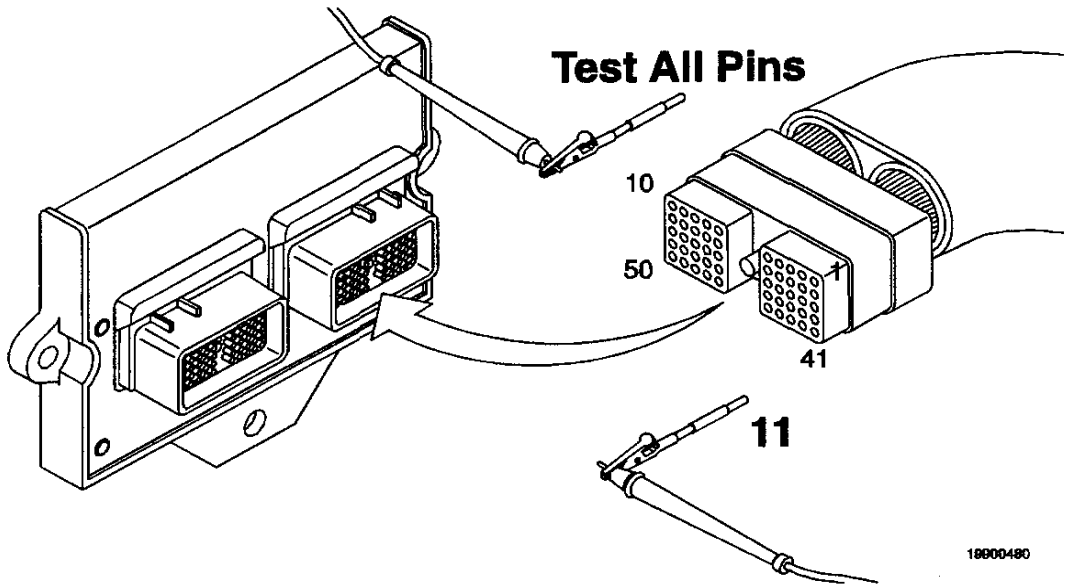
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack/Deutsch test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the ECM.
- Disconnect engine harness from lift pump.

Action	Specifications/Repair	Next Step
Check for short circuit from pin to pin. • Measure the resistance from pin 11 of the engine harness connector to all other pins in the connector.	OK More the 100k ohms	2E
	NOT OK Replace the engine harness Refer to Procedure 019-043.	3A



STEP 2E: Measure voltage at the lift pump.

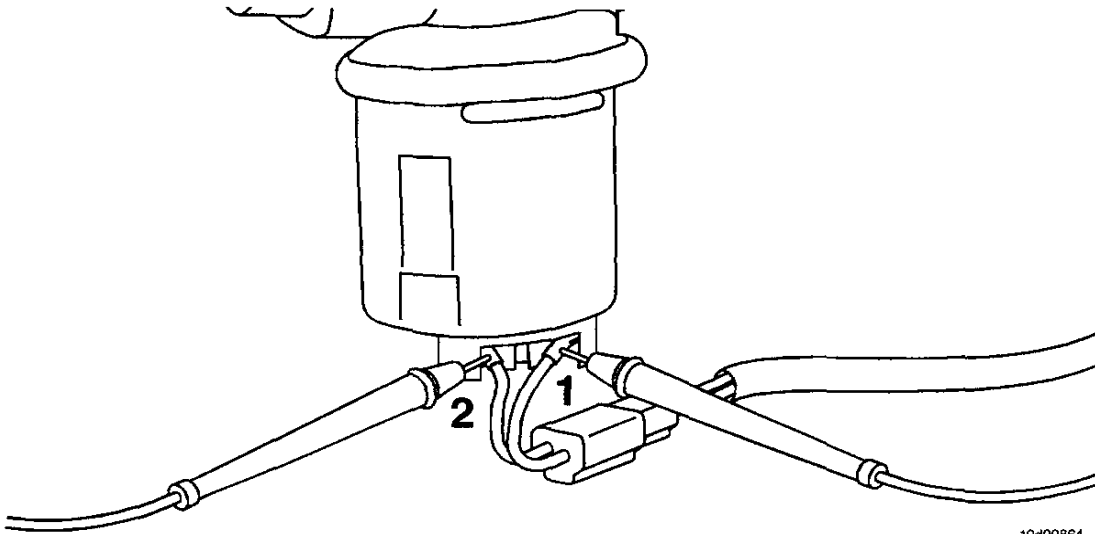
⚠ CAUTION ⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch to the ON position.
- Connect INSITE™, and perform lift pump override test.

Action	Specifications/Repair	Next Step
Measure voltage at the lift pump. • Measure the voltage from the terminals on the underside of the pump with the lift pump connected to the engine harness.	OK (+) 11 to 13 VDC	3A
	NOT OK Replace the ECM Refer to Procedure 019-031.	3A



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STEP 3: Clear the fault codes.

STEP 3A: Disable the fault code.

Condition:

- Connect all the components
- Turn keyswitch to the ON position.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine, and let idle for 1 minute. • Verify Fault Code 278 is inactive.	OK Fault Code 278 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.

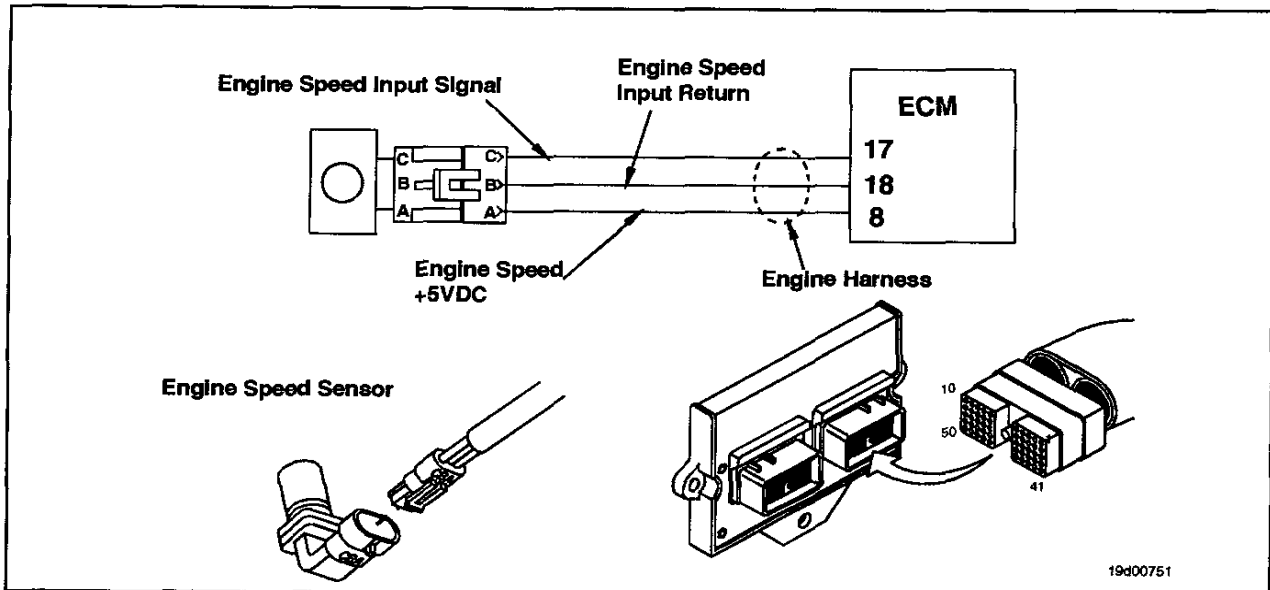
Condition:		
<ul style="list-style-type: none">• Connect all the components.• Turn keyswitch to the ON position.		
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none">• Erase the inactive fault codes using INSITE™.	OK All faults cleared	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting chart

Fault Code 283 or 284

Engine Speed Sensor Supply

CODES	REASON	EFFECT
Fault Code: 283 or 284 PID(P), SID(S): P190 SPN: 190 FMI: 3 or 4 Lamp: Yellow	FC 283: High voltage detected at main engine speed sensor voltage supply pin 8 of the engine harness. FC 284: Low voltage detected at main engine speed sensor voltage supply pin 8 of the engine harness.	The electronic control module (ECM) will use the VP44 pump speed signal as a backup. Possible white smoke, hard start, and power derate.

Engine Speed Sensor



Circuit Description:

The engine speed sensor provides engine speed information to the electronic control module (ECM). The sensor **must** be powered up by +5 VDC to operate. The sensor generates its signals by sensing the movement of target teeth cast into a tone wheel that is mounted to the crankshaft. The tone wheel has 35 teeth and a gap where the 36th tooth would be placed. This missing tooth indicates that cylinder No. 1 (and No. 6) is at top dead center.

Component Location:

The engine speed sensor is located on the intake side of the engine block, at crankshaft level, between cylinders No. 4 and No. 5.

TROUBLESHOOTING SUMMARY



To avoid damaging a new ECM, all other fault codes must be investigated prior to replacing the ECM.



To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack/Deutsch test lead.

STEPS

STEP 1: Check the engine speed sensor.

STEP 1A: Inspect the sensor connector pins.

STEP 1B: Check for an internal short circuit to ground.

STEP 2: Check the engine harness.

STEP 2A: Inspect the engine harness and ECM connector pins.

STEP 2B: Check for a short circuit to ground.

STEP 2C: Check for a short circuit from pin to pin.

STEP 2D: Check sensor supply voltage.

STEP 3: Clear the fault codes.

STEP 3A: Disable the fault code.

STEP 3B: Clear the inactive fault codes.

SPECIFICATIONS

No damaged pins

Fault Code 283 or 284 still active

No damaged pins

More than 100k ohms

More than 100k ohms

(+) 4.75 to 5.25 VDC

Fault Codes 283 and 284 inactive

All faults cleared

SRT CODE

TROUBLESHOOTING STEP

STEP 1: Check the engine speed sensor.

STEP 1A: Inspect the engine speed sensor connector pins.



To avoid damaging a new ECM, all other codes must be investigated prior to replacing the ECM.

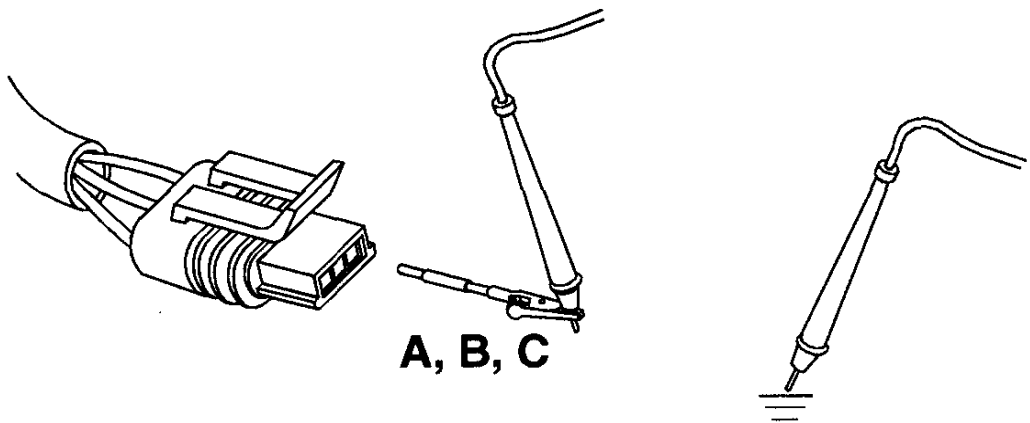
Condition:

- Turn keyswitch to the OFF position.
- Disconnect the harness from the engine speed sensor.

Action	Specifications/Repair	Next Step
Inspect the engine speed sensor connector for: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	OK No damaged pins	1B
	NOT OK Repair the damaged pins Repair or replace the engine harness or the engine speed sensor, whichever has the damaged pins. <ul style="list-style-type: none"> • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the engine speed sensor. Refer to Procedure 019-042. 	3A

STEP 1B: Check for an internal short circuit to ground.

Action	Specifications/Repair	Next Step
Check for an internal short circuit to ground.	OK Fault Codes 283 or Fault Code 284 still active	2A
	NOT OK Replace the engine speed sensor Refer to Procedure 019-042.	3A



The diagram illustrates the testing procedure. On the left, a multi-pin connector is shown with three wires extending from it. A probe is shown testing the wires at points labeled 'A, B, C'. On the right, a probe is shown testing a ground symbol, which consists of three horizontal lines of decreasing length.

STEP 2: Check the engine harness.

STEP 2A: Inspect the engine harness and ECM connectors pins.

⚠ CAUTION ⚠

To avoid damaging a new ECM, all other fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect engine harness from the ECM.

Action	Specifications/Repair	Next Step
Inspect the engine harness and ECM connectors for the following: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	OK No damaged pins	2B
	NOT OK Repair the damaged pins Repair or replace the engine harness or ECM, whichever has the damaged pins. <ul style="list-style-type: none"> • 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 a short circuit to ground.

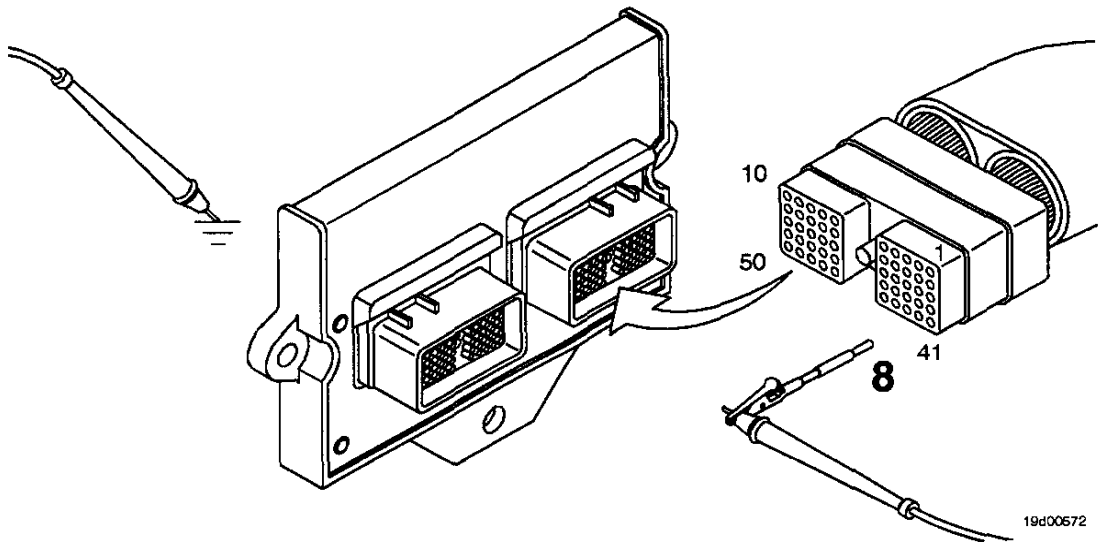
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack/Deutsch test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the ECM.
- Disconnect the engine speed/position sensor.

Action	Specifications/Repair	Next Step
Check for short circuit to ground. • Measure the resistance from pin 8 of the engine harness connector to engine block ground.	OK More than 100k ohms	2C
	NOT OK Replace the engine harness Refer to Procedure 019-043.	3A



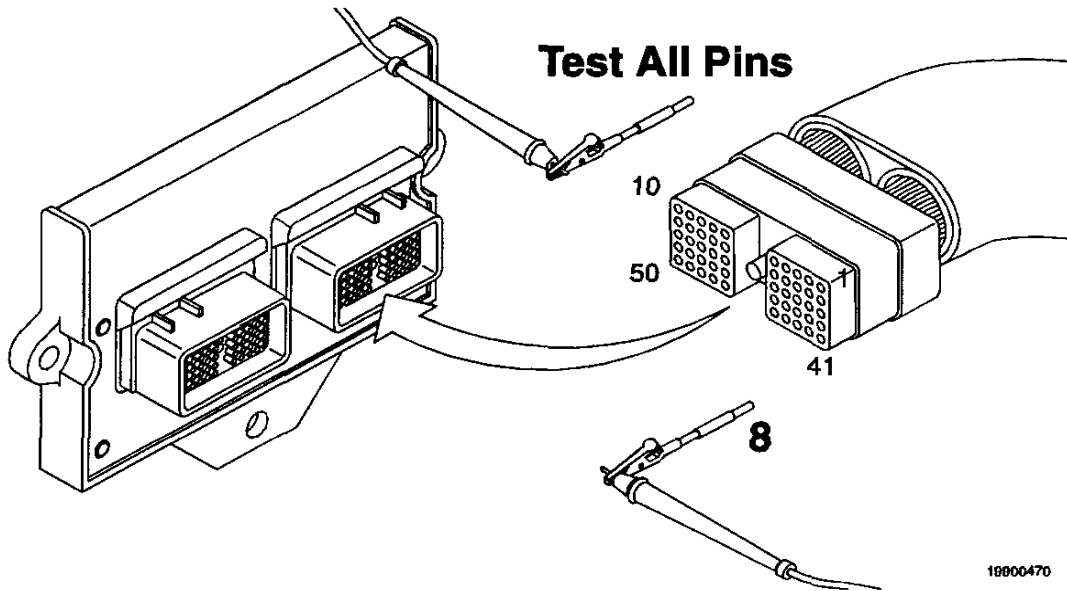
STEP 2C: Check for a short circuit from pin to pin.

Condition:

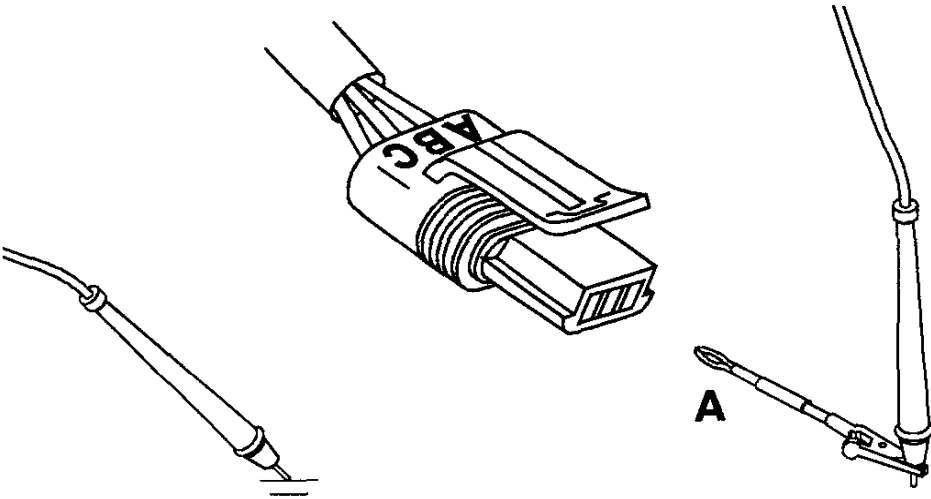
- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the ECM.
- Disconnect the engine speed/position sensor.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pin 8 to all other pins on the harness side of the engine harness connector.	OK More than 100k ohms	2D
	NOT OK Replace the engine harness Refer to Procedure 019-043.	3A

Test All Pins



STEP 2D: Check sensor supply voltage.

Condition: <ul style="list-style-type: none"> • Turn keyswitch to the ON position. • Disconnect the speed sensor. 		
Action	Specifications/Repair	Next Step
Check sensor supply voltage. <ul style="list-style-type: none"> • Measure voltage from pin A on the harness side of the engine speed sensor connector to engine block ground. 	OK (+) 4.75 to 5.25 VDC	3A
	NOT OK Replace the ECM Refer to Procedure 019-031.	3A
		
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STEP 3: Clear the fault codes.
STEP 3A: Disable the fault code.

Condition: <ul style="list-style-type: none"> • Connect all components • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> • Start the engine, and let it idle for 1 minute. • Verify that Fault Codes 283 and 284 are inactive. 	OK Fault Codes 283 and 284 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.

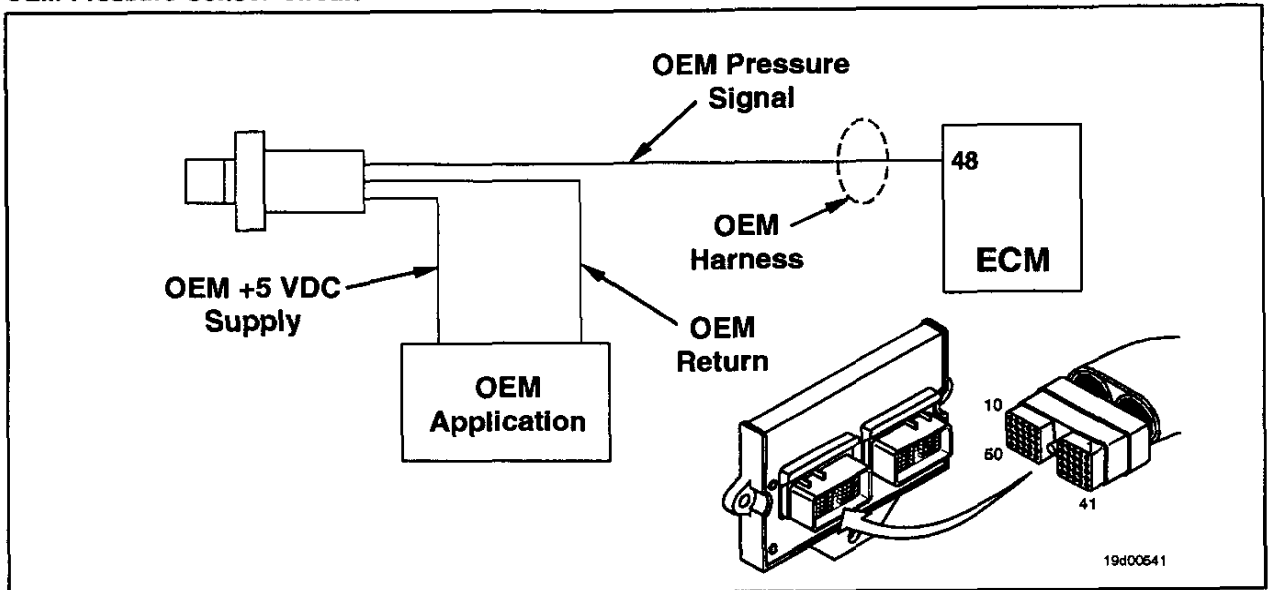
Condition:		
<ul style="list-style-type: none">• Connect all components• Keyswitch in the ON position.		
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none">• Erase the inactive fault codes using INSITE™.	OK All faults cleared	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting chart

Fault Code 297

OEM Pressure Sensor Circuit

CODES	REASON	EFFECT
Fault Code: 297 PID(P), SID(S): P223 SPN: 1084 FMI: 3 Lamp: Yellow	High voltage detected at the original equipment manufacturer's (OEM) pressure sensor signal.	Default value used for OEM pressure.

OEM Pressure Sensor Circuit



Circuit Description:

The OEM sensor signal is used by the electronic control module (ECM) to monitor the OEM pressure. The OEM pressure is used by the ECM in one of two ways:

1. The ECM can shut down the engine based on an OEM pressure input value exceeding or falling below a customer-specified value.
 2. The ECM can control a device (dual-output driver A and driver B) based on the value of the OEM pressure.
- A sensor that has failed high can be caused by an open circuit in the signal or return wire, voltage shorts in the signal or return wire, or a faulty sensor.

Component Location:

The location varies with the OEM. Refer to the OEM manual.

Shop Talk:

The sensor voltage signal is the responsibility of the OEM. Refer to the OEM manual for specifications.

TROUBLESHOOTING SUMMARY



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 OEM pressure sensor.		
STEP 1A: <i>Inspect the OEM harness and the sensor connector pins.</i>	No damaged pins	
STEP 1B: Check the voltage of the OEM pressure sensor.	Proper voltage	
STEP 2: Check the OEM harness.		
STEP 2A: <i>Inspect the OEM harness connector pins.</i>	No damaged pins	
STEP 2B: Read the fault codes.	Fault Code 297 active	
STEP 2C: Check for an open circuit in the signal wire.	Less than 10 ohms	
STEP 2D: Check for a short circuit from the signal wire to all other pins.	More than 100k ohms	
STEP 3: Check the ECM.		
STEP 3A: Check for appropriate ECM response.	Fault Code 297 inactive Fault Code 298 active	
STEP 4: Clear the fault codes.		
STEP 4A: Disable the fault code.	Fault Code 297 inactive	
STEP 4B: Clear the inactive fault codes.	All fault codes cleared	

TROUBLESHOOTING STEP

STEP 1: Check the OEM pressure sensor.

STEP 1A: Inspect the OEM harness and sensor connector pins.

Condition:		
<ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the OEM harness from the OEM pressure sensor. 		
Action	Specifications/Repair	Next Step
Inspect the OEM harness and sensor connector pins for the following: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • 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 the OEM pressure sensor. <ul style="list-style-type: none"> • Repair the OEM harness. Refer to Procedure 019-203. • Replace the OEM harness. Refer to Procedure 019-071. • Repair or replace the OEM pressure sensor. Refer to the OEM manual for procedure. • Dry the connector using electrical contact cleaner, Part No. 3824510. • Flush the dirt, debris, or moisture from the connector pins using electronic contact cleaner. 	4A

STEP 1B: Check the voltage of the OEM pressure sensor.

Condition:		
<ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the OEM harness from the OEM pressure sensor. 		
Action	Specifications/Repair	Next Step
Check the voltage of the OEM pressure sensor.	OK Refer to the OEM troubleshooting and repair manual NOTE: Typical good voltages range from (+) 0.5 to 4.5 VDC.	2A
	NOT OK Replace the OEM pressure sensor, or repair OEM pressure sensor voltage source/wiring Refer to the OEM troubleshooting and repair manual for procedure.	4A

STEP 2: Check the OEM harness.

STEP 2A: Inspect the OEM harness and connector pins.

⚠ CAUTION ⚠		
<p>To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.</p>		
<p>Condition:</p> <ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the OEM harness from the OEM pressure sensor. • Disconnect the OEM harness from the ECM. 		
Action	Specifications/Repair	Next Step
Inspect the OEM harness and connector pins for the following: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Dirt or debris in or on the connector pins. 	<p>OK No damaged pins</p>	2B
	<p>NOT OK Repair the damaged pins Repair or replace the OEM harness.</p> <ul style="list-style-type: none"> • Repair the OEM harness. Refer to Procedure 019-250. • Replace the OEM harness. Refer to Procedure 019-071. • Dry the connector using electrical contact cleaner, Part No. 3824510. • Flush the dirt, debris, or moisture from the connector pins using electronic contact cleaner. 	4A

STEP 2B: Read the fault codes.

<p>Condition:</p> <ul style="list-style-type: none"> • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Read the fault codes. <ul style="list-style-type: none"> • Read the fault codes using INSITE™. 	<p>OK Fault Code 297 active</p>	2C
	<p>NOT OK Repair complete</p>	4B

STEP 2C: Check for an open circuit in the signal wire.

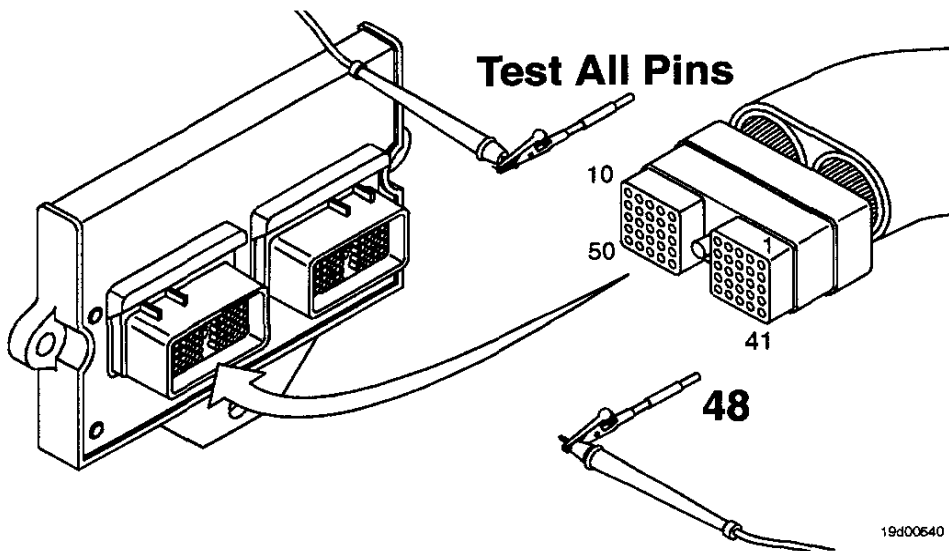
<p>Condition:</p> <ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the OEM harness from the OEM pressure sensor. • Disconnect the OEM harness from the ECM. 		
Action	Specifications/Repair	Next Step
Check for an open circuit in the signal wire. <ul style="list-style-type: none"> • Measure the resistance from pin 48 of the OEM harness connector to the appropriate pin of the OEM pressure sensor connector. 	<p>OK Less than 10 ohms</p>	2D
	<p>NOT OK Replace the OEM harness Refer to Procedure 019-071.</p>	4A

STEP 2D: Check for a short circuit from the signal wire to all other pins.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the OEM pressure sensor.
- Disconnect the OEM harness from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit from the signal wire to all other pins.	OK More than 100k ohms	3A
<ul style="list-style-type: none"> • Measure the resistance from pin 48 of the OEM harness connector to all other pins in the OEM harness connector. 	NOT OK Replace the OEM harness Refer to Procedure 019-071.	4A



STEP 3: Check the ECM.

STEP 3A: Check for appropriate ECM response.

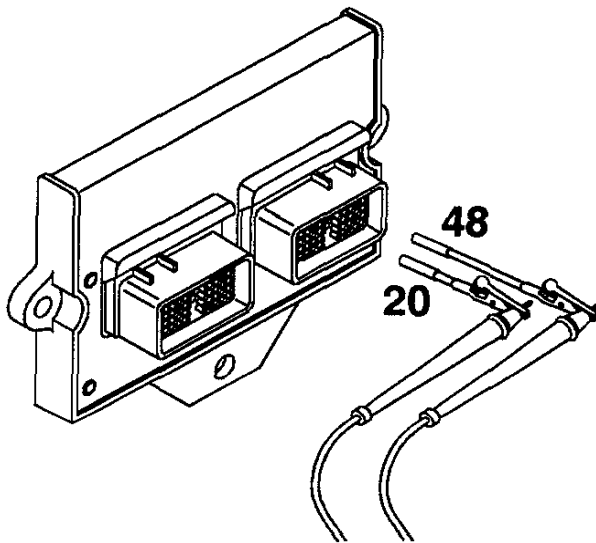
⚠ CAUTION ⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the ECM.

Action	Specifications/Repair	Next Step
Check for appropriate ECM response. <ul style="list-style-type: none"> • Install a jumper wire between pins 48 and 20 of the OEM side of the ECM. • Turn the keyswitch to the ON position. • Read the fault codes using INSITE™. 	OK Fault Code 297 inactive Fault Code 298 active	4A
	NOT OK Replace the ECM Refer to Procedure 019-031.	4A



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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. <ul style="list-style-type: none"> • Start the engine, and let it idle for 1 minute. • Verify that Fault Code 297 is inactive. 	OK Fault Code 297 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 inactive fault codes.

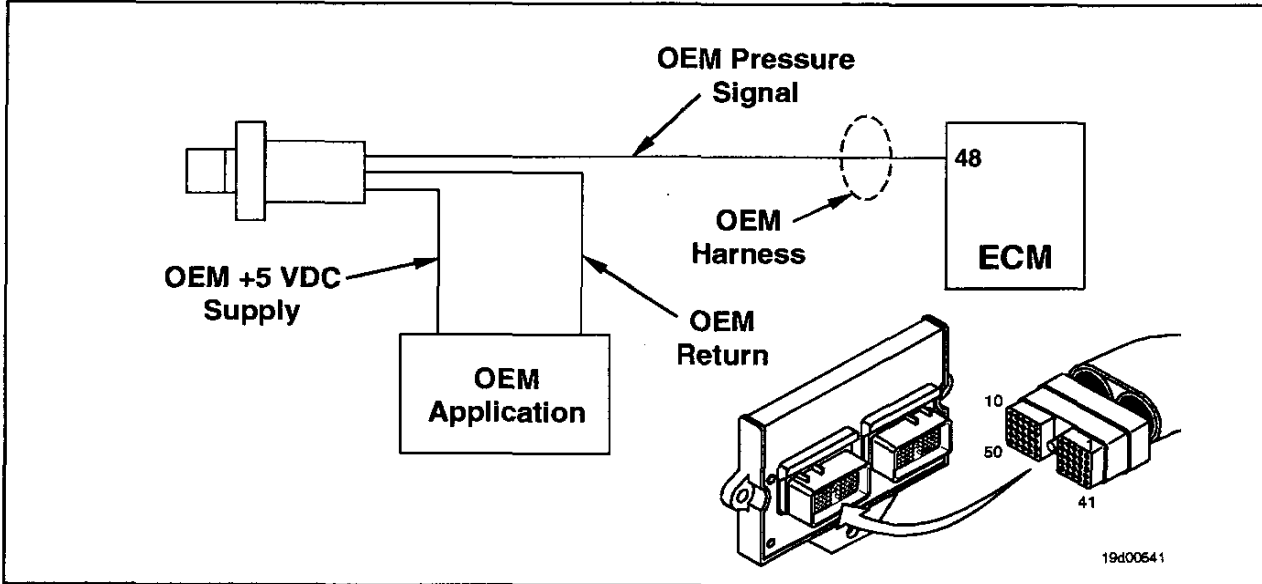
Condition:		
• Connect all components.		
Action	Specifications/Repair	Next Step
Clear inactive fault codes. • Erase the inactive fault codes using INSITE™.	OK All faults cleared	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting chart

Fault Code 298

OEM Pressure Sensor Circuit

CODES	REASON	EFFECT
Fault Code: 298 PID(P), SID(S): P223 SPN: 1084 FMI: 4 Lamp: Yellow	Low voltage detected at the original equipment manufacturer's (OEM) pressure sensor signal.	Default value used for OEM pressure.

OEM Pressure Sensor Circuit



Circuit Description:

The OEM sensor signal is used by the electronic control module (ECM) to monitor the OEM pressure. The OEM pressure is used by the ECM in one of two ways:

1. The ECM can shut down the engine based on an OEM pressure input value exceeding or falling below a customer-specified value.
 2. The ECM can control a device (dual-output driver A and driver B) based on the value of the OEM pressure.
- A sensor that has failed low can be caused by shorts to ground on the signal wire or an internally grounded (faulty) sensor.

Component Location:

The location varies with the OEM. Refer to the OEM manual.

Shop Talk:

The resistance of all pressure sensors varies with the pressure. Refer to the OEM troubleshooting and repair manual for specifications.

TROUBLESHOOTING SUMMARY



To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

STEPS	SPECIFICATIONS	SRT CODE
<u>STEP 1:</u> Check the OEM pressure sensor.		
<u>STEP 1A:</u> Inspect the OEM harness and the sensor connector pins.	No damaged pins	
<u>STEP 1B:</u> Check the voltage of the OEM pressure sensor.	Proper voltage	
<u>STEP 2:</u> Check the OEM harness.		
<u>STEP 2A:</u> Inspect the OEM harness connector pins.	No damaged pins	
<u>STEP 2B:</u> Read the fault codes.	Fault Code 298 active	
<u>STEP 2C:</u> Check for an open circuit in the OEM harness.	Less than 10 ohms	
<u>STEP 2D:</u> Check for a short circuit from the signal pin to all other pins.	More than 100k ohms	
<u>STEP 2E:</u> Check for a short circuit to ground in the signal wire.	More than 100k ohms	
<u>STEP 3:</u> Check the ECM.		
<u>STEP 3A:</u> Check for appropriate ECM response.	Fault Code 298 inactive Fault Code 297 active	
<u>STEP 4:</u> Clear the fault codes.		
<u>STEP 4A:</u> Disable the fault code.	Fault Code 298 inactive	
<u>STEP 4B:</u> Clear the inactive fault codes.	All fault codes cleared	

TROUBLESHOOTING STEP

STEP 1: Check the OEM pressure sensor.

STEP 1A: Inspect the OEM harness and sensor connector pins.

Condition:		
<ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the OEM harness from the OEM pressure sensor. 		
Action	Specifications/Repair	Next Step
Inspect the OEM harness and sensor connector pins for the following: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • 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 the OEM pressure sensor. <ul style="list-style-type: none"> • Repair the OEM harness. Refer to Procedure 019-203. • Replace the OEM harness. Refer to Procedure 019-071. • Repair or replace the OEM pressure sensor. Refer to the OEM troubleshooting and repair manual for procedure. • Dry the connector using electrical contact cleaner, Part No. 3824510. • Flush the dirt, debris, or moisture from the connector pins using electronic contact cleaner. 	4A

STEP 1B: Check the resistance of the OEM pressure sensor.

Condition:		
<ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the OEM harness from the OEM pressure sensor. 		
Action	Specifications/Repair	Next Step
Check the resistance of the OEM pressure sensor.	OK Refer to the OEM manual NOTE: Typical good voltages range from (+) 0.5 to 4.5 VDC.	2A
	NOT OK Replace the OEM pressure sensor, or repair OEM pressure sensor voltage source/wiring Refer to the OEM troubleshooting and repair manual for procedure.	4A

STEP 2: Check the OEM harness.

STEP 2A: Inspect the OEM harness and OEM harness connector pins.

Condition: <ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the OEM harness from the OEM pressure sensor. • Disconnect the OEM harness from the ECM. 		
Action	Specifications/Repair	Next Step
Inspect the OEM harness and OEM harness connector pins for the following: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • 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. <ul style="list-style-type: none"> • Repair the OEM harness. Refer to Procedure 019-250. • Replace the OEM harness. Refer to Procedure 019-071. • Dry the connector using electrical contact cleaner, Part No. 3824510. • Flush the dirt, debris, or moisture from the connector pins using electronic contact cleaner. 	4A

STEP 2B: Read the fault codes.

Condition: <ul style="list-style-type: none"> • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Read the fault codes. <ul style="list-style-type: none"> • Read the fault codes using INSITE™. 	OK Fault Code 298 active	2C
	NOT OK Repair complete	4B

STEP 2C: Check for an open circuit in the OEM harness.

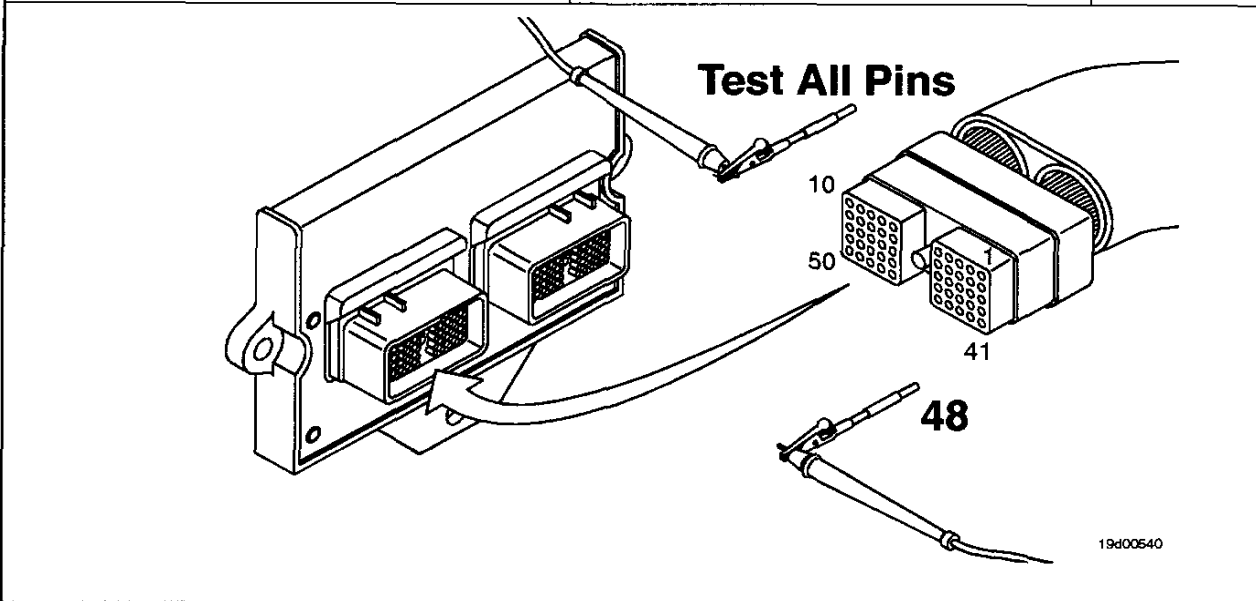
Condition: <ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the OEM harness from the ECM. • Disconnect the OEM harness from the OEM pressure sensor. 		
Action	Specifications/Repair	Next Step
Check for an open circuit in the OEM harness. <ul style="list-style-type: none"> • Measure the resistance from pin 48 of the OEM harness connector to the appropriate pin of the OEM pressure sensor connector. 	OK Less than 10 ohms	2D
	NOT OK Replace the OEM harness Refer to Procedure 019-071.	4A

STEP 2D: Check for a short circuit from the signal pin to all other pins.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the ECM.
- Disconnect the OEM harness from the OEM pressure sensor.

Action	Specifications/Repair	Next Step
Check for a short circuit from the signal pin to all other pins. • Measure the resistance from pin 48 of the OEM harness connector to all other pins in the connector.	OK More than 100k ohms	2E
	NOT OK Replace the OEM harness Refer to Procedure 019-071.	4A

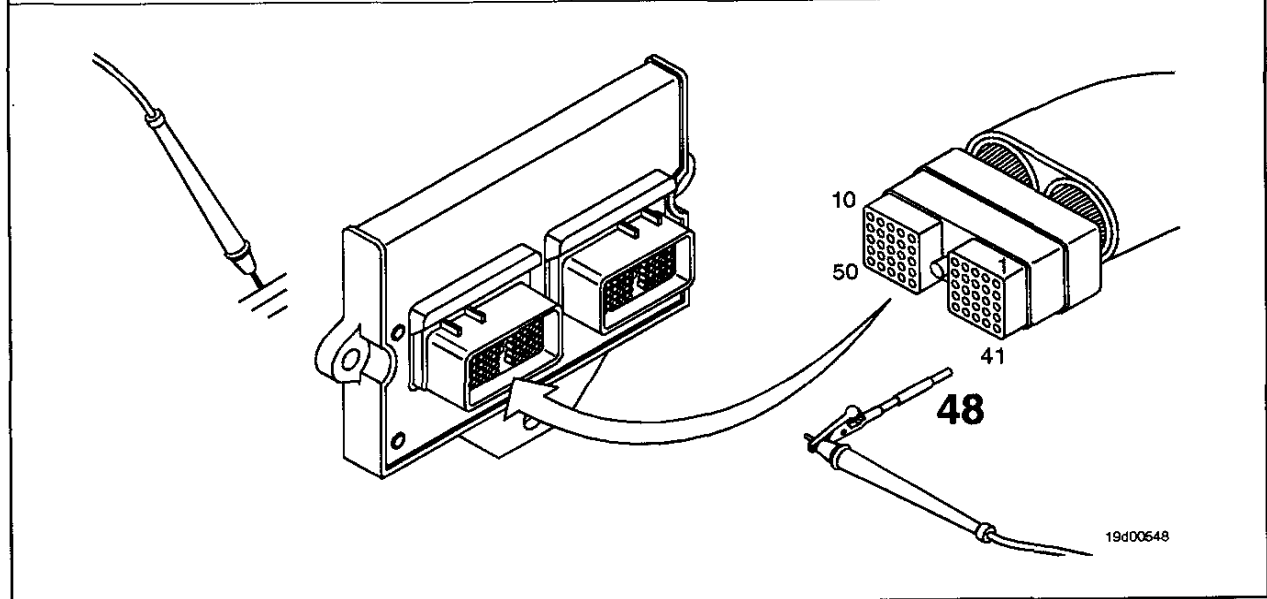


STEP 2E: Check for a short circuit to ground in the signal wire.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the ECM.
- Disconnect the OEM harness from the OEM pressure sensor.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground in the signal wire. • Measure the resistance from pin 48 of the OEM harness connector to engine block ground.	OK More than 100k ohms	3A
	NOT OK Replace the OEM harness Refer to Procedure 019-071.	4A



STEP 3: Check the ECM.

STEP 3A: Check for appropriate ECM response.

⚠ CAUTION ⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch to the OFF position.

Action	Specifications/Repair	Next Step
Check for appropriate ECM response. • Disconnect the OEM interface harness from the ECM. • Turn the keyswitch to the ON position. • Read the fault codes using INSITE™.	OK Fault Code 298 inactive Fault Code 297 active	4A
	NOT OK 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 298 is inactive.	OK Fault Code 298 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 inactive fault codes.

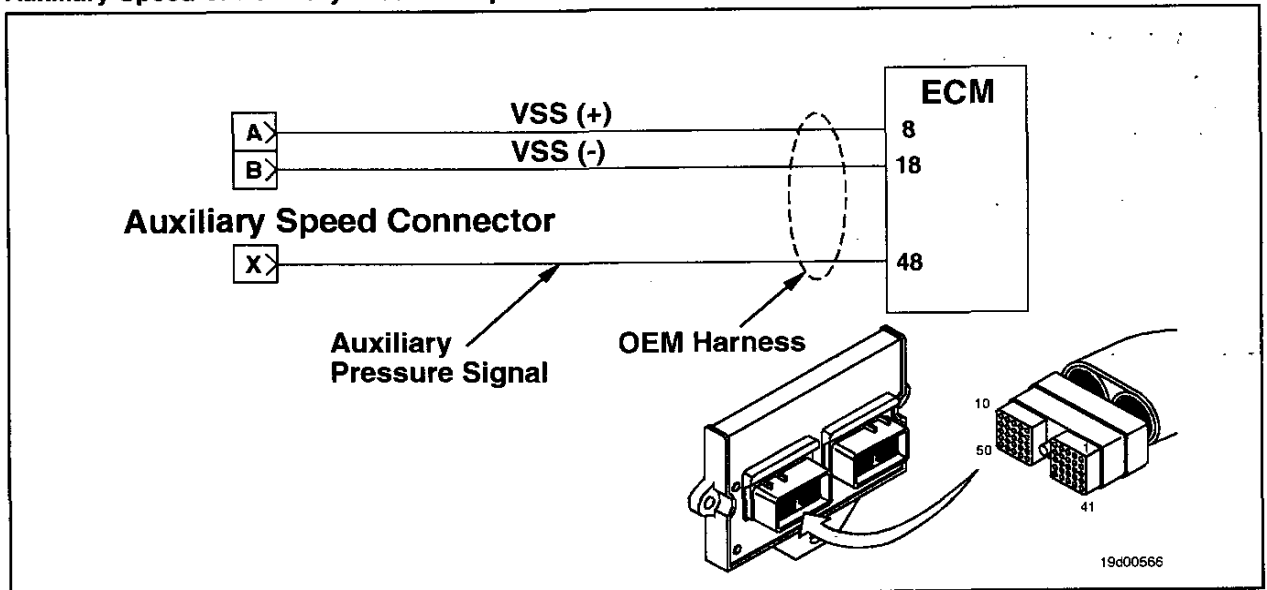
Condition: • Connect all components.		
Action	Specifications/Repair	Next Step
Clear inactive fault codes. • Erase the inactive fault codes using INSITE™.	OK All faults cleared	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting chart

Fault Code 349

Auxiliary Speed or Auxiliary Pressure Input Error

CODES	REASON	EFFECT
Fault Code: 349 PID(P), SID(S): P191 SPN: 191 FMI: 0 Lamp: Yellow	The auxiliary speed or auxiliary pressure indicates the frequency is above a calibrated threshold value.	Engine will go to idle and lose ability to control the speed of the auxiliary device.

Auxiliary Speed or Auxiliary Pressure Input Circuit



Circuit Description:

The auxiliary speed input is a frequency signal from an auxiliary speed or pressure pickup. It is sent to the electronic control module (ECM) and is used to control the engine speed. Auxiliary reference speed is based on the throttle position.

Component Location:

The auxiliary speed or pressure pickup device location is dependent on the original equipment manufacturer's (OEM) application. Refer to OEM troubleshooting and repair manual for component location.

Shop Talk:

The auxiliary speed governor controls engine speed based on a measured auxiliary speed or pressure. The auxiliary speed governor feature **must** be enabled in the calibration and set properly for speed or pressure, depending on the OEM application.

TROUBLESHOOTING SUMMARY



To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3823996 - female Metri-Pack test lead.



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 for fault codes.		
STEP 1A: Read fault codes.	No other fault codes active	
STEP 2: Check the auxiliary device for proper function.		
STEP 2A: Refer to the OEM troubleshooting and repair manual for troubleshooting the auxiliary device overspeed.	Auxiliary device functioning properly	
STEP 3: Check the auxiliary speed sensor.		
STEP 3A: Inspect the OEM harness and the sensor connectors.	No damaged pins	
STEP 3B: Check for proper adjustment (if adjustable).	1/2 to 3/4 turn out from gear for threaded type of sensor	
STEP 3C: Check for the correct sensor resistance.	750 to 1500 ohms	
STEP 3D: Check for a short circuit to ground.	More than 100k ohms	
STEP 3E: Check for a short circuit between coils (if two coils exist).	More than 100k ohms	
STEP 4: Check the auxiliary pressure sensor.		
STEP 4A: Inspect pins.	No bent pins	
STEP 4B: Measure voltage to the ECM.	(+) 0.5 to 4.5 VDC	
STEP 5: Check the OEM harness.		
STEP 5A: Inspect the OEM harness and the ECM connectors.	No damaged pins	
STEP 5B: Check for an open circuit.	Less than 10 ohms	
STEP 5C: Check for a short circuit to ground.	More than 100k ohms	
STEP 5D: Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 6: Clear the fault codes.		
STEP 6A: Disable the fault code.	Fault Code 147 inactive	
STEP 6B: Clear the inactive fault codes.	All faults cleared	

TROUBLESHOOTING STEP

STEP 1: Check for faults codes.
STEP 1A: Read the fault codes.

Condition:		
<ul style="list-style-type: none"> • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Read the fault codes. <ul style="list-style-type: none"> • Read the fault codes using INSITE™. 	OK No other active fault codes	2A
	NOT OK Troubleshoot other fault codes first.	Appropriate fault tree

STEP 2: Check the auxiliary device for proper function.

STEP 2A: Refer to the OEM troubleshooting and repair manual for troubleshooting the auxiliary device overspeed.

Condition:		
Action	Specifications/Repair	Next Step
Refer to the OEM troubleshooting and repair manual. <ul style="list-style-type: none"> • Refer to the OEM troubleshooting and repair manual for proper function of the auxiliary device. • Check for slipping clutches or broken drive-line components. • Measure OEM pressure to verify proper OEM equipment function. 	OK Auxillary device functioning properly	3A for auxiliary speed applications; 4A for auxiliary pressure applications
	NOT OK Repair the auxiliary device Refer to the OEM troubleshooting and repair manual.	6A

STEP 3: Check the auxiliary speed sensor.

STEP 3A: Inspect the OEM harness and the sensor connectors.

Condition: <ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the OEM harness from the auxiliary speed sensor. 		
Action	Specifications/Repair	Next Step
Inspect the OEM harness and the sensor connectors for the following: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	OK No damaged pins	3B
	NOT OK Repair the damaged pins Repair or replace the OEM harness or sensor, whichever has the damaged pins. <ul style="list-style-type: none"> • Repair the OEM harness. Refer to Procedure 019-202. • Replace the OEM harness. Refer to Procedure 019-071. • Replace the auxiliary speed sensor. Refer to the OEM troubleshooting and repair manual. 	6A

STEP 3B: Check the auxiliary speed sensor for the proper adjustment (if adjustable).

Condition: <ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the OEM harness from the auxiliary speed sensor. 		
Action	Specifications/Repair	Next Step
Check the auxiliary speed sensor for the proper adjustment (if adjustable).	OK 1/2 to 3/4 of a turn out from the gear	3C
	NOT OK Adjust the auxiliary speed sensor Refer to the OEM troubleshooting and repair manual.	6A

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STEP 3C: Check for the correct sensor resistance.

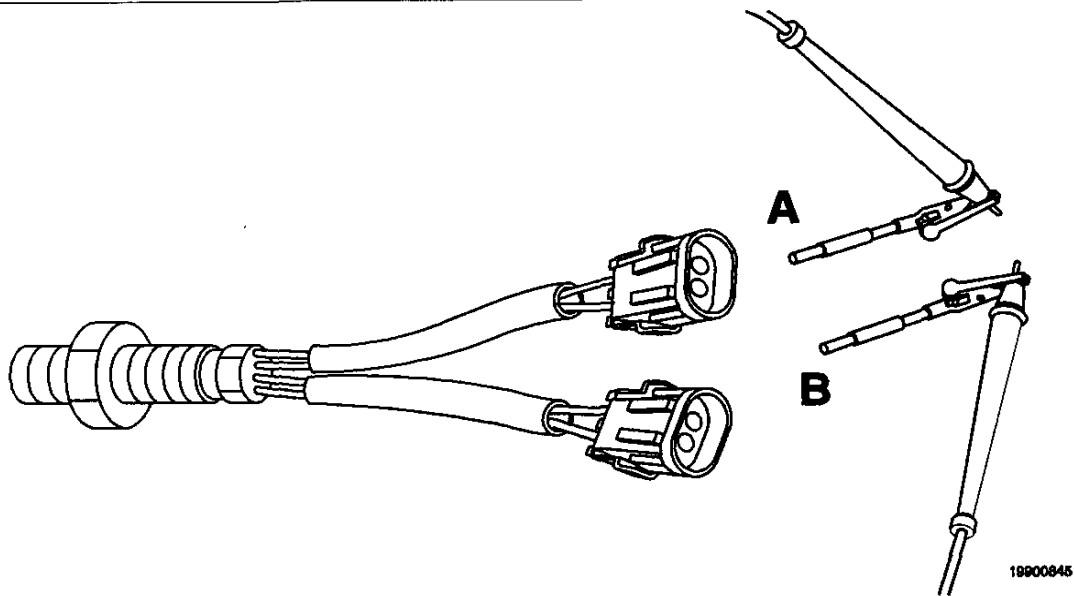
⚠ CAUTION ⚠

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 to the OFF position.
- Disconnect the OEM harness from the auxiliary speed sensor.

Action	Specifications/Repair	Next Step
Check the auxiliary speed sensor for the correct resistance. • Measure the resistance from pin A to pin B for each auxiliary speed sensor connector on the sensor side.	OK 750 to 1500 ohms	3D
	NOT OK Replace the auxiliary speed sensor Refer to the OEM troubleshooting and repair manual.	6A



STEP 3D: Check for a short circuit to ground.

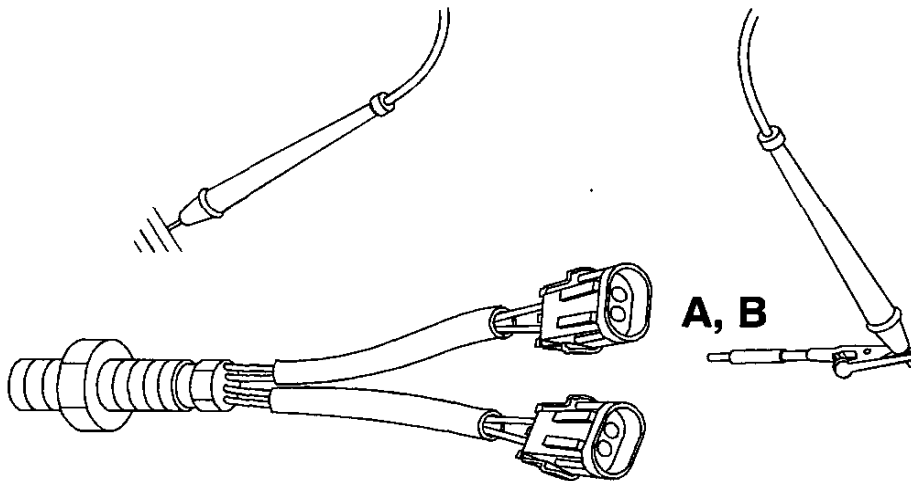
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3823996 - female Weather-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the auxiliary speed sensor.

Action	Specifications/Repair	Next Step
Check the auxiliary speed sensor for a short circuit to ground. <ul style="list-style-type: none">• Measure the resistance from pin A on the sensor side of the auxiliary speed sensor connector to engine block ground.• Measure the resistance from pin B on the sensor side of the auxiliary speed sensor connector to engine block ground.	OK More than 100k ohms	3E
	NOT OK Replace the auxiliary speed sensor Refer to the OEM troubleshooting and repair manual.	6A



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STEP 3E: Check for a short circuit between coils (if two coils exist).

⚠ 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 to the OFF position.
- Disconnect the OEM harness from the auxiliary speed sensor.

Action	Specifications/Repair	Next Step
Check the auxiliary speed sensor for a short circuit between coils. • Measure the resistance from pin A on the sensor side of one of the auxiliary speed sensor connectors to pin A of the other connector.	OK More than 100k ohms	5A
	NOT OK Replace the auxiliary speed sensor Refer to the OEM troubleshooting and repair manual.	6A

STEP 4: Check the auxiliary pressure sensor.

STEP 4A: Inspect pins.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the auxiliary pressure sensor.


Action	Specifications/Repair	Next Step
Inspect the sensor and OEM harness connectors for the following: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	OK No bent pins	4B
	NOT OK	6A

STEP 4B: Measure voltage to ECM.

Condition: <ul style="list-style-type: none"> • Turn keyswitch to the ON position. • Disconnect the OEM connector from the ECM. 		
Action	Specifications/Repair	Next Step
Measure voltage. <ul style="list-style-type: none"> • Measure pin 48 to engine block ground. 	OK (+) 0.5 to 4.5 VDC	5A
	NOT OK Replace pressure sensor Refer to OEM troubleshooting and repair manual.	6A

STEP 5: Check the OEM harness.

STEP 5A: Inspect the OEM harness and the ECM connectors.

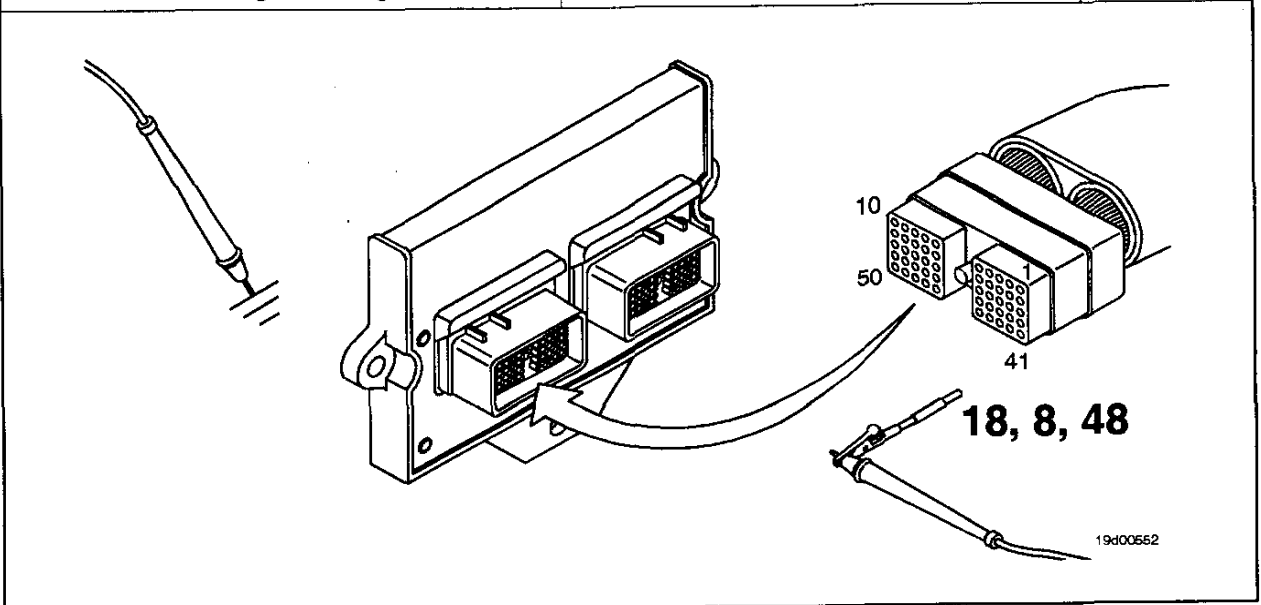
		
To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.		
Condition: <ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the OEM harness from the ECM. 		
Action	Specifications/Repair	Next Step
Inspect the OEM harness and the ECM connectors for the following: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Dirt or debris in or on the connector pins. 	OK No damaged pins	5B
	NOT OK Repair damaged pins Repair or replace the OEM harness or OEM interface harness, whichever has the damaged pins. <ul style="list-style-type: none"> • Repair the OEM harness. Refer to Procedure 019-250. • Replace the OEM harness. Refer to Procedure 019-071. • Dry the connector by using electrical contact cleaner, Part No. 3824510. • Flush the dirt, debris, or moisture from the connector pins using electronic contact cleaner. 	6A

STEP 5B: Check for an open circuit.

Condition:		
<ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the OEM harness from the ECM. • Disconnect the OEM harness from the auxiliary speed or pressure input signal sending unit. 		
Action	Specifications/Repair	Next Step
Check for an open circuit. <ul style="list-style-type: none"> • Measure the resistance from pin 8 of the OEM harness to pin A of the OEM harness, auxiliary speed sensor. • Measure the resistance from pin 18 of the OEM harness to pin B of the OEM harness, auxiliary speed sensor. • Measure the resistance from pin 48 of the OEM harness to pin X of the OEM harness, auxiliary pressure sensor. 	OK Less than 10 ohms	5C
	NOT OK Replace the OEM harness Refer to Procedure 019-071.	6A

STEP 5C: Check for a short circuit to ground.

Condition:		
<ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the OEM harness from the ECM. • Disconnect the OEM harness from the auxiliary speed or pressure sensor. 		
Action	Specifications/Repair	Next Step
Check for a short circuit to ground. <ul style="list-style-type: none"> • Measure the resistance from pin 18 of the OEM harness to engine block ground. • Measure the resistance from pin 8 of the OEM harness to engine block ground. • Measure the resistance from pin 48 of the OEM harness to engine block ground. 	OK More than 100k ohms	5D
	NOT OK Replace the OEM harness Refer to Procedure 019-071.	6A

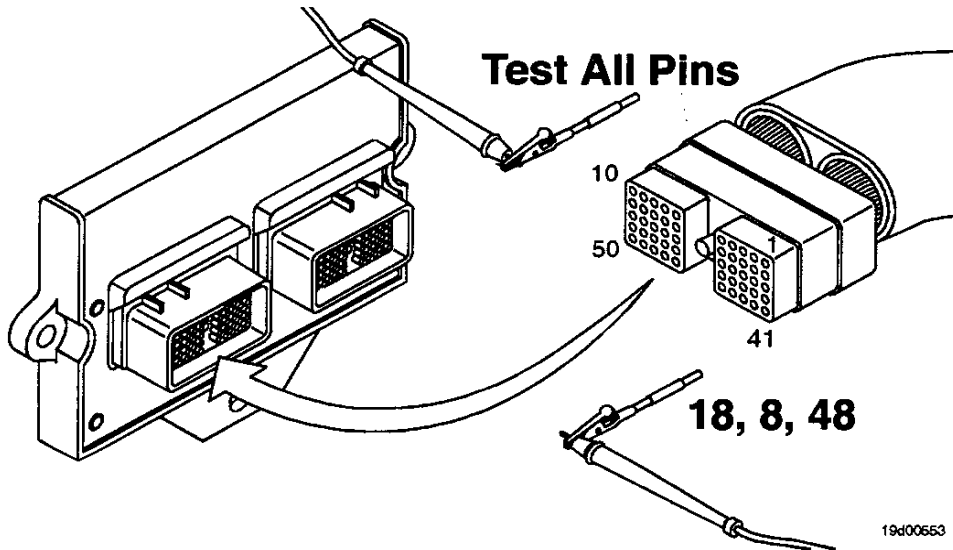


STEP 5D: Check for a short circuit from pin to pin.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the ECM.
- Disconnect the OEM harness from the auxiliary speed or pressure sensor.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pin 18 of the OEM harness connector to all other pins in the connector. • Measure the resistance from pin 8 of the OEM harness connector to all other pins in the connector. • Measure the resistance from pin 48 of the OEM harness connector to all other pins in the connector.	OK More than 100k ohms	6A
	NOT OK Replace the OEM harness Refer to Procedure 019-071.	6A



STEP 6: Clear the fault codes.

STEP 6A: Disable the fault code.

Condition:

- Connect all components.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start engine, and let idle for 1 minute.	OK Fault Code 349 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 any inactive fault codes.

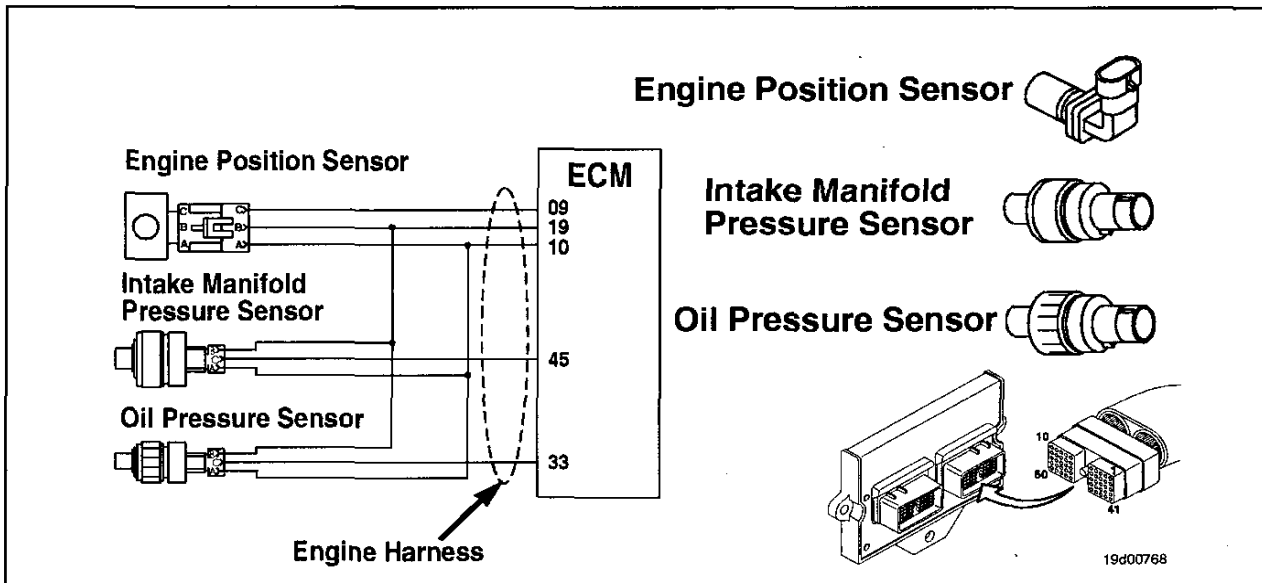
Condition: Connect all components.		
Action	Specifications/Repair	Next Step
Clear any inactive fault codes. • Erase any inactive fault codes using INSITE™.	OK All faults cleared	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting chart

Fault Code 352 or 386

Sensor Supply Circuit

CODES	REASON	EFFECT
Fault Code: 352 or 386 PID(P), SID(S): S232 SPN: 620 FMI: 4 or 3 Lamp: Yellow	FC 352: Low voltage detected at +5-VDC supply, pin 10 of the engine harness. FC 386: High voltage detected at +5-VDC supply, pin 10 of the engine harness.	Default value used for sensors connected to this +5-VDC supply. Engine will derate to no-boost fueling and loss of engine protection for oil pressure, intake manifold pressure, and coolant temperature.

Sensor Supply Circuit



Circuit Description:

The engine position sensor (EPS), the intake manifold pressure sensor, and the oil pressure sensor are powered by the same +5-VDC source and the same return in the electronic control module (ECM). This supply is also used to operate the intake manifold temperature and coolant temperature sensors.

Component Location:

The +5-VDC sensor supply circuit is located in the sensor harness. See Section E of this manual for the sensor locations.

Shop Talk:

These faults could also cause high- or low-voltage faults on the coolant temperature and intake manifold temperature sensors.

