



# Troubleshooting and Repair Manual

ISB, ISBe2, ISBe3, ISBe4, QSB4.5, QSB5.9, QSB6.7, ISC, QSC8.3, ISL, ISLe3, ISLe4, and QSL9, CM850 Electronic Control System

## Volume 3

**SYMPTOM: COOLANT TEMPERATURE ABOVE NORMAL**

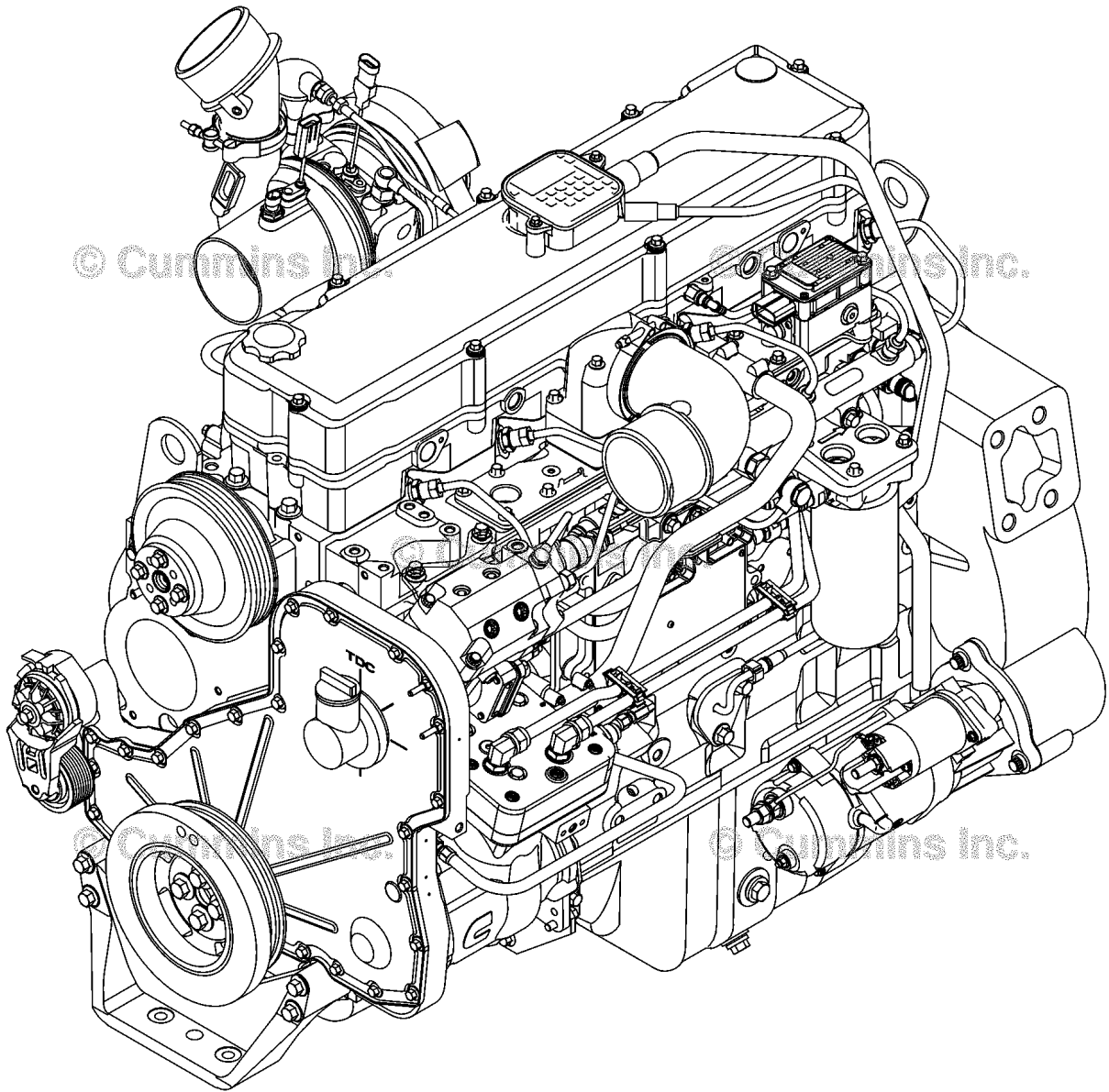
Cause	Correction
Low Coolant Level	Add Coolant. Refer to Section
Collapsed Radiator Hose	
Engine Lubricating Oil Level is too High or Low	
Engine is Receiving too Much Fuel	
Dirty Engine (Exterior)	
Loose Fan Drive Belt	
Radiator Shut Opening Closed	
Temperature Sensor Faulty	
Water Pump Faulty	
Thermostat Faulty	

Continued





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ISB, ISBe2, ISBe3, ISBe4, QSB4.5, QSB5.9, QSB6.7, ISC,  
QSC8.3, ISL, ISLe3, ISLe4, and QSL9, CM850 Electronic Control  
System  
Volume 3



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# 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 contacting your local area Cummins Regional office. A Cummins Regional office listing is located in Service Literature (Section L).

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

Cummins 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 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.

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Section i - Introduction

Section Contents

Table with 2 columns: Section Name and Page. Includes sections like About the Manual, Acronyms and Abbreviations, General Cleaning Instructions, General Repair Instructions, General Safety Instructions, How to Use the Manual, Illustrations, and Symbols.

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## About the Manual

### General Information

This Troubleshooting and Repair Manual is intended to aid in determining the cause of engine related problems and to provide recommended repair procedures.

The manual is divided into sections. Each section is equivalent to a group used in Cummins' filmcard system. Some sections contain **reference** numbers and **procedure** numbers. **Reference** numbers provide general information, specifications, diagrams, and service tools where applicable. **Procedure** numbers are used to identify and reference specific repair procedures for correcting the problem.

This manual **does not** contain fuel systems electronic troubleshooting. Use the troubleshooting trees in this manual, if there are no electronic fault codes.

This manual is designed so the troubleshooting trees are used to locate the cause of an engine problem. The troubleshooting trees then direct the user to the correct repair procedure. The repair procedures within a section are in numerical order. However, the repair steps within a given procedure are organized in the order the repair **must** be performed regardless of the numerical order of the steps. The user **must** use the contents pages or the index at the back of the manual to locate specific topics when **not** using the troubleshooting trees.

## How to Use the Manual

### General Information

This manual is organized to provide an easy flow from problem identification to problem correction.

A list of troubleshooting symptoms containing the most common problems is in the Troubleshooting Symptoms, Section (TS). The manual is designed to use the Troubleshooting Symptoms as a guide to locating the problem and directing the end user to the correct procedure for making the repair. Complete the following steps to locate and correct the problem.

- 1 Locate the symptom on the Section Contents pages of Section TS.
  - Reference to the page number where the Troubleshooting Symptom Tree is found is made to the right of the symptom tree title.
- 2 The left column of boxes in the Troubleshooting Symptom Charts indicates a probable cause of the problem, starting at the top with the simplest and easiest to repair, and continuing downward to the most difficult.
  - The right column of boxes provides a brief description of the corrective action with a reference number to the correct procedure used to make the repair.
- 3 Locate the probable cause in the left column then turn to the procedure referenced in the right column.
- 4 The Troubleshooting Symptom Charts are based on the following assumptions:
  - The components have been installed according to the manufacturer's specifications.
  - The easiest repairs are done first.
  - All generic solutions are designed for the most common applications and Original Equipment Manufacturer (OEM).

Refer to the Original Equipment Manufacturer's service manual for their specifications.



## Symbols

### General Information

The symbols have been used in this manual to help communicate the intent of the instructions. When one of the symbols appears, it conveys the meaning defined below.

**NOTE:** It is possible to have four symbols for each text and graphic combination.

#### **WARNING**

**Serious personal injury or extensive property damage can result if the warning instructions are not followed.**

#### **CAUTION**

**Minor personal injury can result or a part, and assembly, or the engine can be damaged if the caution instructions are not followed.**

Indicates a **REMOVAL** or **Dissassembly** step.





Indicates an **INSTALLATION** or **ASSEMBLY** step.



**INSPECTION** is required.



**CLEAN** the part or assembly.



**PERFORM** a mechanical or time **MEASUREMENT**.

**LUBRICATE** the part or assembly.



Indicates that a **WRENCH** or **TOOL SIZE** will be given.



**TIGHTEN** to a specific torque.



**PERFORM** an electrical **MEASUREMENT**.





Refer to another location in this manual or another publication for additional information.



The component weighs 23kg [50 lbs] or more. To reduce the possibility of personal injury, use a hoist or get assistance to lift the component.



To reduce the risk of high voltage shock, always follow all warnings and service instructions. Always assume the vehicle and its high voltage system are energized, even if the engine is not running.



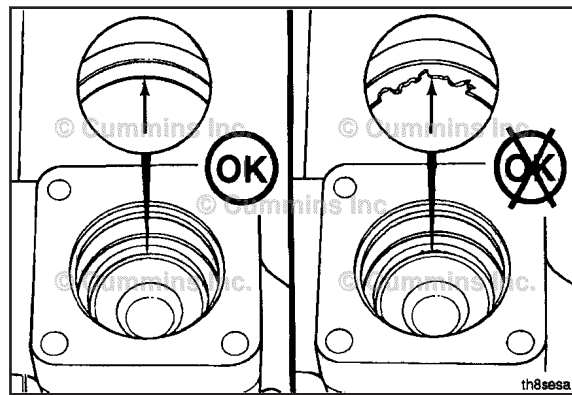
Approved high voltage insulated gloves are required for this procedure.



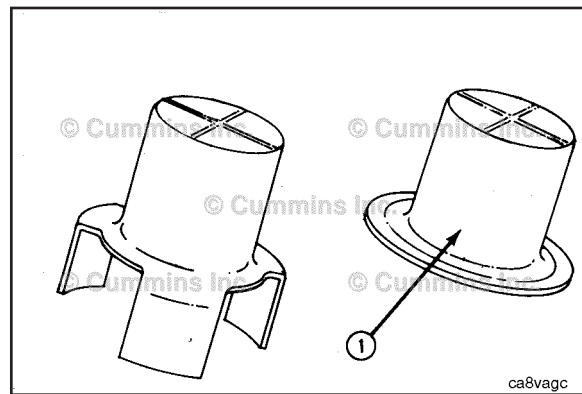
Illustrations

General Information

Some of the illustrations throughout this manual are generic and will not look exactly like the engine or parts used in your application. The illustrations can contain symbols to indicate an action required and an acceptable or not acceptable condition.



The illustrations are intended to show repair or replacement procedures. The procedure will be the same for all applications, although the illustration can differ.





## General Safety Instructions

### Important Safety Notice



**Improper practices, carelessness, or ignoring the warnings can cause burns, cuts, mutilation, asphyxiation or other personal 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.

- Work in an area surrounding the product that 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 slowly loosening the filler cap to relieve the pressure from the cooling system.
- **Always** use blocks or proper stands to support the product before performing any service work. Do **not** work on anything that is supported **ONLY** by lifting jacks or a hoist.
- Relieve all pressure in the air, oil, fuel, and 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 reduce the possibility of suffocation and frostbite, wear protective clothing and **ONLY** disconnect 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 reduce the possibility of 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 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 reduce the possibility of burns, be alert for hot parts on products that have just been turned off, exhaust gas flow, and hot fluids in lines, tubes, and compartments.
- **Always** use tools that are in good condition. Make sure you understand how to use the tools 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.
- When necessary, the removal and replacement of any guards covering rotating components, drives, and/or belts should only be carried out by a trained technician. Before removing any guards the engine **must** be turned off and any starting mechanisms **must** be isolated. All fasteners **must** be replaced on re-fitting the guards.
- 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.
- Do **not** connect the jumper starting or battery charging cables to any ignition or governor control wiring. This can cause electrical damage to the ignition or governor.
- **Always** torque fasteners and fuel connections to the required specifications. Overtightening or undertightening can allow leakage. This is critical to the natural gas and liquefied petroleum gas fuel and air systems.
- **Always** test for fuel leaks as instructed, as odorant can fade.
- Close the manual fuel valves prior to performing maintenance and repairs, and when storing the vehicle inside.
- Coolant is toxic. If **not** reused, dispose of in accordance with local environmental regulations.
- The catalyst reagent contains urea. Do **not** get the substance in your eyes. In case of contact, immediately flood eyes with large amounts of water for a minimum of 15 minutes. Avoid prolonged contact with skin. In case of contact, immediately wash skin with soap and water. Do **not** swallow internally. In the event the catalyst reagent is ingested, contact a physician immediately.
- The catalyst substrate contains Vanadium Pentoxide. Vanadium Pentoxide has been determined by the State of California to cause cancer. Always wear protective gloves and eye protection when handling the catalyst assembly. Do not get the catalyst material in your eyes. In Case of contact, immediately flood eyes with large amounts of water for a minimum of 15 minutes. Avoid prolonged contact with skin. In case of contact, immediately wash skin with soap and water.
- The Catalyst substrate contains Vanadium Pentoxide. Vanadium Pentoxide has been determined by the State of California to cause cancer. In the event the catalyst is being replaced, dispose of in accordance with local regulations.
- California Proposition 65 Warning - Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

## General Repair Instructions

### General Information

This system incorporates the latest technology at the time it was manufactured; yet, it is designed to be repaired using normal repair practices performed to quality standards.



**Cummins Inc. does not recommend or authorize any modifications or repairs to components except for those detailed in Cummins Service Information. In particular, unauthorized repair to safety-related components can cause personal injury or death. Below is a partial listing of components classified as safety-related:**

- 1 Air Compressor
- 2 Air Controls
- 3 Air Shutoff Assemblies
- 4 Balance Weights
- 5 Cooling Fan
- 6 Fan Hub Assembly
- 7 Fan Mounting Bracket(s)
- 8 Fan Mounting Capscrews
- 9 Fan Hub Spindle
- 10 Flywheel
- 11 Flywheel Crankshaft Adapter
- 12 Flywheel Mounting Capscrews
- 13 Fuel Shutoff Assemblies
- 14 Fuel Supply Tubes
- 15 Lifting Brackets
- 16 Throttle Controls
- 17 Turbocharger Compressor Casing
- 18 Turbocharger Oil Drain Line(s)
- 19 Turbocharger Oil Supply Line(s)
- 20 Turbocharger Turbine Casing
- 21 Vibration Damper Mounting Capscrews
- 22 Manual Service Disconnect
- 23 High Voltage Interlock Loop
- 24 High Voltage Connectors/Connections and Harnesses
- 25 High Voltage Battery System
- 26 Power Inverter
- 27 Generator Motor
- 28 Clutch Pressure Plate

- Follow all safety instructions noted in the procedures
- Follow the manufacturer's recommendations for cleaning solvents and other substances used during repairs. Some solvents have been identified by government agencies as toxic or carcinogenic. Avoid excessive breathing, ingestion and contact with such substances. **Always** use good safety practices with tools and equipment
- Provide a clean environment and follow the cleaning instructions specified in the procedures
- All components **must** be kept clean during any repair. Contamination of the components will cause premature wear.
- Perform the inspections specified in the procedures
- Replace all components or assemblies which are damaged or worn beyond the specifications

To buy Cummins Parts and Service Manuals, Training Guides, or Tools go to our website at <https://store.cummins.com>

- Use genuine Cummins new or ReCon® service parts and assemblies
- The assembly instructions have been written to use again as many components and assemblies as possible. When it is necessary to replace a component or assembly, the procedure is based on the use of new Cummins or Cummins ReCon® components. All of the repair services described in this manual are available from all Cummins Distributors and most Dealer locations.
- Follow the specified disassembly and assembly procedures to reduce the possibility of damage to the components

## **Welding on a Vehicle with an Electronic Controlled Fuel System**

### **▲ CAUTION ▲**

**Disconnect both the positive (+) and negative (-) battery cables from the battery before welding on the vehicle. Attach the welder ground cable no more than 0.61 meters [2 feet] from the part being welded. Do not connect the ground clamp of the welder to any of the sensors, wiring harness, electronic control units or the components. Direct welding of any electronic components must not be attempted. Sensors, wiring harness, and electronic control unit should be removed if nearby welding will expose these components to temperatures beyond normal operation. Additionally, all electronic control unit connectors must be disconnected**

## General Cleaning Instructions

### Definition of Clean

Parts **must** be free of debris that can contaminate any engine system. This does **not** necessarily mean they have to appear as new.

Sanding gasket surfaces until the factory machining marks are disturbed adds no value and is often harmful to forming a seal. It is important to maintain surface finish and flatness tolerances to form a quality sealing surface. Gaskets are designed to fill small voids in the specified surface finish.

Sanding gasket surfaces where edge-molded gaskets are used is most often unnecessary. Edge-molded gaskets are those metal carriers with sealing material bonded to the edges of the gasket to seal while the metal portion forms a metal to metal joint for stability. Any of the small amounts of sealing material that can stick to the parts are better removed with a blunt-edged scraper on the spots rather than spending time polishing the whole surface with an air sander or disc.

For those gaskets that do **not** have the edge molding, nearly all have a material that contains release agents to prevent sticking. Certainly this is **not** to say that some gaskets are **not** difficult to remove because the gasket has been in place a long time, has been overheated or the purpose of the release agent has been defeated by the application of some sealant. The object however is just to remove the gasket without damaging the surfaces of the mating parts without contaminating the engine (don't let the little bits fall where they can not be removed).

Bead blasting piston crowns until the dark stain is removed is unnecessary. All that is required is to remove the carbon build-up above the top ring and in the ring grooves. There is more information on bead blasting and piston cleaning later in this document.

Cummins Inc. does **not** recommend sanding or grinding the carbon ring at the top of cylinder liners until clean metal is visible. The liner will be ruined and any signs of a problem at the top ring reversal point (like a dust-out) will be destroyed. It is necessary to remove the carbon ring to provide for easier removal of the piston assembly. A medium bristle, high quality, steel wire wheel that is rated above the rpm of the power tool being used will be just as quick and there will be less damage. Yes, one **must** look carefully for broken wires after the piston is removed but the wires are more visible and can be attracted by a magnet.

Oil on parts that have been removed from the engine will attract dirt in the air. The dirt will adhere to the oil. If possible, leave the old oil on the part until it is ready to be cleaned, inspected and installed, and then clean it off along with any attracted dirt. If the part is cleaned then left exposed it can have to be cleaned again before installation. Make sure parts are lubricated with clean oil before installation. They do **not** need to be oiled all over but do need oil between moving parts (or a good lube system priming process conducted before cranking the engine).

Bead blasting parts to remove exterior paint is also usually unnecessary. The part will most likely be painted again so all that needs happen is remove any loose paint.

### Abrasive Pads and Abrasive Paper

The keyword here is "abrasive". There is no part of an engine designed to withstand abrasion. That is they are all supposed to lock together or slide across each other. Abrasives and dirt particles will degrade both functions.



**Abrasive material must be kept out of or removed from oil passages and parts wear points. Abrasive material in oil passages can cause bearing and bushing failures that can progress to major component damage beyond reuse. This is particularly true of main and rod bearings.**

Cummins Inc. does **not** recommend the use of emery cloth or sand paper on any part of an **assembled** engine or component including but **not** limited to removing the carbon ridge from cylinder liners or to clean block decks or counterbores.

Great care **must** be taken when using abrasive products to clean engine parts, particularly on partially assembled engines. Abrasive cleaning products come in many forms and sizes. All of them contain aluminum oxide particles, silicon carbide, or sand or some other similar hard material. These particles are harder than most of the parts in the engine. Since they are harder, if they are pressed against softer material they will either damage the material or become embedded in it. These materials fall off the holding media as the product is used. If the products are used with power equipment the particles are thrown about the engine. If the particles fall between two moving parts, damage to the moving parts is likely.

If particles that are smaller than the clearance between the parts while they are at rest (engine stopped), but larger than the running clearance then damage will occur when the parts move relative to each other (engine started). While the engine is running and there is oil pressure, particles that are smaller than the bearing clearance are likely to pass between the parts without damage and be trapped in the oil filter. However, particles larger than the bearing clearance will remove material from one part and can become embedded in one of the parts. Once embedded in one part it will



abrade the other part until contact is no longer being made between the two parts. If the damage sufficiently degrades the oil film, the two parts will come into contact resulting in early wear-out or failure from lack of effective lubrication.

Abrasive particles can fly about during cleaning it is very important to block these particles from entering the engine as much as possible. This is particularly true of lubricating oil ports and oil drilling holes, especially those located downstream of the lubricating oil filters. Plug the holes instead of trying to blow the abrasive particles and debris with compressed air because the debris is often simply blown further into the oil drilling.

All old gasket material must be removed from the parts gasket surfaces. However, it is not necessary to clean and polish the gasket surface until the machining marks are erased. Excessive sanding or buffing can damage the gasket surface. Many newer gaskets are of the edge molded type (a steel carrier with a sealing member bonded to the steel). What little sealing material that can adhere is best removed with a blunt-edged scraper or putty knife. Cleaning gasket surfaces where an edge-molded gasket is used with abrasive pads or paper is usually a waste of time.



Excessive sanding or grinding the carbon ring from the top of the cylinder liners can damage the liner beyond reuse. The surface finish will be damaged and abrasive particles can be forced into the liner material which can cause early cylinder wear-out or piston ring failures.

Tape off or plug all openings to any component interior before using abrasive pads or wire brushes. If really necessary because of time to use a power tool with abrasive pads, tape the oil drillings closed or use plug and clean as much of the surface as possible with the tool but clean around the oil hole/opening by hand so as to prevent contamination of the drilling. Then remove the tape or plug and clean the remaining area carefully and without the tool. DO NOT use compressed air to blow the debris out of oil drilling on an assembled engine! More likely than not, the debris can be blown further into the drilling. Using compressed air is fine if both ends of the drilling are open but that is rarely the case when dealing with an assembled engine.

Gasket Surfaces

The object of cleaning gasket surfaces is to remove any gasket material, not refinish the gasket surface of the part. Cummins Inc. does not recommend any specific brand of liquid gasket remover. If a liquid gasket remover is used, check the directions to make sure the material being cleaned will not be harmed. Air powered gasket scrapers can save time but care must be taken to not damage the surface. The angled part of the scraper must be against the gasket surface to prevent the blade from digging into the surface. Using air powered gasket scrapers on parts made of soft materials takes skill and care to prevent damage. Do not scrape or brush across the gasket surface if at all possible.

Solvent and Acid Cleaning

Several solvent and acid-type cleaners can be used to clean the disassembled engine parts (other than pistons. See Below). Experience has shown that the best results can be obtained using a cleaner that can be heated to 90° to 95° Celsius (180° to 200° Fahrenheit). Kerosene emulsion based cleaners have different temperature specifications, see below. A cleaning tank that provides a constant mixing and filtering of the cleaning solution will give the best results. Cummins Inc. does not recommend any specific cleaners. Always follow the cleaner manufacturer's instructions. Remove all the gasket material, o-rings, and the deposits of sludge, carbon, etc., with a wire brush or scraper before putting the parts in a cleaning tank. Be careful not to damage any gasket surfaces. When possible, steam clean the parts before putting them in the cleaning tank.



When using solvents, acids, or alkaline materials for cleaning, follow the manufacturers recommendations for use. Wear goggles and protective clothing to reduce the possibility of personal injury.

Experience has shown that kerosene emulsion based cleaners perform the best to clean pistons. These cleaners should not be heated to temperature in excess of 77°C (170°F). The solution begins to break down at temperatures in excess of 82°C (180°F) and will be less effective.

Do not use solutions composed mainly of chlorinated hydrocarbons with cresols, phenols and/or cresylic components. They often do not do a good job of removing deposits from the ring groove and are costly to dispose of properly.

Solutions with a pH above approximately 9.5 will cause aluminum to turn black; therefore do not use high alkaline solutions.

Chemicals with a pH above 7.0 are considered alkaline and those below 7.0 are acidic. As you move further away from the neutral 7.0, the chemicals become highly alkaline or highly acidic.

Remove all the gasket material, o-rings, and the deposits of sludge, carbon, etc., with a wire brush or scraper before putting the parts in a cleaning tank. Be careful to not damage any gasket surfaces. When possible use hot high

pressure water or steam clean the parts before putting them in the cleaning tank. Removing the heaviest dirt before placing in the tank will allow the cleaner to work more effectively and the cleaning agent will last longer.

Rinse all the parts in hot water after cleaning. Dry completely with compressed air. Blow the rinse water from all the capscrew holes and the oil drillings.

If the parts are **not** to be used immediately after cleaning, dip them in a suitable rust proofing compound. The rust proofing compound **must** be removed from the parts before assembly or installation on the engine.

## Steam Cleaning

Steam cleaning can be used to remove all types of dirt that can contaminate the cleaning tank. It is a good method for cleaning the oil drillings and coolant passages



**When using a steam cleaner, wear safety glasses or a face shield, as well as protective clothing. Hot steam can cause serious personal injury.**

Do **not** steam clean the following components:

- Electrical Components
- Wiring Harnesses
- Belts and Hoses
- Bearings (ball or taper roller)
- Electronic Control Module (ECM)
- ECM Connectors
- Capacitive Coil Driver Module (CCD)
- Ignition Coils and Leads
- NOx Sensor
- Fuel Control Valve
- Throttle Driver and Actuator.

## Plastic Bead Cleaning

Cummins Inc. does **not** recommend the use of glass bead blast or walnut shell media on **any** engine part. Cummins Inc. recommends using **only** plastic bead media, Part Number 3822735 or equivalent on any engine part. **Never** use sand as a blast media to clean engine parts. Glass and walnut shell media when **not** used to the media manufacturer's recommendations can cause excess dust and can embed in engine parts that can result in premature failure of components through abrasive wear.

Plastic bead cleaning can be used on many engine components to remove carbon deposits. The cleaning process is controlled by the use of plastic beads, the operating pressure and cleaning time.



**Do not use bead blasting cleaning methods on aluminum pistons skirts or the pin bores in any piston, piston skirt or piston crown. Small particles of the media will embed in the aluminum or other soft metal and result in premature wear of the cylinder liner, piston rings, pins and pin bores. Valves, turbocharger shafts, etc., can also be damaged. Follow the cleaning directions listed in the procedures.**



**Do not contaminate wash tanks and tank type solvent cleaners with the foreign material and plastic beads. Remove the foreign material and plastic beads with compressed air, hot high pressure water or steam before placing them in tanks or cleaners. The foreign material and plastic beads can contaminate the tank and any other engine parts cleaned in the tank. Contaminated parts may cause failures from abrasive wear.**

Plastic bead blasting media, Part Number 3822735, can be used to clean all piston ring grooves. Do **not** use any bead blasting media on piston pin bores or aluminum skirts.

Follow the equipment manufacturer's cleaning instructions. Make sure to adjust the air pressure in the blasting machine to the bead manufacturer's recommendations. Turning up the pressure can move material on the part and cause the plastic bead media to wear out more quickly. The following guidelines can be used to adapt to manufacturer's instructions:

- 1 Bead size: U.S. size Number 16 — 20 for piston cleaning with plastic bead media, Part Number 3822735

- 2 Operating Pressure — 270 kPa (40 psi) for piston cleaning. Pressure should not cause beads to break.
3 Steam clean or wash the parts with solvent to remove all of the foreign material and plastic beads after cleaning. Rinse with hot water. Dry with compressed air.

CAUTION

The bead blasting operation must not disturb the metal surface. If the metal surface is disturbed the engine can be damaged due to increased parts clearance or inadequate surface finish on parts that move against other parts.

When cleaning pistons, it is not necessary to remove all the dark stain from the piston. All that is necessary is to remove the carbon on the rim and in the ring grooves. This is best done by directing the blast across the part as opposed to straight at the part. If the machining marks are disturbed by the blasting process, then the pressure is too high or the blast is being held on one spot too long. The blast operation must not disturb the metal surface.

Walnut shell bead blast material is sometimes used to clean ferrous metals (iron and steel). Walnut shell blasting produces a great amount of dust particularly when the pressure if the air pressure on the blasting machine is increased above media manufacturer's recommendation. Cummins Inc. recommends not using walnut shell media to clean engine parts due to the risk media embedment and subsequent contamination of the engine.

Cummins Inc. now recommends glass bead media NOT used to clean any engine parts. Glass media is too easily embedded into the material particularly in soft materials and when air pressures greater than media manufacturer's recommend are used. The glass is an abrasive so when it is in a moving part, that part is abrading all the parts in contact with it. When higher pressures are used the media is broken and forms a dust of a very small size that floats easily in the air. This dust is very hard to control in the shop, particularly if only compressed air (and not hot water) is used to blow the media after it is removed from the blasting cabinet (blowing the part off inside the cabinet may remove large accumulations but never removes all the media).

Bead blasting is best used on stubborn dirt/carbon build-up that has not been removed by first steam/higher pressure washing then washing in a heated wash tank. This is particularly true of pistons. Steam and soak the pistons first then use the plastic bead method to safely remove the carbon remaining in the grooves (instead of running the risk of damaging the surface finish of the groove with a wire wheel or end of a broken piston ring. Make sure the parts are dry and oil free before bead blasting to prevent clogging the return on the blasting machine.

Always direct the bead blaster nozzle "across" rather than directly at the part. This allows the bead to get under the unwanted material. Keep the nozzle moving rather than hold on one place. Keeping the nozzle directed at one-place too long causes the metal to heat up and be moved around. Remember that the spray is not just hitting the dirt or carbon. If the machining marks on the piston groove or rim have been disturbed then there has not been enough movement of the nozzle and/or the air pressure is too high.

Never bead blast valve stems. Tape or use a sleeve to protect the stems during bead blasting. Direct the nozzle across the seat surface and radius rather than straight at them. The object is to remove any carbon build up and continuing to blast to remove the stain is a waste of time.

Fuel System

When servicing any fuel system components, which can be exposed to potential contaminants, prior to disassembly, clean the fittings, mounting hardware, and the area around the component to be removed. If the surrounding areas are not cleaned, dirt or contaminants can be introduced into the fuel system.

The internal drillings of some injectors are extremely small and susceptible to plugging from contamination. Some fuel injection systems can operate at very high pressures. High pressure fuel can convert simple particles of dirt and rust into a highly abrasive contaminant that can damage the high pressure pumping components and fuel injectors.

Electrical contact cleaner can be used if steam cleaning tools are not available. Use electrical contact cleaner rather than compressed air, to wash dirt and debris away from fuel system fittings. Diesel fuel on exposed fuel system parts attracts airborne contaminants.

Choose lint free towels for fuel system work.

Cap and plug fuel lines, fittings, and ports whenever the fuel system is opened. Rust, dirt, and paint can enter the fuel system whenever a fuel line or other component is loosened or removed from the engine. In many instances, a good practice is to loosen a line or fitting to break the rust and paint loose, and then clean off the loosened material.

When removing fuel lines or fittings from a new or newly-painted engine, make sure to remove loose paint flakes/chips that can be created when a wrench contacts painted line nuts or fittings, or when quick disconnect fittings are removed.

Fuel filters are rated in microns. The word micron is the abbreviation for a micrometer, or one millionth of a meter. The micron rating is the size of the smallest particles that will be captured by the filter media. As a reference, a human hair

is 76 microns [0.003 in] in diameter. One micron measures 0.001 mm [0.00004 in.]. The contaminants being filtered out are smaller than can be seen with the human eye, a magnifying glass, or a low powered microscope.

The tools used for fuel system troubleshooting and repair are to be cleaned regularly to avoid contamination. Like fuel system parts, tools that are coated with oil or fuel attract airborne contaminants. Remember the following points regarding your fuel system tools:

- Fuel system tools are to be kept as clean as possible.
- Clean and dry the tools before returning them to the tool box.
- If possible, store fuel system tools in sealed containers.
- Make sure fuel system tools are clean before use.

## Acronyms and Abbreviations

### General Information

The following list contains some of the acronyms and abbreviations used in this manual.

<b>ANSI</b>	American National Standards Institute
<b>API</b>	American Petroleum Institute
<b>ASTM</b>	American Society of Testing and Materials
<b>ATDC</b>	After Top Dead Center
<b>BTU</b>	British Thermal Unit
<b>BTDC</b>	Before Top Dead Center
<b>°C</b>	Celsius
<b>CAN</b>	Controller Area Network
<b>CO</b>	Carbon Monoxide
<b>CCA</b>	Cold Cranking Amperes
<b>CARB</b>	California Air Resources Board
<b>C.I.B.</b>	Customer Interface Box
<b>C.I.D.</b>	Cubic Inch Displacement
<b>CNG</b>	Compressed Natural Gas
<b>CPL</b>	Control Parts List
<b>cSt</b>	Centistokes
<b>DEF</b>	Diesel Exhaust Fluid
<b>DOC</b>	Diesel Oxidation Catalyst
<b>DPF</b>	Diesel Particulate Filter
<b>ECM</b>	Engine Control Module
<b>EFC</b>	Electronic Fuel Control
<b>EGR</b>	Exhaust Gas Recirculation
<b>EPA</b>	Environmental Protection Agency
<b>°F</b>	Fahrenheit
<b>ft-lb</b>	Foot-Pound Force
<b>FMI</b>	Failure Mode Identifier
<b>GVW</b>	Gross Vehicle Weight
<b>Hg</b>	Mercury
<b>hp</b>	Horsepower
<b>H<sub>2</sub>O</b>	Water
<b>inHg</b>	Inches of Mercury
<b>in H<sub>2</sub>O</b>	Inches of Water
<b>ICM</b>	Ignition Control Module
<b>IEC</b>	International Electrotechnical Commission
<b>km/l</b>	Kilometers per Liter
<b>kPa</b>	Kilopascal
<b>LNG</b>	Liquid Natural Gas
<b>LPG</b>	Liquified Petroleum Gas
<b>LTA</b>	Low Temperature Aftercooling
<b>MCRS</b>	Modular Common Rail System
<b>MIL</b>	Malfunction Indicator Lamp
<b>MPa</b>	Megapascal
<b>mph</b>	Miles Per Hour
<b>mpq</b>	Miles Per Quart
<b>N•m</b>	Newton-meter



<b>NOx</b>	Mono-Nitrogen Oxides
<b>NG</b>	Natural Gas
<b>O2</b>	Oxygen
<b>OBD</b>	On-Board Diagnostics
<b>OEM</b>	Original Equipment Manufacturer
<b>OSHA</b>	Occupational Safety and Health Administration
<b>PID</b>	Parameter Identification Descriptions
<b>ppm</b>	Parts Per Million
<b>psi</b>	Pounds Per Square Inch
<b>PTO</b>	Power Takeoff
<b>REPTO</b>	Rear Power Take Off
<b>RGT</b>	Rear Gear Train
<b>rpm</b>	Revolutions Per Minute
<b>SAE</b>	Society of Automotive Engineers
<b>SCA</b>	Supplemental Coolant Additive
<b>SCR</b>	Selective Catalytic Reduction
<b>STC</b>	Step Timing Control
<b>SID</b>	Subsystem Identification Descriptions
<b>TDC</b>	Top Dead Center
<b>VDC</b>	Volts of Direct Current
<b>VGT</b>	Variable Geometry Turbocharger
<b>VS</b>	Variable Speed
<b>VSS</b>	Vehicle Speed Sensor

Section TF - Troubleshooting Fault Codes

Section Contents

Table listing fault codes (e.g., 1669, 1671, 1673) and their corresponding page numbers (e.g., TF-1, TF-3, TF-12).

Real-Time Clock Power Interrupt - Data Erratic, Intermittent or Incorrect	
<b>Fault Code</b> .....	TF-118
<b>Fault Code 1692</b> .....	TF-127
Aftertreatment Outlet NOx Sensor - Voltage Below Normal, or Shorted to Low Source	
<b>Fault Code</b> .....	TF-129
<b>Fault Code 1694</b> .....	TF-137
Aftertreatment Outlet NOx Sensor - Data Erratic, Intermittent, or Incorrect	
<b>Fault Code</b> .....	TF-139
<b>Fault Code 1697</b> .....	TF-145
Aftertreatment #1 Air Enable Actuator — Voltage Above Normal, or Shorted to High Source.	
<b>Fault Code</b> .....	TF-147
<b>Fault Code 1698</b> .....	TF-153
Aftertreatment #1 Air Enable Actuator — Voltage Below Normal, or Shorted to Low Source.	
<b>Fault Code</b> .....	TF-155
<b>Fault Code 1699</b> .....	TF-165
Catalyst Tank Level Sensor — Data Erratic, Intermittent, or Incorrect.	
<b>Fault Code</b> .....	TF-167
<b>Fault Code 1711</b> .....	TF-173
Dosing Control Unit Data Link — Abnormal Update Rate	
<b>Fault Code</b> .....	TF-175
<b>Fault Code 1712</b> .....	TF-185
Catalyst Tank Heater Circuit — Data Valid But Below Normal Operating Range — Moderately Severe Level	
<b>Fault Code</b> .....	TF-187
<b>Fault Code 1713</b> .....	TF-193
Catalyst Tank Heater Circuit - Data Valid But Above Normal Operating Range - Moderately Severe Level	
<b>Fault Code</b> .....	TF-195
<b>Fault Code 1716</b> .....	TF-200
Auxiliary Temperature Sensor Input 1 Circuit - Root Cause Not Known	
<b>Fault Code</b> .....	TF-202
<b>Fault Code 1717</b> .....	TF-203
Exhaust Gas Temperature 1 — Data Valid but Above Normal Operational Range — Least Severe Level	
<b>Fault Code</b> .....	TF-204
<b>Fault Code 1718</b> .....	TF-207
Engine Misfire for Multiple Cylinders — Condition Exists.	
<b>Fault Code</b> .....	TF-209
<b>Fault Code 1845</b> .....	TF-212
Water-in-Fuel Indicator Sensor Circuit - Voltage Above Normal or Shorted to High Source (For Generator Engines Only)	
<b>Fault Code</b> .....	TF-214
<b>Fault Code 1846</b> .....	TF-224
Water-in-Fuel Indicator Sensor Circuit - Voltage Below Normal or Shorted to Low Source (For Generator Engines Only)	
<b>Fault Code</b> .....	TF-226
<b>Fault Code 1848</b> .....	TF-234
Intake Manifold 1 Temperature — Abnormal Rate of Change	
<b>Fault Code</b> .....	TF-236
<b>Fault Code 1849</b> .....	TF-243
Exhaust Gas Temperature 1 — Abnormal Rate of Change	
<b>Fault Code</b> .....	TF-245

Table listing fault codes (e.g., 1851, 1892, 1911, 1992, 2183, 2185, 2186, 2195, 2215b, 2215cl, 2216b, 2216cl, 2217, 2249, 2265, 2266) and their corresponding page numbers (e.g., TF-251, TF-253, TF-259, TF-261, TF-269, TF-271, TF-283, TF-285, TF-289, TF-291, TF-302, TF-303, TF-308, TF-309, TF-315, TF-316, TF-319, TF-322, TF-340, TF-342, TF-357, TF-359, TF-365, TF-366, TF-371, TF-373, TF-380, TF-381, TF-382, TF-384, TF-400, TF-402).

<b>Fault Code 2271</b> .....	TF-412
EGR Valve Position Sensor Circuit - Voltage Above Normal or Shorted to High Source	
<b>Fault Code</b> .....	TF-413
<b>Fault Code 2272</b> .....	TF-420
EGR Valve Position Sensor Circuit - Voltage Below Normal or Shorted to Low Source	
<b>Fault Code</b> .....	TF-421
<b>Fault Code 2273</b> .....	TF-430
EGR Valve Differential Pressure Sensor Circuit - Shorted High	
<b>Fault Code</b> .....	TF-432
<b>Fault Code 2274</b> .....	TF-439
EGR Valve Differential Pressure Sensor Circuit - Shorted Low	
<b>Fault Code</b> .....	TF-441
<b>Fault Code 2292</b> .....	TF-448
Fuel Inlet Meter Device - Data Valid but Above Normal Operational Range - Moderately Severe Level	
<b>Fault Code</b> .....	TF-450
<b>Fault Code 2293</b> .....	TF-456
Fuel Inlet Meter Device Flow Demand Lower Than Expected - Data Valid but Below Normal Operational Range - Moderately Severe Level	
<b>Fault Code</b> .....	TF-458
<b>Fault Code 2311</b> .....	TF-462
Fueling Actuator Number 1 Circuit Error Conditions Exists	
<b>Fault Code</b> .....	TF-464
<b>Fault Code 2321</b> .....	TF-473
Engine Crankshaft Speed/Position - Data Erratic, Intermittent, or Incorrect	
<b>Fault Code</b> .....	TF-475
<b>Fault Code 2322</b> .....	TF-481
Backup Engine Speed/Position Sensor Number 2 - Data Erratic, Intermittent, or Incorrect	
<b>Fault Code</b> .....	TF-483
<b>Fault Code 2345b</b> .....	TF-489
Turbocharger Speed - Invalid Rate of Change Detected	
<b>Fault Code</b> .....	TF-490
<b>Fault Code 2345cl</b> .....	TF-492
Turbocharger Speed Invalid Rate of Change Detected - Abnormal Rate of Change	
<b>Fault Code</b> .....	TF-493
<b>Fault Code 2346b</b> .....	TF-496
Exhaust Gas Temperature - Data Above Normal	
<b>Fault Code</b> .....	TF-497
<b>Fault Code 2346cl</b> .....	TF-500
Turbocharger Turbine Inlet Temperature (Calculated) - Data Valid but Above Normal Operational Range - Least Severe Level	
<b>Fault Code</b> .....	TF-502
<b>Fault Code 2347b</b> .....	TF-509
Turbocharger Compressor Outlet Temperature - Data Above Normal	
<b>Fault Code</b> .....	TF-511
<b>Fault Code 2347cl</b> .....	TF-515
Turbocharger Compressor Outlet Air Temperature (Calculated) - Data Valid but Above Normal Range	
<b>Fault Code</b> .....	TF-517
<b>Fault Code 2348</b> .....	TF-527

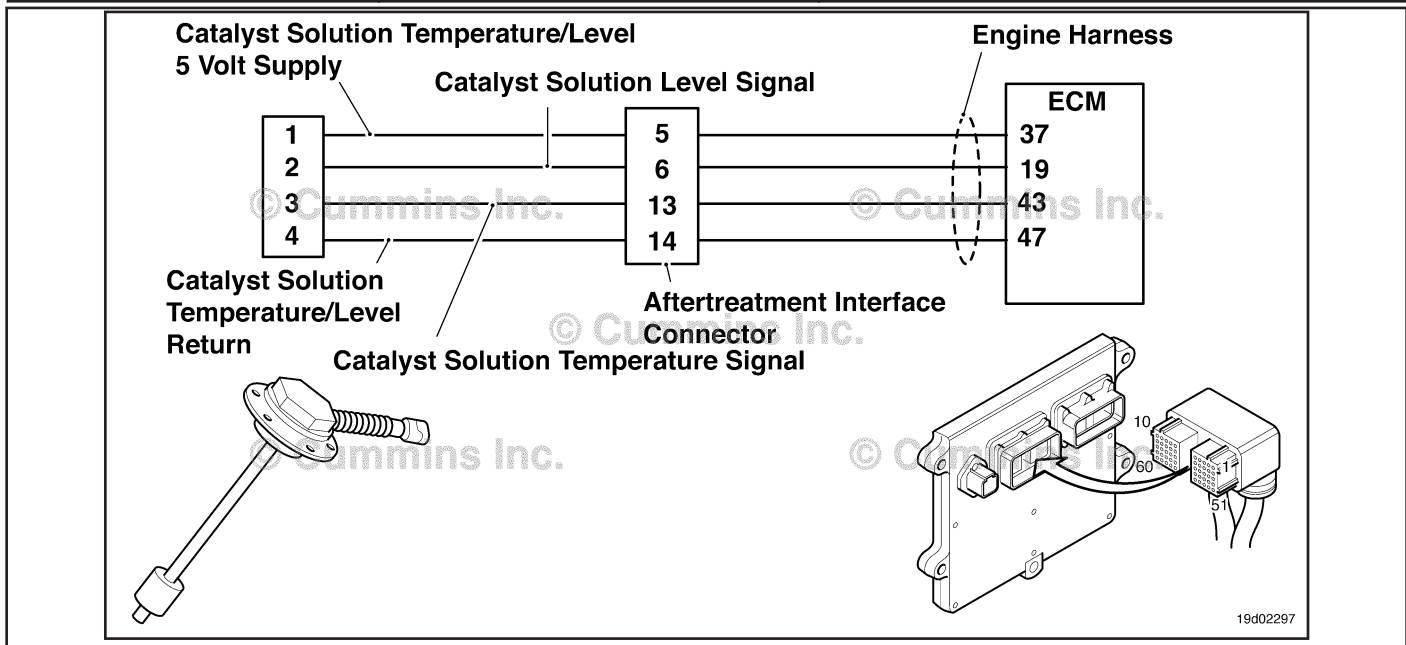
EGR Valve Failed Automatic Calibration Procedure	
<b>Fault Code</b> .....	TF-528
<b>Fault Code 2349</b> .....	TF-532
EGR Valve Control Circuit - Current Below Normal or Open Circuit	
<b>Fault Code</b> .....	TF-534
<b>Fault Code 2351</b> .....	TF-542
EGR Valve Control Circuit - Voltage Below Normal or Shorted to Low Source	
<b>Fault Code</b> .....	TF-543
<b>Fault Code 2352</b> .....	TF-550
EGR Valve Control Circuit - Voltage Above Normal or Shorted to High Source	
<b>Fault Code</b> .....	TF-552
<b>Fault Code 2353</b> .....	TF-557
EGR Valve Control Circuit - Current Above Normal or Grounded Circuit	
<b>Fault Code</b> .....	TF-558
<b>Fault Code 2357</b> .....	TF-564
EGR Valve Control - Mechanical System Not Responding Properly or Out of Adjustment	
<b>Fault Code</b> .....	TF-566
<b>Fault Code 2359</b> .....	TF-572
EGR Differential Pressure Sensor - Data Valid But Above Normal Operating Range - Moderately Severe Level	
<b>Fault Code</b> .....	TF-574
<b>Fault Code 2362</b> .....	TF-582
Engine Brake Actuator Circuit #1 - Voltage Below Normal or Shorted to Low Source	
<b>Fault Code</b> .....	TF-583
<b>Fault Code 2363</b> .....	TF-594
Engine Brake Actuator Circuit #2 - Voltage Below Normal or Shorted to Low Source	
<b>Fault Code</b> .....	TF-595
<b>Fault Code 2366</b> .....	TF-605
Engine Brake Actuator Circuit #1 - Voltage Above Normal or Shorted to High Source	
<b>Fault Code</b> .....	TF-607
<b>Fault Code 2367</b> .....	TF-617
Engine Brake Actuator Circuit #2 - Voltage Above Normal or Shorted to High Source	
<b>Fault Code</b> .....	TF-618
<b>Fault Code 2373</b> .....	TF-627
Exhaust Gas Pressure Sensor Circuit - Shorted High	
<b>Fault Code</b> .....	TF-628
<b>Fault Code 2374</b> .....	TF-635
Exhaust Gas Pressure Sensor Circuit - Shorted Low	
<b>Fault Code</b> .....	TF-636
<b>Fault Code 2375</b> .....	TF-644
Exhaust Gas Recirculation (EGR) Temperature Sensor Circuit - Voltage Above Normal or Shorted to High Source	
<b>Fault Code</b> .....	TF-646
<b>Fault Code 2376</b> .....	TF-656
Recirculation Exhaust Gas Temperature Sensor Circuit - Voltage Below Normal or Shorted to Low Source	
<b>Fault Code</b> .....	TF-658
<b>Fault Code 2377</b> .....	TF-666
Fan Control Circuit - Voltage Above Normal or Shorted to High Source	
<b>Fault Code</b> .....	TF-668
<b>Fault Code 2381</b> .....	TF-677

Turbocharger Position Sensor Circuit - Shorted High	
<b>Fault Code</b> .....	TF-678
<b>Fault Code 2382</b> .....	TF-685
Turbocharger Position Sensor Circuit - Shorted Low	
<b>Fault Code</b> .....	TF-686
<b>Fault Code 2383</b> .....	TF-693
Variable Geometry Turbocharger Actuator Circuit - Current Below Normal, or Open Circuit	
<b>Fault Code</b> .....	TF-695
<b>Fault Code 2384b</b> .....	TF-704
VGT Actuator Driver Circuit - Voltage Below Normal, or Shorted to Low Source	
<b>Fault Code</b> .....	TF-705
<b>Fault Code 2384cl</b> .....	TF-713
VGT Actuator - Voltage Below Normal or Shorted to Low Source	
<b>Fault Code</b> .....	TF-715
<b>Fault Code 2385b</b> .....	TF-722
VGT Actuator Driver Circuit - Voltage Above Normal or Shorted to High Source	
<b>Fault Code</b> .....	TF-723
<b>Fault Code 2385cl</b> .....	TF-728
VGT Actuator - Voltage Above Normal or Shorted to High Source	
<b>Fault Code</b> .....	TF-730
<b>Fault Code 2386</b> .....	TF-740
Turbocharger Actuator Motor Circuit - Current Above Normal	
<b>Fault Code</b> .....	TF-741
<b>Fault Code 2387</b> .....	TF-749
Turbocharger Actuator Motor - Mechanical System Not Responding Properly	
<b>Fault Code</b> .....	TF-750
<b>Fault Code 2388</b> .....	TF-755
Variable Geometry Turbocharger Actuator Position Failed Automatic Calibration Procedure - Out of Calibration	
<b>Fault Code</b> .....	TF-756
<b>Fault Code 2448</b> .....	TF-761
Coolant Level - Data Valid But Below Normal Operational Range - Least Severe Level	
<b>Fault Code</b> .....	TF-763
<b>Fault Code 2554</b> .....	TF-764
Exhaust Pressure Sensor Circuit - Data Erratic, Intermittent, or Incorrect	
<b>Fault Code</b> .....	TF-765
<b>Fault Code 2555</b> .....	TF-767
Intake Air Heater #1 Circuit - Voltage Above Normal or Shorted to High Source	
<b>Fault Code</b> .....	TF-768
<b>Fault Code 2556</b> .....	TF-778
Intake Air Heater #1 Circuit - Voltage Below Normal or Shorted to Low Source	
<b>Fault Code</b> .....	TF-779

## Fault Code 1669

### Catalyst Tank Level Sensor Circuit — Voltage Above Normal, or Shorted to High Source

CODES	REASON	EFFECT
Fault Code: 1669 PID(P), SID(S): SPN: 1761 FMI: 3 Lamp: Amber SRT:	Catalyst Tank Level Sensor Circuit — Voltage Above Normal, or Shorted to High Source. High signal voltage detected at the catalyst tank level sensor circuit.	Catalyst solution injection into the aftertreatment system is disabled.