TROUBLESHOOTING SUMMARY



To avoid damaging a new ECM, all other fault codes must be investigated prior to replacing the ECM.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the sensors.		
<u>STEP 1A:</u> Read the fault codes.	Fault Code 386 active	
<u>STEP 1B:</u> Check the engine position sensor.	Fault Code 352 remains active	
<u>STEP 1C:</u> Check the intake manifold pressure sensor.	Fault Code 352 remains active	
<u>STEP 1D:</u> Check the oil pressure sensor.	Fault Code 352 remains active	
STEP 2: Check the engine harness.		
<u>STEP 2A:</u> Inspect the engine harness and ECM connectors.	No damaged pins	
<u>STEP 2B:</u> Check for a short circuit to ground.	More than 100k ohms	
<u>STEP 2C:</u> Check for a short circuit from pin to pin.	More than 100k ohms	
<u>STEP 2D:</u> Check sensor supply voltage.	(+) 4.75 to 5.25 VDC	
STEP 3: Clear the fault codes.		
<u>STEP 3A:</u> Disable the fault codes.	Fault Codes 352 and 386 inactive	
<u>STEP 3B:</u> Clear the inactive fault codes.	All faults cleared	

TROUBLESHOOTING STEP

STEP 1: Check the sensors.
STEP 1A: Read the fault codes.

Condition:		
<ul style="list-style-type: none"> • Turn keyswitch to the ON position. • Connect INSITE™. 		
Action	Specifications/Repair	Next Step
Read faults with INSITE™.	OK Fault Code 386 active	2A
	NOT OK Fault Code 352 active	1B

STEP 1B: Check the engine position sensor.

Condition: <ul style="list-style-type: none"> • Turn keyswitch to the ON position. • Connect INSITE™. • Disconnect the engine position sensor from the engine harness. 		
Action	Specifications/Repair	Next Step
Check the engine position sensor.	OK Fault Code 352 remains active	1C
	NOT OK Replace the engine position sensor Refer to Procedure 019-038.	3A

STEP 1C: Check the intake manifold pressure sensor.

Condition: <ul style="list-style-type: none"> • Turn keyswitch to the ON position. • Connect INSITE™. • Disconnect the intake manifold pressure sensor from the engine harness. 		
Action	Specifications/Repair	Next Step
Check the intake manifold pressure sensor.	OK Fault Code 352 remains active	1D
	NOT OK Replace intake manifold sensor Refer to Procedure 019-061.	3A

STEP 1D: Check the oil pressure sensor.

Condition: <ul style="list-style-type: none"> • Turn keyswitch to the ON position. • Connect INSITE™. • Disconnect the oil pressure sensor from the engine harness. 		
Action	Specifications/Repair	Next Step
Check the oil pressure sensor.	OK Fault Code 352 remains active	2A
	NOT OK Replace oil pressure sensor Refer to Procedure 019-066.	3A

STEP 2: Check the engine harness.

STEP 2A: Inspect the engine harness and ECM connectors.



To avoid damaging a new ECM, all other fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the ECM.

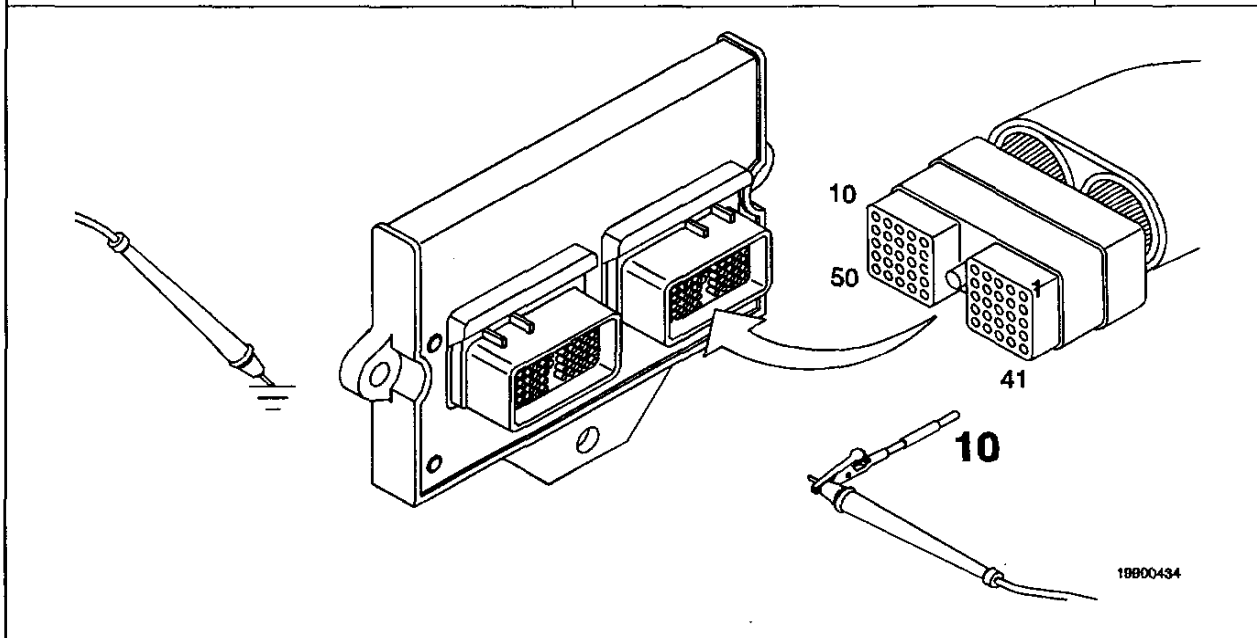
Action	Specifications/Repair	Next Step
Inspect the engine harness and the ECM connectors for the following: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	OK No damaged pins	2B
	NOT OK Repair the damaged pins Repair or replace the engine harness or ECM, whichever has the damaged pins. <ul style="list-style-type: none"> • 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 a short circuit to ground.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the ECM.
- Disconnect the engine position sensor from the engine harness.
- Disconnect the oil pressure sensor from the engine harness.
- Disconnect the intake manifold pressure sensor from the engine harness.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground in the engine harness. • Measure the resistance from pin 10 of the engine harness connector to engine block ground.	OK More than 100k ohms	2C
	NOT OK Repair or replace the engine harness <ul style="list-style-type: none">• Repair the engine harness. Refer to Procedure 019-250.• Replace the engine harness. Refer to Procedure 019-043.	3A

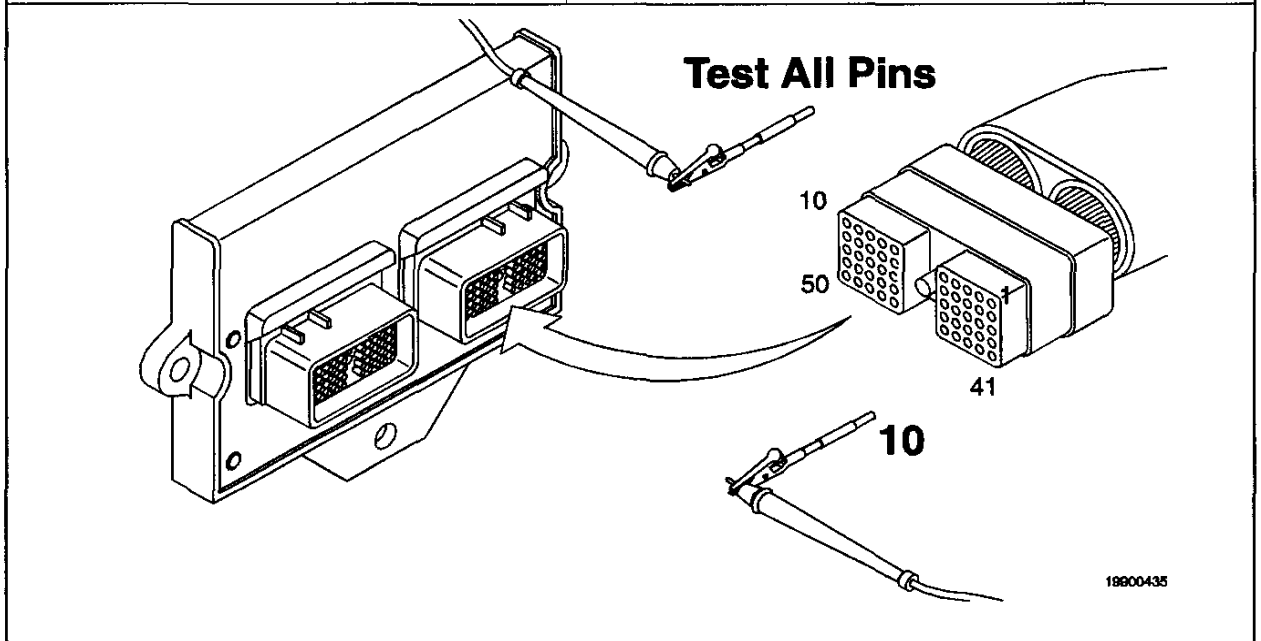


STEP 2C: Check for a short circuit from pin to pin.

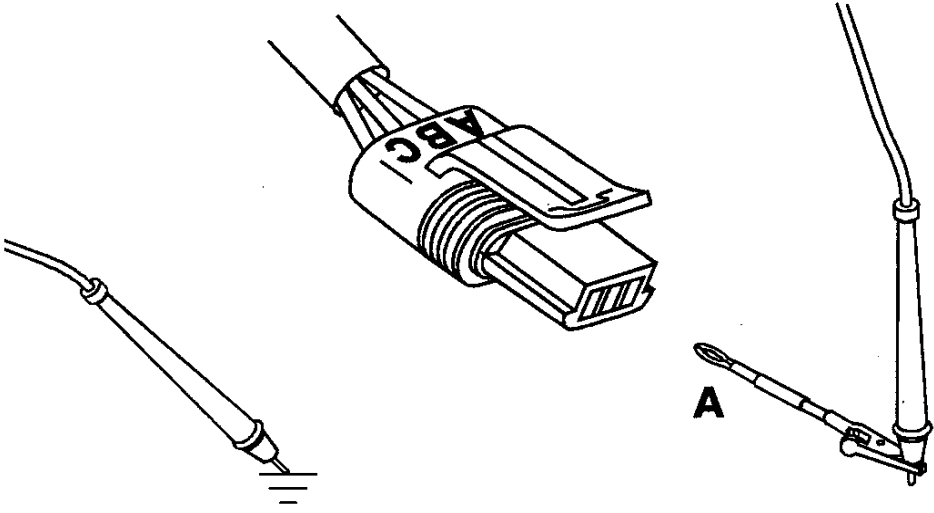
Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the ECM.
- Disconnect the engine position sensor from the engine harness.
- Disconnect the oil pressure sensor from the engine harness.
- Disconnect the intake manifold 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 10 of the engine harness connector to all the other pins in the connector.	OK More than 100k ohms	2D
	NOT OK Replace the engine harness Refer to Procedure 019-043.	3A



STEP 2D: Check sensor supply voltage.

<p>Condition:</p> <ul style="list-style-type: none"> • Connect the engine harness to the ECM. • Disconnect the engine position sensor from the engine harness. • Disconnect the oil pressure sensor from the engine harness. • Disconnect the intake manifold pressure sensor from the engine harness. • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
<p>Check for sensor +5-VDC supply voltage.</p> <ul style="list-style-type: none"> • Measure the voltage from pin A on the harness side of the engine speed sensor to engine block ground. 	<p>OK (+) 4.75 to 5.25 VDC</p>	3A
	<p>NOT OK Replace the ECM Refer to Procedure 019-031.</p>	3A
 <p>The diagram illustrates the measurement of the sensor supply voltage. On the left, a probe is shown touching a ground point. In the center, a multi-pin connector is labeled 'ABC'. On the right, a probe is shown touching pin 'A' on the engine speed sensor harness.</p>		
<p>19900918</p>		

STEP 3: Clear the fault codes.

STEP 3A: Disable the fault codes.

<p>Condition:</p> <ul style="list-style-type: none"> • Connect all components. • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
<p>Disable the fault code.</p> <ul style="list-style-type: none"> • Start the engine, and let idle for 1 minute. • Verify that Fault Codes 352 and 386 are inactive. 	<p>OK Fault Codes 352 and 386 Inactive</p>	3B
	<p>NOT OK Return to troubleshooting steps, or contact your local Cummins Authorized Repair Location if all steps have been completed and checked again.</p>	1A

STEP 3B: Clear the inactive fault codes.

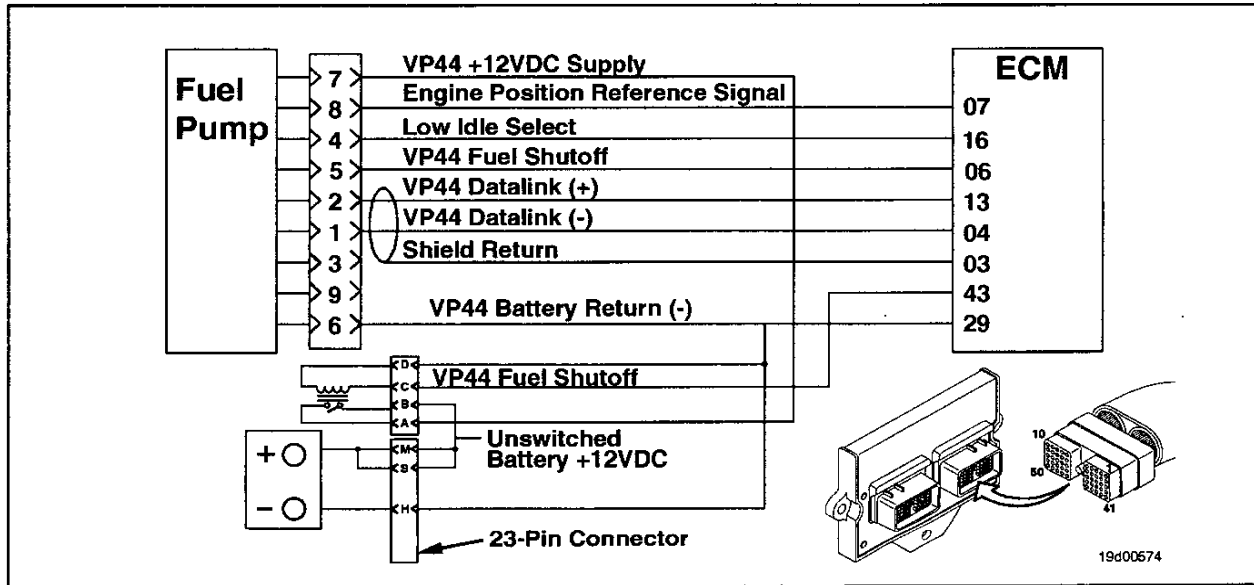
Condition:		
<ul style="list-style-type: none">• Connect all the components.• Turn keyswitch to the ON position.		
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault code using INSITE™.	OK All faults cleared	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting chart

Fault Code 362

Fuel Pump Fuel-Metering Valve Open Circuit

CODES	REASON	EFFECT
Fault Code: 362 PID(P), SID(S): S251 SPN: 1076 FMI: 4 Lamp: Yellow	Low current or no current detected at the VP44 fuel-metering valve.	Engine will die or run rough.

VP44 Fuel Pump Circuit



Circuit Description:

This circuit is internal to the VP44 fuel pump control module (FPCM). It controls the quantity of fuel being delivered to each cylinder.

Component Location:

The fuel-metering valve is located inside the VP44 fuel pump in the middle of the delivery valve holders.

Shop Talk:

An electronic control module (ECM) low-voltage fault could cause this fault.

TROUBLESHOOTING SUMMARY



To avoid damaging a new ECM, all other fault codes must be investigated prior to replacing the ECM.

STEPS	SPECIFICATIONS	SRT CODE
<u>STEP 1:</u> Check equipment voltage supply. <u>STEP 1A:</u> Check the battery voltage supply.	Normal conditions: At least 12 (+) VDC During cranking: At least 8 (+) VDC	
<u>STEP 2:</u> Check engine harness. <u>STEP 2A:</u> Inspect the engine harness, fuel pump, and ECM connectors. <u>STEP 2B:</u> Check VP44 supply resistance. <u>STEP 2C:</u> Check resistance in VP44 controller ground circuit.	No damaged pins Less than 0.2 ohm Less than 0.2 ohm	
<u>STEP 3:</u> Check pump wiring. <u>STEP 3A:</u> Inspect fuel-metering valve connections.	No frayed or damaged wires	
<u>STEP 4:</u> Clear the fault code. <u>STEP 4A:</u> Disable the fault code. <u>STEP 4B:</u> Clear the inactive fault codes.	Fault Code 362 inactive All faults cleared	

TROUBLESHOOTING STEP

STEP 1: Check equipment voltage supply.
STEP 1A: Check the battery voltage.

Condition:		
<ul style="list-style-type: none"> • Turn keyswitch to the OFF position. 		
Action	Specifications/Repair	Next Step
Check the battery voltage. <ul style="list-style-type: none"> • 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 (+) 8 VDC	2A
	NOT OK Charge or replace the battery Refer to the OEM troubleshooting and repair manual.	4A

STEP 2: Check engine harness.

STEP 2A: Inspect the engine harness, fuel pump, and ECM connectors.

⚠ CAUTION ⚠

To avoid damaging a new ECM, all other fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the ECM.
- Disconnect the engine harness from the VP44 fuel pump.

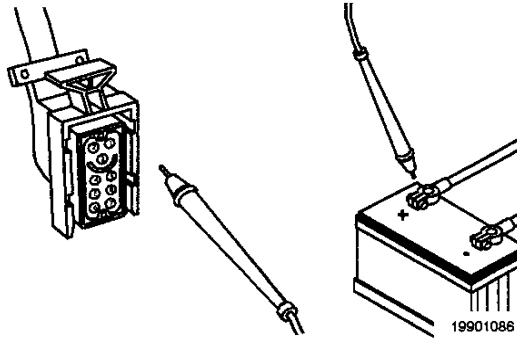
Action	Specifications/Repair	Next Step
Inspect the engine harness, fuel pump, and ECM connectors for the following: <ul style="list-style-type: none"> • <i>Bent or broken pins</i> • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	OK No damaged pins	2B
	NOT OK Repair the damaged pins Repair or replace the engine harness, ECM, or fuel pump, whichever has the damaged pins. <ul style="list-style-type: none"> • 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. • Replace the fuel pump. Refer to Procedure 005-014 in the Troubleshooting and Repair Manual, ISB Engines, Bulletin No. 3666193. 	4A

STEP 2B: Check VP44 supply resistance.

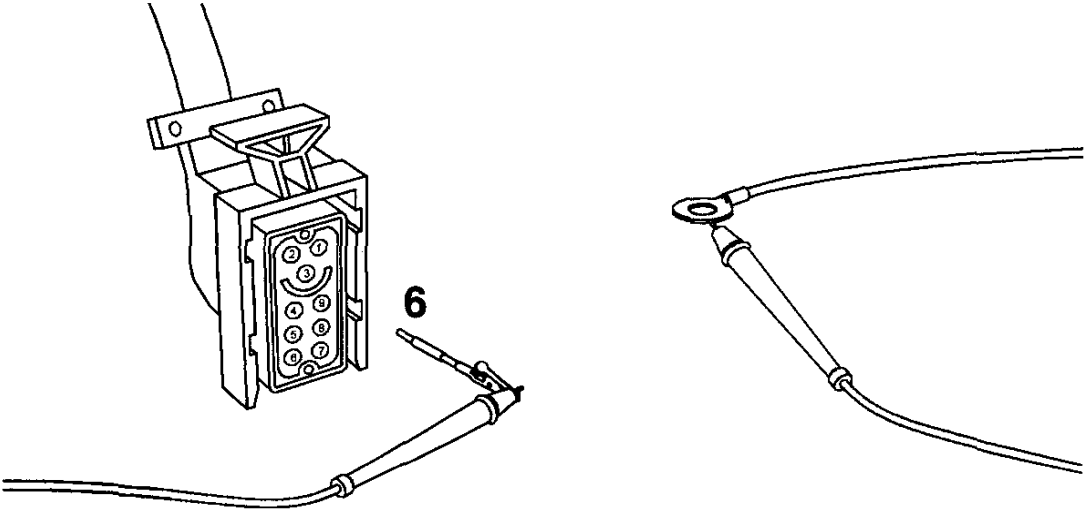
Condition:

- Turn keyswitch to the ON position.
- Disconnect the engine harness from the fuel pump.

Action	Specifications/Repair	Next Step
<p>Check the resistance of the fuel pump.</p> <ul style="list-style-type: none">• Measure the resistance from pin 7 of the VP44 connector, harness side, to the positive (+) battery terminal. <p>NOTE: This check may cause the ECM to register Fault Code 364.</p>	<p>OK Less than 0.2 ohm</p>	2C
	<p>NOT OK Greater than 0.2 ohm</p>	Refer to Fault Code 391



STEP 2C: Check resistance in VP44 controller ground circuit.

<p>Condition:</p> <ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the engine harness from the fuel pump. • Disconnect the negative (-) terminal from the battery post. 		
Action	Specifications/Repair	Next Step
<p>Measure the resistance from pin 6 of VP44 connector, harness side, to ground side battery terminal.</p> <p>NOTE: Remove paint and dirt from block surface you are using for ground to obtain a good reading.</p>	<p>OK Less than 0.2 ohm</p>	3A
	<p>NOT OK Greater than 0.2 ohm</p>	Refer to Fault Code 391
 <p style="text-align: right;">19d00865</p>		

STEP 3: Check pump wiring.

STEP 3A: Inspect fuel-metering valve connections.

<p>Condition:</p> <ul style="list-style-type: none"> • Turn keyswitch to the OFF position. 		
Action	Specifications/Repair	Next Step
<p>Inspect wires from VP44 fuel pump control module to fuel-metering solenoid for damage.</p>	<p>OK No frayed or damaged wires</p>	4A
	<p>NOT OK Replace the fuel pump Refer to Procedure 005-014 in the Troubleshooting and Repair Manual, ISB Engines, Bulletin No. 3666193.</p>	4A

STEP 4: Clear the fault code.

STEP 4A: Disable the fault code.

Condition: • Connect all components.		
Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine, and let idle for 1 minute. • Verify that Fault Code 362 is inactive.	OK Fault Code 362 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.

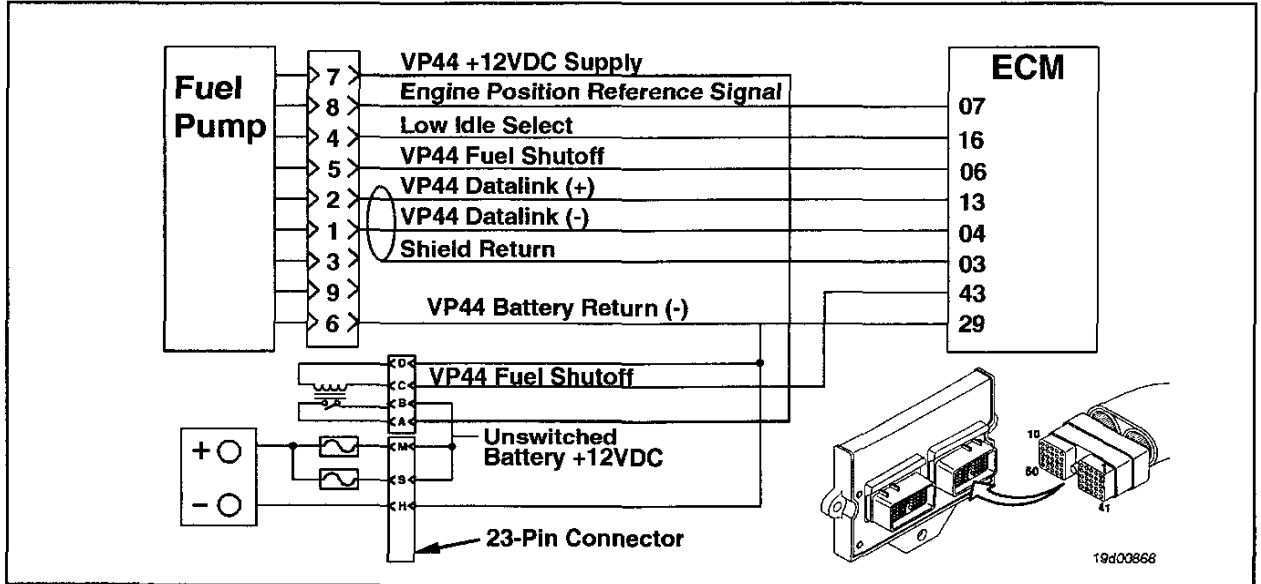
Condition: • Connect all the components.		
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault code using INSITE™.	OK All faults cleared	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting chart

Fault Code 363

Fuel Pump Fuel Solenoid Valve Closing at Wrong Time

CODES	REASON	EFFECT
Fault Code: 363 PID(P), SID(S): S251 SPN: 1076 FMI: 7 Lamp: Yellow	No fuel-metering valve movement detected by the VP44 pump controller.	Engine power derate. Engine possibly stops.

VP44 Fuel Pump Circuit



Circuit Description:

This circuit is internal to the VP44 fuel pump and detects fuel solenoid movement.

Component Location:

The VP44 fuel pump is located on the backside of the gear housing on the intake side of the engine.

TROUBLESHOOTING SUMMARY



To avoid damaging a new ECM, all other fault codes must be investigated prior to replacing the ECM.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check for active fault codes.		
<u>STEP 1A:</u> Read the fault codes.	Fault Code 366 inactive	
STEP 2: Check engine harness.		
<u>STEP 2A:</u> Inspect the engine harness, fuel pump, and ECM connectors.	No damaged pins	
<u>STEP 2B:</u> Check battery voltage.	At least (+) 12 VDC in a (+) 12-VDC system	
<u>STEP 2C:</u> Check for an open circuit.	Less than 0.2 ohm	
<u>STEP 2D:</u> Check for high harness resistance.	Less than 0.2 ohm	
STEP 3: Check equipment voltage supply.		
<u>STEP 3A:</u> Check alternator output.	Refer to equipment repair manual	
STEP 4: Clear the fault codes.		
<u>STEP 4A:</u> Disable the fault code.	Fault Code 363 inactive	
<u>STEP 4B:</u> Clear the inactive fault codes.	All faults cleared	

TROUBLESHOOTING STEP

STEP 1: Check for active fault codes.

STEP 1A: Read the fault codes.

Condition:		
<ul style="list-style-type: none"> Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Read the fault codes. <ul style="list-style-type: none"> Read the fault codes using INSITE™. 	OK Fault Code 366 inactive	2A
	NOT OK Fault Code 366 active	Refer to Fault Code 366

STEP 2: Check engine harness.

STEP 2A: Inspect the engine harness, fuel pump, and ECM connectors.

⚠ CAUTION ⚠

To avoid damaging a new ECM, all other fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the ECM.
- Disconnect the engine harness from the VP44 fuel pump.

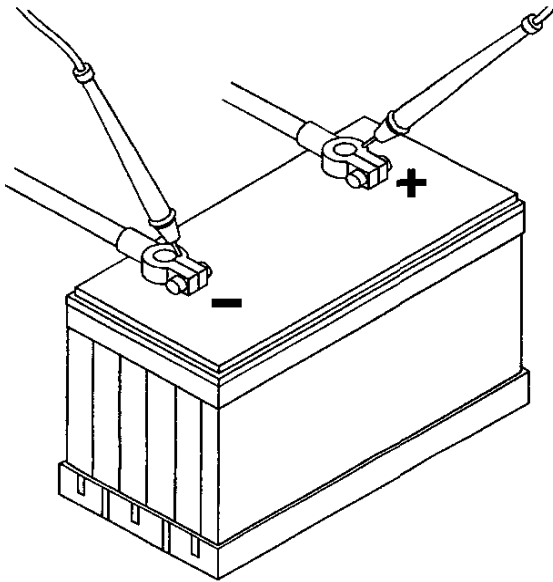
Action	Specifications/Repair	Next Step
Inspect the engine harness, fuel pump, and ECM connectors for the following: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing connector seal. 	OK No damaged pins	2B
	NOT OK Repair damaged pins Repair or replace the engine harness, ECM, or fuel pump, whichever has the damaged pins. <ul style="list-style-type: none"> • 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. • Replace the VP44 fuel pump. Refer to Procedure 005-014 in the Troubleshooting and Repair Manual, ISB Engines, Bulletin No. 3666193. • Dry the connector by using electrical contact cleaner, Part No. 3824510. 	4A

STEP 2B: Check battery voltage.

Condition:

- Turn keyswitch to the ON position.

Action	Specifications/Repair	Next Step
Check battery voltage. • Measure the voltage at the battery.	OK At least (+) 12 VDC in a (+) 12-VDC system NOTE: If the engine will not start, check the battery voltage during cranking. Battery voltage should remain above (+) 8 VDC during cranking.	2C
	NOT OK Charge or replace batteries Refer to the OEM troubleshooting and repair manual.	3A



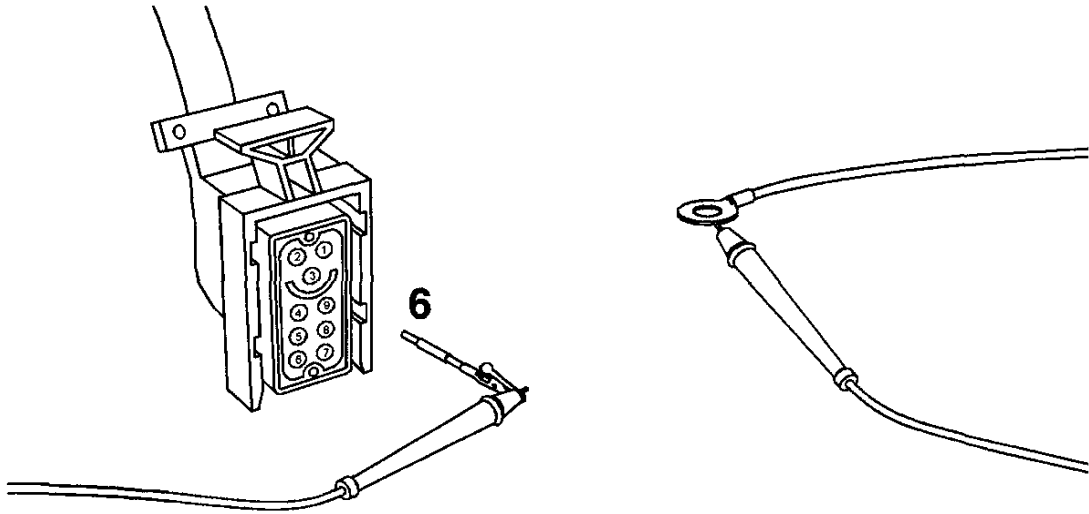
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STEP 2C: Check for an open circuit.

Condition:

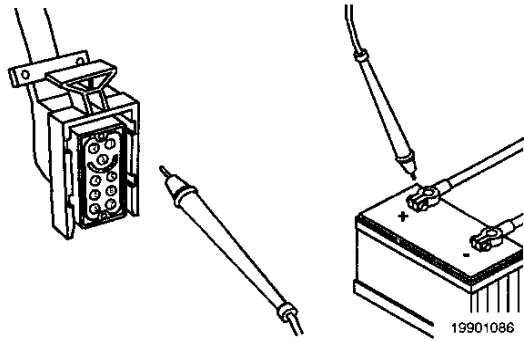
- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the ECM.
- Disconnect the engine harness from the VP44 fuel pump.
- Disconnect the negative (-) battery terminal from the negative battery post.

Action	Specifications/Repair	Next Step
Check for open circuit in VP44 controller ground circuit. • Measure the resistance from pin 6 on the harness side of the fuel pump connector to the ground side battery terminal.	OK Less than 0.2 ohm	2D
	NOT OK Greater than 0.2 ohm	Refer to Fault Code 391



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STEP 2D: Check for high harness resistance.

Condition: <ul style="list-style-type: none"> • Turn keyswitch to the ON position. • Disconnect engine harness from the VP44 fuel pump. 		
Action	Specifications/Repair	Next Step
Measure VP44 supply resistance. <ul style="list-style-type: none"> • Measure the resistance from pin 7 on the harness side of the VP44 connector to the positive (+) battery terminal. NOTE: This check may cause the ECM to register Fault Code 364.	OK Less than 0.2 ohm	4A
	NOT OK Greater than 0.2 ohm	Refer to Fault Code 391
 <p>19901086</p>		

STEP 3: Check equipment voltage supply.
STEP 3A: Check alternator voltage.

Condition: <ul style="list-style-type: none"> • Engine running. 		
Action	Specifications/Repair	Next Step
Check alternator voltage. <ul style="list-style-type: none"> • Refer to the OEM troubleshooting and repair manual. 	OK Refer to the equipment repair manual	2C
	NOT OK Charge or replace alternator Refer to the OEM troubleshooting and repair manual.	4A

STEP 4: Clear the fault codes.

STEP 4A: Disable the fault code.

Condition: <ul style="list-style-type: none"> • Connect all the components. 		
Action	Specifications/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> • Verify that Fault Code 363 is inactive. 	OK Fault Code 363 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.

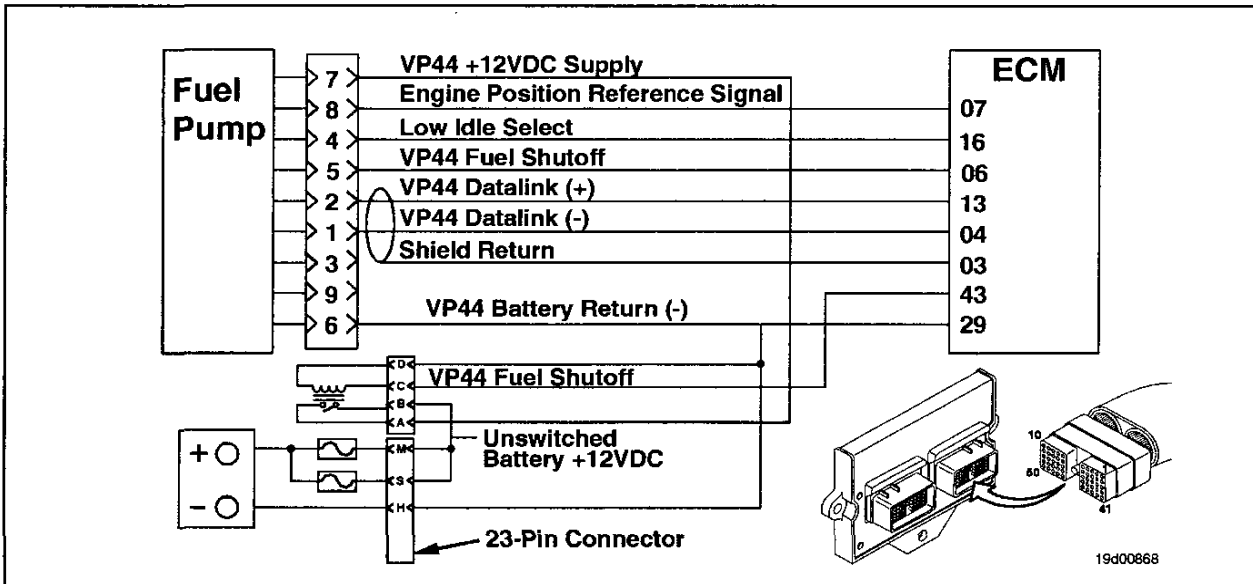
Condition: <ul style="list-style-type: none"> • Connect all the components. 		
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> • Erase the inactive fault code using INSITE™. 	OK All faults cleared	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting chart

Fault Code 364

Electronic Control Module (ECM) to Pump Communications Error

CODES	REASON	EFFECT
Fault Code: 364 PID(P), SID(S): S233 SPN: 1077 FMI: 9 Lamp: Yellow	No communications or invalid data transfer rate detected on datalink between ECM and VP44 fuel pump control module at pins 4 and 13 of the engine harness or no voltage detected at pin 7 of the VP44 fuel pump connector.	Engine will run in a backup mode set speed when accelerator is off idle or engine will not start.

VP44 Fuel Pump Circuit



Circuit Description:

This circuit is the communications datalink between the ECM and fuel pump control module.

Component Location:

The datalink is located within the ECM and fuel pump control module.

Shop Talk:

- The datalink is used to communicate fueling and timing commands as well as pump status messages. If the datalink is lost, the pump will run in backup mode based on idle signal (pin 4 at VP44 connector).
- This code will be active if the VP44 power supply is inadequate. Refer to Fault Code 391 first if Fault Code 364 is active.
- If this code is active and the engine will **not** start, be very sure that the power and ground legs of the VP44 power supply are in good order; inspect the power relay and OEM fuses for corrosion.

TROUBLESHOOTING SUMMARY



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 engine harness.

STEP 1A: Inspect the engine harness, fuel pump, and ECM connectors.

No damaged pins

STEP 1B: Check the battery voltage.

Cranking: At least (+) 8 VDC

STEP 1C: Check resistance of VP44 connector to battery positive (+).

Less than 0.2 ohm

STEP 1D: Inspect fuses, relay, and harnesses.

No corrosion or failed harnesses

STEP 1E: Check for high resistance in VP44 ground circuit.

Less than 0.2 ohm

STEP 1F: Check for an open circuit in the VP44 datalink circuit.

Less than 10 ohms

STEP 1G: Check for a short circuit to ground in the VP44 datalink circuit.

More than 100k ohms

STEP 1H: Check for a short circuit from pin to pin in the VP44 datalink circuit.

More than 100k ohms

STEP 2: Clear the fault codes.

STEP 2A: Disable the fault code.

Fault Code 364 inactive

STEP 2B: Clear the inactive fault codes.

All faults cleared

TROUBLESHOOTING STEP

STEP 1: Check engine harness.

STEP 1A: Inspect the engine harness, fuel pump, and ECM connectors.



To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the ECM.
- Disconnect the engine harness from the fuel pump.

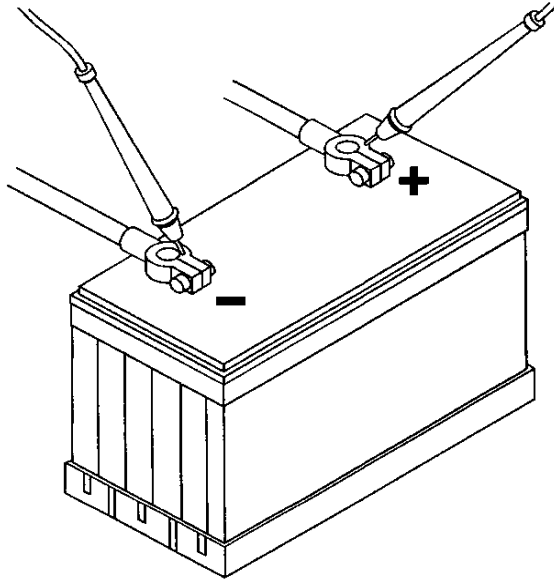
Action	Specifications/Repair	Next Step
Inspect the engine harness, fuel pump, and ECM connectors for the following: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	OK No damaged pins	1B
	NOT OK Repair the damaged pins Repair or replace the engine harness, ECM, or fuel pump, whichever has the damaged pins. <ul style="list-style-type: none"> • 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. • Replace the fuel pump. Refer to Procedure 005-014 in the Troubleshooting and Repair Manual, ISB Engines, Bulletin No. 3666193. 	2A

STEP 1B: Check the battery voltage.

Condition:

- Turn keyswitch to the ON position.
- Engine running, or measure while cranking.

Action	Specifications/Repair	Next Step
Check the battery voltage. • Measure the battery voltage from the positive (+) post to the negative (-) battery post.	OK Cranking: At least (+) 8 VDC	1C
	NOT OK	Refer to Fault Code 391



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STEP 1C: Check resistance of VP44 connector to battery positive (+).

Condition:

- Disconnect engine harness from the fuel pump.
- Turn keyswitch to the ON position.

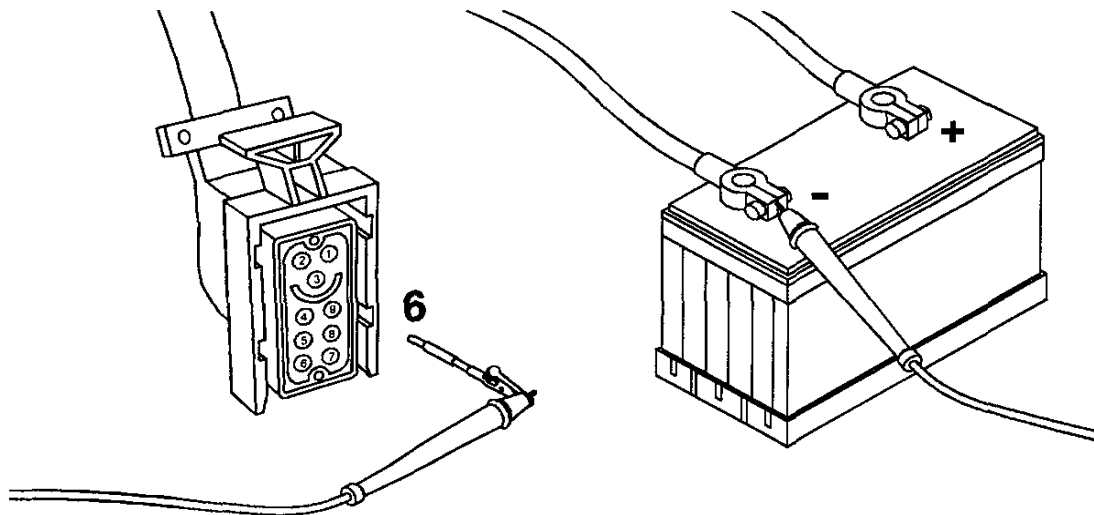
Action	Specifications/Repair	Next Step
Measure the resistance from pin 7 on the VP44 connector to positive (+) battery terminal.	OK Less than 0.2 ohm	1H
	NOT OK More than 0.2 ohm	1D

STEP 1D: Inspect fuses, relay, and harnesses.

Condition:		
<ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect battery cables. 		
Action	Specifications/Repair	Next Step
<ul style="list-style-type: none"> • Inspect the two 10-amp fuses for being blown or corroded. • Inspect the VP44 power relay. • Inspect the OEM harness, battery terminals, and 23-pin OEM connector for source of resistance. 	OK Fuses, relay, harnesses OK	1E
	NOT OK Replace fuses	2A

STEP 1E: Check for high resistance in the VP44 ground circuit.

Condition:		
<ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the engine harness from the fuel pump. • Disconnect the engine harness from the ECM. • Disconnect the ECM battery return connector. 		
Action	Specifications/Repair	Next Step
Measure resistance in ground leg of the VP44 controller ground circuit. <ul style="list-style-type: none"> • Measure the resistance from pin 6 on the harness side of the fuel pump connector to the negative (-) battery terminal. 	OK Less than 0.2 ohm	1F
	NOT OK	2A



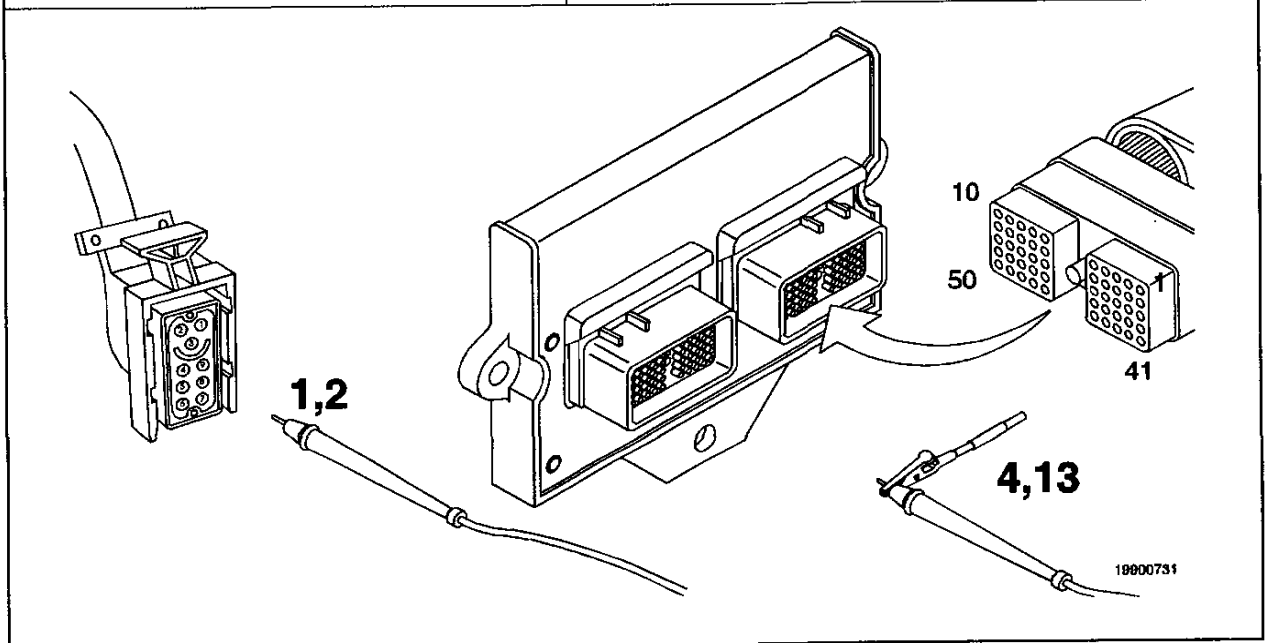
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STEP 1F: Check for an open circuit in the VP44 datalink circuit.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the fuel pump.
- Disconnect the engine harness from the ECM.

Action	Specifications/Repair	Next Step
Check for an open circuit in datalink circuit. <ul style="list-style-type: none"> • Measure the resistance from pin 2 on harness side of the fuel pump connector to pin 13 on harness side of ECM connector. 	OK Less than 10 ohms	1G
<ul style="list-style-type: none"> • Measure the resistance from pin 1 on harness side of the fuel pump connector to pin 4 on harness side of ECM connector. 	NOT OK Replace the engine harness Refer to Procedure 019-043.	2A

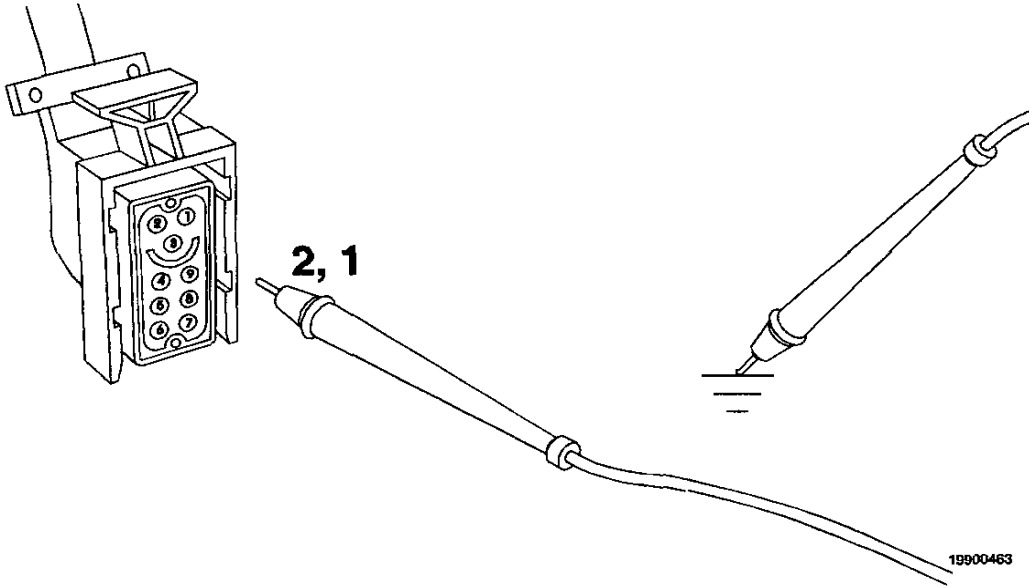


STEP 1G: Check for a short circuit to ground in the VP44 datalink circuit.

Condition:

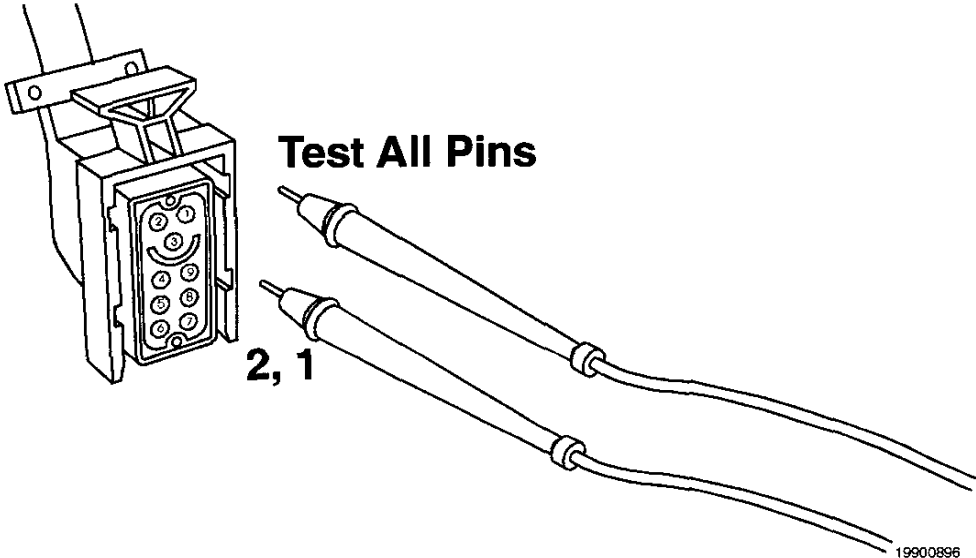
- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the fuel pump control module.
- Disconnect the engine harness from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground in the datalink circuit. <ul style="list-style-type: none">• Measure the resistance from pin 2 on engine harness side of the fuel pump connector to engine block ground.• Measure the resistance from pin 1 on engine harness side of the fuel pump connector to engine block ground.	OK More than 100k ohms	1H
	NOT OK Replace engine harness Refer to Procedure 019-043.	2A



STEP 1H: Check for a short circuit from pin to pin in the VP44 datalink circuit.

<p>Condition:</p> <ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the engine harness from the VP44 fuel pump control module. • Disconnect the engine harness from the ECM. 		
Action	Specifications/Repair	Next Step
<p>Check for a short from pin to pin.</p> <ul style="list-style-type: none"> • Measure the resistance from pin 2 on harness side of the fuel pump connector to all other pins in the connector. • Measure the resistance from pin 1 on harness side of the fuel pump connector to all other pins in the connector. 	<p>OK More than 100k ohms</p>	2A
	<p>NOT OK Replace engine harness Refer to Procedure 019-043.</p>	2A



Test All Pins

2, 1

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STEP 2: Clear the fault codes.

STEP 2A: Disable the fault code.

<p>Condition:</p> <ul style="list-style-type: none"> • Connect all components. 		
Action	Specifications/Repair	Next Step
<p>Disable the fault code.</p> <ul style="list-style-type: none"> • Start the engine, and let idle for 1 minute. • Verify that Fault Code 364 is inactive. 	<p>OK Fault Code 364 inactive</p>	2B
	<p>NOT OK Return to troubleshooting steps, or contact your local Cummins Authorized Repair Location if all steps have been completed and checked again.</p>	1A

STEP 2B: Clear the inactive fault codes.

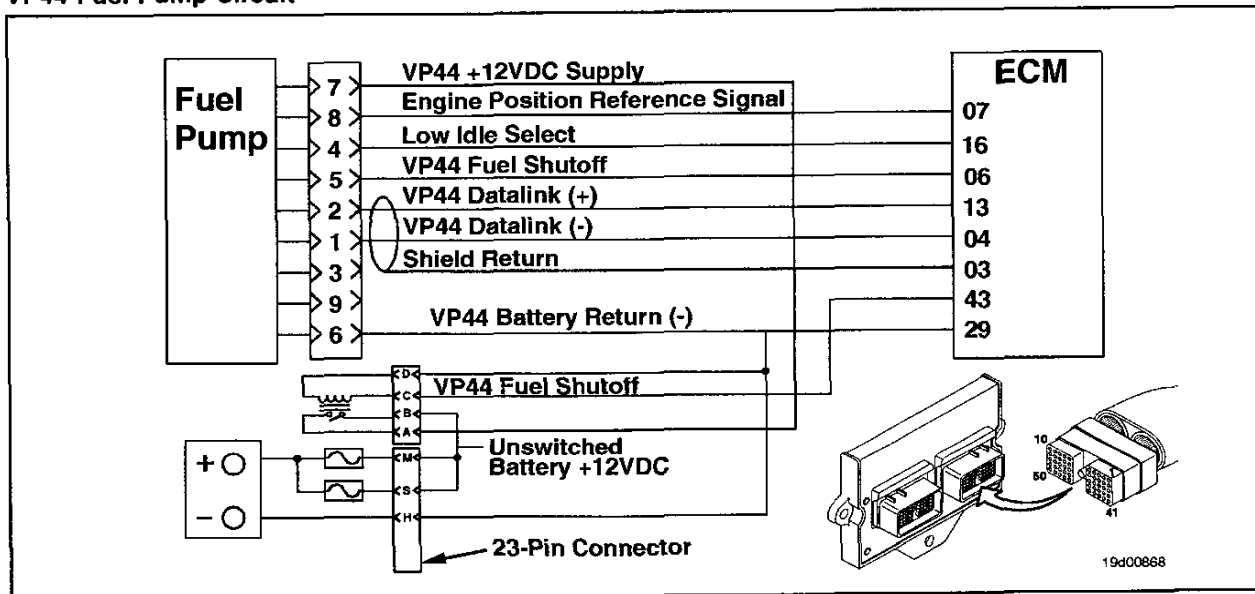
Condition:		
<ul style="list-style-type: none">• Connect all the components.		
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none">• Erase the inactive fault code using <i>INSITE™</i>.	OK All the faults cleared	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting chart

Fault Code 365

Fuel Pump Voltage Out of Range Error Low

CODES	REASON	EFFECT
Fault Code: 365 PID(P), SID(S): S233 SPN: 1077 FMI: 4 Lamp: Yellow	Low voltage detected at VP44 pump controller supply voltage circuit.	Possible engine dying, running rough, or no effect.

VP44 Fuel Pump Circuit



Circuit Description:

Power is supplied to the VP44 through a relay. When the electronic control module (ECM) switches the relay, power is supplied from the battery, through the relay, to the fuel pump.

Component Location:

Internal to the VP44 pump.

Shop Talk:

The fuel pump control module (FPCM) compares battery voltage to supply voltage while energizing the fuel metering solenoid. If this measured voltage drop is excessive, there is high resistance in the fuel pump power supply circuit.

TROUBLESHOOTING SUMMARY



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 engine harness.		
STEP 1A: Inspect the engine harness, fuel pump, and ECM connectors.	No damaged pins	
STEP 1B: Check VP44 supply resistance.	Less than 0.2 ohm	
STEP 1C: Check for an open circuit in VP44 controller ground circuit.	Less than 0.2 ohm	
STEP 2: Check equipment voltage supply.		
STEP 2A: Check the battery voltage.	Normal conditions: At least (+) 12 VDC in a (+) 12-VDC system During cranking: At least (+) 8 VDC	
STEP 2B: Check alternator output.	Refer to equipment repair manual	
STEP 3: Clear the fault codes.		
STEP 3A: Disable the fault code.	Fault Code 365 inactive	
STEP 3B: Clear the inactive fault codes.	All faults cleared	

TROUBLESHOOTING STEP

STEP 1: Check engine harness.

STEP 1A: Inspect the engine harness, fuel pump, and ECM connectors.

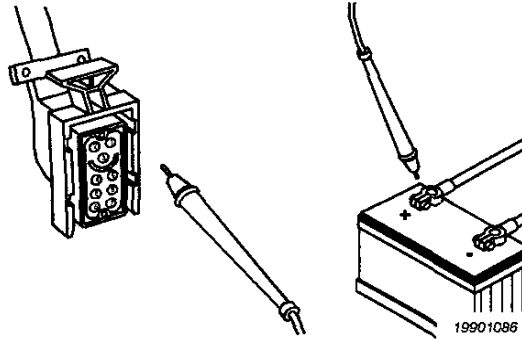
⚠ CAUTION ⚠		
<p>To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.</p>		
<p>Condition:</p> <ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the engine harness from the ECM. • Disconnect the engine harness from the VP44 fuel pump. 		
Action	Specifications/Repair	Next Step
<p>Inspect the engine harness, fuel pump, and ECM connectors for the following:</p> <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	<p>OK No damaged pins</p>	1B
	<p>NOT OK Repair the damaged pins Repair or replace the engine harness, ECM, or fuel pump, whichever has the damaged pins.</p> <ul style="list-style-type: none"> • 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. • Replace the fuel pump. Refer to Procedure 005-014 in the Troubleshooting and Repair Manual, ISB Engines, Bulletin No. 3666193. 	3A

STEP 1B: Check VP44 supply resistance.

Condition:

- Turn keyswitch to the ON position.
- Disconnect the engine harness from the fuel pump.

Action	Specifications/Repair	Next Step
Check the VP44 supply resistance. • Measure the resistance from pin 7 of the VP44 connector, harness side, to the positive (+) battery terminal.	OK Less than 0.2 ohm	1C
	NOT OK Greater than 0.2 ohm; find and correct harness resistance.	Refer to Fault Code 391

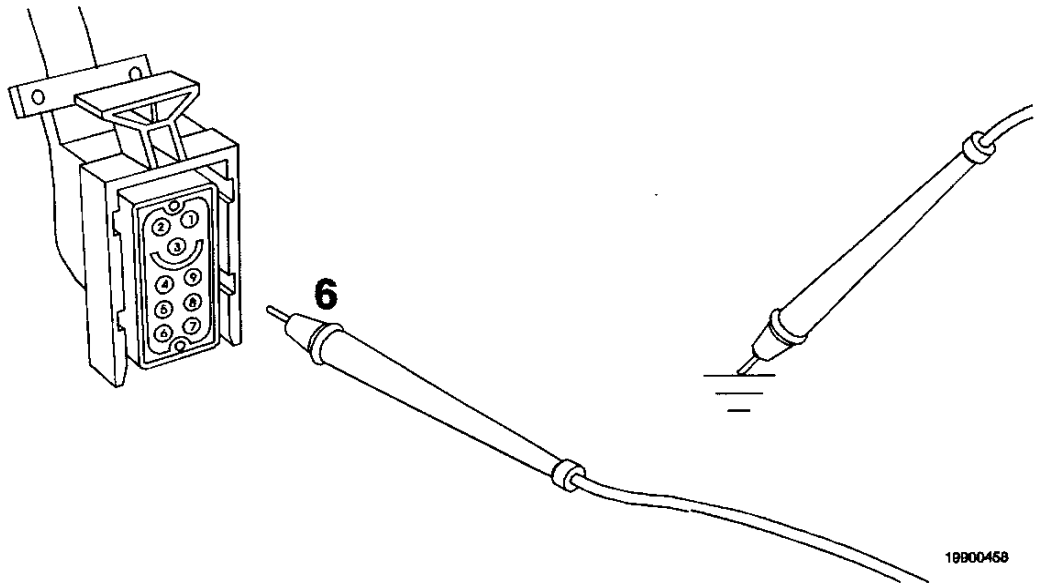


STEP 1C: Check for an open circuit in VP44 controller ground circuit.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect engine harness from the ECM.
- Disconnect engine harness from the fuel pump control module.

Action	Specifications/Repair	Next Step
Check for an open circuit in VP44 controller ground circuit.	OK Less than 0.2 ohm	2A
• Measure the resistance from pin 6 on the harness side of the fuel pump control module to engine block ground.	NOT OK Greater than 0.2 ohm; find and correct harness resistance.	Refer to Fault Code 391



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STEP 2: Check equipment voltage supply.

STEP 2A: Check the battery voltage.

Condition:		
<ul style="list-style-type: none"> Turn keyswitch to the OFF position. 		
Action	Specifications/Repair	Next Step
Check the battery voltage. <ul style="list-style-type: none"> 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 (+) 8 VDC	2B
	NOT OK Charge or replace the battery Refer to the OEM troubleshooting and repair manual.	3A

STEP 2B: Check alternator output.

Condition:		
<ul style="list-style-type: none"> Start and idle engine. 		
Action	Specifications/Repair	Next Step
Measure voltage output. <ul style="list-style-type: none"> Refer to the Troubleshooting and Repair Manual, ISB Engines, Bulletin No. 3666193. 	OK Refer to the alternator manufacturer diagnostic instructions	3A
	NOT OK Repair or replace alternator Refer to Procedure 013-001 in the Troubleshooting and Repair Manual, ISB Engines, Bulletin No. 3666193.	3A

STEP 3: Clear the fault code.

STEP 3A: Disable the fault code.

Condition:		
<ul style="list-style-type: none"> • Connect all components. 		
Action	Specifications/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> • Start the engine, and let idle for 1 minute. • Verify that Fault Code 365 is inactive. 	OK Fault Code 365 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.

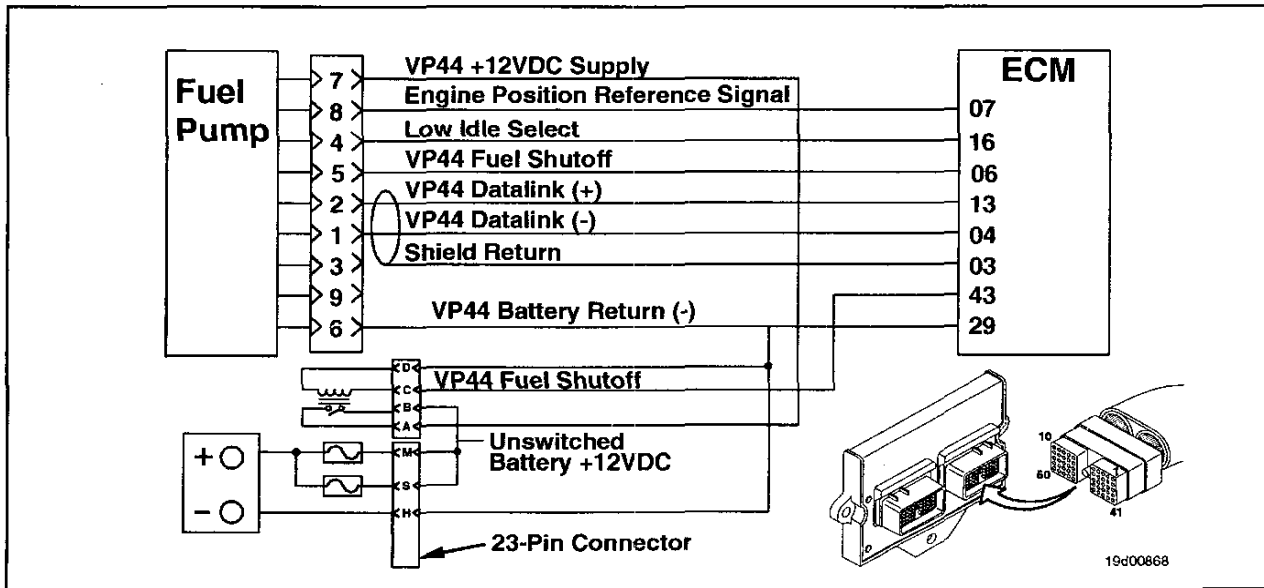
Condition:		
<ul style="list-style-type: none"> • Connect all components. 		
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> • Erase the inactive fault code using INSITE™. 	OK All the faults cleared	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting chart

Fault Code 368

Fuel Pump Can Not Reach Commanded Timing

CODES	REASON	EFFECT
Fault Code: 368 PID(P), SID(S): S254 SPN: 1078 FMI: 8 Lamp: Yellow	The VP44 pump can not achieve the timing value being commanded by the electronic control module (ECM).	Engine power derate.

VP44 Fuel Pump Circuit



Circuit Description:

The VP44 fuel pump uses an internal check to determine if the fuel injection pump can reach the commanded timing.

Component Location:

Internal to the VP44 fuel pump.

Shop Talk:

- The VP44 fuel injection pump uses fuel pressure generated by an internal vane pump and a timing solenoid to vary timing. Any restriction either to the pump inlet or outlet could cause timing problems (i.e., plugged fuel filter could cause this error).
- If the problem is intermittent and the fault code count increases with each occurrence, operate the engine under the conditions that cause the power derate while monitoring injection pump inlet restriction, measured at the fuel filter outlet (5-psi minimum).
- A mistimed fuel pump due to an incorrect key or mistimed fuel pump gear can result in intermittent low power and Fault Code 368 increasing; the engine may also be hard to start if this is the case.

TROUBLESHOOTING SUMMARY

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check ECM calibration. <u>STEP 1A:</u> Verify the correct calibration is in the ECM.	Calibration correct	
STEP 2: Check for multiple fault codes. <u>STEP 2A:</u> Read the fault codes.	Fault Codes 115, 365, and 369 inactive	
STEP 3: Check fuel plumbing. <u>STEP 3A:</u> Check fuel inlet pressure. <u>STEP 3B:</u> Check fuel pressure before and after the fuel filter.	Less than 152 mm Hg [6 in Hg] More than 10 psi before the filter More than 5 psi after the filter	
STEP 4: Check gear train. <u>STEP 4A:</u> Check for slipped gears.	Key aligned, and timing marks aligned on gears	
STEP 5: Clear the fault codes. <u>STEP 5A:</u> Disable the fault code. <u>STEP 5B:</u> Clear the inactive fault codes.	Fault Code 368 inactive All faults cleared	

TROUBLESHOOTING STEP

STEP 1: Check ECM calibration.
STEP 1A: Verify the correct calibration is in the ECM.

Condition: • Turn keyswitch to the ON position.		
Action	Specifications/Repair	Next Step
Read the calibration. • Read the calibration using INSITE™.	OK Calibration correct	2A
	NOT OK Download the correct calibration	5A

STEP 2: Check for multiple fault codes.

STEP 2A: Read the fault codes.

Condition: <ul style="list-style-type: none"> • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Read the fault codes. <ul style="list-style-type: none"> • Read the fault codes using INSITE™. 	OK Fault Codes 115, 365, and 369 inactive	3A
	NOT OK Fault Codes 115, 365, and 369 are active	Refer to Fault Code 115, 365, or 369

STEP 3: Check fuel plumbing.

STEP 3A: Check for high fuel inlet restriction.

Condition: <ul style="list-style-type: none"> • Run engine at high idle. • Connect all components. 		
Action	Specifications/Repair	Next Step
Check for high fuel inlet restriction. <ul style="list-style-type: none"> • Check to see if the restriction on the fuel inlet to the lift pump is above specifications. Refer to Procedure 006-020 in the Troubleshooting and Repair Manual, ISB Engines, Bulletin No. 3666193. 	OK Fuel inlet restriction less than 152 mm Hg [6 in Hg]	3B
	NOT OK Troubleshoot low-pressure fuel system (Lines, filters, lift pump).	Refer to the appropriate troubleshooting tree

STEP 3B: Check fuel pressure before and after the fuel filter.

Condition: <ul style="list-style-type: none"> • Run engine at high idle. • Connect all components. 		
Action	Specifications/Repair	Next Step
Check fuel pressure before and after the fuel filter. <ul style="list-style-type: none"> • Measure the fuel pressure before and after the fuel filter. 	OK More than 10 psi before the filter More than 5 psi after the filter	4A
	NOT OK Replace the fuel pump Refer to Procedure 005-014 in the Troubleshooting and Repair Manual, ISB Engines, Bulletin No. 3666193.	5A

STEP 4: Check gear train.

STEP 4A: Check for slipped gears.

Condition:		
<ul style="list-style-type: none"> Remove fuel pump gear access cover or front gear cover. 		
Action	Specifications/Repair	Next Step
Check for slipped gears. <ul style="list-style-type: none"> Check for slipped fuel pump gear by removing fuel pump gear access cover. If fuel pump gear has not slipped, remove front cover to inspect cam and crank gear for slippage. <p>NOTE: Key must be aligned in the center of the keyway and/or the marks on the crankshaft, camshaft, and fuel pump gear are aligned with engine at No. 1 top dead center.</p>	OK Key-aligned, and timing marks aligned on gears.	5A
	NOT OK Remove gear and repair Refer to the Troubleshooting and Repair Manual, ISB Engines, Bulletin No. 3666193.	5A

STEP 5: Clear the fault code.

STEP 5A: Disable the fault code.

Condition:		
<ul style="list-style-type: none"> Connect all components. 		
Action	Specifications/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> Start the engine, and let idle for 1 minute. Verify Fault Code 368 is inactive. 	OK Fault Code 368 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.