#### Circuit Description:

The catalyst tank level sensor is used to monitor the catalyst solution level inside the catalyst tank. The catalyst tanks level sensor is a combination sensor with the catalyst solution temperature sensor. The level and temperature sensors share a common return circuit.

#### Component Location:

The catalyst tank level sensor is located in the catalyst tank. Location of the tank and level sensor is OEM dependent.

#### Shop Talk:

The catalyst tank level sensor shares supply and return wires in the engine harness with other sensors. Opens and shorts in the engine harness can cause multiple fault codes to be active.

Before troubleshooting Fault Code 1669, check for multiple faults.

Possible causes of this fault code include:

- Open return circuit in the harness, connectors, or sensor
- Signal circuit shorted to sensor supply or battery voltage.

On-Board Diagnostics (OBD) Information (Euro 4 Certified Engines):

- The ECM illuminates the malfunction indicator lamp (MIL) when the diagnostic runs and fails.
- The ECM turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does **not** fail. The MIL lamp and fault code can also be cleared using the INSITE™ service tool.



- The fault code will be cleared from memory after 40 consecutive drive cycles where the diagnostic runs and passes.
- On-Board Diagnostics (OBD) Information (Euro 4 Stage 1+ Certified Engines):
- The ECM illuminates the malfunction indicator lamp (MIL) when the diagnostic runs and fails.
  - An engine torque derate will be activated after 50 hours of engine operation with the fault code active.
  - The ECM turns OFF the malfunction indicator lamp (MIL) after 1 ignition cycle that the diagnostic runs and does **not** fail. The MIL lamp **cannot** be cleared using the INSITE™ service tool.
  - The fault code will be cleared from memory after 400 days or 9600 hours of engine operation.

**Refer to Troubleshooting Fault Code t05-1669**

FAULT CODE 1669 - Catalyst Tank Level Sensor Circuit — Voltage Above Normal, or Shorted to High Source
TROUBLESHOOTING SUMMARY



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



To reduce the possibility of pin and harness damage, use the following test leads when taking a measurement: Part Number 3822758 - male Deutsch™/AMP™/Metri-Pack™ test lead and Part Number 3822917 - female Deutsch™/AMP™/Metri-Pack™ test lead.

Table with 3 columns: STEPS, SPECIFICATIONS, and SRT CODE. It lists troubleshooting steps from Step 1 to Step 4, including sub-steps like Step 1A, Step 2A, etc., with corresponding specifications and SRT codes.

**TROUBLESHOOTING STEP****STEP 1: Check the fault codes****STEP 1A: Check for sensor supply fault codes.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
<b>Action</b>	<b>Specification/Repair</b>	<b>Next Step</b>
Check for sensor supply fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 227 active? <b>YES</b>	Refer to Fault Code 227
	Fault Code 227 active? <b>NO</b>	1B

**STEP 1B: Check for an inactive fault code.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
<b>Action</b>	<b>Specification/Repair</b>	<b>Next Step</b>
Check for inactive fault code. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 1669 is inactive? <b>YES</b>	Use the following procedure for an inactive or intermittent fault code. Refer to Procedure 019-362 in Section 19.
	Fault Code 1669 is inactive? <b>NO</b>	2A

**STEP 2: Check the catalyst tank level sensor and circuit.**

**STEP 2A: Inspect the catalyst tank level sensor and connector pins.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the catalyst tank level sensor from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the engine harness and catalyst tank level sensor connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A defective connection has been detected in the sensor or harness connector.</p> <p>Clean the connector and pins.</p> <p>Repair the damaged harness, connector, or pins if possible. Refer to Procedure 019-043 in Section 19.</p>	4A
	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	2B

**STEP 2B: Check the circuit response.**

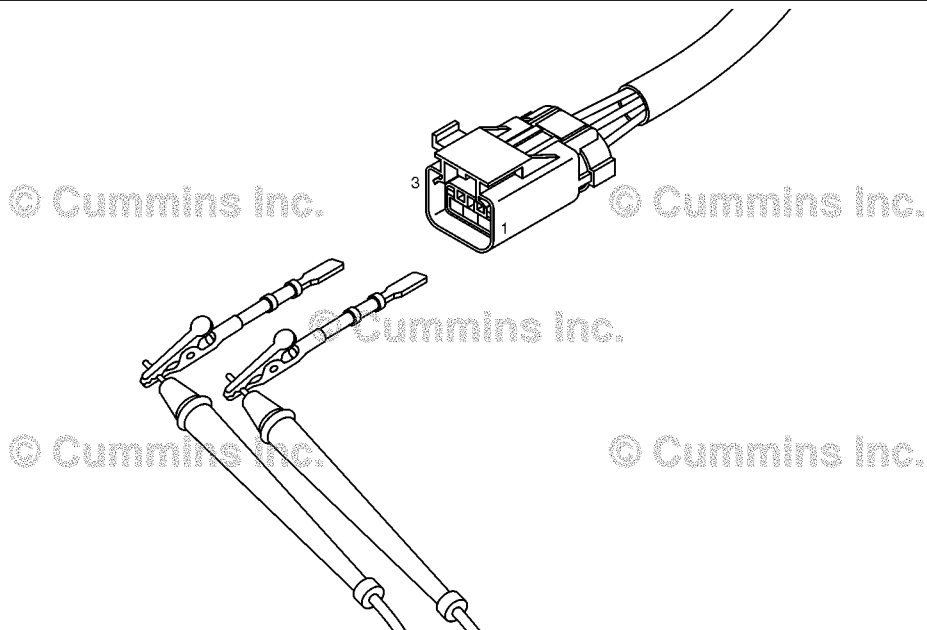
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the catalyst tank level sensor from the engine harness.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check the appropriate circuit response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Using INSITE™ electronic service tool read the fault codes.</li> </ul>	<p>Fault Code 1668 active and fault code 1669 inactive?</p> <p><b>YES</b></p>	2C
	<p>Fault Code 1668 active and fault code 1669 inactive?</p> <p><b>NO</b></p>	3A

**STEP 2C: Check the sensor supply voltage and return circuit.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the catalyst tank level sensor from the engine harness.
- Turn keyswitch ON.

Action	Specification/Repair	Next Step
Check the supply voltage and return circuit. • Measure the voltage from the CATALYST TANK LEVEL +5 VDC SUPPLY pin to the CATALYST TANK LEVEL RETURN pin at the sensor connector of the engine harness.  Refer to the wiring diagram for connector pin identification.	4.75 to 5.25 VDC? <b>YES</b>	2D
	4.75 to 5.25 VDC? <b>NO</b>	3B



19c01108

**STEP 2D: Check the fault codes and verify sensor condition**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Connect the catalyst tank level sensor to the engine harness.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate circuit response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault code 1669 is active?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A damaged sensor has been detected.</p> <p>Replace the catalyst tank level sensor. Refer to OEM service manual.</p>	4A
	<p>Fault code 1669 is active?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>None. The removal and reinstallation of the connector corrected the problem.</p>	4A

**STEP 3: Check the ECM and engine harness.**

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

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM connector.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the engine harness and ECM engine connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A damaged connection has been detected in the ECM engine connector or the engine harness connector.</p> <p>Clean the connector and pins.</p> <p>Repair the damaged harness, connector, or pins if possible. Refer to Procedure 019-043 in Section 19.</p>	4A
	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	3A-1

**STEP 3A-1: Check the engine control module response.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF</li> <li>• Disconnect the engine harness from the ECM</li> <li>• Turn keyswitch ON</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check the appropriate circuit response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault Code 1668 active and fault code 1669 inactive?</p> <p><b>YES</b></p>	3A-2
	<p>Fault Code 1668 active and fault code 1669 inactive?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Replace the ECM. Refer to Procedure 019-031 in Section 19.</p>	4A

**STEP 3A-2: Check for an active fault code.**

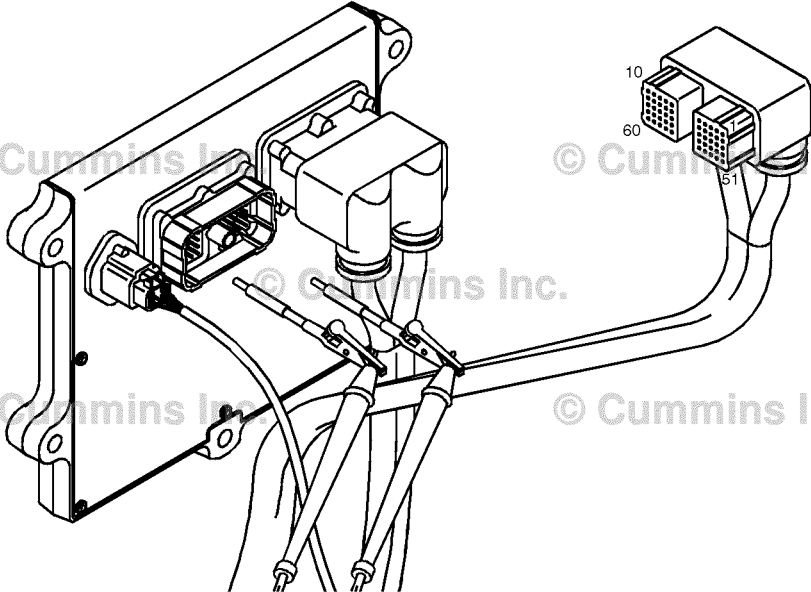
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check the appropriate circuit response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault code 1669 inactive?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>None. The removal and reinstallation of the connector corrected the problem.</p>	4A
	<p>Fault code 1669 active?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>A pin-to-pin short circuit has been detected on the signal line of the engine harness.</p> <p>Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.</p>	4A

**STEP 3B: Inspect engine control module and engine harness connector pins.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the engine harness and engine control module engine connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A damaged connection has been detected in the engine control module engine connector or engine harness connector.</p> <p>Clean the connector and pins.</p> <p>Repair the damaged harness, connector or pins if possible. Refer to Procedure 019-043 in Section 19.</p>	<p>4A</p>
	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	<p>3B-1</p>



**STEP 3B-1: Check the sensor supply voltage and return circuit.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM engine connector.</li> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check the supply voltage and return circuit.</p> <ul style="list-style-type: none"> <li>• Measure the voltage from the CATALYST TANK LEVEL +5 VDC SUPPLY pin and the CATALYST TANK LEVEL RETURN pin at the engine control module engine connector.</li> </ul> <p>Refer to the wiring diagram for connector pin identification.</p>	<p>4.75 to 5.25 VDC? <b>YES</b></p>	<p>3B-2</p>
	<p>4.75 to 5.25 VDC? <b>NO</b></p> <p><b>Repair:</b></p> <p>Replace the ECM. Refer to Procedure 019-031 in Section 19.</p>	<p>4A</p>
		

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**STEP 3B-2: Check for an active fault code.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for the appropriate circuit response after 30 seconds. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 1669 inactive? <b>YES</b> <b>Repair:</b> None. The removal and reinstallation of the connector corrected the problem.	4A
	Fault Code 1669 inactive? <b>NO</b> <b>Repair:</b> An open RETURN circuit has been detected in the engine harness.  Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.	4A

**STEP 4: Clear the fault code.**

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

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> <li>• Start the engine and let it idle for 1 minute.</li> <li>• Use INSITE™ electronic service tool to verify the fault code is inactive.</li> </ul>	Fault Code 1669 inactive? <b>YES</b>	4B
	Fault Code 1669 inactive? <b>NO</b>	1A

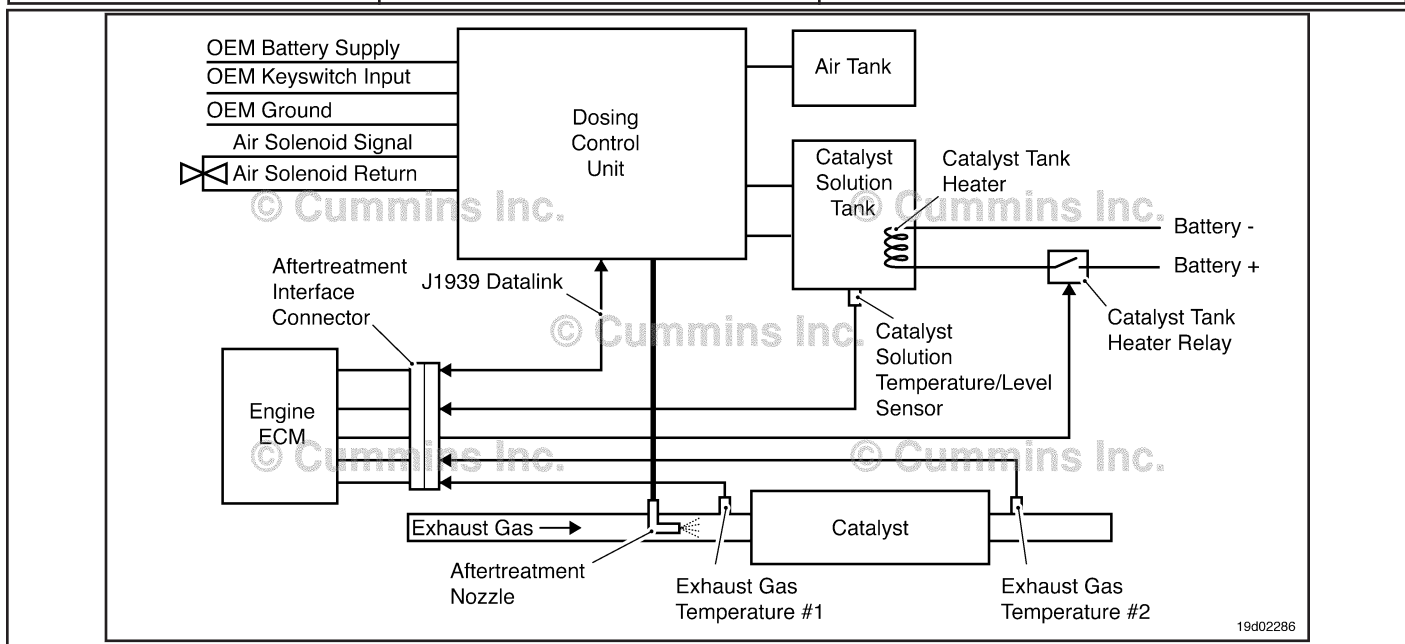
**STEP 4B: Clear the inactive fault codes.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to erase the inactive fault codes.</li> </ul>	All fault codes cleared? <b>YES</b>	Repair complete
	All fault codes cleared? <b>NO</b>	Appropriate troubleshooting steps

## Fault Code 1671

### Catalyst Tank Level — Data Valid but Below Normal Operational Range — Moderately Severe Level.

CODES	REASON	EFFECT
Fault Code: 1671 PID(P), SID(S): SPN: 1761 FMI: 1/18 Lamp: Maintenance SRT:	Catalyst Tank Level — Data Valid but Below Normal Operational Range — Moderately Severe Level. Low catalyst solution level has been detected in the catalyst solution tank.	None on performance.



Circuit: Aftertreatment Control System

#### Circuit Description:

The catalyst solution level sensor is used to monitor the catalyst solution level inside the catalyst tank.

#### Component Location:

The catalyst solution level sensor is located in the catalyst solution tank. Location of the tank and level sensor is OEM dependent.

#### Shop Talk:

Fault code 1671 is triggered when low catalyst solution level has been detected in the catalyst solution tank. Add catalyst solution to the tank. This fault code is only a warning for low catalyst tank solution level.

On-Board Diagnostic (OBD) Information:

- The ECM illuminates the appropriate amber or red fault lamp when the diagnostic runs and fails.
- The ECM turns off the appropriate fault lamp when the diagnostic runs and passes.

#### Refer to Troubleshooting Fault Code t05-1671

## FAULT CODE 1671 - Catalyst Tank Level - Data Valid But Below Normal Operational Range - Moderately Severe Level TROUBLESHOOTING SUMMARY



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



To reduce the possibility of pin and harness damage, use the following test leads when taking a measurement: Part Number 3822758 - male Deutsch™/AMP™/Metri-Pack™ test lead and Part Number 3822917 - female Deutsch™/AMP™/Metri-Pack™ test lead.

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1:</b> Check the fault codes.		
<b>STEP 1A:</b> Read the fault codes.	Fault Code 1671 active?	
<b>STEP 2:</b> Clear the fault code.		
<b>STEP 2A:</b> Disable the fault code.	Fault Code 1671 inactive?	
<b>STEP 2B:</b> Clear the inactive fault code.	All faults cleared?	

### TROUBLESHOOTING STEP

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

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Read fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault code 1671 active? <b>YES</b> <b>Repair:</b> Low catalyst solution level has been detected. Add catalyst solution to the catalyst solution tank.	2A
	Fault code 1671 active? <b>NO</b>	2A

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

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components</li> <li>• Turn the keyswitch ON</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to verify that the fault code is inactive.</li> </ul>	Fault Code 1671 inactive? <b>YES</b>	2B
	Fault Code 1671 inactive? <b>NO</b>	1A

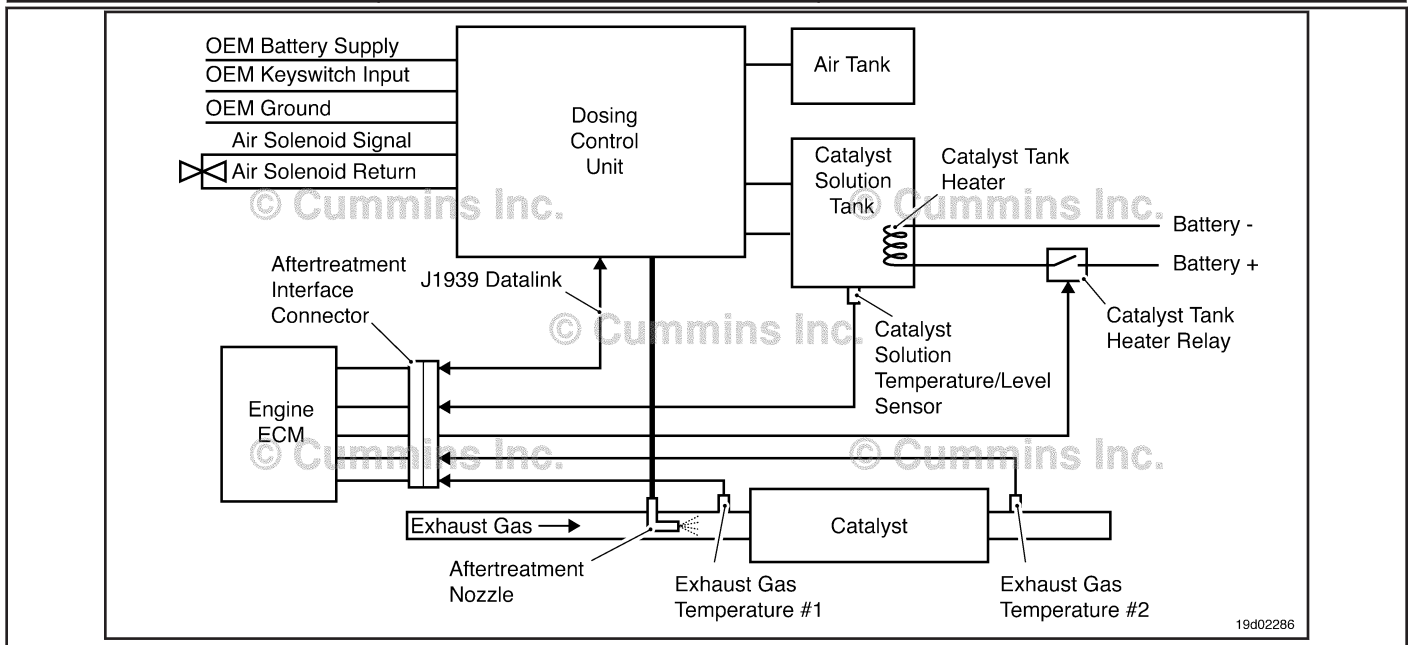
**STEP 2B: Clear the inactive fault codes.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components</li> <li>• Turn the keyswitch ON</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to clear all the inactive fault codes.</li> </ul>	All faults cleared? <b>YES</b>	Repair complete.
	All faults cleared? <b>NO</b>	Appropriate troubleshooting steps.

## Fault Code 1673

### Catalyst Tank Level - Data Erratic, Intermittent, or Incorrect.

CODES	REASON	EFFECT
Fault Code: 1673 PID(P), SID(S): SPN: 1761 FMI: 1 Lamp: Amber SRT:	Catalyst Tank Level — Data Valid but Below Normal Operational Range — Most Severe Level. No catalyst solution has been detected in the catalyst solution tank.	Catalyst solution injection into the aftertreatment system is disabled.



Circuit: Aftertreatment Control System

**Circuit Description:**

The catalyst solution level sensor is used to monitor the catalyst solution level inside the catalyst tank.

**Component Location:**

The catalyst solution level sensor is located in the catalyst solution tank. Location of the tank and level sensor is OEM dependent.

**Shop Talk:**

Fault code 1673 is triggered when the catalyst solution level sensor has detected that the catalyst tank is empty. Catalyst solution may still be visible inside the tank when this fault code is active. Add catalyst solution to the tank.

On-Board Diagnostics (OBD) Information (Euro 4 Certified Engines):

- The ECM illuminates the malfunction indicator lamp (MIL) when the diagnostic runs and fails.
- The ECM turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does **not** fail. The MIL lamp and fault code can also be cleared using the INSITE™ service tool.
- The fault code will be cleared from memory after 40 consecutive drive cycles where the diagnostic runs and passes.

On-Board Diagnostics (OBD) Information (Euro 4 Stage 1+ Certified Engines):

- The ECM illuminates the malfunction indicator lamp (MIL) when the diagnostic runs and fails.
- An engine torque derate will be activated after 50 hours of engine operation with the fault code active.

- The ECM turns OFF the malfunction indicator lamp (MIL) after 1 ignition cycle that the diagnostic runs and does **not** fail. The MIL lamp **cannot** be cleared using the INSITE™ service tool.
- The fault code will be cleared from memory after 400 days or 9600 hours of engine operation.

**Refer to Troubleshooting Fault Code t05-1673**

## FAULT CODE 1673 - Catalyst Tank Level - Data Erratic, Intermittent, or Incorrect

### TROUBLESHOOTING SUMMARY



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



To reduce the possibility of pin and harness damage, use the following test leads when taking a measurement: Part Number 3822758 - male Deutsch™/AMP™/Metri-Pack™ test lead and Part Number 3822917 - female Deutsch™/AMP™/Metri-Pack™ test lead.

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1:</b> Check the fault codes.		
<b>STEP 1A:</b> Read the fault codes.	Fault code 1673 active?	
<b>STEP 2:</b> Clear the fault code.		
<b>STEP 2A:</b> Disable the fault code.	Fault code 1673 inactive?	
<b>STEP 2B:</b> Clear the inactive fault code.	All faults cleared?	

### TROUBLESHOOTING STEP

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

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Read fault codes. <ul style="list-style-type: none"> <li>• Using INSITE™ electronic service tool read the fault codes.</li> </ul>	Fault code 1673 active? <b>YES</b> <b>Repair:</b> No catalyst solution has been detected in the catalyst solution tank. Add catalyst solution to the catalyst solution tank.	2A
	Fault code 1673 active? <b>NO</b>	2A



**STEP 2: Clear the fault code.**

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

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components</li> <li>• Turn the keyswitch ON</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to verify that the fault code is inactive.</li> </ul>	Fault code 1673 inactive? <b>YES</b>	2B
	Fault code 1673 inactive? <b>NO</b>	1A

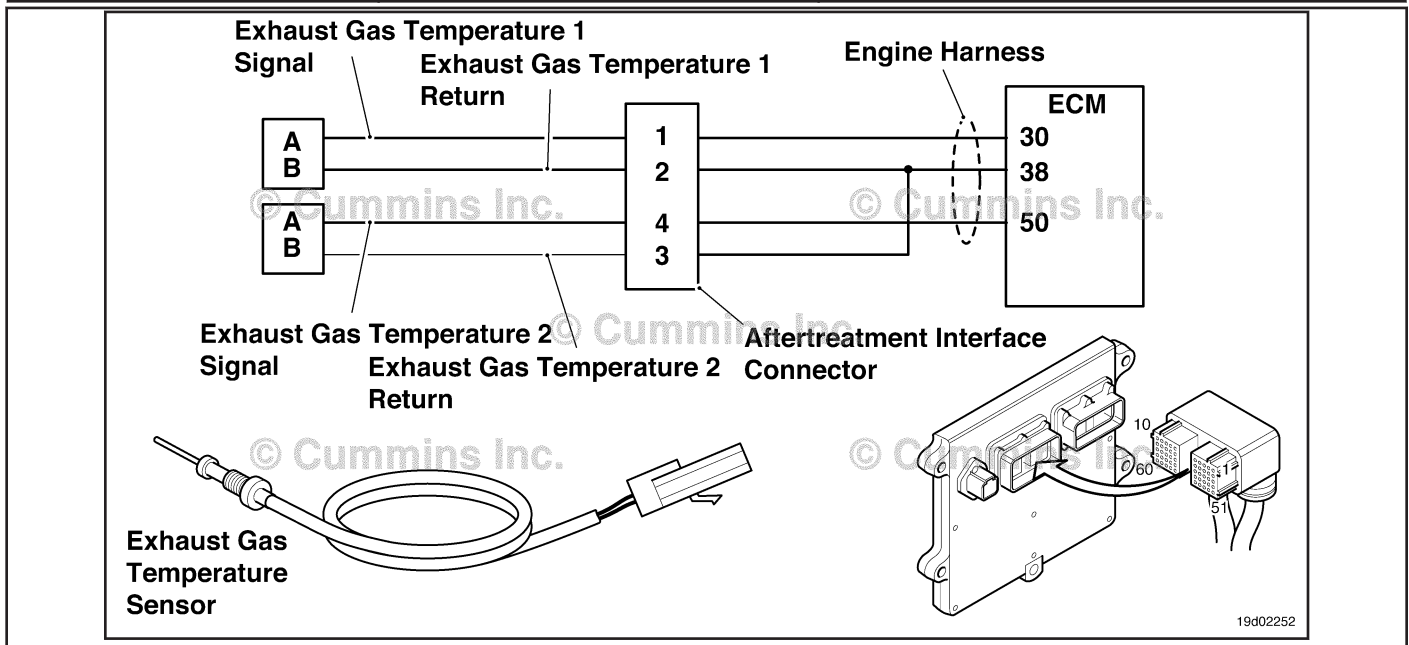
**STEP 2B: Clear the inactive fault codes.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components</li> <li>• Turn the keyswitch ON</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to erase all the inactive fault codes.</li> </ul>	All faults cleared? <b>YES</b>	Repair complete.
	All faults cleared? <b>NO</b>	Appropriate troubleshooting steps.

## Fault Code 1674

### Exhaust Gas Temperature 2 Circuit — Voltage Below Normal, or Shorted to Low Source

CODES	REASON	EFFECT
Fault Code: 1674 PID(P), SID(S): SPN: 3249 FMI: 4 Lamp: Amber SRT:	Exhaust Gas Temperature 2 Circuit — Voltage Below Normal, or Shorted to Low Source. Low signal voltage detected at the catalyst exhaust temperature sensor circuit.	Default temperature used for catalyst exhaust temperature.



Circuit: Exhaust Gas Temperature 2

**Circuit Description:**

The catalyst outlet temperature sensor is used by the electronic control module (ECM) to monitor the engine exhaust temperature exiting the catalyst unit. The ECM monitors the voltage on the signal pin and converts this to a temperature value.

**Component Location:**

The catalyst outlet temperature sensor is located in the aftertreatment system. It is located in the outlet of the aftertreatment catalyst unit.

**Shop Talk:**

The catalyst outlet temperature sensor shares return wires in the engine harness with other sensors. A shorted return can cause multiple fault codes to be active.

Possible causes of this fault code include:

- Signal shorted to ground in the harness
- Signal shorted to return or ground in the sensor.

On-Board Diagnostics (OBD) Information (Euro 4 Certified Engines):

- The ECM illuminates the malfunction indicator lamp (MIL) when the diagnostic runs and fails.
- The ECM turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does **not** fail. The MIL lamp and fault code can also be cleared using the INSITE™ service tool.

- The fault code will be cleared from memory after 40 consecutive drive cycles where the diagnostic runs and passes.
- On-Board Diagnostics (OBD) Information (Euro 4 Stage 1+ Certified Engines):
- The ECM illuminates the malfunction indicator lamp (MIL) when the diagnostic runs and fails.
  - An engine torque derate will be activated after 50 hours of engine operation with the fault code active.
  - The ECM turns OFF the malfunction indicator lamp (MIL) after 1 ignition cycle that the diagnostic runs and does **not** fail. The MIL lamp **cannot** be cleared using the INSITE™ service tool.
  - The fault code will be cleared from memory after 400 days or 9600 hours of engine operation.

**Refer to Troubleshooting Fault Code t05-1674**

FAULT CODE 1674 - Exhaust Gas Temperature 2 Circuit - Voltage Below Normal, or Shorted to Low Source
TROUBLESHOOTING SUMMARY



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



To reduce the possibility of pin and harness damage, use the following test leads when taking a measurement: Part Number 3822758 - male Deutsch™/AMP™/Metri-Pack™ test lead and Part Number 3822917 - female Deutsch™/AMP™/Metri-Pack™ test lead.

Table with 3 columns: STEPS, SPECIFICATIONS, and SRT CODE. It lists troubleshooting steps from STEP 1 to STEP 4, including sub-steps like STEP 1A, STEP 2A, etc., and their corresponding specifications.

**TROUBLESHOOTING STEP****STEP 1: Check the fault codes.****STEP 1A: Check for an inactive fault code.**

<b>Condition:</b>		
<ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
<b>Action</b>	<b>Specification/Repair</b>	<b>Next Step</b>
Check for an inactive fault code. <ul style="list-style-type: none"> <li>• Use INSITE™ to read the fault codes.</li> </ul>	Fault Code 1674 inactive? <b>YES</b>	Use the following procedure for an inactive or intermittent fault code. Refer to Procedure 019-362 in Section 19.
	Fault Code 1674 inactive? <b>NO</b>	2A

**STEP 2: Check the exhaust gas temperature #2 sensor and circuit.****STEP 2A: Inspect the exhaust gas temperature #2 sensor and connector pins.**

<b>Condition:</b>		
<ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the exhaust gas temperature #2 sensor from the engine harness.</li> </ul>		
<b>Action</b>	<b>Specification/Repair</b>	<b>Next Step</b>
Inspect the engine harness and exhaust gas temperature #2 sensor connector pins for the following: <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.	Dirty or damaged pins? <b>YES</b> <b>Repair:</b> A damaged connection has been detected in the sensor or harness connector. Clean the connector and pins. Repair the damaged harness, connector, or pins if possible. Refer to Procedure 019-071 in Section 19.	4A
		Dirty or damaged pins? <b>NO</b>

**STEP 2B: Check the circuit response.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the exhaust gas temperature #2 sensor from the engine harness.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate ECM response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault Code 1675 active and Fault Code 1674 inactive?</p> <p><b>YES</b></p>	2C
	<p>Fault Code 1675 active and Fault Code 1674 inactive?</p> <p><b>NO</b></p>	3A

**STEP 2C: Check the fault codes and verify sensor condition.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Connect the exhaust gas temperature #2 sensor to the engine harness.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate circuit response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault Code 1674 is active?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Replace the exhaust gas temperature #2 sensor. Refer to Procedure 019-013 in Section 19.</p>	4A
	<p>Fault Code 1674 is active?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>None. The removal and installation of the connector corrected the problem.</p>	4A

**STEP 3: Check the ECM and engine harness.**

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

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the engine harness and ECM connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A damaged connection has been detected in the ECM connector or the engine harness connector.</p> <p>Clean the connector and pins.</p> <p>Repair the damaged harness, connector, or pins if possible. Refer to Procedure 019-043 in Section 19.</p>	4A
	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	3B

**STEP 3B: Check the circuit response.**

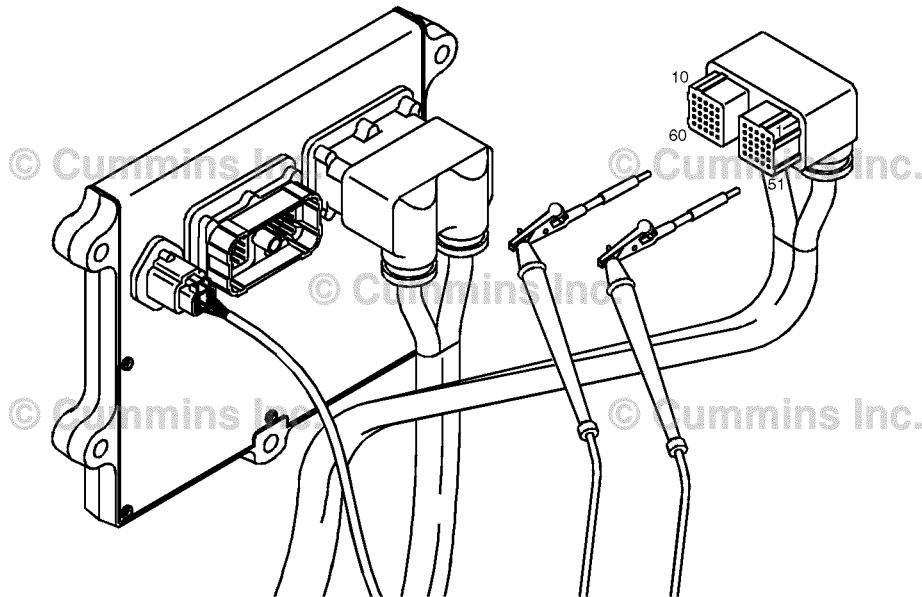
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate circuit response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault Code 1675 is active and Fault Code 1674 is inactive?</p> <p><b>YES</b></p>	3C
	<p>Fault Code 1675 is active and Fault Code 1674 is inactive?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Replace the ECM. Refer to Procedure 019-031 in Section 19.</p>	4A

**STEP 3C: Check for a pin to pin short circuit in the engine harness.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine harness from the ECM.
- Disconnect the exhaust gas temperature #2 sensor from the engine harness.

Action	Specification/Repair	Next Step
Check for a pin-to-pin short. <ul style="list-style-type: none"> <li>• Measure the resistance between the exhaust gas temperature #2 sensor SIGNAL pin in the engine harness ECM connector and all other pins in the engine harness ECM connector.</li> </ul> Refer to the wiring diagram for connector pin identification. Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.	Greater than 100K ohms? <b>YES</b>	3D
	Greater than 100K ohms? <b>NO</b> <b>Repair:</b> A pin-to-pin short circuit on the SIGNAL line has been detected in the engine harness. Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.	4A



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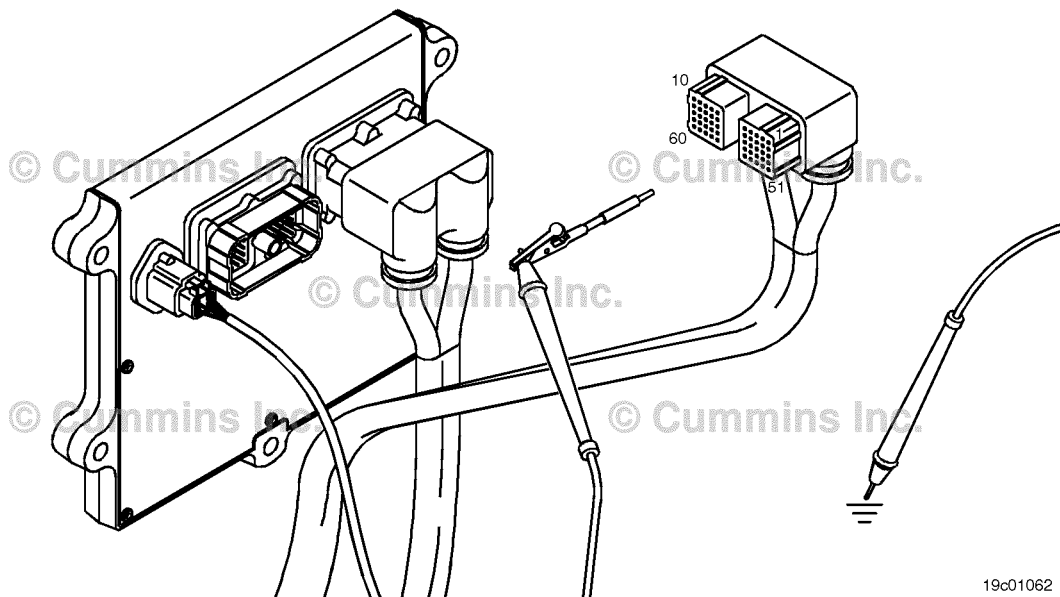


**STEP 3D: Check for a pin short circuit to ground.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine harness from the ECM.
- Disconnect the exhaust gas temperature #2 sensor from the engine harness.

Action	Specification/Repair	Next Step
Check for a pin-to-ground short. <ul style="list-style-type: none"> <li>• Measure the resistance between the exhaust gas temperature #2 sensor SIGNAL pin in the engine harness ECM connector and ground.</li> </ul>	Greater than 100k ohms? <b>YES</b>	3E
Refer to the wiring diagram for connector pin identification.  Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.	Greater than 100k ohms? <b>NO</b> <b>Repair:</b> A pin-to-ground short circuit on the SIGNAL line has been detected in the engine harness.  Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.	4A



19c01062

**STEP 3E: Check for an inactive fault code.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate circuit response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault Code 16674 inactive?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>None. The removal and installation of the connector corrected the fault.</p>	4A
	<p>Fault Code 1674 inactive?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Troubleshooting procedures need to be repeated from the beginning. A failure mode should have been detected.</p>	1A

**STEP 4: Clear the fault code.**

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

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Disable the fault code.</p> <ul style="list-style-type: none"> <li>• Start the engine and let it idle for 1 minute.</li> <li>• Use INSITE™ electronic service tool to verify the fault code is inactive.</li> </ul>	<p>Fault Code 1674 inactive?</p> <p><b>YES</b></p>	4B
	<p>Fault Code 1674 inactive?</p> <p><b>NO</b></p>	1A

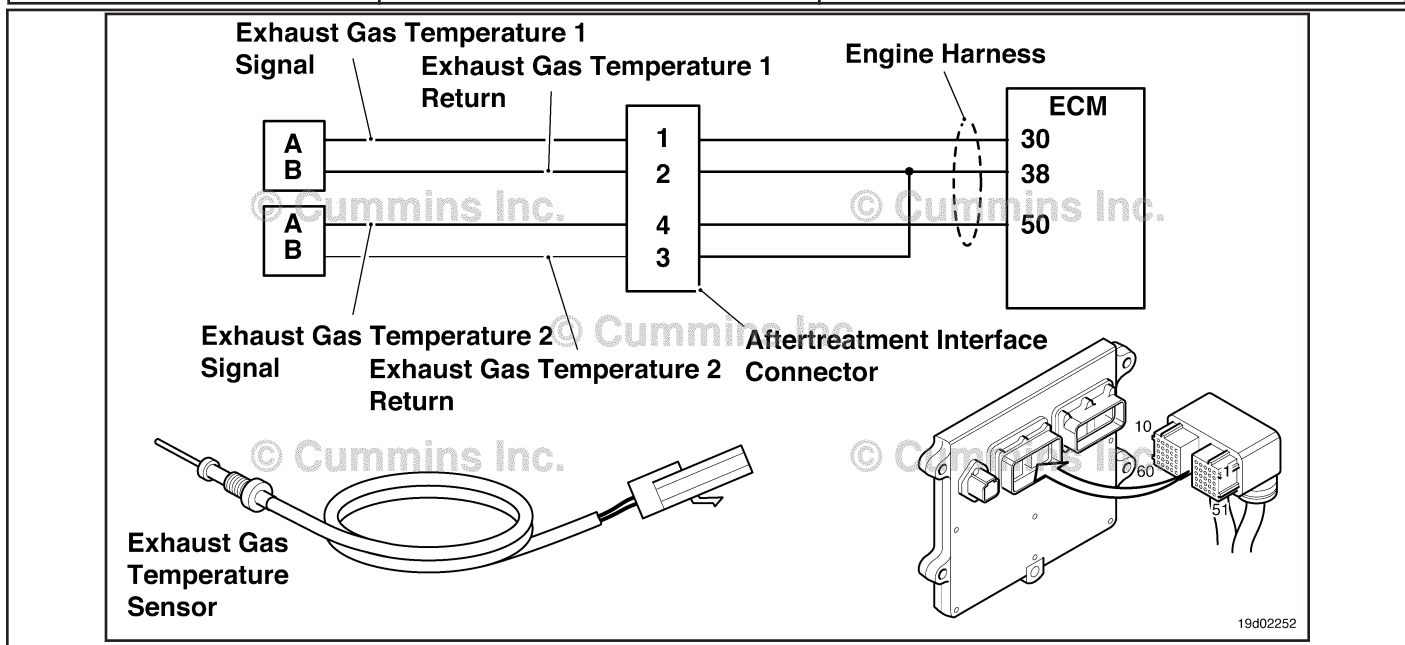
**STEP 4B: Clear the inactive fault code.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Clear the inactive fault codes.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to erase the inactive fault codes.</li> </ul>	<p>All fault codes cleared?</p> <p><b>YES</b></p>	Repair complete
	<p>All fault codes cleared?</p> <p><b>NO</b></p>	Appropriate troubleshooting steps

## Fault Code 1675

### Exhaust Gas Temperature 2 Circuit — Voltage Above Normal, or Shorted to Low Source

CODES	REASON	EFFECT
Fault Code: 1675 PID(P), SID(S): SPN: 3249 FMI: 3 Lamp: Amber SRT:	Exhaust Gas Temperature 2 Circuit — Voltage Above Normal, or Shorted to Low Source. High signal voltage detected at the catalyst outlet temperature sensor circuit.	Default temperature used for catalyst outlet temperature.