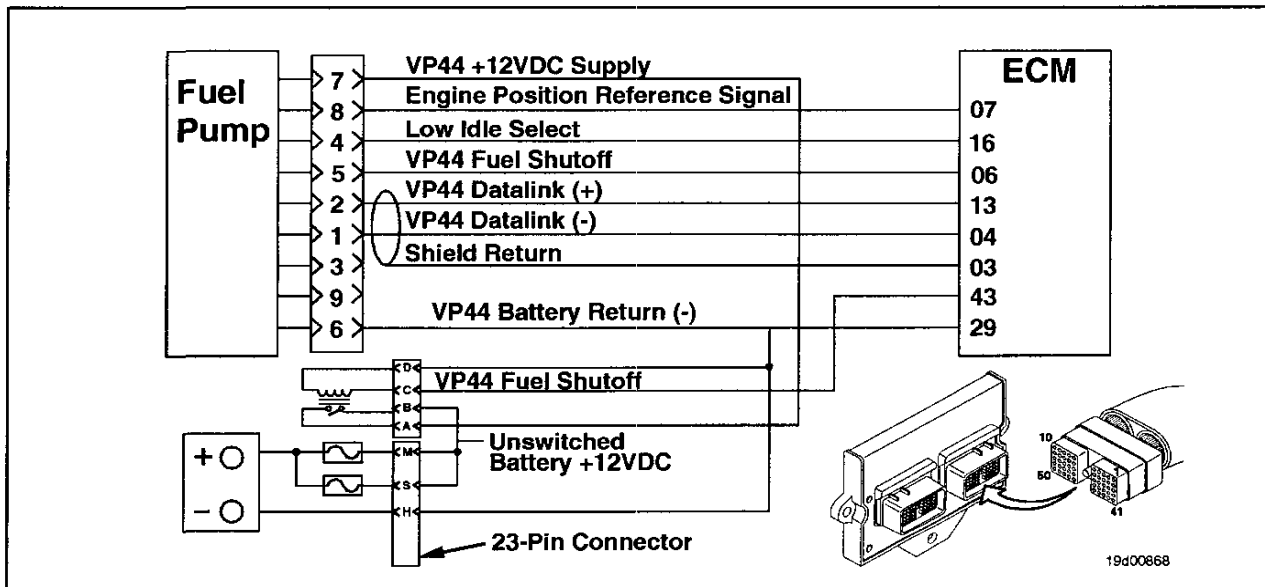
Condition:		
<ul style="list-style-type: none"> Connect all the components. 		
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> Erase the inactive fault code using INSITE™. 	OK All faults cleared	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting chart

Fault Code 369

Fuel Pump To Engine Synchronization Pulse Not Recognized

CODES	REASON	EFFECT
Fault Code: 369 PID(P), SID(S): P190 SPN: 1078 FMI: 2 Lamp: Yellow	VP44 pump controller does not detect engine position pulse at pin 7 of the engine harness.	Engine power derate. Possible white smoke.

Engine Synchronization Error Circuit



Circuit Description:

The electronic control module (ECM) receives a signal from the engine speed/position sensor. This signal is then sent to the fuel pump to tell where top dead center (TDC) is for each cylinder.

Component Location:

The engine speed/position sensor is located on the fuel-pump side of the block behind the starter.

Shop Talk:

- RVs that have DC/AC invertors can have poorly grounded coach batteries. Run with the house batteries disconnected to see if the symptom goes away.
- White or black exhaust smoke in conjunction with this fault code likely means a defective fuel pump; verify low pressure fuel system before replacing pump.
- The fault could be caused by an intermittent connection by the engine speed sensor (ESS). This fault could cause starting problems in cold weather.
- Electrical interference caused by the alternator can sometimes cause Fault Code 369. Try running the engine with the alternator disconnected.
- Running a separate ground wire from the alternator casing to battery negative (-) will sometimes make Fault Code 369 to go inactive.
- Clean and repair battery and chassis grounds.

TROUBLESHOOTING SUMMARY



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 for static timing or engine speed sensor fault.		
<u>STEP 1A:</u> Read fault codes.	Fault Code 115 or 364 inactive	
STEP 2: Check the engine harness.		
<u>STEP 2A:</u> Inspect the engine harness, fuel pump, and ECM connectors.	No damaged pins	
<u>STEP 2B:</u> Check for an open circuit.	Less than 10 ohms	
<u>STEP 2C:</u> Check for a short circuit to ground.	More than 100k ohms	
<u>STEP 2D:</u> Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 3: Check VP44 fuel pump static timing.		
<u>STEP 3A:</u> Verify fuel pump static timing is correct.	Static timing correct	
STEP 4: Clear the fault codes.		
<u>STEP 4A:</u> Disable the fault code.	Fault Code 369 inactive	
<u>STEP 4B:</u> Clear the inactive fault codes.	All faults cleared	

TROUBLESHOOTING STEP

STEP 1: Check for static timing or engine speed sensor fault.
STEP 1A: Read fault codes.

Condition:		
<ul style="list-style-type: none"> Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Read the fault codes. <ul style="list-style-type: none"> Read fault codes using INSITE™. 	OK Fault Code 115 or 364 inactive	2A
	NOT OK Fault Code 115 or 364 active	Refer to Fault Code 115 or 364

STEP 2: Check the engine harness.

STEP 2A: Inspect the engine harness, fuel pump, 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 to the OFF position.
- Disconnect the engine harness from the ECM.
- Disconnect the engine harness from the fuel pump.

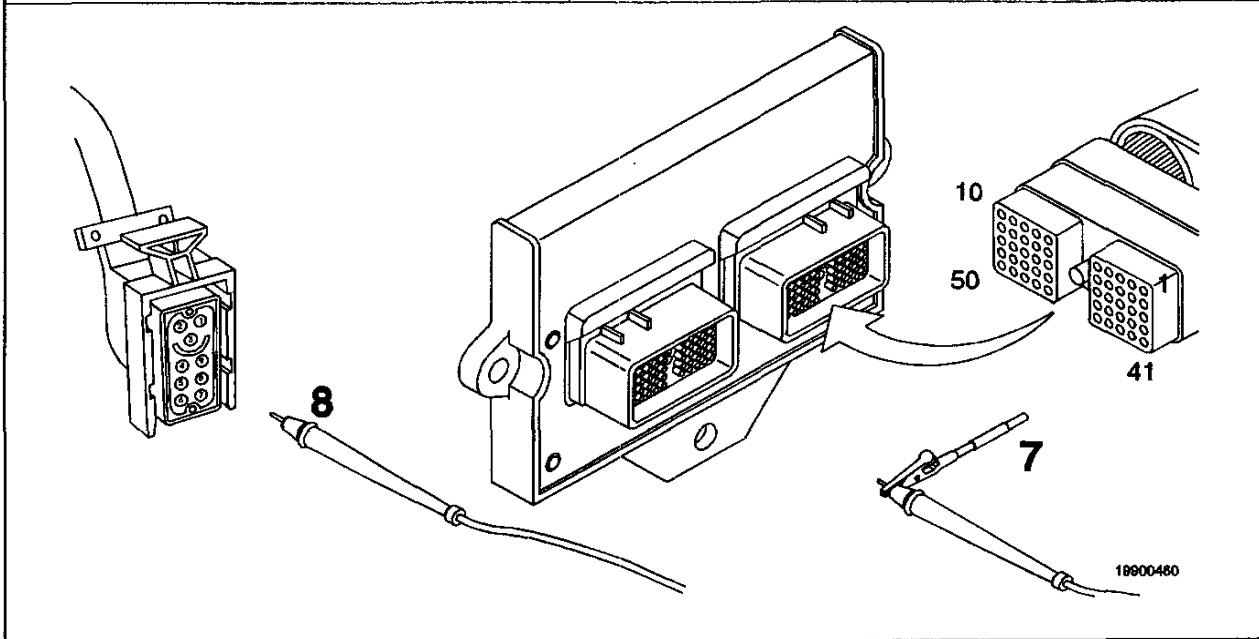
Action	Specifications/Repair	Next Step
Inspect the engine harness, fuel pump, and ECM connectors for the following: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	OK No damaged pins	2B
	NOT OK Repair the damaged pins Repair or replace the engine harness, ECM, or fuel pump, whichever has the damaged pins. <ul style="list-style-type: none"> • 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. • Replace the fuel pump. Refer to Procedure 005-014 in the Troubleshooting and Repair Manual, ISB Engines, Bulletin No. 3666193. 	4A

STEP 2B: Check for an open circuit.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the fuel pump.
- Disconnect the engine harness from the ECM.

Action	Specifications/Repair	Next Step
Check for an open circuit in the engine synchronization signal circuit. • Measure the resistance from pin 8 of VP44 connector, harness-side, to pin 7 of engine harness connector.	OK Less than 10 ohms	2C
	NOT OK Replace the engine harness Refer to Procedure 019-043.	4A

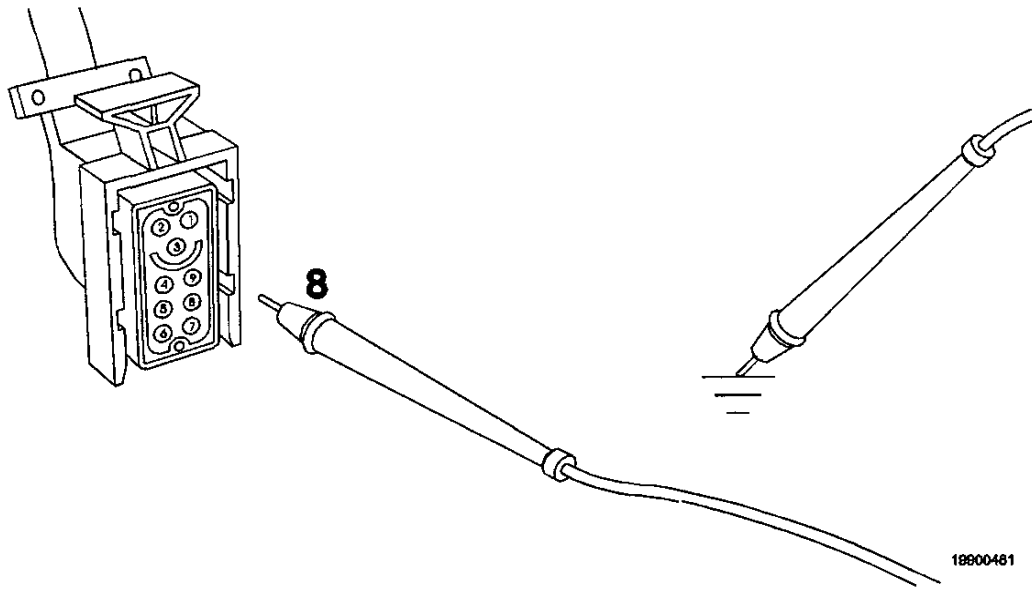


STEP 2C: Check for a short circuit to ground.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the fuel pump.
- Disconnect the engine harness from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground in the engine synchronization signal circuit. • Measure the resistance from pin 8 of the VP44 connector, harness side, to engine block ground.	OK More than 100k ohms	2D
	NOT OK Replace the engine harness Refer to Procedure 019-043.	4A



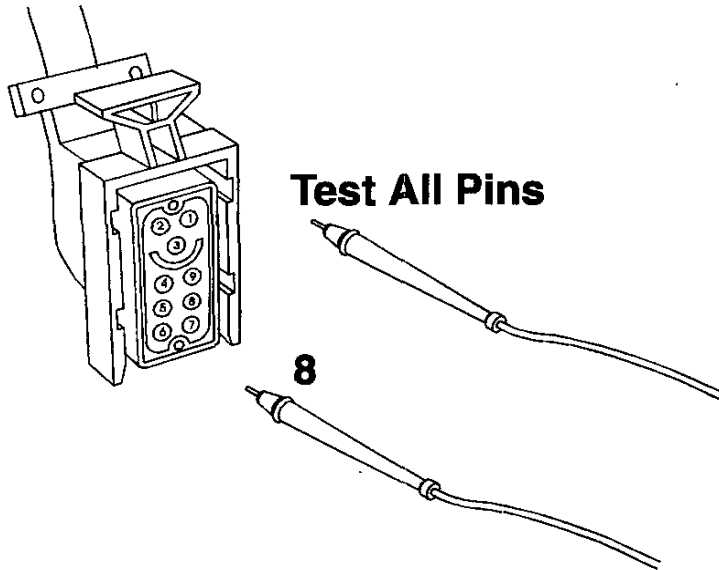
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STEP 2D: Check for a short circuit from pin to pin.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the fuel pump.
- Disconnect the engine harness from the ECM.

Action	Specifications/Repair	Next Step
Check for a short from pin to pin in the engine synchronization signal circuit. • Measure resistance from pin 8 on the harness side of the VP44 connector to all other pins in the connector.	OK More than 100k ohms	3A
	NOT OK Replace engine harness Refer to Procedure 019-043.	4A



STEP 3: Check VP44 fuel pump static timing.
STEP 3A: Verify that pump static timing is correct.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the fuel pump.
- Disconnect the engine harness from the ECM.

Action	Specifications/Repair	Next Step
Verify fuel pump static timing is correct. • Verify the key is present and undamaged. • Verify the key was properly engaged in the pump gear. • Verify pump gear is correctly engaged with the cam gear. NOTE: Refer to Procedure 005-037 in the Troubleshooting and Repair Manual, ISB Engines, Bulletin No. 3666193.	OK Fuel pump static timing correct	4A
	NOT OK Refer to Procedure 005-037 in the Troubleshooting and Repair Manual, ISB Engines, Bulletin No. 3666193.	4A

STEP 4: Clear the fault code.

STEP 4A: Disable the fault code.

Condition: <ul style="list-style-type: none"> • Connect all components. • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> • Start the engine, and let idle for 1 minute. • Verify that Fault Code 369 is inactive. 	OK Fault Code 369 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.

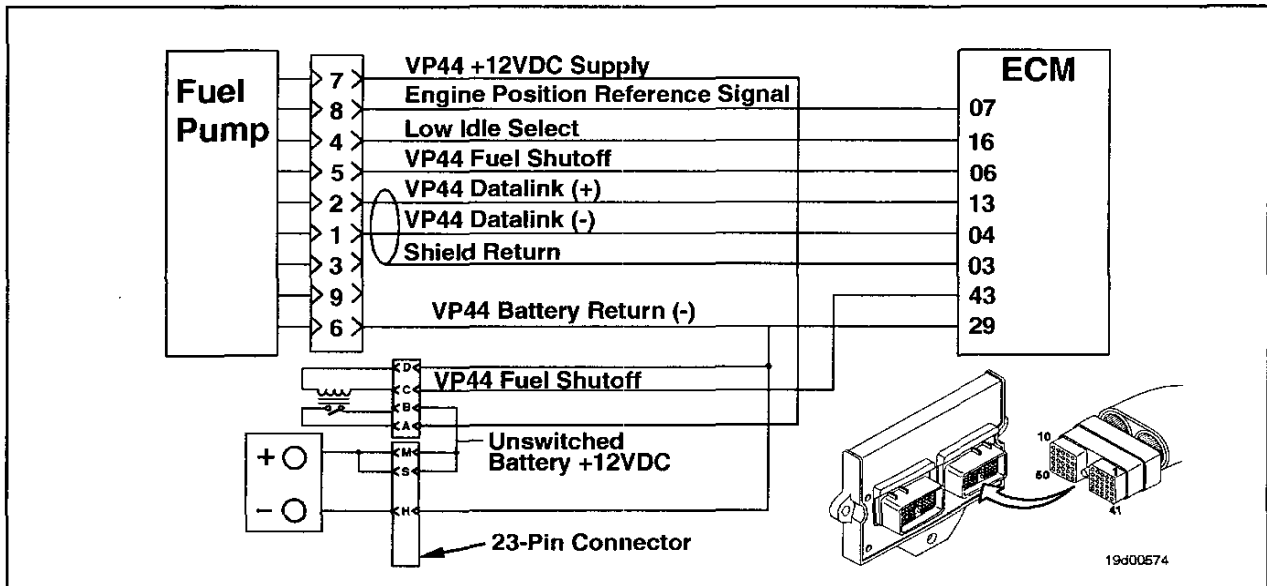
Condition: <ul style="list-style-type: none"> • Connect all the components. • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> • Erase the inactive fault code using INSITE™. 	OK All the faults cleared	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting chart

Fault Code 372

Idle Select High/Low

CODES	REASON	EFFECT
Fault Code: 372 PID(P), SID(S): S233 SPN: 1077 FMI: 11 Lamp: Yellow	VP44 pump controller detects continuous voltage at idle select pin 16 of the engine harness, or pump controller detects an open circuit or short circuit to ground at idle select pin 16 of the engine harness.	The engine will either only idle or will be stuck at a slightly higher set speed.

Fuel Pump Circuit



Circuit Description:

This circuit is used for limp home throttle if communication between the engine and fuel pump is lost. This provides for a two-stage throttle where there are **only** two engine speeds available throughout the full range of throttle travel.

Component Location:

This circuit is internal to the fuel pump control module and the engine ECM.

TROUBLESHOOTING SUMMARY



To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack test lead.



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 fault codes.

STEP 1A: Read the fault codes.

Fault Code 431, 432, 443, or
551 inactive

STEP 2: Check the engine harness.

STEP 2A: Inspect the engine harness, fuel pump, and ECM connectors.

No damaged pins

STEP 2B: Check for an open circuit.

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 2E: Check the resistance of the engine position reference circuit.

Approximately 4k to 8k ohms

STEP 3: Clear the fault code.

STEP 3A: Disable the fault code.

Fault Code 372 inactive

STEP 3B: Clear the inactive fault codes.

All faults cleared

TROUBLESHOOTING STEP

STEP 1: Check the fault codes.

STEP 1A: Read the fault codes

Condition:		
• Turn keyswitch to the OFF position.		
Action	Specifications/Repair	Next Step
Read the fault codes using INSITE™.	OK Fault Code 431, 432, 443, or 551 inactive	2A
	NOT OK Fault Code 431, 432, 443, or 551 active	Refer to Fault Code 431, 432, 443, or 551

STEP 2: Check the engine harness.

STEP 2A: Inspect the engine harness, fuel pump, 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 to the OFF position.
- Disconnect the engine harness from the ECM.
- Disconnect the engine harness from the fuel pump.

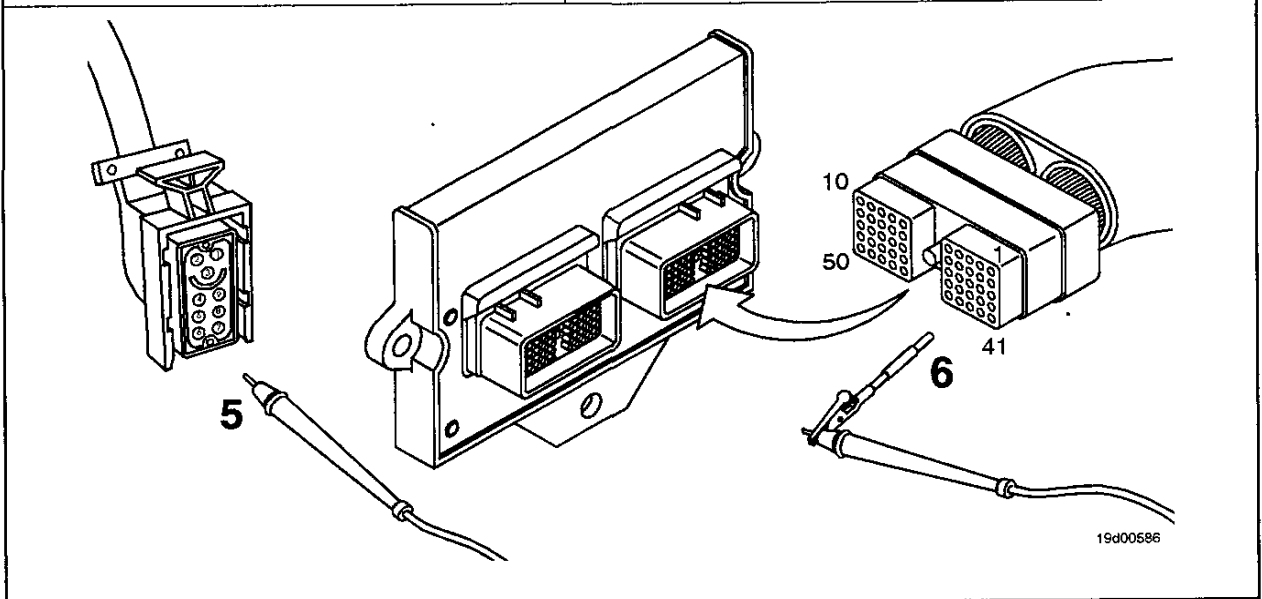
Action	Specifications/Repair	Next Step
Inspect the engine harness, fuel pump, and ECM connectors for the following: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	OK No damaged pins	2B
	NOT OK Repair the damaged pins Repair or replace the engine harness, fuel pump, or ECM, whichever has the damaged pins. <ul style="list-style-type: none"> • 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. • Replace the fuel pump. Refer to Procedure 005-014 in the Troubleshooting and Repair Manual, ISB Engines, Bulletin No. 3666193. 	3A

STEP 2B: Check for an open circuit.

Condition:

- Disconnect the engine harness from the ECM.
- Disconnect the engine harness from the fuel pump.

Action	Specifications/Repair	Next Step
Check for an open circuit. <ul style="list-style-type: none">• Measure the resistance from pin 16 of the engine harness to pin 4 on the harness side of the fuel pump connector.	OK Less than 10 ohms	2C
	NOT OK Replace the engine harness Refer to Procedure 019-043.	3A



STEP 2C: Check for a short circuit from pin to pin.

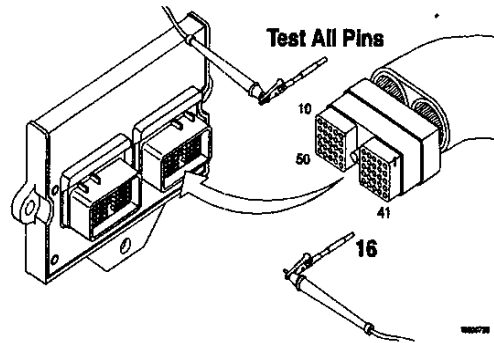


To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack test lead.

Condition:

- Disconnect the engine harness from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pin 16 to all other pins in the engine harness connector.	OK More than 100k ohms	2D
	NOT OK Replace the engine harness Refer to Procedure 019-043.	3A



STEP 2D: Check for a short circuit to ground.

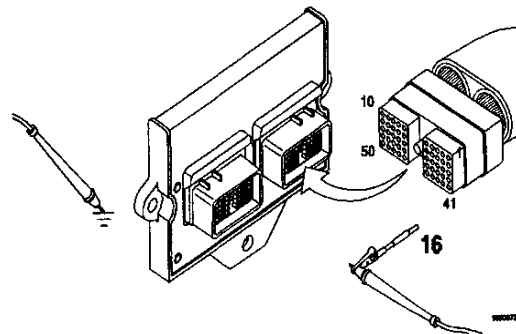
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack test lead.

Condition:

- Disconnect the engine harness from the ECM.
- Disconnect the engine harness from the fuel pump.
- Turn keyswitch to the OFF position.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground. • Measure the resistance from pin 16 of the engine harness connector to engine block ground.	OK More than 100k ohms	2E
	NOT OK Replace the engine harness Refer to Procedure 019-043.	3A



STEP 2E: Check the resistance of the engine position reference circuit.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the fuel pump.

Action	Specifications/Repair	Next Step
Check the resistance of the engine position reference circuit. • Measure the resistance from pin 4 to pin 7 of the fuel pump connector.	OK 4k to 8k ohms	3A
	NOT OK Replace the fuel pump Refer to Procedure 005-014 in the Troubleshooting and Repair Manual, ISB Engines, Bulletin No. 3666193.	3A

STEP 3: Clear the fault codes.

STEP 3A: Disable the fault codes.

Condition: <ul style="list-style-type: none"> • Connect all components. • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> • Start the engine, and let idle for 1 minute. • Depress the accelerator pedal so the engine is running greater than 1000 rpm for 1 minute. • Verify Fault Code 372 is inactive. 	OK Fault Code 372 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 check again.	1A

STEP 3B: Clear the inactive fault codes.

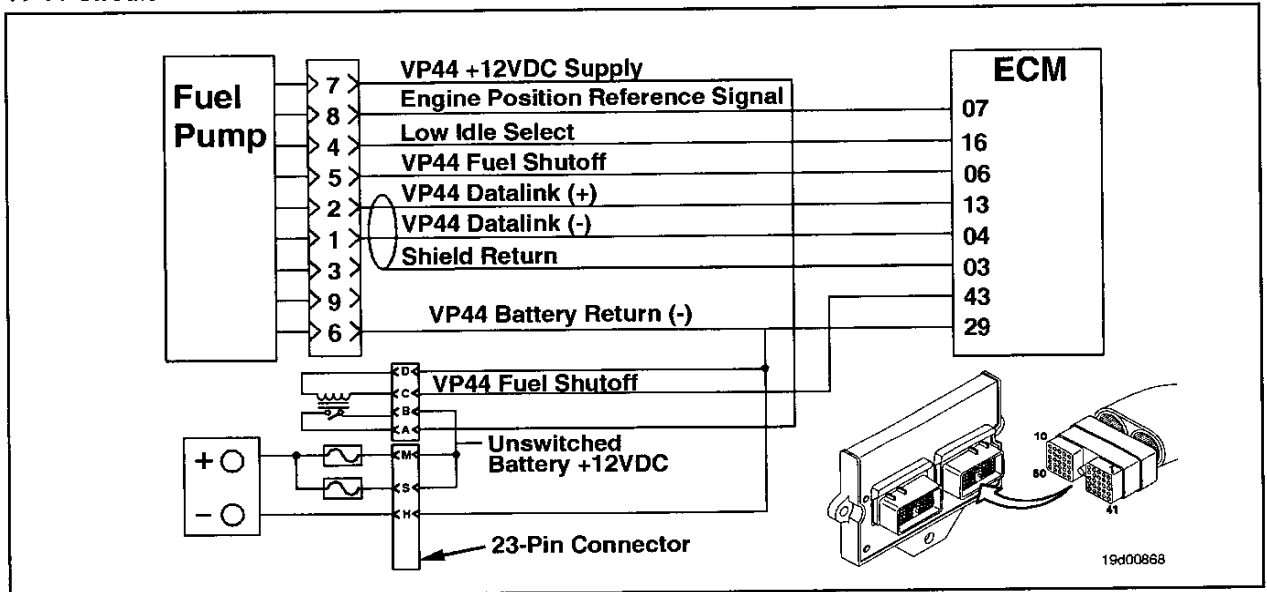
Condition: <ul style="list-style-type: none"> • Connect all the components. • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> • Erase the inactive fault codes using INSITE™. 	OK All faults cleared	Repair complete
	NOT OK Troubleshoot any remaining active fault codes	Appropriate troubleshooting chart

Fault Code 373

VP44 Fuel Pump Fuel Shut Off Error

CODES	REASON	EFFECT
Fault Code: 373 PID(P), SID(S): S233 SPN: 1077 FMI: 3 Lamp: Red	High voltage detected at VP44 fuel shutoff signal pin 6 of the engine harness.	Fueling to injectors disabled. Engine stops.

VP44 Circuit



Circuit Description:

This circuit provides a secondary fuel shutoff signal to the VP44 fuel pump.

Component Location:

The VP44 fuel pump is located on the backside of the gear housing.

Shop Talk:

This code may come active if the pump power supply circuit is faulty.

TROUBLESHOOTING SUMMARY



To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack test lead.



To avoid damaging a new electronic control module (ECM), all other active fault codes must be investigated prior to replacing the ECM.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check engine harness.		
<u>STEP 1A:</u> Inspect the engine harness, ECM, and fuel pump connectors.	No damaged pins	
<u>STEP 1B:</u> Check for a short circuit from pin to pin at the ECM connector.	More than 100k ohms	
<u>STEP 1C:</u> Check for a short circuit from pin to pin at the VP44 connector.	More than 100k ohms	
STEP 2: Clear the fault code.		
<u>STEP 2A:</u> Disable the fault code.	Fault Code 373 inactive	
<u>STEP 2B:</u> Clear the inactive fault codes.	All faults cleared	

TROUBLESHOOTING STEP

STEP 1: Check engine harness.

STEP 1A: Inspect the engine harness, ECM, and fuel pump connectors.

▲ CAUTION ▲

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the ECM.
- Disconnect the engine harness from the fuel pump.

Action	Specifications/Repair	Next Step
Inspect the engine harness, ECM, and fuel pump connectors for the following: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing connector seal. 	OK No damaged pins	1B
	NOT OK Repair damaged pins Repair or replace the engine harness, ECM, or fuel pump, whichever has the damaged pins. <ul style="list-style-type: none"> • 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. • Replace the fuel pump. Refer to Procedure 005-014 in the Troubleshooting and Repair Manual, ISB Engines, Bulletin No. 3666193. • Dry the connector by using electrical contact cleaner, Part No. 3824510. 	2A

STEP 1B: Check for short circuit from pin to pin at the ECM connector.

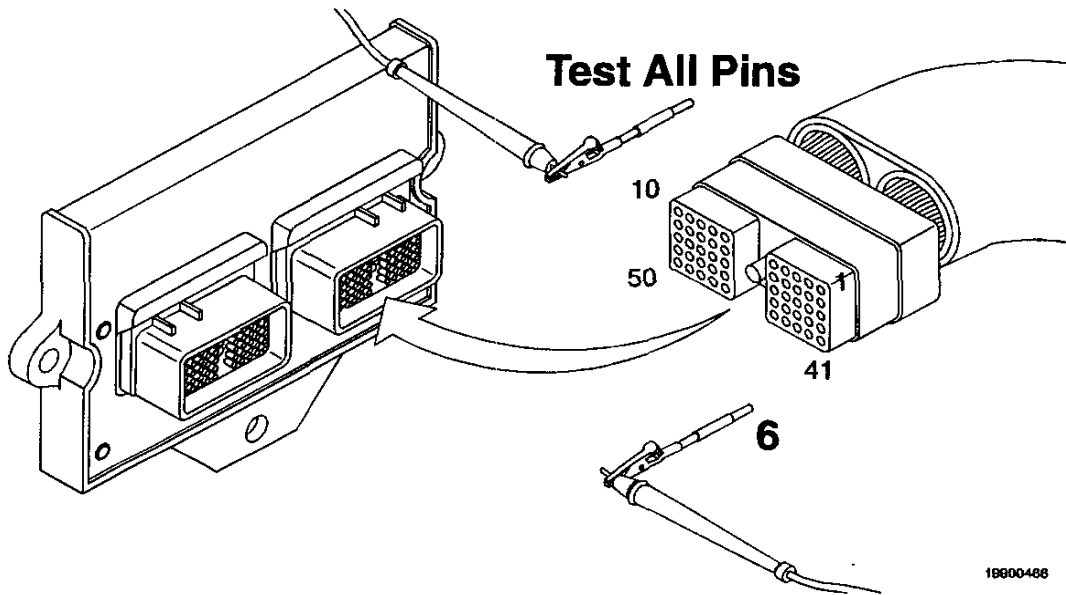
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the ECM.
- Disconnect the engine harness from the fuel pump.

Action	Specifications/Repair	Next Step
Check for short circuit from pin to pin at the ECM connector. • Measure the resistance from engine harness connector pin 6 to all other pins in the connector.	OK More than 100k ohms	1C
	NOT OK Replace the engine harness Refer to Procedure 019-043.	2A

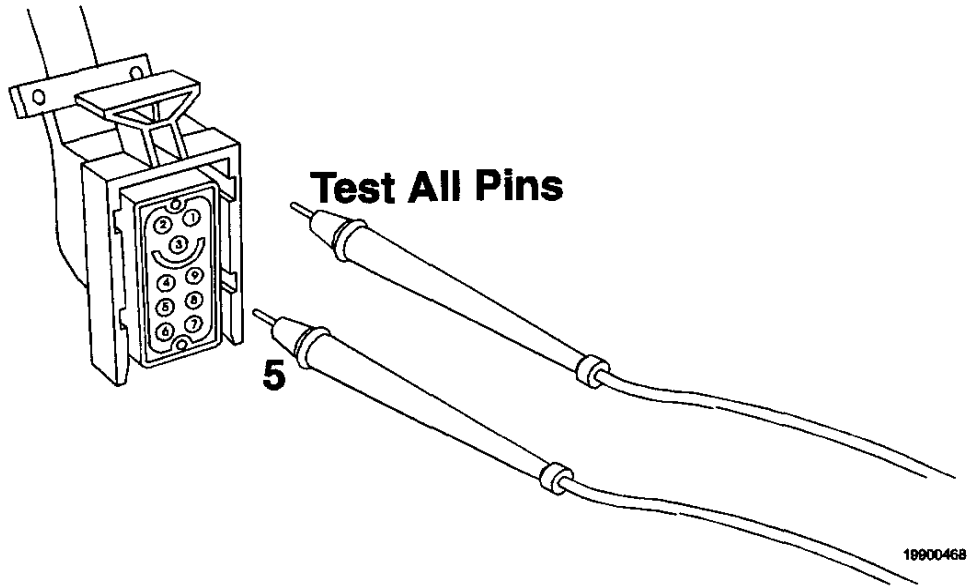


STEP 1C: Check for a short circuit from pin to pin at the VP44 connector.

Condition:

- Keyswitch in the OFF position.
- Disconnect the engine harness from the VP44 fuel pump.
- Disconnect the engine harness from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin in VP44 controller harness. • Measure the resistance from pin 5 on the fuel pump connector to all other pins on the connector, except pin 6.	OK More than 100k ohms.	2A
	NOT OK Replace the engine harness Refer to Procedure 019-043.	2A



STEP 2: Clear the fault code.
STEP 2A: Disable the fault code.

Condition:

- Connect all components.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine, and let idle for 1 minute. • Verify that Fault Code 373 is inactive.	OK Fault Code 373 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.

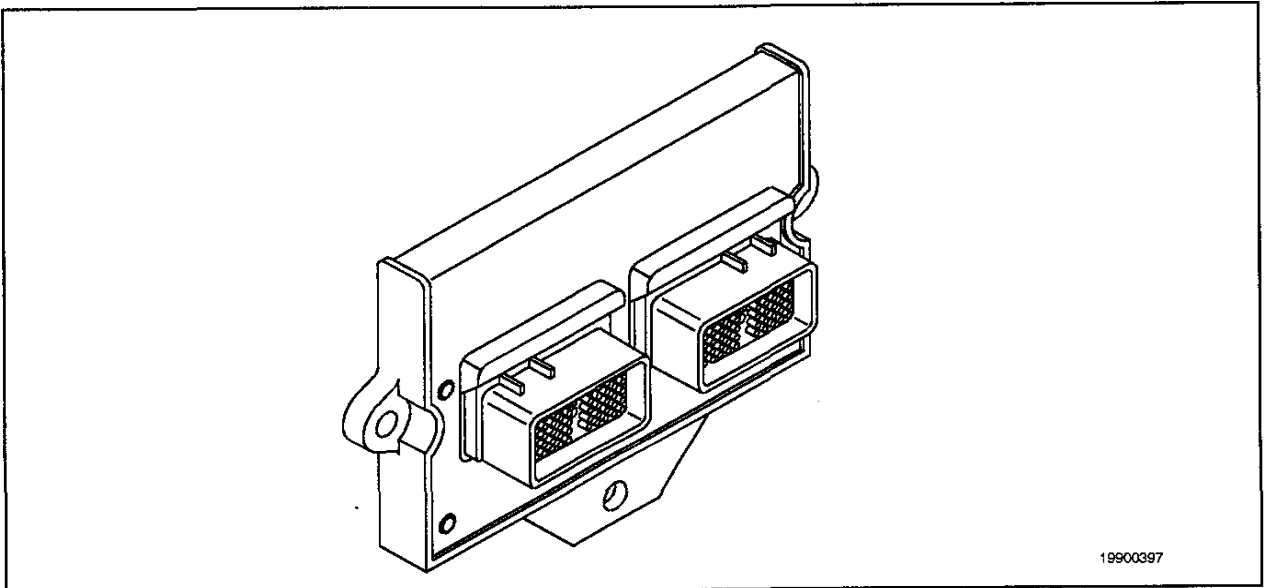
Condition:		
<ul style="list-style-type: none">• Connect all the components.• Turn keyswitch to the ON position.		
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none">• Erase the inactive fault code using INSITE™.	OK All faults cleared	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting chart

Fault Code 375

Electronic Control Module (ECM) Fuel Calibration Corrupted

CODES	REASON	EFFECT
Fault Code: 375 PID(P), SID(S): S254 SPN: 629 FMI: 2 Lamp: Yellow	ECM is requesting a fueling or timing value that the VP44 pump can not achieve.	Possible no effect or engine will run at a backup mode set speed when accelerator is off-idle.

Electronic Control Module



Circuit Description:

The ECM contains the calibration-specific parameters to control the engine's performance and diagnostics. The fuel pump has its own calibration to interpret the ECM message and control the pump. If the fueling calibration in the ECM is altered or tampered with, this fault will be logged.

Component Location:

The logic for this fault code is contained in the engine ECM circuitry.

Shop Talk:

This fault code is meant to detect out-of-range values and protects the pump from excessive duty cycles and illegal calibration tampering.

If this code is active or has high inactive counts, the fuel pump control module (FPCM) has detected an out-of-range value commanded by the ECM. Recalibrate the ECM.

TROUBLESHOOTING SUMMARY

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Make sure the calibration is correct.		
STEP 1A: Download a new, accurate calibration for that particular rating.	Correct calibration for corresponding engine rating	
STEP 2: Clear the fault code.		
STEP 2A: Disable the fault code.	Fault Code 375 inactive	
STEP 2B: Clear the inactive fault codes.	All faults cleared	

TROUBLESHOOTING STEP

STEP 1: Make sure the calibration is correct.
STEP 1A: Download a new, accurate calibration for that particular rating.

Condition:		
<ul style="list-style-type: none"> Connect INSITE™ to the engine datalink. 		
Action	Specifications/Repair	Next Step
Download new calibration.	OK Correct calibration for corresponding engine rating	2A
	NOT OK Refer to INSITE™ manual for correct procedure to download a calibration.	2A

STEP 2: Clear the fault code.
STEP 2A: Disable the fault code.

Condition:		
<ul style="list-style-type: none"> Connect all components. Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> Start the engine, and let idle for 1 minute. Verify that Fault Code 375 is inactive. 	OK Fault Code 375 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 code.

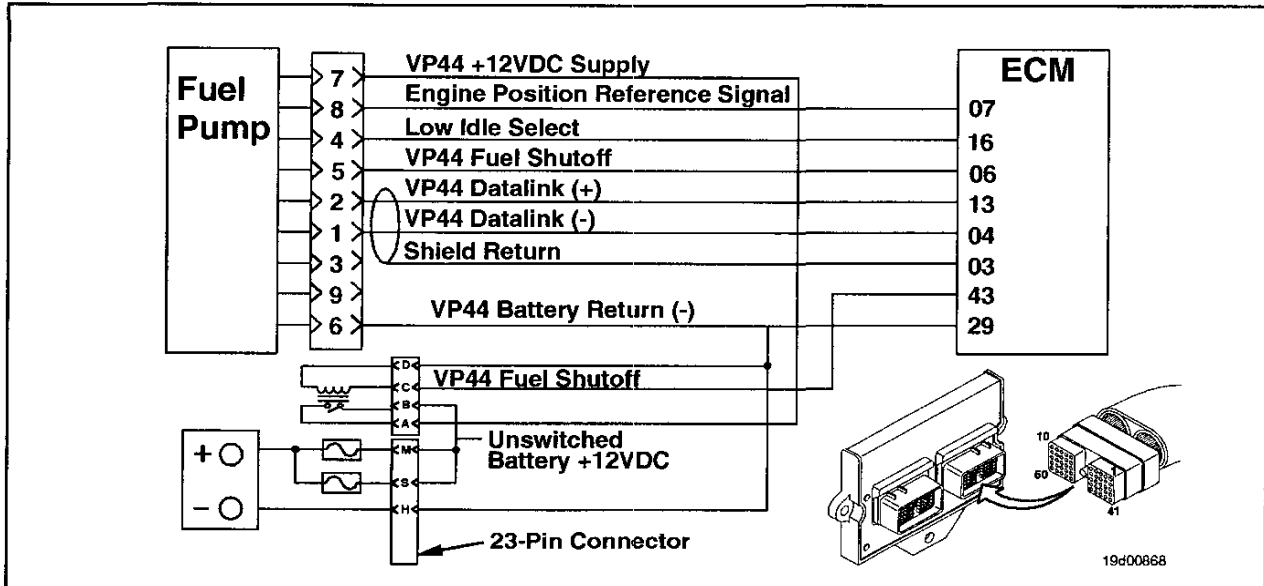
Condition: <ul style="list-style-type: none">• Connect all the components.• Turn keyswitch to the ON position.		
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none">• Erase the inactive fault code using INSITE™.	OK All faults cleared	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting chart

Fault Code 377

Fuel Pump Power Relay Stuck-On

CODES	REASON	EFFECT
Fault Code: 377 PID(P), SID(S): S233 SPN: 1077 FMI: 7 Lamp: Yellow	VP44 pump controller is not powering down when keyswitch power is removed from the electronic control module (ECM).	Equipment batteries can be drained low during long shutdown periods.

Fuel Pump Circuit



Circuit Description:

This circuit is internal to the ECM. If the keyswitch is turned off and the ECM still detects messages being sent from the fuel pump, the ECM will log this fault.

Component Location:

This circuit logic is internal to the ECM.

Shop Talk:

- Some older ISB engines use a different OEM interface connector than illustrated. Refer to Bulletin No. 3666195 for correct wiring diagram.
- Fault Code 377 can be caused by a stuck VP44 relay. If voltage is detected at pin 7 of the VP44 connector, with the keyswitch in the OFF position, check for a faulty VP44 relay.

TROUBLESHOOTING SUMMARY



To avoid damaging a new ECM, all other fault codes must be investigated prior to replacing the ECM.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the engine harness, fuel pump, and ECM connectors.		
STEP 1A: Inspect the engine harness, fuel pump, and ECM connectors.	No damaged pins	
STEP 1B: Check for a short circuit from pin to pin in the VP44 power shutoff circuit.	More than 100k ohms	
STEP 1C: Check for a short circuit to an external voltage source.	Less than 1.0 VDC	
STEP 2: Check relay.		
STEP 2A: Check for stuck relay.	More than 100k ohms	
STEP 3: Clear the fault codes.		
STEP 3A: Disable the fault code.	Fault Code 377 inactive	
STEP 3B: Clear the inactive fault codes.	All faults cleared	

TROUBLESHOOTING STEP

STEP 1: Check the engine harness, fuel pump, and ECM connectors.
STEP 1A: Inspect the engine harness, fuel pump, and ECM connectors.

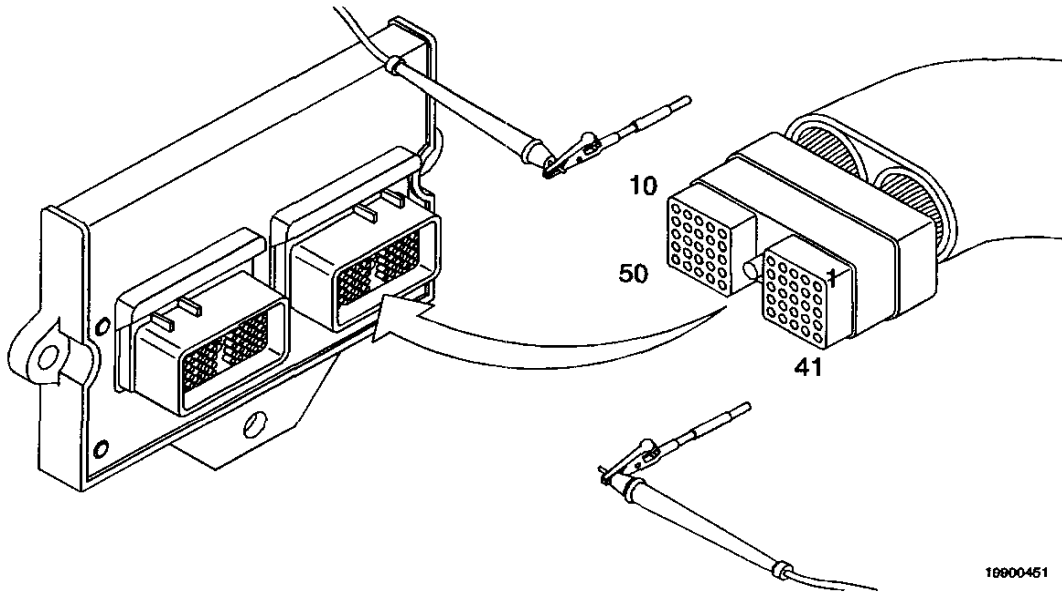
To avoid damaging a new ECM, all other fault codes must be investigated prior to replacing the ECM.		
Condition:		
<ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the engine harness connector from the ECM. • Disconnect the fuel pump relay connector from the engine harness. 		
Action	Specifications/Repair	Next Step
Inspect the engine harness, fuel pump, and ECM connector pins for the following: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	OK No damaged pins	1B
	NOT OK Repair or replace the damaged pins <ul style="list-style-type: none"> • Repair the engine harness. Refer to Procedure and 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031. • Replace the fuel pump. Refer to Procedure 005-014 in the Troubleshooting and Repair Manual, ISB Engines, Bulletin No. 3666193. 	3A

STEP 1B: Check for a short circuit from pin to pin.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the ECM.
- Disconnect the engine harness from the fuel pump.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pin 43 to pins 16, 6, 11, 5, 38, 39, 40, 31, and 42.	OK More than 100k ohms	1C
	NOT OK Replace the engine harness Refer to Procedure 019-043.	3A



STEP 1C: Check for a short circuit to an external voltage source.

Condition:

- Disconnect VP44 relay from the engine harness.
- Connect ECM to the engine harness.
- Turn keyswitch to the ON position.

Action	Specifications/Repair	Next Step
Check for a short circuit to an external voltage source in the VP44 voltage supply circuit. • Measure the voltage from pin A of the VP44 relay connector, harness side, to engine block ground.	OK Less than 1.0 VDC	2A
	NOT OK Replace the engine harness Refer to Procedure 019-043.	3A

STEP 2: Check relay.

STEP 2A: Check for stuck relay.

Condition: <ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the fuel pump relay from the engine harness. 		
Action	Specifications/Repair	Next Step
Check for stuck "ON" relay. <ul style="list-style-type: none"> • Measure resistance between pin 30 and post 87 of the VP44 relay. 	OK More than 100k ohms	3A
	NOT OK Replace the fuel pump relay Refer to Procedure 005-014 in the Troubleshooting and Repair Manual, ISB Engines, Bulletin No. 3666193.	3A

STEP 3: Clear the fault codes.

STEP 3A: Disable the fault code.

Condition: <ul style="list-style-type: none"> • Connect all components. • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> • Start the engine and let idle for one minute • Verify that Fault Code 377 is inactive 	OK Fault Code 377 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.

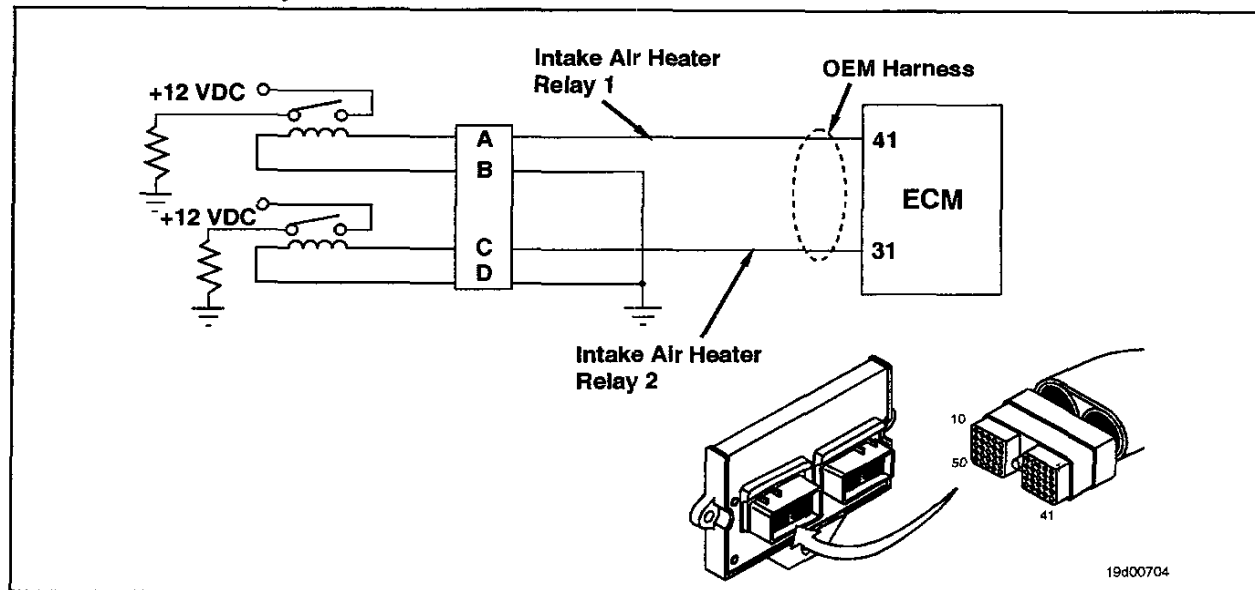
Condition: <ul style="list-style-type: none"> • Connect all components • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> • Erase the inactive fault codes using INSITE™. 	OK All faults cleared	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting chart

Fault Code 381 or 382

Intake Air Heater Relay Circuit

CODES	REASON	EFFECT
Fault Code: 381 or 382 PID(P), SID(S): S237 SPN: 626 FMI: 11 Lamp: Yellow	FC 381: Error detected in the cold start air relay 1 enable circuit at pin 41 of the original equipment manufacturer (OEM) harness. FC 382: Error detected in the cold start air relay 2 enable circuit at pin 31 of the OEM harness.	Intake air heater can not be energized by the electronic control module (ECM). Possible white smoke and/or hard starting in cold ambient conditions.

Intake Air Heater Relay Circuit



Circuit Description:

The intake air heater improves starting and white smoke control in cold ambient conditions. The ECM controls relays that switch power to the air heater. There are two heating coils in the heater that are individually controlled by the ECM.

Component Location:

The intake air heater is located at the air inlet connection into the intake manifold. The location of the heater relays will vary with OEM.

Shop Talk:

- These faults could also indicate the intake air heater circuits are shorted to battery (+). This would command the grids to be on full time. This will drain the batteries, burn out grids, and/or destroy intake gaskets.
- The intake air heater circuits will **only** activate when intake manifold temperature is below 66°F when the keyswitch is in the ON position.

TROUBLESHOOTING SUMMARY



To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.



To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack test lead
Part No. 3823996 - female Weather-Pack test lead.

STEPS

SPECIFICATIONS

SRT CODE

STEP 1: Check OEM harness.

STEP 1A: Inspect the OEM harness, intake air heater relay, and ECM connectors.

STEP 1B: Check for an open circuit.

STEP 1C: Check for an open circuit in the relay and relay ground.

STEP 1D: Check for a short circuit to ground.

STEP 1E: Check for a short circuit from pin to pin.

STEP 1F: Check for a short circuit to battery.

No damaged pins

Less than 10 ohms

Refer to equipment manual for specification

More than 100k ohms

More than 100k ohms

Less than (+) 1.0 VDC

STEP 2: Clear the fault codes.

STEP 2A: Disable the fault code.

STEP 2B: Clear the inactive fault codes.

Fault Codes 381 and 382 inactive

All faults cleared

TROUBLESHOOTING STEP

STEP 1: Check OEM harness.

STEP 1A: Inspect the OEM harness, intake air heater relay, and ECM connectors.



To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the ECM.
- Disconnect the intake air heater relay.

Action	Specifications/Repair	Next Step
Inspect the OEM harness, intake air heater relay, and ECM connectors for the following: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	OK No damaged pins	1B
	NOT OK Repair damaged pins Repair or replace the OEM harness, ECM, or intake air heater relay, whichever has damaged pins. <ul style="list-style-type: none"> • Repair the OEM harness. Refer to Procedures 019-250 and 019-204. • Replace the OEM harness. Refer to Procedure 019-071. • Replace the ECM. Refer to Procedure 019-031. • Replace the intake air heater relay. Refer to the Troubleshooting and Repair Manual ISB Engines, Bulletin No. 3666193. 	2A

STEP 1B: Check for an open circuit.

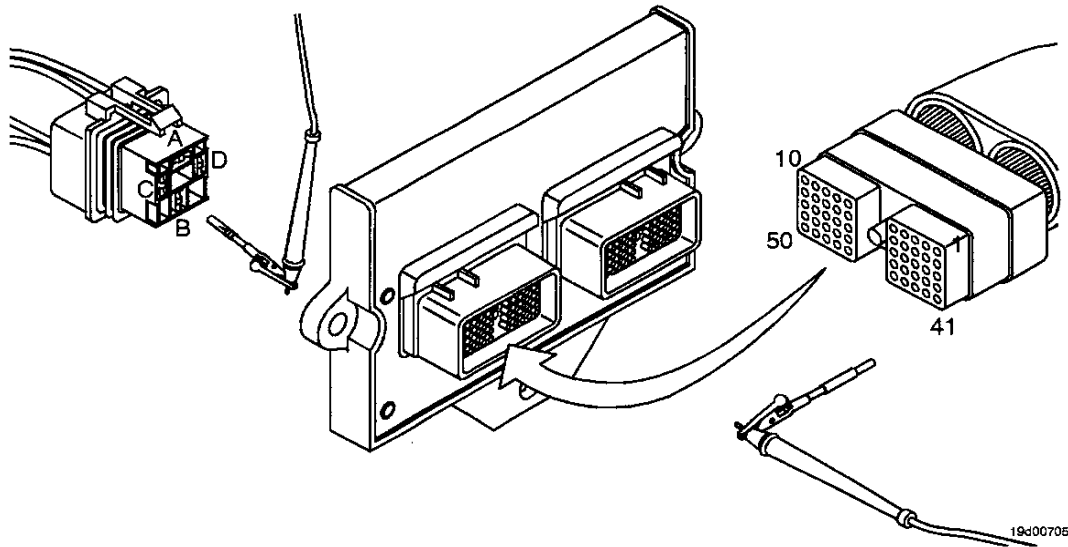
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack test lead
Part No. 3823996 - female Weather-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the ECM.
- Disconnect the OEM harness from the intake air heater relay connector.

Action	Specifications/Repair	Next Step
<p>Check for an open circuit in the relay enable circuit.</p> <ul style="list-style-type: none"> • Measure the resistance from the intake air heater relay pin in the OEM harness connector to the harness side of the heater relay connector. 	<p>OK Less than 10 ohms</p>	<p>1C</p>
<p>Refer to the following to determine the correct pins to check for each fault:</p> <p>FC 381: OEM harness connector pin 41 to heater relay 1 (pin A).</p> <p>FC 382: OEM harness connector pin 31 to heater relay 2 (pin C).</p>	<p>NOT OK Replace the OEM harness Refer to Procedure 019-071.</p>	<p>2A</p>

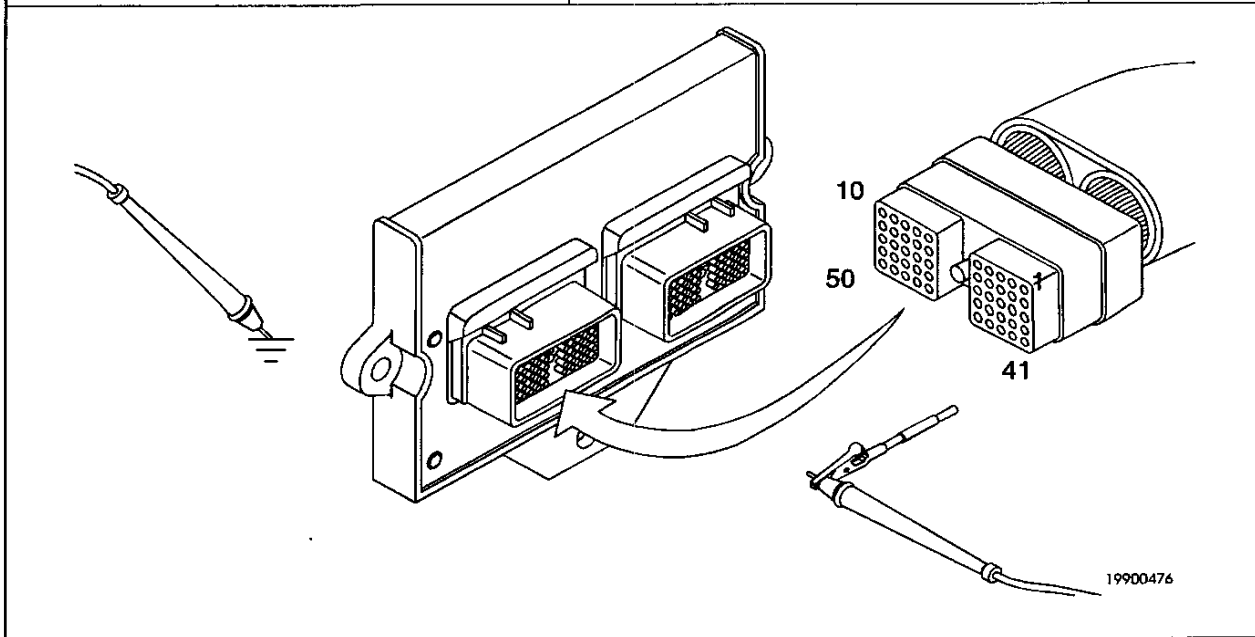


STEP 1C: Check for an open circuit in the relay and relay ground.

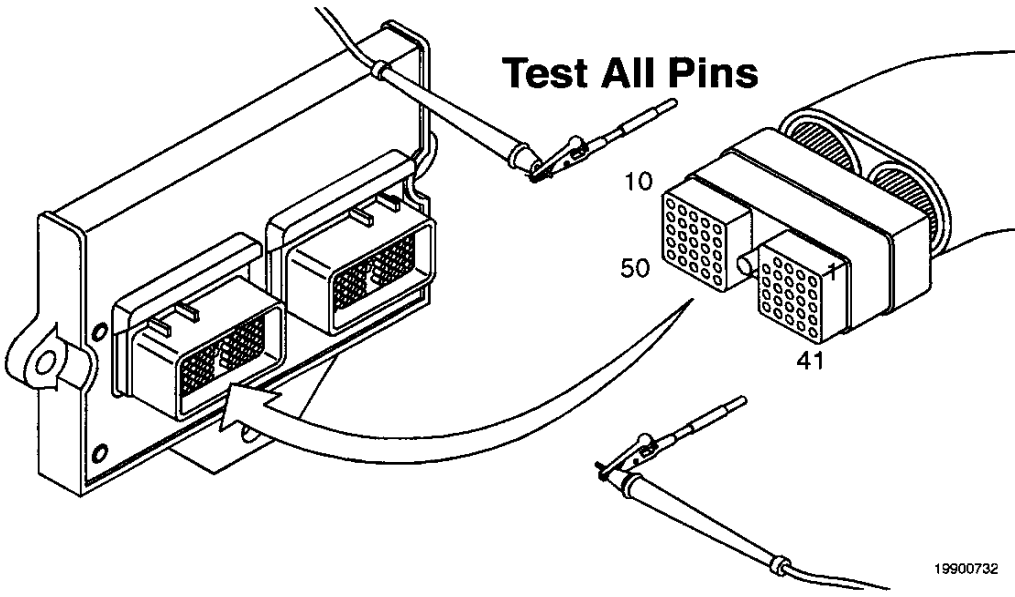
Condition: <ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the OEM harness from the intake air heater relay connector. 		
Action	Specifications/Repair	Next Step
Check for an open circuit in the relay and relay ground. <ul style="list-style-type: none"> • Measure the resistance of the relay and its ground on the pull in coil side of the relay. 	OK Refer to equipment manual for specification	1D
	NOT OK Replace relay or ground circuit Refer to the OEM troubleshooting and repair manual.	2A

STEP 1D: Check for a short circuit to ground.

Condition: <ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the OEM harness from the intake air heater relay connector. • Disconnect the OEM harness connector from the ECM. 		
Action	Specifications/Repair	Next Step
Check for a short circuit to ground in the intake air heater relay circuit. <ul style="list-style-type: none"> • Measure the resistance from the intake air heater relay pin in the OEM harness connector to engine block ground. Refer to the following to determine the correct pins to check for each fault: FC 381: OEM harness connector pin 41. FC 382: OEM harness connector pin 31.	OK More than 100k ohms	1E
	NOT OK Replace the OEM harness Refer to Procedure 019-071.	2A



STEP 1E: Check for a short circuit from pin to pin.

<p>Condition:</p> <ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the OEM harness connector from the ECM. • Disconnect the intake air heater relay connector from the OEM harness. 		
Action	Specifications/Repair	Next Step
<p>Check for a short circuit from pin to pin in the intake air heater relay circuit.</p> <ul style="list-style-type: none"> • Measure the resistance from the intake air heater relay pin in the OEM harness to all other pins in the OEM harness connector. <p>Refer to the following to determine the correct pins to check for each fault: FC 381: OEM harness connector pin 41. FC 382: OEM harness connector pin 31.</p>	<p>OK More than 100k ohms</p>	1F
	<p>NOT OK Replace the OEM harness Refer to Procedure 019-071.</p>	2A
 <p style="text-align: right;">19900732</p>		

STEP 1F: Check for a short circuit to battery.

<p>Condition:</p> <ul style="list-style-type: none"> • Disconnect OEM harness from the ECM. • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
<ul style="list-style-type: none"> • Measure the voltage from pins 41 and 31 on the OEM harness connector to engine block ground. 	<p>OK Less than 1.0 (+) VDC</p>	2A
	<p>NOT OK Replace the OEM harness Refer to Procedure 019-071.</p>	2A

STEP 2: Clear the fault codes.

STEP 2A: Disable the fault code.

Condition:		
<ul style="list-style-type: none"> • Connect all components. • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> • Start the engine, and let idle for 1 minute • Verify that Fault Codes 381 and 382 are inactive. 	OK Fault Codes 381 and 382 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.

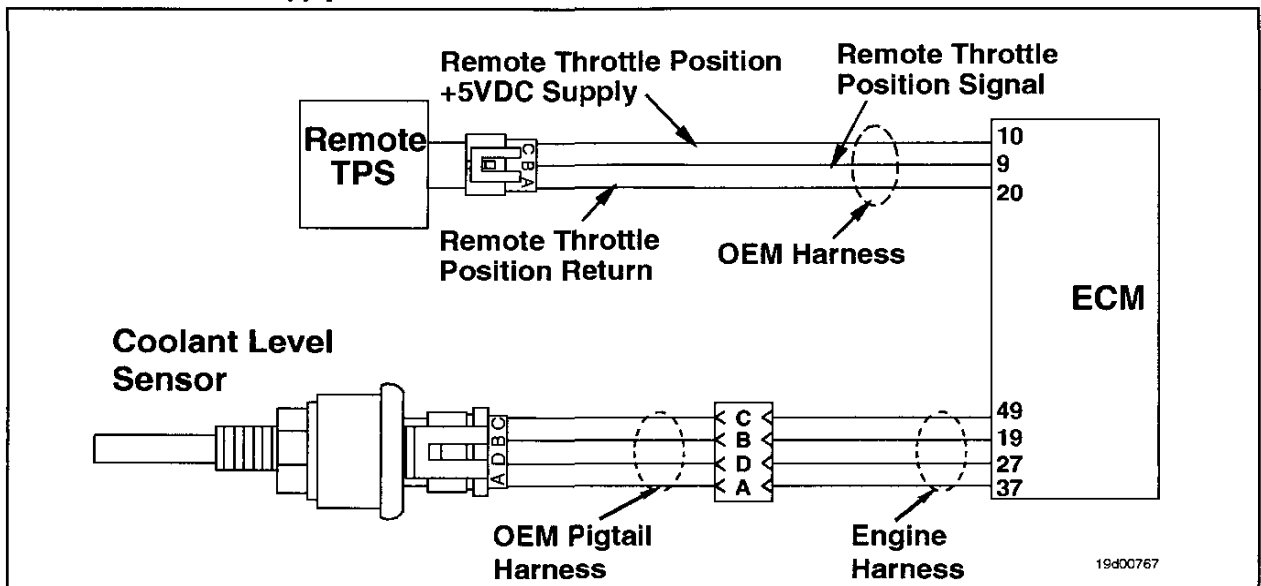
Condition:		
<ul style="list-style-type: none"> • Connect all components. • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> • Erase the inactive fault codes using INSITE™. 	OK All faults cleared	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting chart

Fault Code 385 or 444

Remote Accelerator Supply Circuit

CODES	REASON	EFFECT
Fault Code: 385 or 444 PID(P), SID(S): S232 SPN: 620 FMI: 3 or 1 Lamp: Yellow	FC 385: High voltage detected at remote accelerator position sensor supply pin 10 of the original equipment manufacturer (OEM) harness. FC 444: Low voltage detected at remote accelerator position sensor supply pin 10 of the OEM harness.	The remote accelerator, coolant level sensor, and water-in-fuel (WIF) sensor will not function.

Remote Accelerator Supply Circuit



Circuit Description:

The remote accelerator supply circuit supplies + 5 VDC for the remote accelerator and the coolant level sensor. These circuits are connected inside the ECM. Faults on these circuits could also affect the operation of the WIF sensor. These are all OEM options and often do **not** apply to your specific vehicle.

NOTE: The connector pin letters shown for the accelerator pedal wiring in these troubleshooting steps are examples of representative sensors. The connector pin assignments can vary with equipment manufacturer, but the base troubleshooting logic will still apply.

Component Location:

The remote accelerator position sensor is located on the remote accelerator control assembly somewhere outside the cab. The coolant level sensor will be located in the top of the radiator or coolant tank. The WIF sensor is located in the fuel filter or fuel filter head.

TROUBLESHOOTING SUMMARY



To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.



To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack test lead
Part No. 3822917 - female AMP/Metri-Pack/Deutsch test lead.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the sensors.		
<u>STEP 1A:</u> Read the fault codes.	Fault Code 385 is active	
<u>STEP 1B:</u> Check the coolant level sensor.	Fault Code 444 still active	
<u>STEP 1C:</u> Check the remote accelerator.	Fault Code 444 still active	
STEP 2: Check the engine harness.		
<u>STEP 2A:</u> Inspect the OEM pigtail harness and engine harness connectors.	No damaged pins	
<u>STEP 2B:</u> Check OEM pigtail harness.	Fault Code 385 or 444 remains active	
<u>STEP 2C:</u> Inspect the engine harness and ECM connectors.	No damaged pins	
<u>STEP 2D:</u> Check for a short circuit to ground.	More than 100k ohms	
<u>STEP 2E:</u> Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 3: Check the OEM harness.		
<u>STEP 3A:</u> Inspect the OEM harness and ECM connectors.	No damaged pins	
<u>STEP 3B:</u> Check for a short circuit to ground.	More than 100k ohms	
<u>STEP 3C:</u> Check for a short circuit from pin to pin.	More than 100k ohms	
<u>STEP 3D:</u> Check for a short circuit to a voltage source.	Less than (+) 1.0 VDC	
STEP 4: Check the ECM voltage.		
<u>STEP 4A:</u> Measure the sensor supply voltage from the ECM.	(+) 4.75 to 5.25 VDC	
STEP 5: Clear the fault codes.		
<u>STEP 5A:</u> Disable the fault code.	Fault Code 385 or 444 inactive	
<u>STEP 5B:</u> Clear the inactive fault codes.	All faults cleared	

TROUBLESHOOTING STEP

STEP 1: Check the sensors.

STEP 1A: Read the fault codes.

Condition: <ul style="list-style-type: none"> • Turn keyswitch to the ON position. • Connect INSITE™. 		
Action	Specifications/Repair	Next Step
Read the fault codes. • Read the fault codes using INSITE™.	OK Fault Code 385 is active	2A
	NOT OK Fault Code 444 is active	1B

STEP 1B: Check the coolant level sensor (if equipped).

Condition: <ul style="list-style-type: none"> • Turn keyswitch to the ON position. • Connect INSITE™. • Disconnect the coolant level sensor from the engine harness. 		
Action	Specifications/Repair	Next Step
Read the fault codes. • Read the fault codes using INSITE™.	OK Fault Code 444 still active	1C
	NOT OK Replace the coolant level sensor Refer to Procedure 019-017.	5A

STEP 1C: Check the remote accelerator (if equipped).

Condition: <ul style="list-style-type: none"> • Turn keyswitch to the ON position. • Connect INSITE™. • Disconnect the remote accelerator. 		
Action	Specifications/Repair	Next Step
Read the fault codes. • Read the fault codes using INSITE™.	OK Fault Code 444 still active	2A
	NOT OK Replace remote accelerator Refer to the OEM troubleshooting and repair manual.	5A

STEP 2: Check the engine harness.

STEP 2A: Inspect the OEM pigtail harness and engine harness connectors (if equipped).

Condition:		
<ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the OEM pigtail harness from the engine harness. 		
Action	Specifications/Repair	Next Step
Inspect the OEM pigtail harness and engine harness connectors for the following: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	OK No damaged pins	2B
	NOT OK Replace the damaged pins Repair or replace the OEM pigtail harness or the engine harness connector, whichever has damaged pins. <ul style="list-style-type: none"> • Replace the OEM pigtail harness. Refer to the OEM troubleshooting and repair manual. • Install the appropriate connector seal if it is damaged or missing. 	5A

STEP 2B: Check the OEM pigtail harness (if equipped).

Condition:		
<ul style="list-style-type: none"> • Turn keyswitch to the ON position. • Disconnect the OEM pigtail harness from the engine harness. 		
Action	Specifications/Repair	Next Step
Read the fault codes. <ul style="list-style-type: none"> • Read the fault codes using INSITE™. NOTE: If INSITE™ is not available, active fault codes can be flashed out in the OEM dash.	OK Fault Code 385 or 444 remains active	2C
	NOT OK Replace the OEM pigtail harness Refer to the OEM troubleshooting and repair manual.	5A

STEP 2C: Inspect the engine harness and ECM connectors.

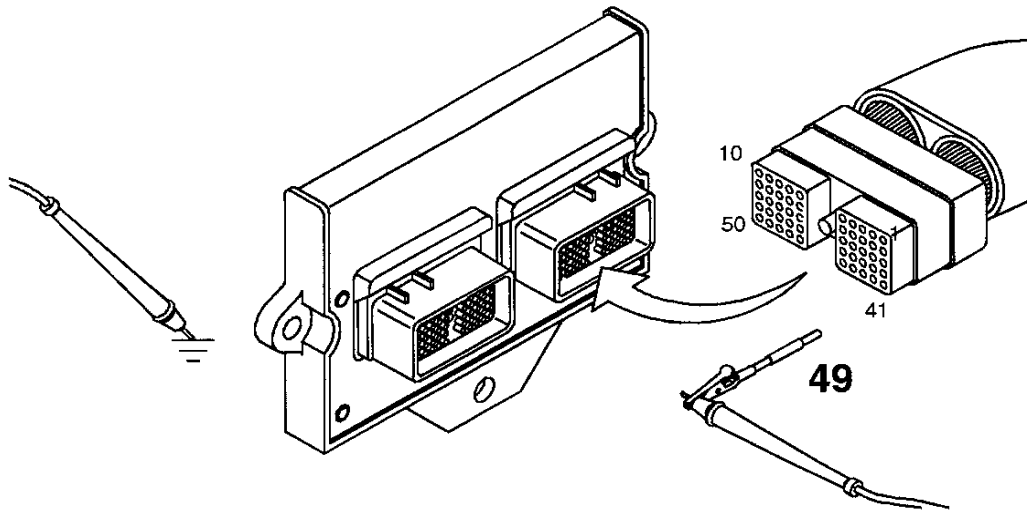
Condition:		
<ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the engine harness from the ECM. • Disconnect the OEM pigtail harness from the engine harness. 		
Action	Specifications/Repair	Next Step
Inspect the engine harness and ECM connectors for the following: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	OK No damaged pins	2D
	NOT OK Replace the damaged pins Repair or replace the engine harness or ECM connectors, whichever have damaged pins. <ul style="list-style-type: none"> • Replace the engine harness. Refer to Procedure 019-043. • Install the appropriate connector seal if it is damaged or missing. 	5A

STEP 2D: Check for a short circuit to ground.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the ECM.
- Disconnect the OEM pigtail harness from the engine harness.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground. • Measure resistance from pin 49 in engine harness connector to engine block ground.	OK More than 100k ohms	2E
	NOT OK Repair or replace engine harness Refer to Procedure 019-043.	5A

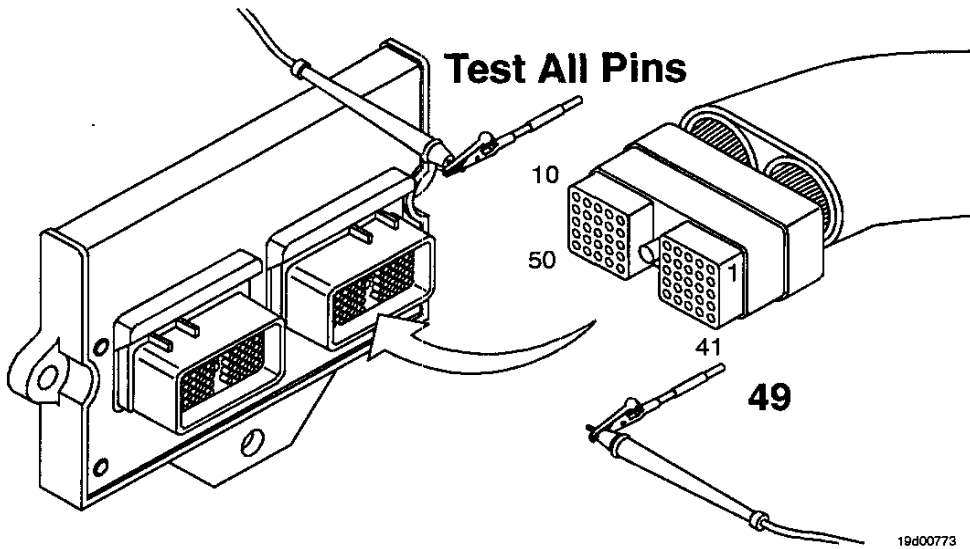


STEP 2E: Check for a short circuit from pin to pin.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the ECM.
- Disconnect the OEM pigtail harness from the engine harness.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure resistance from pin 49 in engine harness connector to all other pins.	OK More than 100k ohms	3A
	NOT OK Repair or replace engine harness Refer to Procedure 019-043.	5A



STEP 3: Check the OEM harness.

STEP 3A: Inspect the OEM 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 to the OFF position.
- Disconnect the OEM harness from the ECM.

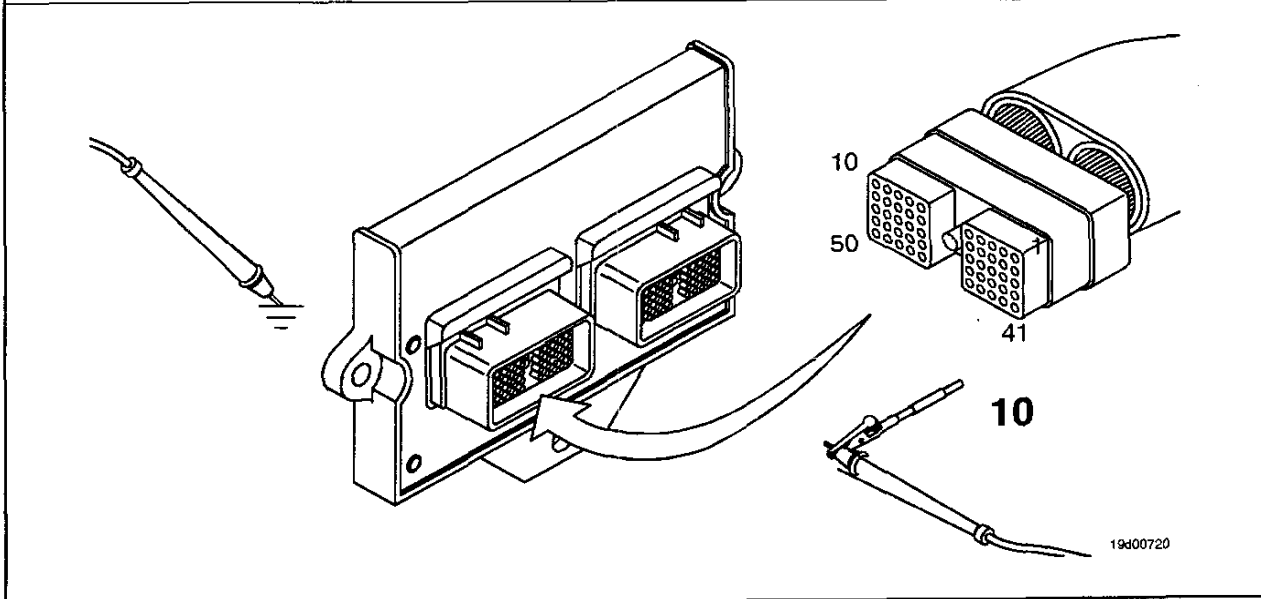
Action	Specifications/Repair	Next Step
Inspect the OEM harness and the ECM connectors for the following: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	OK No damaged pins	3B
	NOT OK Repair the damaged pins Repair or replace the OEM harness or ECM, whichever has the damaged pins. <ul style="list-style-type: none"> • Repair the OEM harness. Refer to Procedure 019-250. • Replace the OEM harness. Refer to Procedure 019-071. • Replace the ECM. Refer to Procedure 019-031. 	5A

STEP 3B: Check for a short circuit to ground.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the remote accelerator position sensor.
- Disconnect the OEM harness from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit to a chassis ground. • Measure the resistance from pin 10 in the OEM harness connector to engine block ground.	OK More than 100k ohms	3C
	NOT OK Replace the OEM harness Refer to Procedure 019-071.	5A

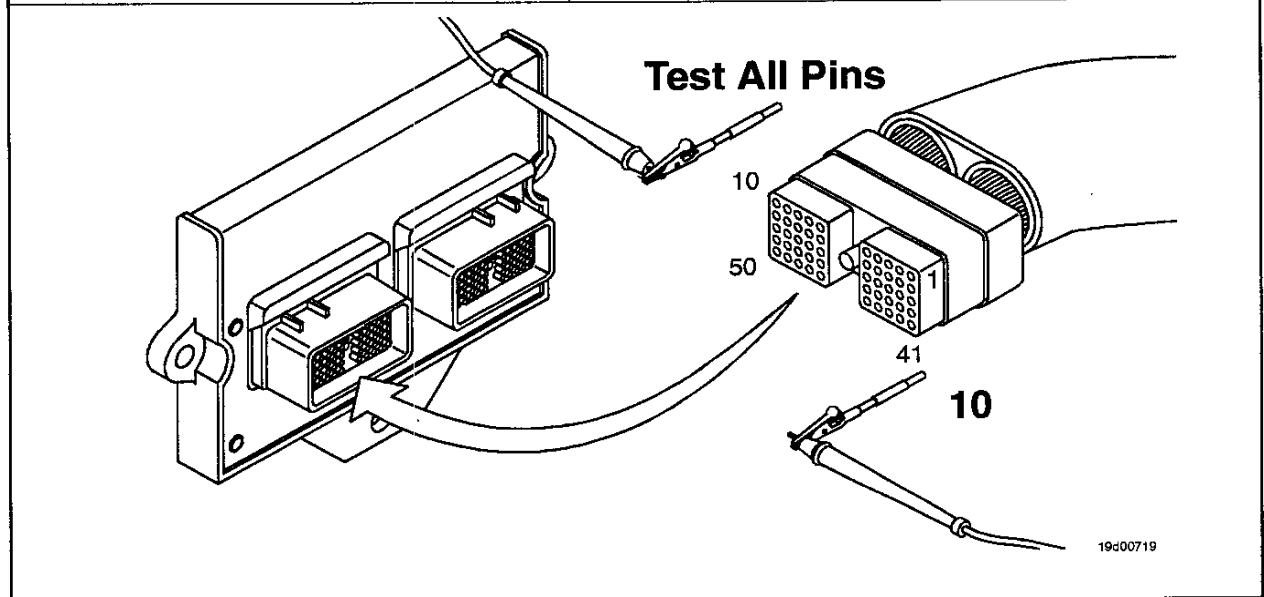


STEP 3C: Check for a short circuit from pin to pin.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the remote accelerator position sensor.
- Disconnect the OEM harness from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin in the OEM harness. • Measure the resistance from pin 10 to all other pins in the OEM harness.	OK More than 100k ohms	3D
	NOT OK Replace the OEM harness Refer to Procedure 019-071.	5A



STEP 3D: Check for a short circuit to a voltage source.

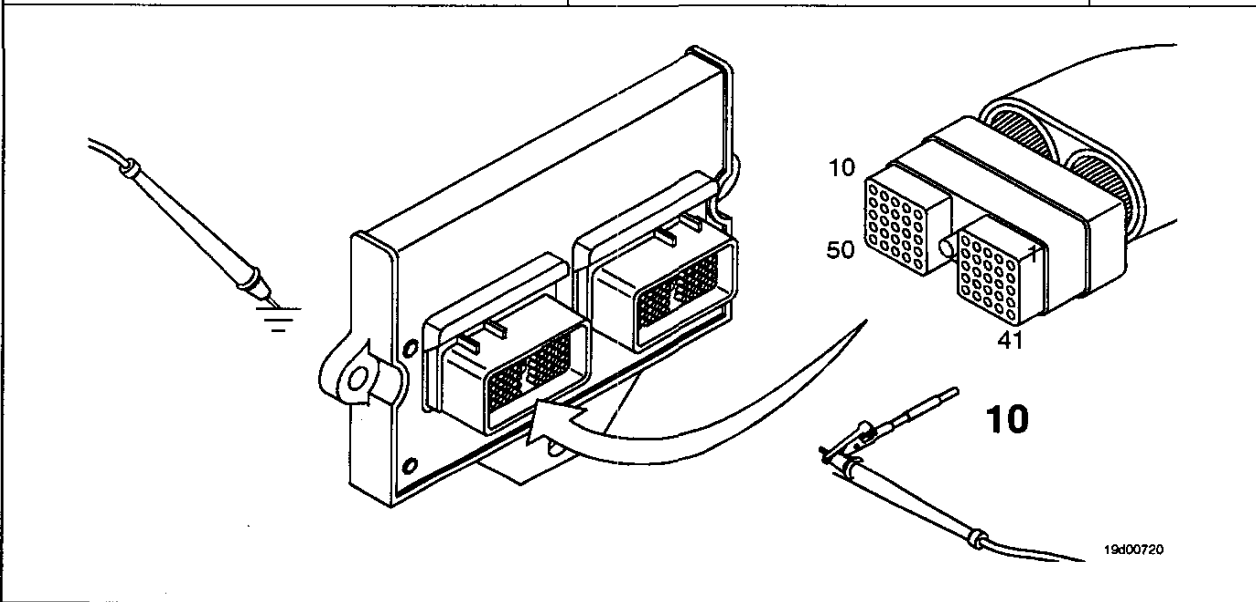
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch to the ON position.
- Disconnect the OEM harness from the ECM.
- Connect the OEM harness to the remote accelerator position sensor.

Action	Specifications/Repair	Next Step
Check for a short circuit to a voltage source. • Measure the voltage from pin 10 in the OEM harness connector to engine block ground.	OK Less than (+) 1.0 VDC	4A
	NOT OK Replace the OEM harness Refer to Procedure 019-071.	5A



STEP 4: Check the ECM voltage.

STEP 4A: Measure the sensor supply voltage from the ECM.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822917 - female AMP/Metri-Pack/Deutsch test lead.

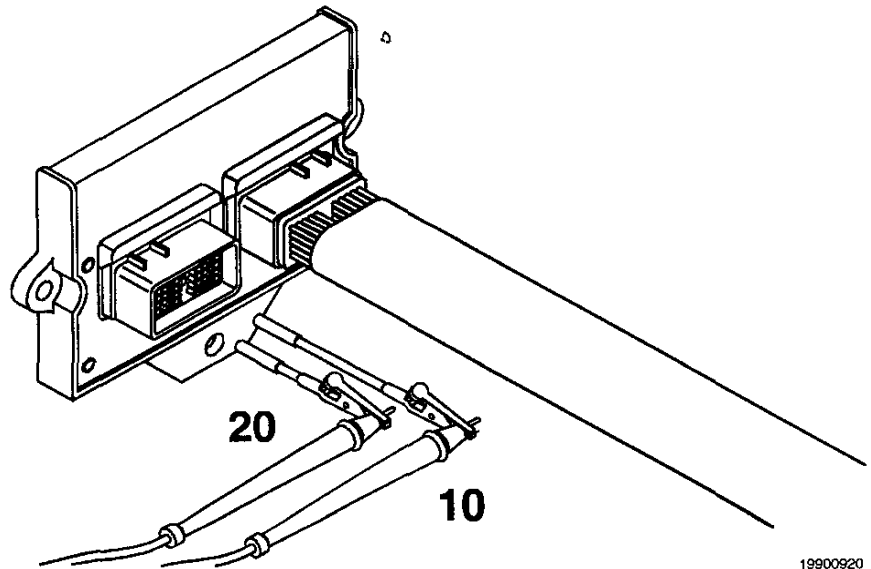
⚠ CAUTION ⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch to the ON position.
- Disconnect the OEM harness from the ECM.
- Disconnect coolant level sensor and OEM pigtail harness from engine harness.

Action	Specifications/Repair	Next Step
Measure the voltage out of the ECM. • Measure the voltage from pin 10 to pin 20 on the ECM OEM connector.	OK (+) 4.75 to 5.25 VDC	5A
	NOT OK Replace the ECM Refer to Procedure 019-031.	5A



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STEP 5: Clear the fault codes.

STEP 5A: Disable the fault code.

Condition: <ul style="list-style-type: none"> • Connect all the components. • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Disable the fault codes. <ul style="list-style-type: none"> • Start the engine, and let idle for 1 minute. • Depress and release the accelerator pedal several times to be sure the ECM is getting an accelerator signal. • Verify Fault Code 385 or 444 is inactive. 	OK Fault Code 385 or 444 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.

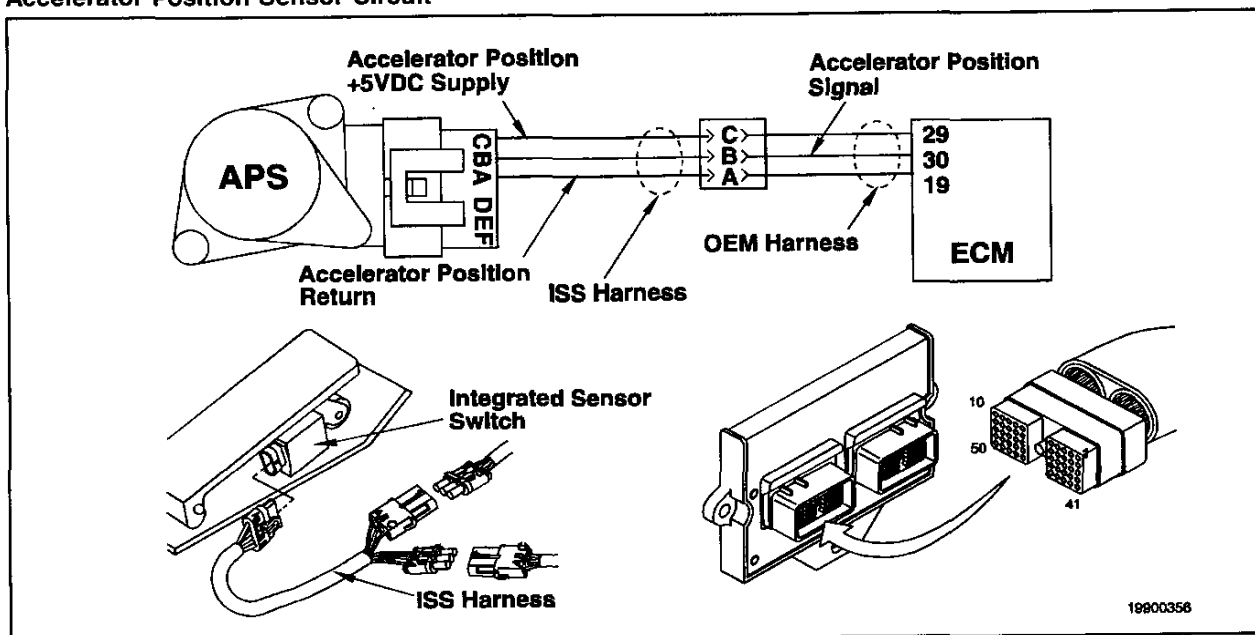
Condition: <ul style="list-style-type: none"> • Connect all the components. • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> • Erase the inactive fault codes using INSITE™. 	OK All fault codes cleared	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 387 or 443

Accelerator Position Sensor Circuit

CODES	REASON	EFFECT
Fault Code: 387 or 443 PID(P), SID(S): P091 or S232 SPN: 091 or 620 FMI: 3 or 1 Lamp: Yellow	FC 387: High voltage detected at accelerator position sensor supply pin 29 of the original equipment manufacturer's (OEM) harness. FC 443: Low voltage detected at accelerator position sensor supply pin 29 of the OEM harness.	Engine idles when accelerator is not pressed and ramps up to a default set speed when off-idle.

Accelerator Position Sensor Circuit



Circuit Description:

The accelerator pedal assembly with accelerator position sensor relays the accelerator percentage requested by the operator to the electronic control module (ECM). Percent accelerator is used by the ECM to determine fueling. In order for the accelerator position sensor to function properly, it is necessary that a good +5-VDC supply voltage is available.

Component Location:

The accelerator position sensor is located on the accelerator pedal inside the vehicle cab.

TROUBLESHOOTING SUMMARY



To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.



To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack test lead
Part No. 3823996 - female Weather-Pack test lead
Part No. 3822917 - female AMP/Metri-Pack/Deutsch test lead.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the accelerator position sensor.		
<u>STEP 1A:</u> Inspect OEM harness and sensor connectors.	No damaged pins	
<u>STEP 1B:</u> Check for active fault codes.	Fault Code 387 or 443 remains active	
STEP 2: Check the OEM harness.		
<u>STEP 2A:</u> Inspect the OEM harness and ECM connectors.	No damaged pins	
<u>STEP 2B:</u> Check for an open circuit.	Less than 10 ohms	
<u>STEP 2C:</u> Check for a short circuit to ground.	More than 100k ohms	
<u>STEP 2D:</u> Check for a short circuit from pin to pin.	More than 100k ohms	
<u>STEP 2E:</u> Check for a short circuit to a voltage source.	Less than (+) 1.0 VDC	
STEP 3: Check the ECM voltage.		
<u>STEP 3A:</u> Measure the sensor supply voltage from the ECM.	(+) 4.75 to 5.25 VDC	
STEP 4: Clear the fault codes.		
<u>STEP 4A:</u> Disable the fault code.	Fault Code 387 or 443 inactive	
<u>STEP 4B:</u> Clear the inactive fault codes.	All faults cleared	

TROUBLESHOOTING STEP

STEP 1: Check the accelerator position sensor.

STEP 1A: Inspect the OEM harness and sensor connectors.

Condition: <ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the OEM harness from the accelerator position sensor. 		
Action	Specifications/Repair	Next Step
Inspect the harness and the sensor connectors for the following: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	OK No damaged pins	1B
	NOT OK Replace the damaged pins Repair or replace the OEM harness or the accelerator position sensor, whichever has damaged pins. <ul style="list-style-type: none"> • Repair the OEM harness. Refer to Procedure 019-203. • Replace the OEM harness. Refer to Procedure 019-071. • Repair or replace the accelerator position sensor. Refer to the equipment manufacturer's troubleshooting and repair manual. • Install the appropriate connector seal if it is damaged or missing. 	4A

STEP 1B: Check for active fault code.

Condition: <ul style="list-style-type: none"> • Turn keyswitch to the ON position. • Disconnect the OEM harness from the accelerator position sensor. 		
Action	Specifications/Repair	Next Step
Read the fault codes using INSITE™.	OK Fault Code 387 or 443 remains active	2A
	NOT OK Replace the accelerator pedal assembly or the accelerator position sensor Refer to the OEM troubleshooting and repair manual.	4A

STEP 2: Check the OEM harness.

STEP 2A: Inspect the OEM 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 to the OFF position.
- Disconnect the OEM harness from the ECM.

Action	Specifications/Repair	Next Step
Inspect the OEM harness and the ECM connectors for the following: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or extended pins • Corroded pins • Moisture in or on the connector. 	OK No damaged pins	2B
	NOT OK Repair the damaged pins Repair or replace the OEM harness or ECM, whichever has the damaged pins. <ul style="list-style-type: none"> • Repair the OEM harness. Refer to Procedure 019-250. • Replace the OEM harness. Refer to Procedure 019-071. • Replace the ECM. Refer to Procedure 019-031. 	4A

STEP 2B: Check for an open circuit.

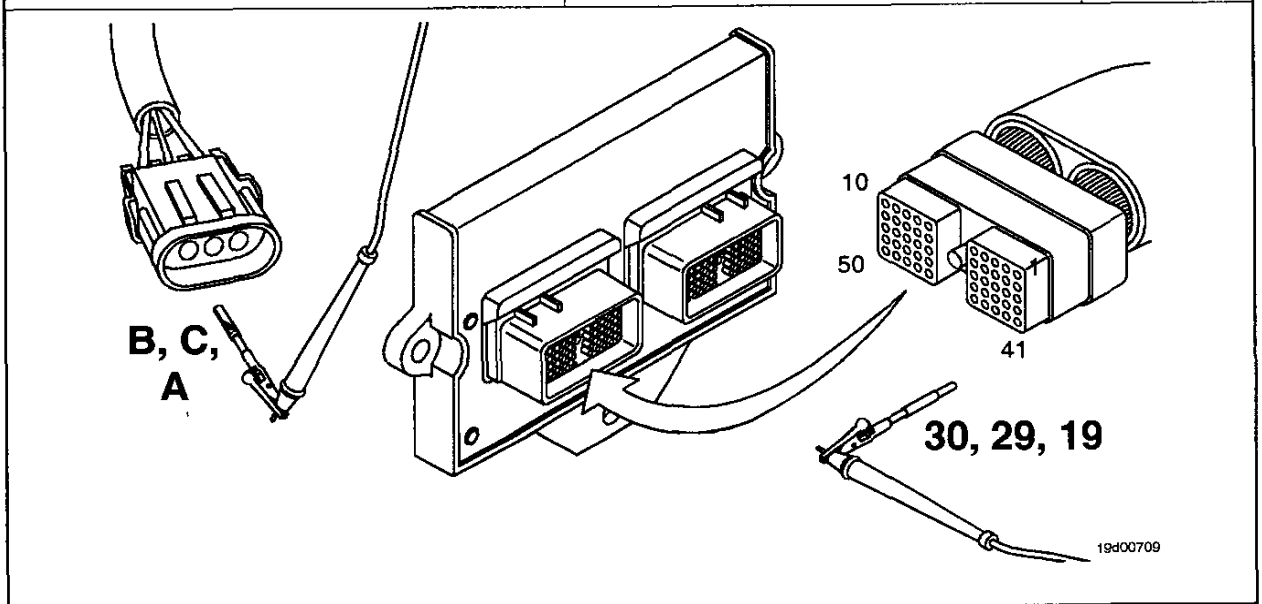
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack test lead
Part No. 3823996 - female Weather-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the accelerator position sensor.
- Disconnect the OEM harness from the ECM.

Action	Specifications/Repair	Next Step
Check for an open circuit. <ul style="list-style-type: none"> • Measure the resistance from pin 29 of the OEM harness connector to pin C on the harness side of the accelerator position sensor connector. • Measure the resistance from pin 19 of the OEM harness connector to pin A on the harness side of the accelerator position sensor connector. • Measure the resistance from pin 30 of the OEM harness connector to pin B on the harness side of the accelerator position sensor connector. 	OK Less than 10 ohms	2C
	NOT OK Replace the OEM harness Refer to Procedure 019-071.	4A



STEP 2C: Check for a short circuit to ground.

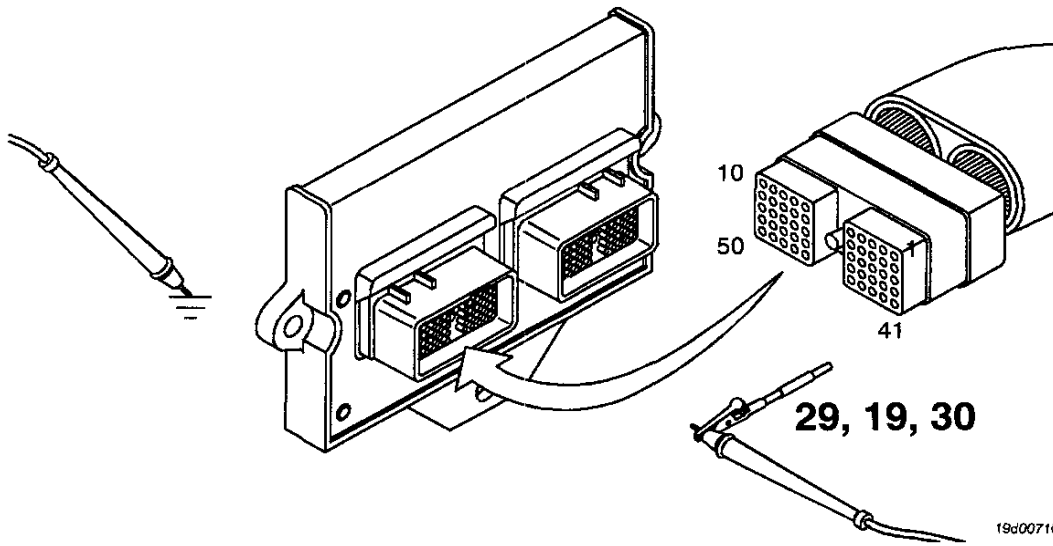
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the accelerator position sensor.
- Disconnect the OEM harness from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit to a chassis ground. • Measure the resistance from pin 29 in the OEM harness connector to engine block ground. • Measure the resistance from pin 19 in the OEM harness connector to engine block ground. • Measure the resistance from pin 30 in the OEM harness connector to engine block ground.	OK More than 100k ohms	2D
	NOT OK Replace the OEM harness Refer to Procedure 019-071.	4A



STEP 2D: Check for a short circuit from pin to pin.

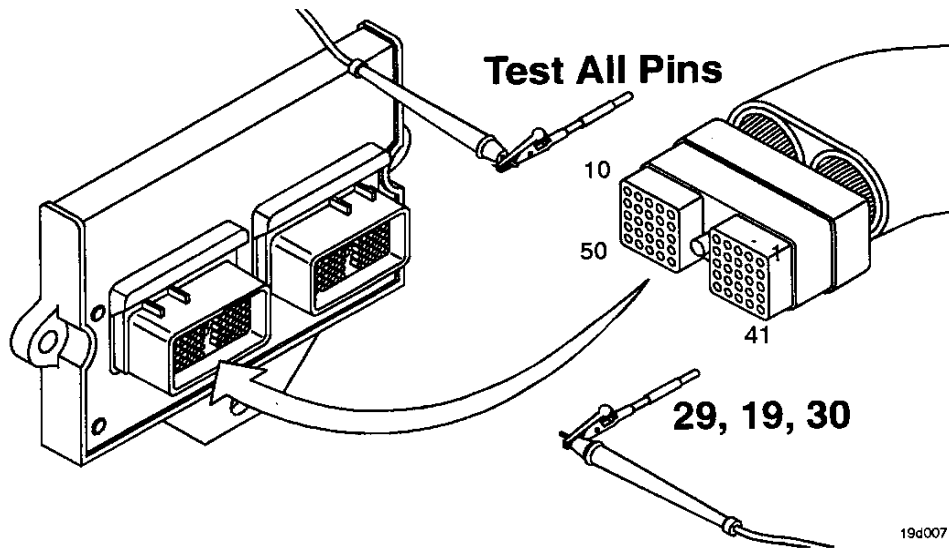
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the accelerator position sensor.
- Disconnect the OEM harness from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pin 29 to all other pins in the OEM harness connector. • Measure the resistance from pin 19 to all other pins in the OEM harness connector. • Measure the resistance from pin 30 to all other pins in the OEM harness connector.	OK More than 100k ohms	2E
	NOT OK Replace the OEM harness Refer to Procedure 019-071.	4A



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STEP 2E: Check for a short circuit to a voltage source.

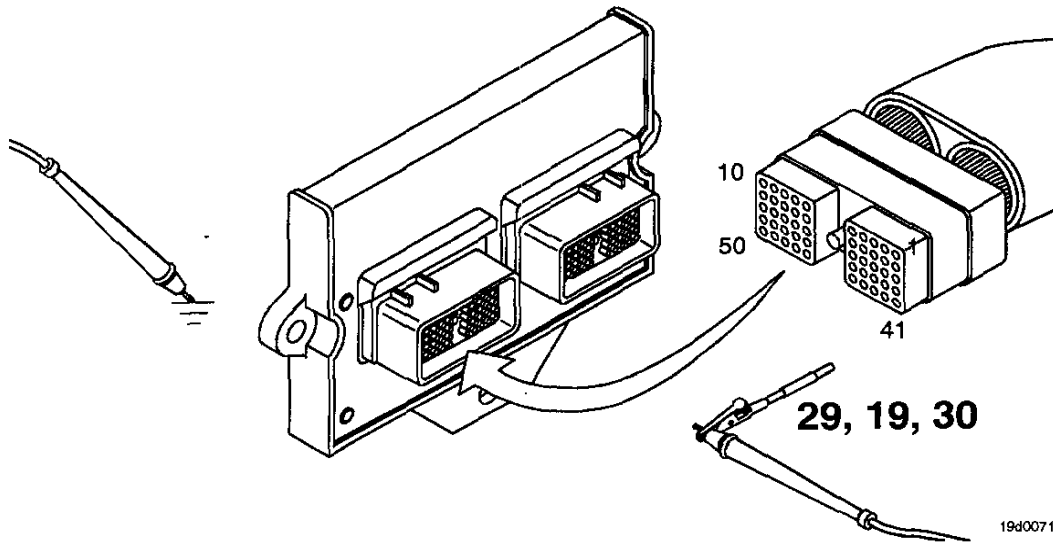
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch to the ON position.
- Disconnect the OEM harness from the ECM.
- Connect the OEM harness to the accelerator position sensor.

Action	Specifications/Repair	Next Step
Check for a short circuit to a voltage source. • Measure the voltage from pin 29 in the OEM harness connector to engine block ground. • Measure the voltage from pin 19 in the OEM harness connector to engine block ground. • Measure the voltage from pin 30 in the OEM harness connector to engine block ground.	OK Less than 1.0 volts	3A
	NOT OK Replace the OEM harness Refer to Procedure 019-071.	4A



STEP 3: Check the ECM voltage.

STEP 3A: Measure the sensor supply voltage from the ECM

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822917 - female AMP/Metri-Pack/Deutsch test lead.

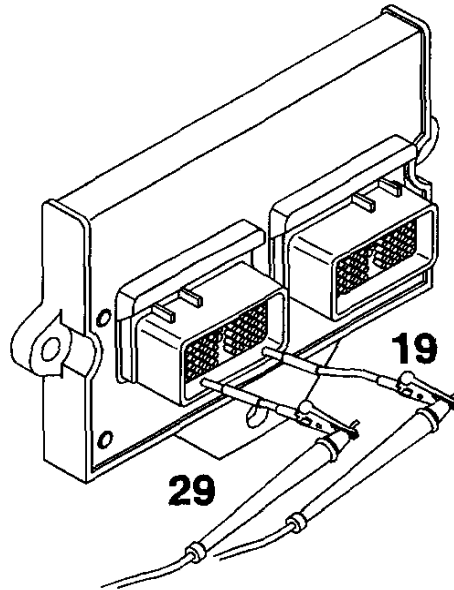
⚠ CAUTION ⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch to the ON position.
- Disconnect the OEM harness from the ECM.

Action	Specifications/Repair	Next Step
Measure the voltage out of the ECM. • Measure the voltage from pin 29 to pin 19 on the ECM OEM connector.	OK (+) 4.75 to 5.25 VDC	4A
	NOT OK Replace the ECM Refer to Procedure 019-031.	4A



STEP 4: Clear the fault codes.

STEP 4A: Disable the fault code.

Condition: <ul style="list-style-type: none"> • Connect all components. • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> • Start the engine, and let idle for 1 minute. • Depress and release the accelerator pedal several times to be sure the ECM is getting an accelerator signal. • Verify Fault Code 387 or 443 inactive. 	OK Fault Code 387 and 443 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.

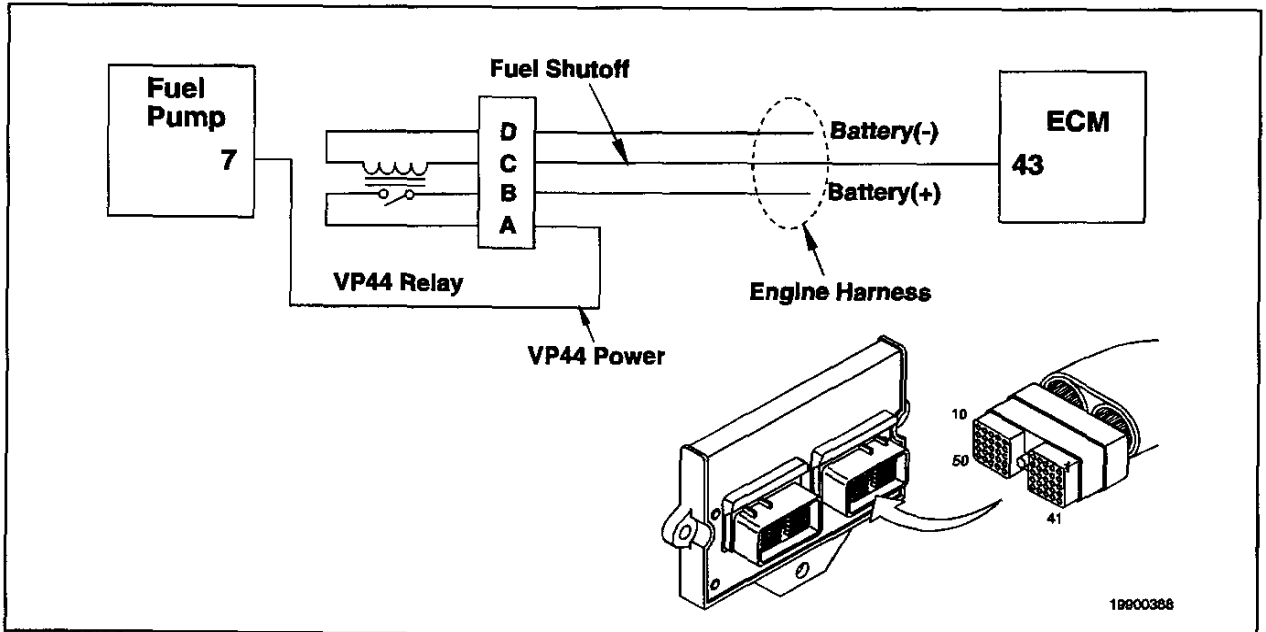
Condition: <ul style="list-style-type: none"> • Connect all the components. • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> • Erase the inactive fault code using INSITE™. 	OK All faults cleared	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 391

VP44 Relay Coil Supply Circuit

CODES	REASON	EFFECT
Fault Code: 391 PID(P), SID(S): S017 SPN: 632 FMI: 11 Lamp: Yellow	Short to ground detected in VP44 power supply relay enable circuit at pin 43 of the engine harness.	Engine will not start; it dies.

VP44 Relay Coil Supply Circuit



Circuit Description:

The VP44 relay is used to supply voltage to the VP44 fuel pump. The electronic control module (ECM) can shut down the engine by cutting off the power to the fuel shutoff relay circuit.

Component Location:

This component is supplied by the equipment manufacturer. Refer to the OEM troubleshooting and repair manual for component location.

Shop Talk:

- Inspect the VP44 relay circuit for external wires that are 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 relay circuit 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, unpainted, dry surface.
- Check the starter solenoid (+) terminal for a loose connector or accessory wiring with damaged insulation.
- High resistance in the VP44 power supply circuit can result in active Fault Code 364 and an engine that will **not** start. The troubleshooting steps for Fault Code 391 apply to other symptoms and fault codes that are voltage-dependent.
- Fault Code 364 may be active in conjunction with this fault. Follow fault code tree 391 first.

TROUBLESHOOTING SUMMARY



To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.



To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack/Deutsch test lead.

STEPS	SPECIFICATIONS	SRT CODE
<u>STEP 1:</u> Check engine harness.		
<u>STEP 1A:</u> Inspect the engine harness and ECM connectors.	No damaged pins	
<u>STEP 1B:</u> Check the battery voltage.	Normal: (+) 12 VDC in a (+) 12-VDC system Cranking: (+) 8 VDC in a (+) 12-VDC system	
<u>STEP 1C:</u> Check for an open circuit in the fuel shutoff circuit.	Less than 10 ohms	
<u>STEP 1D:</u> Check for an open circuit in the relay ground circuit.	Less than 10 ohms	
<u>STEP 1E:</u> Check for an open circuit in the ground circuit.	Less than 10 ohms	
<u>STEP 1F:</u> Check for a short circuit to ground.	More than 100k ohms	
<u>STEP 1G:</u> Check for a short circuit from pin to pin.	More than 100k ohms	
<u>STEP 1H:</u> Check the fuel shutoff voltage from the ECM.	(+) 11 VDC	
<u>STEP 2:</u> Check original equipment manufacturer's (OEM) harness.		
<u>STEP 2A:</u> Check the pump power supply circuit.	No damaged pins	
<u>STEP 2B:</u> Measure pump power supply resistance.	Less than 0.2 ohm	
<u>STEP 2C:</u> Measure the pump ground resistance.	Less than 0.2 ohm	
<u>STEP 3:</u> Clear the fault codes		
<u>STEP 3A:</u> Disable the fault code.	Fault Code 391 inactive	
<u>STEP 3B:</u> Clear the inactive fault codes.	All faults cleared	

TROUBLESHOOTING STEP

STEP 1: Check engine harness.

STEP 1A: Inspect the engine harness and ECM connectors.



To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the ECM.

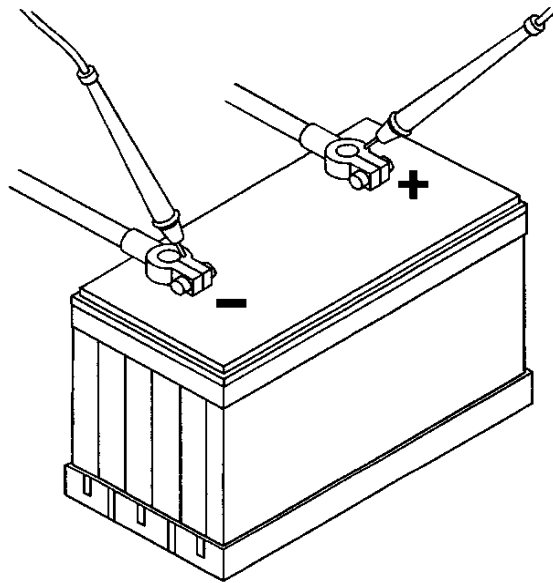
Action	Specifications/Repair	Next Step
Check the engine harness and the ECM connectors for the following: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	OK No damaged pins	1B
	NOT OK Repair the damaged pins Repair or replace the engine harness or ECM, whichever has the damaged pins. <ul style="list-style-type: none"> • 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 voltage.

Condition:

- Turn keyswitch to the ON position.

Action	Specifications/Repair	Next Step
Check the battery voltage. • Measure the battery voltage from the positive (+) to the negative (-) post.	OK Normal: (+) 12 VDC in a (+) 12-VDC system Cranking: (+) 8 VDC in a (+) 12-VDC system	1C
	NOT OK Replace the battery.	3A



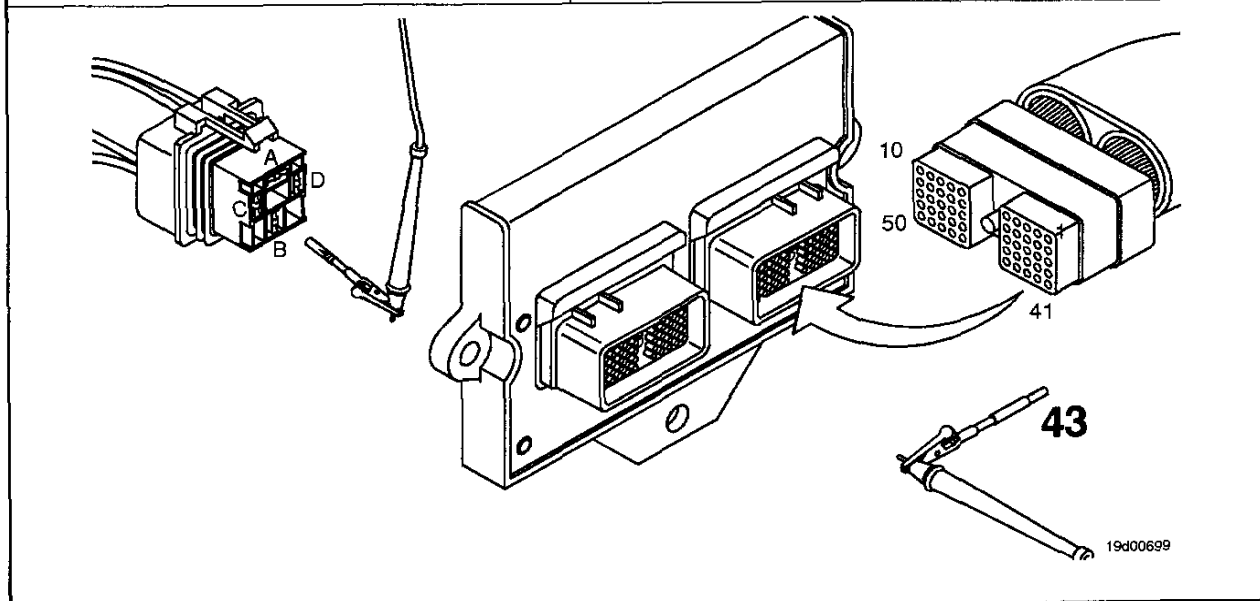
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STEP 1C: Check for an open circuit in the fuel shutoff circuit.

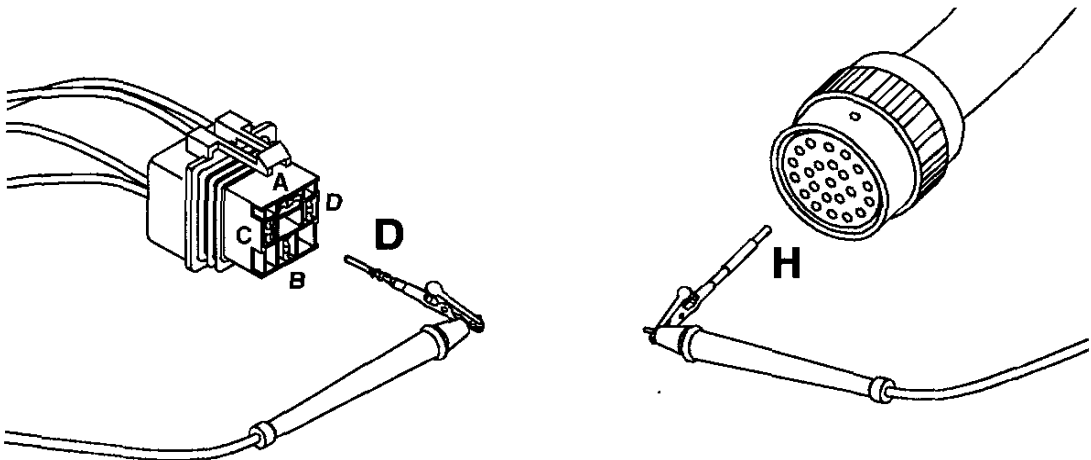
Condition:

- Turn keyswitch to the OFF position.
- Disconnect engine harness from the ECM.
- Disconnect engine harness from OEM fuel shutoff circuit.

Action	Specifications/Repair	Next Step
Check for open circuit in the fuel shutoff circuit. • Measure resistance from pin 43 of the engine harness connector to pin C on the harness side of the fuel shutoff relay connector.	OK Less than 10 ohms	1D
	NOT OK Replace the engine harness Refer to Procedure 019-043.	3A



STEP 1D: Check for an open circuit in the relay ground circuit.

Condition:		
<ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect engine harness from the ECM. • Disconnect engine harness from OEM fuel shutoff circuit. 		
Action	Specifications/Repair	Next Step
Check for open circuit in the relay ground circuit. <ul style="list-style-type: none"> • Measure the resistance from pin H of the 23-pin OEM connector to pin D on the harness side of the fuel shutoff relay connector. 	OK Less than 10 ohms	1E
	NOT OK Replace the engine harness Refer to Procedure 019-043.	3A
		
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STEP 1E: Check for an open circuit in the relay ground circuit.

Condition:		
<ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the engine harness from the ECM. 		
Action	Specifications/Repair	Next Step
Check for an open circuit in the engine harness ground circuit. <ul style="list-style-type: none"> • Measure the resistance from pin H of the 23-pin OEM harness to battery return. 	OK Less than 10 ohms	1F
	NOT OK Repair or replace the OEM harness or battery return connector <ul style="list-style-type: none"> • Replace the OEM harness. Refer to Procedure 019-071. • Replace the battery return connector. Refer to Procedure 019-199. 	3A

STEP 1F: Check for a short circuit to ground.

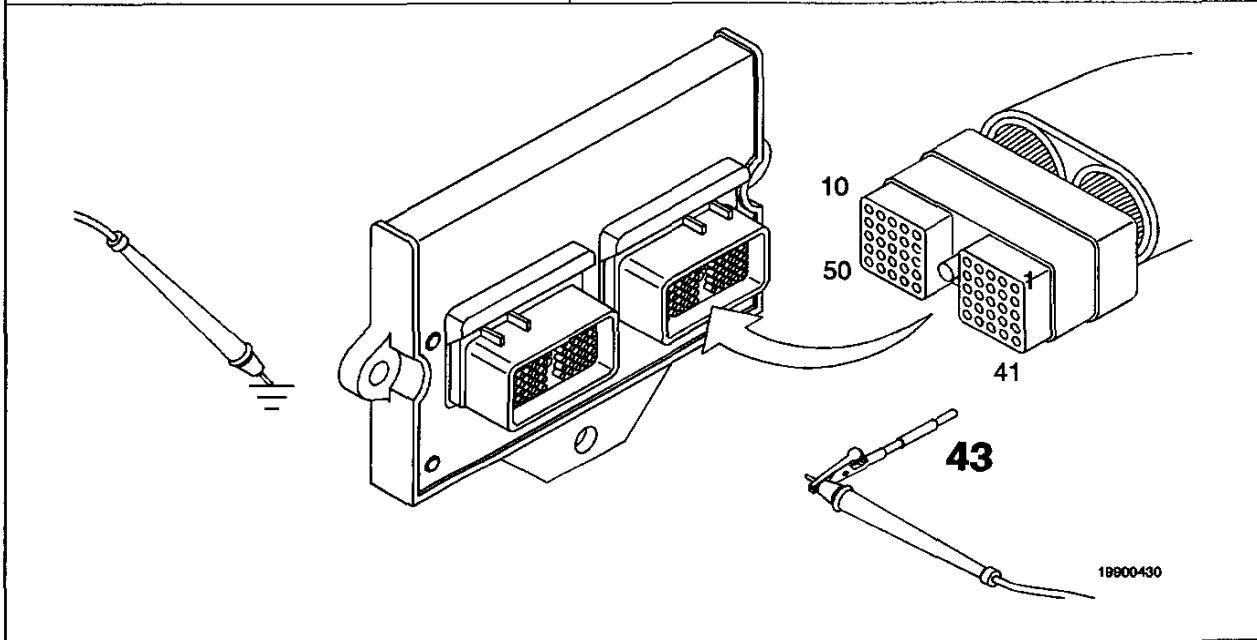
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack/Deutsch test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect engine harness from the ECM.
- Disconnect engine harness from OEM fuel shutoff circuit.

Action	Specifications/Repair	Next Step
Check for short circuit to ground. • Measure the resistance from pin 43 of the engine harness connector to engine block ground.	OK More than 100k ohms	1G
	NOT OK Replace the engine harness Refer to Procedure 019-043.	3A



STEP 1G: Check for a short circuit from pin to pin.

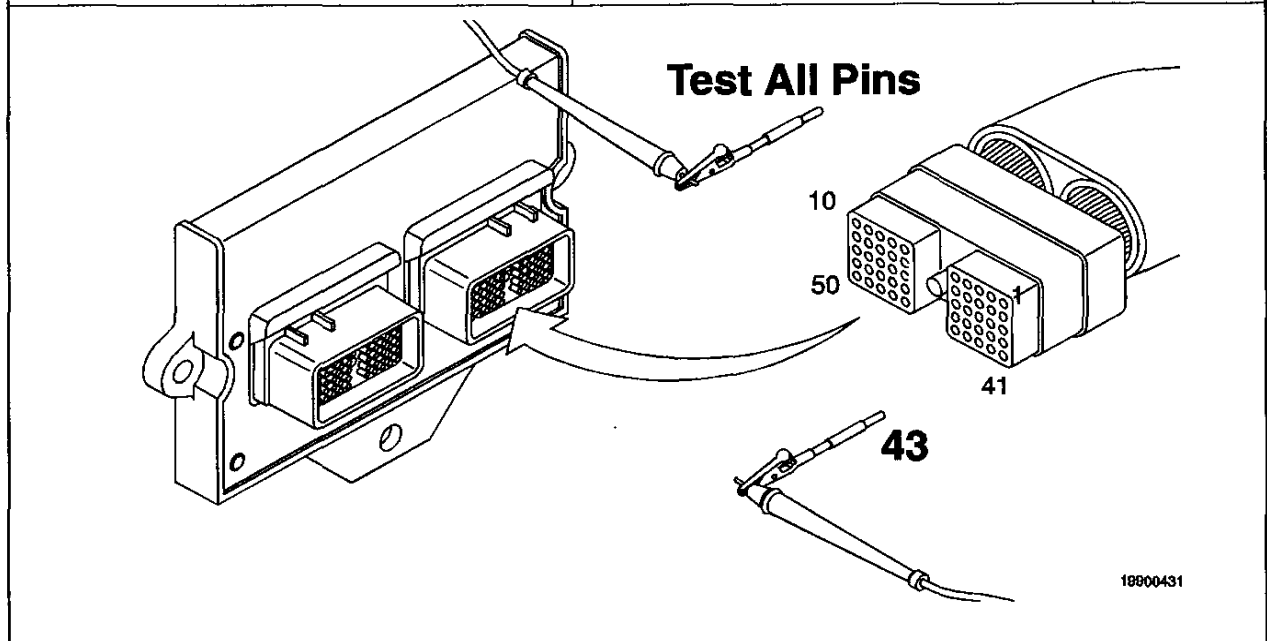
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack/Deutsch test lead.

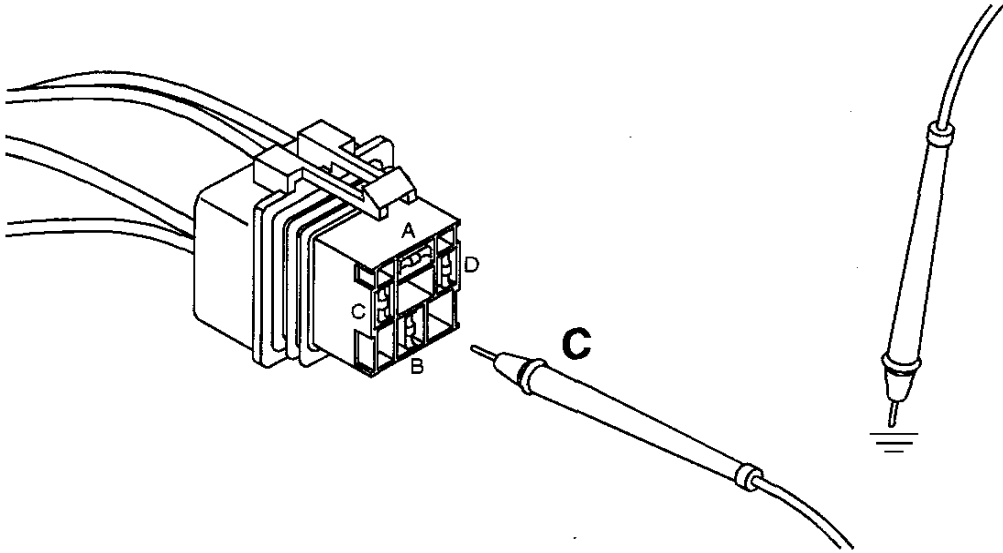
Condition:

- Turn keyswitch to the OFF position.
- Disconnect engine harness from the ECM.
- Disconnect engine harness from OEM fuel shutoff circuit (disconnect the VP44 relay).

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pin 43 of the engine harness to all other pins in the engine harness.	OK More than 100k ohms	1H
	NOT OK Replace the engine harness Refer to Procedure 019-043.	3A



STEP 1H: Check for signal voltage from the ECM.

Condition:		
<ul style="list-style-type: none"> • Turn keyswitch to the ON position. • Disconnect the VP44 relay from the engine harness. 		
Action	Specifications/Repair	Next Step
Check for signal voltage from the ECM. <ul style="list-style-type: none"> • Check the supply voltage from pin C of the VP44 relay connector, harness side, to the engine block ground. NOTE: This will cause Fault Code 364 to register an additional count.	OK More than (+) 11 VDC	2A
	NOT OK Check ECM power supply	Refer to appropriate troubleshooting chart
		
19d00698		

STEP 2: Check the + 12-VDC pump power supply and ground circuit.
STEP 2A: Check the pump power supply circuit.

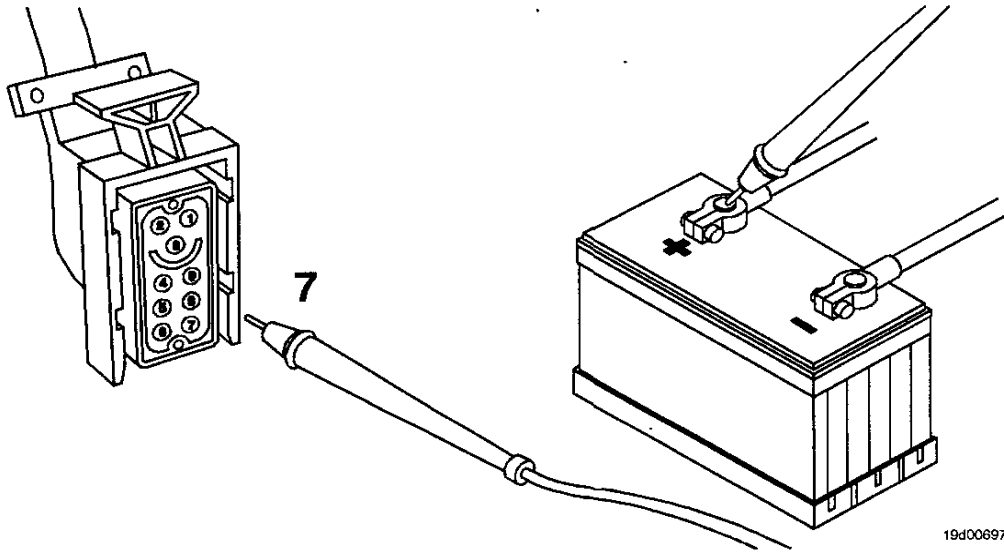
Condition:		
<ul style="list-style-type: none"> • Disconnect the VP44 power relay. • Turn keyswitch to the OFF position. 		
Action	Specifications/Repair	Next Step
Check the VP44 power relay and the engine harness for: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	OK No damaged pins	2B
	NOT OK Repair the damage pins <ul style="list-style-type: none"> • Repair or replace the VP44 relay. Refer to Procedure 019-204. or • Repair or replace the engine harness. Refer to Procedure 019-043. 	3A

STEP 2B: Check +12-VDC harness resistance to VP44 injection pump.

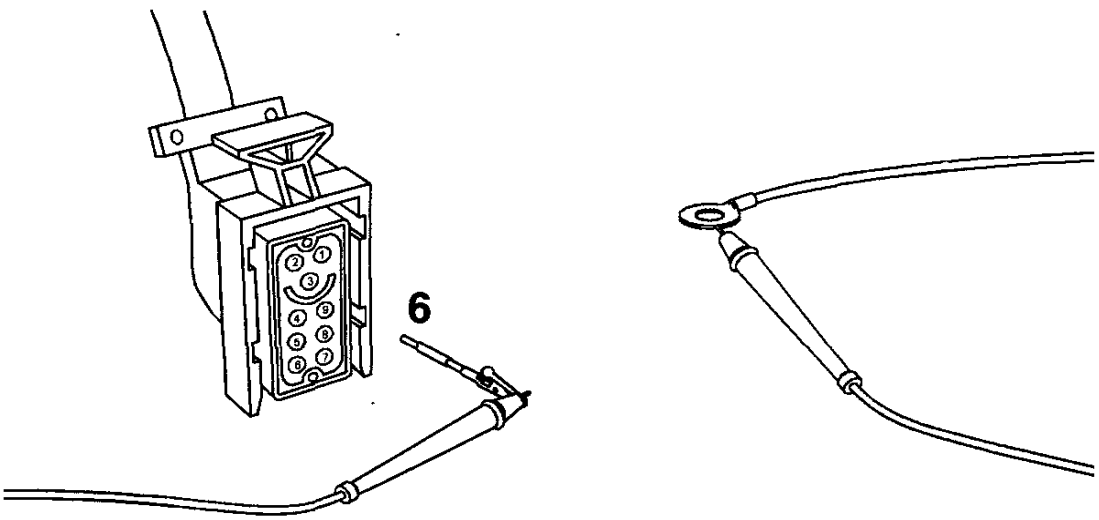
Condition:

- Disconnect engine harness from the VP44 pump.
- Turn keyswitch to the ON position.

Action	Specifications/Repair	Next Step
Check +12-VDC harness resistance to VP44 injection pump: • Measure the resistance from positive (+) battery terminal to pin 7 of the VP44 connector.	OK Less than 0.2 ohm	2C
	NOT OK Repair or replace the section of the power supply circuit causing high resistance Refer to the OEM troubleshooting and repair manual.	3A



STEP 2C: Check the resistance of the VP44 ground circuit.

<p>Condition:</p> <ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect engine harness from the ECM. • Disconnect the engine harness from the VP44 connector. • Disconnect the negative (-) battery terminal from the negative (-) post. 		
Action	Specifications/Repair	Next Step
<p>Check the resistance of the VP44 ground circuit.</p> <ul style="list-style-type: none"> • Measure the resistance from pin 6 at the VP44 connector, harness side, to the negative (-) battery ground terminal. 	<p>OK Less than 0.2 ohm</p>	3A
	<p>NOT OK Replace or repair the section of ground circuit causing high resistance Refer to the OEM troubleshooting and repair manual.</p>	3A
 <p style="text-align: right; font-size: small;">19d00865</p>		

STEP 3: Clear the fault codes.

STEP 3A: Disable the fault code.

<p>Condition:</p> <ul style="list-style-type: none"> • Connect all components. 		
Action	Specifications/Repair	Next Step
<p>Disable the fault code.</p> <ul style="list-style-type: none"> • Start the engine, and let idle for 1 minute. • Verify Fault Code 391 is inactive. 	<p>OK Fault Code 391 inactive</p>	3B
	<p>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.</p>	1A

STEP 3B: Clear the inactive fault codes.

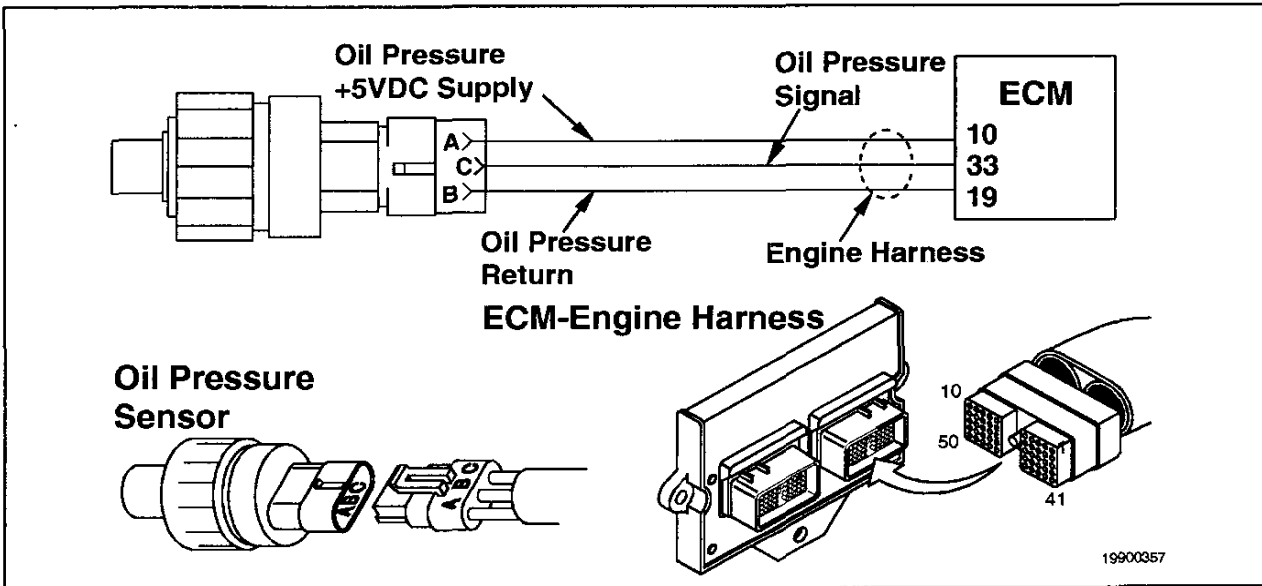
Condition:		
<ul style="list-style-type: none">• Connect all components.		
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none">• Erase the inactive fault code using INSITE™.	OK All faults cleared	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 415

Oil Pressure - Engine Protection

CODES	REASON	EFFECT
Fault Code: 415 PID(P), SID(S): P100 SPN: 100 FMI: 1 Lamp: Red	Oil pressure signal indicates oil pressure below the very low engine protection limit.	Power and/or speed derate and possible engine protection shutdown if feature is enabled.

Oil Pressure Sensor Circuit



Circuit Description:

The oil pressure 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 sensor is located on the engine block below the ECM.

Shop Talk:

- Verify, with the driver, the engine speed at which the fault occurs. If the engine is being operated at too low of a speed, the oil pressure can drop below the engine protection limits.
- Possible causes:
 - Low oil level
 - Low operation speeds
 - Oil dilution
 - Oil filters change

TROUBLESHOOTING SUMMARY

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the sensor accuracy.		
STEP 1A: Verify the sensor accuracy with a mechanical gauge.	Sensor reading is correct	
STEP 2: Clear the fault code.		
STEP 2A: Disable the fault code.	Fault Code 415 inactive	
STEP 2B: Clear the inactive fault codes.	All faults cleared	

TROUBLESHOOTING STEP

STEP 1: Check the sensor accuracy.
STEP 1A: Verify the sensor accuracy with a mechanical gauge.

Condition:		
<ul style="list-style-type: none"> • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Verify the sensor accuracy with a mechanical gauge. <ul style="list-style-type: none"> • Connect a mechanical oil pressure gauge to the engine. • Connect INSITE™ to the vehicle datalink. • Start the engine, and compare the oil pressure reading on the service tool monitor screen to the reading on the mechanical oil pressure gauge. NOTE: The engine must be revved up to make it easier to see differences in readings.	OK Sensor reading correct within 5 psi Locate and repair the cause of low oil pressure. Refer to Procedure 007-048 in the Troubleshooting and Repair Manual, ISB Engines, Bulletin No. 3666193.	2A
	NOT OK Sensor reading incorrect	Refer to Fault code 135 or 141

STEP 2: Clear the fault code.
STEP 2A: Disable the fault code.

Condition:		
<ul style="list-style-type: none"> • Connect all the components. • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> • Start the engine, and let idle for 1 minute. • Verify fault code 415 is inactive. 	OK Fault Code 415 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.

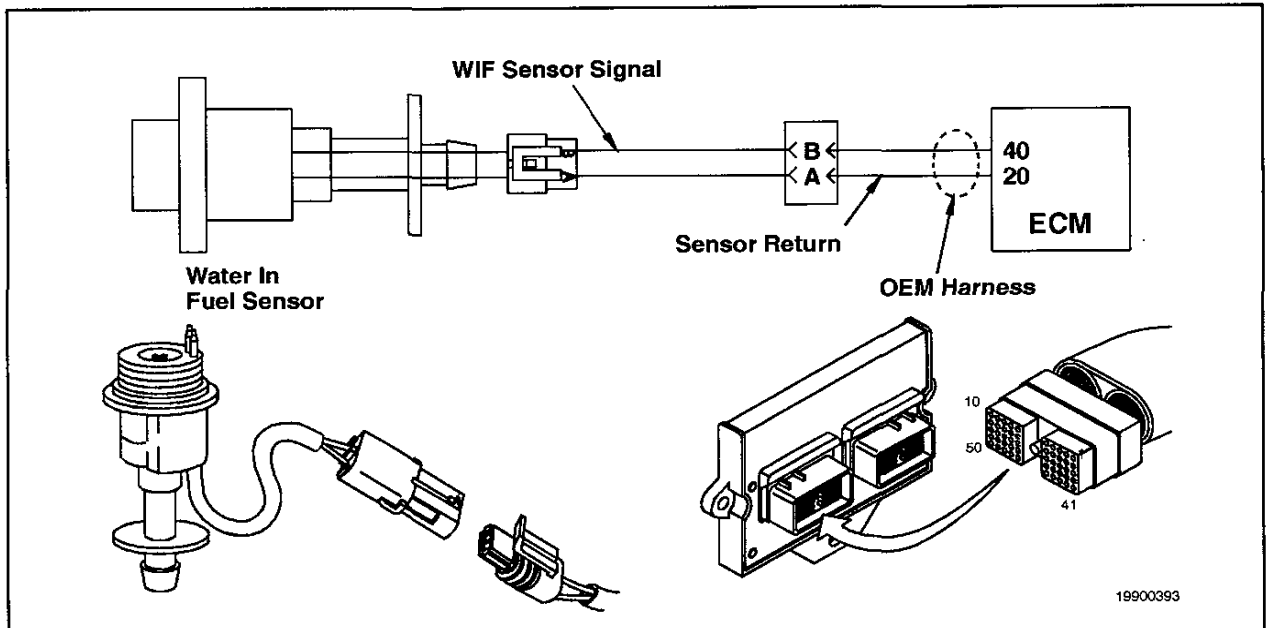
Condition:		
<ul style="list-style-type: none">• Connect all the components.• Turn keyswitch to the ON position.		
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none">• Erase the inactive fault code using INSITE™.	OK All faults cleared	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting chart

Fault Code 418

Water-In-Fuel Sensor Circuit

CODES	REASON	EFFECT
Fault Code: 418 PID(P), SID(S): P097 SPN: 097 FMI: 0 Lamp: WIF	Water-in-fuel (WIF) signal indicates water in the fuel filter needs to be drained.	Excessive water in the fuel can lead to severe fuel system damage.