**Circuit Description:**

The catalyst outlet temperature sensor is used by the electronic control module (ECM) to monitor the engine exhaust temperature entering the catalyst unit. The ECM monitors the voltage on the signal pin and converts this to a temperature value.

**Component Location:**

The catalyst outlet temperature sensor is located in the aftertreatment system. It is located in the outlet of the aftertreatment catalyst unit.

**Shop Talk:**

Catalyst outlet temperature sensor shares return wires in the engine harness with other sensors. A shorted return can cause multiple fault codes to be active.

Possible causes of this fault code include:

- Open return circuit in the harness, connectors, or sensor.
- Open signal circuit or shorted to a voltage source.

On-Board Diagnostics (OBD) Information (Euro 4 Certified Engines):

- The ECM illuminates the malfunction indicator lamp (MIL) when the diagnostic runs and fails.
- The ECM turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does **not** fail. The MIL lamp and fault code can also be cleared using the INSITE™ service tool.

- The fault code will be cleared from memory after 40 consecutive drive cycles where the diagnostic runs and passes.
- On-Board Diagnostics (OBD) Information (Euro 4 Stage 1+ Certified Engines):
- The ECM illuminates the malfunction indicator lamp (MIL) when the diagnostic runs and fails.
  - An engine torque derate will be activated after 50 hours of engine operation with the fault code active.
  - The ECM turns OFF the malfunction indicator lamp (MIL) after 1 ignition cycle that the diagnostic runs and does **not** fail. The MIL lamp **cannot** be cleared using the INSITE™ service tool.
  - The fault code will be cleared from memory after 400 days or 9600 hours of engine operation.

**Refer to Troubleshooting Fault Code t05-1675**

## FAULT CODE 1675 - Exhaust Gas Temperature 2 Circuit - Voltage Above Normal, or Shorted to Low Source

### TROUBLESHOOTING SUMMARY



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



To reduce the possibility of pin and harness damage, use the following test leads when taking a measurement: Part Number 3822758 - male Deutsch™/AMP™/Metri-Pack™ test lead and Part Number 3822917 - female Deutsch™/AMP™/Metri-Pack™ test lead.

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1:</b> Check the fault codes.		
<b>STEP 1A:</b> Check for an inactive fault code.	Fault Code 1675 inactive?	
<b>STEP 2:</b> Check the exhaust gas temperature #2 sensor and circuit.		
<b>STEP 2A:</b> Inspect the exhaust gas temperature #2 sensor and connector pins.	Dirty or damaged pins?	
<b>STEP 2B:</b> Check the circuit response.	Fault Code 1674 is active and fault code 1675 is inactive?	
<b>STEP 2C:</b> Check the fault codes and verify sensor condition.	Fault Code 1675 is active?	
<b>STEP 3:</b> Check the ECM and engine harness.		
<b>STEP 3A:</b> Inspect the ECM and engine harness connector pins.	Dirty or damaged pins?	
<b>STEP 3B:</b> Check the circuit response.	Fault Code 1674 is active and Fault Code 1675 is inactive?	
<b>STEP 3C:</b> Check for an open circuit in the engine harness.	Less than 10 ohms?	
<b>STEP 3C-1:</b> Check for an open circuit in the engine harness.	Less than 10 ohms?	
<b>STEP 3D:</b> Check for a pin-to-pin short circuit in the engine harness.	Greater than 100K ohms?	
<b>STEP 3E:</b> Check for an inactive fault code.	Fault Code 1675 inactive?	
<b>STEP 4:</b> Clear the fault code.		
<b>STEP 4A:</b> Disable the fault code.	Fault Code 1675 inactive?	
<b>STEP 4B:</b> Clear the inactive fault codes.	All fault codes cleared?	

## TROUBLESHOOTING STEP

### STEP 1: Check the fault codes.

#### STEP 1A: Check for an inactive fault code.

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for an inactive fault code. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 1675 inactive? <b>YES</b>	Use the following procedure for an inactive or intermittent fault code. Refer to Procedure 019-362 in Section 19.
	Fault Code 1675 inactive? <b>NO</b>	2A

### STEP 2: Check the exhaust gas temperature #2 sensor and circuit.

#### STEP 2A: Inspect the exhaust gas temperature #2 sensor and connector pins.

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the exhaust gas temperature #2 sensor from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
Inspect the engine harness and exhaust gas temperature #2 sensor connector pins for the following: <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.	Dirty or damaged pins? <b>YES</b> <b>Repair:</b> A damaged connection has been detected in the sensor or harness connector. Clean the connector and pins. Repair the damaged harness, connector, or pins if possible. Refer to Procedure 019-071 in Section 19.	4A
		Dirty or damaged pins? <b>NO</b>

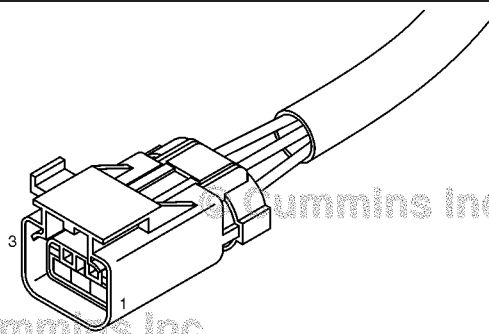
**STEP 2B: Check the circuit response.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the exhaust gas temperature #2 sensor from the engine harness.
- Turn keyswitch ON.
- Connect INSITE™ electronic service tool.

Action	Specification/Repair	Next Step
Place a jumper wire between the exhaust gas temperature #2 SIGNAL pin and the exhaust gas temperature #2 RETURN pin at the sensor connector of the engine harness. <ul style="list-style-type: none"> <li>• Refer to the wiring diagram for connector pin identification.</li> </ul>	Fault Code 1674 is active and Fault Code 1675 is inactive? <b>YES</b>	2C
	Fault Code 1674 is active and Fault Code 1675 is inactive? <b>NO</b>	3A

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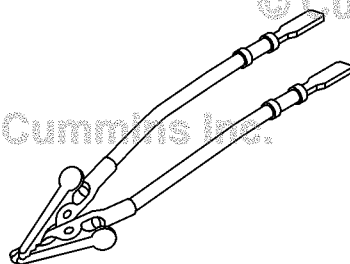


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**STEP 2C: Check the fault codes and verify sensor condition.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Connect the exhaust gas temperature #2 sensor to the engine harness.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate circuit response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault Code 1675 is active?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A damaged exhaust gas temperature #2 sensor has been detected.</p> <p>Replace the exhaust gas temperature #2 sensor. Refer to Procedure 019-013 in Section 19.</p>	4A
	<p>Fault Code 1675 is active?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>None. The removal and installation of the connector corrected the problem.</p>	4A

**STEP 3: Check the ECM and engine harness.**

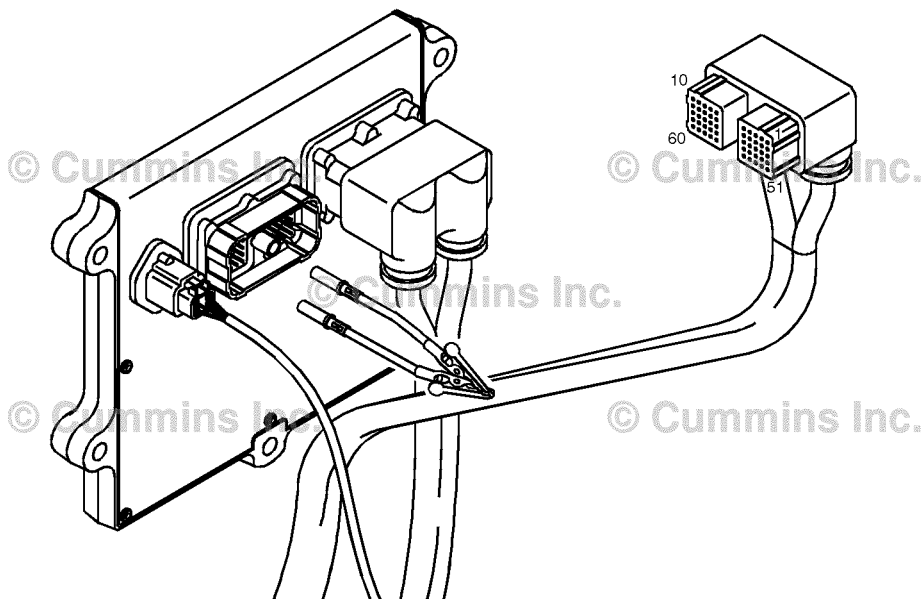
**STEP 3A: Inspect the ECM and engine harness connector pins.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM connector.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the engine harness and ECM connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A damaged connection has been detected in the ECM connector or the engine harness connector.</p> <p>Clean the connector and pins.</p> <p>Repair the damaged harness, connector, or pins if possible. Refer to Procedure 019-043 in Section 19.</p>	4A
	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	3B



**STEP 3B: Check the circuit response.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Place a jumper wire between the exhaust gas temperature #2 sensor SIGNAL pin and the exhaust gas temperature #2 sensor RETURN pin at the ECM connector.</p> <ul style="list-style-type: none"> <li>• Check for the appropriate circuit response after 30 seconds.</li> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul> <p>Refer to the wiring diagram for connector pin identification.</p>	<p>Fault Code 1674 active and Fault Code 1675 is inactive?</p> <p><b>YES</b></p>	3C
	<p>Fault Code 1674 active and Fault Code 1675 is inactive?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Replace the ECM. Refer to Procedure 019-031 in Section 19.</p>	4A



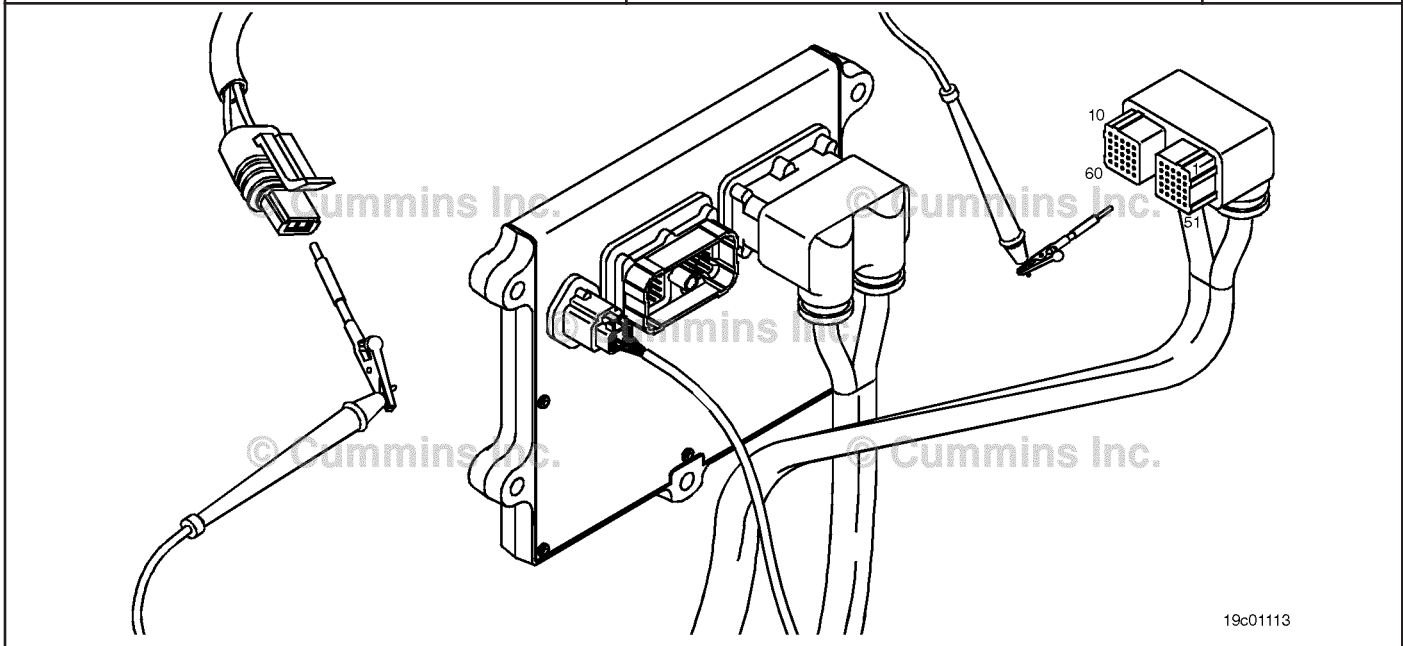
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**STEP 3C: Check for an open circuit in the engine harness.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine harness from the ECM.
- Disconnect the exhaust gas temperature #2 sensor from the engine harness.

Action	Specification/Repair	Next Step
Check for an open circuit. <ul style="list-style-type: none"> <li>• Measure the resistance between the engine harness ECM connector exhaust gas temperature #2 sensor RETURN pin and the engine harness exhaust gas temperature #2 sensor connector RETURN pin.</li> </ul> Refer to the wiring diagram for connector pin identification. Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.	Less than 10 ohms? <b>YES</b>	3C-1
	Less than 10 ohms? <b>NO</b> <b>Repair:</b> An open RETURN circuit has been detected in the engine harness. Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.	4A



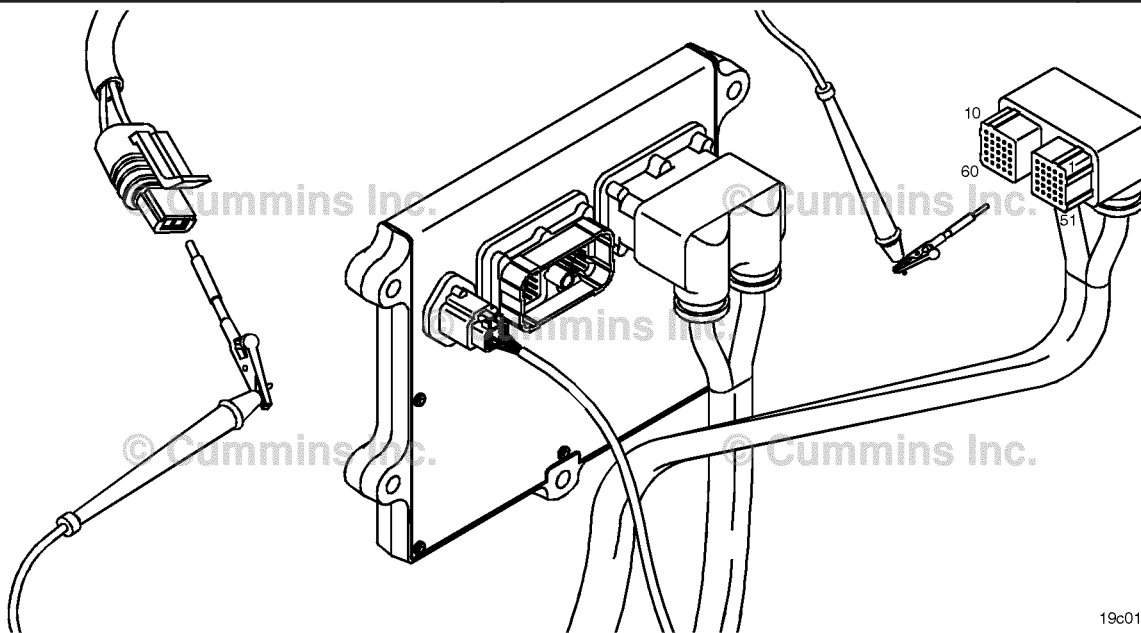
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**STEP 3C-1: Check for an open circuit in the engine harness.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine harness from the ECM.
- Disconnect the exhaust gas temperature #2 sensor from the engine harness.

Action	Specification/Repair	Next Step
<p>Check for an open circuit.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the engine harness ECM connector exhaust gas temperature #2 sensor SIGNAL pin and the engine harness exhaust gas temperature #2 sensor connector SIGNAL pin.</li> </ul> <p>Refer to the wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Less than 10 ohms? <b>YES</b></p>	<p>3D</p>
	<p>Less than 10 ohms? <b>NO</b></p> <p><b>Repair:</b> An open SIGNAL circuit has been detected in the engine harness.</p> <p>Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.</p>	<p>4A</p>



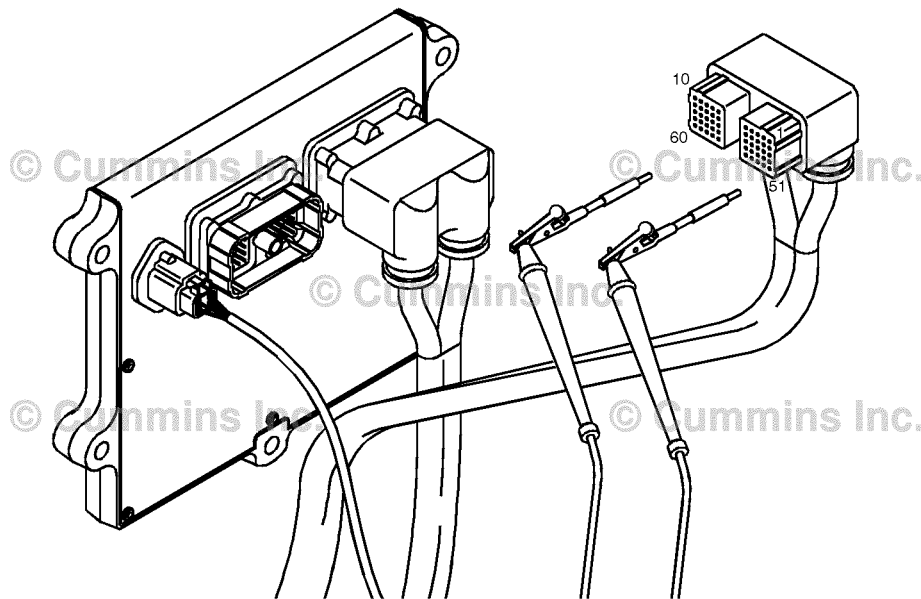
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**STEP 3D: Check for a pin-to-pin short circuit in the engine harness.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine harness from the ECM.
- Disconnect the exhaust gas temperature #2 sensor from the engine harness.

Action	Specification/Repair	Next Step
Check for a pin-to-pin short. <ul style="list-style-type: none"> <li>• Measure the resistance between the exhaust gas temperature #2 sensor SIGNAL pin in the engine harness ECM connector and all other pins in the engine harness ECM connector.</li> </ul> Refer to the wiring diagram for connector pin identification. Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.	Greater than 100K ohms? <b>YES</b>	3E
	Greater than 100K ohms? <b>NO</b> <b>Repair:</b> A pin-to-pin short circuit on the SIGNAL line has been detected in the engine harness. Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.	4A



19c01046

**STEP 3E: Check for an inactive fault code.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate circuit response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault Code 1675 inactive?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>None. The removal and installation of the connector corrected the fault.</p>	4A
	<p>Fault Code 1675 inactive?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Troubleshooting procedures need to be repeated from the beginning. A failure mode should have been detected.</p>	1A

**STEP 4: Clear the fault code.**

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

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Disable the fault code.</p> <ul style="list-style-type: none"> <li>• Start the engine and let it idle for 1 minute.</li> <li>• Use INSITE™ electronic service tool to verify the fault code is inactive.</li> </ul>	<p>Fault Code 1675 inactive?</p> <p><b>YES</b></p>	4B
	<p>Fault Code 1675 inactive?</p> <p><b>NO</b></p>	1A

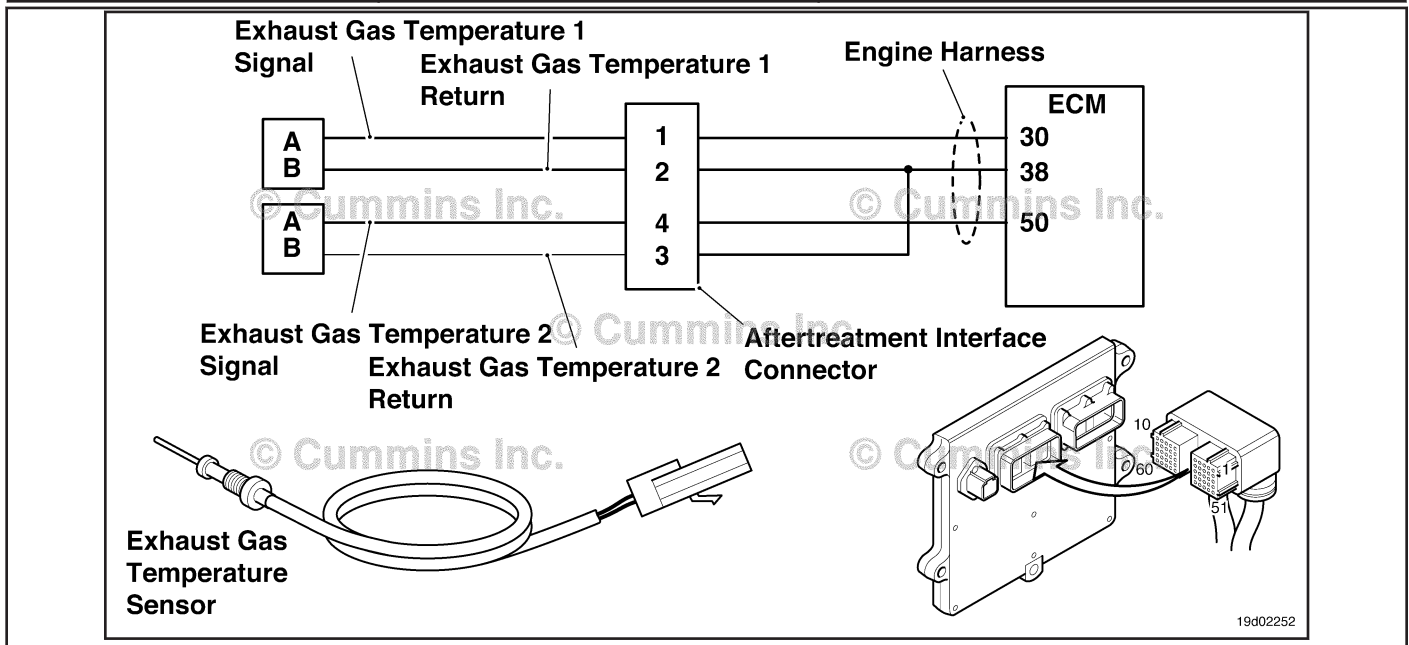
**STEP 4B: Clear the inactive fault codes.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Clear the inactive fault codes.</p> <ul style="list-style-type: none"> <li>• Using INSITE™ electronic service tool erase the inactive fault codes.</li> </ul>	<p>All fault codes cleared?</p> <p><b>YES</b></p>	Repair complete
	<p>All fault codes cleared?</p> <p><b>NO</b></p>	Appropriate troubleshooting steps

## Fault Code 1676

### Exhaust Gas Temperature 2— Data Erratic, Intermittent, or Incorrect

CODES	REASON	EFFECT
Fault Code: 1676 PID(P), SID(S): SPN: 3249 FMI: 2 Lamp: Amber SRT:	Exhaust Gas Temperature 2 — Data Erratic, Intermittent, or Incorrect. The exhaust gas temperature #2 sensor is not changing with engine operating conditions.	Default temperature value used for exhaust gas temperature #2.



**Circuit Description:**

The exhaust gas temperature #2 sensor is used by the electronic control module (ECM) to monitor the engine exhaust temperature entering the catalyst unit. The ECM monitors the voltage on the signal pin and converts this to a temperature value. This sensor is also called the catalyst outlet temperature sensor.

**Component Location:**

The exhaust gas temperature #2 sensor is located in the aftertreatment system. It is located between the turbocharger outlet and the catalyst unit outlet in the exhaust system.

**Shop Talk:**

This diagnostic runs when the exhaust gas temperature sensors are compared to other engine temperatures during engine operation. The engine coolant temperature **must** be above 140°F before the diagnostic will run. If the value of the exhaust gas temperature #2 does **not** match the engine operating conditions, this fault code is logged.

Possible causes of this fault code include:

- Stuck in-range exhaust gas temperature #2 sensor
- High resistance in the exhaust gas temperature #2 sensor signal or return lines.

On-Board Diagnostics (OBD) Information:

- The ECM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.

- The ECM turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does **not** fail. The MIL lamp and fault code can also be cleared using the INSITE™ service tool.
- The fault code will be cleared from memory after 40 consecutive drive cycles where the diagnostic runs and passes.

**Refer to Troubleshooting Fault Code t05-1676**

## FAULT CODE 1676 - Exhaust Gas Temperature 2 - Data Erratic, Intermittent, or Incorrect

### TROUBLESHOOTING SUMMARY



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



To reduce the possibility of pin and harness damage, use the following test leads when taking a measurement: Part Number 3822758 - male Deutsch™/AMP™/Metri-Pack™ test lead and Part Number 3822917 - female Deutsch™/AMP™/Metri-Pack™ test lead.

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1: Check for sensor circuit fault codes.</b>		
<b>STEP 1A:</b> Check for Fault Codes 1674 and 1675.	Fault Code 1674 or 1675 is active?	
<b>STEP 2: Check the exhaust gas temperature #2 sensor and circuit.</b>		
<b>STEP 2A:</b> Inspect the exhaust gas temperature #2 sensor and connector pins.	Dirty or damaged pins?	
<b>STEP 2B:</b> Check the circuit response.	Fault Code 1675 active?	
<b>STEP 3: Check the ECM and engine harness.</b>		
<b>STEP 3A:</b> Inspect the ECM and engine harness connector pins.	Dirty or damaged pins?	
<b>STEP 3B:</b> Check the circuit response.	Fault Code 1675 active?	
<b>STEP 4: Clear the fault codes.</b>		
<b>STEP 4A:</b> Verify the repair	Catalyst Inlet Temperature and Catalyst Outlet Temperature reading within 13.9°C or 25°F of each other?	
<b>STEP 4B:</b> Clear the fault codes.	All fault codes cleared?	

### TROUBLESHOOTING STEP

**STEP 1: Check for sensor circuit fault codes.**

**STEP 1A: Check for Fault Codes 1674 and 1675.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for an active fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 1674 or 1675 is active? <b>YES</b>	Fault Code 1674 or 1675 troubleshooting tree.
	Fault Code 1674 or 1675 is active? <b>NO</b>	2A



**STEP 2: Check the exhaust gas temperature #2 sensor and circuit.****STEP 2A: Inspect the exhaust gas temperature #2 sensor and connector pins.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the exhaust gas temperature #2 sensor from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
Inspect the engine harness and exhaust gas temperature #2 sensor connector pins for the following: <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.	Dirty or damaged pins? <b>YES</b> <b>Repair:</b> A damaged connection has been detected in the sensor or harness connector. Clean the connector and pins. Repair the damaged harness, connector, or pins if possible. Refer to Procedure 019-071 in Section 19.	4A
	Dirty or damaged pins? <b>NO</b>	2B

**STEP 2B: Check the circuit response.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the exhaust gas temperature #2 sensor from the engine harness.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> <li>• Engine coolant temperature <b>must</b> be above 60°C [140°F].</li> </ul>		
Action	Specification/Repair	Next Step
Check for the appropriate ECM response after 30 seconds. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 1675 active? <b>YES</b>	3A
	Fault Code 1675 active? <b>NO</b> <b>Repair:</b> Replace the exhaust gas temperature #2 sensor. Refer to Procedure 019-013 in Section 19.	4A

**STEP 3: Check the ECM and engine harness.**

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

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM connector.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the engine harness and ECM connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A damaged connection has been detected in the ECM connector or the engine harness connector.</p> <p>Clean the connector and pins.</p> <p>Repair the damaged harness, connector, or pins if possible. Refer to Procedure 019-043 in Section 19.</p>	4A
	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	3B

**STEP 3B: Check the circuit response.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> <li>• Engine coolant temperature <b>must</b> be above 60°C [140°F].</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate circuit response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault Code 1675 is active?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>High resistance or a short circuit has been detected in the engine harness.</p> <p>Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.</p>	4A
	<p>Fault Code 1675 is active?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Replace the ECM. Refer to Procedure 019-031 in Section 19.</p>	4A

**STEP 4: Clear the fault code.**

**STEP 4A: Verify the repair.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Start the INSITE™ Data Monitor/Logger.</p> <ul style="list-style-type: none"> <li>• Compare the INSITE™ electronic service tool reading for Catalyst Inlet Temperature and Catalyst Outlet Temperature.</li> </ul>	<p>Catalyst Inlet Temperature and Catalyst Outlet Temperature reading within 13.9°C or 25°F of each other?</p> <p><b>YES</b></p>	4B
	<p>Catalyst Inlet Temperature and Catalyst Outlet Temperature reading within 13.9°C or 25°F of each other?</p> <p><b>NO</b></p>	1A

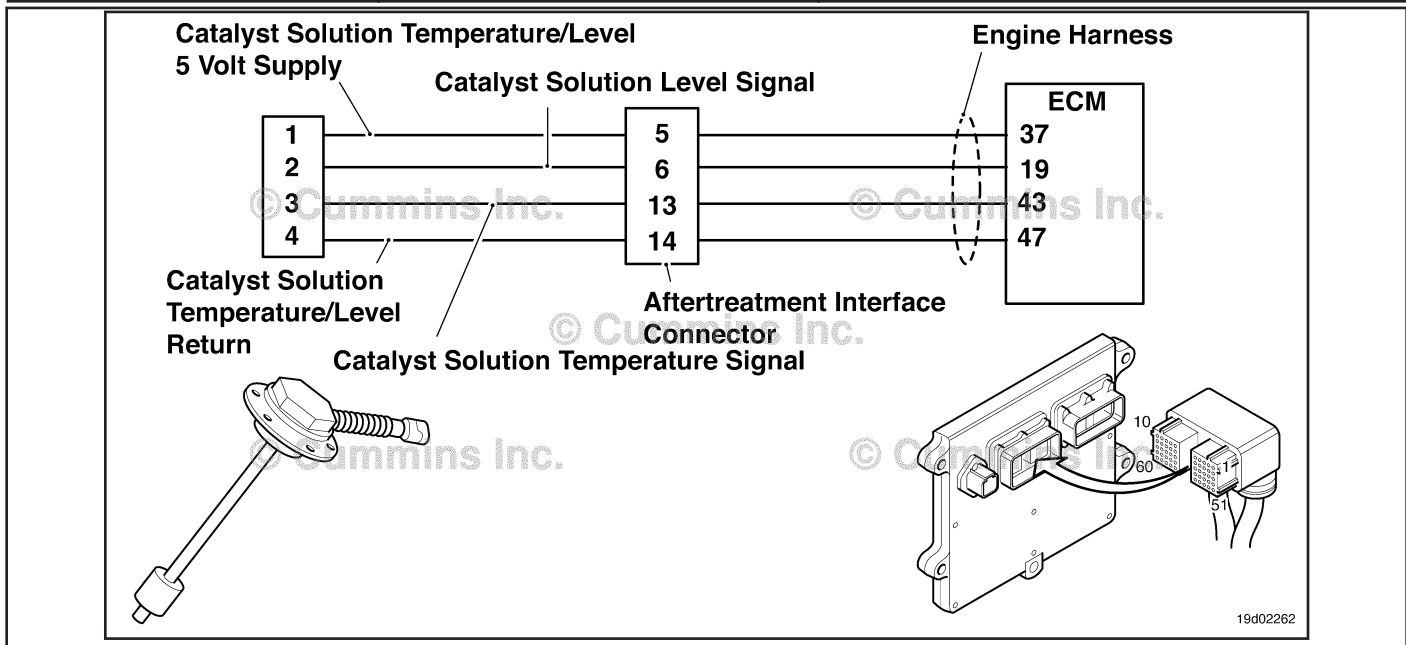
**STEP 4B: Clear the fault codes.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Clear the fault codes.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to erase all active and inactive fault codes.</li> </ul>	<p>All fault codes cleared?</p> <p><b>YES</b></p>	Repair complete
	<p>All fault codes cleared?</p> <p><b>NO</b></p>	Appropriate troubleshooting steps

## Fault Code 1677

### Catalyst Tank Temperature — Voltage Below Normal, or Shorted to Low Source

CODES	REASON	EFFECT
Fault Code: 1677 PID(P), SID(S): SPN: 3031 FMI: 4 Lamp: Amber SRT:	Catalyst Tank Temperature — Voltage Below Normal, or Shorted to Low Source. Low signal voltage detected at the catalyst solution temperature sensor circuit.	Default temperature used for catalyst solution temperature.



#### **Circuit Description:**

The catalyst solution temperature sensor is used by the electronic control module (ECM) to monitor the temperature of the catalyst solution inside the catalyst tank. The ECM monitors the voltage on the signal pin and converts this to a temperature value.

#### **Component Location:**

The catalyst solution temperature sensor is located in the catalyst tank. The tank is mounted by the OEM. For more information, contact the OEM service manual.

#### **Shop Talk:**

The catalyst solution temperature sensor shares return wires in the engine harness with other sensors. A shorted return can cause multiple fault codes to be active. Before troubleshooting Fault Code 1677, check for multiple fault codes.

Possible causes of this fault code include:

- Signal shorted to ground in the harness
- Signal shorted to return or ground in the sensor.

On-Board Diagnostics (OBD) Information (Euro 4 Certified Engines):

- The ECM illuminates the malfunction indicator lamp (MIL) when the diagnostic runs and fails.

- The ECM turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does **not** fail. The MIL lamp and fault code can also be cleared using the INSITE™ service tool.
- The fault code will be cleared from memory after 40 consecutive drive cycles where the diagnostic runs and passes.

On-Board Diagnostics (OBD) Information (Euro 4 Stage 1+ Certified Engines):

- The ECM illuminates the malfunction indicator lamp (MIL) when the diagnostic runs and fails.
- An engine torque derate will be activated after 50 hours of engine operation with the fault code active.
- The ECM turns OFF the malfunction indicator lamp (MIL) after 1 ignition cycle that the diagnostic runs and does **not** fail. The MIL lamp **cannot** be cleared using the INSITE™ service tool.
- The fault code will be cleared from memory after 400 days or 9600 hours of engine operation.

**Refer to Troubleshooting Fault Code t05-1677**

FAULT CODE 1677 - Catalyst Tank Temperature - Voltage Below Normal, or Shorted to Low Source
TROUBLESHOOTING SUMMARY



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



To reduce the possibility of pin and harness damage, use the following test leads when taking a measurement: Part Number 3822758 - male Deutsch™/AMP™/Metri-Pack™ test lead and Part Number 3822917 - female Deutsch™/AMP™/Metri-Pack™ test lead.

Table with 3 columns: STEPS, SPECIFICATIONS, and SRT CODE. It lists troubleshooting steps from STEP 1 to STEP 4, including sub-steps like STEP 1A, STEP 2A, etc., and their corresponding specifications.

**TROUBLESHOOTING STEP****STEP 1: Check the fault codes.****STEP 1A: Check for an inactive fault code.**

<b>Condition:</b>		
<ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
<b>Action</b>	<b>Specification/Repair</b>	<b>Next Step</b>
Check for an inactive fault code. <ul style="list-style-type: none"> <li>• Use INSITE™ to read the fault codes.</li> </ul>	Fault Code 1677 inactive? <b>YES</b>	Use the following procedure for an inactive or intermittent fault code. Refer to Procedure 019-362 in Section 19.
	Fault Code 1677 inactive? <b>NO</b>	2A

**STEP 2: Check the catalyst solution temperature sensor and circuit.****STEP 2A: Inspect the catalyst solution temperature sensor and connector pins.**

<b>Condition:</b>		
<ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the catalyst solution temperature sensor from the engine harness.</li> </ul>		
<b>Action</b>	<b>Specification/Repair</b>	<b>Next Step</b>
Inspect the engine harness and catalyst solution temperature sensor connector pins for the following: <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.	Dirty or damaged pins? <b>YES</b> <b>Repair:</b> A damaged connection has been detected in the sensor or harness connector. Clean the connector and pins. Repair the damaged harness, connector, or pins if possible. Refer to Procedure 019-071 in Section 19.	4A
	Dirty or damaged pins? <b>NO</b>	2B

**STEP 2B: Check the circuit response.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the catalyst solution temperature sensor from the engine harness.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate ECM response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault code 1678 active and Fault Code 1677 inactive?</p> <p><b>YES</b></p>	2C
	<p>Fault code 1678 active and Fault Code 1677 inactive?</p> <p><b>NO</b></p>	3A

**STEP 2C: Check the fault codes and verify sensor condition.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Connect the catalyst solution temperature sensor to the engine harness.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate circuit response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault Code 1677 is active?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Replace the catalyst solution temperature sensor. Refer to OEM service manual.</p>	4A
	<p>Fault Code 1677 is active?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>None. The removal and installation of the connector corrected the fault.</p>	4A



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

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> </ul>		
Action	Specification/Repair	Next Step
Inspect the engine harness and ECM connector pins for the following: <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.	Dirty or damaged pins? <b>YES</b> <b>Repair:</b> A damaged connection has been detected in the ECM connector or the engine harness connector. Clean the connector and pins. Repair the damaged harness, connector, or pins if possible. Refer to Procedure 019-043 in Section 19.	4A
	Dirty or damaged pins? <b>NO</b>	3B

**STEP 3B: Check the circuit response.**

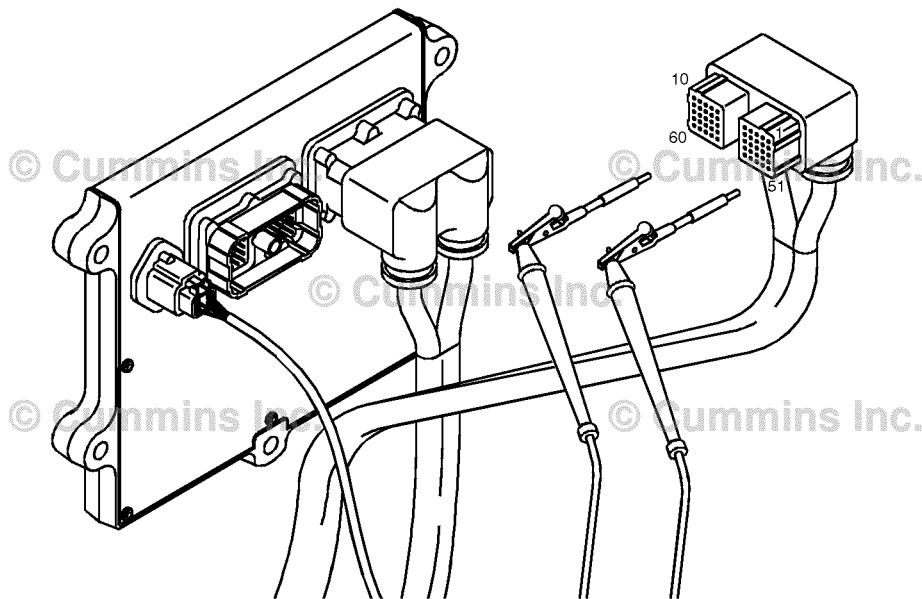
<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for the appropriate circuit response after 30 seconds. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 1678 is active and Fault Code 1677 is inactive? <b>YES</b>	3C
	Fault Code 1678 is active and Fault Code 1677 is inactive? <b>NO</b> <b>Repair:</b> Replace the ECM. Refer to Procedure 019-031 in Section 19.	4A

**STEP 3C: Check for a pin-to-pin short circuit in the engine harness.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine harness from the ECM.
- Disconnect the catalyst solution temperature sensor from the engine harness.

Action	Specification/Repair	Next Step
Check for a pin-to-pin short. <ul style="list-style-type: none"> <li>• Measure the resistance between the catalyst solution temperature sensor SIGNAL pin in the engine harness ECM connector and all other pins in the engine harness ECM connector.</li> </ul> Refer to the wiring diagram for connector pin identification. Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.	Greater than 100K ohms? <b>YES</b>	3D
	Greater than 100K ohms? <b>NO</b> <b>Repair:</b> A pin-to-pin short circuit on the SIGNAL line has been detected in the engine harness. Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.	4A



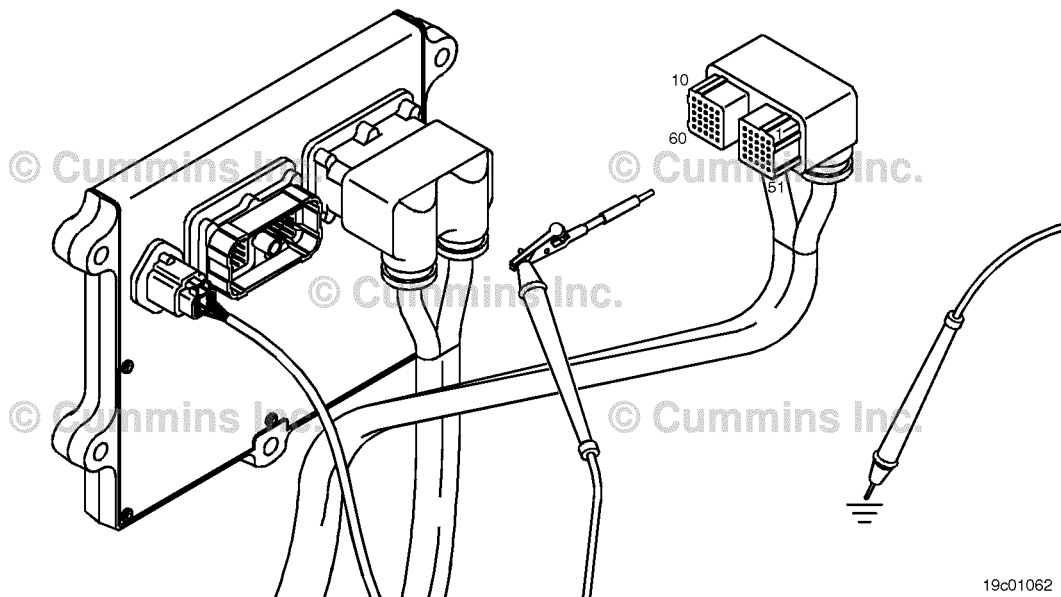
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**STEP 3D: Check for a pin short circuit to ground.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine harness from the ECM.
- Disconnect the catalyst solution sensor from the engine harness.

Action	Specification/Repair	Next Step
<p>Check for a pin-to-ground short.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the catalyst solution sensor SIGNAL pin in the engine harness ECM connector and ground.</li> </ul> <p>Refer to the wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Greater than 100k ohms? <b>YES</b></p>	<p>3E</p>
	<p>Greater than 100k ohms? <b>NO</b></p> <p><b>Repair:</b></p> <p>A pin-to-ground short circuit on the SIGNAL line has been detected in the engine harness.</p> <p>Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.</p>	<p>4A</p>



19c01062

**STEP 3E: Check for an inactive fault code.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate circuit response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault Code 1677 inactive?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>None. The removal and installation of the connector corrected the fault.</p>	4A
	<p>Fault Code 1677 inactive?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Troubleshooting procedures need to be repeated from the beginning. A failure mode should have been detected.</p>	1A

**STEP 4: Clear the fault code.**

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

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Disable the fault code.</p> <ul style="list-style-type: none"> <li>• Start the engine and let it idle for 1 minute.</li> <li>• Use INSITE™ electronic service tool to verify the fault code is inactive.</li> </ul>	<p>Fault Code 1677 inactive?</p> <p><b>YES</b></p>	4B
	<p>Fault Code 1677 inactive?</p> <p><b>NO</b></p>	1A

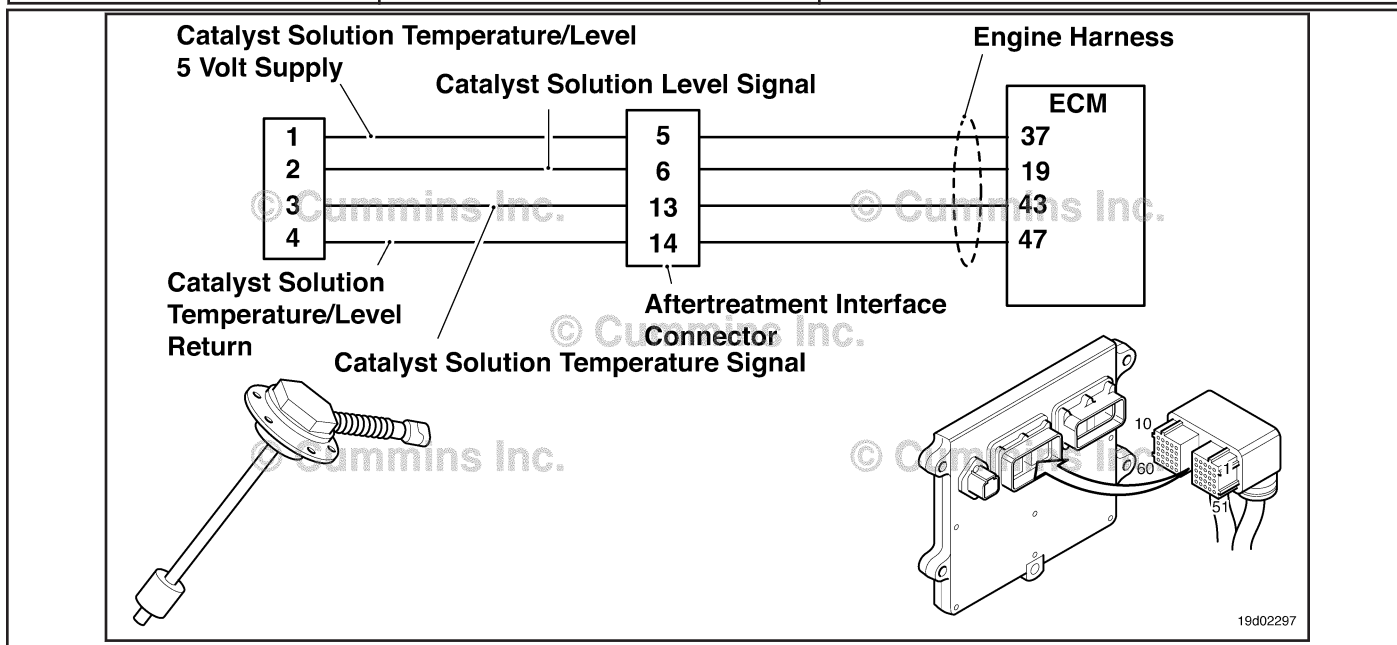
**STEP 4B: Clear the inactive fault codes.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Clear the inactive fault codes.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to erase the inactive fault codes.</li> </ul>	<p>All fault codes cleared?</p> <p><b>YES</b></p>	Repair complete
	<p>All fault codes cleared?</p> <p><b>NO</b></p>	Appropriate troubleshooting steps

## Fault Code 1678

### Catalyst Tank Temperature — Voltage Above Normal, or Shorted to High Source

CODES	REASON	EFFECT
Fault Code: 1678 PID(P), SID(S): SPN: 3031 FMI: 3 Lamp: Amber SRT:	Catalyst Tank Temperature — Voltage Above Normal, or Shorted to High Source. High signal voltage or open circuit detected at the catalyst tank temperature sensor circuit	Default temperature value used for catalyst tank temperature.