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.

Component Location:

The WIF sensor is installed in the bottom or side of the fuel filter, which is located on the intake side of the cylinder head approximately midengine.

TROUBLESHOOTING SUMMARY

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the fuel filter.		
STEP 1A: Drain the water from the fuel filter.	Fault Code 418 inactive	
STEP 2: Clear the fault codes.		
STEP 2A: Disable the fault code.	Fault Code 418 inactive	
STEP 2B: Clear the inactive fault codes.	All faults cleared	

TROUBLESHOOTING STEP

STEP 1: Check the fuel filter.
STEP 1A: Drain the water from the fuel filter.

Condition: • Turn keyswitch to the ON position.		
Action	Specifications/Repair	Next Step
Drain the water from the fuel filter. • Read fault codes using INSITE™.	OK Fault Code 418 inactive	2A
	NOT OK Drain water from the fuel filter Refer to Procedure 006-050 in the Troubleshooting and Repair Manual, ISB Engines, Bulletin No. 3666193.	2A

STEP 2: Clear the fault codes.
STEP 2A: Disable the fault code.

Condition: • Connect all the components. • Turn keyswitch to the ON position.		
Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine, and let idle for 1 minute. • Using INSITE™, verify that the Fault Code 418 is inactive.	OK Fault Code 418 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.

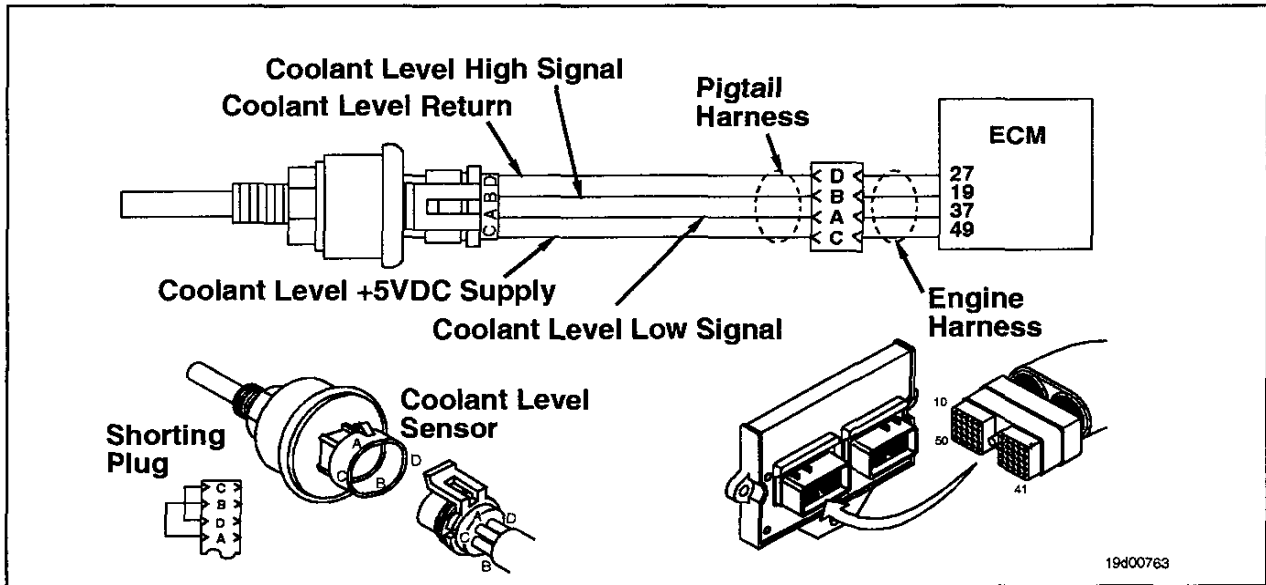
Condition:		
<ul style="list-style-type: none">• Connect all the components.• Turn keyswitch to the ON position.		
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none">• Erase the inactive fault codes using INSITE™.	OK All faults cleared	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting chart

Fault Code 422

Coolant Level Sensor Circuit

CODES	REASON	EFFECT
Fault Code: 422 PID(P), SID(S): P111 SPN: 111 FMI: 2 Lamp: Yellow	Voltage detected simultaneously on both the coolant level high and low signal pins 27 and 37 of the engine harness, or no voltage detected on either pin.	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 engine 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 progressive power derate with increasing time after alert will occur.

Component Location:

The coolant level sensor is located in the radiator top tank or surge tank.

Shop Talk:

This is an original equipment manufacturer (OEM)-supplied component and will vary in sensor 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 makes a turn.
- Sterling trucks utilize ECM pin A22 for coolant level sensing through a 2-pin sensor; refer to SPT 98T19-46.

TROUBLESHOOTING SUMMARY



Wait until the coolant temperature is below 50°C [120°F] before removing the coolant system pressure cap or the coolant temperature sensor. Failure to do so can cause personal injury from heated coolant spray.



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. 3823993 - male Deutsch test lead
Part No. 3823995 - male Weather-Pack test lead
Part No. 3822917 - female AMP test lead.



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 for multiple fault codes and presence of a coolant level sensor.		
STEP 1A: Read the fault codes.	Fault Codes 123, 141, 352, and 444 inactive	
STEP 1B: Check whether the vehicle has a coolant level sensor.	Coolant level sensor present	
STEP 1B-1: Check whether a shorting plug is installed.	Shorting plug installed	
STEP 2: Check the coolant level sensor jumper harness.		
STEP 2A: Inspect the coolant level sensor and the coolant level sensor jumper harness connector pins.	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: Check the engine harness.		
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 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 code.		
STEP 4A: Disable the fault code.	Fault Code 422 inactive	
STEP 4B: Clear the inactive fault codes.	All faults cleared	

TROUBLESHOOTING STEP

STEP 1: Check for multiple fault codes and presence of coolant level sensor.

STEP 1A: Read the fault codes.

▲WARNING▲		
Wait until the coolant temperature is below 50°C [120°F] before removing the coolant system pressure cap or the coolant temperature sensor. Failure to do so can cause personal injury from heated coolant spray.		
Condition:		
• Turn keyswitch to the ON position.		
Action	Specifications/Repair	Next Step
Read the fault codes. • Read the fault codes using INSITE™.	OK Fault Codes 123, 141, 352, and 444 inactive	1B
	NOT OK Fault codes are active	Fault Tree 352

STEP 1B: Check whether the vehicle has a coolant level sensor.

▲WARNING▲		
Wait until the coolant temperature is below 50°C [120°F] before removing the coolant system pressure cap or the coolant temperature sensor. Failure to do so can cause personal injury from heated coolant spray.		
Condition:		
• Turn keyswitch to the OFF position.		
Action	Specifications/Repair	Next Step
Check whether the vehicle has a coolant level sensor.	OK Coolant level sensor present	2A
	NOT OK No coolant level sensor present	1B-1

STEP 1B-1: Check whether a shorting plug is installed.



▲WARNING▲		
Wait until the coolant temperature is below 50°C [120°F] before removing the coolant system pressure cap or the coolant temperature sensor. Failure to do so can cause personal injury from heated coolant spray.		
Condition:		
• Turn keyswitch to the OFF position.		
Action	Specifications/Repair	Next Step
Check whether a shorting plug is installed in place of the coolant level sensor harness connection.	OK Shorting plug installed	2A
	NOT OK Install the shorting plug	4A

STEP 2: Check the coolant level sensor jumper harness.

STEP 2A: Inspect the coolant level sensor and the coolant level sensor jumper harness connector pins.

Condition: <ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the coolant level sensor jumper harness from the coolant level sensor. 		
Action	Specifications/Repair	Next Step
Inspect the coolant level sensor and the coolant level sensor jumper harness connector pins for: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	OK No damaged pins	2B
	NOT OK Repair the damaged pins Repair or replace the coolant level sensor jumper harness or the coolant level sensor, whichever has the damaged pins. <ul style="list-style-type: none"> • Repair the coolant level sensor jumper harness. Refer to Procedure 019-204. • Replace the coolant level sensor jumper harness. Refer to the OEM troubleshooting and repair manual. • Replace the coolant level sensor. Refer to the OEM troubleshooting and repair manual. 	4A

STEP 2B: Check for an open circuit.

 WARNING		
Wait until the coolant temperature is below 50° C [120°F] before removing the coolant system pressure cap or the coolant temperature sensor. Failure to do so can cause personal injury from heated coolant spray.		
 CAUTION		
To avoid pin and harness damage, use the following test leads when taking a measurement: Part No. 3823993 - male Deutsch test lead Part No. 3823995 - male Weather-Pack test lead.		
Condition: <ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the engine harness from the coolant level sensor jumper harness. • Disconnect the coolant level sensor jumper harness from the coolant level sensor. 		
Action	Specifications/Repair	Next Step
Check for an open circuit. <ul style="list-style-type: none"> • Measure the resistance from pin A to pin A on the coolant level sensor jumper harness connector. • Measure the resistance from pin B to pin B on the coolant level sensor jumper harness connector. • Measure the resistance from pin C to pin C on the coolant level sensor jumper harness connector. • Measure the resistance from pin D to pin D on the coolant level sensor jumper harness connector. 	OK Less than 10 ohms	2C
	NOT OK Repair or replace the coolant level sensor jumper harness Refer to the OEM troubleshooting and repair manual.	4A

STEP 2C: Check for a short circuit to ground.

▲WARNING▲

Wait until the coolant temperature is below 50°C [120°F] before removing the coolant system pressure cap or the coolant temperature sensor. Failure to do so can cause personal injury from heated coolant spray.

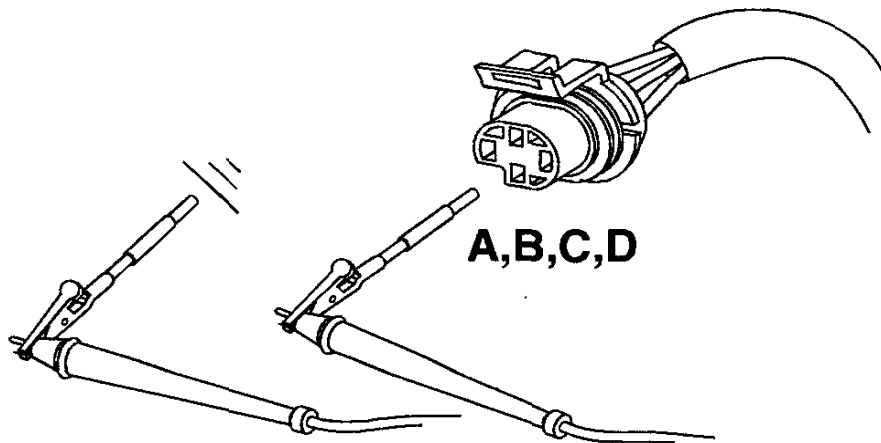
▲CAUTION▲

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3823993 - male Deutsch test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the coolant level sensor jumper harness.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground. <ul style="list-style-type: none"> • Measure the resistance from pin A on the coolant level sensor jumper harness connector to engine block ground. • Measure the resistance from pin B on the coolant level sensor jumper harness connector to engine block ground. 	OK More than 100k ohms	2D
<ul style="list-style-type: none"> • Measure the resistance from pin C on the coolant level sensor jumper harness connector to engine block ground. • Measure the resistance from pin D on the coolant level sensor jumper harness connector to engine block ground. 	NOT OK Replace the coolant level sensor jumper harness Refer to the OEM troubleshooting and repair manual.	4A



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STEP 2D: Check for a short circuit from pin to pin.

▲WARNING▲

Wait until the coolant temperature is below 50°C [120°F] before removing the coolant system pressure cap or the coolant temperature sensor. Failure to do so can cause personal injury from heated coolant spray.

▲CAUTION▲

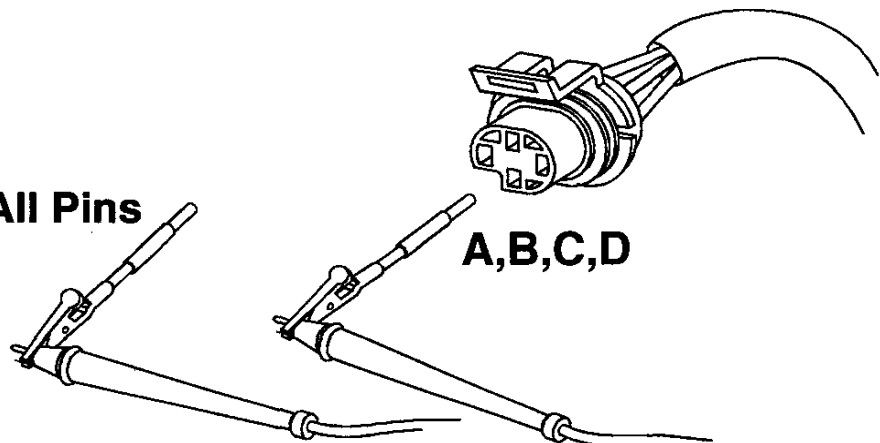
To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3823993 - male Deutsch test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the coolant level sensor jumper harness.
- Disconnect the coolant level sensor jumper harness from the coolant level sensor.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. <ul style="list-style-type: none"> • Measure the resistance from pin A on the coolant level sensor jumper harness connector to all other pins in the connector. • Measure the resistance from pin B on the coolant level sensor jumper harness connector to all other pins in the connector. 	OK More than 100k ohms	3A
<ul style="list-style-type: none"> • Measure the resistance from pin C on the coolant level sensor jumper harness connector to all other pins in the connector. • Measure the resistance from pin D on the coolant level sensor jumper harness connector to all other pins in the connector. 	NOT OK Replace the coolant level sensor jumper harness Refer to the OEM troubleshooting and repair manual.	4A

Test All Pins



STEP 3: Check the engine harness.

STEP 3A: 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 to the OFF position.
- Disconnect the engine harness from the ECM.

Action	Specifications/Repair	Next Step
Inspect the engine harness and the ECM connector pins for: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	OK No damaged pins	3B
	NOT OK Repair the damaged pins Repair or replace the engine harness or the ECM, whichever has the damaged pins. <ul style="list-style-type: none"> • 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.



Wait until the coolant temperature is below 50°C [120°F] before removing the coolant system pressure cap or the coolant temperature sensor. Failure to do so can cause personal injury from heated coolant spray.



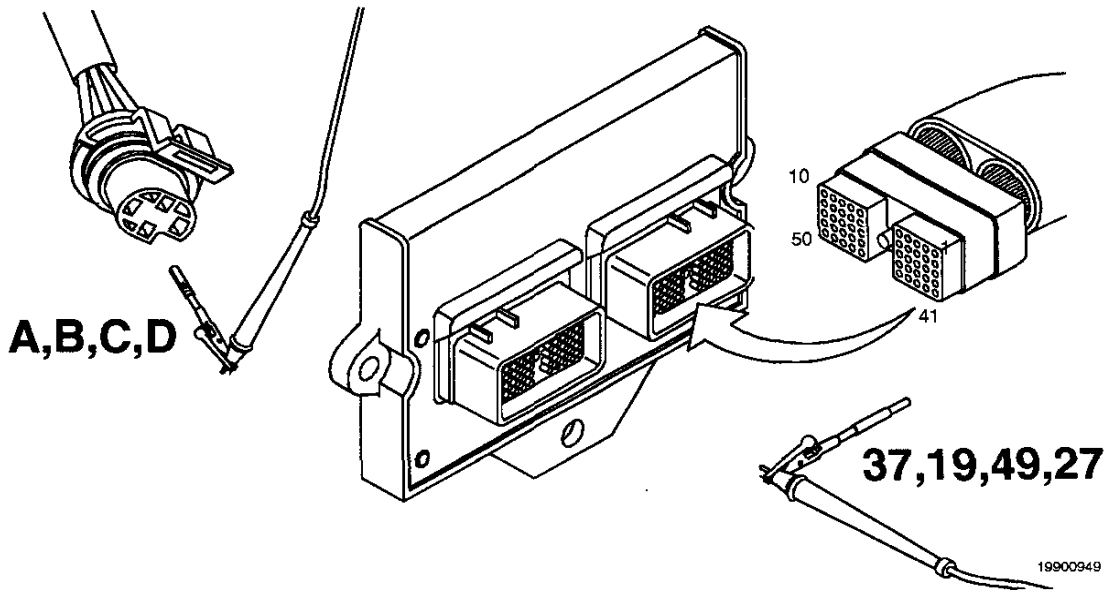
To avoid pin and harness damage, use the following test leads when taking a measurement:

- Part No. 3823993 - male Deutsch test lead
- Part No. 3822758 - male Deutsch/AMP/Metri-Pack test lead
- Part No. 3822917 - female AMP test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the coolant level sensor jumper harness.
- Disconnect the engine harness from the ECM.

Action	Specifications/Repair	Next Step
Check for an open circuit. <ul style="list-style-type: none"> • Measure the resistance from pin 37 in the engine harness connector to pin A on the engine harness side of the coolant level sensor jumper harness connector. • Measure the resistance from pin 19 in the engine harness connector to pin B on the engine harness side of the coolant level sensor jumper harness connector. 	OK Less than 10 ohms	3C
<ul style="list-style-type: none"> • Measure the resistance from pin 49 in the engine harness connector to pin C on the engine harness side of the coolant level sensor jumper harness connector. • Measure the resistance from pin 27 in the engine harness connector to pin D on the engine harness side of the coolant level sensor jumper harness connector. 	NOT OK Repair or replace the engine harness Refer to Procedure 019-043.	4A



STEP 3C: Check for a short circuit to ground.

▲WARNING▲

Wait until the coolant temperature is below 50°C [120°F] before removing the coolant system pressure cap or the coolant temperature sensor. Failure to do so can cause personal injury from heated coolant spray.

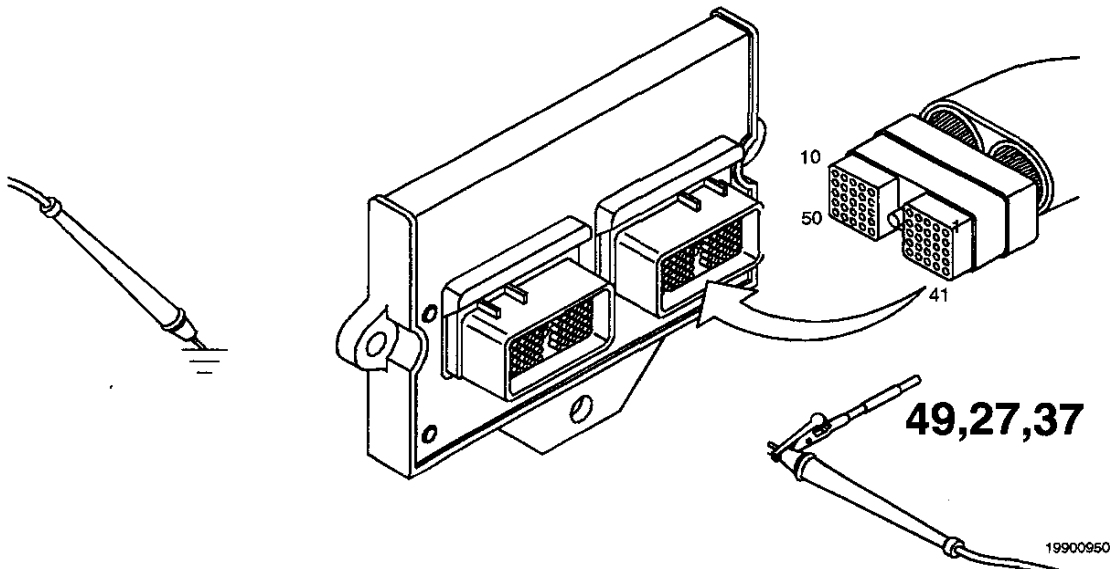
▲CAUTION▲

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 to the OFF position.
- Disconnect the engine harness from the coolant level sensor jumper harness.
- Disconnect the engine harness from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground in the coolant level sensor signal wires. <ul style="list-style-type: none"> • Measure the resistance from pin 49 of the engine harness connector to engine block ground. 	OK More than 100k ohms	3D
<ul style="list-style-type: none"> • Measure the resistance from pin 27 of the engine harness connector to engine block ground. • Measure the resistance from pin 37 of the engine harness connector to engine block ground. 	NOT OK Repair or replace the engine harness Refer to Procedure 019-043.	4A



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STEP 3D: Check for a short circuit from pin to pin.

▲WARNING▲

Wait until the coolant temperature is below 50°C [120°F] before removing the coolant system pressure cap or the coolant temperature sensor. Failure to do so can cause personal injury from heated coolant spray.

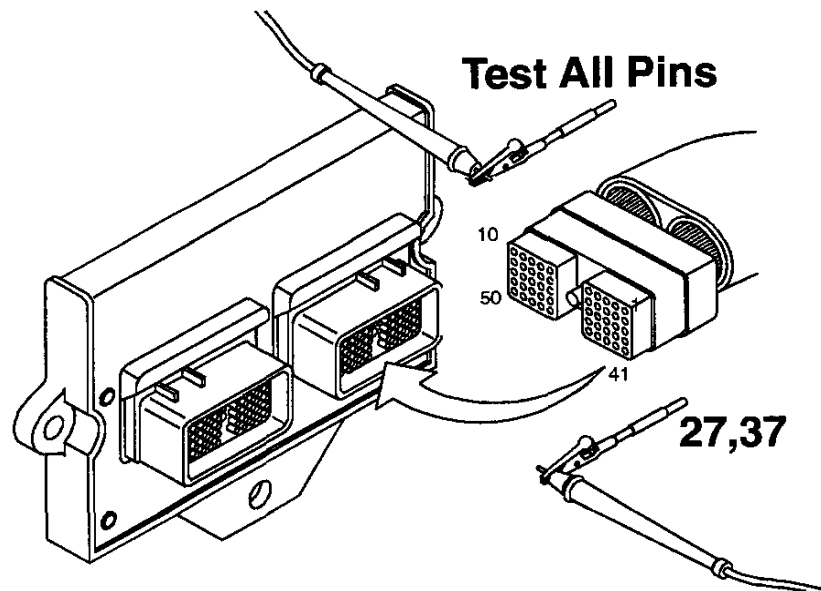
▲CAUTION▲

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 to the OFF position.
- Disconnect the engine harness from the coolant level sensor jumper harness.
- Disconnect the engine harness from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pin 27 in the engine harness connector to all other pins in the connector. • Measure the resistance from pin 37 in the engine harness connector to all other pins in the connector.	OK More than 100k ohms	4A
	NOT OK Repair or replace the engine harness Refer to Procedure 019-043.	4A



STEP 4: Clear the fault code.

STEP 4A: Disable the fault code.

Condition: <ul style="list-style-type: none"> • Connect all the components. • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> • Start the engine, and let it idle for 1 minute. • Using INSITE™, verify Fault Code 422 is inactive. 	OK Fault Code 422 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.

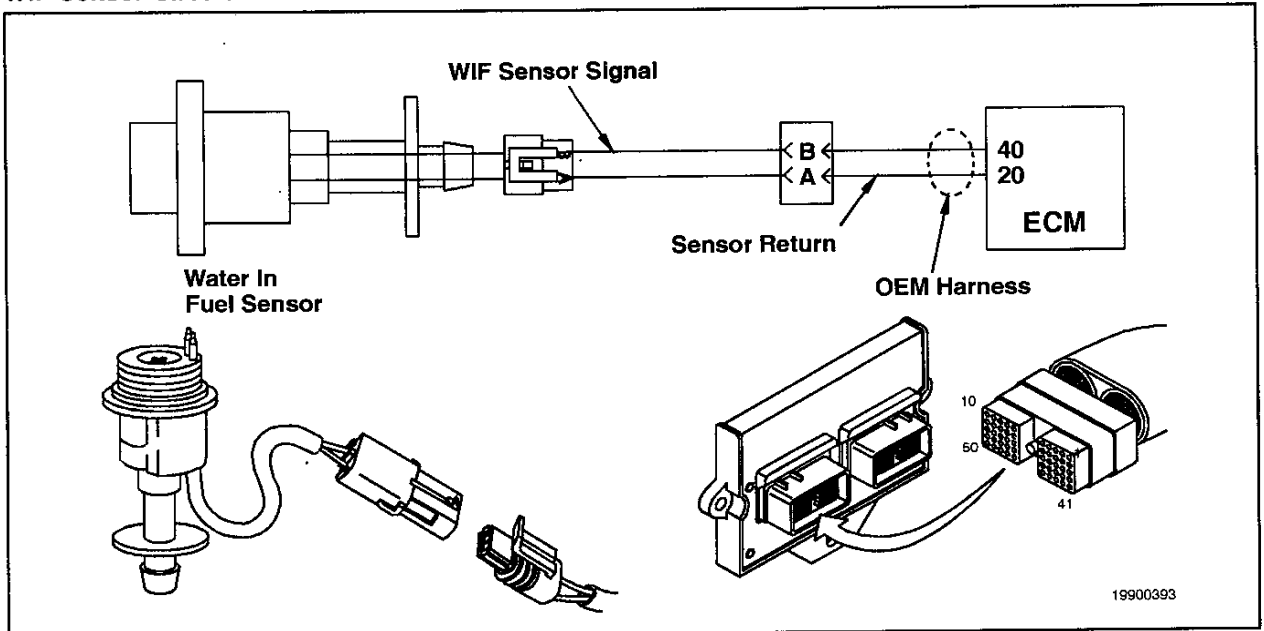
Condition: <ul style="list-style-type: none"> • Connect all the components. • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> • Erase the inactive fault codes using INSITE™. 	OK All faults cleared	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting chart

Fault Code 429

Water-In-Fuel (WIF) Sensor Circuit

CODES	REASON	EFFECT
Fault Code: 429 PID(P), SID(S): P097 SPN: 097 FMI: 4 Lamp: Yellow	Low voltage detected at WIF signal pin 40 of the original equipment manufacturer (OEM) harness.	No water in fuel detection capability.

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 20), and a signal wire (pin 40).

Component Location:

The water-in-fuel sensor is installed in the fuel filter and is located on the side of the head approximately midway on the engine.

TROUBLESHOOTING SUMMARY



To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.



To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack test lead.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check for sensor supply fault code.		
<u>STEP 1A:</u> Read fault codes.	Fault Code 444 inactive	
STEP 2: Check OEM harness.		
<u>STEP 2A:</u> Inspect the OEM harness, WIF sensor, and ECM connectors.	No damaged pins	
<u>STEP 2B:</u> Check for a short circuit to ground.	More than 100k ohms	
<u>STEP 2C:</u> Check for a short circuit from pin to pin.	More than 100k ohms	
<u>STEP 2D:</u> Check sensor supply voltage.	(+) 4.75 to 5.25 VDC	
STEP 3: Clear the fault codes.		
<u>STEP 3A:</u> Disable the fault code.	Fault Code 429 inactive	
<u>STEP 3B:</u> Clear the inactive fault codes.	All faults cleared	

TROUBLESHOOTING STEP

STEP 1: Check for sensor supply fault code.
STEP 1A: Read the fault codes.

Condition: <ul style="list-style-type: none"> Turn keyswitch to the ON position. Connect all components. 		
Action	Specifications/Repair	Next Step
Read the active fault codes. <ul style="list-style-type: none"> Read fault codes using INSITE™. 	OK Fault Code 385 or 444 inactive	2A
	NOT OK Fault Code 385 or 444 active	Refer to Fault Code 385 or 444

STEP 2: Check OEM harness.

STEP 2A: Inspect the OEM 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 to the OFF position.
- Disconnect the OEM harness from the WIF sensor.
- Disconnect the OEM harness from the ECM.

Action	Specifications/Repair	Next Step
Inspect the OEM harness, WIF sensor, and ECM connectors for the following: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	OK No damaged pins	2B
	NOT OK Repair the damaged pins Repair or replace the ECM, WIF sensor, or OEM harness, whichever has the damaged pins. <ul style="list-style-type: none"> • Repair OEM harness. Refer to Procedures 019-250 and 019-202. • Replace the OEM harness. Refer to Procedure 019-071. • Replace the WIF sensor. Refer to the Troubleshooting and Repair Manual, ISB Engines, Bulletin No. 3666193. • Repair or replace the ECM. Refer to Procedure 019-031. 	3A

STEP 2B: Check for short circuit to ground.

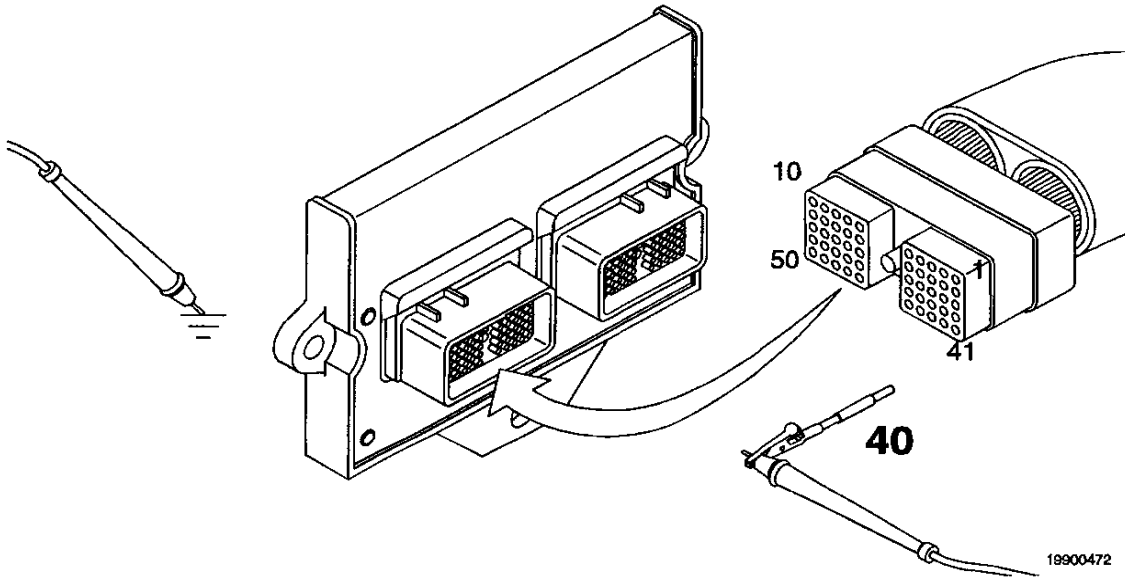
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the WIF sensor.
- Disconnect the OEM harness from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground. • Measure the resistance from pin 40 of the OEM harness connector to engine block ground.	OK More than 100k ohms	2C
	NOT OK Replace the OEM harness Refer to Procedure 019-071.	3A



STEP 2C: Check for a short circuit from pin to pin.

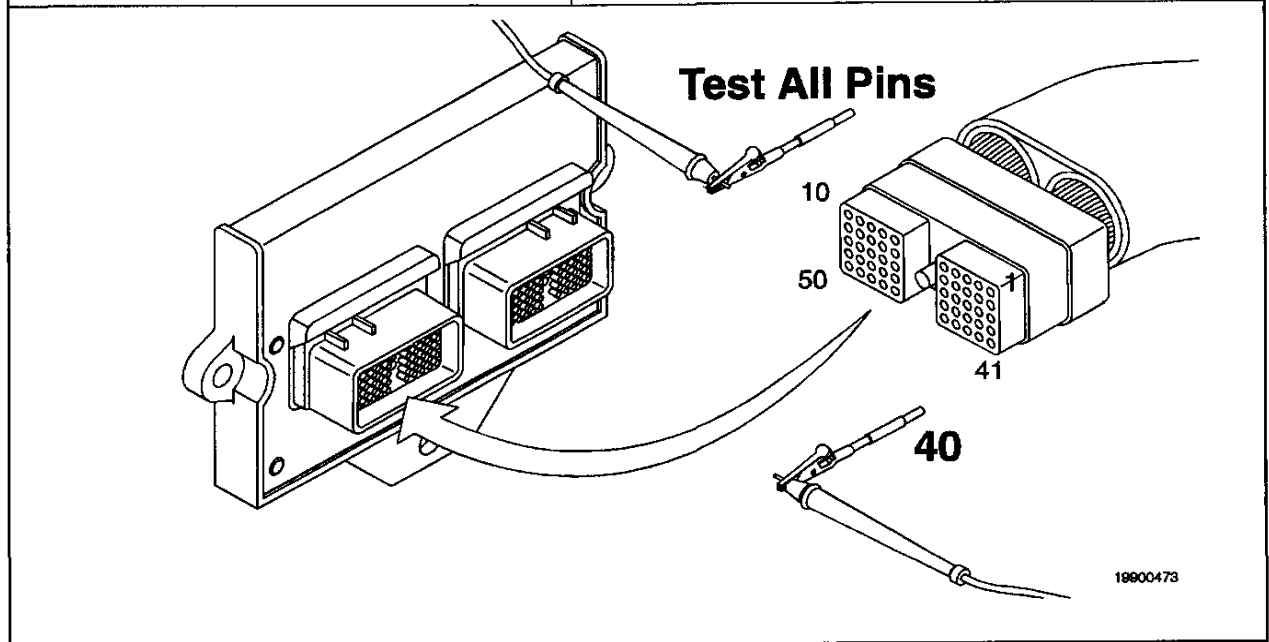
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the WIF sensor.
- Disconnect the OEM harness 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 on the harness side of the OEM harness connector.	OK More than 100k ohms	2D
	NOT OK Replace the OEM harness Refer to Procedure 019-071.	3A



STEP 2D: Check sensor supply voltage.

⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack test lead.

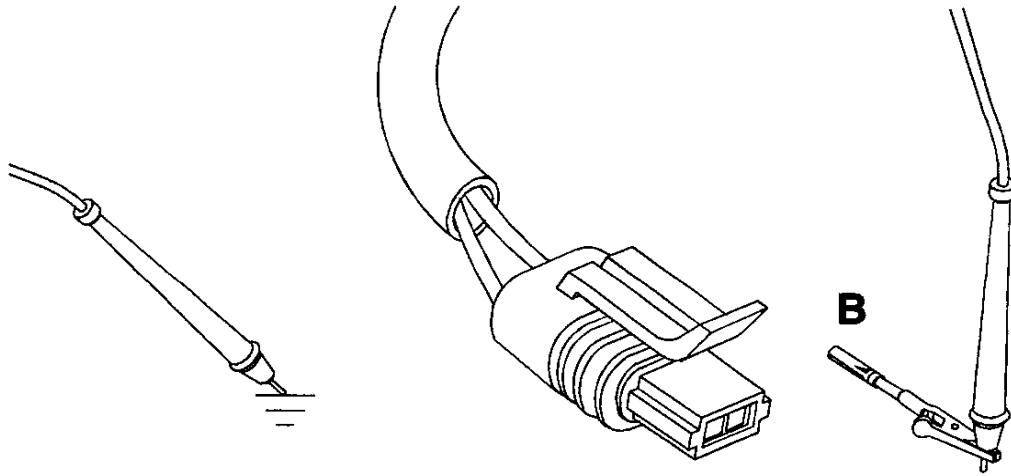
⚠ CAUTION ⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch to the ON position.
- Disconnect the OEM harness from the WIF sensor.
- Connect the OEM harness to the ECM.

Action	Specifications/Repair	Next Step
Check sensor supply voltage. • Measure the voltage from pin B 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 the Troubleshooting and Repair Manual, ISB Engines, Bulletin No. 3666193.	3A
	NOT OK Replace the ECM Refer to Procedure 019-031.	3A



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STEP 3: Clear the fault codes.

STEP 3A: Disable the fault code.

Condition: <ul style="list-style-type: none"> • Connect all components. • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> • Start the engine, and let idle for 1 minute. • Verify that the Fault Code 429 is inactive. 	OK Fault Code 429 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.

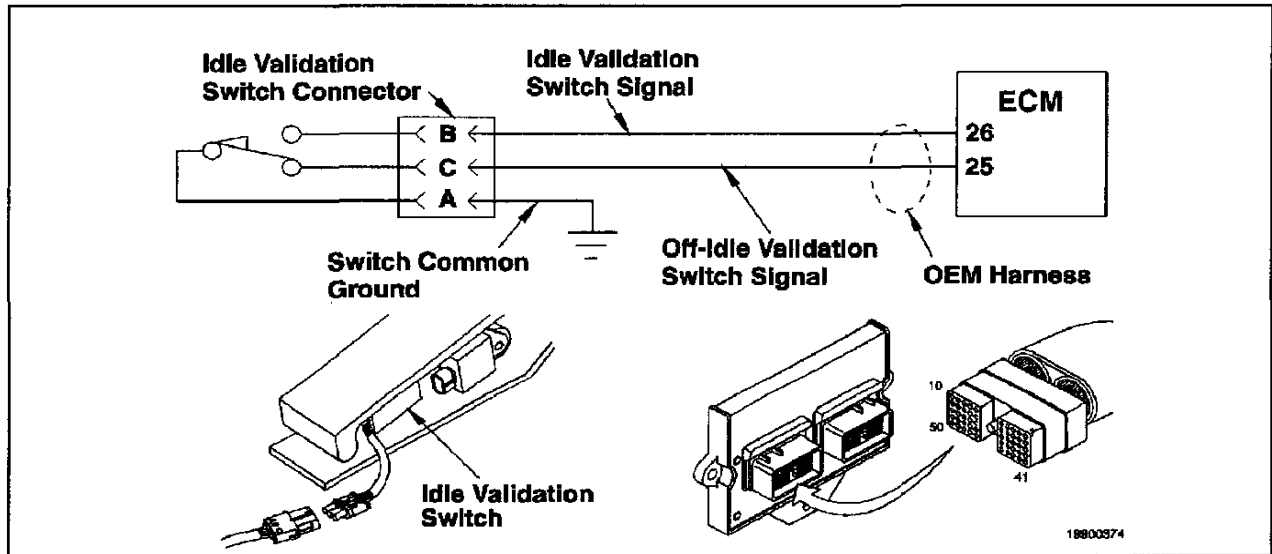
Condition: <ul style="list-style-type: none"> • Connect all the components • Keyswitch in the ON position. 		
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> • Erase the inactive fault codes using INSITE™. 	OK All faults cleared	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting chart

Fault Code 431 or 551

Idle Validation Switch (IVS) Circuit

CODES	REASON	EFFECT
Fault Code: 431 or 551 PID(P), SID(S): P091 SPN: 091 FMI: 2 or 4 Lamp: Yellow	FC 431: Idle validation signals on pins 25 and 26 of the original equipment manufacturer's (OEM) harness indicate +5 VDC present at both pins 25 and 26. FC 551: Idle validation signals on pins 25 and 26 of the original equipment manufacturer's (OEM) harness indicate voltage detected simultaneously on both pins.	FC 431: No effect on performance but loss of idle validation. FC 551: Engine will only idle. Limp home throttle will not function.

Idle Validation Switch Circuit



Circuit Description:

The idle validation switch (IVS) is used by the electronic control module (ECM) to indicate when the accelerator pedal is released (on-idle) or depressed (off-idle). The switch is adjusted by the accelerator pedal manufacturers to switch from on-idle to off-idle at the correct accelerator pedal position.

NOTE: The connector pin letters shown for the accelerator pedal wiring in these troubleshooting steps are examples of representative sensors. The connector pin assignments can vary with the equipment manufacturer, but the base troubleshooting logic will still apply.

Component Location:

The idle validation switch is located on the accelerator pedal assembly.

Shop Talk:

This fault code is usually caused by a loose connection, uncalibrated accelerator pedal, or miswired IVS. A bad ground on pin A of the IVS can also cause this fault.

TROUBLESHOOTING SUMMARY

WARNING

Set the service brake using the trailer brake hand valve. Make sure there is enough air pressure to activate the brake pressure switch. Securely chock the wheels. Truck movement during troubleshooting can cause severe equipment damage, personal injury, or death.

CAUTION

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack test lead
Part No. 3823995 - male Weather-Pack test lead
Part No. 3822917 - female AMP/Metri-Pack test lead
Part No. 3823996 - female Weather-Pack test lead.

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 accelerator pedal.		
<u>STEP 1A:</u> Verify the IVS is connected to the OEM harness.	IVS connected	
<u>STEP 1B:</u> Calibrate the accelerator pedal.	Fault Code 431 or 551 inactive	
<u>STEP 1C:</u> Inspect the engine harness and the IVS connector.	No damaged pins	
<u>STEP 1D:</u> Check for an open circuit.	Less than 10 ohms	
<u>STEP 1E:</u> Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 2: Check the OEM harness.		
<u>STEP 2A:</u> Inspect the OEM harness and ECM connectors.	No damaged pins	
<u>STEP 2B:</u> Check the ECM supply.	(+) 4.75 to 5.25 VDC	
<u>STEP 2C:</u> Check for a short circuit from pin to pin.	More than 100k ohms	
<u>STEP 2D:</u> Check for an open circuit.	Less than 10 ohms	
<u>STEP 2E:</u> Check for a short circuit to ground.	More than 100k ohms	
STEP 3: Clear the fault codes.		
<u>STEP 3A:</u> Disable the fault code.	Fault Code 431 or 551 inactive	
<u>STEP 3B:</u> Clear the inactive fault codes.	All faults cleared	

TROUBLESHOOTING STEP

STEP 1: Check the accelerator pedal.

STEP 1A: Verify the IVS is connected to the OEM harness.

Condition:		
<ul style="list-style-type: none"> • Turn keyswitch to the OFF position. 		
Action	Specifications/Repair	Next Step
Verify the IVS is connected to the OEM harness.	OK IVS connected	1B
	NOT OK Connect the IVS Connect the OEM harness to the IVS. Refer to the OEM troubleshooting and repair manual.	3A

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STEP 1B: Calibrate the accelerator pedal.

Condition:		
<ul style="list-style-type: none"> • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Calibrate the accelerator pedal. <ul style="list-style-type: none"> • Depress the accelerator pedal to the full-fuel position. • Release the accelerator pedal. • Repeat this procedure two more times. 	OK Fault Code 431 or 551 active	1C
	NOT OK Pedal not calibrated Fault Code 431 or 551 inactive.	3A

STEP 1C: Inspect the OEM harness and the IVS connectors.

Condition:		
<ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the OEM harness from the IVS. 		
Action	Specifications/Repair	Next Step
Inspect the OEM harness and the IVS connectors for the following: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	OK No damaged pins	1D
	NOT OK Repair the damaged pins Repair or replace the IVS or OEM harness, whichever has the damaged pins. <ul style="list-style-type: none"> • Repair the OEM harness. Refer to Procedure 019-203. • Replace the OEM harness. Refer to Procedure 019-071. • Repair or replace the IVS. Refer to the OEM troubleshooting and repair manual. • Install the appropriate connector seal if it is damaged or missing. Refer to the OEM troubleshooting and repair manual. 	3A

STEP 1D: Check for an open circuit.

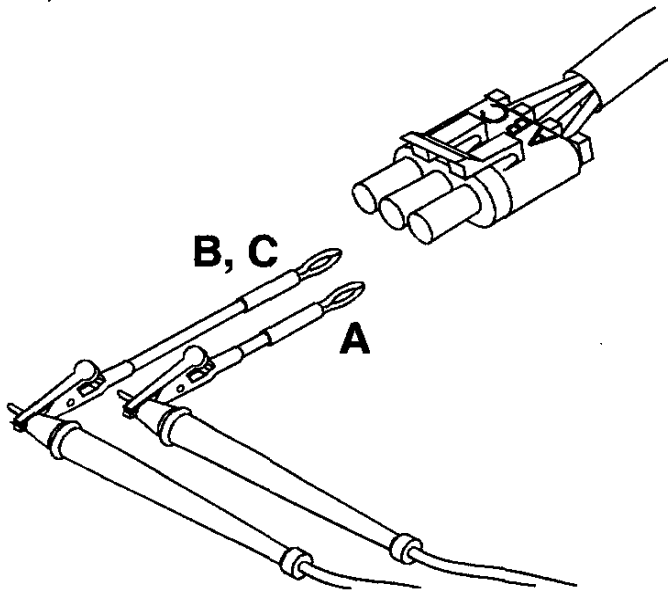
▲ CAUTION ▲

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 to the OFF position.
- Disconnect the OEM harness from the IVS.

Action	Specifications/Repair	Next Step
Check for an open circuit in the IVS. • Measure the resistance from pin B to pin A on the switch side of the IVS connector with the accelerator pedal released. • Measure the resistance from pin C to pin A on the switch side of the IVS connector with the accelerator pedal depressed.	OK Less than 10 ohms	1E
	NOT OK Replace the IVS Refer to the OEM troubleshooting and repair manual.	3A



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STEP 1E: Check for a short circuit from pin to pin.

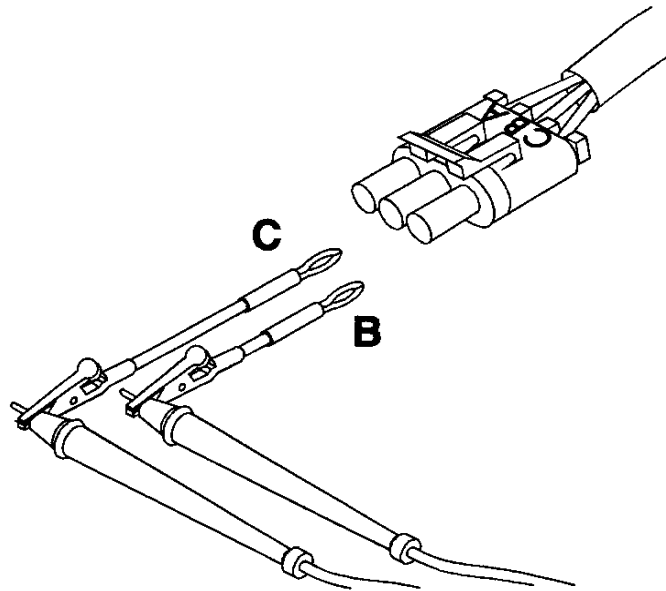
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3823995 - male Weather-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the IVS.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin in the IVS. • Measure the resistance from pin B to pin C on the switch side of the IVS connector with the accelerator pedal released and depressed.	OK More than 100k ohms	2A
	NOT OK Replace the IVS Refer to the OEM troubleshooting and repair manual.	3A



19900438

STEP 2: Check the OEM harness.

STEP 2A: Inspect the OEM 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 to the OFF position.
- Disconnect the OEM harness from the ECM.
- Disconnect the OEM harness from the IVS.

Action	Specifications/Repair	Next Step
Inspect the OEM harness and ECM connectors for the following: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	OK No damaged pins	2B
	NOT OK Repair the damaged pins Repair or replace the OEM harness or ECM, whichever has the damaged pins. <ul style="list-style-type: none"> • Repair the OEM harness. Refer to Procedure 019-250. • Replace the OEM harness. Refer to Procedure 019-071. • Replace the ECM. Refer to Procedure 019-031. 	3A

STEP 2B: Check the ECM supply.

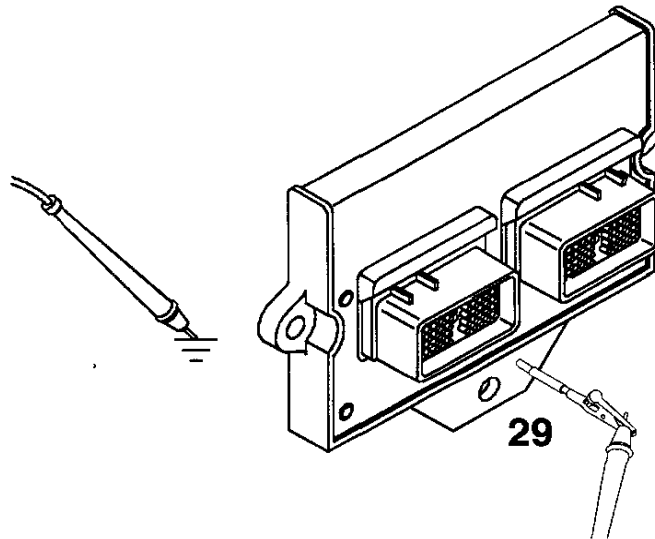
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822917 - female AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch to the ON position.
- Disconnect the OEM harness from the ECM.

Action	Specifications/Repair	Next Step
Check the ECM supply. • Measure the voltage from pin 29 of the OEM harness of the ECM connector to engine block ground.	OK (+) 4.75 to 5.25 VDC	2C
	NOT OK Replace the ECM Refer to Procedure 019-031.	3A



19d00765

STEP 2C: Check for a short circuit from pin to pin.

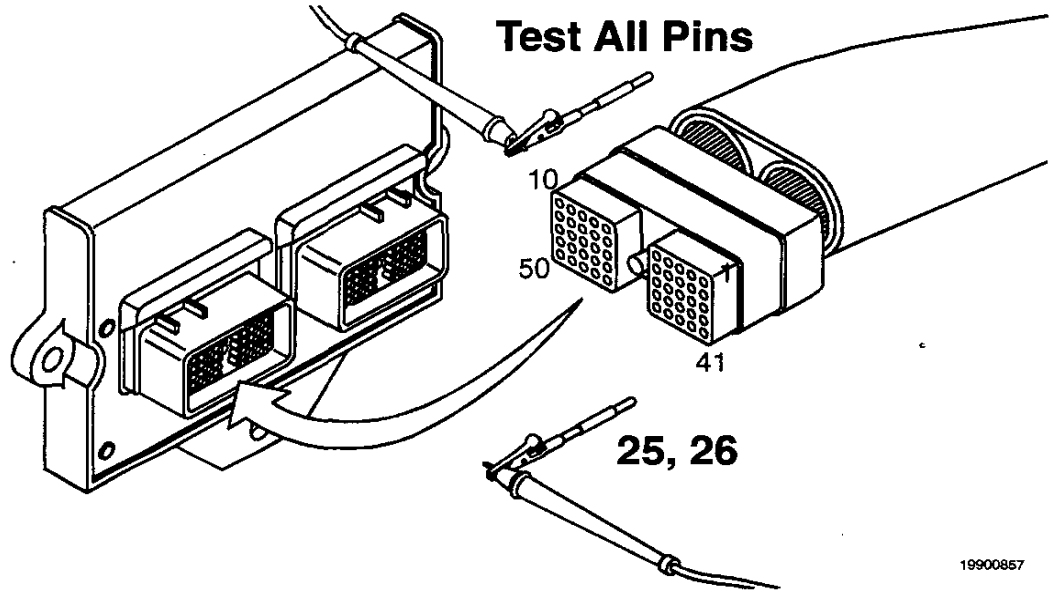
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the ECM.
- Disconnect the OEM harness from the IVS.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pins 25 and 26 of the OEM harness connector to all other pins in the connector.	OK More than 100k ohms	2D
	NOT OK Replace the OEM harness Refer to Procedure 019-071.	3A



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STEP 2D: Check for an open circuit.

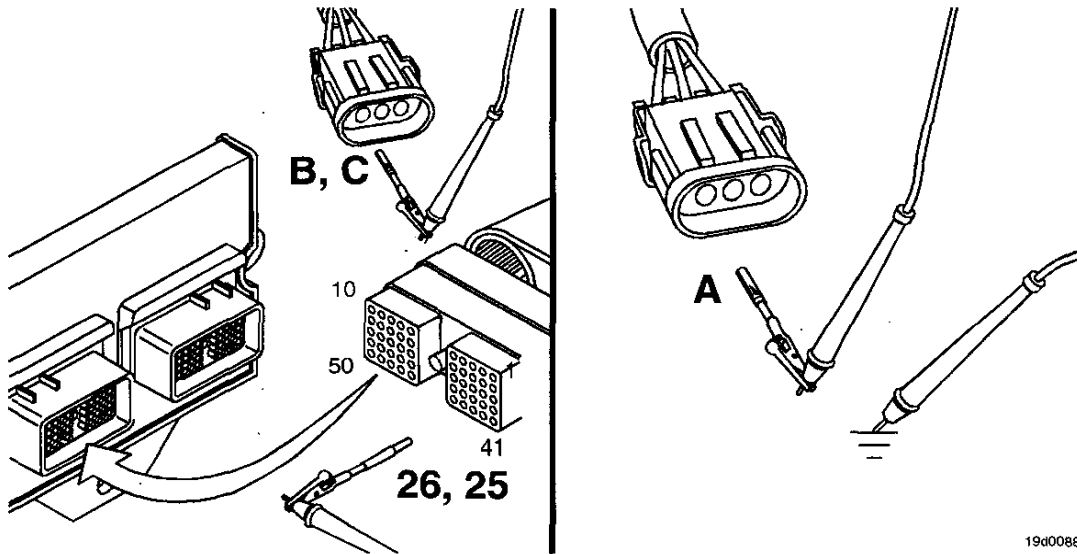
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack test lead
Part No. 3823996 - female Weather-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the ECM.
- Disconnect the OEM harness from the IVS.

Action	Specifications/Repair	Next Step
Check for an open circuit. <ul style="list-style-type: none"> • Measure the resistance from pin 26 on the harness side of the OEM harness connector to pin B on the harness side of the IVS connector. • Measure the resistance from pin 25 on the harness side of the OEM harness connector to pin C on the harness side of the IVS connector. • Measure the resistance from pin A on the harness side of the IVS connector to engine block ground. 	OK Less than 10 ohms	2E
	NOT OK Replace the OEM harness Refer to Procedure 019-071.	3A



19d00887

STEP 2E: Check for a short circuit to ground.

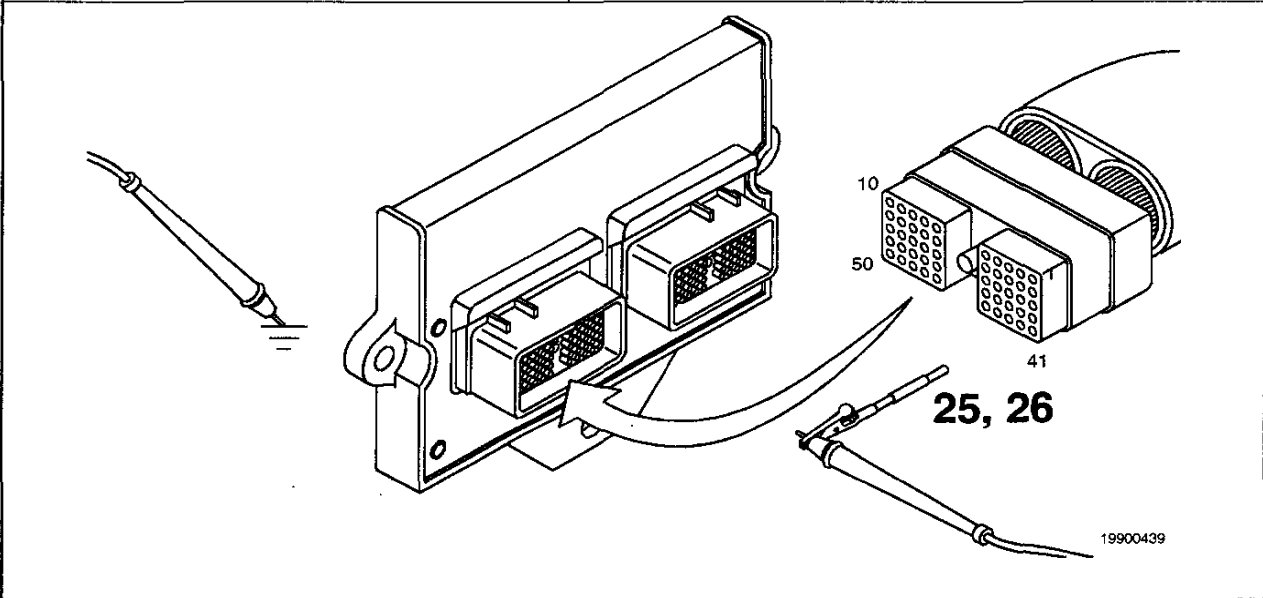
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the ECM.
- Disconnect the OEM harness to the IVS.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to ground. • Measure the resistance from pin 25 on the harness side of the OEM connector to engine block ground.	OK More than 100k ohms	3A
• Measure the resistance from pin 26 on the harness side of the OEM connector to engine block ground.	NOT OK Replace the OEM harness Refer to Procedure 019-071.	3A



STEP 3: Clear the fault codes.

STEP 3A: Disable the fault code.

Condition: <ul style="list-style-type: none"> • Connect all components. • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> • Turn the keyswitch to the ON position and completely depress and release the accelerator pedal four to five times. • Turn the keyswitch to the OFF position for 5 seconds. • Start the engine, and let idle for 1 minute. • Verify that Fault Code 431 or 551 is inactive. 	OK Fault Code 431 or 551 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.

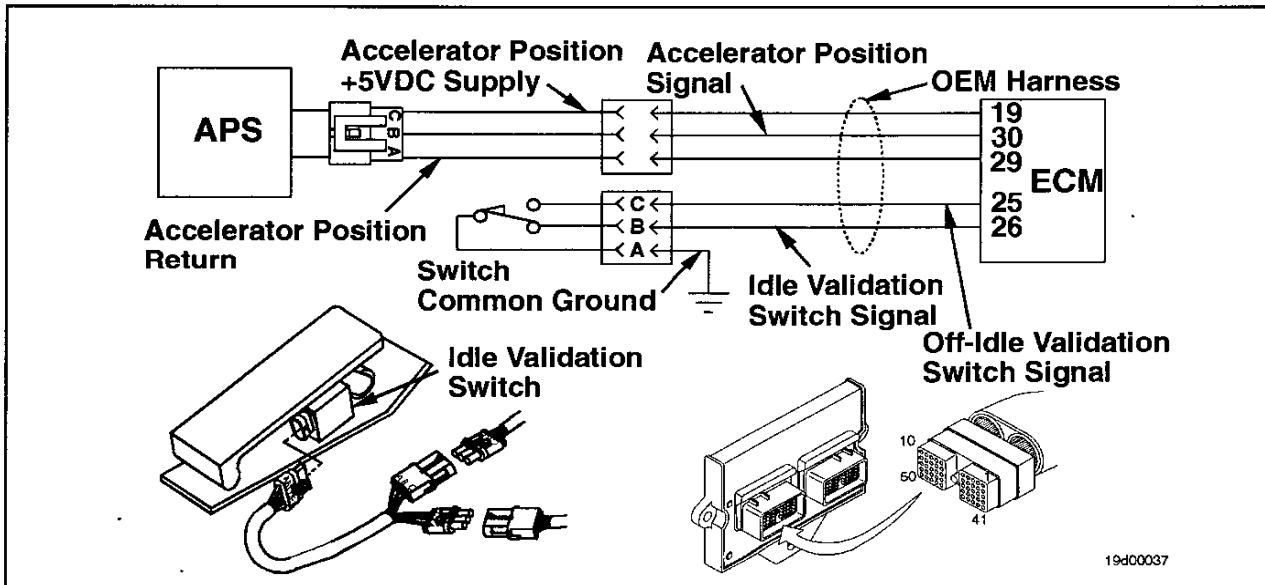
Condition: <ul style="list-style-type: none"> • Connect all the components. • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> • Erase the inactive fault code using INSITE™. 	OK All faults cleared	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting chart

Fault Code 432

Accelerator Pedal Circuit (ISS)

CODES	REASON	EFFECT
Fault Code: 432 PID(P), SID(S): P091 SPN: 091 FMI: 13 Lamp: Yellow	No voltage detected at pin 26 of the original equipment manufacturer's (OEM) harness indicates the accelerator is at the idle position when the accelerator position signal at pin 30 of the OEM harness indicates the accelerator is not at the idle position, or idle validation signal at pin 26 of the OEM harness indicates the accelerator is not at the idle position when the accelerator position signal pin 30 of the OEM harness indicates the accelerator is at the idle position.	Engine will only idle.

Accelerator Pedal Circuit



Circuit Description:

The accelerator pedal assembly relays the accelerator percentage requested by the operator to the electronic control module (ECM). Percent accelerator is used to determine fueling. The accelerator position sensor and the idle validation switch on the accelerator pedal are adjusted at the factory to provide the correct output signals. **NOTE:** The connector pin letters shown for the accelerator pedal wiring in these troubleshooting steps are examples of representative sensors. The connector pin assignments can vary with the equipment manufacturer, but the base troubleshooting logic will still apply.

Component Location:

The accelerator position sensor and the idle validation switch are located on the accelerator pedal in the cab.

Shop Talk:

Confirm that the idle validation switch (IVS) is properly calibrated. Refer to the accelerator pedal manufacturer's instructions for adjustment information.

NOTE: The three wires in the accelerator position sensor circuit **must** be twisted together. Depending on ground location, IVS will, perhaps, **only** have two wires.

TROUBLESHOOTING SUMMARY



To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack test lead
Part No. 3823995 - male Weather-Pack test lead
Part No. 3823996 - female Weather-Pack test lead.



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 fault status.		
STEP 1A: Perform the fault code disable procedure.	Fault Code 432 still active	
STEP 1B: Check for idle validation fault codes.	Fault Codes 551 and 431 inactive	
STEP 2: Check the OEM harness.		
STEP 2A: Inspect the OEM harness and the ECM connectors.	No damaged pins	
STEP 2B: Check the resistance.	1500 to 3000 ohms (released) 250 to 1500 ohms (depressed)	
STEP 2B-1: Check the resistance of the accelerator position sensor.	1500 to 3000 ohms (released) 250 to 1500 ohms (depressed)	
STEP 2B-2: Check the resistance in the OEM harness.	Less than 10 ohms	
STEP 2C: Check for an open circuit.	2000 to 3000 ohms	
STEP 2C-1: Check for an open circuit of the accelerator position sensor supply and return circuit.	2000 to 3000 ohms	
STEP 2C-2: Check for an open circuit in the OEM harness.	Less than 10 ohms	
STEP 2D: Check for a short circuit to ground.	More than 100k ohms	
STEP 2D-1: Check for a short circuit to ground in the accelerator position sensor.	More than 100k ohms	
STEP 2D-2: Check for a short circuit to ground in the OEM harness.	More than 100k ohms	
STEP 2E: Check for a short circuit from pin to pin in the OEM harness.	More than 100k ohms	
STEP 3: Clear the fault code.		
STEP 3A: Disable the fault code.	Fault Code 432 inactive	
STEP 3B: Clear the inactive fault codes.	All faults cleared	

TROUBLESHOOTING STEP

STEP 1: Check the fault status.

STEP 1A: Perform the fault code disable procedure.

Condition: <ul style="list-style-type: none"> • Turn keyswitch to the ON position. • Connect all components. 		
Action	Specifications/Repair	Next Step
Perform the fault code disable procedure. <ul style="list-style-type: none"> • Slowly depress the accelerator pedal to the full-fuel position, and release it completely three times. • Read the inactive fault codes using INSITE™. 	OK Fault Code 432 still active	1B
	NOT OK Replace the accelerator pedal assembly Refer to the OEM troubleshooting and repair manual.	3A

STEP 1B: Check for idle validation fault codes.

Condition: <ul style="list-style-type: none"> • Turn keyswitch to the ON position. • Connect all components. 		
Action	Specifications/Repair	Next Step
Read the fault codes. <ul style="list-style-type: none"> • Read the fault codes using INSITE™. 	OK Fault Codes 551 and 431 inactive	2A
	NOT OK Fault Codes inactive	Refer to Fault Code 431 or 551

STEP 2: Check the OEM harness.

STEP 2A: Inspect the OEM 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 to the OFF position.
- Disconnect the OEM harness from the ECM.

Action	Specifications/Repair	Next Step
Inspect the OEM harness and the ECM connectors for the following: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	OK No damaged pins	2B
	NOT OK Repair the damaged pins Repair or replace the OEM harness or ECM, whichever has the damaged pins. <ul style="list-style-type: none"> • Repair the OEM harness. Refer to Procedure 019-250. • Replace the OEM harness. Refer to Procedure 019-071. • Replace the ECM. Refer to Procedure 019-031. 	3A

STEP 2B: Check the resistance.

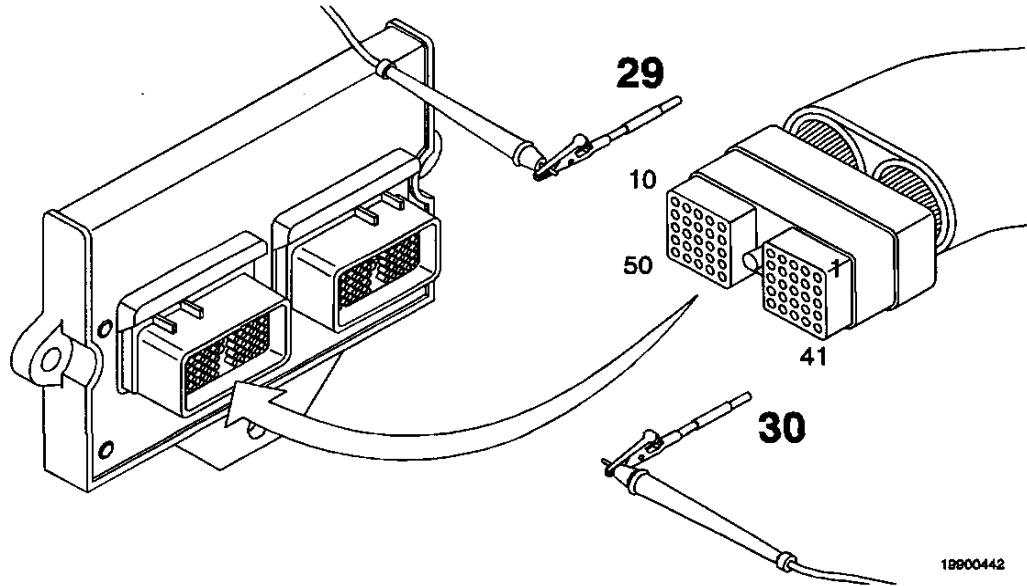
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the ECM.

Action	Specifications/Repair	Next Step
Check the resistance. <ul style="list-style-type: none"> • Measure the resistance from pin 29 to pin 30 of the OEM harness connector with the accelerator pedal in the released (idle) position. • Repeat the measurement with the accelerator pedal in the depressed (full-fuel) position. 	OK 1500 to 3000 ohms (released) 250 to 1500 ohms (depressed) Released value must be at least 1000 ohms greater than depressed value	2C
NOTE: Resistance with the pedal released must be at least 1000 ohms greater than when it is depressed.	NOT OK Repair the circuit	2B-1



18900442

STEP 2B-1: Check the resistance of the accelerator position sensor.

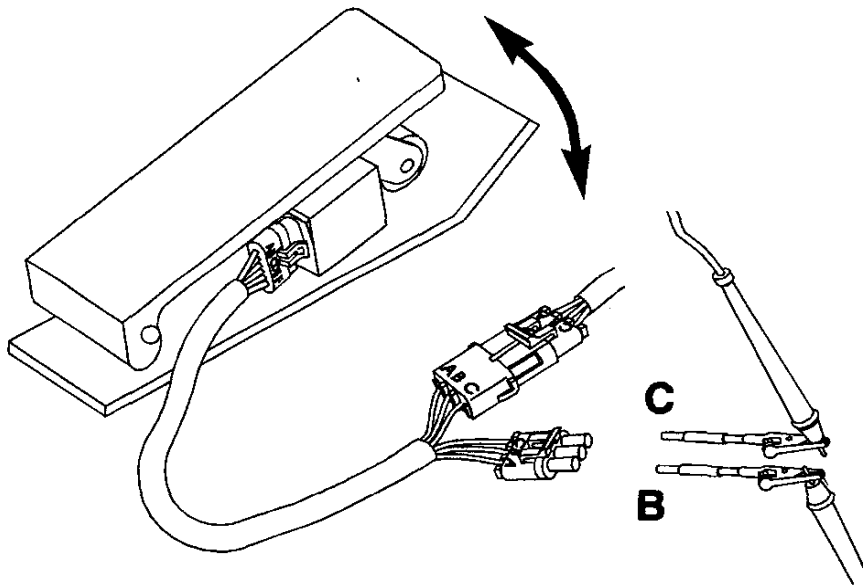
⚠ CAUTION ⚠

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 to the OFF position.
- Disconnect the OEM harness from the accelerator position sensor.
- Disconnect the OEM harness from the ECM.

Action	Specifications/Repair	Next Step
<p>Check the resistance of the throttle position sensor.</p> <ul style="list-style-type: none"> • Measure the resistance from pin C to pin B on the sensor side of the accelerator position sensor connector with the accelerator pedal in the released (idle) position. • Repeat the above measurement with the accelerator pedal in the depressed (full-fuel) position. <p>Note: Resistance when the pedal is released must be at least 1000 ohms greater than when it is depressed.</p>	<p>OK 1500 to 3000 ohms (released) 250 to 1500 ohms (depressed) Released value at least 1000 ohms greater than depressed value</p>	<p>2B-2</p>
	<p>NOT OK Replace the accelerator pedal assembly Refer to the OEM troubleshooting and repair manual.</p>	<p>3A</p>



19900380

STEP 2B-2: Check the resistance in the OEM harness.

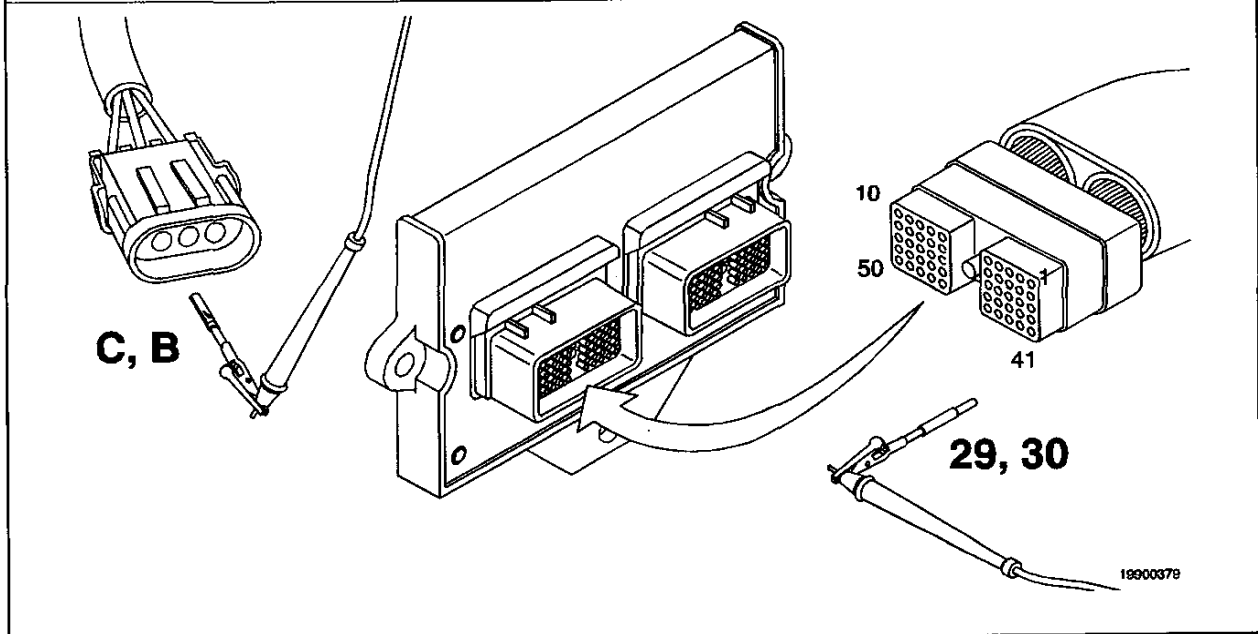
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack test lead
Part No. 3823995 - male Weather-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the accelerator position sensor.
- Disconnect the OEM harness from the ECM.

Action	Specifications/Repair	Next Step
Check the resistance in the OEM harness. <ul style="list-style-type: none"> • Measure the resistance from pin 29 of the OEM harness connector to pin C on the harness side of the accelerator position sensor connector. 	OK Less than 10 ohms	2C
<ul style="list-style-type: none"> • Measure the resistance from pin 30 of the OEM harness connector to pin B on the harness side of the accelerator position sensor connector. 	NOT OK Repair or replace the OEM harness Refer to the OEM troubleshooting and repair manual.	3A



STEP 2C: Check for an open circuit.

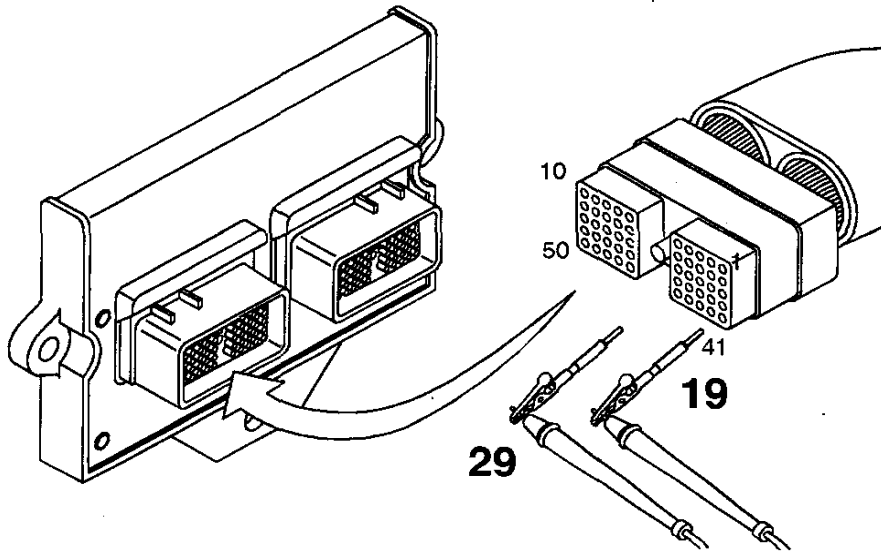
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Connect the OEM harness to the accelerator position sensor.
- Disconnect the OEM harness from the ECM.

Action	Specifications/Repair	Next Step
Check for an open circuit. • Measure the resistance from pin 29 to pin 19 of the OEM harness connector (the accelerator pedal can be either released or depressed).	OK 2000 to 3000 ohms	2D
	NOT OK Repair the circuit	2C-1



STEP 2C-1: Check for an open circuit of the accelerator position sensor supply and return circuit.

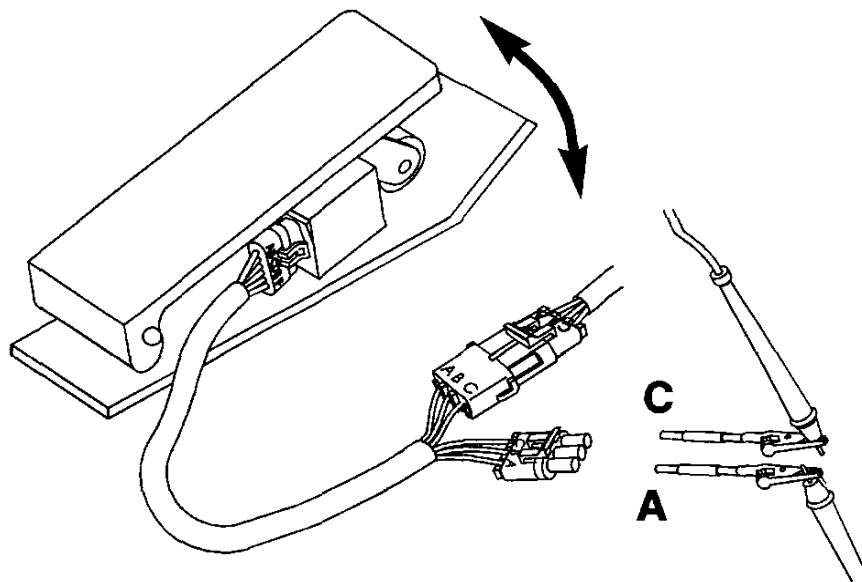
⚠ CAUTION ⚠

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 to the OFF position.
- Disconnect the OEM harness from the accelerator position sensor.
- Disconnect the OEM harness from the ECM.

Action	Specifications/Repair	Next Step
Check for an open circuit of the throttle position sensor supply and return circuit.	OK 2000 to 3000 ohms	2C-2
<ul style="list-style-type: none"> • Measure the resistance from pin C to pin A on the sensor side of the accelerator position sensor connector (the accelerator pedal can be either released or depressed). 	NOT OK Replace the accelerator pedal assembly Refer to the OEM troubleshooting and repair manual.	3A



19900444

STEP 2C-2: Check for an open circuit in the OEM harness.

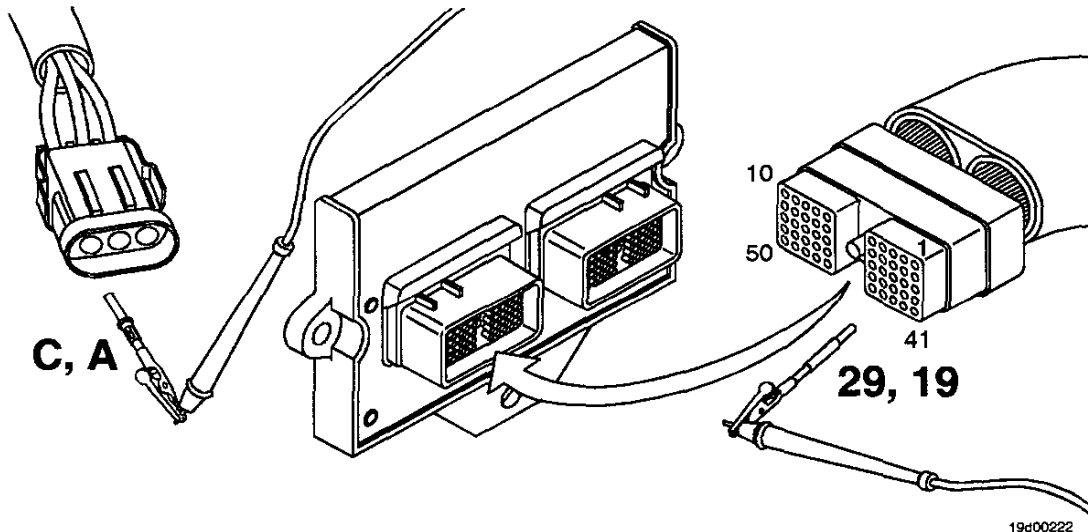
▲ CAUTION ▲

To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack test lead
Part No 3823995 - male Weather-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the accelerator position sensor.
- Disconnect the OEM harness from the ECM.

Action	Specifications/Repair	Next Step
<p>Check the resistance in the OEM harness from the ECM.</p> <ul style="list-style-type: none"> • Measure the resistance from pin 29 of the OEM harness connector to pin C on the harness side of the accelerator position sensor connector. • Measure the resistance from pin 19 of the OEM harness connector to pin A on the harness side of the accelerator position sensor connector. 	<p>OK Less than 10 ohms</p>	<p>2D</p>
	<p>NOT OK Repair or replace the OEM harness Refer to the OEM troubleshooting and repair manual.</p>	<p>3A</p>



19d00222

STEP 2D: Check for a short circuit to ground.

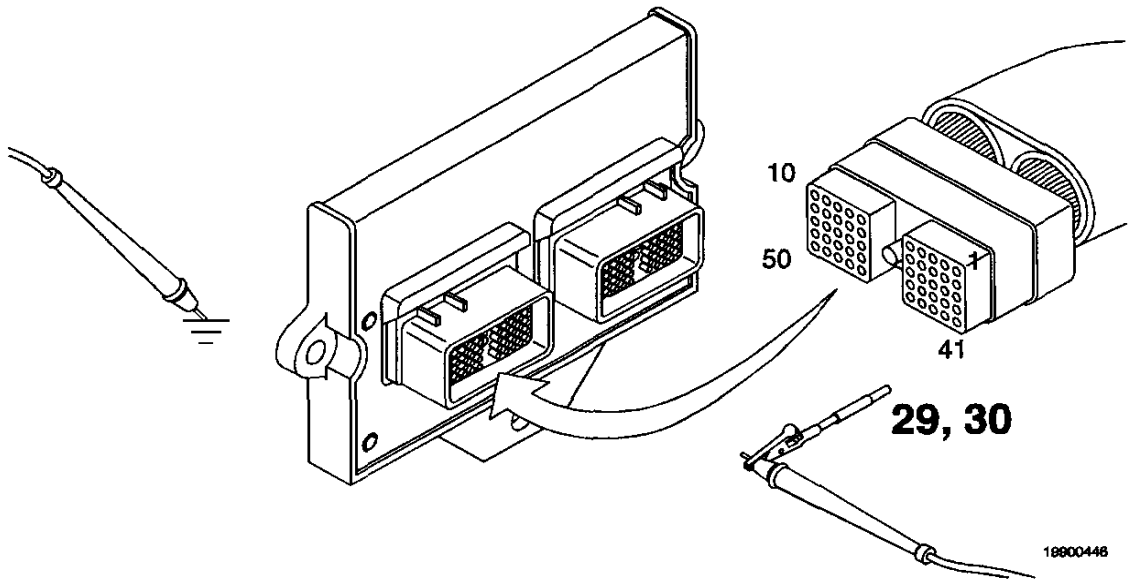
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Connect the OEM harness to the accelerator position sensor.
- Disconnect the OEM harness from ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground. • Measure the resistance from pin 29 in the OEM harness to the engine block ground. • Measure the resistance from pin 30 in the OEM harness to the engine block ground.	OK More than 100k ohms	2E
	NOT OK Repair the circuit	2D-1



STEP 2D-1: Check for a short circuit to ground in the accelerator position sensor.

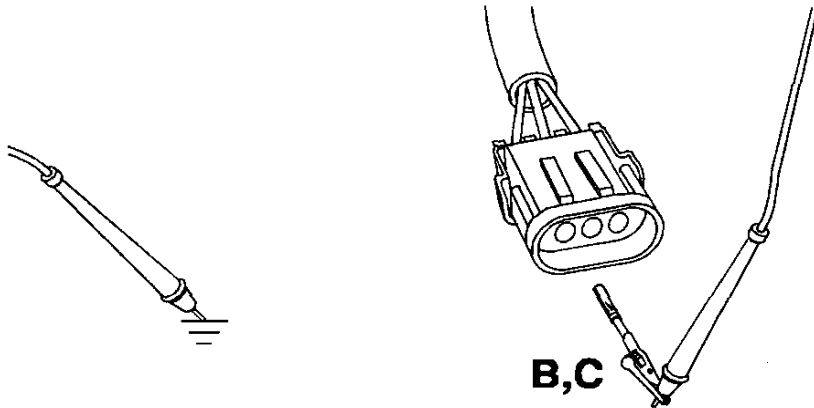
▲ CAUTION ▲

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 to the OFF position.
- Disconnect the OEM harness from the accelerator position sensor.
- Disconnect the OEM harness from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground in the throttle position sensor. • Measure the resistance from pin B on the sensor side of the accelerator position sensor connector to the engine block ground. • Measure the resistance from pin C on the sensor side of the accelerator position sensor connector to the engine block ground.	OK More than 100k ohms	2D-2
	NOT OK Replace the accelerator pedal assembly Refer to the OEM troubleshooting and repair manual.	3A



19900872

STEP 2D-2: Check for a short circuit to ground in the OEM harness.

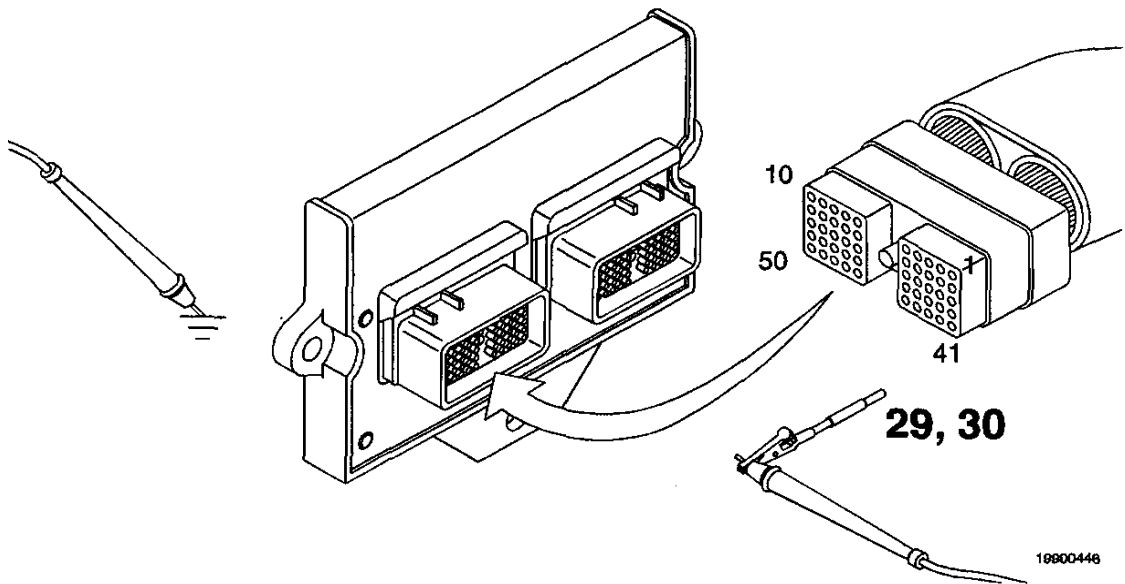
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the accelerator position sensor.
- Disconnect the OEM harness from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground in the OEM harness.	OK More than 100k ohms	2E
<ul style="list-style-type: none"> • Measure the resistance from pin 29 of the OEM harness to the engine block ground. • Measure the resistance from pin 30 of the OEM harness to the engine block ground. 	NOT OK Replace or replace the OEM harness Refer to the OEM troubleshooting and repair manual.	3A



19800446

STEP 2E: Check for a short circuit from pin to pin in the OEM harness.

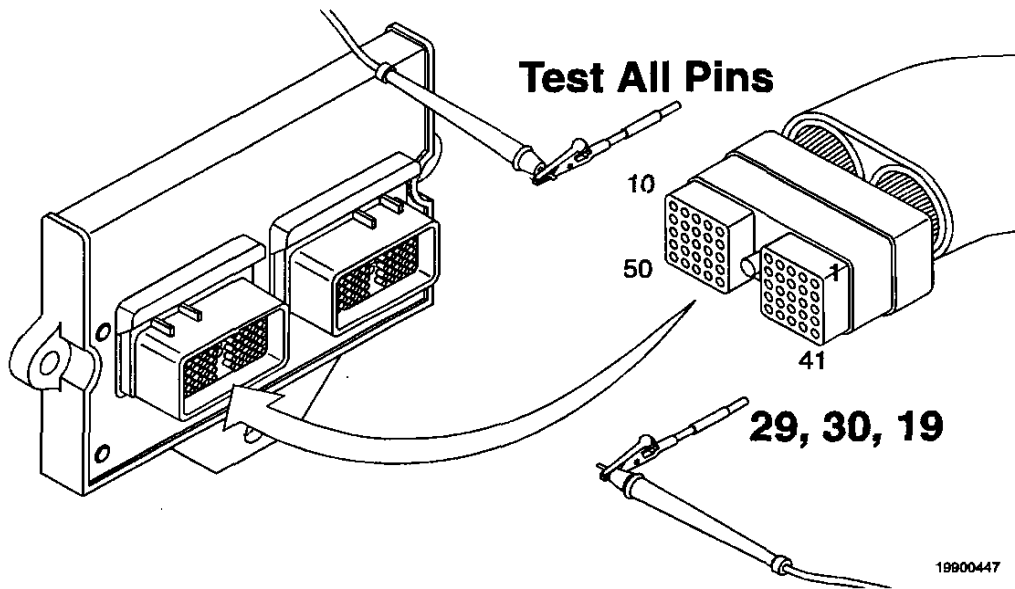
▲ CAUTION ▲

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the accelerator position sensor.
- Disconnect the OEM harness from the ECM.

Action	Specifications/Repair	Next Step
Check for short circuit from pin to pin in the OEM harness. <ul style="list-style-type: none"> • Measure the resistance from pin 29 in the OEM harness to all other pins in the connector. 	OK More than 100k ohms	3A
<ul style="list-style-type: none"> • Measure the resistance from pin 30 in the OEM harness to all other pins in the connector. • Measure the resistance from pin 19 in the OEM harness to all other pins in the connector. 	NOT OK Repair or replace the OEM harness Refer to the OEM troubleshooting and repair manual.	3A



STEP 3: Clear the fault code.

STEP 3A: Disable the fault code.

Condition: <ul style="list-style-type: none"> • Connect all components. • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> • Depress the accelerator pedal to the full-fuel position, and release it completely three times. • Start the engine, and let idle for 1 minute. • Drive the vehicle. • Verify Fault Code 432 is inactive. 	OK Fault Code 432 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.

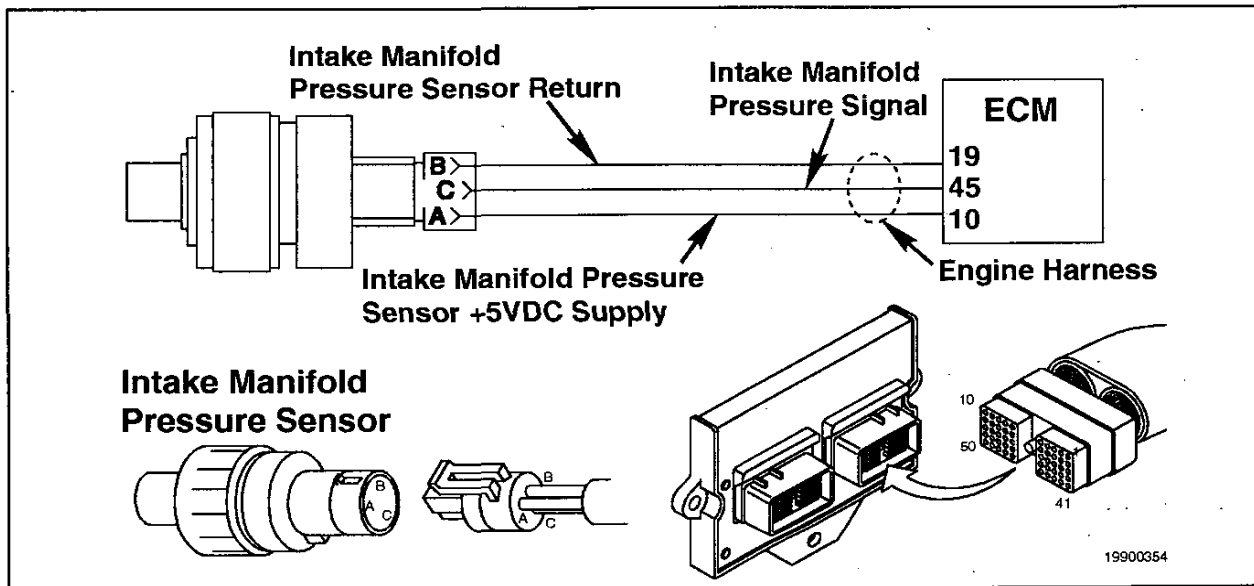
Condition: <ul style="list-style-type: none"> • Connect all the components. • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> • Erase the inactive fault code using INSITE™. 	OK All faults cleared	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting chart

Fault Code 433

Intake Manifold Pressure Sensor Circuit

CODES	REASON	EFFECT
Fault Code: 433 PID(P), SID(S): P102 FMI: 2 Lamp: Yellow	Boost pressure signal indicates boost pressure is high when other engine parameters (i.e., speed and load) indicate boost pressure should be low.	Possible overfueling during acceleration. Increase in black smoke.

Intake Manifold Pressure Sensor Circuit



Circuit Description:

The intake manifold pressure 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 sensor is located in the side of the intake manifold, just to the right of the fuel filter.

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 a fault code.

TROUBLESHOOTING SUMMARY



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.



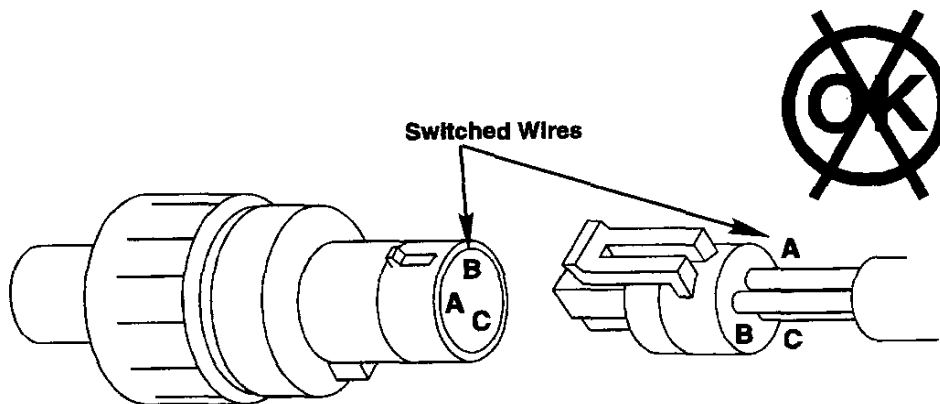
To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

STEPS	SPECIFICATIONS	SRT CODE
<u>STEP 1:</u> Check the intake manifold pressure sensor.		
<u>STEP 1A:</u> Inspect the sensor circuit for tampering.	No tampering	
<u>STEP 1B:</u> Inspect the engine harness and the sensor connectors.	No damaged pins	
<u>STEP 2:</u> Check the engine harness.		
<u>STEP 2A:</u> Inspect the harness and the ECM connectors.	No damaged pins	
<u>STEP 2B:</u> Check for a short circuit from pin to pin.	More than 100k ohms	
<u>STEP 2C:</u> Check for a short circuit to ground.	More than 100k ohms	
<u>STEP 2D:</u> Check for an open circuit in the return line.	Less than 10 ohms	
<u>STEP 3:</u> Clear the fault codes.		
<u>STEP 3A:</u> Disable the fault code.	Fault Code 433 inactive	
<u>STEP 3B:</u> Clear the inactive fault code.	All faults cleared	

TROUBLESHOOTING STEP

STEP 1: Check the intake manifold pressure sensor.
STEP 1A: Inspect the sensor circuit for tampering.

Condition:		
<ul style="list-style-type: none"> • Turn keyswitch to the OFF position. 		
Action	Specifications/Repair	Next Step
Inspect the sensor circuit for tampering. <ul style="list-style-type: none"> • Check the intake manifold pressure sensor and the engine 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



18800085

STEP 1B: Inspect the engine harness and the sensor connectors.

Condition: <ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the engine harness from the intake manifold pressure sensor. 		
Action	Specifications/Repair	Next Step
Inspect the harness and the sensor connectors for: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	OK No damaged pins	2A
	NOT OK Repair the damaged pins Repair or replace the engine harness or sensor, whichever has the damaged pins. <ul style="list-style-type: none"> • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-043. • Replace the intake manifold pressure sensor. Refer to Procedure 019-061. 	3A

STEP 2: Check the engine harness.

STEP 2A: Inspect the 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: <ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the engine harness from the ECM. 		
Action	Specifications/Repair	Next Step
Inspect the harness and the ECM connectors for: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	OK No damaged pins	2B
	NOT OK Repair the damaged pins Repair or replace the engine harness or ECM, whichever has the damaged pins. <ul style="list-style-type: none"> • 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 a short from pin to pin.

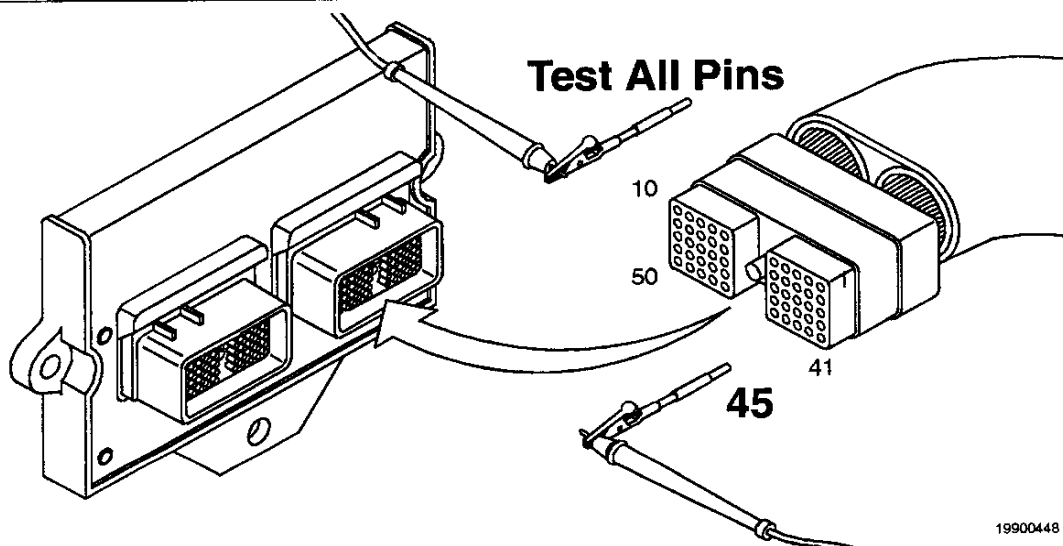
CAUTION

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male Deutsch/Cannon/Metri-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the intake manifold pressure sensor.
- Disconnect the engine harness from the ECM.

Action	Specifications/Repair	Next Step
Check for a short from pin to pin. • Measure the resistance from pin 45 in the engine harness connector to all other pins in the engine harness connector.	OK More than 100k ohms	2C
	NOT OK Replace the engine harness Refer to Procedure 019-043.	3A



STEP 2C: Check for a short circuit to ground.

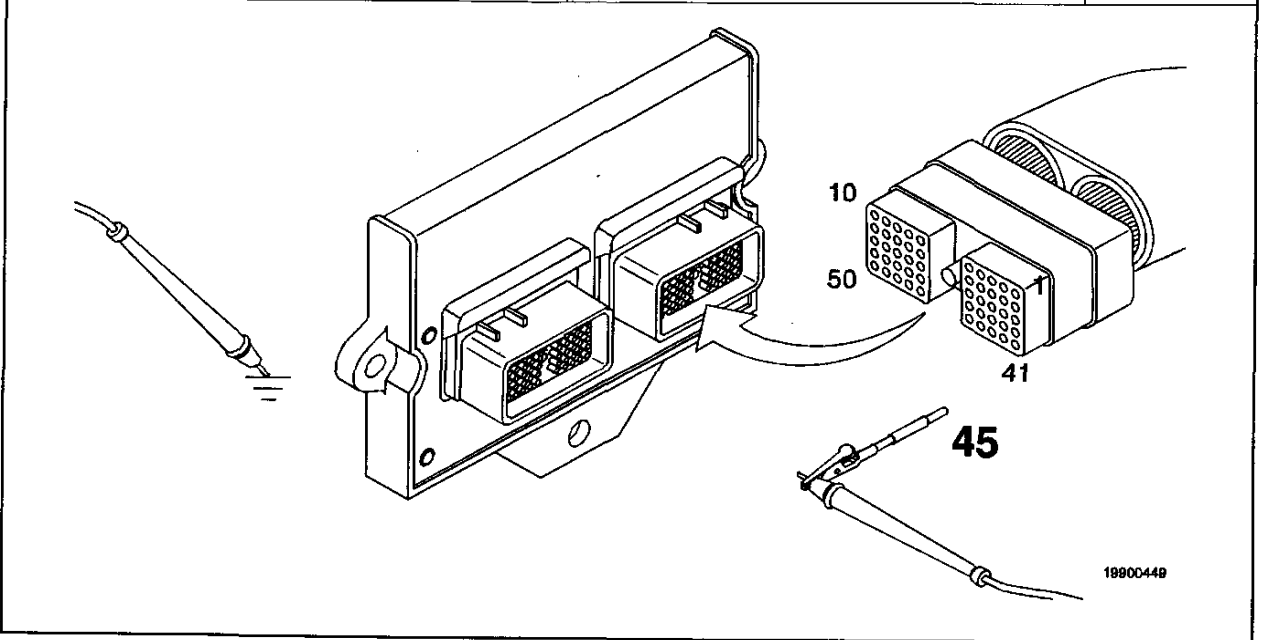
⚠ CAUTION ⚠

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 to the ON position.
- Disconnect the engine harness from the intake manifold pressure sensor.
- Disconnect the engine harness from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground. • Measure the voltage from pin 45 in the engine harness connector to engine block ground.	OK More than 100k ohms	2D
	NOT OK Replace the engine harness Refer to Procedure 019-043.	3A



STEP 2D: Check for an open circuit in the return line.

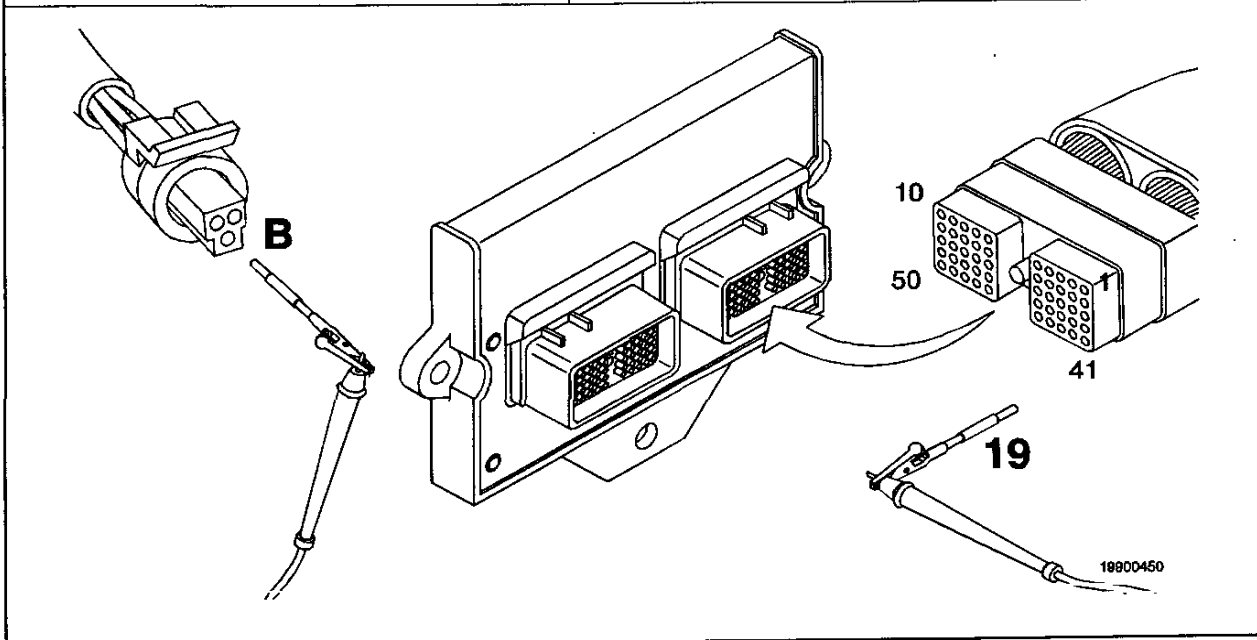
⚠ CAUTION ⚠

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 to the OFF position.
- Disconnect the engine harness from the intake manifold pressure sensor.
- Disconnect the engine harness from the ECM.

Action	Specifications/Repair	Next Step
Check for an open circuit in the return line. • Measure the resistance from pin 19 of the engine harness connector to pin B of the intake manifold pressure sensor connector on the harness side.	OK Less than 10 ohms Replace the intake manifold pressure sensor. Refer to Procedure 019-061.	3A
	NOT OK Replace the engine harness Refer to Procedure 019-043.	3A



STEP 3: Clear the fault code.

STEP 3A: Disable the fault code.

Condition: <ul style="list-style-type: none"> • Connect all the components. • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> • Start the engine, and let 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

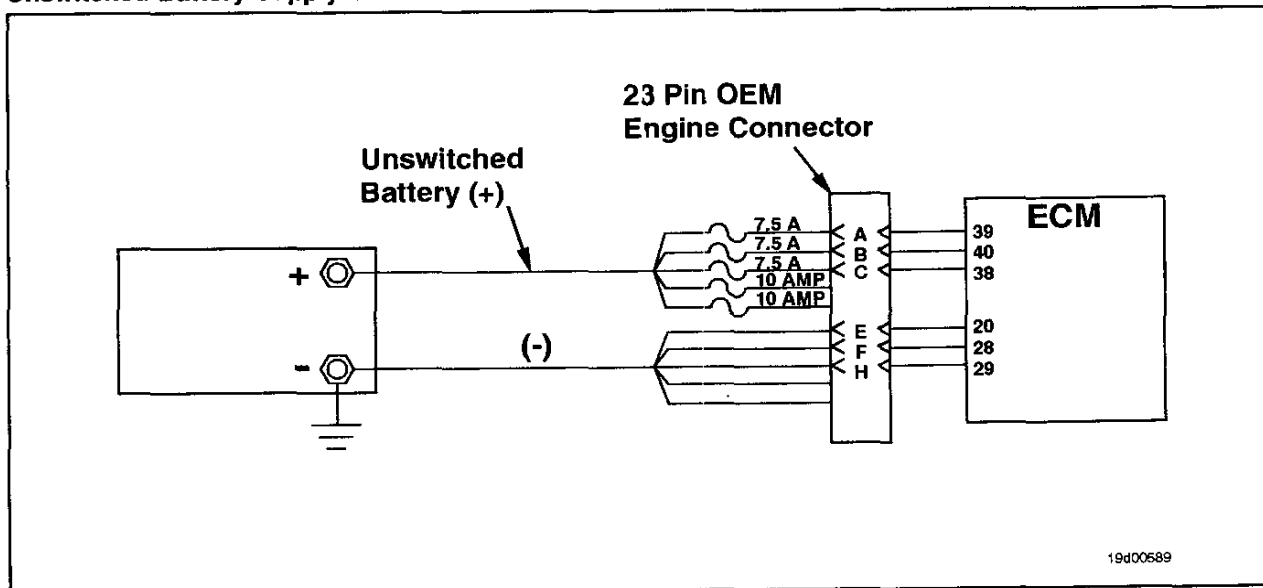
Condition: <ul style="list-style-type: none"> • Connect all the components. • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Clear the inactive fault code. <ul style="list-style-type: none"> • Erase the inactive fault code using INSITE™. 	OK All faults cleared.	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting chart

Fault Code 434

Unswitched Battery Supply Circuit

CODES	REASON	EFFECT
Fault Code: 434 PID(P), SID(S): S251 SPN: 627 FMI: 2 Lamp: Yellow	Supply voltage fell below (+) 6.2 VDC for a fraction of a second, or the electronic control module (ECM) was not allowed to power down correctly (retain battery voltage for 30 seconds after key-off).	None on performance. Fault code table, trip information data, and maintenance monitor data can be inaccurate.

Unswitched Battery Supply Circuit



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 three in-line 7.5-amp fuses and one 20-amp fuse 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.

Component Location:

The ECM is connected to the battery by the engine harness. This direct link provides a constant power supply for the ECM. The location of the battery will vary with the equipment manufacturer. Refer to the equipment manufacturer repair manual.

Shop Talk:

NOTE: If a battery disconnect switch is turned off after the keyswitch is turned off, but before the ECM completely powers down (up to 20 seconds) this fault may register.

Make sure that ECM unswitched power is coming from the batteries and **not** the starter or other device. 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.

Corrupted voltage (short interruptions or spikes that may only be seen with an oscilloscope) on keyswitch line can cause this fault. If the voltage at pin 5 of engine connector is measured as negative with oscilloscope at key-off, Fault Code 434 can be logged.

TROUBLESHOOTING SUMMARY



To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male amp/Metri-Pack test lead.



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 batteries and the power connector.		
<u>STEP 1A:</u> Inspect the 23-pin OEM interface connector.	No damaged pins or loose connections	
<u>STEP 1B:</u> Check the resistance of the battery supply circuit.	Less than 10 ohms	
<u>STEP 1C:</u> Check the battery voltage.	Normal conditions: At least (+) 12 VDC ((+) 12-VDC system) At least (+) 24 VDC ((+) 24-VDC system) During cranking: At least (+) 6.2 VDC ((+) 12-VDC system) At least (+) 12 VDC ((+) 24-VDC system)	
<u>STEP 1D:</u> Check the battery connections.	Connections tight and corrosion-free	
STEP 2: Check the fuses.		
<u>STEP 2A:</u> Check if the three 7.5-amp fuses are installed correctly.	Fuses installed correctly	
<u>STEP 2B:</u> Check if the two 10-amp fuses are installed correctly.	Fuses installed correctly	
<u>STEP 2C:</u> Check if the fuses are blown.	Fuses not blown	
STEP 3: Check the engine harness.		
<u>STEP 3A:</u> Inspect the harness and the ECM connector pins.	No damaged pins	
<u>STEP 3B:</u> Check for an open circuit in the battery power circuits.	(+) 10 to 15 VDC ((+) 12-VDC system) (+) 22 to 27 VDC ((+) 24-VDC system)	
<u>STEP 3C:</u> Check for a short circuit in the battery return wires.	More than 100k ohms	
<u>STEP 3D:</u> Check the add-on or the accessory wiring at (+) terminal of the battery.	No damaged wires	

STEP 4: Clear the fault code.

STEP 4A: Disable the fault code.

Fault Code 434 inactive

STEP 4B: Clear the inactive fault codes.

All faults cleared

TROUBLESHOOTING STEP

STEP 1: Check the batteries and the power connector.

STEP 1A: Inspect the 23-pin OEM interface connector.

Condition:		
<ul style="list-style-type: none">• Turn keyswitch in to the OFF position.• Disconnect the engine harness from the 23-pin Deutsch connector.		
Action	Specifications/Repair	Next Step
Inspect the 23-pin connector on both the battery side and harness side for the following: <ul style="list-style-type: none">• Bent or broken pins• Pushed back or expanded pins• Corroded pins• Moisture in or on the connector• Missing or damaged seals.	OK No damaged pins or loose connections	1B
	NOT OK Repair or replace the damaged pins Refer to Procedure 019-204.	4A

STEP 1B: Check the resistance of the battery supply circuit.

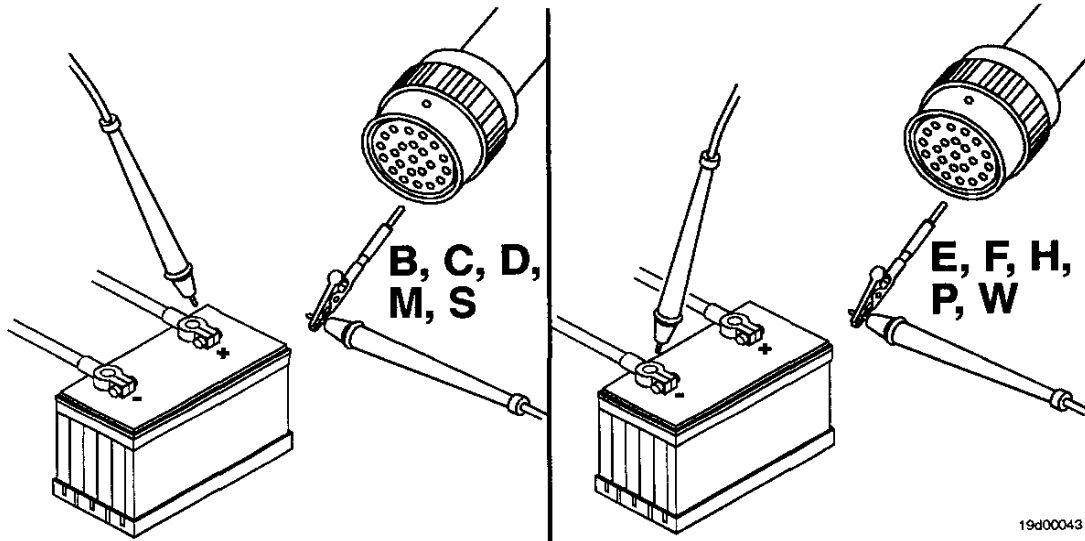
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758- male Deutsch/Cannon/AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch in to the OFF position.
- Disconnect the engine harness from the 23-pin Deutsch connector.

Action	Specifications/Repair	Next Step
Check the resistance of the battery supply circuit. • Measure the resistance from pins B, C, D, M, and S of the battery supply connector to the positive (+) battery terminal. • Measure the resistance from pins E, F, H, P, and W of the battery return connector to the negative (-) battery terminal.	OK Less than 10 ohms	1C
	NOT OK Repair or replace the harness Refer to the OEM troubleshooting and repair manual.	4A

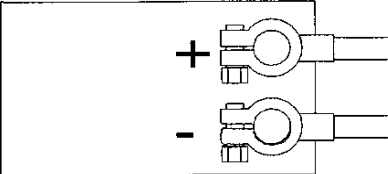


19d00043

STEP 1C: Check the battery voltage.

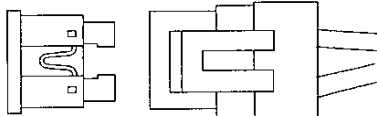
Condition:		
<ul style="list-style-type: none"> • Turn keyswitch in to the ON position. • Connect the engine harness to 23-pin Deutsch connector. 		
Action	Specifications/Repair	Next Step
Check the battery voltage. <ul style="list-style-type: none"> • Place positive (+) probe of multimeter on the positive battery terminal and touch negative (-) probe to the negative battery terminal. Measure the voltage before and during cranking. 	OK Normal conditions: At least (+) 12 VDC ((+) 12-VDC system) At least (+) 24 VDC ((+) 24-VDC system) During cranking: At least (+) 6.2 VDC ((+) 12-VDC system) At least (+) 12 VDC ((+) 24-VDC system)	1D
	NOT OK Charge or replace the battery Refer to the OEM troubleshooting and repair manual.	4A

STEP 1D: Check the battery connections.

Condition: <ul style="list-style-type: none"> • Turn keyswitch in to the ON position. • Connect engine harness to 23-pin Deutsch connector. 		
Action	Specifications/Repair	Next Step
Check the battery 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
 <p>19800237</p>		

STEP 2: Check the fuses.

STEP 2A: Check if the three 7.5-amp fuses are installed correctly.

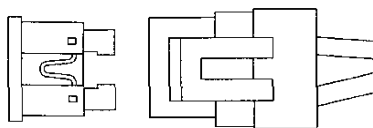
Condition: <ul style="list-style-type: none"> • Turn keyswitch in to the ON position. • Connect the engine harness to the 23-pin Deutsch connector. 		
Action	Specifications/Repair	Next Step
Check whether the three 7.5-amp fuses are installed correctly. <ul style="list-style-type: none"> • Inspect the three 7.5-amp fuses for correct installation. 	OK Fuses installed correctly	2B
	NOT OK Install the fuses correctly Refer to Procedure 019-198.	4A
 <p>19800243</p>		

STEP 2B: Check if the two 10-amp fuses are installed correctly.

Condition:

- Turn keyswitch in to the ON position.
- Connect the engine harness to the 23-pin Deutsch connector.

Action	Specifications/Repair	Next Step
Check if the two 10-amp fuses are installed correctly. • Inspect the 10-amp fuses for correct installation.	OK Fuses installed correctly	2C
	NOT OK Install the fuses correctly Refer to Procedure 019-198.	4A



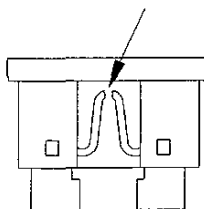
19800243

STEP 2C: Check if the fuses are blown.

Condition:

- Turn keyswitch to the ON position.
- Connect the engine harness to the 23-pin Deutsch connector.

Action	Specifications/Repair	Next Step
Check if the three 7.5-amp fuses and the two 10-amp fuses are blown.	OK Fuses not blown	3A
	NOT OK Replace the engine harness Refer to Procedure 019-043.	4A



19800238

STEP 3: Check the engine harness.

STEP 3A: Inspect the harness and the ECM connector pins.



To avoid damaging the ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch to the OFF position.
- Connect the engine harness to the 23-pin Deutsch connector.
- Disconnect the engine harness from the ECM.

Action	Specifications/Repair	Next Step
Inspect the harness and the ECM connector pins for the following: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	OK No damaged pins	3B
	NOT OK Repair the damaged pins Repair or replace the engine harness or ECM, whichever has the damaged pins. <ul style="list-style-type: none"> • 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.

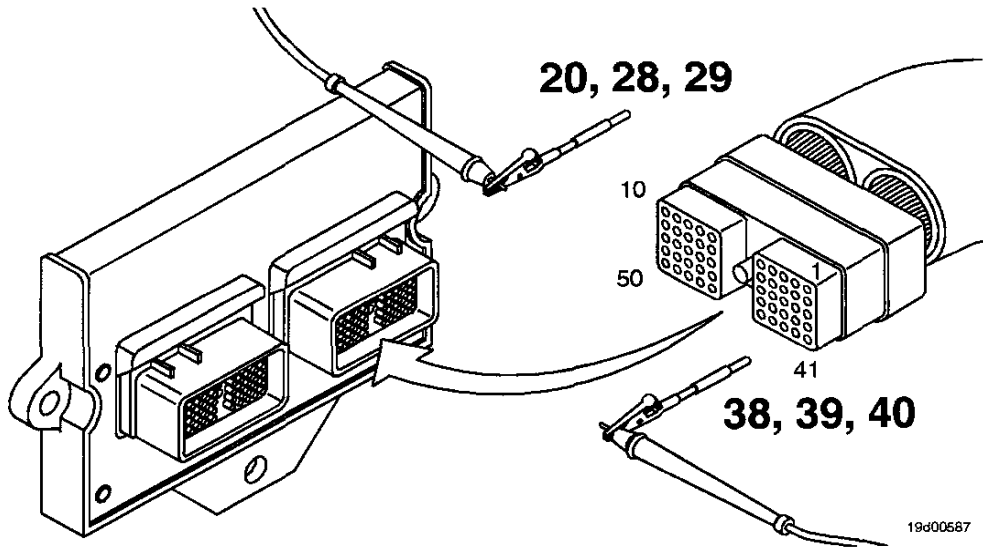
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Connect the engine harness to the 23-pin Deutsch connector.
- Disconnect the engine harness from the ECM.

Action	Specifications/Repair	Next Step
Check for an open circuit in the battery power and return circuits. • Measure the voltage from pin 38 to pins 20, 28, and 29. • Measure the voltage from pin 39 to pins 20, 28, and 29. • Measure the voltage from pin 40 to pins 20, 28, and 29.	OK (+) 10 to 15 VDC ((+) 12-VDC system) (+) 22 to 27 VDC ((+) 24-VDC system)	3C
	NOT OK Replace the engine harness Refer to Procedure 019-043.	4A



STEP 3C: Check for a short circuit.

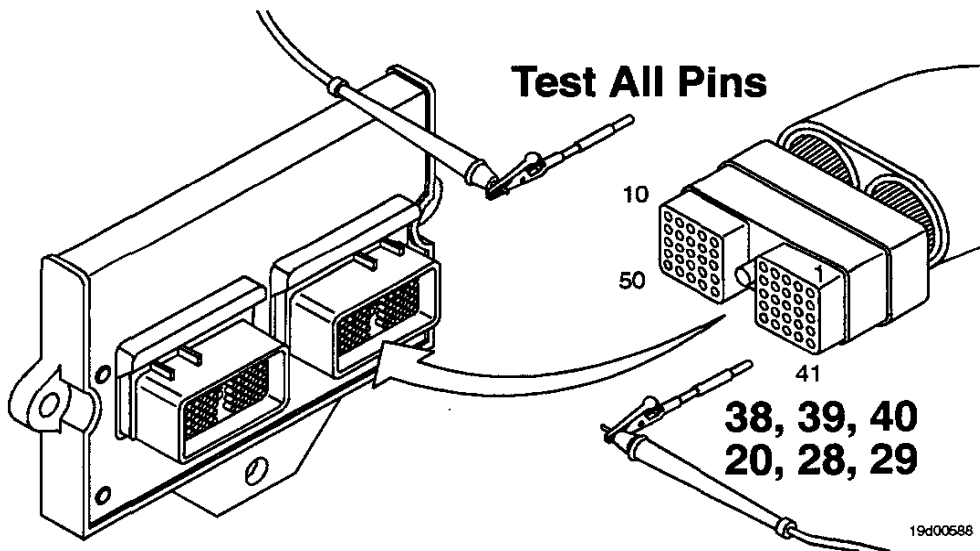
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack test lead.

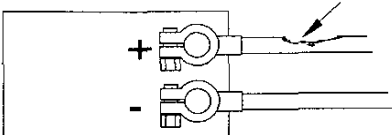
Condition:

- Turn keyswitch to the OFF position.
- Connect the engine harness to the 23-pin Deutsch connector.
- Disconnect the engine harness from the ECM.

Action	Specifications/Repair	Next Step
<p><i>Check for a short circuit.</i></p> <ul style="list-style-type: none"> • Measure the resistance from pin 38 to all other pins in the engine harness. • Measure the resistance from pin 39 to all other pins in the engine harness. • Measure the resistance from pin 40 to all other pins in the engine harness. 	<p>OK More than 100k ohms</p>	<p>3D</p>
<ul style="list-style-type: none"> • Measure the resistance from pin 20 to all other pins in the engine harness. • Measure the resistance from pin 28 to all other pins in the engine harness. • Measure the resistance from pin 29 to all other pins in the engine harness. 	<p>NOT OK Replace the engine harness Refer to Procedure 019-043.</p>	<p>4A</p>



STEP 3D: Check the add-on or accessory wiring at positive (+) terminal of the battery.

Condition: <ul style="list-style-type: none"> • Turn keyswitch to the OFF position. 		
Action	Specifications/Repair	Next Step
Check the add-on or the accessory wiring at the positive (+) terminal of the battery. <ul style="list-style-type: none"> • Starting at the positive (+) 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 ground. 	OK No damaged wires	4A
	NOT OK Repair or replace the damaged wiring Refer to the OEM troubleshooting and repair manual.	4A
		
19800241		

STEP 4: Clear the fault code.

STEP 4A: Disable the fault code.

Condition: <ul style="list-style-type: none"> • Connect all the components. • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> • Start the engine and let idle for one minute. • 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.

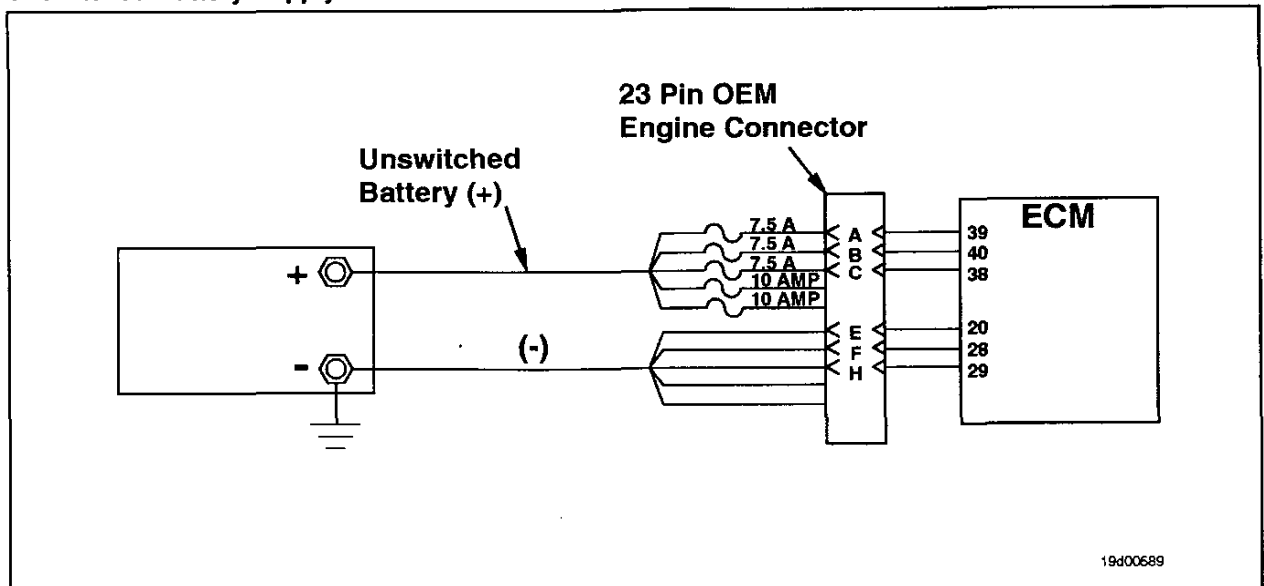
Condition:		
<ul style="list-style-type: none">• Connect all the components.• Turn keyswitch to the ON position.		
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none">• Erase the inactive fault code using INSITE™.	OK All faults cleared	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting chart

Fault Code 441

Unswitched Battery Supply Circuit

CODES	REASON	EFFECT
Fault Code: 441 PID(P), SID(S): P168 SPN: 168 FMI: 1 Lamp: None	Voltage detected at electronic control module (ECM) power supply pins 38, 39, and 40 of the engine harness indicates ECM supply voltage fell below (+) 6 VDC.	Engine will die or run rough.

Unswitched Battery Supply Circuit



Circuit Description:

The ECM receives unswitched battery input through the engine harness. There are three in-line 7.5-amp fuses and two 10-amp fuses in the unswitched battery wire of the actuator harness to protect the engine harness from overheating.

Component Location:

The ECM is connected to the battery by the engine harness. This direct link provides a constant power supply for the ECM. The location of the battery will vary with the equipment manufacturer. Refer to the equipment manufacturer's 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 or other device. Check for possible weak batteries.

TROUBLESHOOTING SUMMARY



To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male AMP/Cannon Metri-Pack/Deutsch test lead
Part No. 3822917 - female AMP/Cannon Metri-Pack/Deutsch test lead



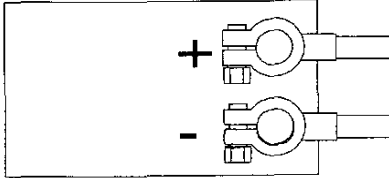
To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the 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 ((+) 12-VDC system) At least (+) 24 VDC ((+) 24-VDC system) During cranking: At least (+) 6.2 VDC ((+) 12-VDC system) At least (+) 12 VDC ((+) 24-VDC system)	
STEP 2: Check the engine harness.		
STEP 2A: Inspect the fuse connections.	Fuses installed correctly	
STEP 2B: Check the fuse.	Fuses not blown	
STEP 2C: Inspect the 23-pin power connector.	No damaged pins or loose connections	
STEP 2D: Check for an open circuit in the unswitched battery supply circuit.	Less than 10 ohms	
STEP 2E: Check for an add-on or accessory wiring at the positive (+) terminal of the battery.	No damaged wires	
STEP 3: Check the engine harness.		
STEP 3A: Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 3B: Check for an open circuit.	Less than 10 ohms	
STEP 3C: 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 441 inactive	
STEP 4B: Clear the inactive fault codes.	All faults cleared	

TROUBLESHOOTING STEP

STEP 1: Check the equipment battery system.

STEP 1A: Inspect the battery cable connections.

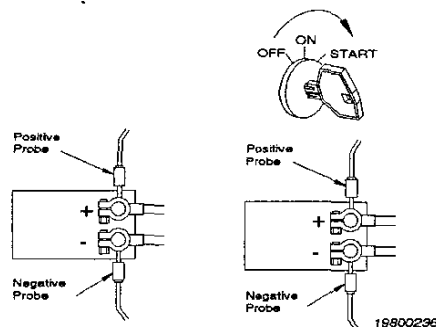
Condition: <ul style="list-style-type: none">• Turn keyswitch to the OFF position.		
Action	Specifications/Repair	Next Step
Inspect the battery cable connections for the following: <ul style="list-style-type: none">• Corrosion• Loose connection.	OK No damaged connections	1B
	NOT OK Repair the damaged connections Tighten the battery connections, and clean the battery terminals. Refer to the OEM troubleshooting and repair manual.	4A
 19800237		

STEP 1B: Check the battery voltage.

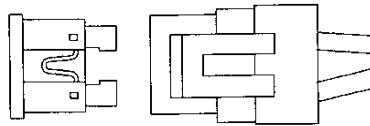
Condition:

- Turn keyswitch to the OFF position.

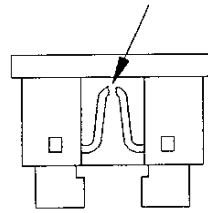
Action	Specifications/Repair	Next Step
<p>Check the battery voltage.</p> <ul style="list-style-type: none"> • Measure the battery voltage from the positive (+) terminal to the negative (-) terminal. • Measure the battery voltage from the positive (+) terminal to the negative (-) terminal while trying to start the engine. 	<p>OK Normal conditions: At least (+) 12 VDC ((+) 12-VDC system) At least (+) 24 VDC ((+) 24-VDC system) During cranking: At least (+) 6.2 VDC ((+) 12-VDC system) At least (+) 12 VDC ((+) 24-VDC system)</p>	2A
	<p>NOT OK Charge or replace the battery Refer to the OEM troubleshooting and repair manual.</p>	4A



STEP 2: Check the engine harness.
STEP 2A: Inspect the fuse connections.

Condition: <ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the 7.5-amp fuses and 10 amp-fuse from the engine harness. 		
Action	Specifications/Repair	Next Step
Check if the three 7.5-amp fuses and the 10-amp fuse are installed correctly.	OK Fuses installed correctly	2B
	NOT OK Install fuses correctly Install fuses correctly. Refer to Procedure 019-198.	4A
		
19800243		

STEP 2B: Check the fuse.

Condition: <ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the 7.5-amp fuses and 10-amp fuse from the engine harness. 		
Action	Specifications/Repair	Next Step
Check if the three 7.5-amp fuses and the 10-amp fuse are blown.	OK Fuses not blown	2C
	NOT OK Replace the fuses Refer to Procedure 019-198.	4A
		
19800238		

STEP 2C: Inspect the 23-pin power connector.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the battery at the 23-pin Deutsch connector.

Action	Specifications/Repair	Next Step
Inspect the 23-pin connectors on both the battery side and the harness side for: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	OK No damaged pins or loose connections	2D
	NOT OK Repair or replace the 23-pin connector Refer to Procedure 019-223.	4A

STEP 2D: Check for an open circuit in the unswitched battery supply circuit.

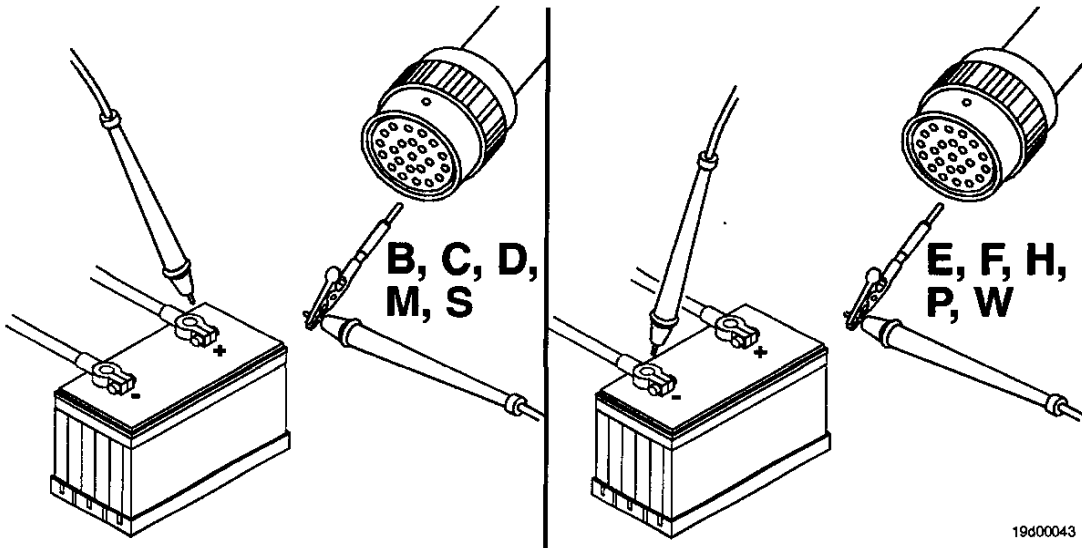
⚠CAUTION⚠

To avoid pin and harness damage, use the following test leads when taking a measurement:
 Part No. 3822758 - male AMP/Cannon Metri-Pack/Deutsch test lead
 Part No. 3822917 - female AMP/Cannon Metri-Pack/Deutsch test lead

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the battery supply at the 23-pin Deutsch connector.

Action	Specifications/Repair	Next Step
Check for an open circuit in the battery supply and return circuits. <ul style="list-style-type: none"> • Measure the resistance from pins B, C, D, M, and S to the positive (+) terminal of the battery. • Measure the resistance from pins E, F, H, P, and W to the negative (-) battery terminal. 	OK Less than 10 ohms	2E
	NOT OK Repair or replace the harness Refer to the OEM troubleshooting and repair manual.	4A



19d00043

STEP 2E: Check the add-on or accessory wiring at the positive (+) terminal of the battery.

Condition:		
<ul style="list-style-type: none"> • Turn keyswitch to the OFF position. 		
Action	Specifications/Repair	Next Step
Check the add-on or accessory wiring at the positive (+) terminal of the battery. <ul style="list-style-type: none"> • 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 supply wire to be shorted to the engine block ground. 	OK No damaged wires	3A
	NOT OK Repair the damaged wiring Refer to the OEM troubleshooting and repair manual.	4A

STEP 3: Check the engine harness.

STEP 3A: Check for short circuit from pin to pin.

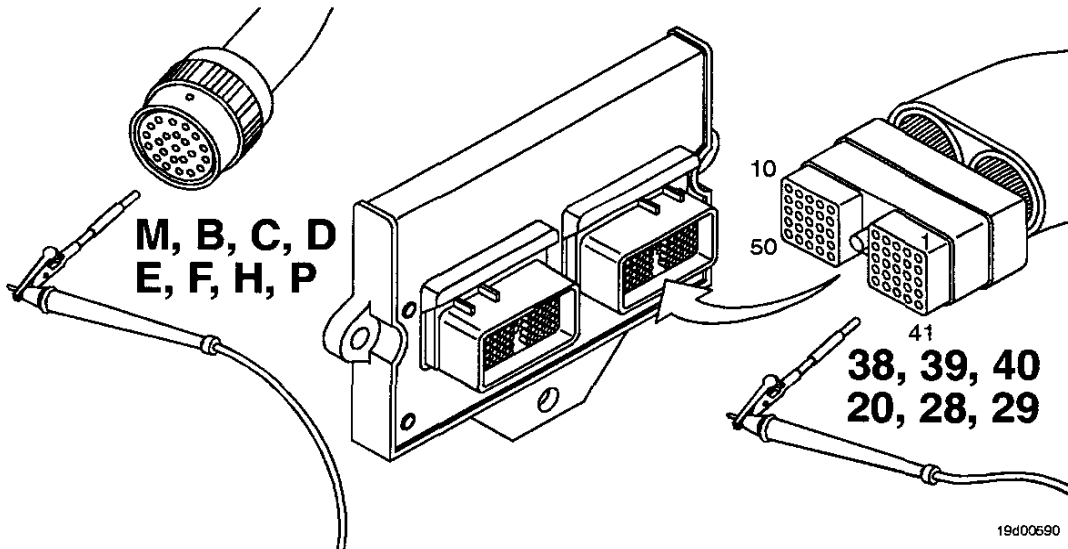
⚠ CAUTION ⚠		
To avoid pin and harness damage, use the following test leads when taking a measurement: Part No. 3822758 - male AMP/Cannon/Metri-Pack/Deutsch test lead Part No. 3822917 - female AMP/Cannon/Metri-Pack/Deutsch test lead		
Condition:		
<ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the engine harness from the ECM. • Disconnect the engine harness from the 23-pin Deutsch connector. 		
Action	Specifications/Repair	Next Step
Check for a short circuit. <ul style="list-style-type: none"> • Measure the resistance from pin 38 to all other pins in the engine harness. • Measure the resistance from pin 39 to all other pins in the engine harness. • Measure the resistance from pin 40 to all other pins in the engine harness. • Measure the resistance from pin 20 to all other pins in the engine harness. • Measure the resistance from pin 28 to all other pins in the engine harness. • Measure the resistance from pin 29 to all other pins in the engine harness. 	OK More than 100k ohms	3B
	NOT OK Replace the engine harness Refer to Procedure 019-043.	4A

STEP 3B: Check for an open circuit.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect engine harness from the ECM.
- Disconnect engine harness from the 23-pin Deutsch connector.