#### Circuit Description:

The catalyst solution temperature sensor is used by the electronic control module (ECM) to monitor the temperature of the catalyst solution inside the catalyst tank. The ECM monitors the voltage on the signal pin and converts this to a temperature value.

#### Component Location:

The catalyst solution temperature sensor is located in the catalyst tank. The tank is mounted by the OEM. For more information, contact the OEM service manual.

#### Shop Talk:

The catalyst solution temperature sensor shares return wires in the engine harness with other sensors. An open return can cause multiple fault codes to be active.

Possible causes of this fault code include:

- Open return circuit in the harness, connectors, or sensor.
- Open signal circuit or shorted to a voltage source.

On-Board Diagnostics (OBD) Information (Euro 4 Certified Engines):

- The ECM illuminates the malfunction indicator lamp (MIL) when the diagnostic runs and fails.
- The ECM turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does **not** fail. The MIL lamp and fault code can also be cleared using the INSITE™ service tool.

- The fault code will be cleared from memory after 40 consecutive drive cycles where the diagnostic runs and passes.
- On-Board Diagnostics (OBD) Information (Euro 4 Stage 1+ Certified Engines):
- The ECM illuminates the malfunction indicator lamp (MIL) when the diagnostic runs and fails.
  - An engine torque derate will be activated after 50 hours of engine operation with the fault code active.
  - The ECM turns OFF the malfunction indicator lamp (MIL) after 1 ignition cycle that the diagnostic runs and does **not** fail. The MIL lamp **cannot** be cleared using the INSITE™ service tool.
  - The fault code will be cleared from memory after 400 days or 9600 hours of engine operation.

**Refer to Troubleshooting Fault Code t05-1678**

## FAULT CODE 1678 - Catalyst Tank Temperature - Voltage Above Normal, or Shorted to High Source

### TROUBLESHOOTING SUMMARY



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



To reduce the possibility of pin and harness damage, use the following test leads when taking a measurement: Part Number 3822758 - male Deutsch™/AMP™/Metri-Pack™ test lead and Part Number 3822917 - female Deutsch™/AMP™/Metri-Pack™ test lead.

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1:</b> Check the fault codes.		
<b>STEP 1A:</b> Check for an inactive fault code.	Fault Code 1678 inactive?	
<b>STEP 2:</b> Check the catalyst solution temperature sensor and circuit.		
<b>STEP 2A:</b> Inspect the catalyst solution temperature sensor and connector pins.	Dirty or damaged pins?	
<b>STEP 2B:</b> Check the sensor resistance.	180 ohms to 160k ohms?	
<b>STEP 2C:</b> Check the fault codes and verify sensor condition.	Fault Code 1678 is active?	
<b>STEP 3:</b> Check the ECM and engine harness.		
<b>STEP 3A:</b> Inspect the ECM and engine harness connector pins.	Dirty or damaged pins?	
<b>STEP 3B:</b> Check the circuit response.	Fault Code 1677 is active and Fault Code 1678 is inactive?	
<b>STEP 3C:</b> Check for an open circuit in the engine harness.	Less than 10 ohms?	
<b>STEP 3C-1:</b> Check for an open circuit in the engine harness.	Less than 10 ohms?	
<b>STEP 3D:</b> Check for a pin to pin short circuit in the engine harness.	Greater than 100K ohms?	
<b>STEP 3E:</b> Check for an inactive fault code.	Fault Code 1678 inactive?	
<b>STEP 4:</b> Clear the fault code.		
<b>STEP 4A:</b> Disable the fault code.	Fault Code 1678 inactive?	
<b>STEP 4B:</b> Clear the inactive fault codes.	All fault codes cleared?	

## TROUBLESHOOTING STEP

**STEP 1: Check the fault codes.**  
**STEP 1A: Check for an inactive fault code.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for an inactive fault code. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 1678 inactive? <b>YES</b>	Use the following procedure for an inactive or intermittent fault code. Refer to Procedure 019-362 in Section 19.
	Fault Code 1678 inactive? <b>NO</b>	2A

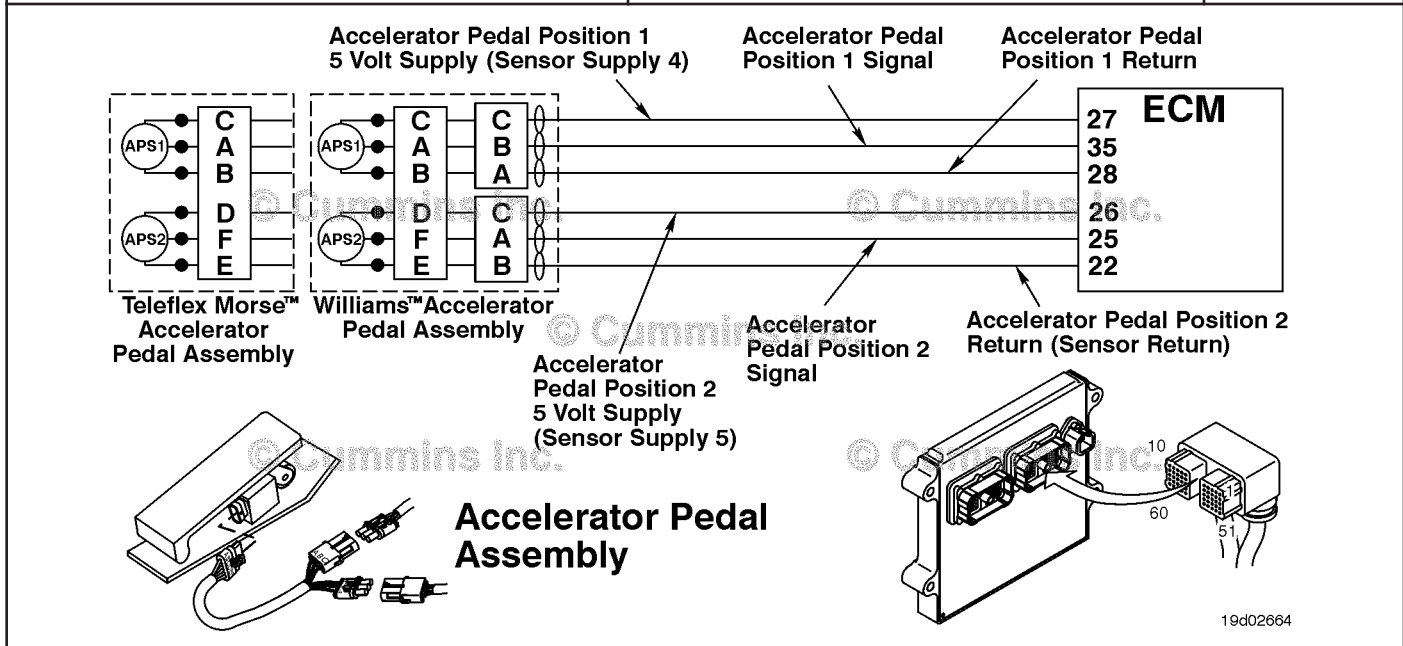
**STEP 2: Check the catalyst solution temperature sensor and circuit.**  
**STEP 2A: Inspect the catalyst solution temperature sensor and connector pins.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the catalyst solution temperature sensor from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
Inspect the engine harness and catalyst sensor temperature sensor connector pins for the following: <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.	Dirty or damaged pins? <b>YES</b> <b>Repair:</b> A damaged connection has been detected in the sensor or harness connector. Clean the connector and pins. Repair the damaged harness, connector, or pins if possible. Refer to Procedure 019-071 in Section 19.	4A
		Dirty or damaged pins? <b>NO</b>



**STEP 2B: Check the sensor resistance.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the catalyst solution temperature sensor from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Measure the sensor resistance.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the catalyst solution temperature sensor SIGNAL pin and catalyst solution temperature sensor RETURN pin at the catalyst solution temperature sensor.</li> </ul> <p>Refer to the wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>180 ohms to 160k ohms?</p> <p><b>YES</b></p>	2C
	<p>180 ohms to 160k ohms?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Replace the catalyst solution temperature sensor. Refer to the OEM service manual.</p>	4A



**STEP 2C: Check the fault codes and verify sensor condition.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Connect the catalyst solution temperature sensor to the engine harness.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate circuit response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault Code 1678 is active?</p> <p><b>YES</b></p>	3A
	<p>Fault Code 1678 is active?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>None. The removal and installation of the connector corrected the fault.</p>	4A

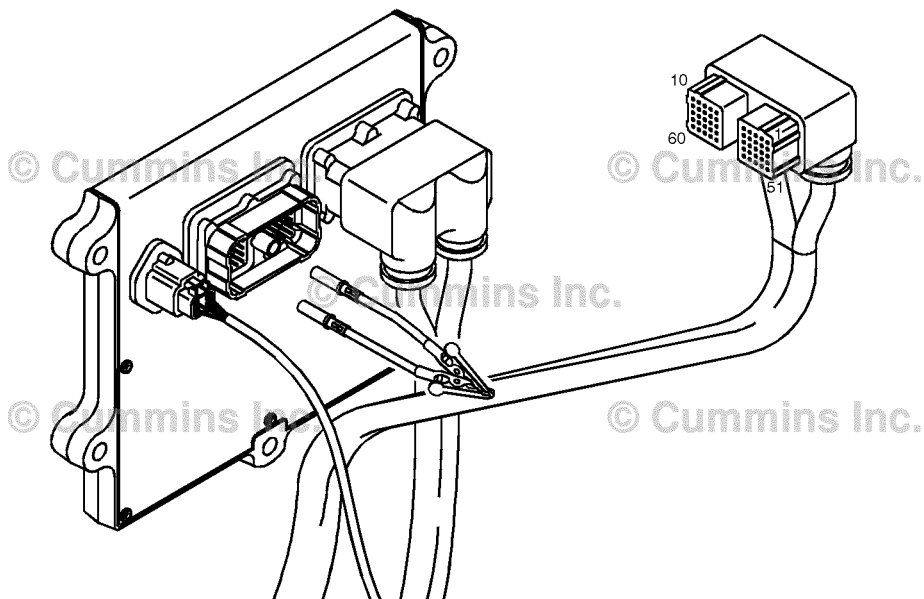
**STEP 3: Check the ECM and engine harness.**

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

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM connector.</li> </ul>		
Action	Specification/Repair	Next Step
<p>:Inspect the engine harness and ECM connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A damaged connection has been detected in the ECM connector or the engine harness connector.</p> <p>Clean the connector and pins.</p> <p>Repair the damaged harness, connector, or pins if possible. Refer to Procedure 019-043 in Section 19.</p>	4A
		<p>Dirty or damaged pins?</p> <p><b>NO</b></p>

**STEP 3B: Check the circuit response.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Place a jumper wire between the catalyst solution temperature sensor SIGNAL pin and the catalyst solution temperature sensor RETURN pin at the ECM connector.</p> <ul style="list-style-type: none"> <li>• Check for the appropriate circuit response after 30 seconds.</li> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul> <p>Refer to the wiring diagram for connector pin identification.</p>	<p>Fault Code 1677 active and Fault Code 1678 is inactive? <b>YES</b></p>	<p>3C</p>
	<p>Fault Code 1677 active and Fault Code 1678 is inactive? <b>NO</b></p> <p><b>Repair:</b> Replace the ECM. Refer to Procedure 019-031 in Section 19.</p>	<p>4A</p>



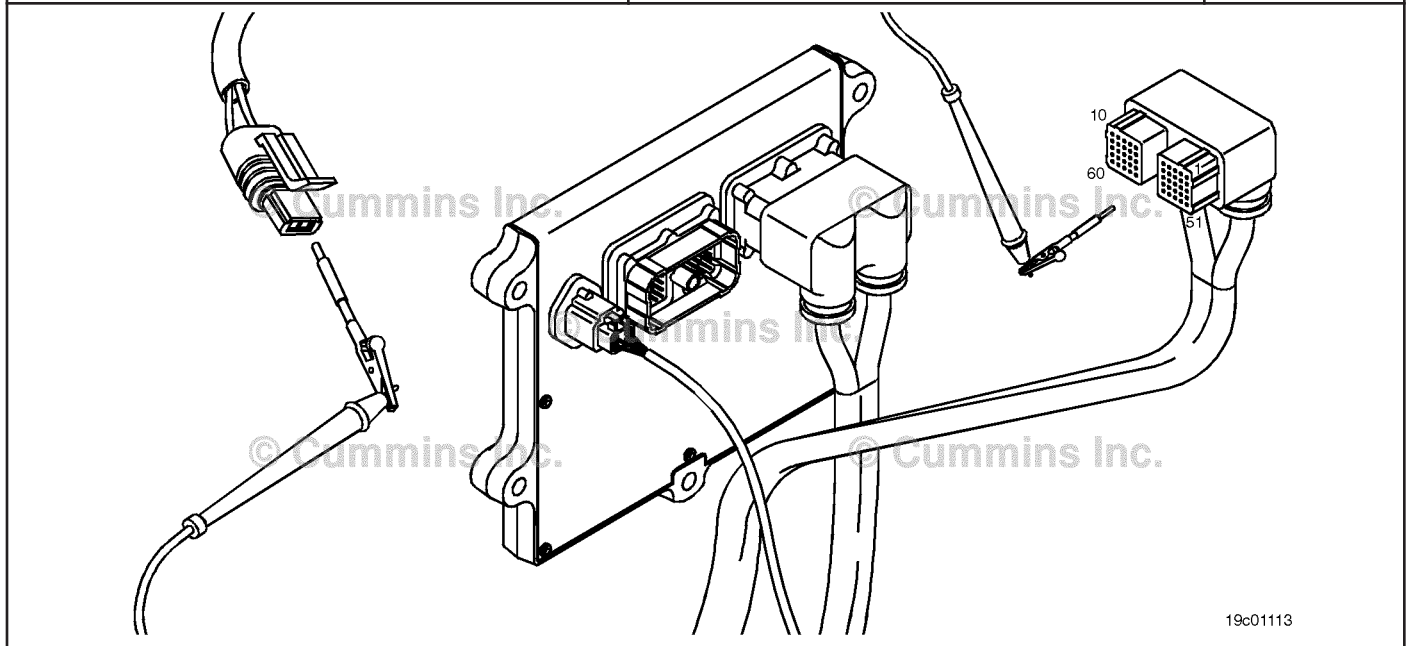
19c01111

**STEP 3C: Check for an open circuit in the engine harness.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine harness from the ECM.
- Disconnect the catalyst solution temperature sensor from the engine harness.

Action	Specification/Repair	Next Step
<p>Check for an open circuit.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the engine harness ECM connector catalyst solution temperature sensor RETURN pin and the engine harness catalyst solution temperature sensor connector RETURN pin.</li> </ul> <p>Refer to the wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Less than 10 ohms? <b>YES</b></p> <hr/> <p>Less than 10 ohms? <b>NO</b></p> <p><b>Repair:</b></p> <p>An open RETURN circuit has been detected in the engine harness.</p> <p>Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.</p>	<p>3C-1</p> <hr/> <p>4A</p>

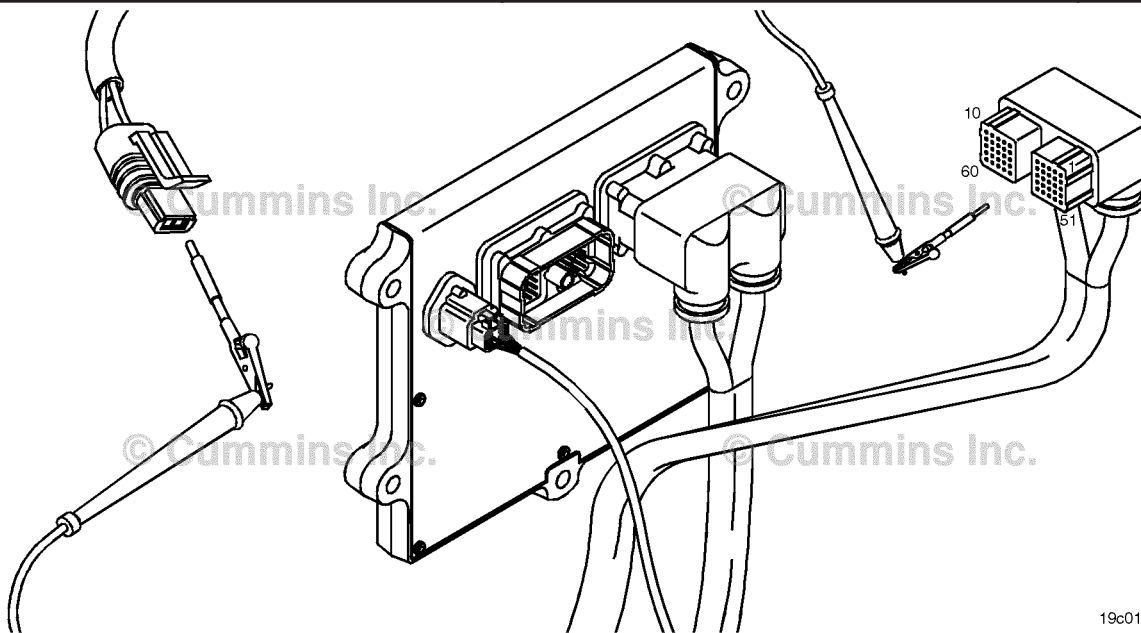


**STEP 3C-1: Check for an open circuit in the engine harness.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine harness from the ECM.
- Disconnect the catalyst solution temperature sensor from the engine harness.

Action	Specification/Repair	Next Step
Check for an open circuit. • Measure the resistance between the engine harness ECM connector catalyst solution temperature sensor SIGNAL pin and the engine harness catalyst solution temperature sensor connector SIGNAL pin.  Refer to the wiring diagram for connector pin identification.  Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.	Less than 10 ohms? <b>YES</b>	3D
	Less than 10 ohms? <b>NO</b> <b>Repair:</b> An open SIGNAL circuit has been detected in the engine harness.  Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.	4A

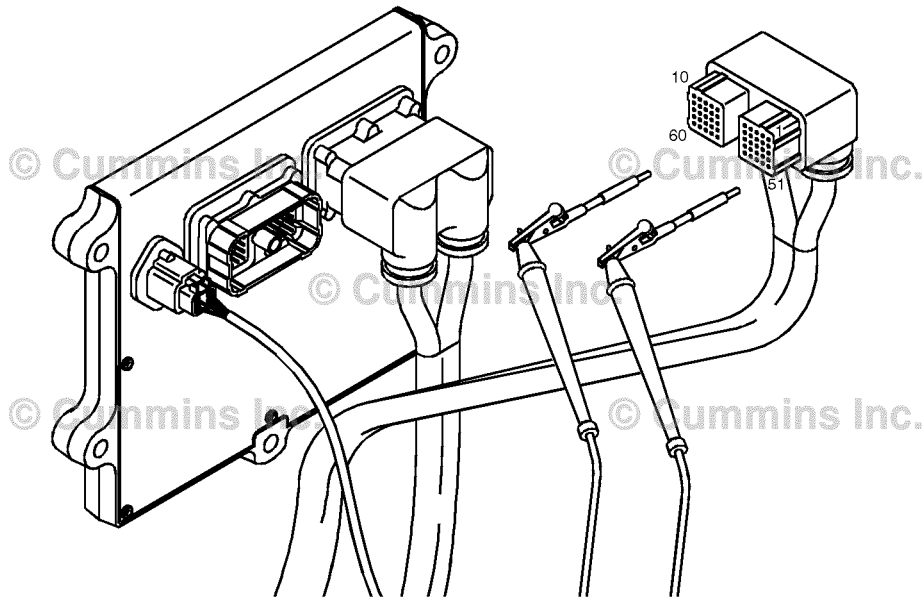


**STEP 3D: Check for a pin-to-pin short circuit in the engine harness.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine harness from the ECM.
- Disconnect the catalyst solution temperature sensor from the engine harness.

Action	Specification/Repair	Next Step
Check for a pin-to-pin short. <ul style="list-style-type: none"> <li>• Measure the resistance between the catalyst solution temperature sensor SIGNAL pin in the engine harness ECM connector and all other pins in the engine harness ECM connector.</li> </ul> Refer to the wiring diagram for connector pin identification. Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.	Greater than 100K ohms? <b>YES</b>	3E
	Greater than 100K ohms? <b>NO</b> <b>Repair:</b> A pin-to-pin short circuit on the SIGNAL line has been detected in the engine harness. Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.	4A



19c01046

**STEP 3E: Check for an inactive fault code.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate circuit response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault Code 1678 inactive?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>None. The removal and installation of the connector corrected the fault.</p>	4A
	<p>Fault Code 1678 inactive?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Troubleshooting procedures need to be repeated from the beginning. A failure mode should have been detected.</p>	1A

**STEP 4: Clear the fault code.**

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

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Disable the fault code.</p> <ul style="list-style-type: none"> <li>• Start the engine and let it idle for 1 minute.</li> <li>• Use INSITE™ electronic service tool to verify the fault code is inactive.</li> </ul>	<p>Fault Code 1678 inactive?</p> <p><b>YES</b></p>	4B
	<p>Fault Code 1678 inactive?</p> <p><b>NO</b></p>	1A

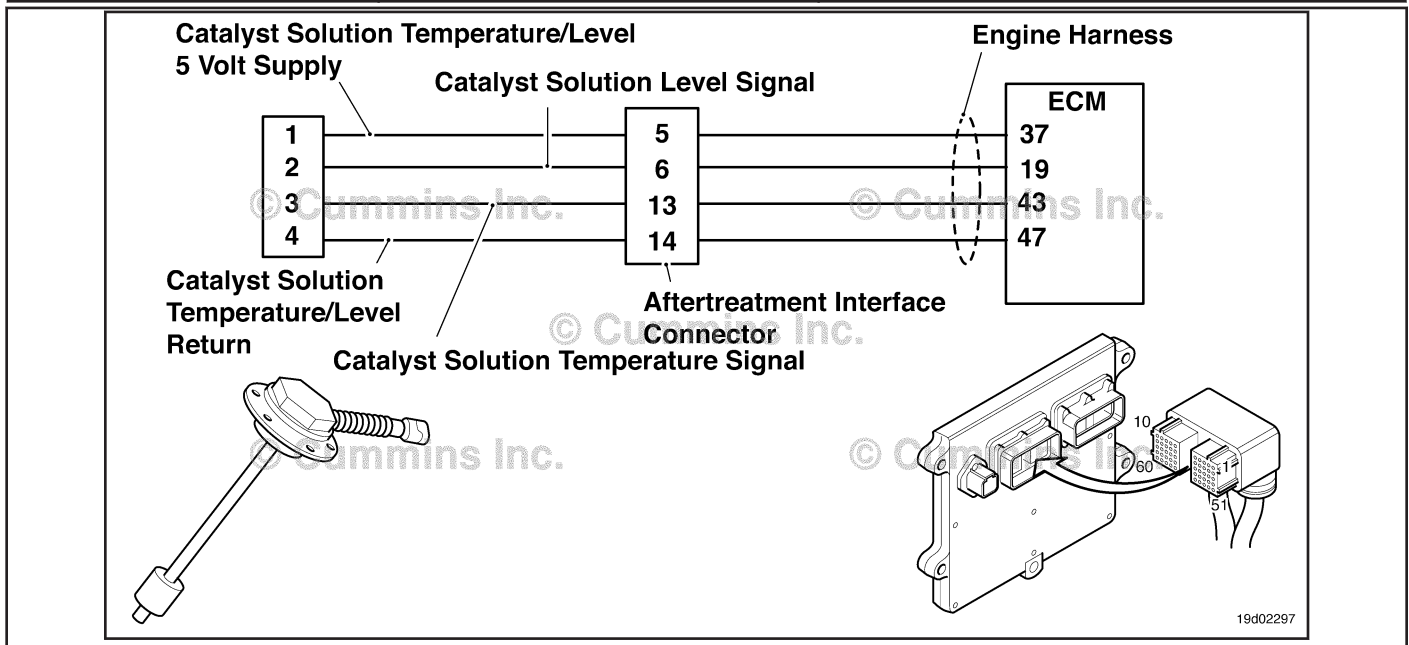
**STEP 4B: Clear the inactive fault codes.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Clear the inactive fault codes.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to erase the inactive fault codes.</li> </ul>	<p>All fault codes cleared?</p> <p><b>YES</b></p>	Repair complete
	<p>All fault codes cleared?</p> <p><b>NO</b></p>	Appropriate troubleshooting steps

## Fault Code 1679

### Catalyst Tank Temperature — Data Erratic, Intermittent, or Incorrect

CODES	REASON	EFFECT
Fault Code: 1679 PID(P), SID(S): SPN: 3031 FMI: 2 Lamp: Amber SRT:	Catalyst Tank Temperature — Data Erratic, Intermittent, or Incorrect. The catalyst solution temperature sensor is not changing with engine operating conditions.	Default temperature value used for catalyst solution temperature.



Circuit: Catalyst Solution Temperature Sensor

#### Circuit Description:

The catalyst solution temperature sensor is used by the electronic control module (ECM) to monitor the temperature of the catalyst solution in the catalyst tank. The ECM monitors the voltage on the signal pin and converts this to a temperature value.

#### Component Location:

The catalyst solution temperature sensor is located in the catalyst tank. The tank is OEM mounted. For more information, contact the OEM service manual.

#### Shop Talk:

This diagnostic runs when the engine has not been running for at least eight hours. The catalyst solution temperature sensor is compared to engine coolant temperature and intake manifold temperature when the key is turned on after the extended eight hour shutdown. This fault code is logged if the reading from the catalyst solution temperature sensor does not match the readings from engine coolant temperature and intake manifold temperature.

Possible causes of this fault code include:

- Stuck in-range catalyst solution temperature sensor
- High resistance in the catalyst solution temperature sensor signal or return lines.

On-Board Diagnostics (OBD) Information (Euro 4 and Euro 4 Stage 1+ Certified Engines):



- The ECM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The ECM turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does **not** fail. The MIL lamp and fault code can also be cleared using the INSITE™ service tool.
- The fault code will be cleared from memory after 40 consecutive drive cycles where the diagnostic runs and passes.

**Refer to Troubleshooting Fault Code t05-1679**

## TROUBLESHOOTING SUMMARY



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



To reduce the possibility of pin and harness damage, use the following test leads when taking a measurement: Part Number 3822758 - male Deutsch/AMP/Metri-Pack test lead Part Number 3822917 - female Deutsch/AMP/Metri-Pack test lead.

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1: Check for sensor circuit fault codes.</b>		
<b>STEP 1A:</b> Check for fault codes.	Fault Code 1677 or 1678 is active?	
<b>STEP 2: Check the catalyst solution temperature sensor and circuit.</b>		
<b>STEP 2A:</b> Inspect the catalyst solution temperature sensor and connector pins.	Dirty or damaged pins?	
<b>STEP 2B:</b> Check the circuit response.	Fault Code 1678 active?	
<b>STEP 2C:</b> Check the circuit response.	Fault Code 1677 active?	
<b>STEP 3: Check the ECM and engine harness.</b>		
<b>STEP 3A:</b> Inspect the ECM and engine harness connector pins.	Dirty or damaged pins?	
<b>STEP 3B:</b> Check the circuit response.	Fault Code 1678 active?	
<b>STEP 3C:</b> Check the circuit response.	Fault Code 1677 active?	
<b>STEP 4: Clear the fault codes.</b>		
<b>STEP 4A:</b> Verify the repair	Catalyst Solution Temperature and the Thermometer are reading within 5°F of each other?	
<b>STEP 4B:</b> Clear the fault codes.	All fault codes cleared?	

## TROUBLESHOOTING STEP

**STEP 1: Check for sensor circuit fault codes.**

**STEP 1A: Check for fault codes.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for an active fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ to read the fault codes.</li> </ul>	Fault Codes 1677 or 1678 is active? <b>YES</b>	Appropriate fault code troubleshooting tree.
	Fault Code 1677 or 1678 is active? <b>NO</b>	2A

**STEP 2: Check the catalyst solution temperature sensor and circuit.****STEP 2A: Inspect the catalyst solution temperature sensor and connector pins.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the catalyst solution temperature sensor from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
Inspect the engine harness and catalyst solution temperature sensor connector pins for the following: <ul style="list-style-type: none"> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Wire insulation damage</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Connector shell broken</li> <li>• Dirt or debris in or on the connector pins</li> </ul> For general inspection techniques, refer to Component Connector and Pin Inspection, Refer to Procedure 019-361.	Dirty or damaged pins? <b>YES</b> <b>Repair:</b> A defective connection has been detected in the sensor or harness connector. Clean the connector and pins. Repair the damaged harness, connector, or pins if possible. Refer to Procedure 019-071.	4A
	Dirty or damaged pins? <b>NO</b>	2B

**STEP 2B: Check the circuit response.**

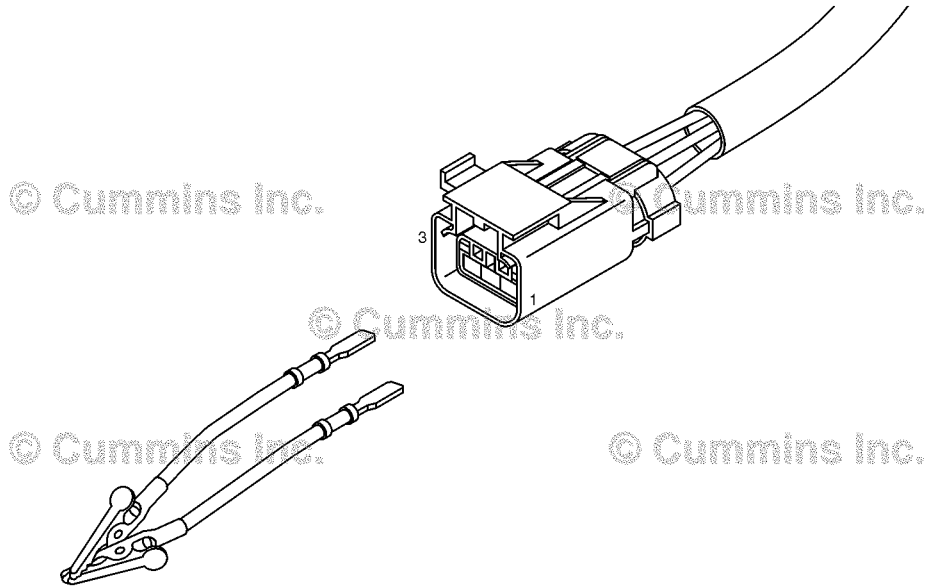
<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the catalyst solution temperature sensor from the engine harness.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for the appropriate ECM response after 30 seconds. <ul style="list-style-type: none"> <li>• Use INSITE™ to read the fault codes.</li> </ul>	Fault code 1678 active? <b>YES</b>	2C
	Fault code 1678 active? <b>NO</b>	3A

**STEP 2C: Check the circuit response.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the catalyst solution temperature sensor from the engine harness.
- Turn keyswitch ON.
- Connect INSITE™ electronic service tool.

Action	Specification/Repair	Next Step
Place a jumper wire between the catalyst solution temperature SIGNAL pin and the catalyst solution temperature RETURN pin at the catalyst solution temperature connector of the engine harness. Refer to the wiring diagram for connector pin identification. Check the appropriate circuit response after 30 seconds.	Fault Code 1677 is active? <b>YES</b> <b>Repair:</b> Replace the catalyst solution temperature sensor. Refer to OEM troubleshooting procedures.	4A
Check the appropriate circuit response after 30 seconds. • Use INSITE™ to read the fault codes.	Fault Code 1677 is active? <b>NO</b>	3A



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**STEP 3: Check the ECM and engine harness.**

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

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM connector.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the engine harness and ECM connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Wire insulation damage</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Connector shell broken</li> <li>• Dirt or debris in or on the connector pins</li> </ul> <p>For general inspection techniques, refer to Component Connector and Pin Inspection, Refer to Procedure 019-361.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A defective connection has been detected in the ECM connector or the engine harness connector.</p> <p>Clean the connector and pins.</p> <p>Repair the damaged harness, connector, or pins if possible.</p> <p>Refer to Procedure 019-043.</p>	4A
	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	3B

**STEP 3B: Check the circuit response.**

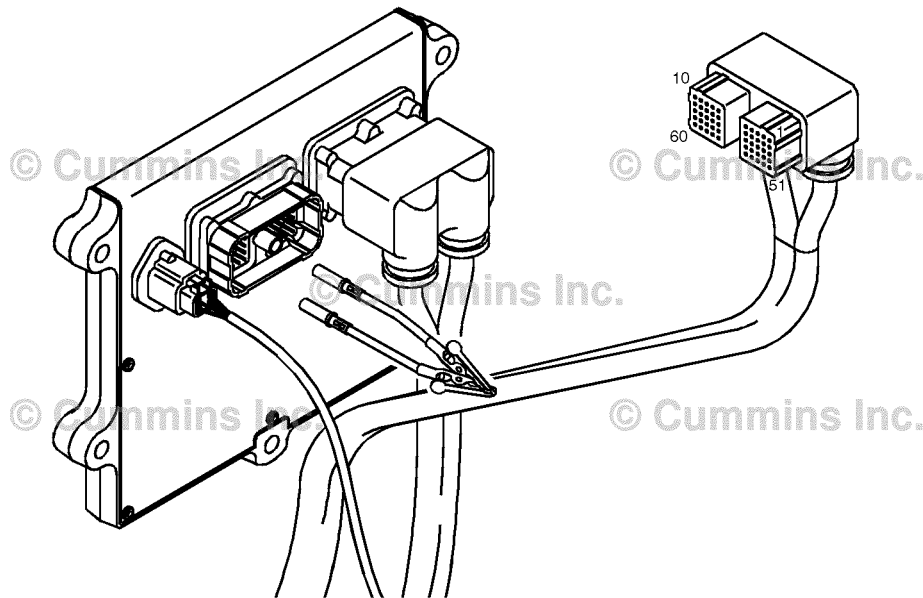
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate circuit response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ to read the fault codes.</li> </ul>	<p>Fault Code 1678 is active?</p> <p><b>YES</b></p>	3C
	<p>Fault Code 1678 is active?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Call for pre-authorization.</p> <p>Replace the ECM.</p> <p>Refer to Procedure 019-031.</p>	4A

**STEP 3C: Check the circuit response.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine harness from the ECM.
- Turn keyswitch ON.
- Connect INSITE™ electronic service tool.

Action	Specification/Repair	Next Step
Place a jumper wire between the catalyst solution temperature SIGNAL pin and catalyst solution temperature RETURN pin at the ECM connector.  Check for the appropriate circuit response after 30 seconds.  • Use INSITE™ to read the fault codes.	Fault Code 1677 is active? <b>YES</b> <b>Repair:</b> High resistance or a short circuit has been detected in the engine harness. Repair or replace the engine harness. Refer to Procedure 019-043.	4A
	Fault Code 1677 is active? <b>NO</b> <b>Repair:</b> Call for pre-authorization. Replace the ECM. Refer to Procedure 019-031.	4A



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**STEP 4: Clear the fault code.**

**STEP 4A: Verify the repair.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> <li>• Insert a thermometer into the catalyst solution tank.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Start the INSITE Data Monitor/Logger .</p> <ul style="list-style-type: none"> <li>• Compare the INSITE reading for Catalyst Solution Temperature with the thermometer.</li> </ul>	<p>Catalyst Solution Temperature and thermometer reading within 5°F of each other?</p> <p><b>YES</b></p>	4B
	<p>Catalyst Solution Temperature and thermometer reading within 5°F of each other?</p> <p><b>NO</b></p>	1A

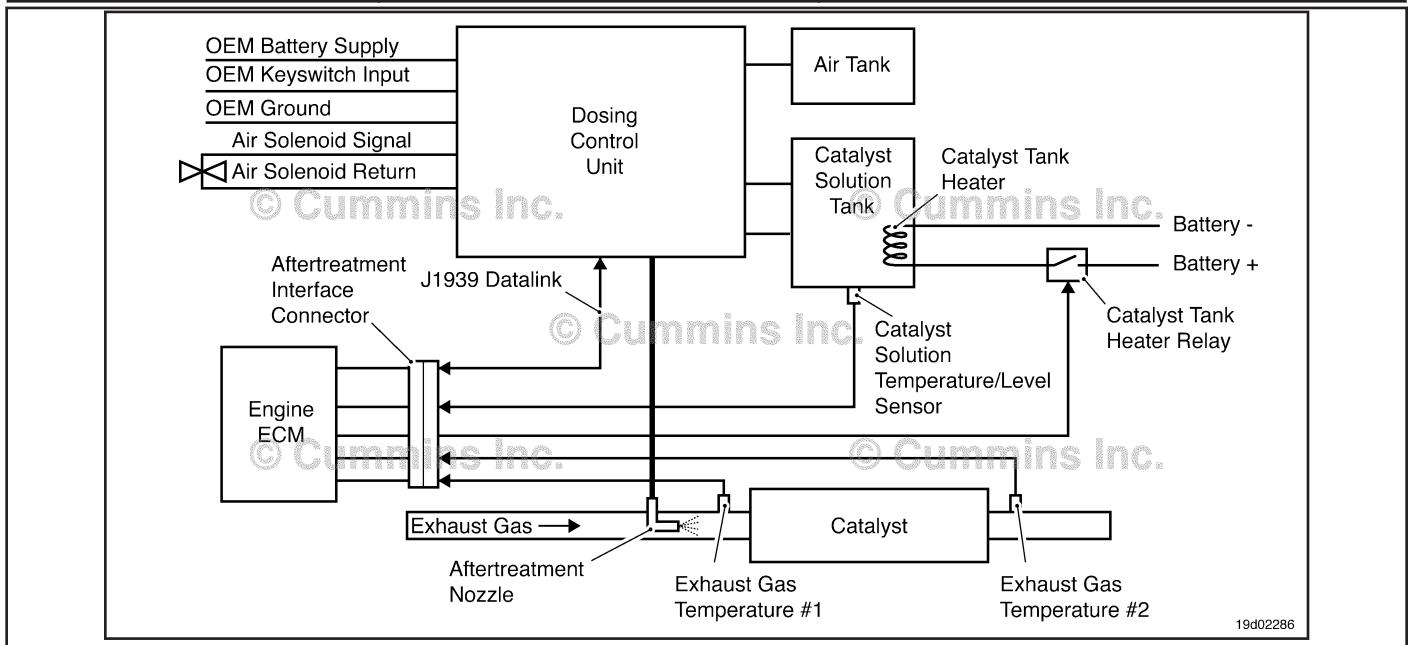
**STEP 4B: Clear the fault codes.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Clear the fault codes.</p> <ul style="list-style-type: none"> <li>• Using INSITE™ electronic service tool, erase all active and inactive fault codes.</li> </ul>	<p>All fault codes cleared?</p> <p><b>YES</b></p>	Repair complete
	<p>All fault codes cleared?</p> <p><b>NO</b></p>	Appropriate troubleshooting steps

## Fault Code 1681

### Dosing Control Unit — Bad Intelligent Device or Component.

CODES	REASON	EFFECT
Fault Code: 1681 PID(P), SID(S): SPN: 3361 FMI: 12 Lamp: Amber SRT:	Catalyst Dosing Control Unit — Bad Intelligent Device or Component. An internal error has been detected in the catalyst dosing control unit.	Catalyst solution injection into the aftertreatment system is disabled.



Circuit: Aftertreatment Control System

**Circuit Description:**

The Dosing Control Unit communicates to the primary engine Electronic Control Module (ECM) through the J1939 datalink network. The dosing control unit precisely measures the amount of catalyst solution to be injected into the aftertreatment system. The dosing control unit has three primary cycles. A priming cycle at initial key on makes sure that catalyst solution is available at the dosing control unit. During the dosing cycle, catalyst solution is being delivered to the aftertreatment nozzle. A purge cycle occurs when the engine is turned off. The purge cycle makes sure that all the catalyst solution is removed from the aftertreatment line and nozzle.

**Component Location:**

The Dosing Control Unit location is OEM dependent.

**Shop Talk:**

Fault code 1681 is triggered when the Dosing Control Unit has detected an internal error. The only troubleshooting that can be done is to recalibrate the engine ECM. If fault code 1681 is still active after the engine ECM has been recalibrated, the Dosing Control Unit will need to be replaced.

On-Board Diagnostics (OBD) Information (Euro 4 Certified Engines):

- The ECM illuminates the malfunction indicator lamp (MIL) when the diagnostic runs and fails.
- The ECM turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does **not** fail. The MIL lamp and fault code can also be cleared using the INSITE™ service tool.
- The fault code will be cleared from memory after 40 consecutive drive cycles where the diagnostic runs and passes.



On-Board Diagnostics (OBD) Information (Euro 4 Stage 1+ Certified Engines):

- The ECM illuminates the malfunction indicator lamp (MIL) when the diagnostic runs and fails.
- An engine torque derate will be activated after 50 hours of engine operation with the fault code active.
- The ECM turns OFF the malfunction indicator lamp (MIL) after 1 ignition cycle that the diagnostic runs and does **not** fail. The MIL lamp **cannot** be cleared using the INSITE™ service tool.
- The fault code will be cleared from memory after 400 days or 9600 hours of engine operation.

**Refer to Troubleshooting Fault Code t05-1681**

## FAULT CODE 1681 - Dosing Control Unit - Bad Intelligent Device or Component

### TROUBLESHOOTING SUMMARY



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



To reduce the possibility of pin and harness damage, use the following test leads when taking a measurement: Part Number 3822758 - male Deutsch™/AMP™/Metri-Pack™ test lead and Part Number 3822917 - female Deutsch™/AMP™/Metri-Pack™ test lead.

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1:</b> Check the fault codes.		
<b>STEP 1A:</b> Read the fault codes.	Fault code 1681 active?	
<b>STEP 2:</b> Clear the fault code.		
<b>STEP 2A:</b> Disable the fault code.	Fault code 1681 inactive?	
<b>STEP 2B:</b> Clear the inactive fault code.	All faults cleared?	

### TROUBLESHOOTING STEP

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

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Read the fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool read the fault codes.</li> </ul>	Fault code 1681 active? <b>YES</b> <b>Repair:</b> Replace the dosing control unit. Refer to Procedure 019-440 in Section 19.	2A
	Fault code 1681 active? <b>NO</b>	2A

**STEP 2: Check ECM calibration and clear fault codes.****STEP 2A: Check if an ECM calibration update is available.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>Connect all components.</li> <li>Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Compare the ECM code and revision number in the ECM to the calibration revisions listed in the ECM Calibration Revision History for applicable changes related to this fault code. <ul style="list-style-type: none"> <li>Use INSITE™ electronic service tool to find the present ECM code and revision number in the ECM. The ECM code and revision number are found in the Calibration Information section of System ID and Dataplate in Features and Parameters.</li> </ul>	If a calibration update for this fault code is available, does the ECM contain that revision or higher? <b>YES</b>	2B
	If a calibration update for this fault code is available, does the ECM contain that revision or higher? <b>NO</b> <b>Repair:</b> If necessary, calibrate the ECM. Refer to Procedure 019-032 in Section 19.	2B

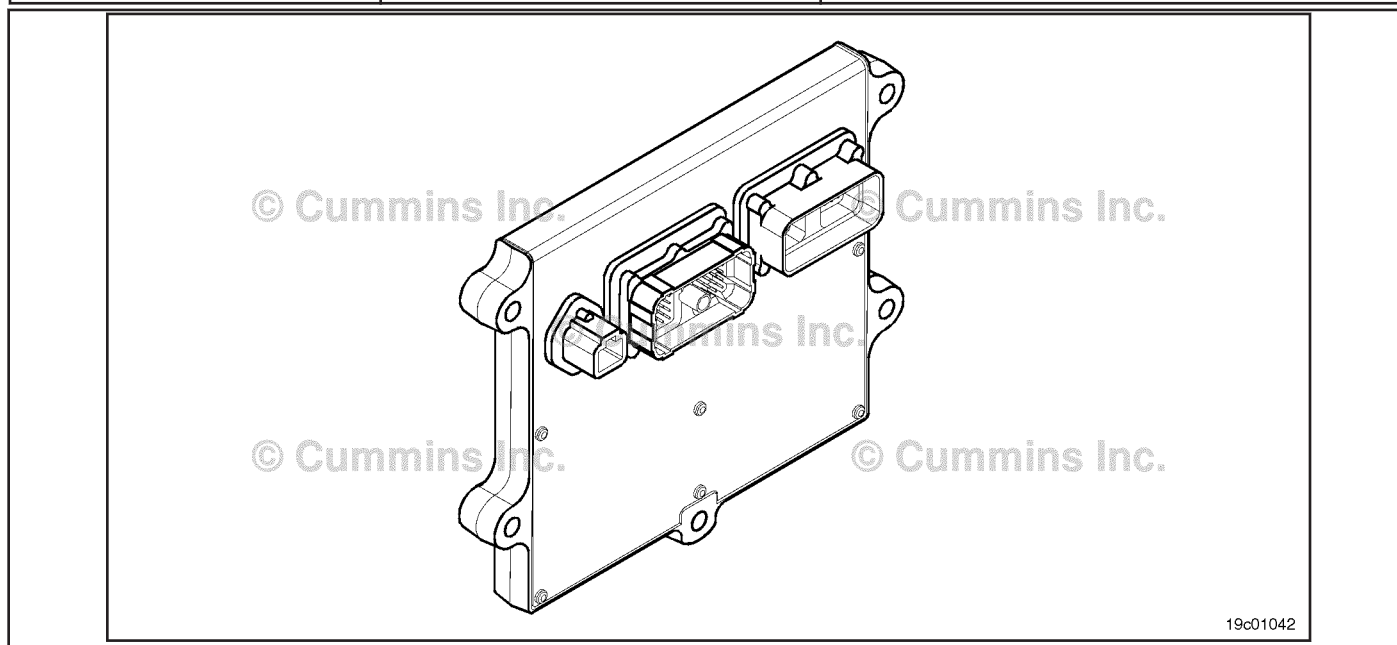
**STEP 2B: Disable the fault code.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>Connect all components.</li> <li>Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Disable and clear the fault code. <ul style="list-style-type: none"> <li>Operate the engine within the "Conditions for Clearing the Fault Code" found in the Overview section of this troubleshooting procedure.</li> </ul>	Fault code inactive? <b>YES</b>	Repair complete.
	Fault code inactive? <b>NO</b> <b>Repair:</b> Return to the troubleshooting steps or contact a Cummins® Authorized Repair Location if all steps have been completed and checked again.	1A

## Fault Code 1682

### Aftertreatment Diesel Exhaust Fluid Dosing Control Unit Input Lines - Condition Exists

CODES	REASON	EFFECT
Fault Code: 1682 PID(P), SID(S): SPN: 3362 FMI: 11/31 Lamp: Amber SRT:	Aftertreatment Diesel Exhaust Fluid Dosing Unit Input Lines - Condition Exists. An error has been detected by the catalyst dosing control unit.	Diesel exhaust fluid injection into the SCR aftertreatment system is disabled.



Aftertreatment Control System Circuit

#### **Circuit Description:**

For an air-assisted SCR aftertreatment system, the aftertreatment diesel exhaust fluid (Urea) dosing unit requires air pressure from the OEM air tanks. The diesel exhaust fluid dosing unit precisely measures the amount of diesel exhaust fluid to be injected into the aftertreatment system. The diesel exhaust fluid dosing unit has three primary cycles. A priming cycle at initial engine start makes sure that diesel exhaust fluid is available at the diesel exhaust fluid dosing unit. During the dosing cycle, the diesel exhaust fluid is being delivered to the aftertreatment nozzle. A purge cycle occurs when the engine is turned off. The purge cycle makes sure that all the diesel exhaust fluid is removed from the diesel exhaust fluid line and aftertreatment nozzle.

#### **Component Location:**

The aftertreatment diesel exhaust fluid dosing unit location is OEM dependent. Refer to the OEM service manual for more information.

#### **Conditions for Running the Diagnostics:**

This diagnostic consists of multiple parts, which run on engine "Run". This can take up to 12 minutes. If the Doser Override Test passed after the repair, the repair is considered to be complete.

### **Conditions for Setting the Fault Codes:**

The aftertreatment diesel exhaust fluid dosing unit is **not** able to provide the correct dosing rate to the aftertreatment nozzle.

### **Action Taken When the Fault Code is Active:**

- The ECM illuminates the amber CHECK ENGINE light and/or the MIL (malfunction indicator lamp) immediately when the diagnostic runs and fails.
- An engine torque derate will be activated after 50 hours of engine operation with the fault code active, if the engine has a NOx sensor fitted.
- Diesel exhaust fluid injection into the SCR aftertreatment system is disabled. The Dosing Unit status in INSITE™ electronic service tool will be OFF.

### **Conditions for Clearing the Fault Code:**

- This fault code can **not** be cleared with INSITE™ electronic service tool while it is active.
- To validate the repair, it is necessary to use INSITE™ electronic service tool to perform the Diesel Exhaust Fluid Doser Pump Override Test. Refer to Procedure 019-440 in Section 19.
- Make sure the diesel exhaust fluid dosing unit is able to successfully cycle through all phases (priming, dosing, and purging) and that diesel exhaust fluid flows evenly from the aftertreatment nozzle.
- The ECM will turn off the amber CHECK ENGINE light and/or MIL immediately after the diagnostic runs and passes (engines with NOx sensors **only**).
- Use INSITE™ electronic service tool to verify that the fault code is inactive.
- The inactive fault code will be cleared from memory automatically after the completion of 9600 hours of operation without a reoccurrence.

### **Shop Talk:**

The diesel exhaust fluid dosing unit process consists of three phases, which occur in the following sequence: priming, dosing, and purging.

#### **Priming:**

- The diesel exhaust fluid dosing unit will attempt to prime every 30 seconds for 20 attempts. The attempts can be counted by listening for the air solenoid to click every 30 seconds.
- The diesel exhaust fluid dosing unit can take up to 12 minutes to complete the priming cycle before a fault code will become active.
- During priming, the diesel exhaust fluid dosing unit will pump diesel exhaust fluid through the supply and return lines, and back to the tank.
- Under most conditions, the system will prime within 3 or 4 attempts.
- If priming is **not** successful, the diesel exhaust fluid dosing unit will be disabled and Fault Code 1682 will be activated.

#### **Dosing:**

- Immediately after successful priming, the system will go into the dosing mode, the solenoid will stop clicking, and a constant flow of air will flow through the aftertreatment nozzle, which helps transport the diesel fluid and keeps the aftertreatment nozzle clear.
- The air flow will remain constant until the system reaches all dosing conditions before diesel exhaust fluid is delivered to the aftertreatment system (catalyst temperature greater than 200°C [392°F], engine speed and load conditions met, etc.).

#### **Purging:**

- After the engine is stopped and the keyswitch is turned off, the dosing unit enters the purging cycle, which clears any diesel exhaust fluid left in the line and the aftertreatment nozzle after operation.
- Purging consists of flowing compressed air through the aftertreatment nozzle and diesel exhaust fluid line for 30 seconds.
- If the full purge time is **not** completed, it is possible to leave diesel exhaust fluid in the line, leading to a buildup of hard urea crystals, resulting in a blocked diesel exhaust fluid line or aftertreatment nozzle.
- If the vehicle is equipped with a battery isolation switch, it should have a built-in delay device to prevent power down of the dosing unit until the purge sequence is completed.
- Incomplete purge events are recorded by the ECM and by increments at the next keyswitch ON event.
- Incomplete purge counts can be viewed using the Data Monitor/Logger menu in the aftertreatment section of INSITE™ electronic service tool.

Fault Code 1682 is triggered by the following external failure modes:

- Low aftertreatment diesel exhaust fluid level in the diesel exhaust fluid tank
- Low air pressure is detected at the dosing control unit
- Air pressure is cycling below the minimum limit required by the dosing control unit
- Blocked or restricted aftertreatment nozzle
- Blocked or restricted/frozen diesel exhaust fluid lines
- Plugged or restricted inline air filter.
- By the operation of the SCR aftertreatment system in environments where the ambient temperature falls below -11 degrees C, without suitable line and tank heating protection.
- This can lead to the freezing of the dosing control unit (DCU), and can cause permanent internal damage to the DCU.

Fault Code 1682 is triggered by the following internal diesel exhaust fluid dosing unit failure modes:

- Diesel exhaust fluid dosing unit fails to initialize on keyswitch ON (fault code will be active immediately after keyswitch ON)
- Buildup of urea crystals in the dosing unit restricts air flow to the aftertreatment nozzle, and possibly leads to buildups and restrictions in the aftertreatment nozzle itself. This results in low/no air flow to the nozzle
- Internal pressure sensor malfunction - pump does **not** prime and diesel exhaust fluid is injected as the air solenoid operates during priming. Fault Code 1682 will become active after 12 minutes of consecutive priming attempts
- Internal poppet valve malfunction, causing priming to **not** occur. This will cause diesel exhaust fluid to flow continuously during priming (fault code will be active after 12 minutes of failed priming attempts)
- Contamination in the dosing unit inlet check valve from an external source, such as the diesel exhaust fluid line or tank
- Diesel exhaust fluid dosing unit drawing in air through loose or damaged lines or connectors.

**Refer to Troubleshooting Fault Code t05-1682**

## FAULT CODE 1682 - Aftertreatment Diesel Exhaust Fluid Dosing Control Unit Input Lines - Condition Exists TROUBLESHOOTING SUMMARY

### ⚠ WARNING ⚠

To reduce the possibility of personal injury to the eyes, wear appropriate eye protection when removing the diesel exhaust fluid nozzle line. Air pressure may be present in the reagent nozzle line if there is a fault in the system.

### ⚠ WARNING ⚠

The exhaust and exhaust components can become heated during troubleshooting. To avoid the risk of fire, property damage, burns, or other serious personal injury, allow the exhaust system to cool before beginning any procedure or repair, and make sure that no combustible materials are located where they are likely to come in contact with hot exhaust or exhaust components.

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1: Check the fault codes.</b>		
<b>STEP 1A:</b> Check for active fault codes.	Fault Code 434, 1665, 1666, 1668, 1669, 1671, 1673, 1674, 1675, 1677, 1678, 1697, 1698, or 1711 active?	
<b>STEP 2: Inspect the aftertreatment nozzle.</b>		
<b>STEP 2A:</b> Inspect the aftertreatment nozzle.	Plugged or restricted aftertreatment nozzle detected?	
<b>STEP 3: Verify the priming cycle of the diesel exhaust fluid (DEF ) dosing unit.</b>		
<b>STEP 3A:</b> Check the aftertreatment nozzle DEF line during priming.	Dosing unit attempts to prime for only 3 seconds? (Plus the 140 second prime delay if applicable)	
<b>STEP 3B:</b> Check the air solenoid operation during priming.	Air solenoid click and exhaust air down the aftertreatment nozzle line continuously after 30 seconds? (Note: will attempt to prime up to 20 times)	
<b>STEP 3C:</b> Confirm the successful priming of the DEF dosing unit.	Air flow above 25 liters per minute [6.6 gallons per minute]?	
<b>STEP 4: Check the DEF dosing unit air supply system.</b>		
<b>STEP 4A:</b> Inspect the air supply lines to the DEF dosing unit.	OEM air supply correctly attached to the DEF dosing unit and supplying adequate air pressure?	
<b>STEP 4B:</b> Clear the DEF dosing unit air side circuit. Carry out the flushing procedure.	Flushing procedure successful?	
<b>STEP 5: Check the DEF lines and fittings for restriction and contamination.</b>		
<b>STEP 5A:</b> Check the DEF dosing unit fittings and lines.	DEF fittings and lines pass the inspections?	
<b>STEP 5B:</b> Inspect the DEF dosing unit inline screen filter connection.	Contamination present at the screen filter?	
<b>STEP 5C:</b> Check the DEF dosing lines for restrictions or leaks.	Restriction line test completed successfully?	

- STEP 5D:** Inspect the DEF tank and the 35 micron tank filter. DEF tank contaminated or the urea solution less than 32.5%?
- STEP 6:** Verify the purging cycle of the aftertreatment dosing unit.
- STEP 6A:** Monitor the aftertreatment dosing unit purging cycle. All the actions in this step confirmed and zero incomplete purge counts in the ECM image?
- STEP 7:** Perform the DEF Doser Pump Override Test.
- STEP 7A:** Perform the DEF doser pump override test with INSITE™ electronic service tool. Dosing control unit operates correctly during INSITE™ electronic service tool override test? (It is recommended to complete this test 3 times)
- STEP 8:** Check the ECM calibration and clear the fault codes.
- STEP 8A:** Check if an ECM calibration update is available. If a calibration update for this fault code is available, does the ECM contain that revision or higher?
- STEP 8B:** Disable the fault code. Fault code inactive?

### TROUBLESHOOTING STEP

- STEP 1:** Check the fault codes.
- STEP 1A:** Check for active fault codes.

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for active fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 434, 1665, 1666, 1668, 1669, 1671, 1673, 1674, 1675, 1677, 1678, 1697, 1698, or 1711 active? <b>YES</b>	Appropriate Fault Code Troubleshooting Tree
	Fault Code 434, 1665, 1666, 1668, 1669, 1671, 1673, 1674, 1675, 1677, 1678, 1697, 1698, or 1711 active? <b>NO</b>	2A



**STEP 2: Inspect the aftertreatment nozzle.**

**STEP 2A: Inspect the aftertreatment nozzle.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Make sure the nozzle has been warmed in the exhaust prior to removal. Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 011-040 in Section 11.</li> <li>• Turn keyswitch OFF.</li> <li>• Remove the aftertreatment nozzle. Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 011-040 in Section 11.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the aftertreatment nozzle for blockage or restrictions.</p> <ul style="list-style-type: none"> <li>• Inspect the aftertreatment nozzle. Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 011-040 in Section 11.</li> <li>• Soft crystal and ash like buildup in the spray holes can be dissolved with 40°C [104°F] warm water.</li> <li>• Be sure that the soft buildup in the spray holes clears when the dosing unit begins dosing.</li> </ul>	<p>Plugged or restricted aftertreatment nozzle detected?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Clean or replace the aftertreatment nozzle. Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 011-040 in Section 11.</p>	3A
	<p>Plugged or restricted aftertreatment nozzle detected?</p> <p><b>NO</b></p>	3A

**STEP 3: Verify the priming cycle of the DEF dosing unit.**

**STEP 3A: Check the aftertreatment nozzle DEF line during priming.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>Isolate the vehicle main power for at least 30 seconds prior to carrying out this check</li> <li>Disconnect the DEF line from the aftertreatment nozzle and secure it appropriately.</li> <li>Leave the aftertreatment nozzle installed.</li> <li>Turn keyswitch ON.</li> <li>Start the engine and operate at low idle</li> <li>Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check the aftertreatment nozzle fluid line during priming.</p> <ul style="list-style-type: none"> <li>After key ON with the engine operating, listen for the diesel exhaust fluid dosing pump to start.</li> <li>Time the pump operation until the pump automatically switches off (The pump is attempting to prime).</li> </ul> <p>NOTE: While the engine is operating it may be difficult to hear the pump. If this is the case, listen for the air solenoid to click, indicating that the pump has completed 1 prime attempt.</p> <p>NOTE: Older calibrations did not incorporate the 140 second delay from key ON to initial prime cycle. During the 140 second delay, the dosing unit will remain on standby before receiving the command to prime. This was introduced to remove any crystallization built up on injection tip prior to the priming cycle and to avoid any blocked injection lines.</p> <p>A correct prime cycle is as follows:</p> <ol style="list-style-type: none"> <li>Key ON</li> <li>140 second pump start delay</li> <li>Pump starts and operates for 30 seconds. (The system is now priming, this step may be attempted up to 20 times).</li> <li>The diesel exhaust fluid injection line will now exhaust air. Priming is now complete.</li> </ol> <p>NOTE: If the pump detects a problem during priming, the priming attempt will be aborted after 3 seconds.</p>	<p>Dosing unit attempts to prime for <b>only 3</b> seconds? (Plus the 140 second prime delay if applicable)</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Complete line restriction testing procedure then re-prime. Use the following procedure for ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 1 or ISC, ISCe, QSC8.3, ISL, ISLe3, and QSL9 engines.</p> <ul style="list-style-type: none"> <li>Refer to Procedure 011-086 in Section 11.</li> </ul>	3A
	<p>Dosing unit attempts to prime for <b>only 3</b> seconds? (Plus the 140 second prime delay if applicable)</p> <p><b>NO</b></p>	3B

**STEP 3B: Check the air solenoid operation during priming.**

<b>Condition:</b>		
<ul style="list-style-type: none"> <li>• Disconnect the DEF line from the aftertreatment nozzle and secure it appropriately.</li> <li>• Leave the aftertreatment nozzle installed.</li> <li>• Turn keyswitch ON</li> <li>• Connect INSITE™ electronic service tool.</li> <li>• Start the engine and operate at low idle.</li> </ul>		
<b>Action</b>	<b>Specification/Repair</b>	<b>Next Step</b>
<p>Make sure that the DEF dosing unit has successfully primed and entered the dosing state.</p> <ul style="list-style-type: none"> <li>• The DEF dosing unit enters the dosing state <b>only</b> when a successful prime is completed, and the air solenoid has clicked.</li> <li>• At this point, air will be flowing continuously down the aftertreatment nozzle line.</li> <li>• The DEF dosing unit could attempt to prime for up to 12 minutes, at which point, if a prime is successful, the pump will switch off.</li> <li>• Use INSITE™ electronic service tool Data/Monitor Logger for Aftertreatment DEF Dosing Unit State to confirm the doser status.</li> </ul>	<p>Air solenoid click and exhaust air down the aftertreatment nozzle line continuously after 30 seconds? (Note: will attempt to prime up to 20 times)</p> <p><b>YES</b></p>	3C
	<p>Air solenoid click and exhaust air down the aftertreatment nozzle line continuously after 30 seconds? (Note: will attempt to prime up to 20 times)</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>NOTE: The diesel exhaust fluid dosing unit has <b>not</b> primed.</p>	5A

**STEP 3C: Confirm the successful priming of the DEF dosing unit.**

<b>Condition:</b>		
<ul style="list-style-type: none"> <li>• Turn keyswitch OFF for a minimum of 1 minute.</li> <li>• Disconnect the DEF line from the aftertreatment nozzle.</li> <li>• Attach the air flow meter to the DEF dosing line. Use the following procedure for ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 1 or ISC, ISCe, QSC8.3, ISL, ISLe3, and QSL9 engines. Refer to Procedure 011-058 in Section 11.</li> <li>• Secure the DEF dosing line and the attached air flow meter.</li> <li>• Start the engine and operate at low idle.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
<b>Action</b>	<b>Specification/Repair</b>	<b>Next Step</b>
<p>The DEF dosing unit should start the priming cycle immediately after the prime delay when the engine is started. After 30 seconds (each prime attempt will take 30 seconds, if not successful the doser will attempt to prime up to 20 times) air should continuously flow through the DEF Injection line, and the attached air flow meter.</p> <ul style="list-style-type: none"> <li>• Record the measured air flow from the DEF dosing line.</li> </ul>	<p>Air flow above 25 liters per minute [6.6 gallons per minute]?</p> <p><b>YES</b></p>	6A
	<p>Air flow above 25 liters per minute [6.6 gallons per minute]?</p> <p><b>NO</b></p>	4A

**STEP 4: Check the DEF dosing unit air supply system.**

**STEP 4A: Inspect the air supply lines to the DEF dosing unit.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Start the engine.</li> <li>• Operate the engine at low idle.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the OEM air supply line attached to the DEF dosing unit.</p> <ul style="list-style-type: none"> <li>• Check for leaks or loose connections in the air supply line.</li> <li>• Check the DEF dosing unit air filter for water or excessive oil from the vehicle's compressed air system.</li> <li>• Make sure a clean supply of air, at least 517 kPa [75 psi], pressure is present at the DEF dosing unit, downstream of the air filter.</li> </ul> <p>NOTE: Most vehicles are equipped with an inline air filter in the air line prior to the DEF dosing unit. A plugged or restricted inline air filter can cause low air pressure to the DEF dosing unit.</p>	<p>OEM air supply correctly attached to the DEF dosing unit and supplying adequate air pressure?</p> <p><b>YES</b></p>	4B
	<p>OEM air supply correctly attached to the DEF dosing unit and supplying adequate air pressure?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Correct the OEM air supply connection or supply.</p> <p>Refer to the OEM service manual.</p>	3A

**STEP 4B: Check the DEF dosing unit air solenoid.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Disconnect the DEF line from the aftertreatment nozzle and secure it appropriately.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> <li>• Be sure the vehicle air tanks are full.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Carry out the DEF dosing unit flushing procedure.</p> <p>Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 011-082 in Section 11.</p> <p>Most vehicles are equipped with an inline air filter in the air line prior to the DEF dosing unit. A plugged or restricted inline air filter can cause low air pressure to the DEF dosing unit.</p>	<p>Flushing procedure successful?</p> <p><b>YES</b></p>	5A
	<p>Flushing procedure successful?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>A damaged DEF dosing unit has been detected.</p> <p>Replace the DEF dosing unit. Refer to Procedure 019-440 in Section 19.</p>	7A

**STEP 5: Check the DEF lines and fittings for restriction and contamination.****STEP 5A: Check the DEF dosing unit fittings and lines.**

<b>Condition:</b>		
<ul style="list-style-type: none"> <li>• Clean the front face of the doser before removing any lines.</li> <li>• Disconnect the DEF line from the aftertreatment nozzle and secure appropriately.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> <li>• Start the engine and operate at low idle.</li> </ul>		
<b>Action</b>	<b>Specification/Repair</b>	<b>Next Step</b>
Inspect the DEF dosing unit fittings and lines for the following:  NOTE: Clean the front face of the aftertreatment dosing unit and lines with warm water or mild detergent before removing any line. This is to prevent any contamination due to service intervention. <ul style="list-style-type: none"> <li>• Loose DEF inlet connectors or fitting</li> <li>• Cracked DEF lines, resulting in leaks or drawing in air</li> <li>• Restricted or damaged DEF supply or return lines</li> <li>• Be sure DEF is returning to the tank during the priming cycle.</li> </ul>	DEF fittings and lines pass the inspections? <b>YES</b>	5B
	DEF fittings and lines pass the inspections? <b>NO</b> <b>Repair:</b> Repair or replace DEF fittings, lines, and/or connector. Refer to the OEM service manual.	3B

**STEP 5B: Inspect the DEF dosing unit inline screen filter connection.**

<b>Condition:</b>		
<ul style="list-style-type: none"> <li>• Clean the front face of the doser before removing any lines.</li> <li>• Disconnect the DEF supply line from the dosing unit and secure appropriately.</li> </ul>		
<b>Action</b>	<b>Specification/Repair</b>	<b>Next Step</b>
Inspect the DEF dosing unit inline screen filter connection. <ul style="list-style-type: none"> <li>• Remove the diesel exhaust fluid dosing unit supply line</li> <li>• Inspect the inlet screen filter. Use the following procedure for ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 1 or ISC, ISCe, QSC8.3, ISL, ISLe3, and QSL9 engines. Refer to Procedure 011-060 in Section 11.</li> </ul> NOTE: Clean the front face of the aftertreatment dosing unit and lines with warm water or mild detergent before removing any lines. This is to prevent any contamination due to service intervention.  Use the following procedure to identify the different connections on the DEF dosing unit. Refer to Procedure 019-440 in Section 19.	Contamination present at the screen filter? <b>YES</b> <b>Repair:</b> Replace the screen filter.	5C
	Contamination present at the screen filter? <b>NO</b>	5C

**STEP 5C: Check the DEF dosing lines for restrictions or leaks**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Do <b>not</b> operate the engine.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Complete the line restriction procedure.</p> <p>Use the following procedure for ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 1 or ISC, ISCe, QSC8.3, ISL, ISLe3, and QSL9 engines. Refer to Procedure 011-086 in Section 11.</p> <p>Check the DEF lines for leaks or restrictions.</p> <p>NOTE: Clean the front face of the aftertreatment dosing unit and lines with warm water or mild detergent before removing any lines. This is to prevent any contamination due to service intervention.</p> <ul style="list-style-type: none"> <li>• Remove and check the supply and return lines.</li> </ul> <p>Use the following procedure to identify the different connections on the DEF dosing unit. Refer to Procedure 019-440 in Section 19.</p>	<p>Restriction line test completed successfully?</p> <p><b>YES</b></p>	5D
	<p>Restriction line test completed successfully?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Repair or replace DEF fittings, lines, and/or connector. Refer to the OEM service manual.</p>	3B

**STEP 5D: Inspect the DEF tank and the 35 micron tank filter.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Do not operate the engine.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the DEF tank and filters for fuel, oil, coolant, dirt, and debris.</p> <p>Refer to the OEM service manual for removal/installation procedures for the DEF tank and DEF tank level sensor assembly.</p> <p>NOTE: In some cases, the DEF tank is bonded to the vehicle chassis leaving no access to DEF tank level sensor assembly. If this is the case contact the OEM to arrange for the tank to be removed and inspected.</p> <ul style="list-style-type: none"> <li>• Inspect the contents of the tank.</li> <li>• Inspect the condition of the tank filter.</li> <li>• Check that a 35 micron tank filter is fitted. Use the following procedure for ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 1 or ISC, ISCe, QSC8.3, ISL, ISLe3, and QSL9 engines. Refer to Procedure 011-083 in Section 11.</li> <li>• Check and record the urea concentration of the DEF using a sample from the tank. Refer to Procedure 018-026 in Section V.</li> </ul>	<p>DEF tank contaminated or the urea solution less than 32.5%?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Locate/remove source, inform OEM. If required replace components and connectors. Drain/refill the DEF tank. Refer to OEM service manual.</p>	6A
	<p>DEF tank contaminated or the urea solution less than 32.5%?</p> <p><b>NO</b></p>	6A

**STEP 6: Verify the purging cycle of the aftertreatment dosing unit.**

**STEP 6A: Monitor the aftertreatment dosing unit purging cycle.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>Start the engine and operate at low idle.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Verify completion of the aftertreatment dosing unit purge cycle.</p> <ul style="list-style-type: none"> <li>Turn the keyswitch OFF to shut down the engine.</li> <li>Verify that the aftertreatment dosing unit remains powered for at least 30 seconds after keyswitch OFF to complete the purge cycle.</li> <li>Confirm that air flow is present for 30 seconds after keyswitch OFF.</li> <li>Confirm the battery isolation switch allows the purge to continue for a full 30 seconds.</li> </ul> <p>NOTE: The procedure above will flag incomplete purge counts in the ECM, if incorrect. See the Purging section under Shop Talk.</p>	<p>All the actions in this step confirmed and zero incomplete purge counts in the ECM image?</p> <p><b>YES</b></p>	7A
	<p>All the actions in this step confirmed and zero incomplete purge counts in the ECM image?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <ul style="list-style-type: none"> <li>Verify the correct battery power and keyswitch wiring to the aftertreatment dosing unit.</li> <li>Consult the engine and OEM wiring diagrams.</li> <li>Repair any OEM wiring issue and notify the OEM.</li> <li>If the battery isolator switch increases incomplete purge counts, the OEM <b>must</b> be notified. A timer relay <b>must</b> be in the system to allow a 30 second purge.</li> </ul>	7A

**STEP 7: Perform the DEF Doser Pump Override Test.**

**STEP 7A: Perform the DEF Doser Pump Override Test with INSITE™ electronic service tool.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>Turn keyswitch ON.</li> <li>Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Use INSITE™ electronic service tool to perform the DEF Doser Pump Override Test, under Aftertreatment Diagnostics Tests.</p> <ul style="list-style-type: none"> <li>Use the following procedure for instructions and specifications. Refer to Procedure 019-440 in Section 19.</li> <li>Check to make sure that the DEF is being injected through the aftertreatment nozzle during the dosing state.</li> </ul> <p>NOTE: The aftertreatment nozzle <b>must</b> have been warmed in the exhaust before removing and placing it in a measuring container larger than 200 ml [6.8 oz] capacity to perform the DEF Doser Pump Override Test.</p> <p>The troubleshooting tree <b>must</b> be followed completely before completing this test.</p>	<p>Dosing control unit operates correctly during INSITE™ electronic service tool override test ? (It is recommended to complete this test 3 times)</p> <p><b>YES</b></p>	8A
	<p>Dosing control unit operates correctly during INSITE™ electronic service tool override test? (It is recommended to complete this test 3 times)</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>A damaged DEF dosing unit has been detected. Replace the DEF dosing unit. Refer to Procedure 019-440 in Section 19.</p>	8A



**STEP 8: Check the ECM calibration and clear the fault codes.**

**STEP 8A: Check if an ECM calibration update is available.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Compare the ECM code and revision number in the ECM to the calibration revisions listed in the ECM Calibration Revision History for applicable changes related to this fault code.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to find the present ECM code and revision number in the ECM. The ECM code and revision number are found in the Calibration Information section of System ID and Dataplate in Features and Parameters.</li> </ul>	<p>If a calibration update for this fault code is available, does the ECM contain that revision or higher?</p> <p><b>YES</b></p>	8B
	<p>If a calibration update for this fault code is available, does the ECM contain that revision or higher?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>If necessary, calibrate the ECM. Refer to Procedure 019-032 in Section 19.</p>	8B

**STEP 8B: Disable the fault code.**

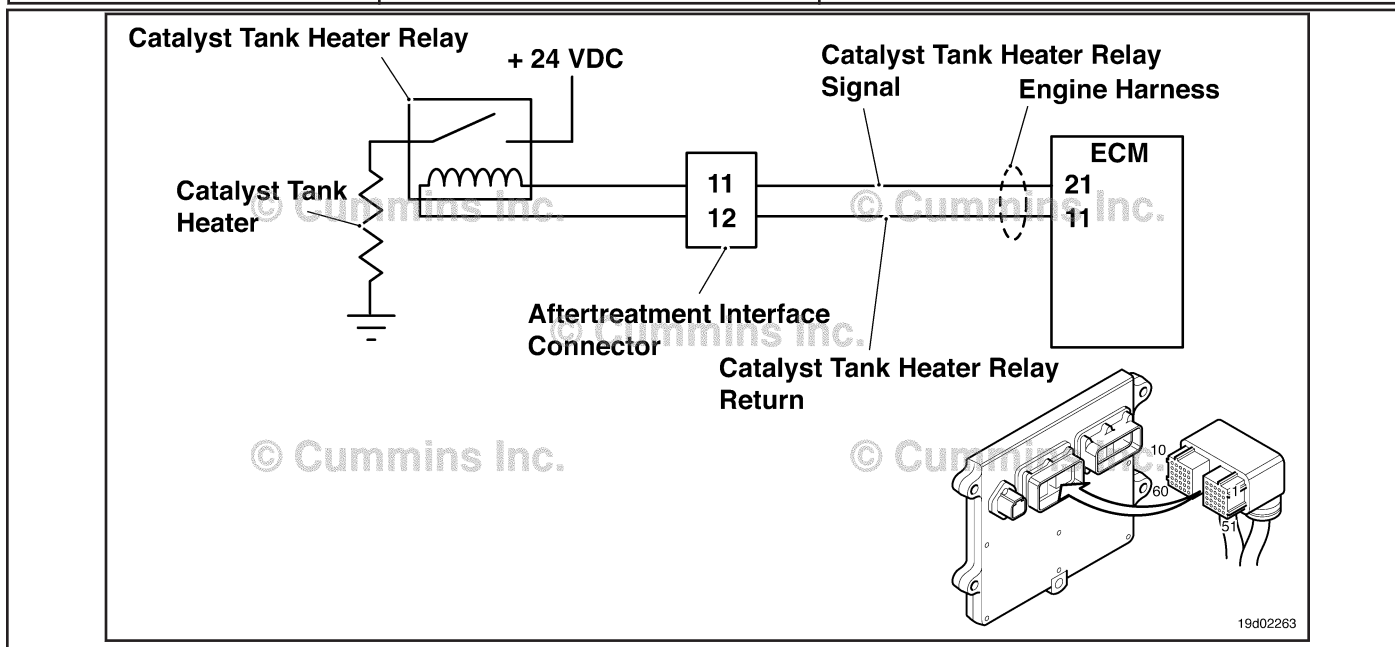
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Disable and clear the fault code.</p> <ul style="list-style-type: none"> <li>• Operate the engine within the “Conditions for Clearing the Fault Code” found in the Overview section of this troubleshooting procedure.</li> </ul>	<p>Fault code inactive?</p> <p><b>YES</b></p>	Repair complete
	<p>Fault code inactive?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Return to the troubleshooting steps or contact a Cummins® Authorized Repair Location if all steps have been completed and checked again.</p>	1A



## Fault Code 1683

### Catalyst Tank Heater Circuit — Voltage Above Normal, or Shorted to High Source

CODES	REASON	EFFECT
Fault Code: 1683 PID(P), SID(S): SPN: 3449 FMI: 3 Lamp: Amber SRT:	Catalyst Tank Heater Circuit — Voltage Above Normal, or Shorted to High Source. High signal voltage detected at the catalyst tank heater relay sensor circuit.	Catalyst tank heater will be disabled.



Circuit: Catalyst Tank Heater Relay

#### Circuit Description:

The catalyst tank heater keeps the catalyst solution from freezing in the catalyst tank. The catalyst heater element is powered by the catalyst tank heater relay.

#### Component Location:

The catalyst tank heater is located in the catalyst tank. The location of the catalyst tank heater relays will vary by OEM.

#### Shop Talk:

This fault code cannot detect any circuit failures on the heater side of the relay. Only circuit errors between the ECM and the relay can be detected by this fault code.

Possible causes of this fault code include:

- Catalyst tank heater relay signal wire not connected to the relay
- Catalyst tank heater relay return wire not connected to the relay
- Faulty catalyst tank heater relay
- Open circuit in the catalyst tank heater relay signal wire
- Open circuit in the catalyst tank heater relay return wire
- Catalyst tank heater signal wire shorted to a voltage source.

On-Board Diagnostics (OBD) Information:

- The ECM illuminates the malfunction indicator lamp (MIL) when the diagnostic runs and fails.
- The ECM turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does **not** fail. The MIL lamp and fault code can also be cleared using the INSITE™ service tool.
- The fault code will be cleared from memory after 40 consecutive drive cycles where the diagnostic runs and passes.

**Refer to Troubleshooting Fault Code t05-1683**

## FAULT CODE 1683 - Catalyst Tank Heater Circuit -Voltage Above Normal, or Shorted to High Source

### TROUBLESHOOTING SUMMARY



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



To reduce the possibility of pin and harness damage, use the following test leads when taking a measurement: Part Number 3822758 - male Deutsch™/AMP™/Metri-Pack™ test lead and Part Number 3822917 - female Deutsch™/AMP™/Metri-Pack™ test lead.

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1: Check the fault codes.</b>		
<b>STEP 1A:</b> Check for an inactive fault code.	Fault Code 1683 inactive?	
<b>STEP 2: Check the catalyst tank heater relay and circuit.</b>		
<b>STEP 2A:</b> Inspect the catalyst tank heater relay and electrical connections.	Dirty or damaged pins?	
<b>STEP 2B:</b> Check for an open circuit in the catalyst tank heater relay.	Less than 100 ohms?	
<b>STEP 2C:</b> Check the catalyst tank heater diagnostic voltage, supply line and return circuit.	Greater than 6-VDC?	
<b>STEP 2D:</b> Check for an open circuit in the catalyst tank heater return circuit.	Less than 10 ohms?	
<b>STEP 3: Check the ECM and engine harness.</b>		
<b>STEP 3A:</b> Inspect the ECM and engine harness connector pins.	Dirty or damaged pins?	
<b>STEP 3B:</b> Check the catalyst tank heater relay diagnostic supply voltage.	Greater than 6-VDC?	
<b>STEP 3C:</b> Check for an open circuit in the engine harness.	Less than 10 ohms?	
<b>STEP 3D:</b> Check for a pin-to-pin short circuit in the engine harness.	Greater than 100K ohms?	
<b>STEP 3E:</b> Check for an inactive fault code.	Fault Code 1683 inactive?	
<b>STEP 4: Clear the fault code.</b>		
<b>STEP 4A:</b> Disable the fault code.	Fault Code 1683 inactive?	
<b>STEP 4B:</b> Clear the inactive fault codes.	All fault codes cleared?	

## TROUBLESHOOTING STEP

### STEP 1: Check the fault codes.

#### STEP 1A: Check for an inactive fault code.

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for an inactive fault code. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 1683 inactive? <b>YES</b>	Use the following procedure for an inactive or intermittent fault code. Refer to Procedure 019-362 in Section 19.
	Fault Code 1683 inactive? <b>NO</b>	2A

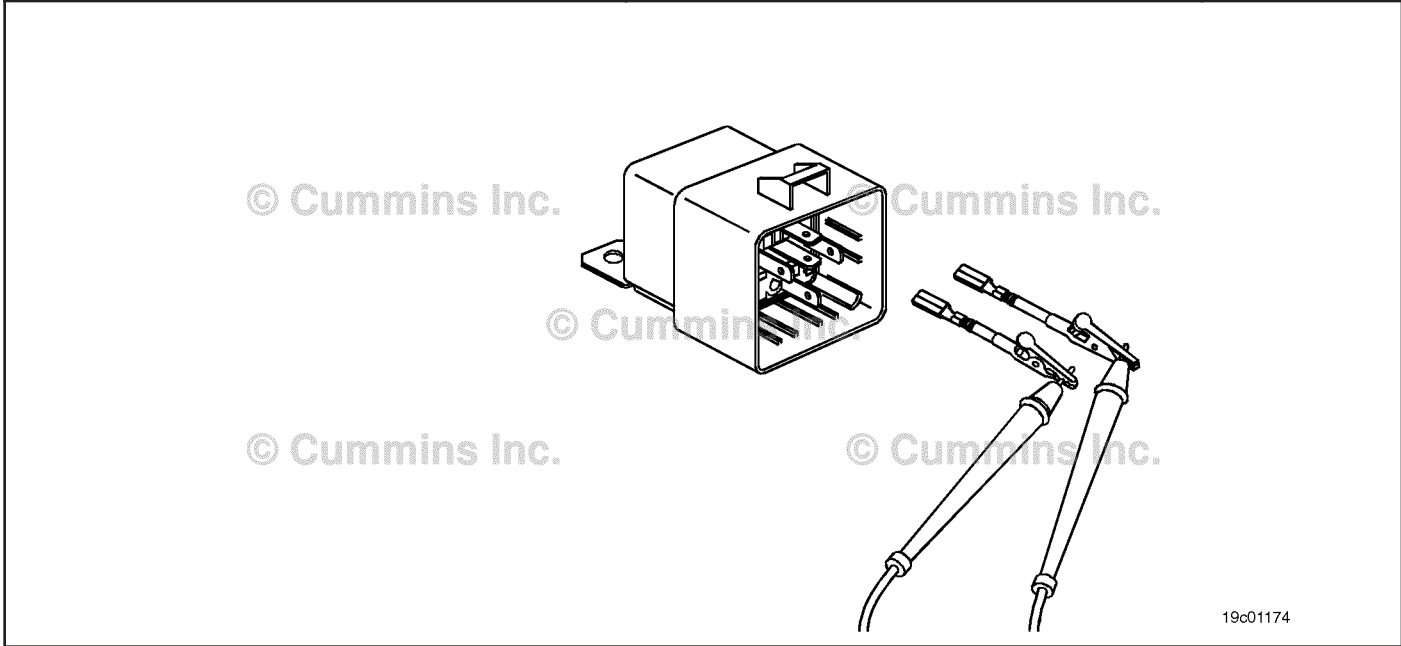
### STEP 2: Check the catalyst tank heater relay and circuit.

#### STEP 2A: Inspect the catalyst tank heater relay and electrical connections.

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the catalyst tank heater relays from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
Inspect the engine harness and catalyst tank heater relay connections for the following: <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul>	Dirty or damaged pins? <b>YES</b> <b>Repair:</b> A damaged connection has been detected in the sensor or harness connector. Clean the connector and pins. Repair the damaged harness, connector, or pins if possible. Refer to Procedure 019-071 in Section 19.	4A
	Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.	Dirty or damaged pins? <b>NO</b>

**STEP 2B: Check for an open circuit in the catalyst tank heater relay.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the catalyst tank heater relays from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check catalyst tank heater relay resistance.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the catalyst tank heater SIGNAL pin and the catalyst tank heater RETURN pin at the catalyst tank heater relay.</li> </ul> <p>Refer to the wiring diagram for connector pin identification.</p>	<p>Less than 100 ohms?</p> <p><b>YES</b></p>	2C
	<p>Less than 100 ohms?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>An open circuit has been detected in the catalyst tank heater relay.</p> <p>Replace the catalyst tank heater relay. Refer to the OEM service manual.</p>	4A



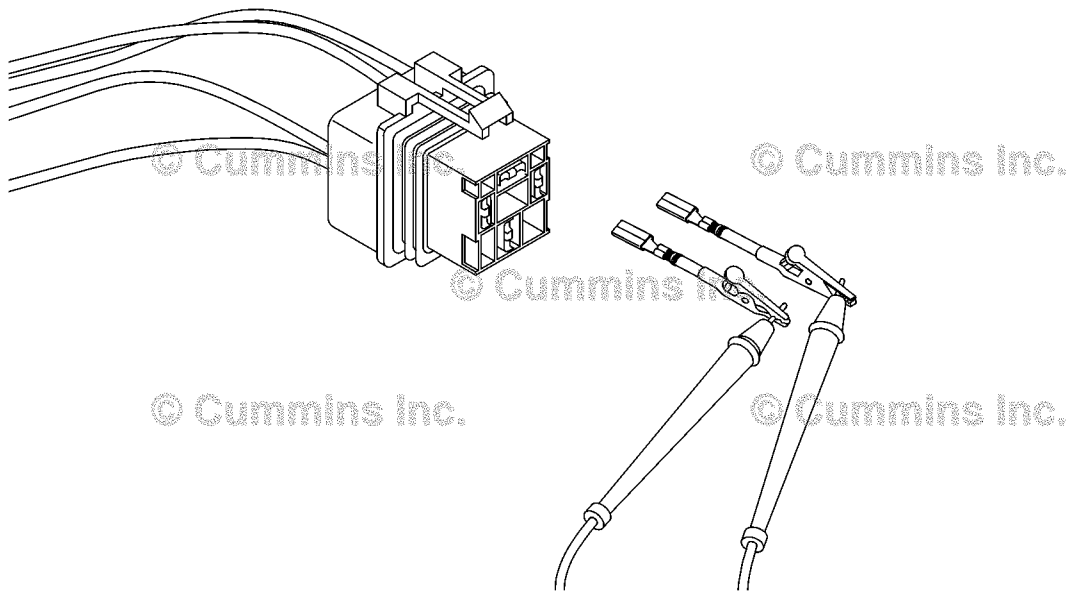
19c01174

**STEP 2C: Check the catalyst tank heater diagnostic voltage, supply line and return circuit.**

**Condition:**

- Turn keyswitch OFF.
- Connect the catalyst tank heater relay from the engine harness.
- Turn keyswitch ON.