Action	Specifications/Repair	Next Step
<p>Check for an open circuit.</p> <ul style="list-style-type: none"> • Measure the resistance, on the engine harness side, from pin 38 of the ECM connector to pin D of the 23-pin connector. • Measure the resistance, on the engine harness side, from pin 39 of the ECM connector to pin B of the 23-pin connector. • Measure the resistance, on the engine harness side, from pin 40 of the ECM connector to pin C of the 23-pin connector. 	<p>OK Less than 10 ohms</p>	<p>3C</p>
<ul style="list-style-type: none"> • Measure the resistance, on the engine harness side, from pin 20 of the ECM connector to pin E of the 23-pin connector. • Measure the resistance, on the engine harness side, from pin 28 of the ECM connector to pin F of the 23-pin connector. • Measure the resistance, on the engine harness side, from pin 29 of the ECM connector to pin H of the 23-pin connector. 	<p>NOT OK Replace the engine harness Refer to Procedure 019-043.</p>	<p>4A</p>

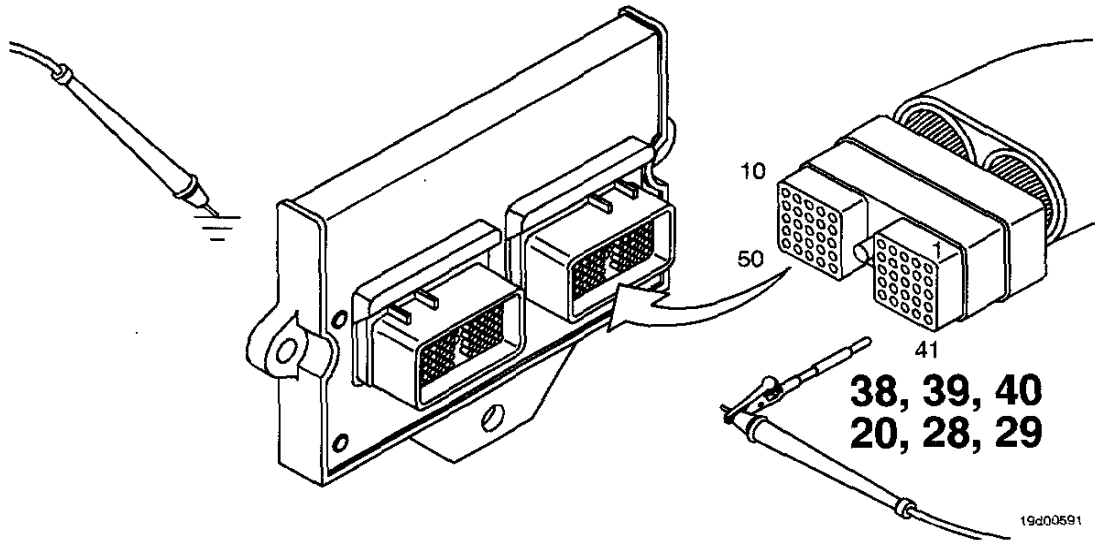


STEP 3C: Check for a short circuit to ground.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect engine harness from the ECM.
- Disconnect engine harness from the 23-pin Deutsch connector.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground. <ul style="list-style-type: none"> • Measure the resistance from pin 38 of the ECM connector on the engine harness to chassis ground. • Measure the resistance from pin 39 of the ECM connector on the engine harness to chassis ground. • Measure the resistance from pin 40 of the ECM connector on the engine harness to chassis ground. 	OK More than 100k ohms	4A
<ul style="list-style-type: none"> • Measure the resistance from pin 20 of the ECM connector on the engine harness to chassis ground. • Measure the resistance from pin 28 of the ECM connector on the engine harness to chassis ground. • Measure the resistance from pin 29 of the ECM connector on the engine harness to chassis ground. 	NOT OK Replace the engine harness Refer to Procedure 019-043.	4A



STEP 4: Clear the fault code.
STEP 4A: Disable the fault Code.

Condition:		
<ul style="list-style-type: none"> • Connect all components. • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> • Start the engine, and let idle for 1 minute. • Verify that Fault Code 441 is inactive. 	OK Fault Code 441 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.

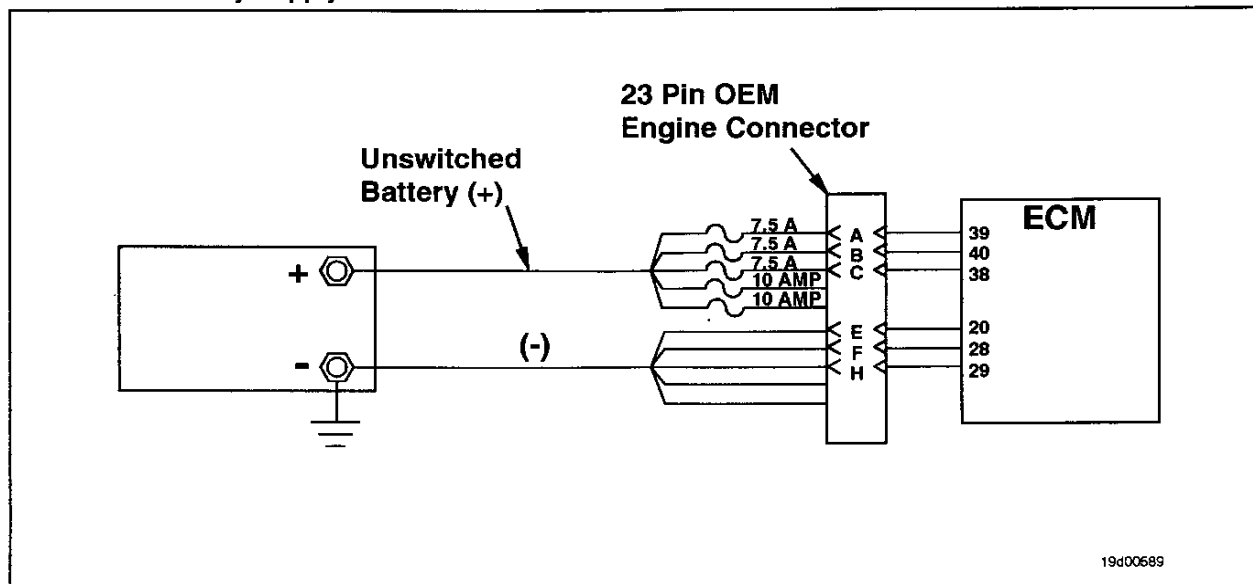
Condition:		
<ul style="list-style-type: none"> • Connect all the components. • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Clear the inactive Fault codes. <ul style="list-style-type: none"> • Erase the inactive fault code using INSITE™. 	OK All faults cleared	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting chart

Fault Code 442

Unswitched Battery Supply Circuit

CODES	REASON	EFFECT
Fault Code: 442 PID(P), SID(S): P168 SPN: 168 FMI: 0 Lamp: Yellow	Voltage detected at electronic control module (ECM) power supply pins 38, 39, and 40 of the engine harness indicates ECM supply voltage is above the maximum system voltage level.	None on performance.

Unswitched Battery Supply Circuit



Circuit Description:

The ECM receives unswitched battery input through the engine harness. There are two in-line 10-amp fuses and three 7.5-amp fuses in the unswitched battery wire 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 engine harness. This direct link provides a constant power supply for the ECM. The location of the battery will vary with the original equipment manufacturer (OEM). Refer to the OEM manual for battery location.

Shop Talk:

Disconnect all aftermarket devices from the battery supply circuit. Make sure the proper size fuses are being used (10-amp fuse or 7.5-amp fuse).

TROUBLESHOOTING SUMMARY



To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack/Deutsch test lead
Part No. 3823995 - male Weather-Pack test lead..

STEPS

SPECIFICATIONS

SRT CODE

STEP 1: Check the equipment battery system.

STEP 1A: Check the battery voltage.

Less than (+) 32 VDC

STEP 1B: Check the battery ground.

Less than 10 ohms

STEP 1C: 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 faults cleared

TROUBLESHOOTING STEP

STEP 1: Check the equipment battery system.

STEP 1A: Check the battery voltage.

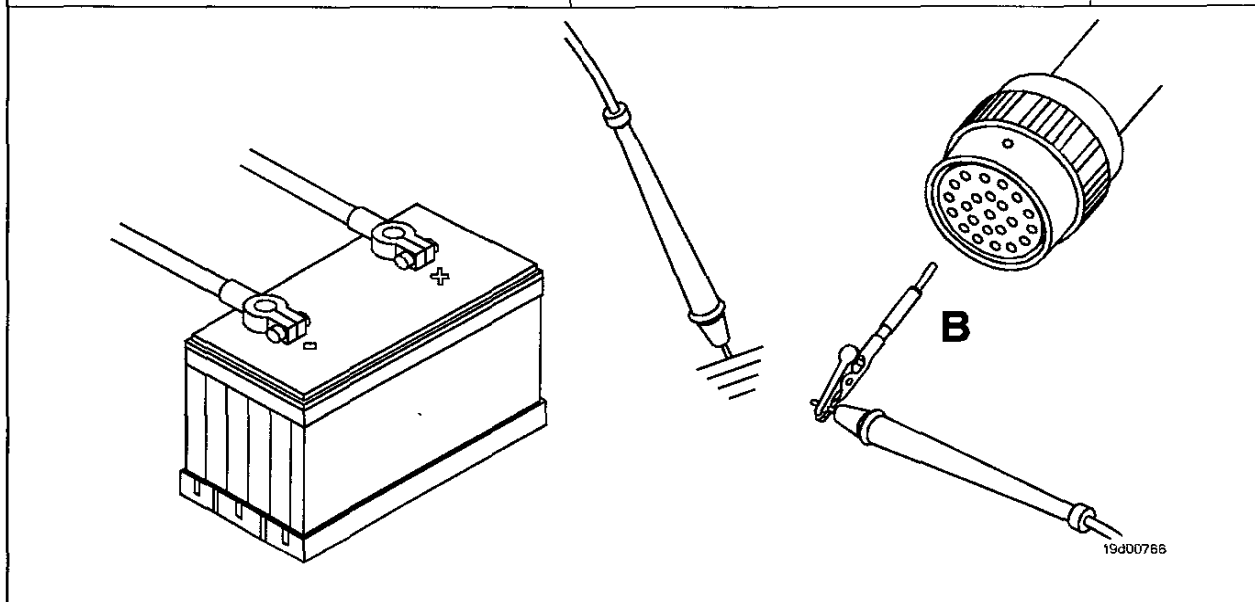
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male AMP/Metri-Pack/Deutsch test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect all aftermarket devices from the battery supply circuit.
- Disconnect the engine harness from the battery at the positive (+) 23-pin Deutsch connector.

Action	Specifications/Repair	Next Step
Check the battery voltage. • Measure the battery voltage from pin B of the 23-pin OEM connector to engine block ground.	OK Less than (+) 32 VDC	1B
	NOT OK Install the battery system correctly Refer to the OEM troubleshooting and repair manual.	2A



STEP 1B: Check the battery ground.

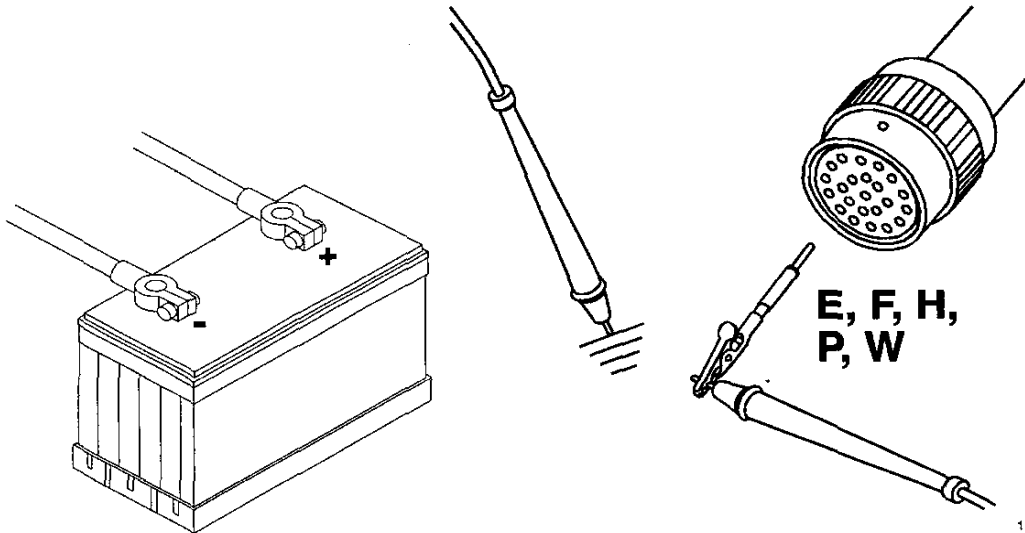


To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3823995 - male Weather-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect all aftermarket devices from the battery supply circuit.
- Disconnect the engine harness from the battery at 23-pin Deutsch connector.

Action	Specifications/Repair	Next Step
<p>Check the battery ground.</p> <ul style="list-style-type: none"> • Measure the resistance from pin E of the 23-pin OEM connector to ground. • Measure the resistance from pin F of the 23-pin OEM connector to ground. • Measure the resistance from pin H of the 23-pin OEM connector to ground. • Measure the resistance from pin P of the 23-pin OEM connector to ground. • Measure the resistance from pin W of the 23-pin OEM connector to ground. 	<p>OK Less than 10 ohms</p>	<p>1C</p>
	<p>NOT OK Replace the OEM harness Refer to Procedure 019-072.</p>	<p>2A</p>



19d00045

STEP 1C: Check the alternator.

Condition:		
<ul style="list-style-type: none"> • Turn keyswitch to the OFF position. 		
Action	Specifications/Repair	Next Step
Inspect the alternator for normal operation.	OK Alternator functioning normally	2A
	NOT OK Repair or replace the alternator Refer to the OEM troubleshooting and repair manual.	2A

STEP 2: Clear the fault code.

STEP 2A: Disable the fault code.

Condition:		
<ul style="list-style-type: none"> • Connect all components. • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> • Start the engine, and let idle for 1 minute. • 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.

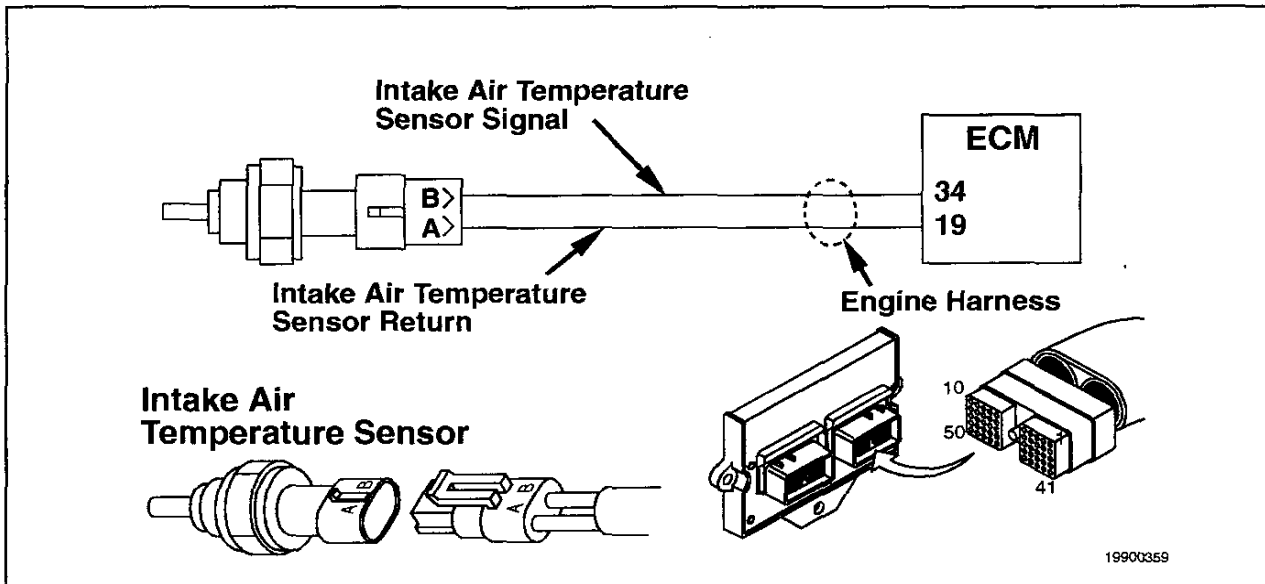
Condition:		
<ul style="list-style-type: none"> • Connect all the components. • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> • Erase the inactive fault code using INSITE™. 	OK All faults cleared	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting chart

Fault Code 488

Intake Manifold Air Temperature Sensor - Engine Protection Circuit

CODES	REASON	EFFECT
Fault Code: 488 PID(P), SID(S): P105 SPN: 105 FMI: 0 Lamp: Yellow	Intake manifold air temperature signal indicates the intake manifold air temperature is approaching the engine protection limit.	Power derate.

Intake Manifold Air Temperature Sensor Circuit



Circuit Description:

The intake manifold air temperature sensor is used by the electronic control module (ECM) to monitor the temperature of the engine intake air. The intake air temperature is used by the ECM for the engine protection system, and the timing and fueling control.

Component Location:

The intake manifold temperature sensor is located on the side of the intake manifold, toward the rear of the cylinder head, near cylinder No. 6.

Shop Talk:

This is a warning fault code. If the intake manifold air temperature continues to rise, Fault Code 155 will become active and shut down the engine.

Possible causes:

- clogged, dirty, inadequate capacity air cleaner element; faulty fan clutch.
- intake restriction. Refer to Procedure 010-031 in the Troubleshooting and Repair Manual, ISB Engines, Bulletin No. 3666193.

TROUBLESHOOTING SUMMARY

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the sensor accuracy.		
STEP 1A: Verify the sensor accuracy with a thermocouple or similar temperature probe.	Sensor reading correct	
STEP 2: Clear the fault code.		
STEP 2A: Disable the fault code.	Fault Code 488 inactive	
STEP 2B: Clear the inactive fault codes.	All faults cleared	

TROUBLESHOOTING STEP

STEP 1: Check the sensor accuracy.
STEP 1A: Verify the sensor accuracy with a thermocouple or similar temperature probe.

Condition:		
• Turn keyswitch to the ON position.		
Action	Specifications/Repair	Next Step
Verify the sensor accuracy with a thermocouple or similar temperature probe. • Connect the temperature probe to the engine near the intake manifold air temperature sensor. • Connect INSITE™ to the datalink. • Run the engine, and compare the intake manifold temperature sensor reading on INSITE™ monitor screen to the reading from the temperature probe. NOTE: If a temperature measuring device is not available, answer "OK" to this step. NOTE: Readings will, perhaps, need to be checked while engine is operating at normal temperature conditions (180°F coolant).	OK Sensor reading correct within 5°F Locate and repair the cause of high intake manifold air temperature. (Refer to the Shop Talk section of this fault code for the correct procedure.)	2A
	NOT OK Sensor not reading within 5°F	Fault Code 154

STEP 2: Clear the fault code.
STEP 2A: Disable the fault code.

Condition: <ul style="list-style-type: none"> • Connect all the components. • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> • Start the engine, and let idle for 1 minute. • Load and operate engine to typical operating temperature (180°F coolant). • Using INSITE™, verify Fault Code 488 is inactive and did not reoccur. 	OK Fault Code 488 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.

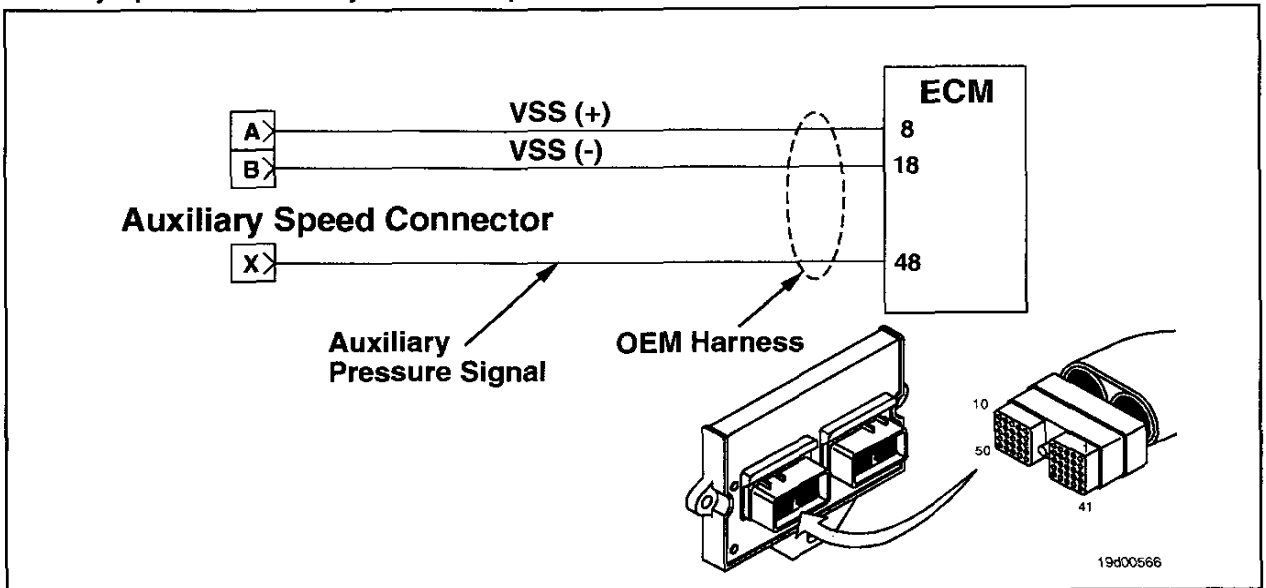
Condition: <ul style="list-style-type: none"> • Connect all the components. • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> • Erase the inactive fault code using INSITE™. 	OK All faults cleared	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting chart

Fault Code 489

Auxiliary Speed or Auxiliary Pressure Input Error

CODES	REASON	EFFECT
Fault Code: 489 PID(P), SID(S): P191 SPN: 191 FMI: 0 Lamp: Yellow	The auxiliary speed or auxiliary pressure indicates the frequency is below a calibrated threshold value.	Engine will go to idle and lose ability to control the speed of the auxiliary device.

Auxiliary Speed and Auxiliary Pressure Input Circuit



Circuit Description:

The auxiliary speed input is a frequency signal from an auxiliary speed or pressure pickup. It is sent to the electronic control module (ECM) and is used to control the engine speed. Auxiliary reference speed is based on the throttle position.

Component Location:

The auxiliary speed or pressure pickup device location is dependent on the original equipment manufacturer's (OEM) application. Refer to OEM manual for component location.

Shop Talk:

The auxiliary speed governor controls engine speed based on a measured auxiliary speed or pressure. The auxiliary speed governor feature **must** be enabled in the calibration and set properly for speed or pressure, depending on the OEM application.

TROUBLESHOOTING SUMMARY



To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3823996 - female Weather-Pack test lead.



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 for active faults.		
STEP 1A: Read fault codes.	No other faults active	
STEP 2: Check the auxiliary device for proper function.		
STEP 2A: Refer to the OEM troubleshooting and repair manual for troubleshooting auxiliary device overspeed.	Auxiliary device functioning properly	
STEP 3: Check the auxiliary speed sensor.		
STEP 3A: Inspect the OEM harness and the sensor connectors.	No damaged pins	
STEP 3B: Check for proper adjustment (if adjustable).	1/2 to 3/4 turn out from gear for threaded type of sensor	
STEP 3C: Check for the correct sensor resistance.	750 to 1500 ohms	
STEP 3D: Check for a short circuit to ground.	More than 100k ohms	
STEP 3E: Check for a short circuit between coils (if two coils exist).	More than 100k ohms	
STEP 4: Check the auxiliary pressure sensor.		
STEP 4A: Inspect pins.	No bent pins	
STEP 4B: Measure voltage to the ECM.	(+) 0.5 to 4.5 VDC	
STEP 5: Check the OEM harness.		
STEP 5A: Inspect the OEM harness and the ECM connectors.	No damaged pins	
STEP 5B: Check for an open circuit.	Less than 10 ohms	
STEP 5C: Check for a short circuit to ground.	More than 100k ohms	
STEP 5D: Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 6: Clear the fault codes.		
STEP 6A: Disable the fault code.	Fault code 147 inactive	
STEP 6B: Clear the inactive fault codes.	All faults cleared	

TROUBLESHOOTING STEP

STEP 1: Check for fault codes.

STEP 1A: Read fault codes.

Condition:		
<ul style="list-style-type: none"> • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Read the fault codes. <ul style="list-style-type: none"> • Read the fault codes using INSITE™. 	OK No other active fault codes	2A
	NOT OK Troubleshoot other fault codes first.	Appropriate fault tree

STEP 2: Check the auxiliary device for proper function.

STEP 2A: Refer to the OEM troubleshooting and repair manual for troubleshooting auxiliary device overspeed.

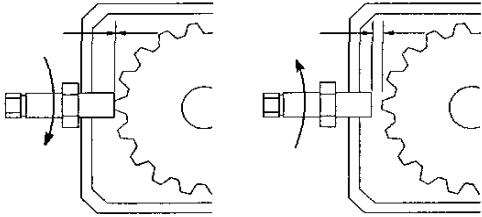
Condition:		
Action	Specifications/Repair	Next Step
Refer to the OEM troubleshooting and repair manual. <ul style="list-style-type: none"> • Refer to the OEM troubleshooting and repair manual for proper function of the auxiliary device. • Check for slipping clutches or broken drive-line components. • Measure OEM pressure to verify proper OEM equipment function. 	OK Auxiliary device functioning properly	3A for auxiliary speed applications; 4A for auxiliary pressure applications
	NOT OK Repair the auxiliary device Refer to the OEM troubleshooting and repair manual.	6A

STEP 3: Check the auxiliary speed sensor.

STEP 3A: Inspect the OEM harness and the sensor connectors.

Condition:		
<ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the OEM harness from the auxiliary speed sensor. 		
Action	Specifications/Repair	Next Step
Inspect the OEM harness and the sensor connectors for the following: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	OK No damaged pins	3B
	NOT OK Repair the damaged pins Repair or replace the OEM harness or sensor, whichever has the damaged pins. <ul style="list-style-type: none"> • Repair the OEM harness. Refer to Procedure 019-202. • Replace the OEM harness. Refer to Procedure 019-071. • Replace the auxiliary speed sensor. Refer to the OEM troubleshooting and repair manual. 	6A

STEP 3B: Check the auxiliary speed sensor for the proper adjustment (if adjustable).

Condition:		
<ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the OEM harness from the auxiliary speed sensor. 		
Action	Specifications/Repair	Next Step
Check the auxiliary speed sensor for the proper adjustment (if adjustable).	OK 1/2 to 3/4 of a turn out from the gear	3C
	NOT OK Adjust the auxiliary speed sensor Refer to the OEM troubleshooting and repair manual.	6A
		
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STEP 3C: Check for the correct sensor resistance.

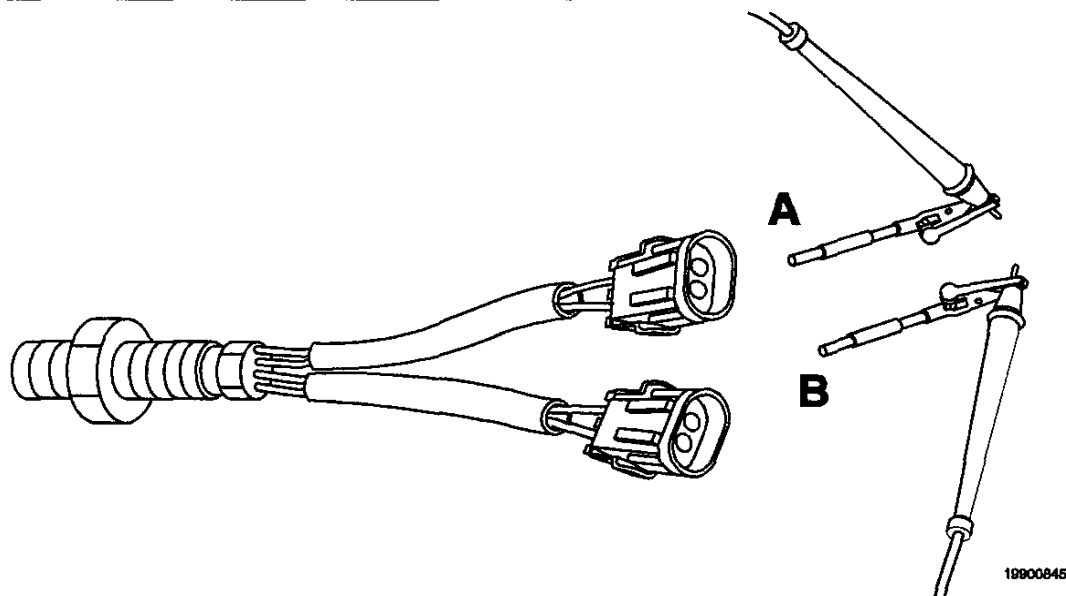
⚠ CAUTION ⚠

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 to the OFF position.
- Disconnect the OEM harness from the auxiliary speed sensor.

Action	Specifications/Repair	Next Step
Check the auxiliary speed sensor for the correct resistance.	OK 750 to 1500 ohms	3D
<ul style="list-style-type: none"> • Measure the resistance from pin A to pin B for each auxiliary speed sensor connector on the sensor side. 	NOT OK Replace the auxiliary speed sensor Refer to the OEM troubleshooting and repair manual.	6A



STEP 3D: Check for a short circuit to ground.

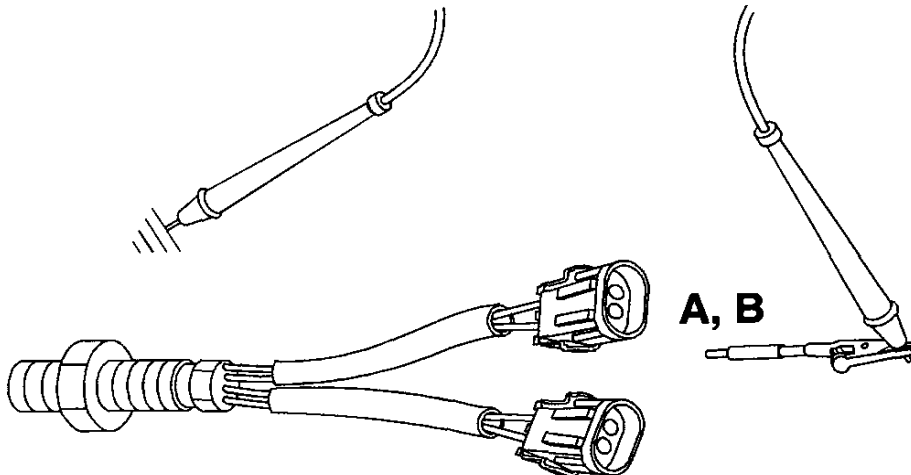
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3823996 - female Weather-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the auxiliary speed sensor.

Action	Specifications/Repair	Next Step
Check the auxiliary speed sensor for a short circuit to ground. <ul style="list-style-type: none">• Measure the resistance from pin A on the sensor side of the auxiliary speed sensor connector to engine block ground.• Measure the resistance from pin B on the sensor side of the auxiliary speed sensor connector to engine block ground.	OK More than 100k ohms	3E
	NOT OK Replace the auxiliary speed sensor Refer to the OEM troubleshooting and repair manual.	6A



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STEP 3E: Check for a short circuit between coils (if two coils exist).

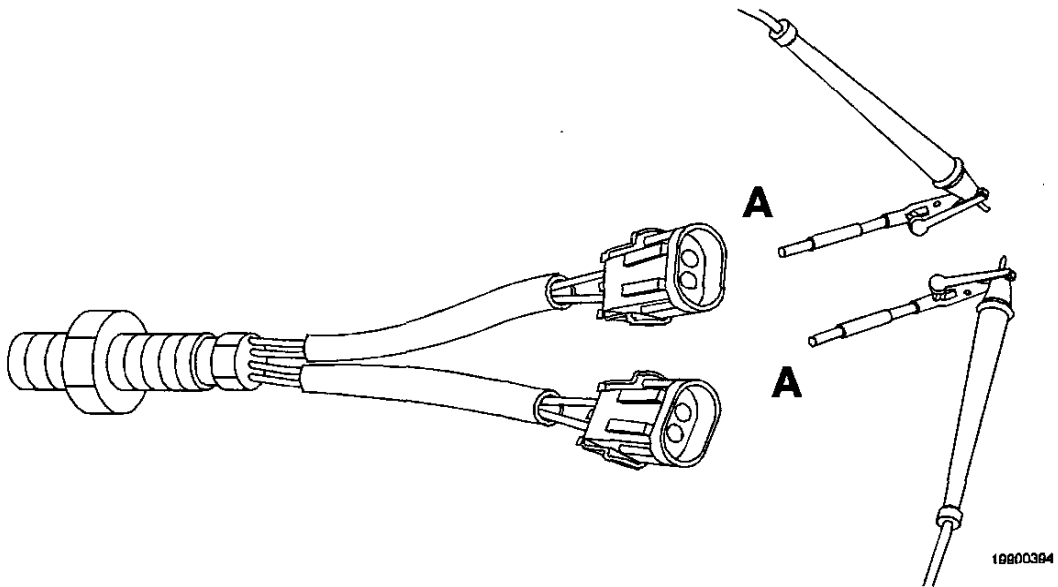
⚠ CAUTION ⚠

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 to the OFF position.
- Disconnect the OEM harness from the auxiliary speed sensor.

Action	Specifications/Repair	Next Step
Check the auxiliary speed sensor for a short circuit between coils. • Measure the resistance from pin A on the sensor side of one of the auxiliary speed sensor connectors to pin A of the other connector.	OK More than 100k ohms	5A
	NOT OK Replace the auxiliary speed sensor Refer to the OEM troubleshooting and repair manual.	6A



STEP 4: Check the auxiliary pressure sensor.

STEP 4A: Inspect pins.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the auxiliary pressure sensor.

Action	Specifications/Repair	Next Step
Inspect the sensor and OEM harness connectors for the following: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	OK No bent pins	4B
	NOT OK	6A

STEP 4B: Measure voltage to ECM.

Condition: <ul style="list-style-type: none"> • Turn keyswitch to the ON position. • Disconnect the OEM connector from the ECM. 		
Action	Specifications/Repair	Next Step
Measure voltage. <ul style="list-style-type: none"> • Measure pin 48 to engine block ground. 	OK (+) 0.5 to 4.5 VDC	5A
	NOT OK Replace pressure sensor Refer to OEM troubleshooting and repair manual.	6A

STEP 5: Check the OEM harness.

STEP 5A: Inspect the OEM harness and the ECM connectors.

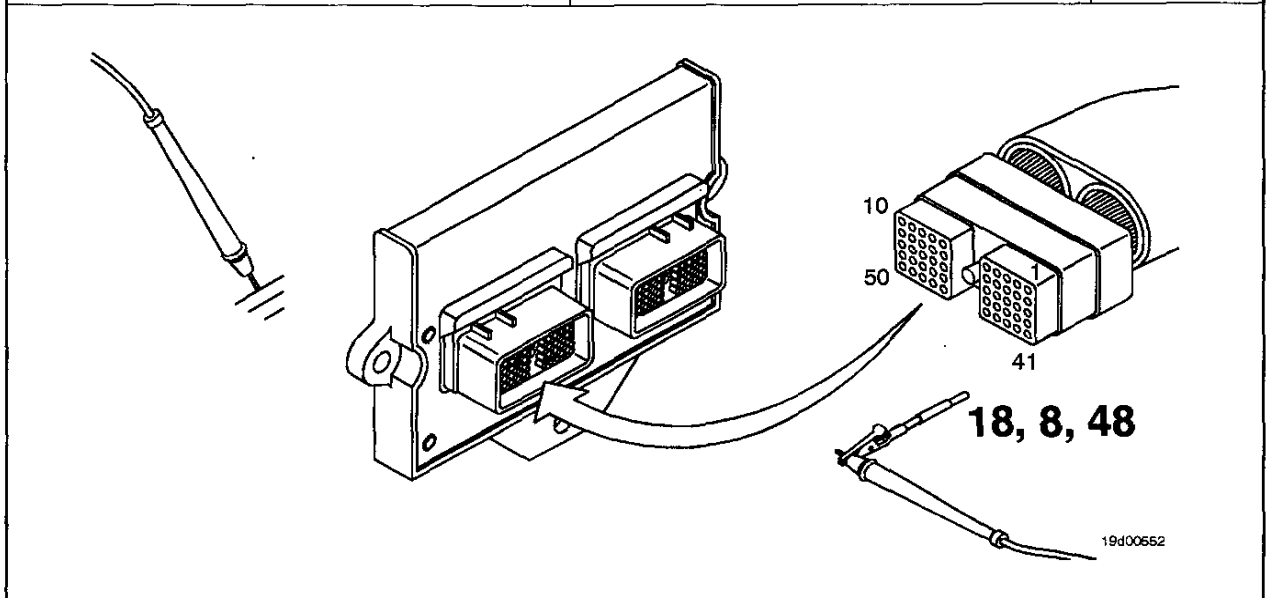
⚠ CAUTION ⚠		
To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.		
Condition: <ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the OEM harness from the ECM harness. 		
Action	Specifications/Repair	Next Step
Inspect the OEM harness and the ECM connectors for the following: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Dirt or debris in or on the connector pins. 	OK No damaged pins	5B
	NOT OK Repair damaged pins Repair or replace the OEM harness or OEM interface harness, whichever has the damaged pins. <ul style="list-style-type: none"> • Repair the OEM harness. Refer to Procedure 019-221. • Replace the OEM harness. Refer to Procedure 019-071. • Dry the connector by using an electrical contact cleaner, Part No. 3824510. • Flush the dirt, debris, or moisture from the connector pins using electronic contact cleaner. 	6A

STEP 5B: Check for an open circuit.

<p>Condition:</p> <ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the OEM harness from the ECM. • Disconnect the OEM harness from the auxiliary speed or pressure sensor. 		
Action	Specifications/Repair	Next Step
<p>Check for an open circuit.</p> <ul style="list-style-type: none"> • Measure the resistance from pin 8 of the OEM harness connector to pin A of the OEM harness, auxiliary speed sensor. • Measure the resistance from pin 18 of the OEM harness connector to pin B of the OEM harness, auxiliary speed sensor. • Measure the resistance from pin 48 of the OEM harness connector to pin X of the OEM harness, auxiliary pressure sensor. 	<p>OK Less than 10 ohms</p>	5C
	<p>NOT OK Replace the OEM harness Refer to Procedure 019-071.</p>	6A

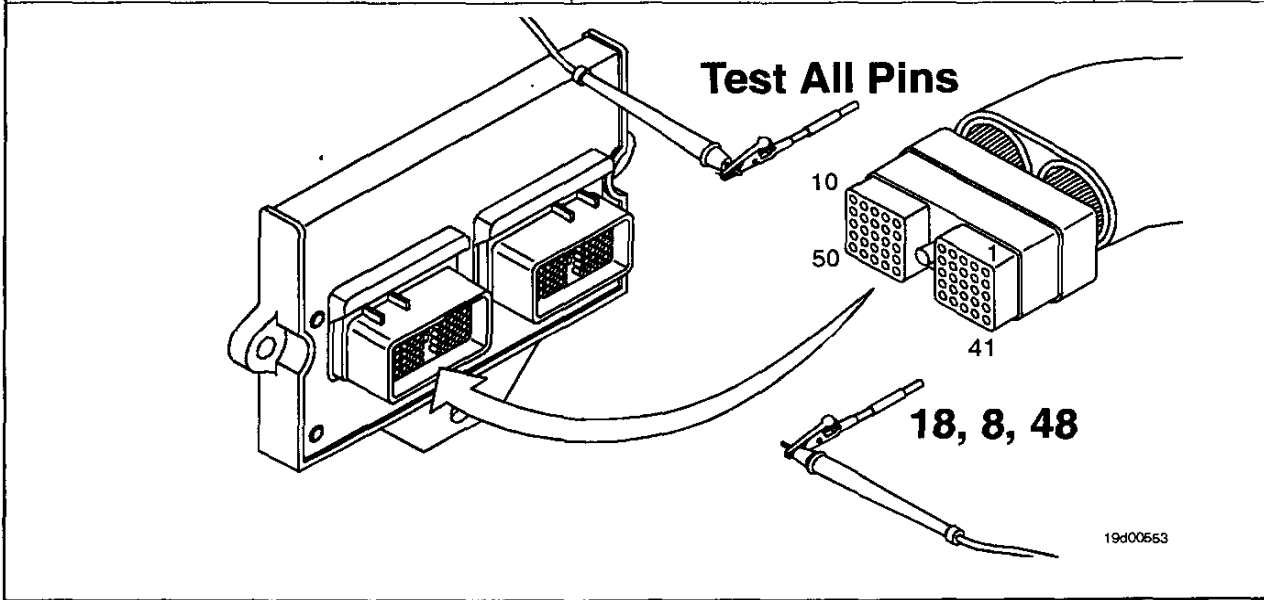
STEP 5C: Check for a short circuit to ground.

<p>Condition:</p> <ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the OEM harness from the ECM. • Disconnect the OEM harness from the auxiliary speed or pressure sensor. 		
Action	Specifications/Repair	Next Step
<p>Check for a short circuit to ground.</p> <ul style="list-style-type: none"> • Measure the resistance from pin 18 of the OEM harness to engine block ground. • Measure the resistance from pin 8 of the OEM harness to engine block ground. • Measure the resistance from pin 48 of the OEM harness to engine block ground. 	<p>OK More than 100k ohms</p>	5D
	<p>NOT OK Replace the OEM harness Refer to Procedure 019-071.</p>	6A



STEP 5D: Check for a short circuit from pin to pin.

Condition: <ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the OEM harness from the ECM. • Disconnect the OEM harness from the auxiliary speed or pressure sensor. 		
Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. <ul style="list-style-type: none"> • Measure the resistance from pin 18 of the OEM harness to all other pins in the connector. • Measure the resistance from pin 8 of the OEM harness to all other pins in the connector. • Measure the resistance from pin 48 of the OEM harness to all other pins in the connector. 	OK More than 100k ohms	6A
	NOT OK Replace the OEM harness Refer to Procedure 019-071.	6A



STEP 6: Clear the fault codes.

STEP 6A: Disable the fault code.

Condition: <ul style="list-style-type: none"> • Connect all components. 		
Action	Specifications/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> • Start engine, and let idle for 1 minute. 	OK Fault Code 489 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 any inactive fault codes.

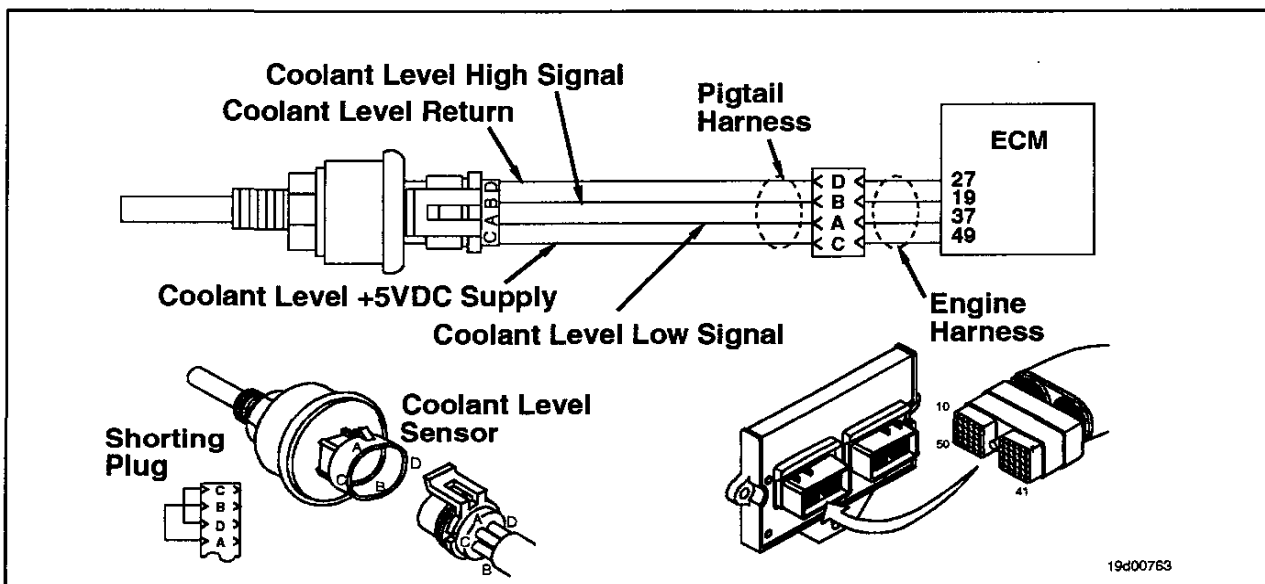
Condition: Connect all components.		
Action	Specifications/Repair	Next Step
Clear any inactive fault codes. • Erase any inactive fault codes using INSITE™.	OK All faults cleared	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting chart

Fault Code 515 or 516

Coolant Level Sensor Circuit

CODES	REASON	EFFECT
Fault Code: 515 or 516 PID(P), SID(S): P091 SPN: 091 FMI: 3 or 4 Lamp: Yellow	FC 515: High voltage detected at the coolant level +5-VDC sensor supply voltage pin 49 of the engine harness. FC 516: Low voltage detected at the coolant level +5-VDC sensor supply voltage pin 49 of the engine harness.	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 engine harness.

Component Location:

The coolant level sensor is located in the radiator top tank or surge tank.

Shop Talk:

- This is an original equipment manufacturer (OEM)-supplied component and will vary in sensor 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 makes a turn.

NOTE: Sterling trucks utilize ECM pin A22 for coolant level sensing through a 2-pin sensor; refer to SPT 98T19-46.

TROUBLESHOOTING SUMMARY

WARNING

Wait until the coolant temperature is below 50°C [120°F] before removing the coolant system pressure cap or the coolant level sensor. Failure to do so can cause personal injury from heated coolant spray.

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.

CAUTION

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

STEPS	SPECIFICATIONS	SRT CODE
<u>STEP 1:</u> Check the coolant level sensor.		
<u>STEP 1A:</u> Inspect the engine harness and coolant level sensor connector pins.	No damaged pins	
<u>STEP 1B:</u> Check for active fault codes.	Fault Code 515 or 516 remains active	
<u>STEP 2:</u> Check the engine harness.		
<u>STEP 2A:</u> Inspect the harness and the ECM connector pins.	No damaged pins	
<u>STEP 2B:</u> Check for a short circuit to ground.	More than 100k ohms	
<u>STEP 2C:</u> Check for a short circuit from pin to pin.	More than 100k ohms	
<u>STEP 2D:</u> Check for a short circuit to a voltage source.	Less than (+) 1.0 VDC	
<u>STEP 3:</u> Check the ECM supply voltage.		
<u>STEP 3A:</u> Measure the sensor supply voltage from the ECM.	(+) 4.5 to 5.25 VDC	
<u>STEP 4:</u> Clear the fault code.		
<u>STEP 4A:</u> Disable the fault code.	Fault Code 515 or 516 inactive	
<u>STEP 4B:</u> Clear the inactive fault codes.	All faults cleared	

TROUBLESHOOTING STEP

STEP 1: Check the coolant level sensor.

STEP 1A: Inspect the engine harness and the coolant level sensor connector pins.



Wait until the coolant temperature is below 50°C [120°F] before removing the coolant system pressure cap or the coolant level sensor. Failure to do so can cause personal injury from heated coolant spray.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the coolant level sensor.

Action	Specifications/Repair	Next Step
Inspect the engine harness and the coolant level sensor connector pins for: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	OK No damaged pins	1B
	NOT OK Repair the damaged pins Repair or replace the engine harness or the coolant level sensor, whichever has damaged pins. <ul style="list-style-type: none"> • Repair the engine harness. Refer to Procedure 019-204. • Replace the engine harness. Refer to Procedure 019-043. • Replace the coolant level sensor. Refer to Procedure 019-017. 	4A

STEP 1B: Check for active fault codes.

Condition:		
<ul style="list-style-type: none"> • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Check for active fault codes. <ul style="list-style-type: none"> • Using INSITE™, read the fault codes. 	OK Fault Code 515 or 516 remains active	2A
	NOT OK Clear fault codes	4A

STEP 2: Check the engine harness.

STEP 2A: Inspect the engine harness and the ECM connector pins.

▲WARNING▲

Wait until the coolant temperature is below 50°C [120°F] before removing the coolant system pressure cap or the coolant level sensor. Failure to do so can cause personal injury from heated coolant spray.

▲CAUTION▲

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the ECM.

Action	Specifications/Repair	Next Step
Inspect the engine harness and the ECM connector pins for: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	OK No damaged pins	2B
	NOT OK Repair the damaged pins Repair or replace the engine harness or the ECM, whichever has the damaged pins. <ul style="list-style-type: none"> • 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 for a short circuit to ground.

⚠ WARNING ⚠

Wait until the coolant temperature is below 50°C [120°F] before removing the coolant system pressure cap or the coolant level sensor. Failure to do so can cause personal injury from heated coolant spray.

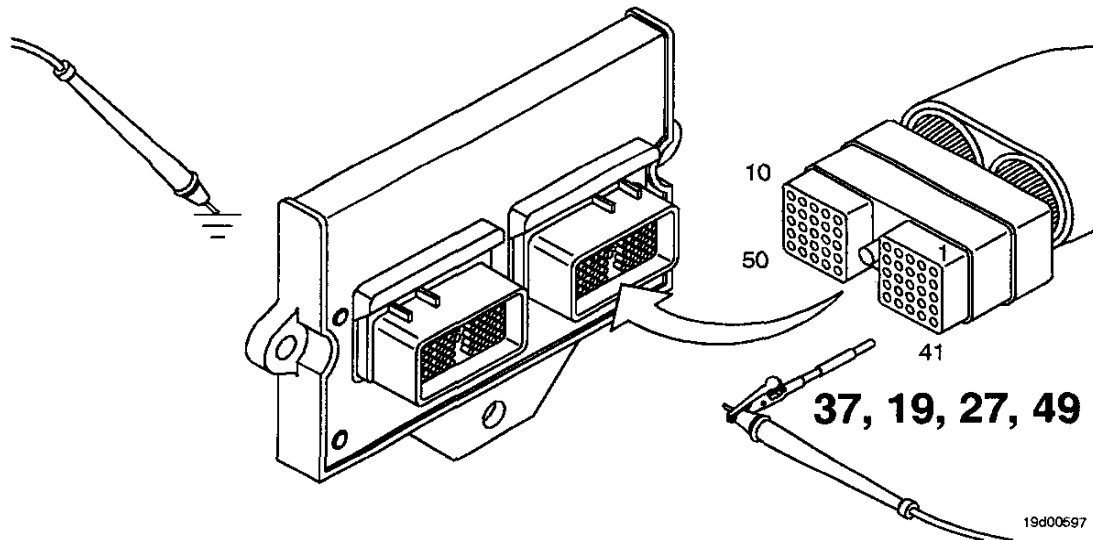
⚠ CAUTION ⚠

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 to the OFF position.
- Disconnect the engine harness from the ECM.
- Disconnect the engine harness from the coolant level sensor.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground. • Measure the resistance from pin 37 of the engine harness connector to engine block ground. • Measure the resistance from pin 19 of the engine harness connector to engine block ground.	OK More than 100k ohms	2C
• Measure the resistance from pin 27 of the engine harness connector to engine block ground. • Measure the resistance from pin 49 of the engine harness connector to engine block ground.	NOT OK Replace the engine harness Refer to Procedure 019-043.	4A



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STEP 2C: Check for a short circuit from pin to pin.

▲WARNING▲

Wait until the coolant temperature is below 50°C [120°F] before removing the coolant system pressure cap or the coolant level sensor. Failure to do so can cause personal injury from heated coolant spray.

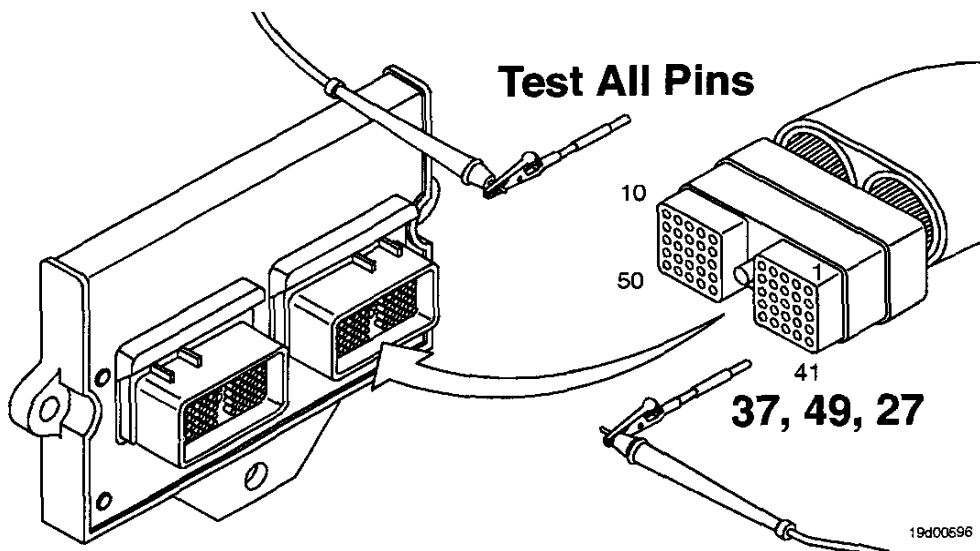
▲CAUTION▲

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 to the OFF position.
- Disconnect the engine harness from the ECM.
- Disconnect the engine harness from the coolant level sensor.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pin 37 of the engine harness connector to all other pins in the connector. • Measure the resistance from pin 49 of the engine harness connector to all other pins in the connector. • Measure the resistance from pin 27 of the engine harness connector to all other pins in the connector.	OK More than 100k ohms	2D
	NOT OK Replace the engine harness Refer to Procedure 019-043.	4A



STEP 2D: Check for a short circuit to a voltage source.

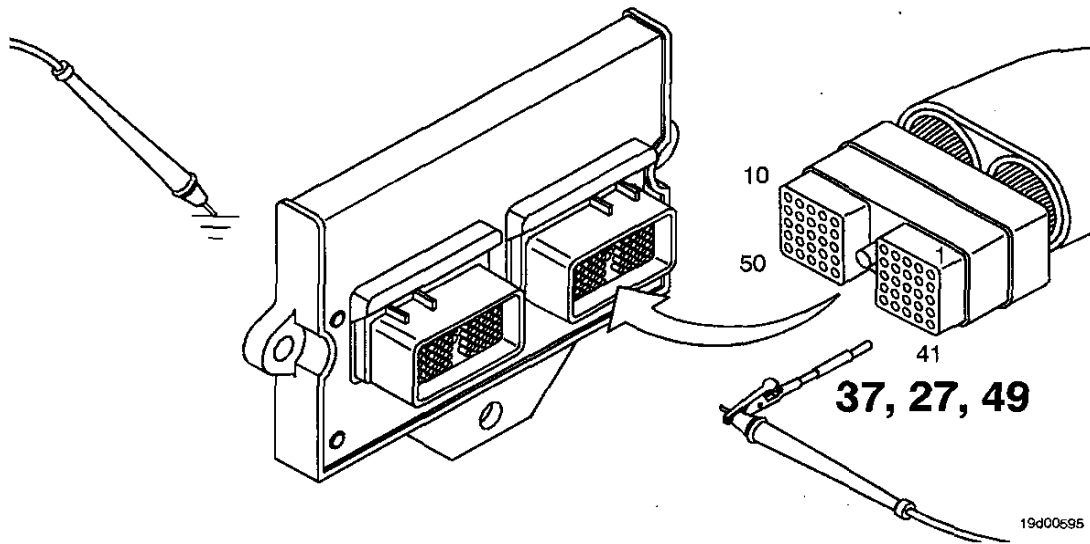
⚠ CAUTION ⚠

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 to the OFF position.
- Disconnect the engine harness from the ECM.
- Disconnect the engine harness from the coolant level sensor.

Action	Specifications/Repair	Next Step
Check for a short circuit to a voltage source. • Measure the voltage from pin 37 of the engine harness connector to engine block ground. • Measure the voltage from pin 27 of the engine harness connector to engine block ground. • Measure the voltage from pin 49 of the engine harness connector to engine block ground.	OK Less than (+) 1.0 VDC	3A
	NOT OK Replace the engine harness Refer to Procedure 019-043.	4A



STEP 3: Check for the ECM voltage.

STEP 3A: Measure the sensor supply voltage from the ECM.

▲WARNING▲		
Wait until the coolant temperature is below 50°C [120°F] before removing the coolant system pressure cap or the coolant level sensor. Failure to do so can cause personal injury from heated coolant spray.		
▲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:		
<ul style="list-style-type: none"> • Disconnect the engine harness from the ECM. • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Measure the sensor supply voltage from the ECM. <ul style="list-style-type: none"> • Measure the voltage from pin 49 of the ECM engine connector to engine block ground. 	OK (+) 4.5 to 5.25 VDC	4A
	NOT OK Replace the ECM Refer to Procedure 019-031.	4A

STEP 4: Clear the fault code.

STEP 4A: Disable the fault code.

Condition:		
<ul style="list-style-type: none"> • Connect all components. • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> • Start the engine, and let idle for 1 minute. • Using INSITE™, verify that Fault Code 515 or 516 is inactive. 	OK Fault Code 515 or 516 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.

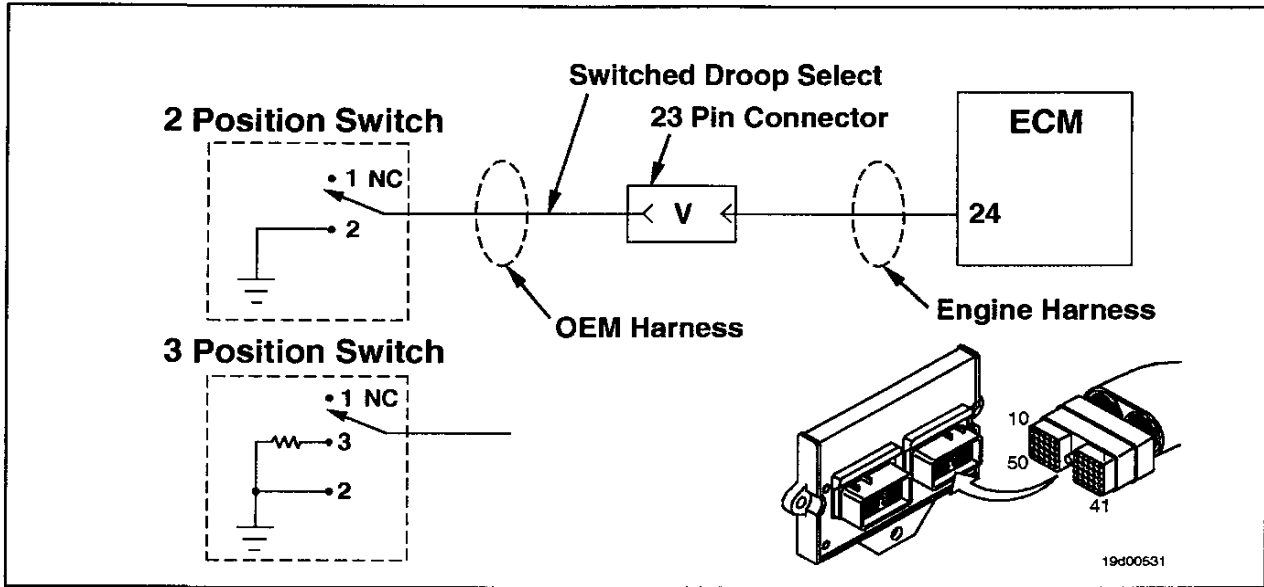
Condition:		
<ul style="list-style-type: none"> • Connect all components. • Turn keyswitch to the ON position. 		
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> • Erase the inactive fault codes using INSITE™. 	OK All faults cleared	Repair complete
	NOT OK Troubleshoot any remaining active fault codes.	Appropriate troubleshooting chart

Fault Code 524

Switched Droop Selection Circuit

CODES	REASON	EFFECT
Fault Code: 524 PID(P), SID(S): P113 FMI: 2 Lamp: Yellow	Error detected on the high-speed governor droop selection switch.	Droop setting defaults to switch position 1 (or normal) preprogrammed droop governor values.

Switched Droop Selection Circuit



Circuit Description:

The switched droop circuit allows the operator to select from up to three preprogrammed droop governor values using a two- or three-position switch, depending on which value the original equipment manufacturer (OEM) has provided.

Component Location:

The location of the droop switch circuit varies with each OEM and equipment model. Refer to the OEM manual.

Shop Talk:

The switch should be monitored for proper operation on INSITE™. If the switch is changing state correctly on the service tool, then the problem does **not** lie in the switch circuit. The three-position switch has three states:

- Position 1 - open
- Position 2 - closed
- Position 3 - 1500-ohm resistance.

The two-position switch has two states:

- Position 1 - open
- Position 2 - closed.

TROUBLESHOOTING SUMMARY



To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.



To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3823254 - male three-way Metri-Pack connector test lead
Part No. 3822758 - male Deutsch/Cannon/Metri-Pack test lead.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the engine harness.		
STEP 1A: Inspect the engine harness and ECM 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 OEM harness.		
STEP 2A: Inspect the OEM and engine harness 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: Check the OEM switch circuit.		
STEP 3A: Inspect the OEM switch.	No damaged pins	
STEP 3B: Check resistance in position 2.	Less than 10 ohms	
STEP 3C: Check resistance in position 3.	Between 1000 and 2000 ohms NOTE: Step 3C can only be performed if the OEM has provided a three-position switch.	
STEP 4: Clear the fault code.		
STEP 4A: Disable the fault code.	Fault Code 524 inactive	
STEP 4B: Clear the inactive fault code.	All faults code cleared	

TROUBLESHOOTING STEP

STEP 1: Check the engine harness.

STEP 1A: 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 to the OFF position.
- Disconnect the engine harness from the ECM.

Action	Specifications/Repair	Next Step
Inspect the engine harness and the ECM connector pins for the following: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing connector seal. 	OK No damaged pins	1B
	NOT OK Repair the damaged pins <ul style="list-style-type: none"> • Repair the engine harness. Refer to Procedure 019-250. • Replace the engine harness. Refer to Procedure 019-072. • Replace the ECM. Refer to Procedure 019-031. • Dry the connector using electrical contact cleaner, Part No. 3824510. 	4A

STEP 1B: Check for an open circuit.

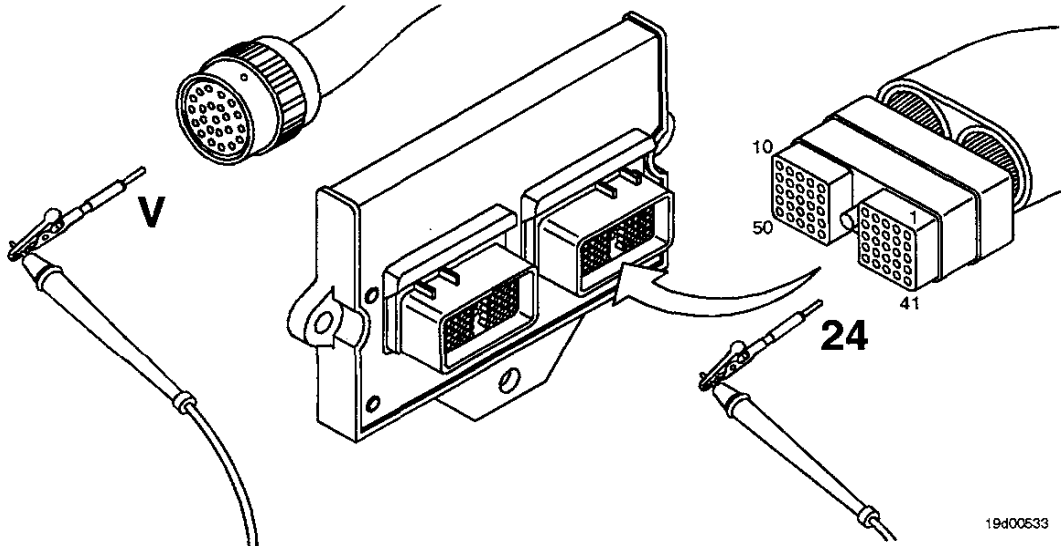
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3823254 - male three-way Metri-Pack connector test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the OEM harness at the 23-pin connector.
- Disconnect the engine harness from the ECM.

Action	Specifications/Repair	Next Step
Check for an open circuit. • Measure the resistance from pin 24 of the engine harness connector to pin V of the OEM 23-pin connector.	OK Less than 10 ohms	1C
	NOT OK Replace the engine harness Refer to Procedure 019-043.	4A



STEP 1C: Check for a short circuit to ground.

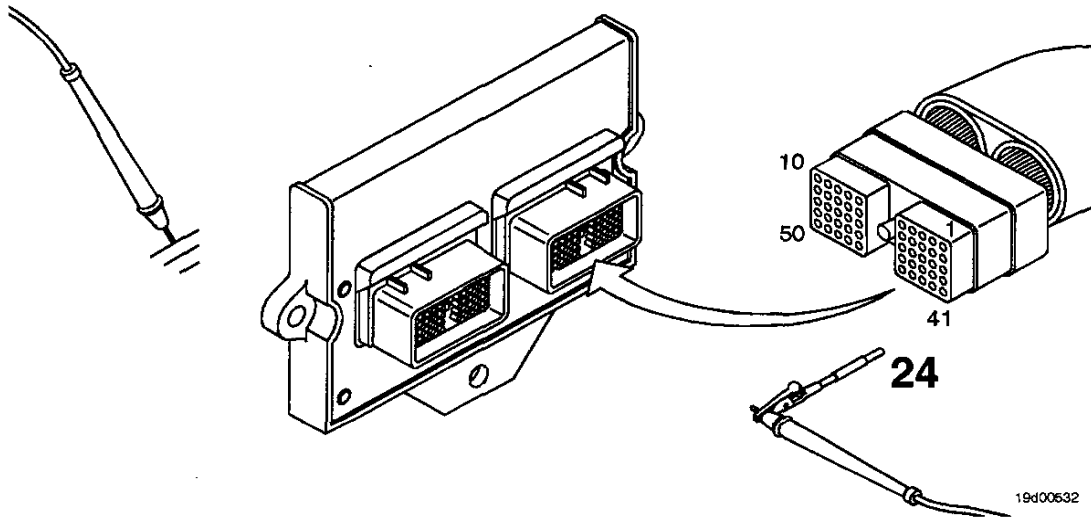
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3823254 - male three-way Metri-Pack connector test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the OEM harness at the 23-pin connector.
- Disconnect the engine harness from the ECM.

Action	Specifications/Repair	Next Step
Check for a short to ground. • Measure the resistance from pin 24 of the engine harness connector to engine block ground.	OK Greater than 100k ohms	1D
	NOT OK Replace the engine harness Refer to Procedure 019-072.	4A



STEP 1D: Check for a short circuit from pin to pin.

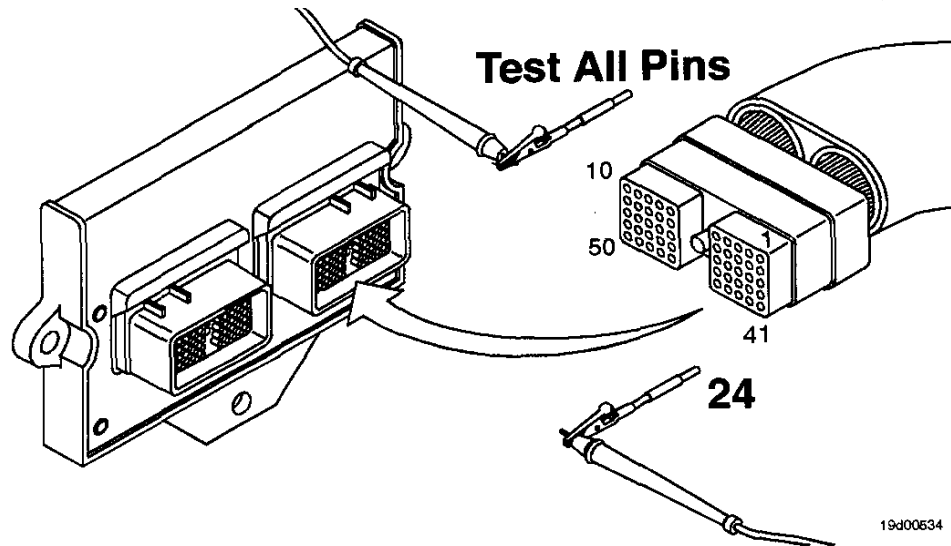
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male Deutsch/Cannon/Metri-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the OEM harness at the 23-pin connector.
- Disconnect the engine harness from the ECM.

Action	Specifications/Repair	Next Step
Check for a short to all other pins in the connector. • Measure resistance from pin 24 of the engine harness ECM connector to all other pins in the connector.	OK Greater than 100k ohms	2A
	NOT OK Replace the engine harness Refer to Procedure 019-043.	4A



STEP 2: Check the OEM harness.