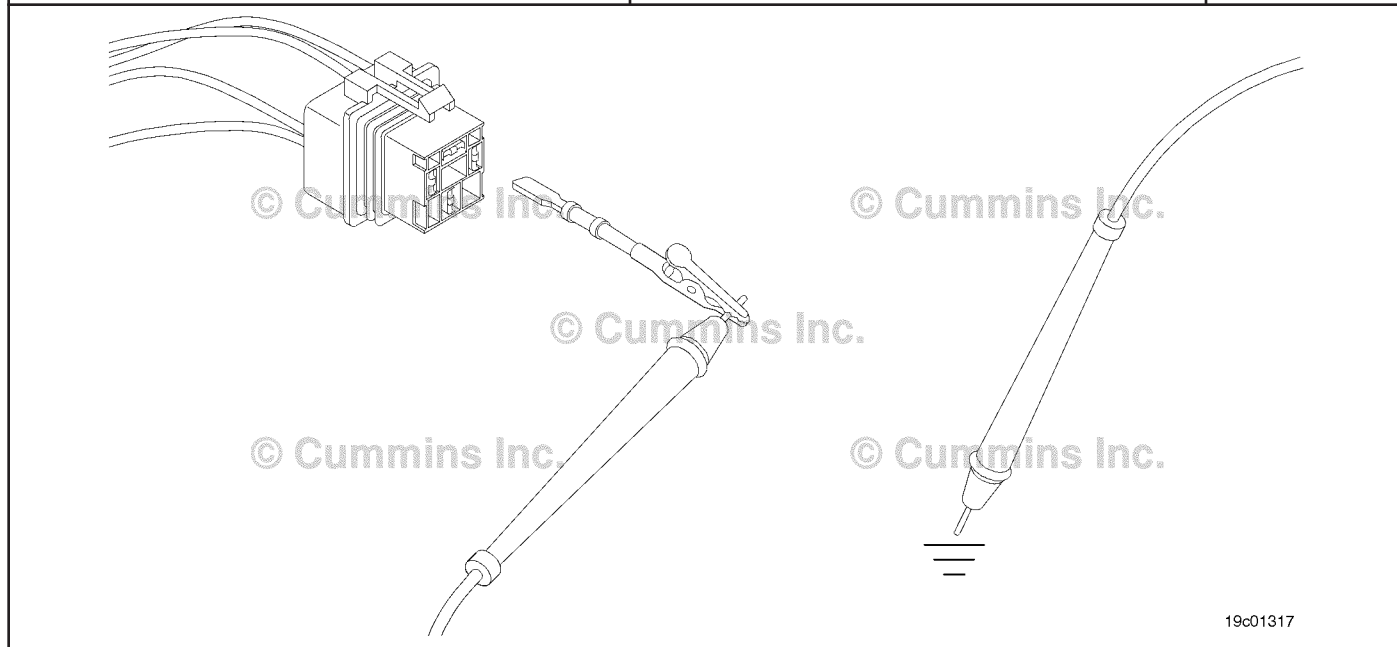
Action	Specification/Repair	Next Step
Check the catalyst tank heater supply voltage and return circuit.	Greater than 6-VDC? <b>YES</b>	3D
<ul style="list-style-type: none"> <li>• Measure the voltage between the catalyst tank heater relay SIGNAL line and the catalyst tank heater relay RETURN line at the catalyst tank heater relay connector of the engine harness.</li> </ul>	Greater than 6-VDC? <b>NO</b>	2D



19d02116

**STEP 2D: Check for an open circuit in the catalyst tank heater return circuit.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the catalyst tank heater relay from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for an open circuit.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the catalyst tank heater relay RETURN pin in the engine harness and ground.</li> </ul> <p>Refer to the wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Less than 10 ohms? <b>YES</b></p>	<p>3A</p>
	<p>Less than 10 ohms? <b>NO</b></p> <p><b>Repair:</b></p> <p>An open pin to ground circuit on the RETURN line has been detected in the engine harness.</p> <p>Troubleshoot each harness connected in series to determine which contains the OPEN RETURN circuit to ground.</p> <p>Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.</p>	<p>4A</p>



19c01317

**STEP 3: Check the ECM and engine harness.**

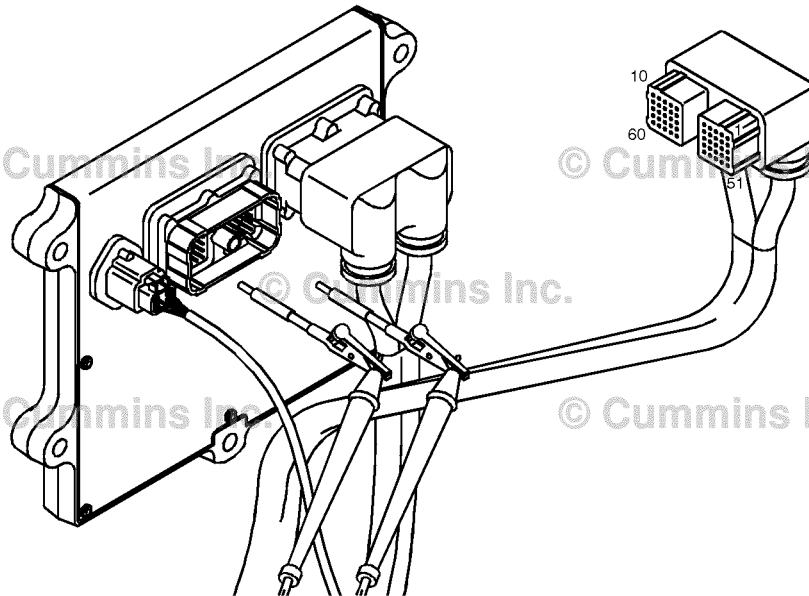
**STEP 3A: Inspect the ECM and engine harness connector pins.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM connector.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the engine harness and ECM connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A damaged connection has been detected in the ECM connector or the engine harness connector.</p> <p>Clean the connector and pins.</p> <p>Repair the damaged harness, connector, or pins if possible. Refer to Procedure 019-043 in Section 19.</p>	4A
	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	3B



**STEP 3B: Check the catalyst tank heater relay diagnostic supply voltage.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check the catalyst tank heater relay diagnostic supply voltage.</p> <ul style="list-style-type: none"> <li>• Measure the voltage between the catalyst tank heater relay signal pin and ground at ECM connector.</li> </ul> <p>Refer to the wiring diagram for connector pin identification.</p>	<p>Greater than 6-VDC? <b>YES</b></p>	<p>3C</p>
	<p>Greater than 6-VDC? <b>NO</b></p> <p><b>Repair:</b></p> <p>Replace the ECM. Refer to Procedure 019-031 in Section 19.</p>	<p>4A</p>



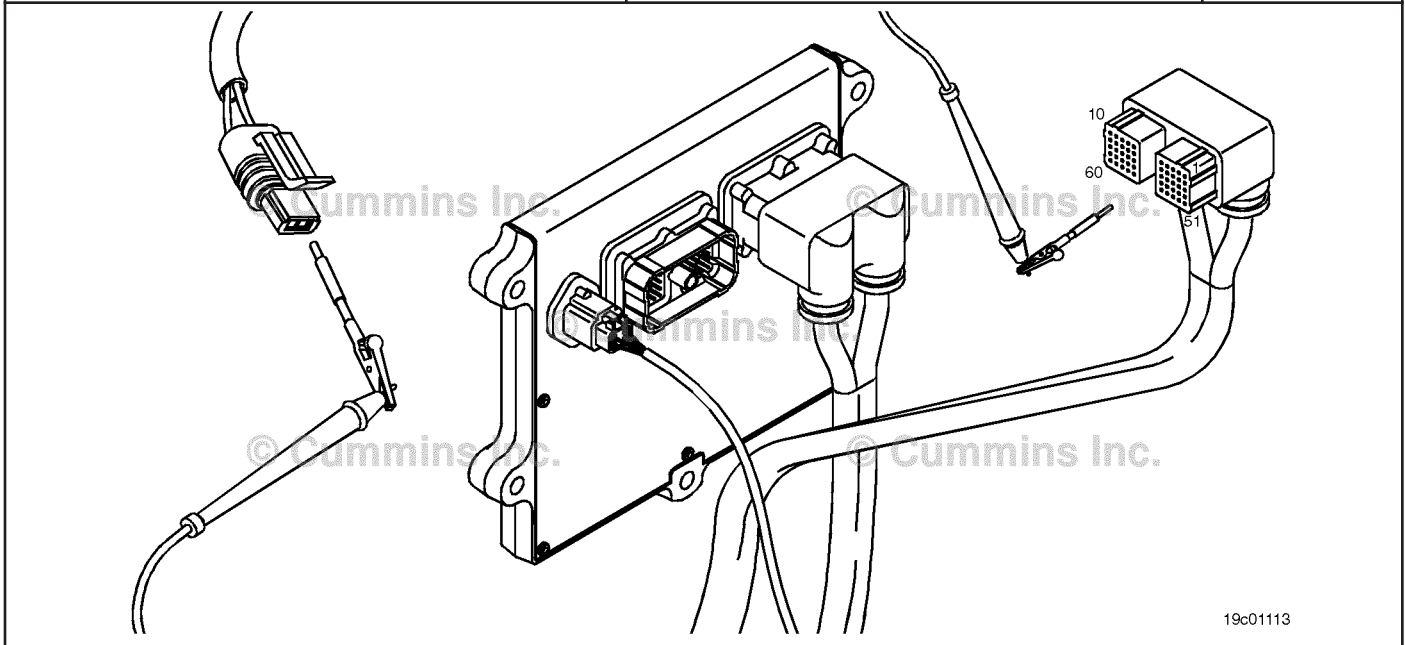
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**STEP 3C: Check for an open circuit in the engine harness.**

**Condition:**

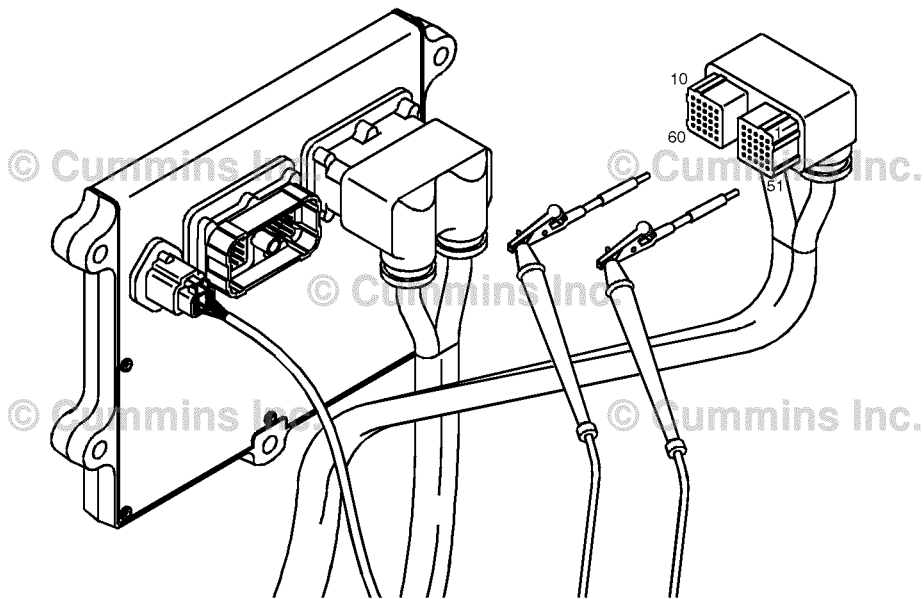
- Turn keyswitch OFF.
- Disconnect the engine harness from the ECM.
- Disconnect the catalyst heater relay from the engine harness.

Action	Specification/Repair	Next Step
<p>Check for an open circuit.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the engine harness ECM connector. catalyst tank heater relay SUPPLY pin and the engine harness catalyst tank heater relay connector catalyst tank heater relay SUPPLY pin.</li> </ul> <p>Refer to the wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Less than 10 ohms? <b>YES</b></p>	<p>3D</p>
	<p>Less than 10 ohms? <b>NO</b></p> <p><b>Repair:</b></p> <p>An open catalyst tank heater SUPPLY circuit has been detected in the engine harness.</p> <p>Troubleshoot each harness connected in series to determine which contains the open circuit.</p> <p>Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.</p>	<p>4A</p>



**STEP 3D: Check for a pin-to-pin short circuit in the engine harness.**

Action	Specification/Repair	Next Step
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> <li>• Disconnect the catalyst tank heater relay from the engine harness.</li> </ul> <p>Check for a pin-to-pin short.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the catalyst tank heater relay SUPPLY pin in the engine harness ECM connector and all other pins in the engine harness ECM connector.</li> </ul> <p>Refer to the wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Greater than 100K ohms? <b>YES</b></p>	<p>3E</p>
	<p>Greater than 100K ohms? <b>NO</b></p> <p><b>Repair:</b></p> <p>A pin-to-pin short circuit on the catalyst tank heater relay SUPPLY line has been detected in the engine harness.</p> <p>Troubleshoot each harness connected in series to determine which contains the shorted supply circuit.</p> <p>Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.</p>	<p>4A</p>



19c01046

**STEP 3E: Check for an inactive fault code.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for the appropriate circuit response after 30 seconds. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 1683 inactive? <b>YES</b> <b>Repair:</b> None. The removal and installation of the connector corrected the problem.	4A
	Fault Code 1683 inactive? <b>NO</b> <b>Repair:</b> Replace the ECM. Refer to Procedure 019-031 in Section 19.	4A

**STEP 4: Clear the fault code.**

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

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> <li>• Start the engine and let it idle for 1 minute.</li> <li>• Use INSITE™ electronic service tool to verify the fault code is inactive.</li> </ul>	Fault Code 1683 inactive? <b>YES</b>	4B
	Fault Code 1683 inactive? <b>NO</b>	1A

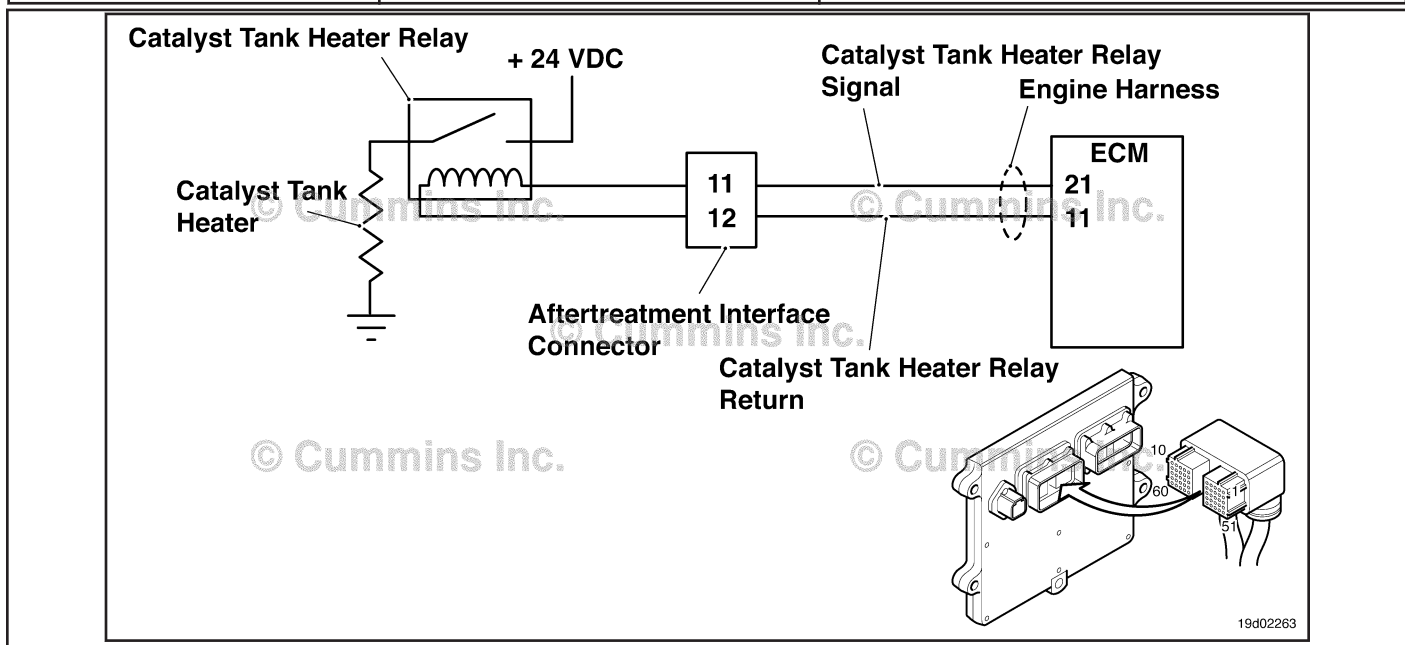
**STEP 4B: Clear the inactive fault codes.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to erase the inactive fault codes.</li> </ul>	All fault codes cleared? <b>YES</b>	Repair complete
	All fault codes cleared? <b>NO</b>	Appropriate troubleshooting steps

## Fault Code 1684

### Catalyst Tank Heater Circuit — Voltage Below Normal, or Shorted to Low Source

CODES	REASON	EFFECT
Fault Code: 1684 PID(P), SID(S): SPN: 3363 FMI: 4 Lamp: Amber SRT:	Catalyst Tank Heater Circuit — Voltage Below Normal, or Shorted to Low Source. Low signal voltage detected at the catalyst tank heater relay sensor circuit.	Catalyst tank heater will be disabled.



Circuit: Catalyst Tank Heater Relay

#### Circuit Description:

The catalyst tank heater keeps the catalyst solution from freezing in the catalyst tank. The catalyst tank heater is also used to thaw a frozen catalyst solution tank. The catalyst heater element is powered by the catalyst tank heater relay.

#### Component Location:

The catalyst tank heater is located in the catalyst tank. The location of the catalyst tank heater relays will vary by OEM.

#### Shop Talk:

This fault code cannot detect any circuit failures on the heater side of the relay. Only circuit errors between the ECM and the relay can be detected by this fault code.

Possible causes of this fault code include:

- A shorted catalyst tank heater relay
- Catalyst tank heater signal wire shorted to ground.

On-Board Diagnostics (OBD) Information (Euro 4 Certified Engines):

- The ECM illuminates the malfunction indicator lamp (MIL) when the diagnostic runs and fails.
- The ECM turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does **not** fail. The MIL lamp and fault code can also be cleared using the INSITE™ service tool.
- The fault code will be cleared from memory after 40 consecutive drive cycles where the diagnostic runs and passes.

On-Board Diagnostics (OBD) Information (Euro 4 Stage 1+ Certified Engines):

- The ECM illuminates the malfunction indicator lamp (MIL) when the diagnostic runs and fails.
- An engine torque derate will be activated after 50 hours of engine operation with the fault code active.
- The ECM turns OFF the malfunction indicator lamp (MIL) after 1 ignition cycle that the diagnostic runs and does **not** fail. The MIL lamp **cannot** be cleared using the INSITE™ service tool.
- The fault code will be cleared from memory after 400 days or 9600 hours of engine operation.

**Refer to Troubleshooting Fault Code t05-1684**

## TROUBLESHOOTING SUMMARY

**△CAUTION△**

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

**△CAUTION△**

To reduce the possibility of pin and harness damage, use the following test leads when taking a measurement: Part Number 3822758 - male Deutsch/AMP/Metri-Pack test lead Part Number 3822917 - female Deutsch/AMP/Metri-Pack test lead.

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1:</b> Check the fault codes.		
<b>STEP 1A:</b> Check for an inactive fault code.	Fault Code 1684 inactive?	
<b>STEP 2:</b> Check the catalyst tank heater relay and circuit.		
<b>STEP 2A:</b> Inspect the catalyst tank heater relay and electrical connections.	Dirty or damaged pins?	
<b>STEP 2B:</b> Check the circuit response.	Fault code 1683 active and fault code 1684 inactive?	
<b>STEP 2C:</b> Check the fault codes and verify relay condition.	Fault code 1684 active?	
<b>STEP 3:</b> Check the ECM and engine harness.		
<b>STEP 3A:</b> Inspect the ECM and engine harness connector pins.	Dirty or damaged pins?	
<b>STEP 3B:</b> Check the circuit response.	Fault code 1683 active and fault code 1684 inactive?	
<b>STEP 3C:</b> Check for a pin to pin short circuit in the engine harness.	Greater than 100k ohms?	
<b>STEP 3D:</b> Check for a pin short circuit to ground	Greater than 100K ohms?	
<b>STEP 3E:</b> Check for an inactive fault code.	Fault Code 1684 inactive?	
<b>STEP 4:</b> Clear the fault code.		
<b>STEP 4A:</b> Disable the fault code.	Fault Code 1684 inactive?	
<b>STEP 4B:</b> Clear the inactive fault codes.	All fault codes cleared?	

## TROUBLESHOOTING STEP

### STEP 1: Check the fault codes.

#### STEP 1A: Check for an inactive fault code.

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for an inactive fault code. <ul style="list-style-type: none"> <li>• Use INSITE™ to read the fault codes.</li> </ul>	Fault Code 1684 inactive? <b>YES</b>	Inactive or Intermittent Fault Code Refer to Procedure 019-362.
	Fault Code 1684 inactive? <b>NO</b>	2A

### STEP 2: Check the catalyst tank heater relay and circuit.

#### STEP 2A: Inspect the catalyst tank heater relay and electrical connections.

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the catalyst tank heater relays from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
Inspect the engine harness and catalyst tank heater relay connections for the following: <ul style="list-style-type: none"> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Wire insulation damage</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Connector shell broken</li> <li>• Dirt or debris in or on the connector pins</li> </ul> For general inspection techniques, refer to Component Connector and Pin Inspection, Refer to Procedure 019-361.	Dirty or damaged pins? <b>YES</b> <b>Repair:</b> A defective connection has been detected in the sensor or harness connector. Clean the connector and pins. Repair the damaged harness, connector, or pins if possible. Refer to Procedure 019-071.	4A
	Dirty or damaged pins? <b>NO</b>	2B



**STEP 2B: Check the circuit response.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF</li> <li>• Disconnect the catalyst tank heater relays from the engine harness</li> <li>• Turn keyswitch ON</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate circuit response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Using INSITE™, read the fault codes.</li> </ul>	<p>Fault code 1683 is active and fault code 1684 is inactive?</p> <p><b>YES</b></p>	2C
	<p>Fault code 1683 is active and fault code 1684 is inactive?</p> <p><b>NO</b></p>	3A

**STEP 2C: Check the fault codes and verify relay condition.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF</li> <li>• Connect the catalyst tank heater relay from the engine harness</li> <li>• Turn keyswitch ON</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate circuit response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Using INSITE™, read the fault codes</li> </ul>	<p>Fault code 1684 is active?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A failed catalyst tank heater relay has been detected.</p> <p>Replace the catalyst tank heater relay.</p> <p>Refer to the OEM troubleshooting and repair manual.</p>	4A
	<p>Fault code 1684 is active?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>None. The removal and installation of the connector corrected the failure.</p>	4A

**STEP 3: Check the ECM and engine harness.**

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

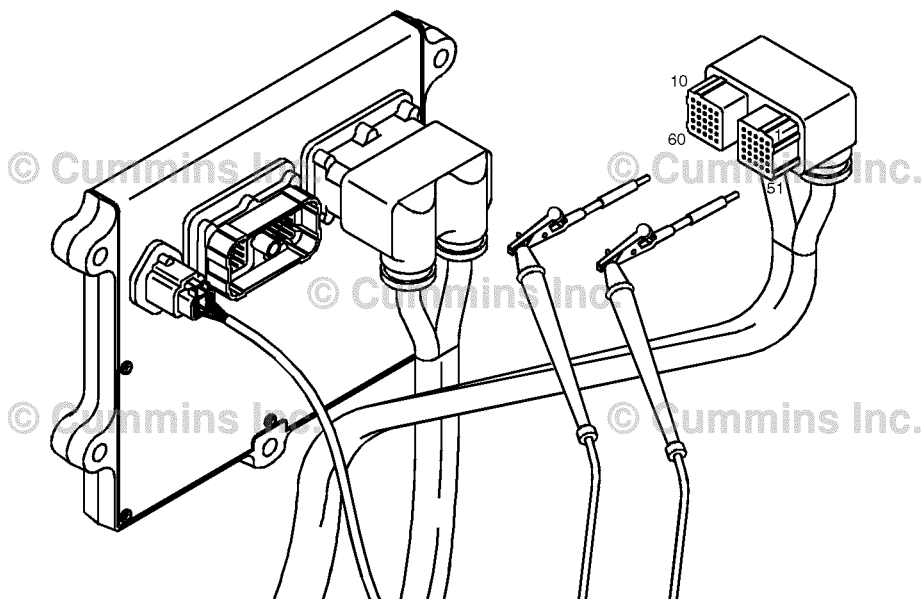
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM connector.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the engine harness and ECM connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Wire insulation damage</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Connector shell broken</li> <li>• Dirt or debris in or on the connector pins</li> </ul> <p>For general inspection techniques, refer to Component Connector and Pin Inspection, Refer to Procedure 019-361.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A defective connection has been detected in the ECM connector or the engine harness connector.</p> <p>Clean the connector and pins.</p> <p>Repair the damaged harness, connector, or pins if possible.</p> <p>Refer to Procedure 019-043.</p>	4A
	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	3B

**STEP 3B: Check the circuit response.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate circuit response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Using INSITE™, read the fault codes.</li> </ul>	<p>Fault code 1683 is active and fault code 1684 is inactive?</p> <p><b>YES</b></p>	3C
	<p>Fault code 1683 is active and fault code 1684 is inactive?</p> <p><b>NO</b></p>	3E

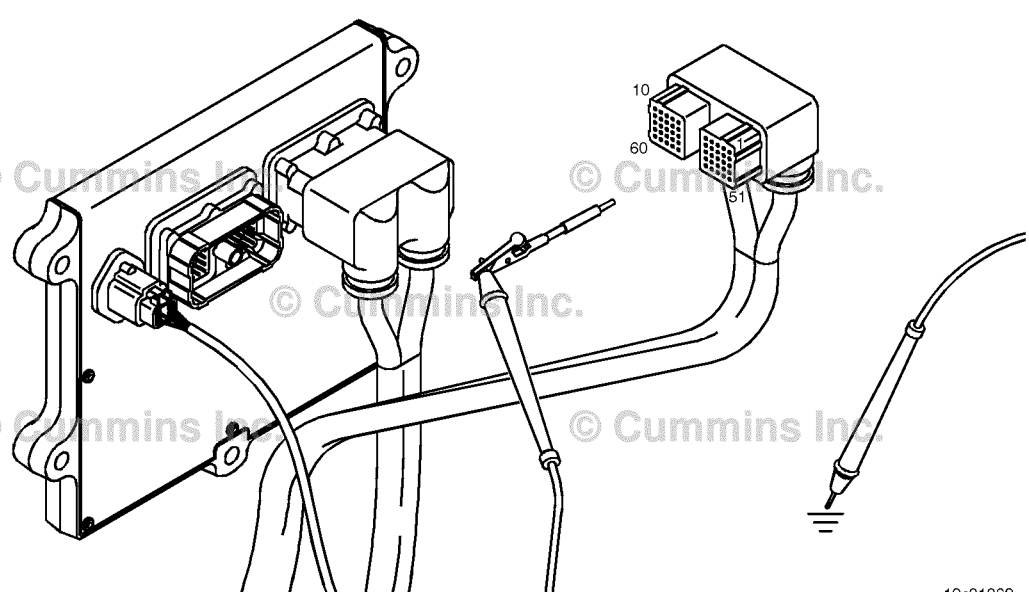
**STEP 3C: Check for a pin to pin short circuit in the engine harness.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> <li>• Disconnect the catalyst heater relay from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for a pin to pin short.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the catalyst tank heater relay SUPPLY pin in the engine harness ECM connector and all other pins in the engine harness ECM connector.</li> </ul> <p>Refer to the wiring diagram for connector pin identification.</p> <p>For general resistance measurement techniques, refer to the Resistance Measurements Using a Multimeter and Wiring Diagram, Refer to Procedure 019-360.</p>	<p>Greater than 100K ohms? <b>YES</b></p>	<p>3D</p>
	<p>Greater than 100K ohms? <b>NO</b></p> <p><b>Repair:</b></p> <p>A pin to pin short circuit on the SIGNAL line has been detected in the engine harness.</p> <p>Repair or replace the engine harness.</p> <p>Refer to Procedure 019-043.</p>	<p>4A</p>



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

Action	Specification/Repair	Next Step
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> <li>• Disconnect the catalyst tank heater relay from the engine harness.</li> </ul>		
<p>Check for a pin to ground short.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the catalyst tank heater relay SUPPLY pin in the engine harness ECM connector and ground.</li> </ul> <p>Refer to the wiring diagram for connector pin identification.</p> <p>For general resistance measurement techniques, refer to the Resistance Measurements Using a Multimeter and Wiring Diagram, Refer to Procedure 019-360.</p>	<p>Greater than 100K ohms? <b>YES</b></p> <hr/> <p>Greater than 100K ohms? <b>NO</b></p> <p><b>Repair:</b></p> <p>A pin to ground short circuit on the SUPPLY line has been detected in the engine harness.</p> <p>Repair or replace the engine harness.</p> <p>Refer to Procedure 019-043.</p>	<p>3E</p> <hr/> <p>4A</p>
 <p style="text-align: right;">19c01062</p>		

**STEP 3E: Check for an inactive fault code.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate circuit response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ to read the fault codes.</li> </ul>	<p>Fault Code 1684 inactive?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>None. The removal and installation of the connector corrected the failure.</p>	4A
	<p>Fault Code 1684 inactive?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Replace the ECM.</p> <p>Call for authorization.</p> <p>019-031.</p>	4A

**STEP 4: Clear the fault code.**

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

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Disable the fault code.</p> <ul style="list-style-type: none"> <li>• Start the engine and let it idle for 1 minute.</li> <li>• Use INSITE™ to verify the fault code is inactive.</li> </ul>	<p>Fault Code 1684 inactive?</p> <p><b>YES</b></p>	4B
	<p>Fault Code 1684 inactive?</p> <p><b>NO</b></p>	1A

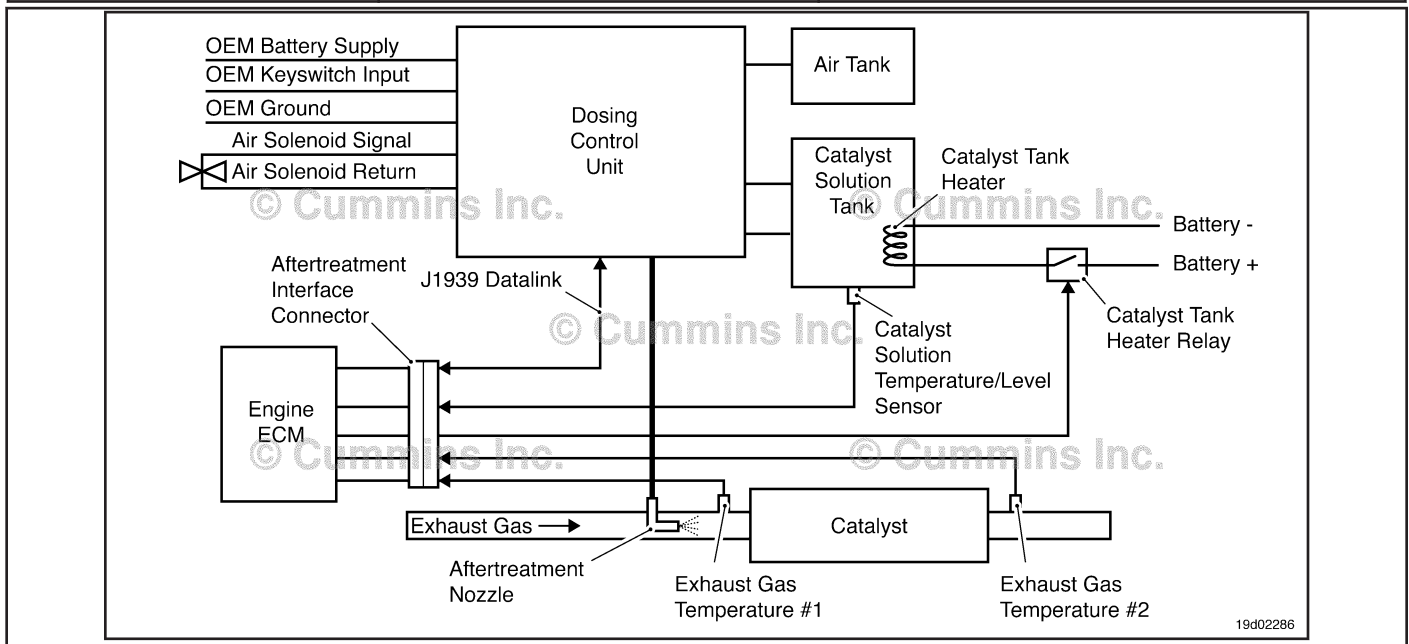
**STEP 4B: Clear the inactive fault codes.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Clear the inactive fault codes.</p> <ul style="list-style-type: none"> <li>• Using INSITE™ erase the inactive fault codes.</li> </ul>	<p>All fault codes cleared?</p> <p><b>YES</b></p>	Repair complete
	<p>All fault codes cleared?</p> <p><b>NO</b></p>	Appropriate troubleshooting steps

## Fault Code 1687

### Catalyst Over Temperature - Data Valid but Above Normal Operational Range - Most Severe Level

CODES	REASON	EFFECT
Fault Code: 1687 PID(P), SID(S): SPN: 3050 FMI: 0 Lamp: Amber SRT:	Catalyst Over Temperature - Data Valid but Above Normal Operational Range - Most Severe Level. Very high temperatures have been detected in the aftertreatment system.	Catalyst solution injection into the aftertreatment system is disabled.



Circuit: Aftertreatment Control System

#### Circuit Description:

The Exhaust Gas Temperature Number 2 sensor is used by the ECM to monitor the engine exhaust gas temperature exiting the catalyst unit. The ECM monitors the voltage on the signal pin and converts this to a temperature value.

#### Component Location:

The catalyst exhaust gas temperature sensor is located in the aftertreatment system. It is located at the outlet of the catalyst exhaust system.

#### Shop Talk:

This fault is triggered when the temperature at the catalyst exhaust outlet exceeds the maximum allowable temperature for a given engine rating.

On-Board Diagnostic (OBD) Information:

- The ECM illuminates the malfunction indicator lamp (MIL) when the diagnostic runs and fails.
- The ECM turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does **not** fail. The MIL lamp and fault code can also be cleared with INSITE™ electronic service tool.
- The fault code will be cleared from the memory after 40 consecutive drive cycles when the diagnostic runs and passes.

#### **Refer to Troubleshooting Fault Code t05-1687**

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## FAULT CODE 1687 - Catalyst Over Temperature - Data Valid but Above Normal Operational Range - Most Severe Level TROUBLESHOOTING SUMMARY

### ⚠CAUTION⚠

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

### ⚠CAUTION⚠

To reduce the possibility of pin and harness damage, use the following test leads when taking a measurement: Part Number 3822758 - male Deutsch™/AMP™/Metri-Pack™ test lead and Part Number 3822917 - female Deutsch™/AMP™/Metri-Pack™ test lead.

STEPS	SPECIFICATIONS	SRT CODE
<b><u>STEP 1:</u></b> Check for fuel system related fault codes.		
<b><u>STEP 1A:</u></b> Check for fuel injector related fault codes.	Fault Codes 1654, 1655, 1656, 1657, 1658, 1659, and 1718 active or high inactive counts?	
<b><u>STEP 2:</u></b> Check the catalyst system for correct operation.		
<b><u>STEP 2A:</u></b> Inspect the catalyst solution.	Is catalyst solution contaminated?	
<b><u>STEP 2B:</u></b> Inspect the turbocharger.	Does the turbocharger turbine housing show signs of oil leaking into the exhaust system?	
<b><u>STEP 3:</u></b> Clear the fault code.		
<b><u>STEP 3A:</u></b> Clear the fault codes.	All faults cleared?	

## TROUBLESHOOTING STEP

### STEP 1: Check for fuel system fault codes.

#### STEP 1A: Check for fuel injector related fault codes.

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for active fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Codes 1654, 1655, 1656, 1657, 1658, 1659, and 1718 active or high inactive counts? <b>YES</b> <b>Repair:</b> Troubleshoot active fault codes, followed by inactive fault codes for which there is the highest number of counts. Refer to appropriate troubleshooting steps. Replace the aftertreatment catalyst. Refer to OEM service manual.	Appropriate Troubleshooting Procedures.
	Fault Codes 1654, 1655, 1656, 1657, 1658, 1659, and 1718 active or high inactive counts? <b>NO</b>	2A

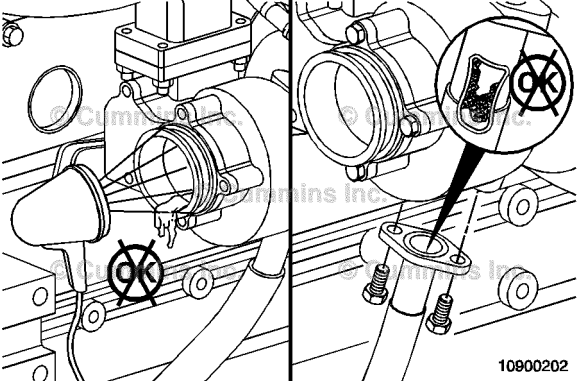
### STEP 2: Check the catalyst system for correct operation.

#### STEP 2A: Inspect the catalyst solution.

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn the keyswitch OFF</li> </ul>		
Action	Specification/Repair	Next Step
Check the catalyst solution for contamination. Take a sample of the catalyst solution from the catalyst tank. Inspect the catalyst solution for contamination from diesel fuel, gasoline, or engine oil.	Is the catalyst solution contaminated? <b>YES</b> <b>Repair:</b> Drain the catalyst tank and flush with distilled water. Flush all catalyst solution lines with distilled water. Replace the aftertreatment catalyst. Refer to OEM service manual.	3A
	Is the catalyst solution contaminated? <b>NO</b>	2B



**STEP 2B: Inspect the turbocharger.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn the keyswitch OFF</li> <li>• Remove the exhaust pipe from the turbocharger.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check turbocharger turbine housing. Check the turbocharger turbine housing for signs of engine oil leaking into the exhaust system.</p>	<p>Does the turbocharger turbine housing show signs of oil leaking into the exhaust system? <b>YES</b></p> <p><b>Repair:</b> Remove the oil drain line and check for restrictions. Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 010-045 in Section 10.  Replace the aftertreatment catalyst. Refer to OEM service manual.</p>	<p>3A</p>
	<p>Does the turbocharger turbine housing show signs of oil leaking into the exhaust system? <b>NO</b></p> <p><b>Repair:</b> Replace the aftertreatment catalyst. Refer to OEM service manual.</p>	<p>3A</p>
		

**STEP 3: Clear the fault code.**

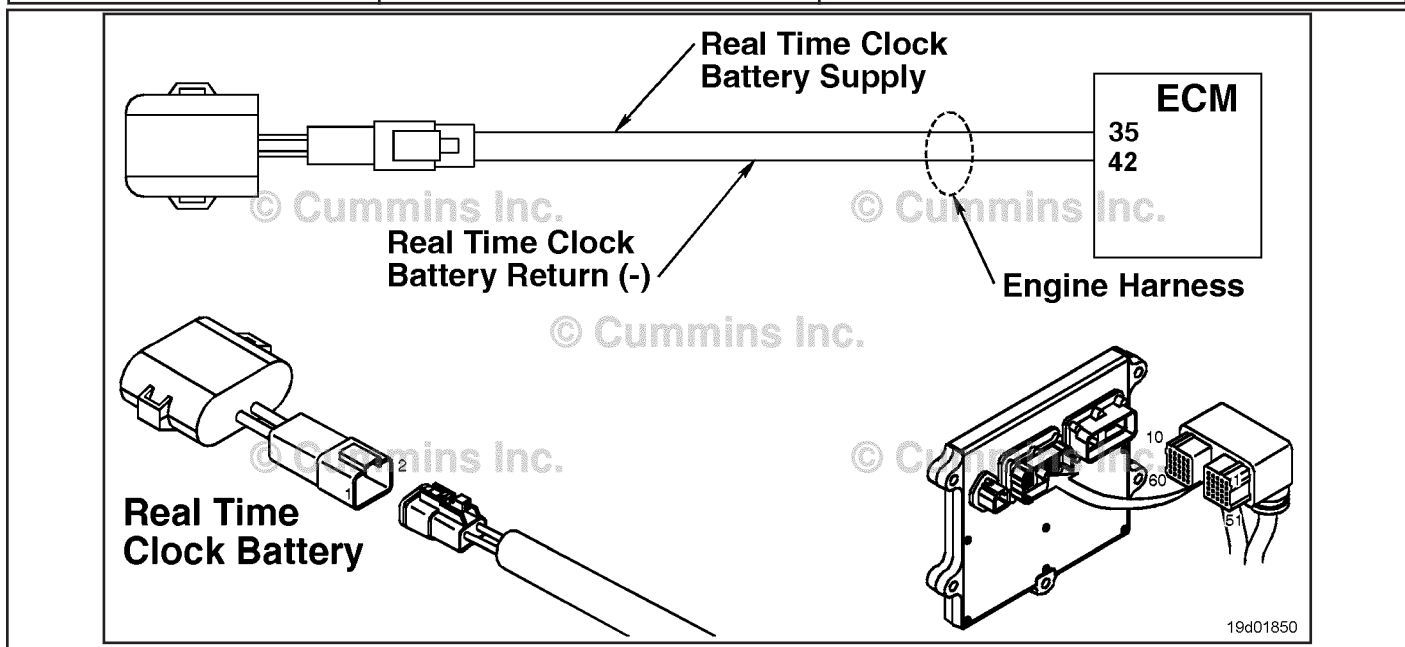
**STEP 3A: Clear the fault codes.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components</li> <li>• Turn keyswitch ON</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Clear the fault codes. • Use INSITE™ electronic service tool to reset all fault codes.	All fault codes cleared? <b>YES</b>	Repair complete.
	All fault codes cleared? <b>NO</b> <b>Repair:</b> Troubleshoot any remaining active fault codes.	Appropriate troubleshooting steps.

## Fault Code 1689

### Real-Time Clock Power Interrupt - Data Erratic, Intermittent or Incorrect

CODES	REASON	EFFECT
Fault Code: 1689 PID(P), SID(S): P251 SPN: 251 FMI: 12/2 Lamp: Amber SRT:	Real-Time Clock Power Interrupt - Data Erratic, Intermittent or Incorrect. The Real-Time clock power has been interrupted.	None on performance. Data in the ECM will <b>not</b> have accurate time and date information.



Real-Time Clock Power Circuit

#### Circuit Description:

Under ordinary operating conditions, the real-time clock in the electronic control module (ECM) is powered by the vehicle's batteries. If battery power to the ECM is lost, then the real-time clock will be powered by a battery in the engine harness (if equipped).

#### Component Location:

The real-time clock battery is secured to the engine harness near the ECM. Refer to Procedure 100-002 (Engine Diagrams) in Section E for a detailed component location view.

#### Shop Talk:

This fault indicates that the real-time clock in the ECM lost power. Possible causes for this fault are weak or failed real-time clock battery, failed wiring or connectors between the battery and ECM, or the engine is **not** equipped with a real-time clock battery and the vehicle battery power to the ECM is lost.

**NOTE:** If the Real Time Clock is supplied by the OEM via a CAN BUS and a battery backup is **not** used, then refer to the OEM wiring diagram. If this is the case, then check INSITE™ electronic service tool, "Advanced ECM Data - Real Time Clock Settings." If the OEM supplies a Real Time Clock signal, then the address **must** be set according to the OEM wiring or the fault code will become active.

On-Board Diagnostics (OBD) Information (Euro 4 Certified Engines):

- The ECM illuminates the malfunction indicator lamp (MIL) when the diagnostic runs and fails.

- The ECM turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does **not** fail. The malfunction indicator lamp and fault code can also be cleared using the INSITE™ electronic service tool.
- The fault code will be cleared from memory after 40 consecutive drive cycles where the diagnostic runs and passes.

On-Board Diagnostics (OBD) Information (Euro 4 Stage 1+ Certified Engines):

- The ECM illuminates the malfunction indicator lamp (MIL) when the diagnostic runs and fails.
- An engine torque derate will be activated after 50 hours of engine operation with the fault code active.
- The ECM turns OFF the malfunction indicator lamp (MIL) after 1 ignition cycle that the diagnostic runs and does **not** fail. The malfunction indicator lamp and fault code can also be cleared using the INSITE™ electronic service tool.
- The fault code will be cleared from memory after 400 days or 9600 hours of engine operation.

**Refer to Troubleshooting Fault Code t05-1689**

## FAULT CODE 1689 - Real-Time Clock Power Interrupt - Data Erratic, Intermittent or Incorrect TROUBLESHOOTING SUMMARY



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



To reduce the possibility of pin and harness damage, use the following test leads when taking a measurement: Part No. 3822758 - male Deutsch™/AMP™/Metri-Pack™ test lead and Part No. 3822917 - female Deutsch™/AMP™/Metri-Pack™ test lead.

STEPS	SPECIFICATIONS	SRT CODE
<b><u>STEP 1:</u> Check the real-time clock battery and connections.</b>		
<b><u>STEP 1A:</u></b> Inspect the ECM and engine harness connector pins.	Dirty or damaged pins?	
<b><u>STEP 1B:</u></b> Check the real-time clock battery voltage at the ECM harness connector.	Between 3.3-VDC and 3.6-VDC?	
<b><u>STEP 1B-1:</u></b> Inspect the real-time clock battery and engine wire harness connector pins.	Dirty or damaged pins?	
<b><u>STEP 1B-2:</u></b> Check the real-time clock battery voltage at the battery module connector.	Between 3.3-VDC and 3.6-VDC?	
<b><u>STEP 2:</u> Check the battery module harness.</b>		
<b><u>STEP 2A:</u></b> Check for an open circuit in the engine harness.	Less than 10 ohms?	
<b><u>STEP 2B:</u></b> Check for a short circuit in the engine harness.	More than 100k ohms?	
<b><u>STEP 2C:</u></b> Check for a short circuit to ground.	More than 100k ohms?	
<b><u>STEP 3:</u> Clear the fault codes.</b>		
<b><u>STEP 3A:</u></b> Disable the fault code.	Fault Code 1689 inactive?	
<b><u>STEP 3B:</u></b> Clear the inactive fault codes.	All fault codes cleared?	

### TROUBLESHOOTING STEP

**STEP 1: Check the real-time clock battery and connections.**

**STEP 1A: Inspect the ECM and engine harness connector pins.**

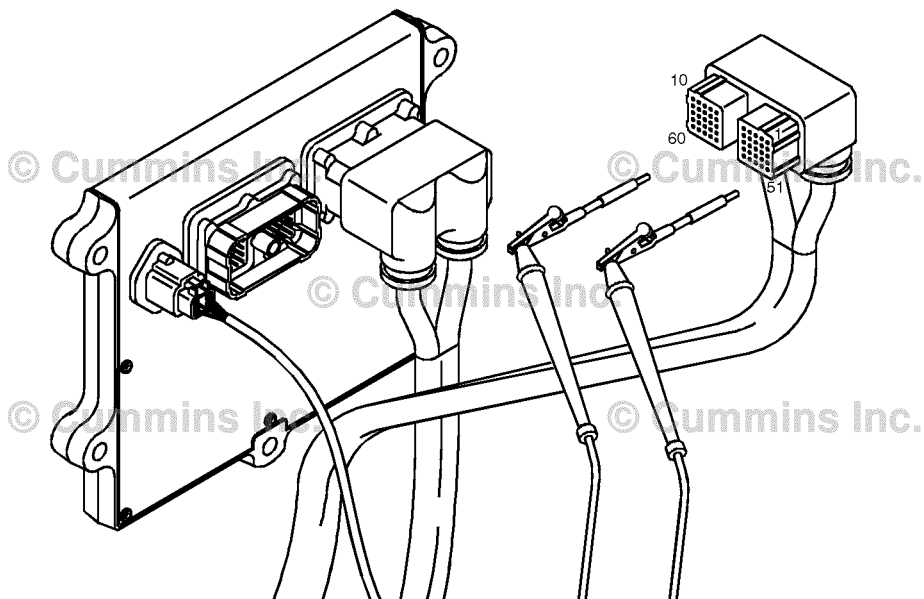
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF</li> <li>• Disconnect the engine harness from the ECM.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the engine harness and ECM connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A damaged connection has been detected in the sensor harness connector.</p> <ul style="list-style-type: none"> <li>• Flush the dirt, debris, or moisture from the connector pins. Use electronic cleaner, Part Number 3824510.</li> <li>• Install the appropriate connector seal if it is damaged or missing.</li> <li>• Repair the engine harness. Refer to Procedure 019-043 in Section 19.</li> </ul>	3A
	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	1B

**STEP 1B: Check the real-time clock battery voltage at the ECM harness connector.**

**Condition:**

- Engine equipped with optional real-time clock battery
- Turn keyswitch OFF
- Disconnect the engine harness from the ECM.

Action	Specification/Repair	Next Step
Measure the voltage between the real-time clock battery SUPPLY pin and the real-time clock battery RETURN (-) pin at the ECM connector of the engine harness.	Between 3.3-VDC and 3.6-VDC? <b>YES</b>	3A
Use the circuit diagram or the wiring diagram for connector pin identification.	Between 3.3-VDC and 3.6-VDC? <b>NO</b>	1B-1



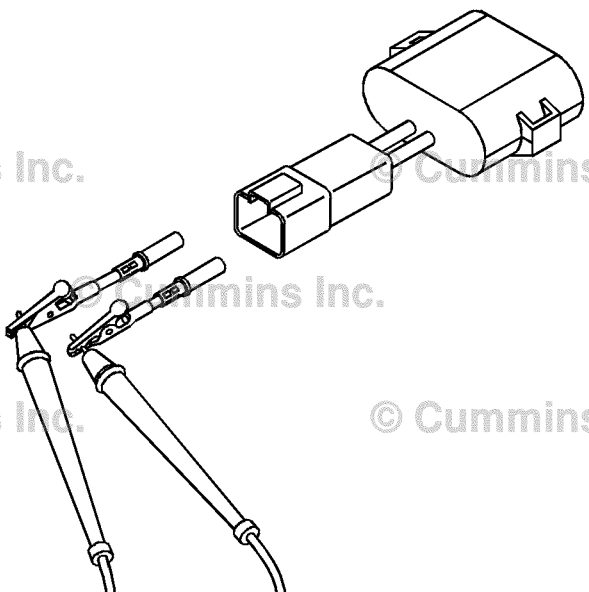
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**STEP 1B-1: Inspect the real-time clock battery and engine wire harness connector pins.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF</li> <li>• Disconnect the real-time clock battery from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the real-time clock battery and engine harness connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A damaged connection has been detected in the sensor or harness connector.</p> <p>Repair or replace the real-time clock battery or engine harness.</p> <ul style="list-style-type: none"> <li>• Refer to Procedure 019-311 in Section 19.</li> <li>• Refer to Procedure 019-043 in Section 19.</li> </ul>	<p>3A</p>
<p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	<p>1B-2</p>



**STEP 1B-2: Check the real-time clock battery voltage at the battery module connector.**

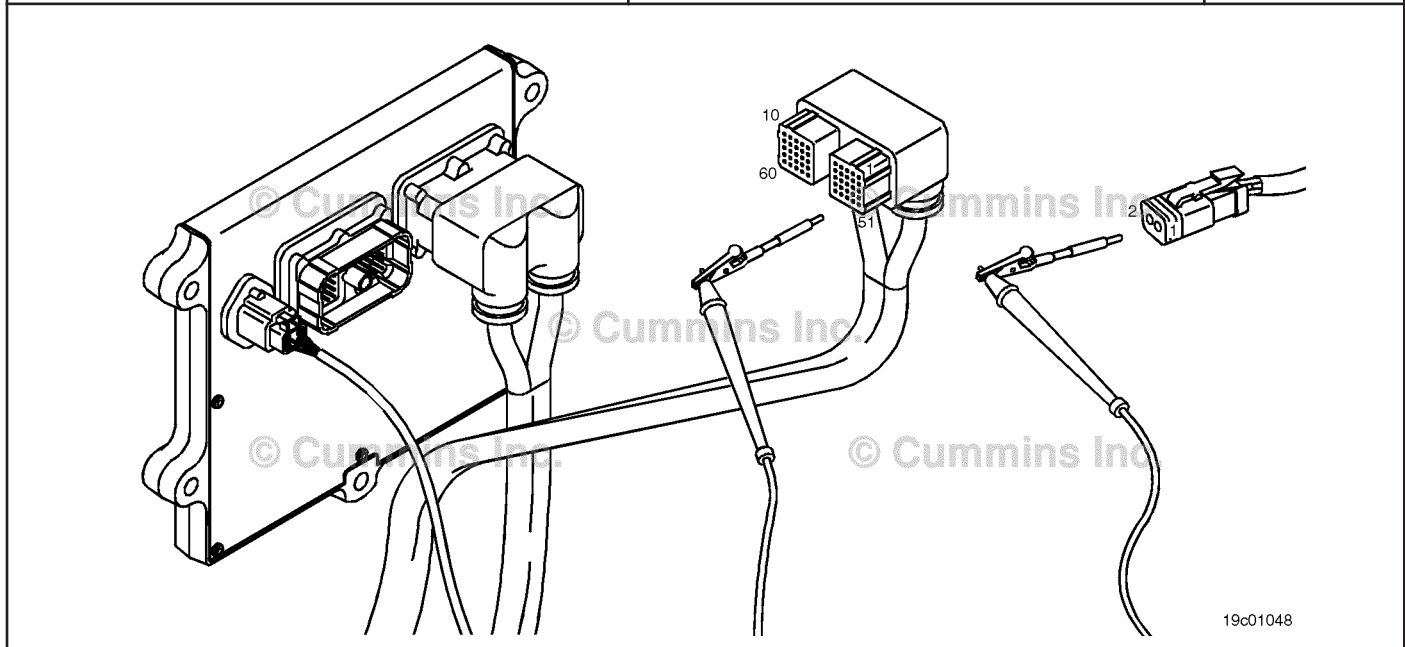
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Engine equipped with optional real-time clock battery</li> <li>• Turn keyswitch OFF</li> <li>• Disconnect the real-time clock battery from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Measure the voltage between the real-time clock battery SUPPLY pin and the real-time clock battery RETURN (-) pin at the real-time clock battery connector.</p> <p>Use the circuit diagram or the wiring diagram for connector pin identification.</p>	<p>Between 3.3-VDC and 3.6-VDC? <b>YES</b></p>	<p>2A</p>
	<p>Between 3.3-VDC and 3.6-VDC? <b>NO</b></p> <p><b>Repair:</b></p> <p>Replace the real-time clock battery. Refer to Procedure 019-311 in Section 19.</p>	<p>3A</p>
 <p>The diagram illustrates the real-time clock battery module and its connector. Two test leads are shown connected to the connector pins. The battery module is a rectangular component with a connector on one side. The test leads are connected to the connector pins, with one lead connected to the SUPPLY pin and the other to the RETURN (-) pin.</p>		

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**STEP 2: Check the battery module harness.**

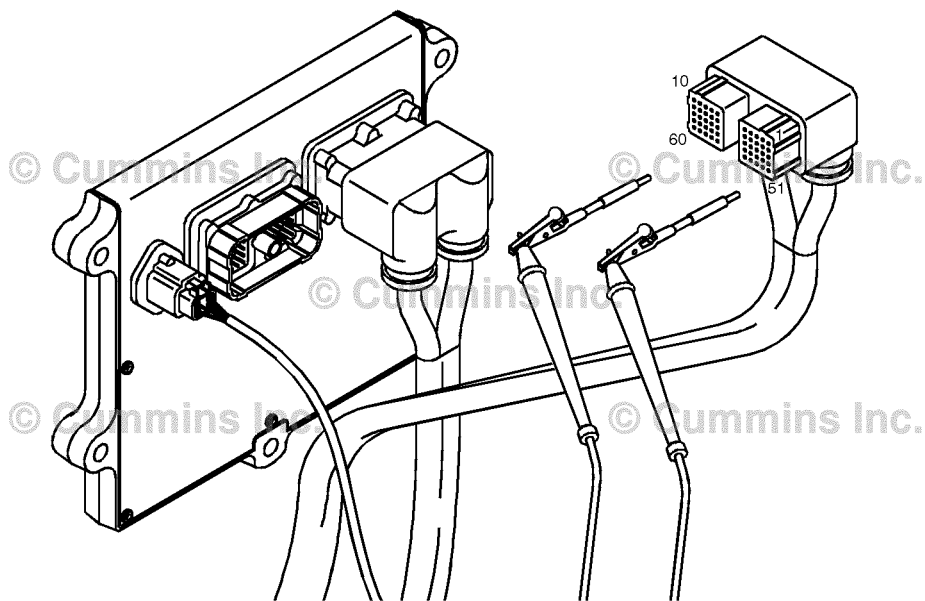
**STEP 2A: Check for an open circuit in the engine harness.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF</li> <li>• Disconnect the engine harness from the ECM.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Measure the following resistance:</p> <ul style="list-style-type: none"> <li>• The resistance between the real-time clock battery SUPPLY pin at the battery connector of the engine harness to the real-time clock battery SUPPLY pin at the ECM harness connector</li> <li>• The resistance between the real-time clock battery RETURN (-) pin at the battery connector of the engine harness to the real-time clock battery RETURN (-) pin at the ECM harness connector.</li> </ul> <p>Use the circuit diagram or the wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Less than 10 ohms?</p> <p><b>YES</b></p>	2B
	<p>Less than 10 ohms?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>An open circuit has been detected in the engine harness.</p> <p>Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.</p>	3A



**STEP 2B: Check for a short circuit in the engine harness.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF</li> <li>• Disconnect the engine harness from the ECM</li> <li>• Disconnect the real-time clock battery from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Use a multimeter to measure the resistance from the real-time clock battery SUPPLY pin at the ECM connector of the engine harness to all other pins in the connector.</p> <p>Use the circuit diagram or the wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>More than 100k ohms? <b>YES</b></p>	<p>2C</p>
	<p>More than 100k ohms? <b>NO</b></p> <p><b>Repair:</b></p> <p>A short circuit has been detected in the engine harness.</p> <p>Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.</p>	<p>3A</p>



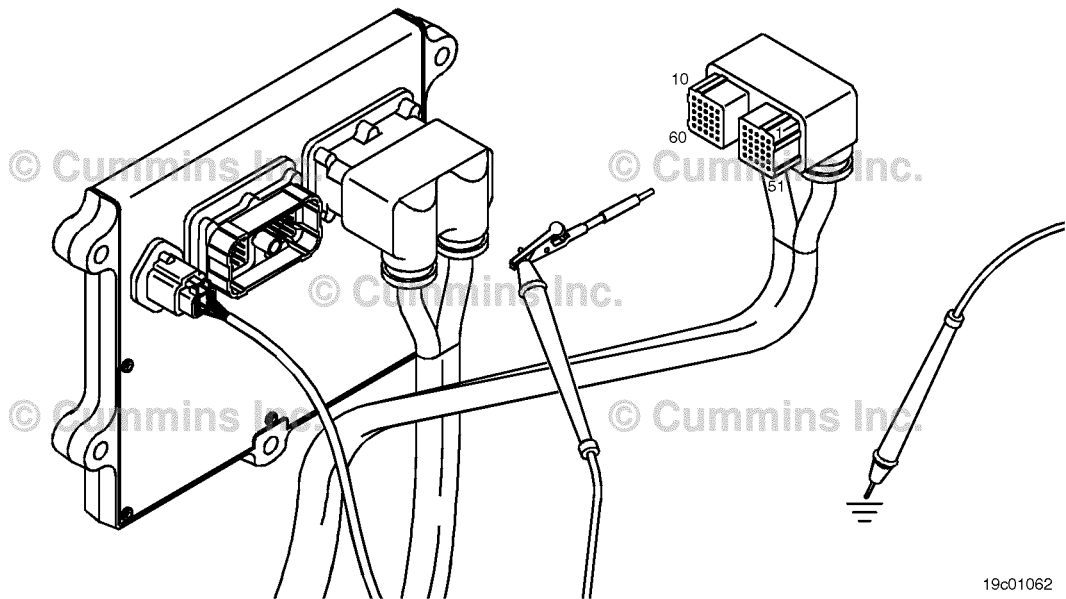
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**STEP 2C: Check for a short circuit to ground.**

**Condition:**

- Turn keyswitch OFF
- Disconnect the engine harness from the ECM
- Disconnect the real-time clock battery from the engine harness.

Action	Specification/Repair	Next Step
Use a multimeter to measure the resistance from the real-time clock battery SUPPLY pin at the ECM connector of the engine harness to engine block ground.  Use the circuit diagram or the wiring diagram for connector pin identification.  Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.	More than 100k ohms? <b>YES</b>	3A
	More than 100k ohms? <b>NO</b> <b>Repair:</b> A short circuit has been detected in the engine harness.  Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.	3A



19c01062

**STEP 3: Clear the fault codes.**

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

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Disable the fault code.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to set real-time clock to the correct date and time.</li> <li>• Verify that Fault Code 1689 is inactive.</li> </ul>	<p>Fault Code 1689 inactive? <b>YES</b></p>	3B
	<p>Fault Code 1689 inactive? <b>NO</b></p> <p><b>Repair:</b></p> <p>Return to the troubleshooting steps or contact a Cummins® Authorized Repair Location if all steps have been completed and checked again.</p>	1A

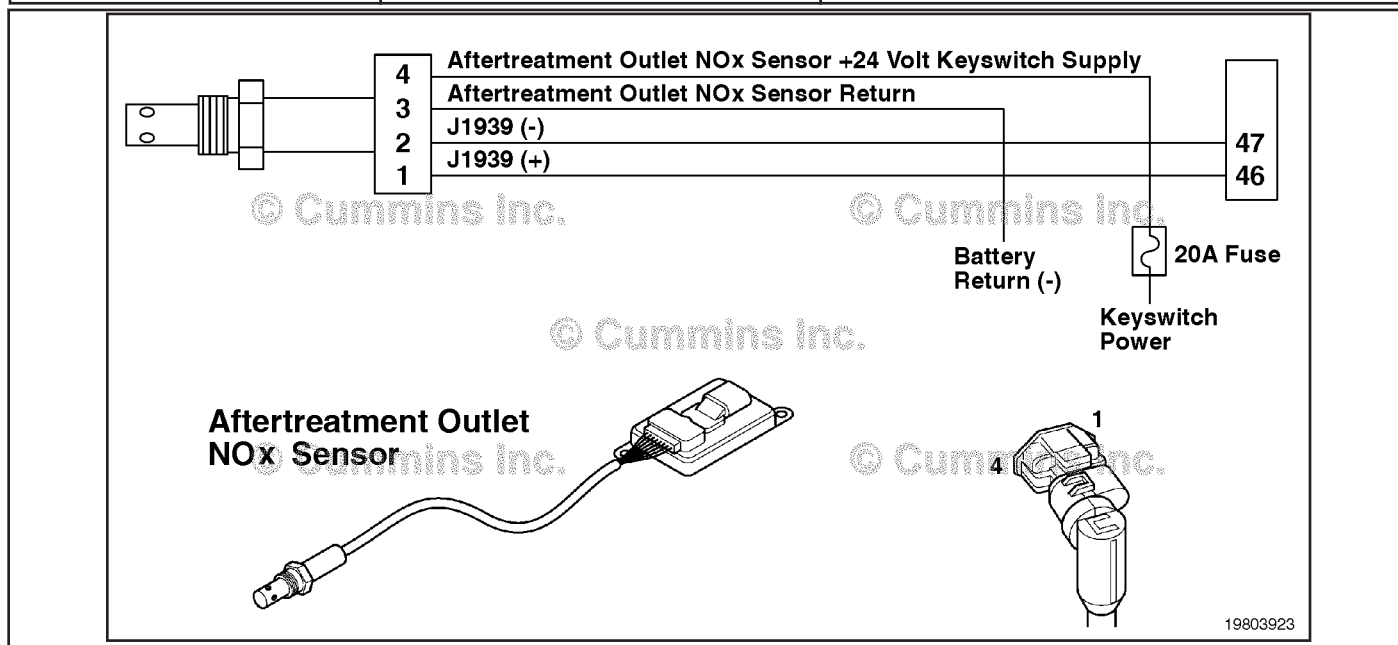
**STEP 3B: Clear the fault codes.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components</li> <li>• Turn keyswitch ON</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Clear the fault codes.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to clear the inactive fault codes.</li> </ul>	<p>All fault codes cleared? <b>YES</b></p>	Repair complete.
	<p>All fault codes cleared? <b>NO</b></p> <p><b>Repair:</b></p> <p>Troubleshoot any remaining active fault codes</p>	Appropriate troubleshooting steps

## Fault Code 1692

### Aftertreatment Outlet NOx Sensor - Voltage Below Normal, or Shorted to Low Source

CODES	REASON	EFFECT
Fault Code: 1692 PID(P), SID(S): SPN: 3234 FMI: 4 Lamp: Amber SRT:	Aftertreatment NOx Sensor - Voltage Below Normal, or Shorted to Low Source. Out-of-range battery voltage has been detected by the aftertreatment outlet NOx sensor.	Aftertreatment outlet NOx sensor operation will be disabled. Engine will derate after running 50 hours with the fault active.



Circuit: Aftertreatment Outlet NOx Sensor Circuit

#### Circuit Description:

The aftertreatment outlet nitrogen oxides (NOx) sensor is a smart device and receives commands from the engine electronic control module (ECM) via the J1939 datalink. The aftertreatment outlet NOx sensor performs its own internal diagnostics and reports malfunctions back to the primary ECM using the J1939 datalink. The NOx sensor is permanently attached to the NOx control module. They are serviced as single component and can **not** be replaced individually. The aftertreatment outlet NOx sensor is used to measure the outlet NOx emissions from the engine.

#### Component Location:

The aftertreatment outlet NOx sensor location can vary depending on engine application. It is usually located in the exhaust system at the outlet of the aftertreatment catalyst.

#### Shop Talk:

The NOx sensor is permanently attached to the NOx control module. They are serviced as a single component and can **not** be replaced individually.

Possible causes of this fault code include:

- The voltage supplied to the aftertreatment outlet NOx sensor is below + 18-VDC
- The voltage supplied to the aftertreatment outlet NOx sensor is above + 32-VDC
- The aftertreatment outlet NOx sensor has malfunctioned or is damaged
- The aftertreatment outlet NOx sensor internal heater has malfunctioned
- The NOx sensor part number is incorrect.

On-Board Diagnostics (OBD) information (Euro 4 Stage 1+ Certified Engines):

- The ECM illuminates the malfunction indicator lamp (MIL) when the diagnostic runs and fails.
- An engine torque derate will be activated after 50 hours of engine operation with the fault code active.
- The ECM turns OFF the malfunction indicator lamp (MIL) after 1 ignition cycle that the diagnostic runs and does **not** fail. The MIL lamp **cannot** be cleared using INSITE™ electronic service tool.
- The fault code will be cleared from memory after 400 days or 9600 hours of engine operation.

**Refer to Troubleshooting Fault Code t05-1692**

FAULT CODE 1692 - Aftertreatment Outlet NOx Sensor - Voltage Below Normal, or Shorted to Low Source
TROUBLESHOOTING SUMMARY



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



To reduce the possibility of pin and harness damage, use the following test leads when taking a measurement: Part Number 3822758 - male Deutsch™/AMP™/Metri-Pack™ test lead and Part Number 3822917 - female Deutsch™/AMP™/Metri-Pack™ test lead.

Table with 3 columns: STEPS, SPECIFICATIONS, and SRT CODE. It lists troubleshooting steps from STEP 1 to STEP 3B, including sub-steps like STEP 1A, STEP 2A-F, and STEP 3A-B, with corresponding specifications and SRT codes.



**TROUBLESHOOTING STEP****STEP 1: Check the fault codes.****STEP 1A: Check for inactive fault codes.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
<b>Action</b>	<b>Specification/Repair</b>	<b>Next Step</b>
Check for inactive fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 1692 inactive? <b>YES</b>	2A
	Fault Code 1692 inactive? <b>NO</b>	2A

**STEP 2: Check the aftertreatment outlet NOx sensor circuit.****STEP 2A: Inspect the NOx sensor body and condition of the NOx sensor harness.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> </ul>		
<b>Action</b>	<b>Specification/Repair</b>	<b>Next Step</b>
Check the NOX sensor body and the NOX-sensor harness. <ul style="list-style-type: none"> <li>• Visually inspect the NOx sensor body and NOx sensor harness for cracks or damage</li> </ul> Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.	External damage to the sensor body, head (component fitted to the EGP), or harness? <b>YES</b> <b>Repair:</b> Replace the NOXx sensor.	3A
	External damage to the sensor body, head (component fitted to the EGP), or harness? <b>NO</b>	2B

**STEP 2B: Inspect the NOx sensor and connector pins.**

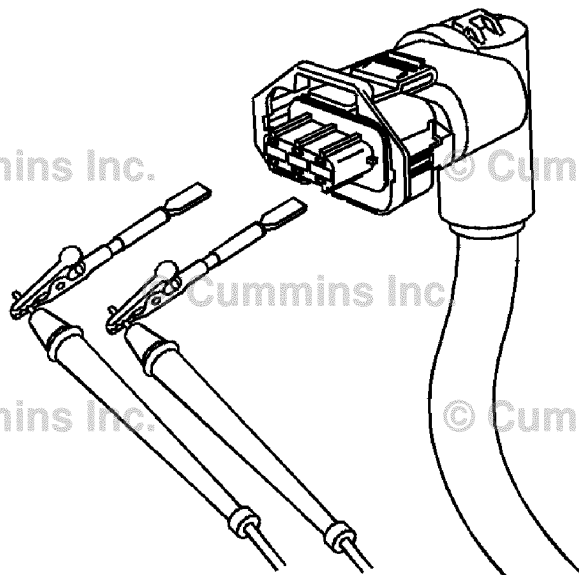
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the aftertreatment outlet NOx sensor from the OEM harness.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the OEM harness and aftertreatment outlet NOx sensor connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A damaged connector has been detected in the sensor or harness connector.</p> <ul style="list-style-type: none"> <li>• Clean the connector and pins.</li> <li>• Repair the damaged harness, connector, or pins, if possible.</li> </ul> <p>Refer to Procedure 019-071 in Section 19.</p>	<p>3A</p>
	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	<p>2C</p>

**STEP 2C: Check the voltage to the NOx sensor.**

**Condition:**

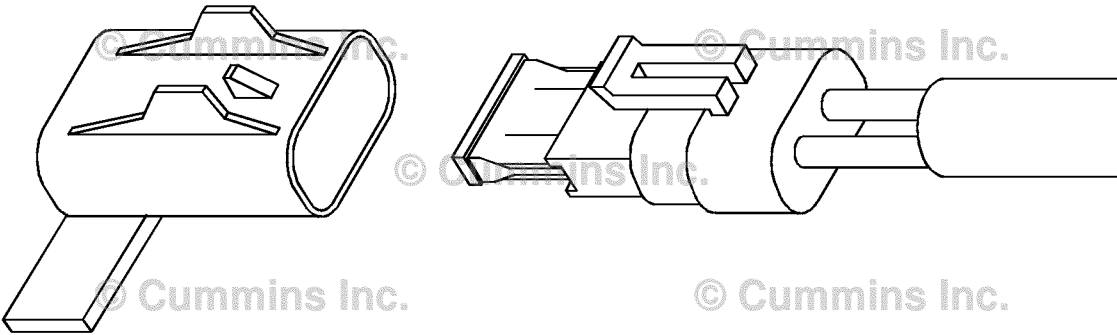
- Turn keyswitch OFF.
- Disconnect the aftertreatment outlet NOx sensor from the OEM harness.
- Turn keyswitch ON.

Action	Specification/Repair	Next Step
<p>Check the power supply and return circuit to the aftertreatment outlet NOx sensor.</p> <ul style="list-style-type: none"> <li>• Measure the voltage between the aftertreatment outlet NOx sensor supply circuit and the aftertreatment outlet NOx sensor return circuit at the OEM harness connector.</li> </ul> <p>Vehicle electrical system voltage specified range.</p> <ul style="list-style-type: none"> <li>• For a 24V electrical system the measured voltage should be between +18-VDC and +32-VDC</li> <li>• For a 12V electrical system the measured voltage should be between +8-VDC and +16-VDC</li> </ul>	<p>Voltage within the specified range for the vehicle's electrical system voltage?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>An out-of-range fault has been detected by the aftertreatment exhaust NOx sensor control module.</p> <p>Replace the aftertreatment exhaust NOx sensor. Refer to Procedure 019-451 in Section 19.</p>	<p>3A</p>
<p>Note: Check the voltage at key ON while cranking the engine and with the engine at idle.</p> <p>Refer to the wiring diagram or the circuit diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Voltage within the specified range for the vehicle's electrical system voltage?</p> <p><b>NO</b></p>	<p>2D</p>



19d01957

**STEP 2D: Verify that the OEM fuse is installed correctly.**

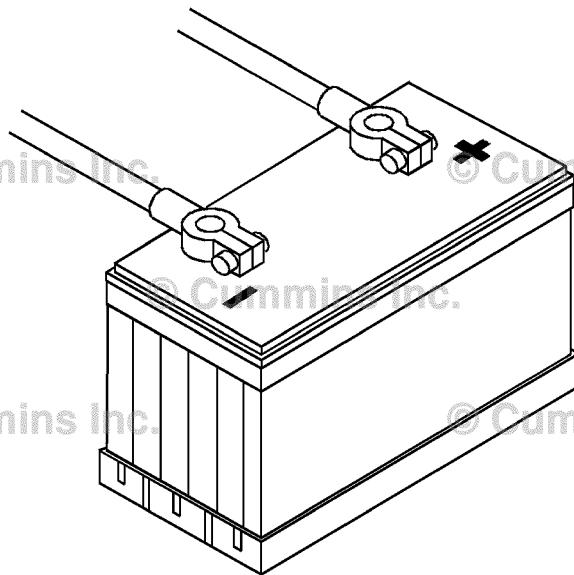
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Verify the fuse is installed correctly.</p> <p>Note: The aftertreatment outlet NOx sensor power supply wire contains a 20-ampere fuse. This fuse is located in the OEM harness.</p> <ul style="list-style-type: none"> <li>• Inspect the OEM fuse for correct installation, or for a blown fuse.</li> <li>• Inspect the fuse for corrosion or damaged pins.</li> </ul>	<p>Fuse installed correctly, or has it been replaced?</p> <p><b>YES</b></p>	<p>2E</p>
	<p>Fuse installed correctly, or has it been replaced?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Install the fuse correctly. Refer to Procedure 019-198 in Section 19.</p>	<p>3A</p>
<div style="text-align: center;">  </div> <p style="text-align: right;">19c00455</p>		

**STEP 2E: Check the batteries and the power connector.**

**Condition:**

- Turn keyswitch OFF.

Action	Specification/Repair	Next Step
Check the battery connections. • Check the battery terminal connections.	Connections tight and corrosion free? <b>YES</b>	2F
	Connections tight and corrosion free? <b>NO</b> <b>Repair:</b> Clean the terminals and tighten the loose connections. Refer to the OEM service manual.	3A



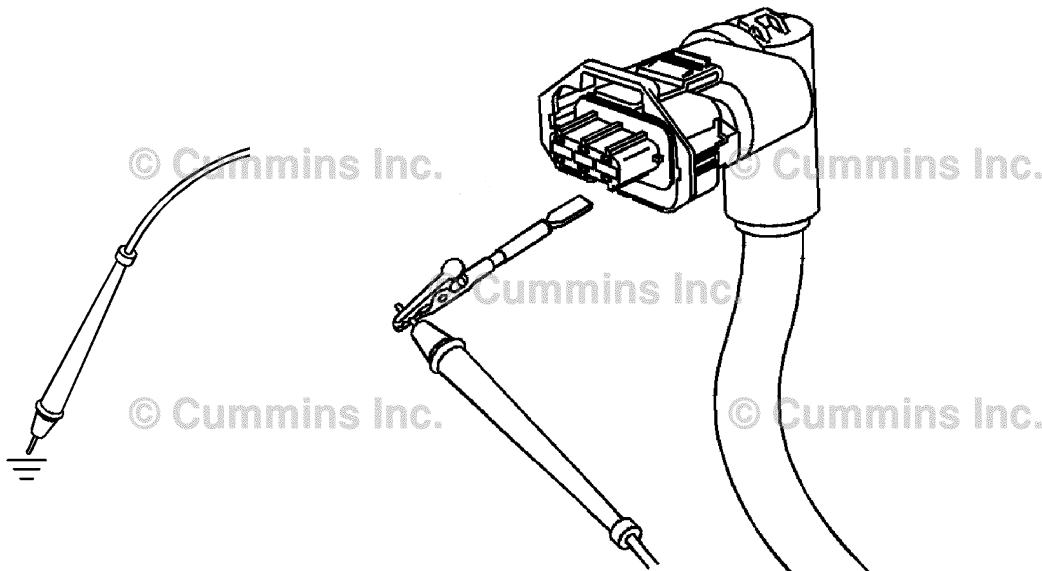
19c00460

**STEP 2F: Check for an open circuit in the battery power circuit.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the aftertreatment outlet NOx sensor from the OEM harness.
- Turn keyswitch ON.

Action	Specification/Repair	Next Step
<p>Check for an open circuit in the battery power circuits.</p> <ul style="list-style-type: none"> <li>• Measure the voltage from the aftertreatment outlet NOx sensor SUPPLY (+) pin of the OEM harness to engine block ground.</li> </ul> <p>Refer to the wiring diagram or the circuit diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>At least +22-VDC?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A damaged connection has been detected in the ECM connector or OEM harness connector.</p> <ul style="list-style-type: none"> <li>• Clean the connector and pins.</li> <li>• Repair the damaged harness, connector, or pins, if possible.</li> </ul> <p>Refer to Procedure 019-071 in Section 19.</p>	3A
	<p>At least +22-VDC?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>An open circuit in the OEM battery supply circuit from the aftertreatment outlet NOx sensor has been detected.</p> <p>Repair or replace the OEM harness. Refer to Procedure 019-071 in Section 19.</p>	3A



09d02422

**STEP 3: Check ECM calibration and clear fault codes.**

**STEP 3A: Check if an ECM calibration update is available.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Compare the ECM code and revision number in the ECM to the calibration revisions listed in the ECM Calibration Revision History for applicable changes related to this fault code.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to find the present ECM code and revision number in the ECM. The ECM code and revision number are found in the Calibration Information section of System ID and Dataplate in Features and Parameters.</li> </ul>	<p>If a calibration update for this fault code is available, does the ECM contain that revision or higher?</p> <p><b>YES</b></p>	3B
	<p>If a calibration update for this fault code is available, does the ECM contain that revision or higher?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>If necessary, calibrate the ECM. Refer to Procedure 019-032 in Section 19.</p>	3B

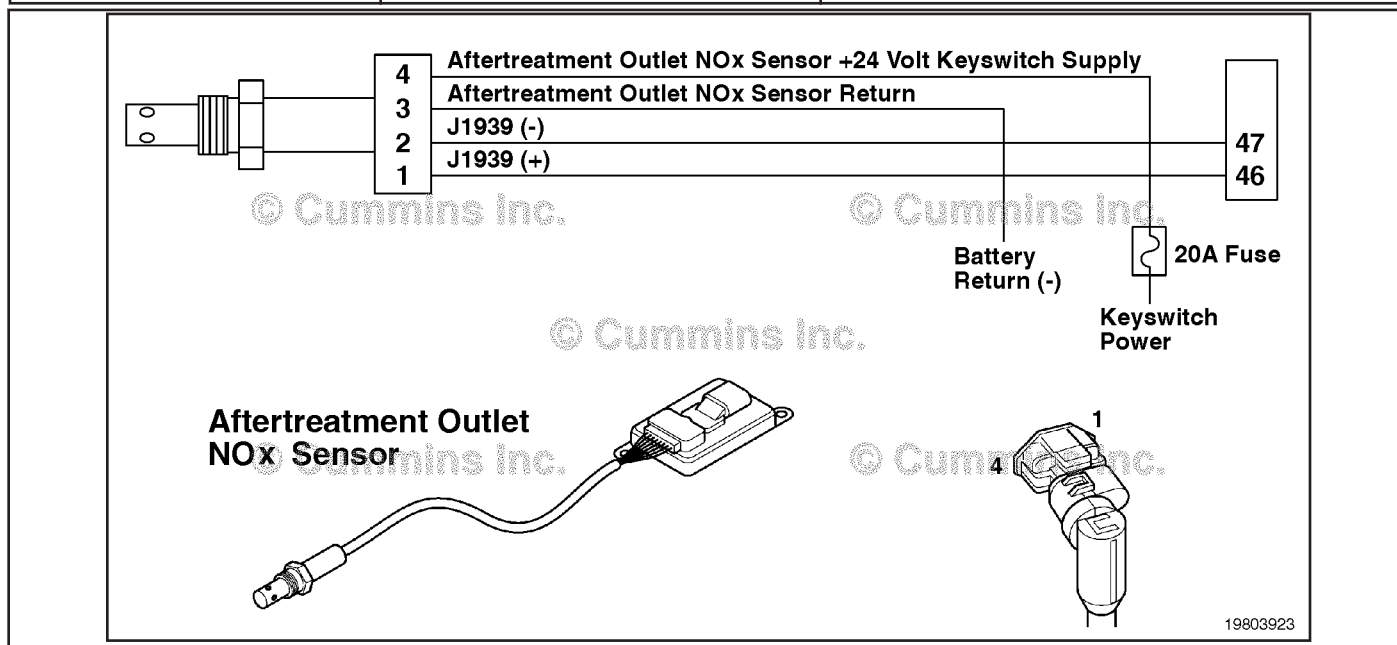
**STEP 3B: Disable the fault code.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Disable and clear the fault code.</p> <ul style="list-style-type: none"> <li>• Start the engine and operate for 1 minute. Diagnostic will perform and fault code will become inactive.</li> <li>• Use INSITE™ electronic service tool to verify the fault code is inactive.</li> </ul> <p>NOTE: The inactive fault code can <b>not</b> be cleared from memory with INSITE™ electronic service tool. The fault code will be cleared from memory after 400 days or 9600 hours of engine operation.</p>	<p>Fault code inactive?</p> <p><b>YES</b></p>	Repair complete.
	<p>Fault code inactive?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Return to the troubleshooting steps or contact a Cummins® Authorized Repair Location if all steps have been completed and checked again.</p>	1A

## Fault Code 1694

### Aftertreatment Outlet NOx Sensor - Data Erratic, Intermittent, or Incorrect

CODES	REASON	EFFECT
Fault Code: 1694 PID(P), SID(S): SPN: 3234 FMI: 2 Lamp: Amber SRT:	Aftertreatment Outlet NOx Sensor - Data Erratic, Intermittent, or Incorrect. An incorrect NOx sensor reading has been detected by the aftertreatment outlet NOx sensor.	Aftertreatment outlet NOx sensor operation will be disabled.  Engine will derate after running 50 hours with the fault code active.



Circuit: Aftertreatment Outlet NOx Sensor Circuit

#### Circuit Description:

The aftertreatment outlet nitrogen oxides (NOx) sensor is a smart device and receives commands from the engine electronic control module (ECM) via the J1939 datalink. The aftertreatment outlet NOx sensor performs its own internal diagnostics and reports malfunctions back to the primary ECM using the J1939 datalink. The NOx sensor is permanently attached to the NOx control module. They are serviced as single component and can **not** be replaced individually. The aftertreatment outlet NOx sensor is used to measure the outlet NOx emissions from the engine.

#### Component Location:

The aftertreatment outlet NOx sensor location can vary depending on engine application. It is usually located in the exhaust system at the outlet of the aftertreatment catalyst.

#### Shop Talk:

On-Board Diagnostics (OBD) information (Euro 4 Stage 1+ Certified Engines):

- The ECM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- An engine torque derate will be activated after 50 hours of engine operation with the fault code active.
- The ECM turns OFF the malfunction indicator lamp (MIL) after 1 ignition cycle that the diagnostic runs and does **not** fail. The MIL lamp **cannot** be cleared using the INSITE™ electronic service tool.
- The fault code will be cleared from memory after 400 days or 9600 hours of engine operation.



The NOx sensor is permanently attached to the NOx control module. They are serviced as a single component and can **not** be replaced individually.

Possible causes of this fault code include:

- The ECM has detected that the NOx reading is higher or lower than is possible from the engine output.
- Exhaust system leaks.
- An incorrectly installed aftertreatment outlet NOx sensor.
- An aftertreatment outlet NOx sensor that has carbon buildup on the tip of the sensor.
- Excessive oil consumption.
- Possible engine misfire
- The NOx sensor part number is incorrect.

**Refer to Troubleshooting Fault Code t05-1694**

FAULT CODE 1694 - Aftertreatment Outlet NOx Sensor - Data Erratic, Intermittent, or Incorrect
TROUBLESHOOTING SUMMARY



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



To reduce the possibility of pin and harness damage, use the following test leads when taking a measurement: Part Number 3822758 - male Deutsch™/AMP™/Metri-Pack™ test lead and Part Number 3822917 - female Deutsch™/AMP™/Metri-Pack™ test lead.

Table with 3 columns: STEPS, SPECIFICATIONS, and SRT CODE. It lists troubleshooting steps from STEP 1 to STEP 3, including sub-steps like STEP 1A, STEP 2A-E, and STEP 3A-B, with corresponding specifications and SRT codes.

**TROUBLESHOOTING STEP****STEP 1: Check the fault codes.****STEP 1A: Check for active fault codes.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for active fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> <li>• Troubleshoot any other active fault codes first.</li> <li>• All other active fault codes <b>must</b> be resolved before following this troubleshooting tree.</li> </ul>	Active fault codes are present? <b>YES</b>	Appropriate fault code troubleshooting tree
	Active fault codes are present? <b>NO</b>	2A

**STEP 2: Check the aftertreatment outlet NOx sensor.****STEP 2A: Inspect the NOx sensor body and condition of the NOx sensor harness.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> </ul>		
Action	Specification/Repair	Next Step
Check the NOx sensor body and the NOx sensor harness. <ul style="list-style-type: none"> <li>• Visually inspect the NOx sensor body and NOx sensor harness for cracks or damage.</li> </ul> Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.	External damage to the sensor body, head (component fitted to the exhaust gas processor), or harness? <b>YES</b> <b>Repair:</b> Replace the NOx sensor.	3A
	External damage to the sensor body, head (component fitted to the exhaust gas processor), or harness? <b>NO</b>	2B

**STEP 2B: Inspect the NOx sensor and connection pins.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the aftertreatment outlet NOx sensor from the original equipment manufacturer (OEM) harness.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the OEM harness and aftertreatment outlet NOx sensor connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A damaged connector has been detected in the sensor or harness connector.</p> <ul style="list-style-type: none"> <li>• Clean the connector and pins.</li> <li>• Repair the damaged harness, connector, or pins, if possible.</li> <li>• If broken pins are found within the NOx sensor, replace the NOx sensor.</li> </ul> <p>Refer to Procedure 019-071 in Section 19.</p>	3A
	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	2C

**STEP 2C: Check the NOx sensor installation.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check the aftertreatment NOx sensor installation and check the vehicle exhaust system.</p> <p>Check for active fault codes.</p> <ul style="list-style-type: none"> <li>• Check that the NOx sensor is securely installed in the correct position with the correct fittings and fasteners.</li> <li>• Check the exhaust system for leaks and loose connections</li> </ul>	<p>NOx sensor installed correctly and the exhaust system free of leaks?</p> <p><b>YES</b></p>	2D
	<p>NOx sensor installed correctly and the exhaust system free of leaks?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Repair the NOx sensor installation and/or exhaust system.</p>	3A

**STEP 2D: Check pin-to-pin continuity in the OEM harness.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the OEM harness from the NOx sensor.</li> <li>• Disconnect the OEM harness ECM connector.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check the continuity of the NOx sensor circuit in the OEM wiring harness.</p> <ul style="list-style-type: none"> <li>• Check the pin-to-pin resistance of the OEM harness between the ECM connector and the NOx sensor connector.</li> </ul> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Resistances less than 10 ohms?</p> <p><b>YES</b></p>	2E
	<p>Resistances less than 10 ohms?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>The OEM wiring harness resistance is excessive. Repair or replace the OEM wiring harness.</p> <p>Refer to the OEM service manual.</p>	3A

**STEP 2E: Check the urea doser pump for proper operation.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check the dosing control unit.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to perform the Urea Doser Pump Override Test found under Aftertreatment Diagnostics Tests.</li> </ul> <p>Use the following procedure for instructions and pass/fail criteria. Refer to Procedure 019-440 in Section 19.</p> <p>Note: The urea injector nozzle <b>must</b> be removed and placed in a measuring container in order to perform this test. Make sure the nozzle is <b>not</b> plugged and urea is flowing from all four holes.</p>	<p>DEF doser pump operates correctly during INSITE™ electronic service tool override tests?</p> <p><b>YES</b></p>	3A
	<p>DEF doser pump operates correctly during INSITE™ electronic service tool override tests?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Replace the catalyst dosing unit. Refer to Procedure 019-440 in Section 19.</p>	3A

**STEP 3: Check ECM calibration and clear fault codes.**

**STEP 3A: Check if an ECM calibration update is available.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Compare the ECM code and revision number in the ECM to the calibration revisions listed in the ECM Calibration Revision History for applicable changes related to this fault code.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to find the present ECM code and revision number in the ECM. The ECM code and revision number are found in the Calibration Information section of System ID and Dataplate in Features and Parameters.</li> </ul>	<p>If a calibration update for this fault code is available, does the ECM contain that revision or higher?</p> <p><b>YES</b></p>	3B
	<p>If a calibration update for this fault code is available, does the ECM contain that revision or higher?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>If necessary, calibrate the ECM. Refer to Procedure 019-032 in Section 19.</p>	3B

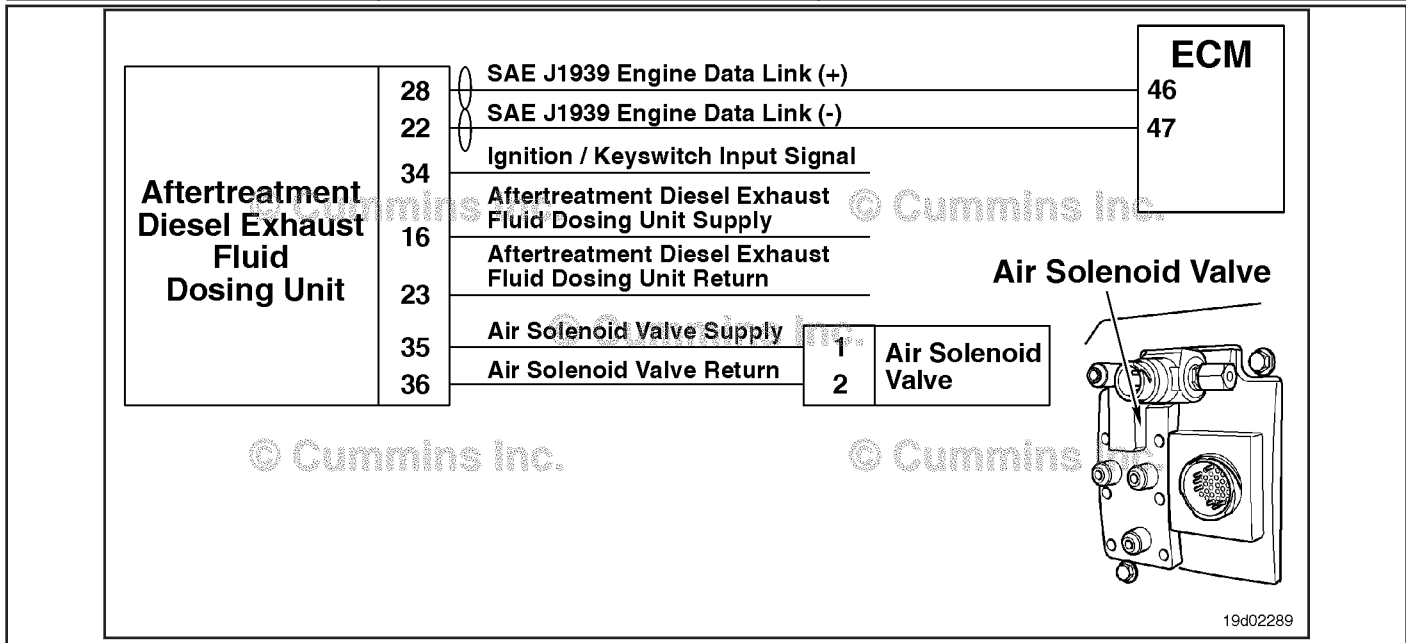
**STEP 3B: Disable the fault code.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Disable the fault code.</p> <p>It is necessary to drive or operate the vehicle on a chassis dynamometer in order to validate the repair and for the fault code to go inactive. INSITE™ electronic service tool can <b>not</b> be used to clear the fault code. The diagnostic <b>must</b> completely perform before the fault code will go inactive and the malfunction indicator lamp (MIL) lamp will go out.</p> <p>First, operate the vehicle in a condition that allows the engine to be motored (throttle released as if coming to a stop) for at least 10 seconds, followed by applying 100 percent throttle for 10 seconds, keeping the engine speed greater than 850 rpm. Repeat this procedure three times. Then, using the Data Monitor/Logger screen in INSITE™ electronic service tool, add the following parameters to the monitor screen: Catalyst Inlet Temperature, Catalyst Outlet Temperature, Catalyst Solution Injection Rate, Stable Fueling Timer, Percent Fuel, Engine Speed, NOx Monitor Pass Count, and NOx Monitor Fail Count.</p> <p>Operate the engine at the following conditions; constant vehicle speed and constant engine speed in the following ranges for the applicable engine model: ISBe4 (4 cylinder) - 1450 rpm to 1750 rpm, ISBe4 (6 cylinder) - 1400 rpm to 1700 rpm, or ISLe4 - 1150 rpm to 1450 rpm.</p> <p>A minimum of 60 percent engine load and 100 percent catalyst solution injection rate and the catalyst inlet and catalyst outlet temperatures over 240°C [464°F]. Drive the vehicle or operate on a chassis dynamomotor at the above condition holding a constant engine speed, engine load, and throttle position for a minimum of 35 seconds. When the diagnostic runs and passes, the MIL lamp will go out and the NOx Monitor Pass Count will increment by one. If the fault code does <b>not</b> go inactive, continue operating at the steady state conditions for an additional 3 minutes. It may be necessary to repeat this procedure until the fault code goes inactive.</p> <p>Note: After the fault code is disabled, the inactive fault code can <b>not</b> be cleared from memory using INSITE™ electronic service tool. The fault code will be cleared from memory after 400 days or 9600 hours of engine operation.</p>	<p>Fault Code 1694 is inactive? <b>YES</b></p>	<p>Repair complete</p>
	<p>Fault Code 1694 is inactive? <b>NO</b></p> <p><b>Repair:</b></p> <p>Return to the troubleshooting steps or contact a Cummins® Authorized Repair Location if all steps have been completed and checked again.</p>	<p>Appropriate troubleshooting steps</p>

## Fault Code 1697

### Aftertreatment #1 Air Enable Actuator — Voltage Above Normal, or Shorted to High Source.

CODES	REASON	EFFECT
Fault Code: 1697 PID(P), SID(S): SPN: 3489 FMI: 3 Lamp: Amber SRT:	Aftertreatment #1 Air Enable Actuator — Voltage Above Normal, or Shorted to High Source. High signal voltage has been detected at the catalyst air solenoid circuit.	Catalyst solution injection into the aftertreatment system is disabled.