STEP 2A: Inspect the OEM harness and the engine harness connectors.

Condition:		
<ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the OEM harness from the engine harness at the 23-pin connector. 		
Action	Specifications/Repair	Next Step
Inspect the OEM harness and the engine harness connector pins for the following: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector. 	OK No damaged pins	2B
	NOT OK Repair the damaged pins Repair or replace the OEM interface harness or the OEM harness, whichever has the damaged pins. <ul style="list-style-type: none"> • Repair the engine harness. Refer to Procedure 019-223. • Replace the engine harness. Refer to Procedure 019-043. • Repair the OEM harness. Refer to Procedure 019-223. • Replace the OEM harness. Refer to Procedure 019-071. • Dry the connector using electrical contact cleaner, Part No. 3824510. 	4A

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/Cannon/Metri-Pack test lead.		
Condition:		
<ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the OEM harness from the engine harness at the 23-pin connector. • Disconnect the OEM harness from the droop select switch. 		
Action	Specifications/Repair	Next Step
Check for an open circuit. <ul style="list-style-type: none"> • Measure the resistance from pin V of the OEM harness 23-pin connector to the appropriate pin of the droop select switch connector. 	OK Less than 10 ohms	2C
	NOT OK Repair or replace the OEM harness Refer to Procedure 019-071.	4A

STEP 2C: Check for a short circuit to ground.

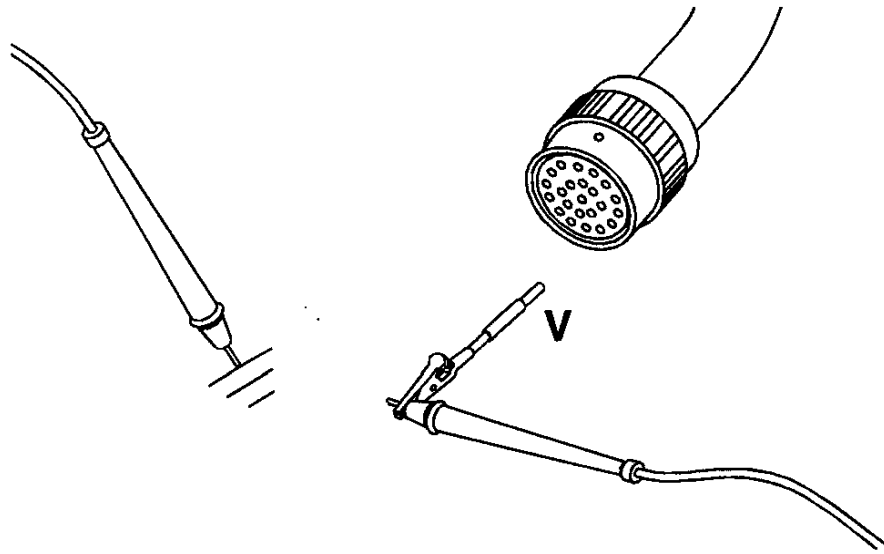
⚠CAUTION⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male Deutsch/Cannon/Metri-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the OEM 23-pin connector.
- Disconnect the OEM harness from the droop select switch.

Action	Specifications/Repair	Next Step
Check for a short to ground. • Measure the resistance from pin V of the OEM harness 23-pin connector to engine block ground.	OK Greater than 100k ohms	2D
	NOT OK Repair or replace the OEM harness Refer to Procedure 019-071.	4A



19d00535

STEP 2D: Check for a short circuit pin to pin.

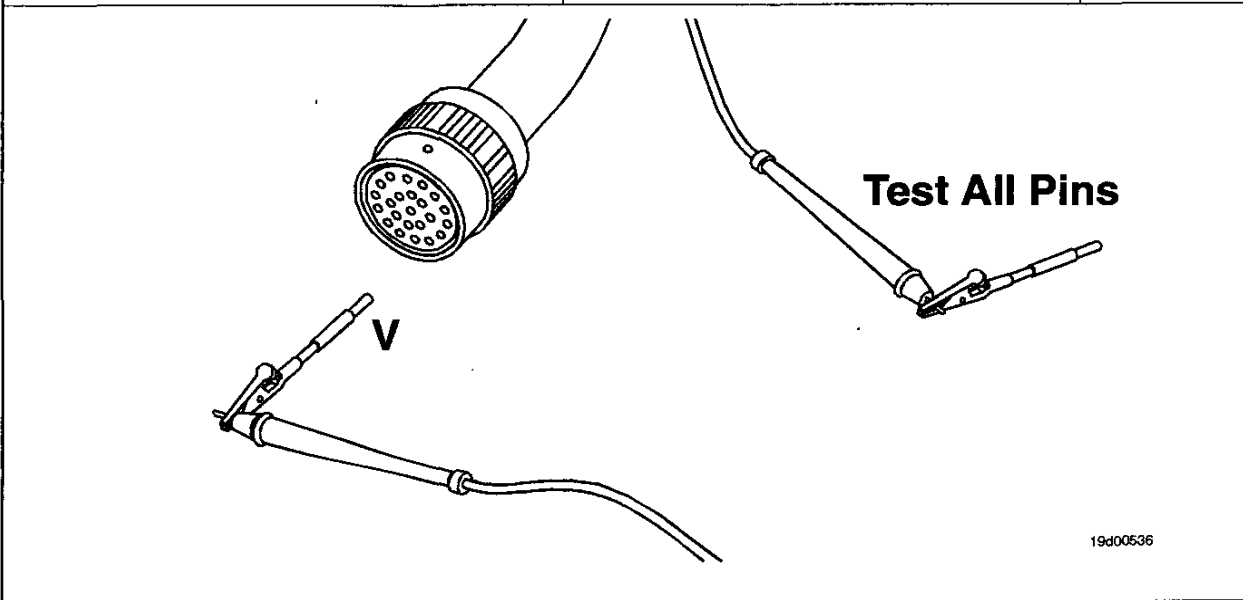
▲ CAUTION ▲

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male Deutsch/Cannon/Metri-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the OEM 23-pin connector.
- Disconnect the OEM harness from the droop select switch.

Action	Specifications/Repair	Next Step
Check for a short from pin to pin. • Measure the resistance from pin V of the OEM harness 23-pin connector to all other pins in the connector.	OK Greater than 100k ohms	3A
	NOT OK Replace the OEM harness Refer to Procedure 019-071.	4A



STEP 3: Check the OEM switch circuit.

STEP 3A: Inspect the OEM switch

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM switch circuit from the OEM.

Action	Specifications/Repair	Next Step
Inspect OEM switch pins for the following: • Bent or broken pins • Pushed back or extended pins • Corroded pins • Moisture in or on switch	OK No damaged pins	3B
	NOT OK Repair the damaged pins Repair or replace the OEM harness or the OEM switches, whichever has the damaged pins. Refer to the OEM troubleshooting and repair manual.	4A

STEP 3B: Check resistance in position 2.

Condition: <ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the OEM harness from the 23-pin OEM harness connector. 		
Action	Specifications/Repair	Next Step
Check resistance in position 2. <ul style="list-style-type: none"> • Position the droop selection switch to the No. 2 position. • Measure the resistance from pin V of the OEM 23-pin connector to the engine block ground. 	OK Less than 10 ohms	3C
	NOT OK Repair or replace the switch or OEM harness Refer to the OEM troubleshooting and repair manual.	4A

STEP 3C: Check resistance in position 3.

Condition: <ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the OEM harness from the 23-pin OEM harness connector. 		
Action	Specifications/Repair	Next Step
Check resistance in position 3. <ul style="list-style-type: none"> • Position the droop selection switch to the No. 3 position. • Measure the resistance from pin V of the OEM 23-pin connector to the engine block ground. <p>NOTE: Step 3C can only be performed if the OEM has provided a three-position switch.</p>	OK Between 1000 and 2000 ohms	4A
	NOT OK Repair or replace the switch or OEM harness Refer to the OEM troubleshooting and repair manual.	4A

STEP 4: Clear the fault codes.

STEP 4A: Disable the fault code.

Condition: <ul style="list-style-type: none"> • Connect all the components. 		
Action	Specifications/Repair	Next Step
Disable fault code. <ul style="list-style-type: none"> • Start the engine, and let idle for 1 minute. • Verify that Fault Code 524 is inactive. 	OK Fault Code 524 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.

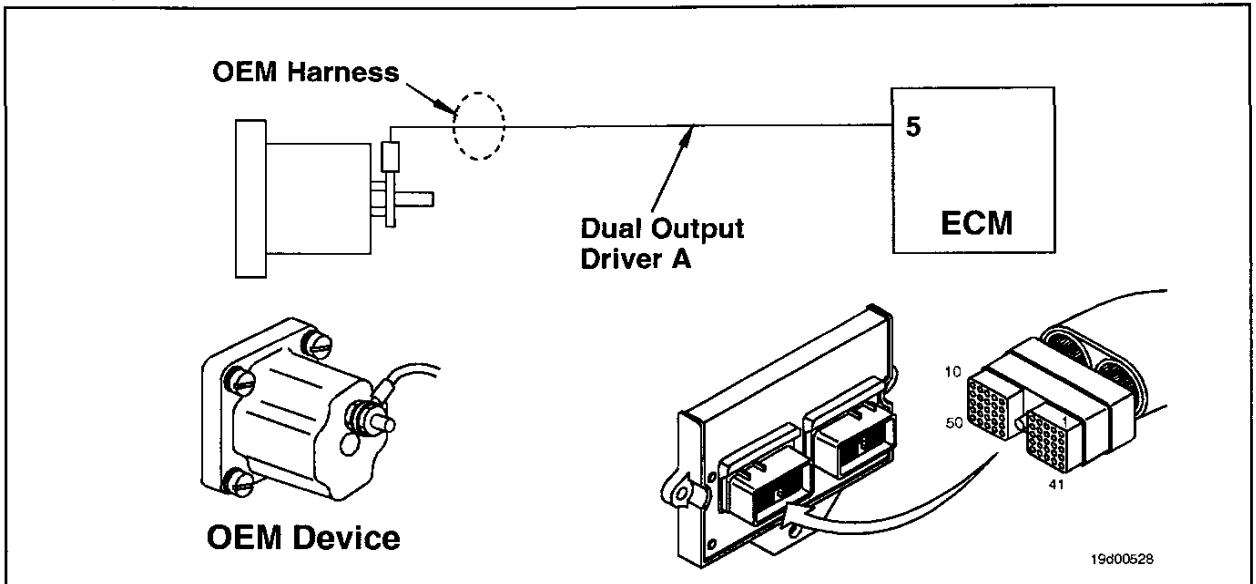
Condition: • Connect all the components.		
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	OK All faults cleared	Repair complete
	NOT OK Refer to the appropriate troubleshooting charts for any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 527

Dual-Output Driver A

CODES	REASON	EFFECT
Fault Code: 527 PID(P), SID(S): P154 SPN: 702 FMI: 3 Lamp: Yellow	A problem was detected with the dual-output driver A circuit.	The device controlled by the driver A output circuit will not function properly.

Dual-Output Driver A



Circuit Description:

The dual-output driver A will control engine and vehicle functions by controlling original equipment manufacturer's (OEM) devices based on up to 12 selected engine parameters and two selected OEM parameters (OEM switch input and OEM pressure input). The solenoid output will control functions like a fan clutch, air cleaner restriction indicator, or an oil filter differential pressure indicator.

Component Location:

The OEM device is dependent upon the OEM.

TROUBLESHOOTING SUMMARY



To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.



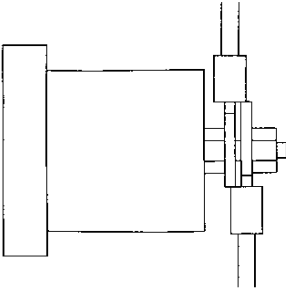
To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/Cannon/Metri-Pack test lead
Part No. 3822917 - female Deutsch/Cannon/Metri-Pack test lead.

STEPS	SPECIFICATIONS	SRT CODE
<u>STEP 1:</u> Check the OEM device.		
<u>STEP 1A:</u> Check for extra wires going to the OEM device.	No extra wires	
<u>STEP 1B:</u> Clean the OEM device wire terminals or OEM connectors.	Terminals or OEM connectors clean	
<u>STEP 1C:</u> Check OEM device resistance.	Refer to OEM specifications	
<u>STEP 2:</u> Check the OEM harness.		
<u>STEP 2A:</u> Check the ECM and the OEM harness connector pins.	No damaged pins	
<u>STEP 2B:</u> Check for an open circuit.	Less than 10 ohms	
<u>STEP 2C:</u> Check for a short circuit of the OEM device supply wire to ground.	More than 100k ohms	
<u>STEP 2D:</u> Check for a short circuit from pin to pin.	More than 100k ohms	
<u>STEP 3:</u> Clear the fault codes.		
<u>STEP 3A:</u> Disable the fault code.	Fault Code 527 inactive	
<u>STEP 3B:</u> Clear the inactive fault codes.	All faults cleared	

TROUBLESHOOTING STEP

STEP 1: Check the OEM device.

STEP 1A: Check for extra wires going to the OEM device.

Condition:		
<ul style="list-style-type: none"> • Turn keyswitch to the OFF position. 		
Action	Specifications/Repair	Next Step
Check for extra wires.	OK No extra wires	1B
	NOT OK Remove the extra wires	3A
 <p>19400464</p>		

STEP 1B: Clean the OEM wire terminals or OEM connectors.

Condition:		
<ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the control wire from the OEM device. 		
Action	Specifications/Repair	Next Step
Clean the OEM device post and the wiring terminal or OEM connectors. <ul style="list-style-type: none"> • Clean the post of the device and the terminal or connectors for the control wire of the OEM harness. 	OK Clean	1C
	NOT OK Repair ring terminal or replace the OEM device <ul style="list-style-type: none"> • Repair the ring terminal. Refer to Procedure 019-197. • Replace the OEM device. Refer to the OEM troubleshooting and repair manual. 	3A

STEP 1C: Check the OEM device resistance.

Condition: <ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the OEM harness. 		
Action	Specifications/Repair	Next Step
Check the shutoff resistance. <ul style="list-style-type: none"> • Measure the resistance from the OEM device to engine block ground. 	OK Refer to OEM specifications	2A
	NOT OK Repair the OEM device Refer to OEM troubleshooting and repair manual.	3A
<p>19800119</p>		

STEP 2: Check the OEM harness.

STEP 2A: Check the ECM and OEM harness connector pins.

⚠ CAUTION ⚠		
To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.		
Condition: <ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the OEM harness from the ECM. 		
Action	Specifications/Repair	Next Step
Check the ECM and OEM harness connector pins for the following: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector. 	OK No damaged pins	2B
	NOT OK Repair the damaged pins Repair or replace the OEM harness or ECM, whichever has the damaged pins. <ul style="list-style-type: none"> • Repair the OEM harness. Refer to Procedure 019-250. • Replace OEM harness. Refer to Procedure 019-071. • Replace the ECM. Refer Procedure 019-031. • Dry the connector by using an electrical contact cleaner, Part No. 3824510. 	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. 3822917 - female Deutsch/Cannon/Metri-Pack test lead.

⚠ CAUTION ⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch to the ON position.
- Disconnect the OEM harness from the ECM.
- Disconnect the OEM harness from the OEM device.

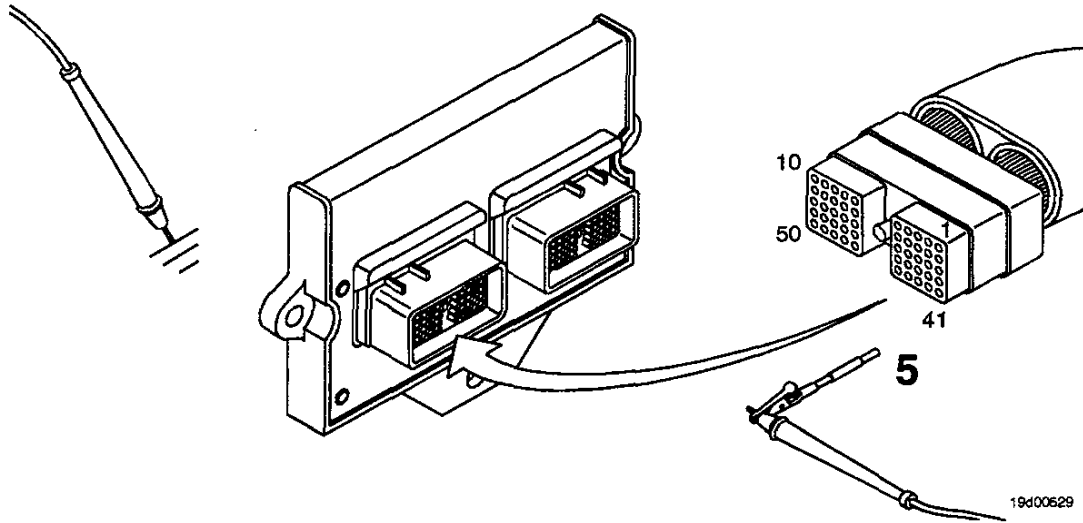
Action	Specifications/Repair	Next Step
Check for an open circuit. • Measure the resistance from pin 5 on the ECM side of the OEM harness connector to the OEM device connector.	OK Less than 10 ohms	2C
	NOT OK Replace the OEM harness Refer to Procedure 019-071.	3A

STEP 2C: Check for a short circuit in the OEM device supply wire to ground.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the ECM.
- Disconnect the OEM harness from the OEM device.

Action	Specifications/Repair	Next Step
Check for a short in the OEM device supply wire to ground. • Measure the resistance from pin 5 to engine block ground.	OK More than 100k ohms	2D
	NOT OK Replace OEM harness Refer to the OEM troubleshooting and repair manual.	3A



STEP 2D: Check for a short circuit from pin to pin.

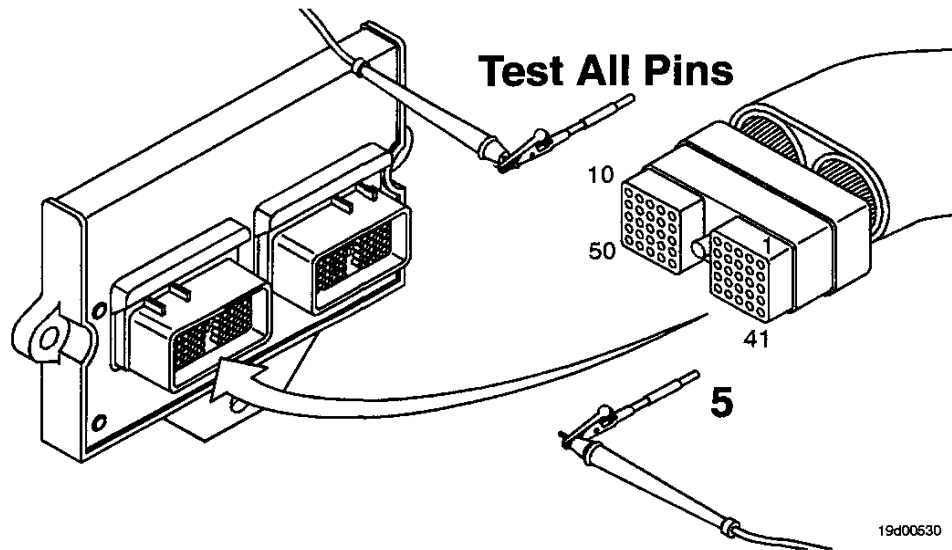


To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male Deutsch/Cannon/Metri-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the ECM.
- Disconnect the OEM harness from the OEM device.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pin 5 to all other wires in the OEM harness connector.	OK More than 100k ohms	3A
	NOT OK Replace the OEM harness Refer to the OEM troubleshooting and repair manual.	3A



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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 idle for one 1 minute.	OK Fault Code 527 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.

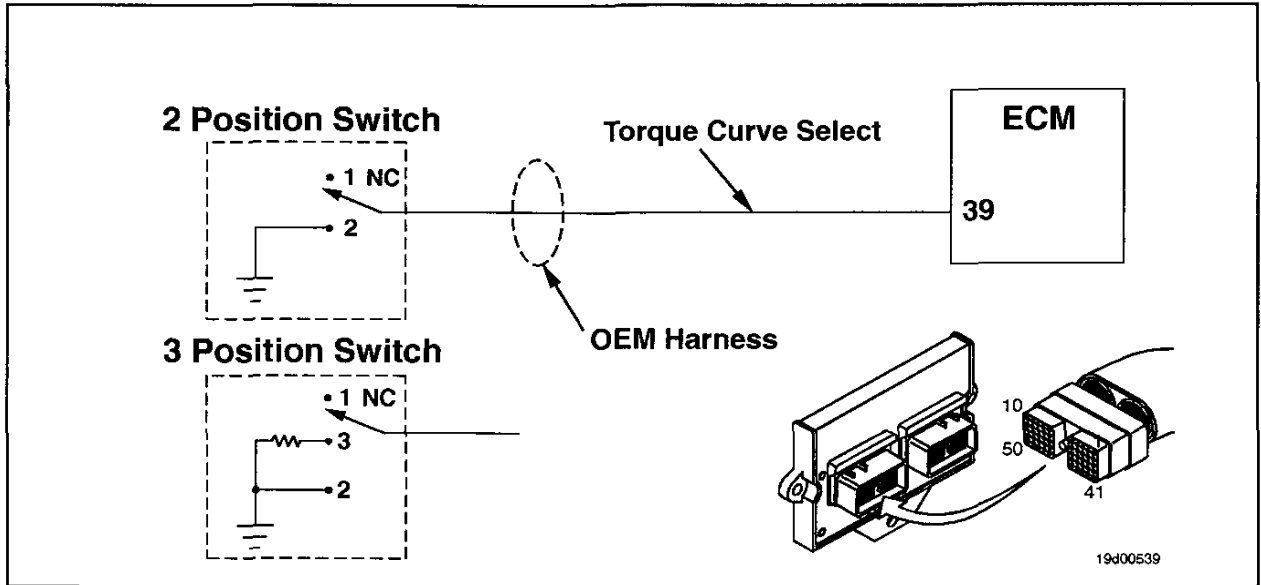
Condition: • Connect all components.		
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™, Part No. 3824801.	OK All faults cleared	Repair complete
	NOT OK Troubleshoot any remaining fault codes.	Appropriate troubleshooting charts

Fault Code 528

Alternate (Switched) Torque Curve Switch Circuit

CODES	REASON	EFFECT
Fault Code: 528 PID(P), SID(S): P093 SPN: 093 FMI: 2 Lamp: Yellow	Error detected on the torque curve selection switch.	Torque curve setting defaults to the preprogrammed torque curve.

Alternate Torque Signal Circuit



Circuit Description:

The torque curve switch circuit allows the operator to select from up to three preprogrammed torque curves using a two- or three-position switch depending on which curve the original equipment manufacturer (OEM) has provided.

Component Location:

The location of the torque curve switch circuit varies with each OEM and equipment model. Refer to the OEM manual.

Shop Talk:

The switch should be monitored for proper operation in INSITE™. If the switch is changing state correctly on the service tool, then the problem does **not** lie in the switch circuit. The three-position switch has three states:

- Position 1 - open
- Position 2 - closed
- Position 3 - 1500-ohm resistance.

The two-position switch has two states:

- Position 1 - open
- Position 2 - closed.

TROUBLESHOOTING SUMMARY



To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.



To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/Cannon/Metri-Pack test lead.

STEPS

SPECIFICATIONS

SRT CODE

STEP 1: Check the OEM harness.

STEP 1A: Inspect the OEM harness connectors.

STEP 1B: Check for an open circuit.

STEP 1C: Check for a short circuit to ground.

STEP 1D: Check for a short circuit from pin to pin.

No damaged pins

Less than 10 ohms

More than 100k ohms

More than 100k ohms

STEP 2: Check the OEM switch circuit.

STEP 2A: Inspect the OEM switch.

STEP 2B: Check resistance in position 2.

STEP 2C: Check resistance in position 3.

No damaged pins

Less than 10 ohms

Between 1000 and 2000 ohms

NOTE: Step 2C can only be performed if the OEM has provided a three-position switch.

STEP 3: Clear the fault code.

STEP 3A: Disable the fault code.

STEP 3B: Clear the inactive fault code.

Fault Code 528 inactive

All faults code cleared

TROUBLESHOOTING STEP

STEP 1: Check the OEM harness.

STEP 1A: Inspect the OEM harness connectors.

⚠ CAUTION ⚠		
To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.		
Condition:		
<ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the OEM harness from the ECM. 		
Action	Specifications/Repair	Next Step
Inspect the OEM harness and the ECM connector pins for the following: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector. 	OK No damaged pins	1B
	NOT OK Repair the damaged pins Repair or replace the OEM harness. <ul style="list-style-type: none"> • Repair the OEM harness. Refer to Procedure 019-250. • Replace the OEM harness. Refer to Procedure 019-071. • Replace the ECM. Refer to Procedure 019-031. • Dry the connector using electrical contact cleaner, Part No. 3824510. 	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/Cannon/Metri-Pack test lead.		
Condition:		
<ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the OEM harness from the ECM. • Disconnect the OEM harness from the torque curve switch. 		
Action	Specifications/Repair	Next Step
Check for an open circuit. <ul style="list-style-type: none"> • Measure the resistance from pin 39 of the OEM harness to the appropriate pin of the torque curve selection switch connector harness side. 	OK Less than 10 ohms	1C
	NOT OK Replace the OEM harness Refer to Procedure 019-071.	3A

STEP 1C: Check for a short circuit to ground.

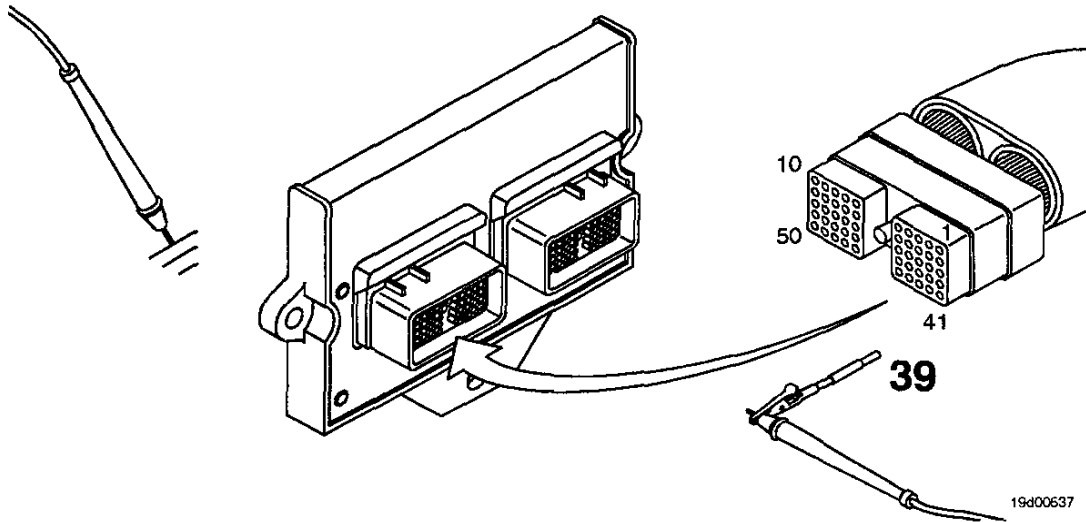
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male Deutsch/Cannon/Metri-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the ECM.
- Disconnect the OEM harness from the torque curve select switch.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground. • Measure the resistance from pin 39 of the OEM harness connector to engine block ground.	OK More than 100k ohms	1D
	NOT OK Replace the OEM harness Refer to Procedure 019-071.	3A



STEP 1D: Check for a short circuit from pin to pin.

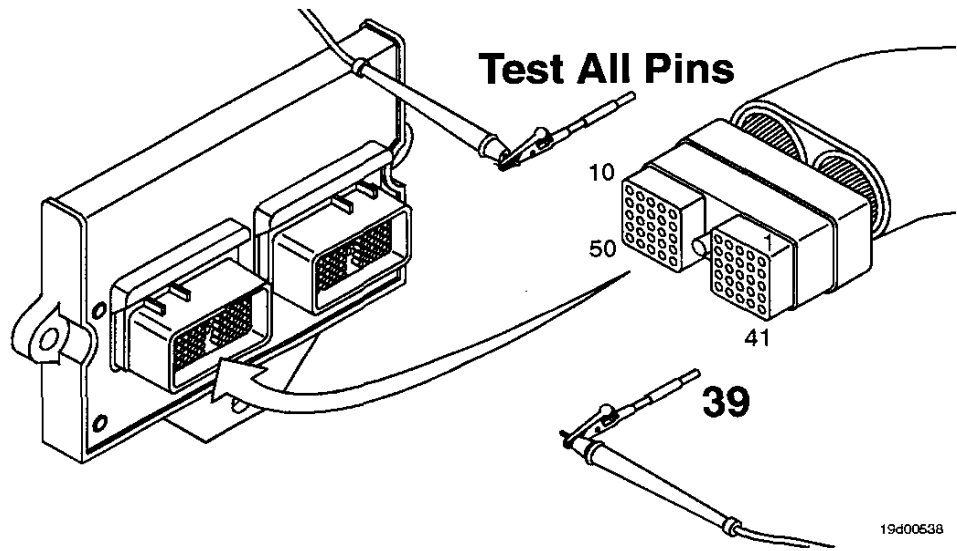
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male Deutsch/Cannon/Metri-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the ECM.
- Disconnect the OEM harness from the torque curve select switch.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pin 39 of the OEM harness connector to all other pins in the connector.	OK Greater than 100k ohms	2A
	NOT OK Replace the OEM harness Refer to Procedure 019-071.	3A



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STEP 2: Check the OEM switch circuit.
STEP 2A: Inspect the OEM switch.

Condition: <ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the OEM switch circuit from the OEM. 		
Action	Specifications/Repair	Next Step
Inspect OEM switch pins for the following: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or extended pins • Corroded pins • Moisture in or on switch 	OK No damaged pins	2B
	NOT OK Repair the damaged pins Repair or replace the OEM harness or the OEM switch, whichever has the damaged pins. Refer to the OEM troubleshooting and repair manual.	3A

STEP 2B: Check resistance in position 2.

Condition: <ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the OEM harness from the ECM. 		
Action	Specifications/Repair	Next Step
Check resistance in position 2. <ul style="list-style-type: none"> • Position the torque curve switch to the No. 2 position. • Measure the resistance from pin 39 of the OEM harness to the engine block ground. 	OK Less than 10 ohms	2C
	NOT OK Replace the switch Refer to the OEM troubleshooting and repair manual.	3A

STEP 2C: Check resistance in position 3.

Condition: <ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the OEM harness from the ECM. 		
Action	Specifications/Repair	Next Step
Check resistance in position 3. <ul style="list-style-type: none"> • Position the torque curve switch to the No. 3 position. • Measure the resistance from pin 39 of the OEM harness to the engine block ground. NOTE: Step 2C can only be performed if the OEM has provided a three-position switch.	OK Between 1000 and 2000 ohms	3A
	NOT OK Replace the switch Refer to the OEM troubleshooting and repair manual.	3A

STEP 3: Clear the fault code.

STEP 3A: Disable the fault code.

Condition: • Connect all the components.		
Action	Specifications/Repair	Next Step
Disable fault code • Start the engine, and let idle for 1 minute. • Verify that Fault Code 528 is inactive.	OK Fault Code 528 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.

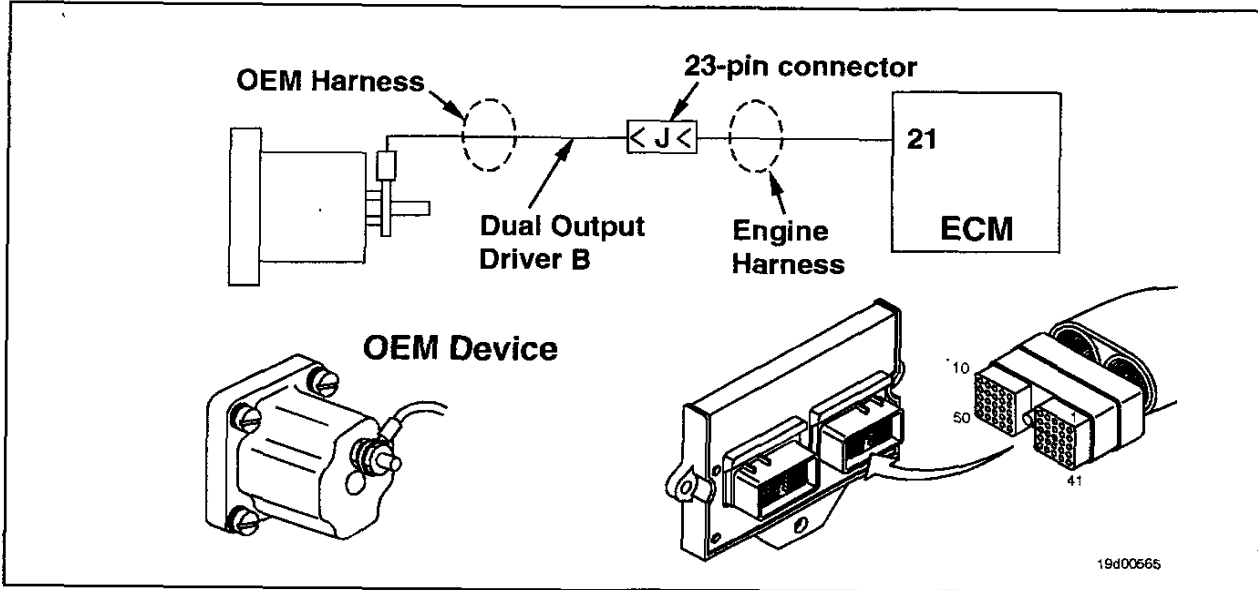
Condition: • Connect all the components.		
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™.	OK All faults cleared	Repair complete
	NOT OK Refer to the appropriate troubleshooting charts for any remaining active fault codes.	Appropriate troubleshooting charts

Fault Code 529

Dual-Output Driver B

CODES	REASON	EFFECT
Fault Code: 529 PID(P), SID(S): S051 SPN: 703 FMI: 3 Lamp: Yellow	Error detected in the dual-output driver B circuit.	The device being controlled by the driver B output signal will not function properly.

Dual-Output Driver B Circuit



Circuit Description:

The dual-output driver B will control engine and vehicle functions by controlling original equipment manufacturer (OEM) devices based on up to 12 selected engine parameters and two selected OEM inputs (the OEM switch and the OEM pressure). The solenoid output will control functions like a fan clutch, intake grid heater, air cleaner restriction indicator, or an oil filter differential pressure indicator.

Component Location:

The location of the OEM device is dependent upon the OEM.

TROUBLESHOOTING SUMMARY



To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.



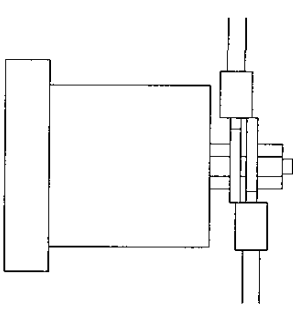
To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3822758 - male Deutsch/Cannon/Metri-Pack test lead
Part No. 3822917 - female Deutsch/Cannon/Metri-Pack test lead.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the OEM device.		
<u>STEP 1A:</u> Check for extra wires going to the OEM device.	No extra wires	
<u>STEP 1B:</u> Clean the solenoid post and the wiring terminal or OEM connectors.	Solenoid post is clean	
<u>STEP 1C:</u> Check the OEM device resistance.	Refer to OEM specifications	
STEP 2: Check the OEM harness.		
<u>STEP 2A:</u> Check the engine harness and the OEM harness connector pins.	No damaged pins	
<u>STEP 2B:</u> Check for an open circuit.	Less than 10 ohms	
<u>STEP 2C:</u> Check for a short of the supply wire to ground.	More than 100k ohms	
<u>STEP 2D:</u> Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 3: Check the engine harness.		
<u>STEP 3A:</u> Check the ECM and the engine harness connector pins.	No damaged pins	
<u>STEP 3B:</u> Check for an open circuit.	Less than 10 ohms	
<u>STEP 3C:</u> Check for a short of the supply wire to ground.	More than 100k ohms	
<u>STEP 3D:</u> Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 4: Clear the fault codes.		
<u>STEP 4A:</u> Disable the fault code.	Fault Code 529 inactive	
<u>STEP 4B:</u> Clear the inactive fault codes.	All faults cleared	

TROUBLESHOOTING STEP

STEP 1: Check the OEM device.

STEP 1A: Check for extra wires going to the OEM device.

Condition: <ul style="list-style-type: none"> Turn keyswitch to the OFF position. 		
Action	Specifications/Repair	Next Step
Check for extra wires on the OEM device.	OK No extra wires	1B
	NOT OK Remove the extra wires	4A
 <p>19400484</p>		

STEP 1B: Clean the solenoid post and the wiring terminal or OEM connectors.

Condition: <ul style="list-style-type: none"> Turn keyswitch to the OFF position. Disconnect the control wire from the solenoid or OEM connectors. 		
Action	Specifications/Repair	Next Step
Clean the solenoid post and the wiring terminal or OEM connectors. <ul style="list-style-type: none"> Clean the post of the solenoid and the terminal or connectors for the solenoid control wire of the OEM harness. 	OK Solenoid post is clean	1C
	NOT OK Repair ring terminal, or replace the solenoid <ul style="list-style-type: none"> Repair the ring terminal. Refer to Procedure 019-197. Replace the solenoid. Refer to the OEM troubleshooting and repair manual. 	4A

STEP 1C: Check the OEM device resistance.

Condition: <ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the OEM harness from the OEM device. 		
Action	Specifications/Repair	Next Step
Check the OEM device resistance. <ul style="list-style-type: none"> • Measure the resistance from the OEM device to engine block ground. 	OK Refer to OEM specifications	2A
	NOT OK Replace the OEM device Refer to the OEM troubleshooting and repair manual.	4A

STEP 2: Check the OEM harness.

STEP 2A: Check the engine harness and OEM harness connector pins.

Condition: <ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect OEM harness from the engine harness at the 23-pin connector. 		
Action	Specifications/Repair	Next Step
Check the engine harness and OEM harness connector pins for the following: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector. 	OK No damaged pins	2B
	NOT OK Repair the damaged pins Repair or replace the OEM harness or the engine harness, whichever has the damaged pins. <ul style="list-style-type: none"> • Repair the OEM harness. Refer to Procedure 019-223. • Replace OEM harness. Refer to Procedure 019-071. • Repair the engine harness. Refer to Procedure 019-223. • Replace engine harness. Refer to Procedure 019-043. • Dry the connector by using an electrical contact cleaner, Part No. 3824510. 	4A

STEP 2B: Check for an open circuit.

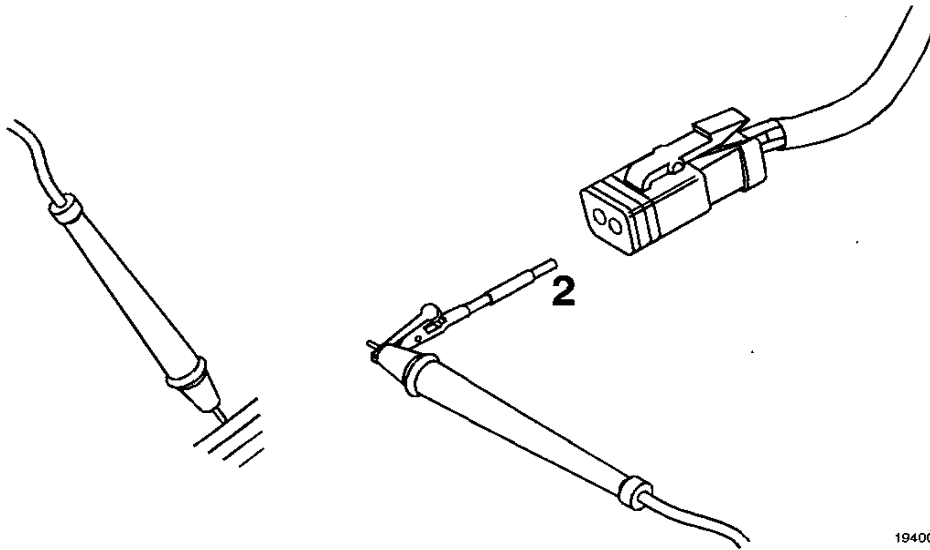
Condition: <ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the OEM harness from the OEM device. • Disconnect the engine harness from the 23-pin OEM harness connector. 		
Action	Specifications/Repair	Next Step
Check for an open circuit. <ul style="list-style-type: none"> • Measure the resistance from pin J of the 23-pin connector on the OEM side to the connector solenoid. 	OK Less than 10 ohms	2C
	NOT OK Replace the OEM harness Refer to Procedure 019-071.	3A

STEP 2C: Check for a short in the supply wire to ground.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the engine harness at the 23-pin connector.
- Disconnect the OEM harness from the OEM device.

Action	Specifications/Repair	Next Step
Check for a short in the supply wire to ground. • Measure the resistance from the OEM device supply wire to engine block ground.	OK More than 100k ohms	2D
	NOT OK Replace the OEM harness Refer to Procedure 019-071.	4A



STEP 2D: Check for a short circuit from pin to pin.

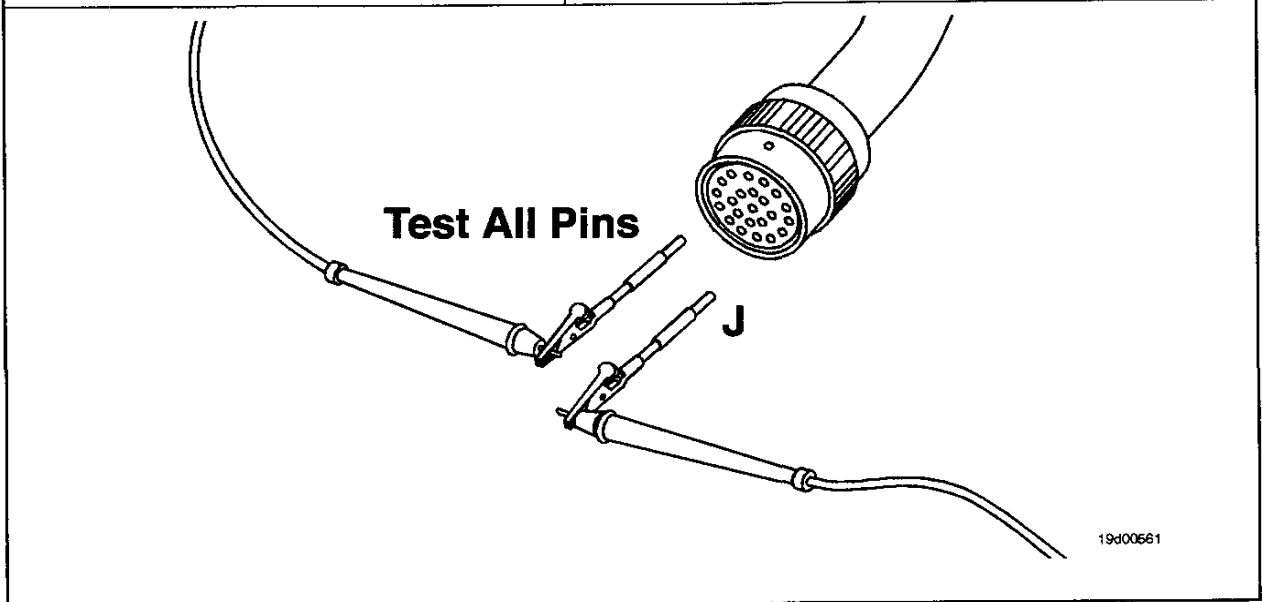
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male Deutsch/Cannon/Metri-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the engine harness at the 23-pin connector.
- Disconnect the OEM harness from the OEM device.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance between pin J in the OEM harness 23-pin connector and all other pins in the connector.	OK More than 100k ohms	3A
	NOT OK Replace the OEM harness Refer to Procedure 019-071.	4A



STEP 3: Check the engine harness.

STEP 3A: Check the ECM and engine 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 to the OFF position.
- Disconnect engine harness from the ECM.

Action	Specifications/Repair	Next Step
Check the ECM and engine harness connector pins for the following: <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector. 	OK No damaged pins	3B
	NOT OK Repair the damaged pins <ul style="list-style-type: none"> • Repair the engine harness. Refer to Procedure 019-250. • Replace engine harness. Refer to Procedure 019-043. • Replace the ECM. Refer to Procedure 019-031. • Dry the connector by using an electrical contact cleaner, Part No. 3824510. 	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. 3822917 - female Deutsch/Cannon/Metri-Pack test lead.

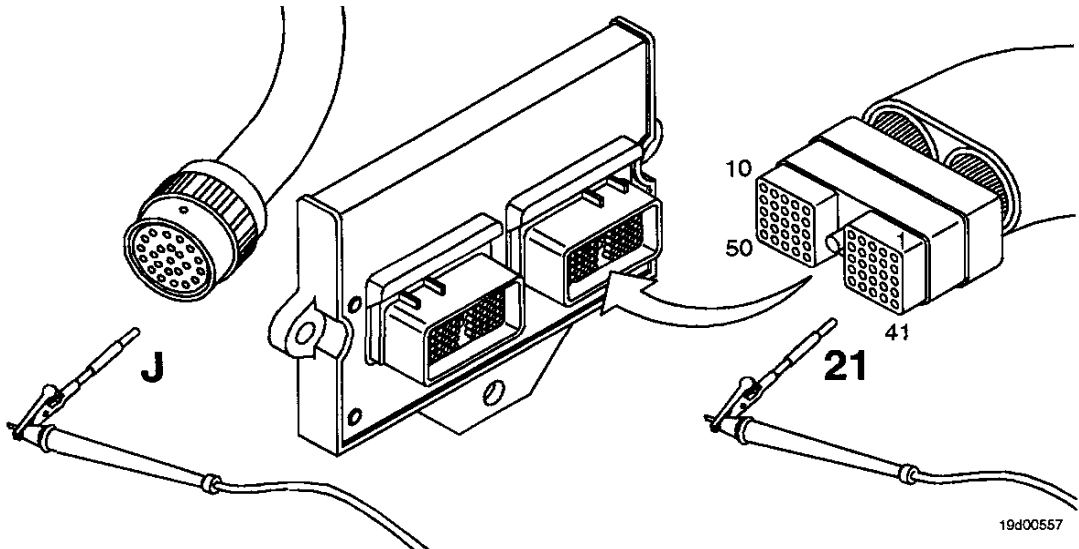
⚠ CAUTION ⚠

To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.

Condition:

- Turn keyswitch to the ON position.
- Disconnect the engine harness from the ECM.
- Disconnect the engine harness from the OEM harness at the 23-pin connector.

Action	Specifications/Repair	Next Step
Check for an open circuit. • Measure the resistance from pin 21 on the ECM side of the engine harness connector to pin J of the 23-pin connector.	OK Less than 10 ohms	3C
	NOT OK Replace the engine harness Refer to Procedure 019-031.	4A

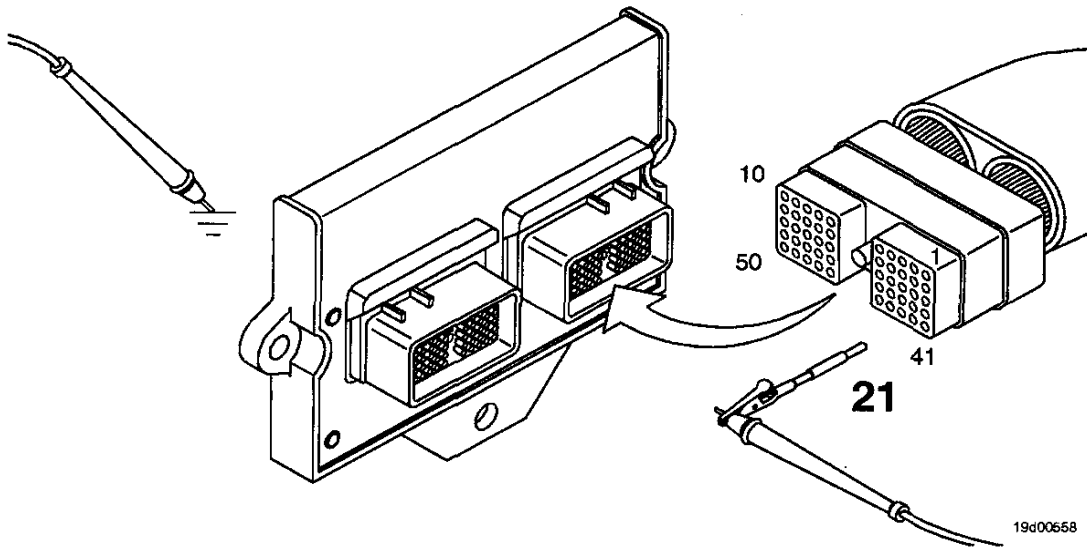


STEP 3C: Check for a short in the supply wire to ground.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the ECM.
- Disconnect the engine harness from the OEM harness at the 23-pin connector.

Action	Specifications/Repair	Next Step
Check for a short in the supply wire to ground. • Measure the resistance from the pin 21 to engine block ground.	OK More than 100k ohms	3D
	NOT OK Replace engine harness Refer to Procedure 019-071.	4A



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STEP 3D: Check for a short circuit from pin to pin.

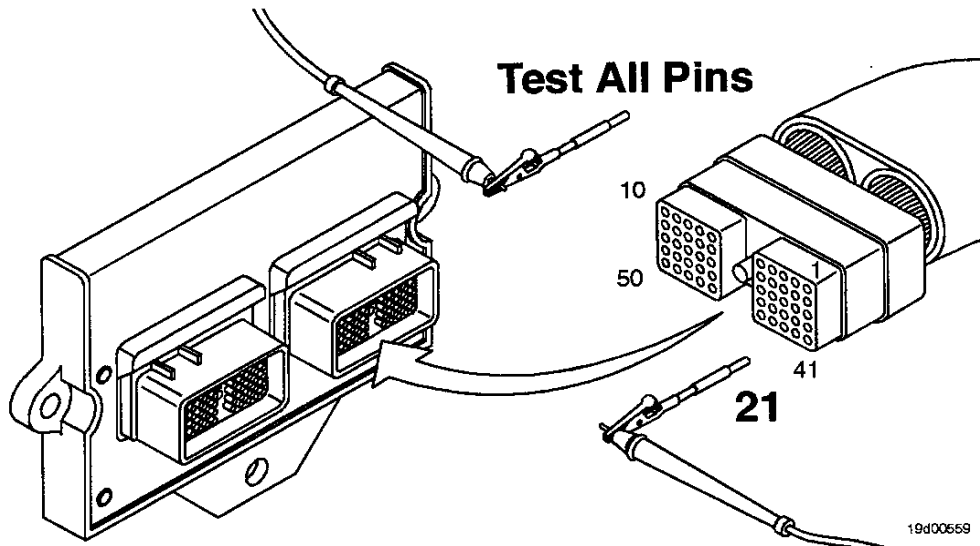
CAUTION

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3822758 - male Deutsch/Cannon/Metri-Pack test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the engine harness from the ECM.
- Disconnect the engine harness from the OEM harness at the 23-pin connector.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin. • Measure the resistance from pin 21 to all other pins in the engine harness connector.	OK More than 100k ohms	4A
	NOT OK Replace engine harness Refer to Procedure 019-071.	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 idle for 1 minute.	OK Fault Code 529 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.

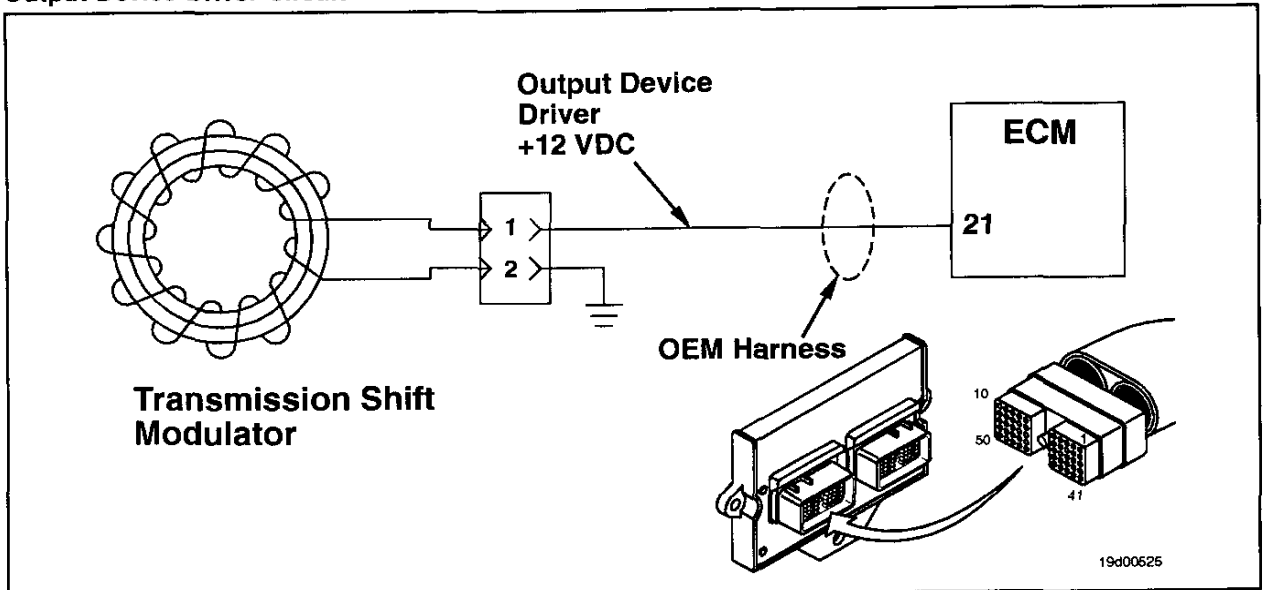
Condition:		
• Connect all components.		
Action	Specifications/Repair	Next Step
Clear the inactive fault codes. • Erase the inactive fault codes using INSITE™, Part No. 3824801, or EcheK™, Part No. 3824898.	OK All faults cleared	Repair complete
	NOT OK Troubleshoot any remaining fault codes.	Appropriate troubleshooting charts

Fault Code 768

Output Device Driver (Transmission Shift Modulation)

CODES	REASON	EFFECT
Fault Code: 768 PID(P), SID(S): S009 SPN: 923 FMI: 11 Lamp: Yellow	Error detected in the output device driver (transmission shift modulation signal) signal pin 21 on the original equipment manufacturer's (OEM) harness.	Can not control the transmission.

Output Device Driver Circuit



Circuit Description:

The output device driver is a device used by the electronic control module (ECM) to control the transmission shift modulation signal.

Component Location:

Refer to an OEM diagram for the location of the transmission shift modulator.

Shop Talk:

Output device driver could be malfunctioning due to a failed engine harness, a bad ground on the transmission shift modulator connector, or a bad transmission shift modulator.

TROUBLESHOOTING SUMMARY



To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.



To avoid pin and harness damage, use the following test leads when taking a measurement:
Part No. 3823993 - male Deutsch test lead.

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the transmission shift modulator.		
<u>STEP 1A:</u> Inspect and test the transmission shift modulator.	Transmission shift modulator within specifications	
STEP 2: Check the OEM harness.		
<u>STEP 2A:</u> Inspect the OEM harness connector.	No damaged pins	
<u>STEP 2B:</u> Check for an open circuit.	Less than 10 ohms	
<u>STEP 2C:</u> Check for a short circuit to ground.	More than 100k ohms	
<u>STEP 2D:</u> Check for a short circuit from pin to pin.	More than 100k ohms	
STEP 3: Clear the fault codes.		
<u>STEP 3A:</u> Disable the fault code.	Fault Code 768 inactive	
<u>STEP 3B:</u> Clear the inactive fault codes.	All faults cleared	

TROUBLESHOOTING STEP

STEP 1: Check the transmission shift modulator.
STEP 1A: Inspect and test the transmission shift modulator.

Condition:		
<ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the OEM harness from the transmission shift modulator. 		
Action	Specifications/Repair	Next Step
Check the transmission shift modulator for: <ul style="list-style-type: none"> • Damaged pins • Open or short circuits • Excessive current draw (power transmission shift modulator directly from battery) • Perform this test in accordance with the OEM instructions. 	OK Transmission shift modulator within specifications	2A
	NOT OK Repair or replace the transmission shift modulator Refer to the OEM troubleshooting and repair manual.	

STEP 2: Check the OEM harness.

STEP 2A: Inspect the OEM harness.

⚠ CAUTION ⚠		
<p>To avoid damaging a new ECM, all other active fault codes must be investigated prior to replacing the ECM.</p>		
<p>Condition:</p> <ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the OEM harness from the transmission shift modulator. • Disconnect the OEM harness from the ECM. 		
Action	Specifications/Repair	Next Step
<p>Inspect the OEM harness and connector for:</p> <ul style="list-style-type: none"> • Bent or broken pins • Pushed back or expanded pins • Corroded pins • Moisture in or on the connector • Missing or damaged seals. 	<p>OK No damaged pins</p>	2B
	<p>NOT OK Repair the damaged pins Repair or replace the OEM harness or transmission shift modulator, whichever has damaged pins.</p> <ul style="list-style-type: none"> • Repair OEM harness. Refer to Procedure 019-071. • Replace the OEM harness. Refer to Procedure 019-071. • Replace the transmission shift modulator. Refer to the OEM troubleshooting and repair manual. 	3A

STEP 2B: Check for an open circuit.

⚠ CAUTION ⚠		
<p>To avoid pin and harness damage, use the following test lead when taking a measurement: Part No. 3823993 - male Deutsch test lead.</p>		
<p>Condition:</p> <ul style="list-style-type: none"> • Turn keyswitch to the OFF position. • Disconnect the OEM harness from the transmission shift modulator. • Disconnect the OEM harness from the ECM. 		
Action	Specifications/Repair	Next Step
<p>Check for an open circuit.</p> <ul style="list-style-type: none"> • Measure the resistance from pin 21 on the OEM harness connector to the appropriate pin on the transmission shift modulator connector. 	<p>OK Less than 10 ohms</p>	2C
	<p>NOT OK Replace the OEM harness Refer to the Procedure 019-071.</p>	3A

STEP 2C: Check for a short circuit to ground in the OEM harness.

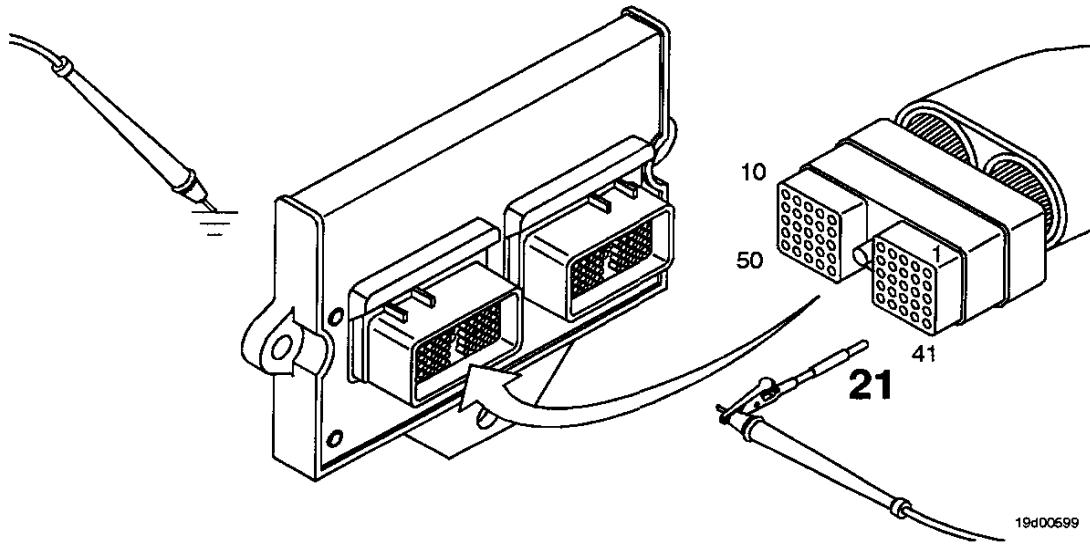
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3823993 - male Deutsch test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the transmission shift modulator.
- Disconnect the OEM harness from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit to ground in the OEM harness. • Measure resistance from pin 21 on the OEM harness connector to ground.	OK More than 100k ohms	2D
	NOT OK Replace the OEM harness Refer to Procedure 019-071.	3A



STEP 2D: Check for a short circuit from pin to pin.

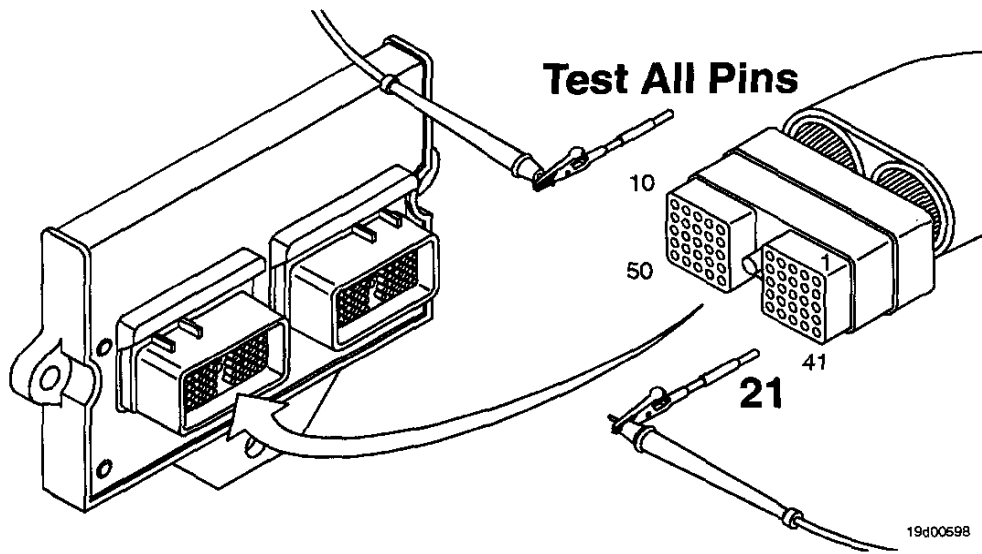
⚠ CAUTION ⚠

To avoid pin and harness damage, use the following test lead when taking a measurement:
Part No. 3823993 - male Deutsch test lead.

Condition:

- Turn keyswitch to the OFF position.
- Disconnect the OEM harness from the transmission shift modulator.
- Disconnect the OEM harness connector from the ECM.

Action	Specifications/Repair	Next Step
Check for a short circuit from pin to pin in the OEM harness. • Measure resistance from pin 21 of the OEM harness connector to all other pins in the OEM harness.	OK More than 100k ohms	3A
	NOT OK 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 the components.
- Turn keyswitch to the ON position.

Action	Specifications/Repair	Next Step
Disable the fault code. • Start the engine, and let idle for 1 minute. • Using INSITE™, verify Fault Code 768 is inactive.	OK Fault Code 768 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 the components.
- Keyswitch in the ON position.

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 chart

Fault Code 111	TF-3	Fault Code 373	TF-287
Electronic Control Module (ECM) Microprocessor.....	TF-3	VP44 Fuel Pump Fuel Shut Off Error	TF-287
Fault Code 115	TF-6	Fault Code 375	TF-293
Engine Speed Sensor (ESS) Circuit.....	TF-6	Electronic Control Module (ECM) Fuel Calibration	
Fault Code 122 or 123	TF-16	Corrupted	TF-293
Intake Manifold Pressure Sensor Circuit.....	TF-16	Fault Code 377	TF-296
Fault Code 131 or 132	TF-28	Fuel Pump Power Relay Stuck-On.....	TF-296
Accelerator Position Sensor Circuit	TF-28	Fault Code 381 or 382	TF-300
Fault Code 133	TF-43	Intake Air Heater Relay Circuit	TF-300
Remote Throttle Position Sensor.....	TF-43	Fault Code 385 or 444	TF-307
Fault Code 134	TF-56	Remote Accelerator Supply Circuit	TF-307
Remote Throttle Position Sensor.....	TF-56	Fault Code 387 or 443	TF-319
Fault Code 135 or 141	TF-69	Accelerator Position Sensor Circuit.....	TF-319
Oil Pressure Sensor Circuit.....	TF-69	Fault Code 391	TF-329
Fault Code 143	TF-79	VP44 Relay Coil Supply Circuit.....	TF-329
Oil Pressure - Engine Protection	TF-79	Fault Code 415	TF-342
Fault Code 144 or 145	TF-82	Oil Pressure - Engine Protection	TF-342
Coolant Temperature Sensor Circuit.....	TF-82	Fault Code 418	TF-345
Fault Code 146	TF-93	Water-In-Fuel Sensor Circuit.....	TF-345
Coolant Temperature - Engine Protection	TF-93	Fault Code 422	TF-348
Fault Code 151	TF-96	Coolant Level Sensor Circuit.....	TF-348
Coolant Temperature - Engine Protection	TF-96	Fault Code 429	TF-359
Fault Code 153 or 154	TF-99	Water-In-Fuel (WIF) Sensor Circuit	TF-359
Intake Manifold Air Temperature Sensor Circuit.....	TF-99	Fault Code 431 or 551	TF-366
Fault Code 155	TF-110	Idle Validation Switch (IVS) Circuit.....	TF-366
Intake Manifold Air Temperature Sensor - Engine		Fault Code 432	TF-378
Protection Circuit.....	TF-110	Accelerator Pedal Circuit (ISS)	TF-378
Fault Code 191	TF-113	Fault Code 433	TF-394
Air Conditioner Clutch Supply Circuit.....	TF-113	Intake Manifold Pressure Sensor Circuit.....	TF-394
Fault Code 211	TF-1	Fault Code 434	TF-402
Fault Code 234	TF-123	Unswitched Battery Supply Circuit	TF-402
Engine Overspeed Circuit	TF-123	Fault Code 441	TF-415
Fault Code 235	TF-127	Unswitched Battery Supply Circuit.....	TF-415
Engine Coolant Level - Engine Protection	TF-127	Fault Code 442	TF-425
Fault Code 241	TF-139	Unswitched Battery Supply Circuit	TF-425
Vehicle Speed Sensor Circuit.....	TF-139	Fault Code 488	TF-430
Fault Code 242	TF-151	Intake Manifold Air Temperature Sensor - Engine	
Vehicle Speed Sensor (VSS) Circuit	TF-151	Protection Circuit	TF-430
Fault Code 243	TF-157	Fault Code 489	TF-433
Exhaust Brake Supply Circuit.....	TF-157	Auxiliary Speed or Auxiliary Pressure Input Error	TF-433
Fault Code 245	TF-167	Fault Code 515 or 516	TF-444
Engine Fan Clutch Supply Circuit.....	TF-167	Coolant Level Sensor Circuit	TF-444
Fault Code 261	TF-178	Fault Code 524	TF-452
Fuel Temperature Sensor Circuit	TF-178	Switched Droop Selection Circuit	TF-452
Fault Code 264, 361, 366, 367, 374, 376, or 517	TF-181	Fault Code 527	TF-463
VP44 Internal Failure.....	TF-181	Dual-Output Driver A.....	TF-463
Fault Code 278	TF-185	Fault Code 528	TF-471
Lift Pump Circuit.....	TF-185	Alternate (Switched) Torque Curve Switch Circuit	TF-471
Fault Code 283 or 284	TF-196	Fault Code 529	TF-478
Engine Speed Sensor Supply	TF-196	Dual-Output Driver B.....	TF-478
Fault Code 287	TF-1	Fault Code 599	TF-1
Fault Code 288	TF-1	Fault Code 611	TF-2
Fault Code 297	TF-205	Fault Code 768	TF-489
OEM Pressure Sensor Circuit	TF-205	Output Device Driver (Transmission Shift Modulation).....	TF-489
Fault Code 298	TF-212	General Safety Instructions	i-1
OEM Pressure Sensor Circuit.....	TF-212	Important Safety Notice	i-1
Fault Code 319	TF-1	Information Fault Codes	TF-1
Fault Code 349	TF-219		
Auxiliary Speed or Auxiliary Pressure Input Error	TF-219		
Fault Code 352 or 386	TF-230		
Sensor Supply Circuit	TF-230		
Fault Code 362	TF-238		
Fuel Pump Fuel-Metering Valve Open Circuit	TF-238		
Fault Code 363	TF-245		
Fuel Pump Fuel Solenoid Valve Closing at Wrong Time	TF-245		
Fault Code 364	TF-252		
Electronic Control Module (ECM) to Pump			
Communications Error	TF-252		
Fault Code 365	TF-261		
Fuel Pump Voltage Out of Range Error Low	TF-261		
Fault Code 368	TF-268		
Fuel Pump Can Not Reach Commanded Timing.....	TF-268		
Fault Code 369	TF-272		
Fuel Pump To Engine Synchronization Pulse Not			
Recognized.....	TF-272		
Fault Code 372	TF-280		
Idle Select High/Low	TF-280		

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