Circuit: Aftertreatment #1 Air Enable Actuator

**Circuit Description:**

The aftertreatment #1 air solenoid is used to enable and disable the truck air supply to the dosing control unit. The air is used to transport the catalyst solution to the catalyst nozzle.

**Component Location:**

The aftertreatment #1 air solenoid is mounted to the back of the dosing control unit. The dosing control unit is OEM mounted.

**Shop Talk:**

This fault code is logged when the supply voltage to the air solenoid is greater than +12 volts.

Possible causes of this fault code include:

- Air solenoid signal wire shorted to a voltage supply
- Failed dosing control unit.

On-Board Diagnostics (OBD) Information (Euro 4 Certified Engines):

- The ECM illuminates the malfunction indicator lamp (MIL) when the diagnostic runs and fails.
- The ECM turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does **not** fail. The MIL lamp and fault code can also be cleared using the INSITE™ service tool.
- The fault code will be cleared from memory after 40 consecutive drive cycles where the diagnostic runs and passes.

On-Board Diagnostics (OBD) Information (Euro 4 Stage 1+ Certified Engines):



- The ECM illuminates the malfunction indicator lamp (MIL) when the diagnostic runs and fails.
- An engine torque derate will be activated after 50 hours of engine operation with the fault code active.
- The ECM turns OFF the malfunction indicator lamp (MIL) after 1 ignition cycle that the diagnostic runs and does **not** fail. The MIL lamp **cannot** be cleared using the INSITE™ service tool.
- The fault code will be cleared from memory after 400 days or 9600 hours of engine operation.

**Refer to Troubleshooting Fault Code t05-1697**

FAULT CODE 1697 - Aftertreatment Number 1 Air Enable Actuator - Voltage Above Normal, or Shorted to High Source
TROUBLESHOOTING SUMMARY



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



To reduce the possibility of pin and harness damage, use the following test leads when taking a measurement: Part Number 3822758 - male Deutsch™/AMP™/Metri-Pack™ test lead and Part Number 3822917 - female Deutsch™/AMP™/Metri-Pack™ test lead.

Table with 3 columns: STEPS, SPECIFICATIONS, and SRT CODE. It lists troubleshooting steps from Step 1 to Step 4, including sub-steps like Step 1A, Step 2A, Step 2B, Step 2C, Step 3A, Step 3B, Step 4A, and Step 4B, with corresponding specifications and SRT codes.

**TROUBLESHOOTING STEP****STEP 1: Check the fault codes****STEP 1A: Check for an inactive fault code.**

<b>Condition:</b>		
<ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
<b>Action</b>	<b>Specification/Repair</b>	<b>Next Step</b>
Check for inactive fault code. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault code 1697 is inactive? <b>YES</b>	Use the following procedure for an inactive or intermittent fault code. Refer to Procedure 019-362 in Section 19.
	Fault code 1697 is inactive? <b>NO</b>	2A

**STEP 2: Check the air solenoid and circuit.****STEP 2A: Inspect the air solenoid and electrical connections.**

<b>Condition:</b>		
<ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the OEM harness from the air solenoid.</li> </ul>		
<b>Action</b>	<b>Specification/Repair</b>	<b>Next Step</b>
Inspect the OEM harness and air solenoid connector pins for the following: <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.	Dirty or damaged pins? <b>YES</b> <b>Repair:</b> A damaged connection has been detected in the sensor or harness connector. <ul style="list-style-type: none"> <li>• Clean the connector and pins.</li> <li>• Repair the damaged harness, connector, or pins, if possible.</li> </ul> Refer to Procedure 019-071 in Section 19.	4A
		Dirty or damaged pins? <b>NO</b>

**STEP 2B: Check for a short circuit in the air solenoid.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the OEM harness from the air solenoid.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check air solenoid resistance.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the air solenoid SIGNAL pin and the air solenoid RETURN pin at the air solenoid.</li> </ul> <p>Refer to the wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Solenoid resistance between 8 and 20 ohms?</p> <p><b>YES</b></p>	2C
	<p>Solenoid resistance between 8 and 20 ohms?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>An open or short circuit has been detected in the air solenoid. Replace the dosing control unit. Refer to the OEM service manual.</p>	4A

**STEP 2C: Check for a short circuit to ground in the air solenoid.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the OEM harness from the air solenoid.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for an air solenoid short to ground.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the air solenoid SIGNAL pin and ground at the air solenoid.</li> </ul> <p>Refer to the wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Greater than 100k ohms?</p> <p><b>YES</b></p>	3A
	<p>Greater than 100k ohms?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Replace the dosing control unit. Refer to OEM service manual.</p>	4A

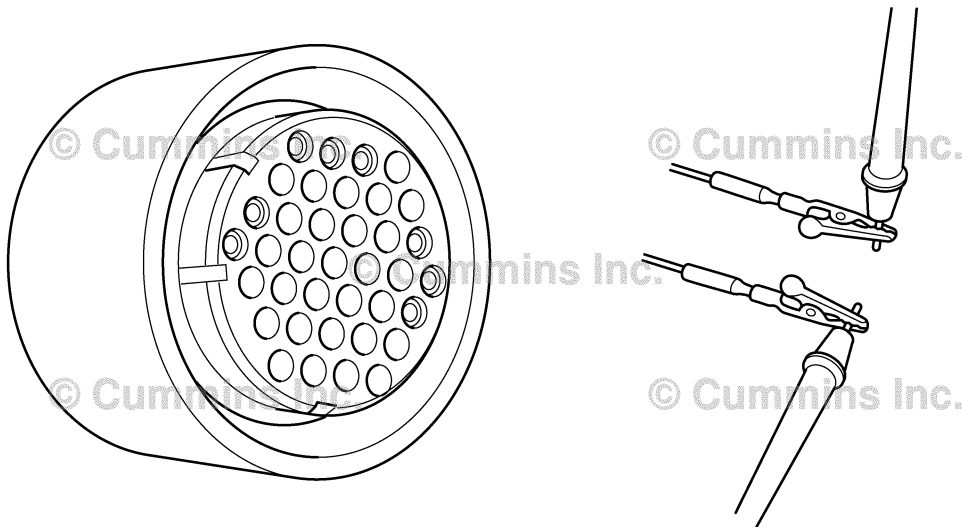
**STEP 3: Check the dosing control unit and dosing control unit harness.**

**STEP 3A: Inspect the dosing control unit and dosing control unit connector pins.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the OEM harness from the dosing control unit.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the OEM harness ECM connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A damaged connection has been detected in the dosing control unit.</p> <ul style="list-style-type: none"> <li>• Clean the connector and pins.</li> <li>• Repair the damaged harness, connector, or pins, if possible.</li> </ul> <p>Refer to Procedure 019-071 in Section 19.</p>	4A
	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	3B

**STEP 3B: Check for a pin-to-pin short circuit in the OEM harness.**

Action	Specification/Repair	Next Step
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the OEM harness from the dosing control unit.</li> <li>• Disconnect the OEM harness from the air solenoid.</li> </ul> <p>Check for a pin-to-pin short.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the air solenoid SIGNAL pin in the OEM harness ECM connector and all other pins in the OEM connector.</li> </ul> <p>Refer to the wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Greater than 100k ohms? <b>YES</b></p>	<p>4A</p>
	<p>Greater than 100k ohms? <b>NO</b></p> <p><b>Repair:</b></p> <p>A pin-to-pin short circuit on the air solenoid signal line has been detected in the OEM harness.</p> <p>Repair or replace the OEM harness. Refer to Procedure 019-071 in Section 19.</p>	<p>4A</p>



19d02290

**STEP 4: Check ECM calibration and clear fault codes.**

**STEP 4A: Check if an ECM calibration update is available.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Compare the ECM code and revision number in the ECM to the calibration revisions listed in the ECM Calibration Revision History for applicable changes related to this fault code.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to find the present ECM code and revision number in the ECM. The ECM code and revision number are found in the Calibration Information section of System ID and Dataplate in Features and Parameters.</li> </ul>	<p>If a calibration update for this fault code is available, does the ECM contain that revision or higher?</p> <p><b>YES</b></p>	4B
	<p>If a calibration update for this fault code is available, does the ECM contain that revision or higher?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>If necessary, calibrate the ECM. Refer to Procedure 019-032 in Section 19.</p>	4B

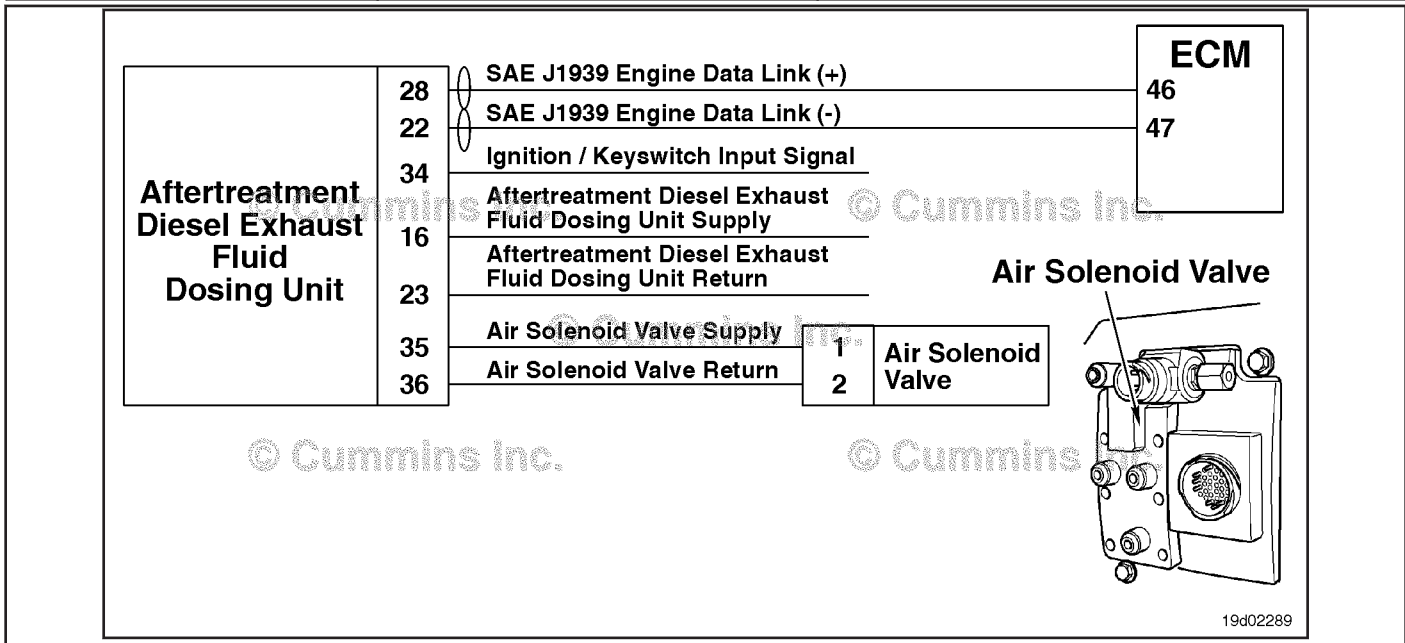
**STEP 4B: Disable the fault code.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Disable and clear the fault code.</p> <ul style="list-style-type: none"> <li>• Start the engine and operate it for 1 minute. The diagnostic will perform and fault code will become inactive.</li> <li>• Use INSITE™ electronic service tool to verify the fault code is inactive.</li> </ul>	<p>Fault Code 1697 inactive?</p> <p><b>YES</b></p>	Repair complete.
	<p>Fault Code 1697inactive?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Return to the troubleshooting steps or contact a Cummins® Authorized Repair Location if all steps have been completed and checked again.</p>	1A

## Fault Code 1698

### Aftertreatment #1 Air Enable Actuator — Voltage Below Normal, or Shorted to Low Source.

CODES	REASON	EFFECT
Fault Code: 1698 PID(P), SID(S): SPN: 3489 FMI: 4 Lamp: Amber SRT:	Aftertreatment #1 Air Enable Actuator — Voltage Below Normal, or Shorted to Low Source. Low signal voltage has been detected at the catalyst air solenoid circuit.	Catalyst solution injection into the aftertreatment system is disabled.



**Circuit Description:**

The aftertreatment #1 air solenoid is used to enable and disable the truck air supply to the dosing control unit. The air is used to transport the catalyst solution to the catalyst nozzle.

**Component Location:**

The aftertreatment #1 air solenoid is mounted to the back of the dosing control unit. The dosing control unit is OEM mounted.

**Shop Talk:**

This fault code is logged when the supply voltage to the air solenoid is less than +12 volts.

Possible causes of this fault code include:

- Open circuit in the air solenoid signal wire
- Open circuit in the air solenoid return wire
- Shorted to pin to pin air solenoid signal wire
- Failed air solenoid
- Failed dosing control unit.

On-Board Diagnostics (OBD) Information (Euro 4 Certified Engines):

- The ECM illuminates the malfunction indicator lamp (MIL) when the diagnostic runs and fails.



- The ECM turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does **not** fail. The MIL lamp and fault code can also be cleared using the INSITE™ service tool.
- The fault code will be cleared from memory after 40 consecutive drive cycles where the diagnostic runs and passes.

On-Board Diagnostics (OBD) Information (Euro 4 Stage 1+ Certified Engines):

- The ECM illuminates the malfunction indicator lamp (MIL) when the diagnostic runs and fails.
- An engine torque derate will be activated after 50 hours of engine operation with the fault code active.
- The ECM turns OFF the malfunction indicator lamp (MIL) after 1 ignition cycle that the diagnostic runs and does **not** fail. The MIL lamp **cannot** be cleared using the INSITE™ service tool.
- The fault code will be cleared from memory after 400 days or 9600 hours of engine operation.

**Refer to Troubleshooting Fault Code t05-1698**

FAULT CODE 1698 - Aftertreatment Number 1 Air Enable Actuator - Voltage Below Normal, or Shorted to Low Source
TROUBLESHOOTING SUMMARY



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



To reduce the possibility of pin and harness damage, use the following test leads when taking a measurement: Part Number 3822758 - male Deutsch™/AMP™/Metri-Pack™ test lead and Part Number 3822917 - female Deutsch™/AMP™/Metri-Pack™ test lead.

Table with 3 columns: STEPS, SPECIFICATIONS, and SRT CODE. It lists troubleshooting steps from STEP 1 to STEP 4, including sub-steps like STEP 1A, STEP 2A, etc., and their corresponding specifications.

**TROUBLESHOOTING STEP****STEP 1: Check the fault codes.****STEP 1A: Check for an inactive fault code.**

<b>Condition:</b>		
<ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
<b>Action</b>	<b>Specification/Repair</b>	<b>Next Step</b>
Check for inactive fault code. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault code 1698 is inactive? <b>YES</b>	Use the following procedure for an inactive or intermittent fault code. Refer to Procedure 019-362 in Section 19.
	Fault code 1698 is inactive? <b>NO</b>	2A

**STEP 2: Check the air solenoid and circuit.****STEP 2A: Inspect the air solenoid and electrical connections.**

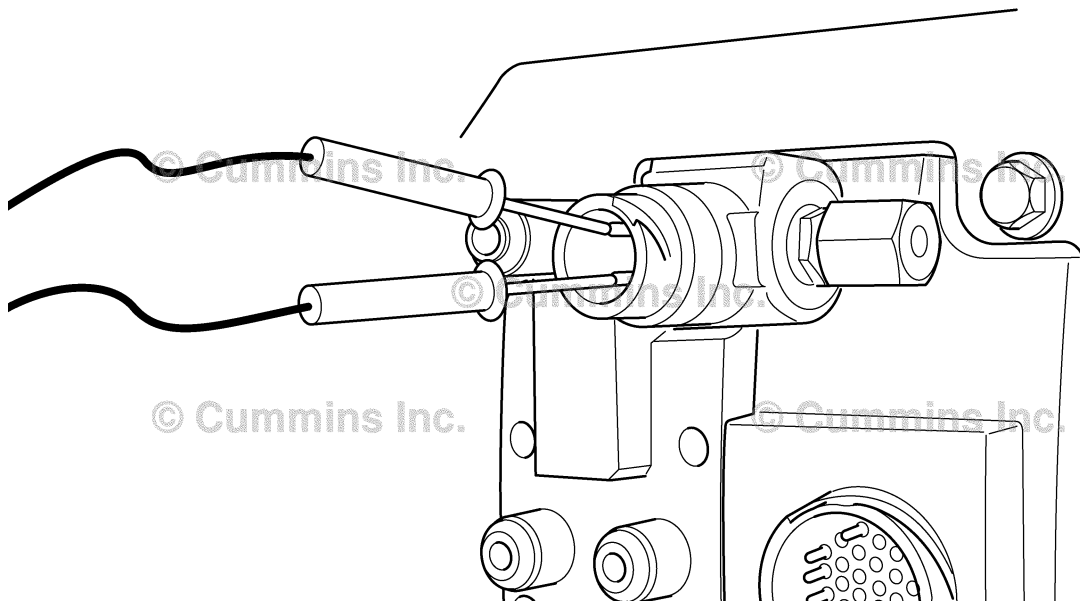
<b>Condition:</b>		
<ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the OEM harness from the air solenoid.</li> </ul>		
<b>Action</b>	<b>Specification/Repair</b>	<b>Next Step</b>
Inspect the dosing control unit harness and air solenoid connector pins for the following: <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.	Dirty or damaged pins? <b>YES</b> <b>Repair:</b> A damaged connection has been detected in the sensor or harness connector. <ul style="list-style-type: none"> <li>• Clean the connector and pins.</li> <li>• Repair the damaged harness, connector, or pins, if possible.</li> </ul> Refer to Procedure 019-071 in Section 19.	4A
		Dirty or damaged pins? <b>NO</b>

**STEP 2B: Check for a short circuit in the air solenoid.**

**Condition:**

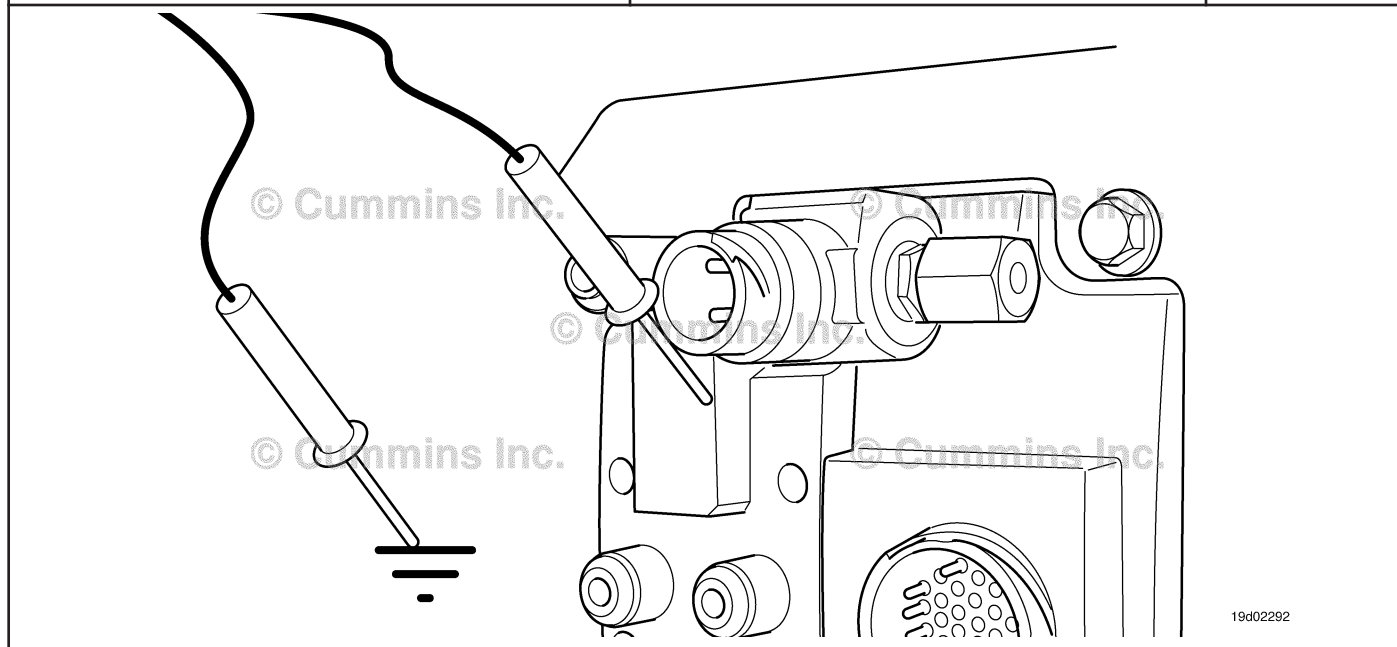
- Turn keyswitch OFF.
- Disconnect the OEM harness from the air solenoid.

Action	Specification/Repair	Next Step
Check air solenoid resistance. <ul style="list-style-type: none"> <li>• Measure the resistance between the air solenoid SIGNAL pin and the air solenoid RETURN pin at the air solenoid.</li> </ul>	Solenoid resistance is between 8 and 20 ohms? <b>YES</b>	2C
Refer to the wiring diagram for connector pin identification.  Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.	Solenoid resistance is between 8 and 20 ohms? <b>NO</b> <b>Repair:</b> An open or short circuit has been detected in the air solenoid.  Replace the dosing control unit. Refer to the OEM service manual.	4A



**STEP 2C: Check for a short circuit to ground in the air solenoid.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the OEM harness from the air solenoid.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for an air solenoid short to ground.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the air solenoid SIGNAL pin and ground at the air solenoid.</li> </ul> <p>Refer to the wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Greater than 100k ohms? <b>YES</b></p>	<p>3A</p>
	<p>Greater than 100k ohms? <b>NO</b></p> <p><b>Repair:</b></p> <p>Replace the dosing control unit. Refer to the OEM service manual.</p>	<p>4A</p>



**STEP 3: Check the dosing control unit and OEM harness.**

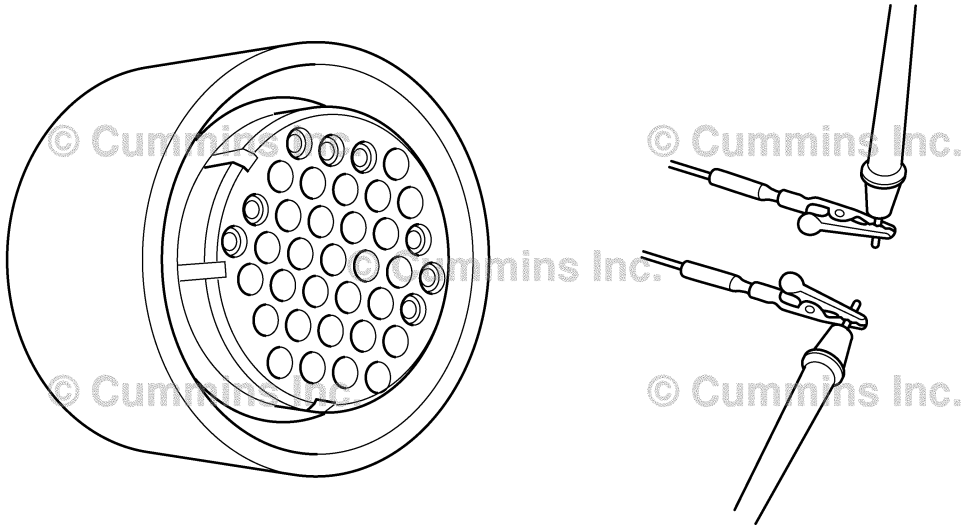
**STEP 3A: Inspect the dosing control unit and OEM harness connector pins.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the OEM harness from the dosing control unit.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the OEM harness ECM connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A damaged connection has been detected in the dosing control unit.</p> <ul style="list-style-type: none"> <li>• Clean the connector and pins.</li> <li>• Repair the damaged harness, connector, or pins, if possible.</li> </ul> <p>Refer to Procedure 019-071 in Section 19.</p>	4A
	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	3B

**STEP 3B: Check for a pin-to-pin short circuit to ground.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the OEM harness from the dosing control unit.</li> <li>• Disconnect the OEM harness from the air solenoid.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for a pin-to-pin short.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the air solenoid SIGNAL pin in the dosing control unit harness and ground.</li> </ul> <p>Refer to the wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Greater than 100k ohms?</p> <p><b>YES</b></p>	3C
	<p>Greater than 100k ohms?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>A pin-to-pin short circuit on the air solenoid signal line has been detected in the OEM harness.</p> <p>Troubleshoot each harness connected in series to determine which contains the shorted signal circuit.</p> <p>Repair or replace the OEM harness. Refer to Procedure 019-071 in Section 19.</p>	4A

**STEP 3C: Check for a pin-to-pin short circuit in the engine.**

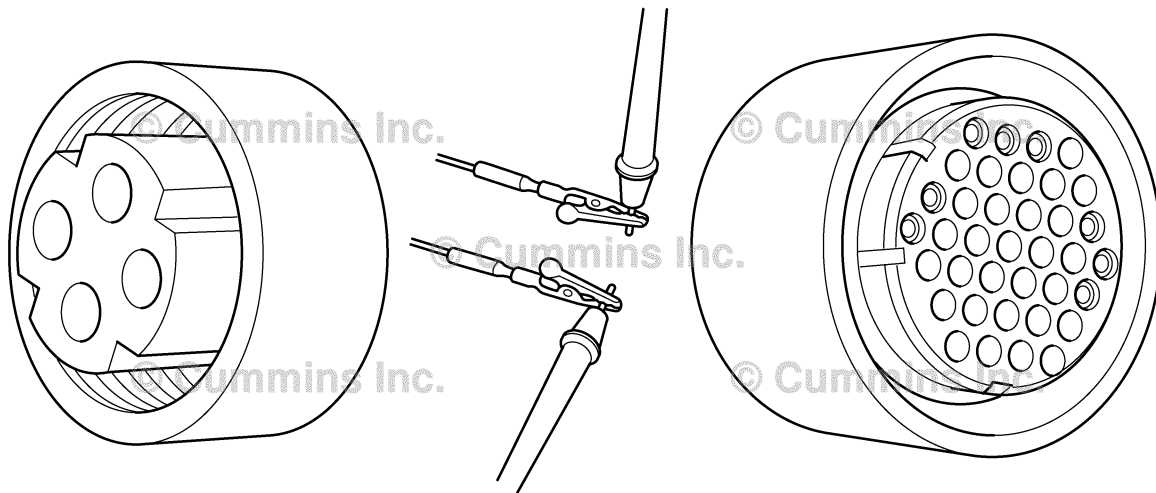
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the OEM harness from the dosing control unit.</li> <li>• Disconnect the air solenoid from the OEM harness.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for a pin-to-pin short.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the air solenoid SIGNAL pin in the OEM harness and all other pins in the OEM harness connector.</li> </ul> <p>Refer to the wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Greater than 100k ohms? <b>YES</b></p>	<p>3D</p>
	<p>Greater than 100k ohms? <b>NO</b></p> <p><b>Repair:</b></p> <p>A pin-to-pin short circuit on the air solenoid signal line has been detected in the OEM harness.</p> <p>Repair or replace the OEM harness. Refer to Procedure 019-071 in Section 19.</p>	<p>4A</p>
 <p>The diagram illustrates the testing procedure. On the left, a circular connector with a grid of pins is shown. On the right, two wire harnesses are connected to the pins. A multimeter is used to measure the resistance between the signal pin and other pins in the harness.</p>		
<p>19d02290</p>		

**STEP 3D: Check for an open circuit in the signal circuit.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the OEM harness from the dosing control unit.
- Disconnect the air solenoid from the OEM harness.

Action	Specification/Repair	Next Step
<p>Check for an open circuit.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the air solenoid SIGNAL pin in the OEM harness at the dosing control unit and the air solenoid SIGNAL pin in the OEM harness at the air solenoid.</li> </ul> <p>Refer to the wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Less than 10k ohms? <b>YES</b></p>	<p>3F</p>
	<p>Less than 10k ohms? <b>NO</b></p> <p><b>Repair:</b></p> <p>A pin-to-pin short circuit on the air solenoid signal line has been detected in the OEM harness.</p> <p>Troubleshoot each harness connected in series to determine which contains the shorted signal circuit.</p> <p>Repair or replace the OEM harness. Refer to Procedure 019-071 in Section 19.</p>	<p>4A</p>

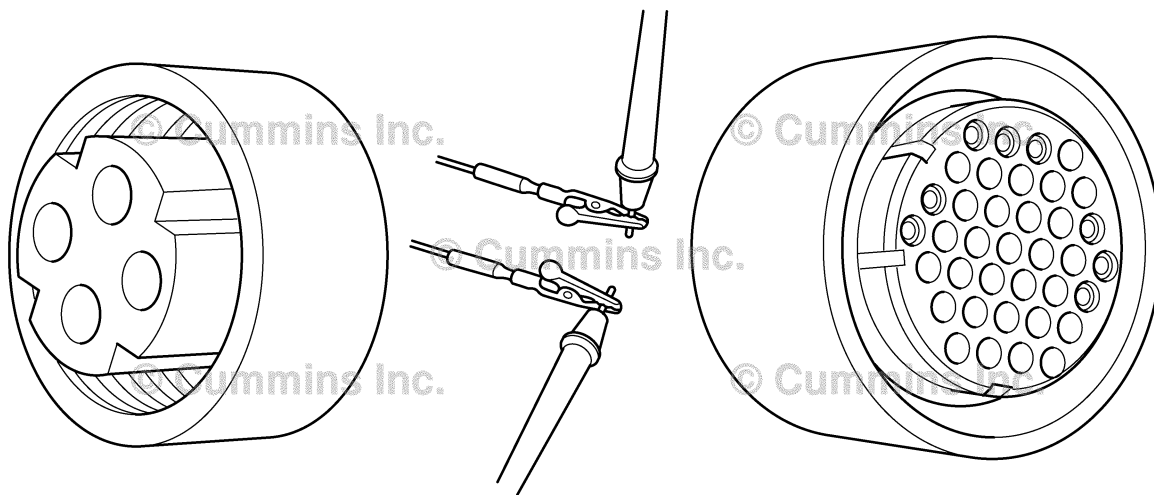


19d02293



**STEP 3E: Check for an open circuit in the return circuit.**

Action	Specification/Repair	Next Step
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the OEM harness from the dosing control unit.</li> <li>• Disconnect the air solenoid from the dosing control unit harness.</li> </ul> <p>Check for an open circuit.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the air solenoid RETURN pin in the OEM harness at the dosing control unit and the air solenoid RETURN pin in the OEM harness at the air solenoid.</li> </ul> <p>Refer to the wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Less than 10 ohms? <b>YES</b></p>	<p>3F</p>
	<p>Less than 10 ohms? <b>NO</b></p> <p><b>Repair:</b></p> <p>A pin-to-pin short circuit on the air solenoid return line has been detected in the OEM harness.</p> <p>Troubleshoot each harness connected in series to determine which contains the shorted signal circuit.</p> <p>Repair or replace the OEM harness. Refer to Procedure 019-071 in Section 19.</p>	<p>4A</p>



19d02293

**STEP 3F: Check for an inactive fault code.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate circuit response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault code 1698 inactive?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>None. The removal and installation of the connector corrected the fault.</p>	4A
	<p>Fault code 1698 inactive?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Replace the dosing control unit. Refer to Procedure 019-440 in Section 19.</p>	4A

**STEP 4: Check ECM calibration and clear fault codes.**

**STEP 4A: Check if an ECM calibration update is available.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Compare the ECM code and revision number in the ECM to the calibration revisions listed in the ECM Calibration Revision History for applicable changes related to this fault code.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to find the present ECM code and revision number in the ECM. The ECM code and revision number are found in the Calibration Information section of System ID and Dataplate in Features and Parameters.</li> </ul>	<p>If a calibration update for this fault code is available, does the ECM contain that revision or higher?</p> <p><b>YES</b></p>	4B
	<p>If a calibration update for this fault code is available, does the ECM contain that revision or higher?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>If necessary, calibrate the ECM. Refer to Procedure 019-032 in Section 19.</p>	4B

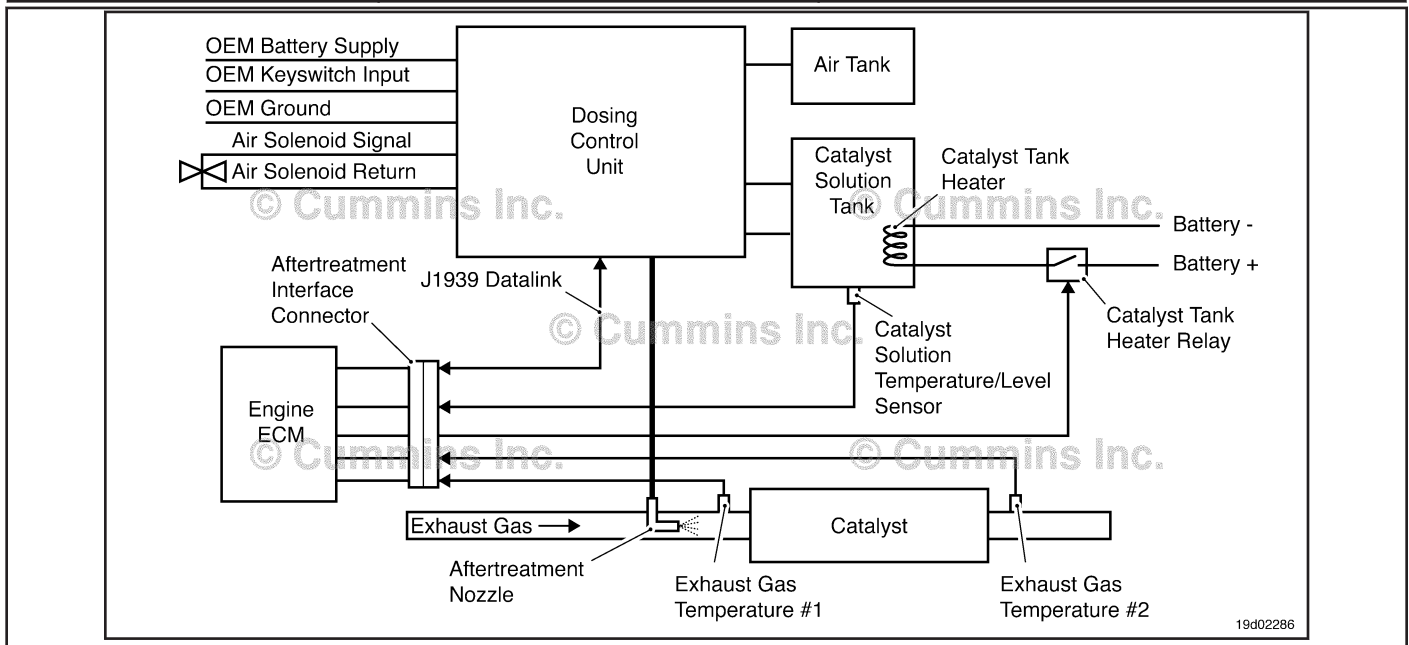
**STEP 4B: Disable the fault code.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Disable the fault code.</p> <ul style="list-style-type: none"> <li>• Start the engine and operate it for 1 minute. Diagnostic will perform and fault code will become inactive.</li> <li>• Use INSITE™ electronic service tool to verify the fault code is inactive.</li> </ul>	<p>Fault Code 1698 inactive?  <b>YES</b></p>	<p>Repair complete.</p>
	<p>Fault Code 1698 inactive?  <b>NO</b></p> <p><b>Repair:</b>                  Return to the troubleshooting steps or contact a Cummins® Authorized Repair Location if all steps have been completed and checked again.</p>	<p>1A</p>

## Fault Code 1699

### Catalyst Tank Level Sensor — Data Erratic, Intermittent, or Incorrect.

CODES	REASON	EFFECT
Fault Code: 1699 PID(P), SID(S): SPN: 1761 FMI: 2 Lamp: Amber SRT:	Catalyst Tank Level Sensor - Data Erratic, Intermittent, or Incorrect. Catalyst solution level is not changing with engine operating conditions.	Catalyst solution injection into the aftertreatment system is disabled.



Catalyst Tank Level Sensor Circuit

#### Circuit Description:

The catalyst tank level sensor is located in the catalyst tank. Location of the tank and level sensor is OEM dependent.

#### Component Location:

The catalyst solution tank location is OEM dependent.

#### Shop Talk:

This fault code is triggered when the catalyst solution level reading in the catalyst tank does not change with engine operating conditions. If the catalyst dosing control unit indicates that catalyst injection has occurred, but the catalyst tank level has not changed, this fault code will be triggered. This fault will also be triggered if catalyst injection has not occurred, but a drop in the level of the catalyst solution has been detected.

Use INSITE™ electronic service tool to make sure the adjustable parameter Linear Urea Tank Volume is adjusted correctly. This fault code can trigger if this parameter is **not** adjusted for the correct urea tank volume.

Possible causes of this fault code include:

- Malfunctioning catalyst tank level sensor
- Plugged or restricted catalyst solution lines
- Plugged or restricted aftertreatment nozzle
- External leaks in the catalyst tank or catalyst solution lines
- Catalyst tank level sensor tampering.

On-Board Diagnostics (OBD) Information:

- The ECM illuminates the malfunction indicator lamp (MIL) when the diagnostic runs and fails
- The ECM turns off the malfunction indicator lamp (MIL) when the diagnostic runs and passes. The diagnostic requires a quantity of diesel exhaust fluid (DEF) to be dosed. Depending on the application and system configuration, this may be up to 3 liters (3.17 qt). The MIL and fault code can also be cleared using INSITE™ electronic service tool.
- The fault code will be cleared from memory after 40 consecutive drive cycles where the diagnostic runs and passes.

**Refer to Troubleshooting Fault Code t05-1699.**

FAULT CODE 1699 - Catalyst Tank Level Sensor - Data Erratic, Intermittent, or Incorrect.
TROUBLESHOOTING SUMMARY



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



To reduce the possibility of pin and harness damage, use the following test leads when taking a measurement: Part Number 3822758 - male Deutsch/AMP/Metri-Pack test lead, and Part Number 3822917 - female Deutsch/AMP/Metri-Pack test lead.

Table with 3 columns: STEPS, SPECIFICATIONS, and SRT CODE. It contains troubleshooting steps 1 through 4, each with sub-steps (A, B, C, D) detailing actions and corresponding specifications.

**TROUBLESHOOTING STEP****STEP 1: Check for fault codes and correct sensor configuration.****STEP 1A: Check for catalyst tank level sensor fault codes.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for active fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ to read the fault codes.</li> </ul>	Fault Code 1669,1671, 1681, or 1682 active? <b>YES</b>	Appropriate fault code troubleshooting tree.
	Fault Code 1669,1671, 1681, or 1682 active? <b>NO</b>	1B

**STEP 1B: Check for correct adjustment of Linear Urea Tank Volume parameter.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Use INSITE™ electronic service tool to check the adjustable parameter for Linear Urea Tank Volume is adjusted correctly.  Make sure that the adjustable parameter is adjusted correctly for the size of the urea tank that is used on the vehicle.	Adjustable parameter for Linear Urea Tank Volume set correctly for the vehicle urea tank volume? <b>YES</b>	2A
	Adjustable parameter for Linear Urea Tank Volume set correctly for the vehicle urea tank volume? <b>NO</b> <b>Repair:</b> Use INSITE™ electronic service tool to adjust the parameter Linear Urea Tank Volume to the correct volume for the tank that is being used on the vehicle.	Repair complete.

**STEP 2: Check the catalyst system.**

**STEP 2A: Inspect the catalyst solution system for external leaks.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> </ul>		
Action	Specification/Repair	Next Step
Inspect catalyst solution lines and catalyst solution tank for: <ul style="list-style-type: none"> <li>• External leaks.</li> </ul>	External leaks detected in the system? <b>YES</b> <b>Repair:</b> Repair the source of the external leak.	4A
	External leaks detected in the system? <b>NO</b>	2B

**STEP 2B: Inspect the catalyst solution lines.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> </ul>		
Action	Specification/Repair	Next Step
Inspect catalyst solution lines for: <ul style="list-style-type: none"> <li>• Plugging or restrictions.</li> </ul>	Plugged or restricted catalyst solution lines detected? <b>YES</b> <b>Repair:</b> Repair or replace the catalyst solution lines. Refer to the OEM service manual.	4A
	Plugged or restricted catalyst solution lines detected? <b>NO</b>	2C



**STEP 2C: Inspect the aftertreatment nozzle.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Use the following procedure in the Troubleshooting and Repair Manual, ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9, Bulletin 4021418 for removing the aftertreatment nozzle. Refer to Procedure 011-040</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the aftertreatment nozzle for:</p> <ul style="list-style-type: none"> <li>• Plugging or restrictions.</li> </ul> <p>Use the following procedure in the Troubleshooting and Repair Manual, ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9, Bulletin 4021418 for inspection techniques. Refer to Procedure 011-040 in Section 11.</p>	<p>Plugged or restricted aftertreatment nozzle detected?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Clean or replace the aftertreatment nozzle.</p> <p>Use the following procedure in the Troubleshooting and Repair Manual, ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9, Bulletin 4021418 for inspection techniques. Refer to Procedure 011-040 in Section 11.</p>	4A
	<p>Plugged or restricted aftertreatment nozzle detected?</p> <p><b>NO</b></p>	2D

**STEP 2D: Inspect the catalyst tank and catalyst tank level sensor for tampering.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the catalyst tank and catalyst tank level sensor for the following:</p> <ul style="list-style-type: none"> <li>• External catalyst solution tanks</li> <li>• Oversized catalyst solution tank</li> <li>• Tampering of the catalyst tank level sensor.</li> </ul>	<p>Tampering detected in the catalyst system?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Remove any external tampering devices.</p> <p>Install the correct catalyst solution tank.</p>	4A
	<p>Tampering detected in the catalyst system?</p> <p><b>NO</b></p>	3A

**STEP 3: Inspect the catalyst tank level sensor.**

**STEP 3A: Check the correct operation of the catalyst tank level sensor.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Connect the INSITE™ electronic service tool.</li> <li>• Check the level of the catalyst solution in the catalyst tank.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check the operation of the catalyst tank level sensor.</p> <ul style="list-style-type: none"> <li>• Monitor the position of the catalyst tank solution level with INSITE™ electronic service tool.</li> <li>• Compare the reading from INSITE™ electronic service tool to the actual level of the catalyst solution.</li> </ul>	<p>Catalyst tank solution level sensor reading correctly?</p> <p><b>YES</b></p>	4A
	<p>Catalyst tank solution level sensor reading correctly?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Replace the catalyst tank solution level sensor.</p> <p>Refer to the OEM service manual.</p>	4A

**STEP 4: Clear the fault code.**

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

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Disable the fault code.</p> <ul style="list-style-type: none"> <li>• Allow the diagnostic to run. The diagnostic requires a quantity of diesel exhaust fluid (DEF) to be dosed. Depending on the application and system configuration, this may be up to 3 liters [3.17 qt].</li> <li>• Use INSITE™ electronic service tool to verify that the fault code is inactive.</li> </ul>	<p>Fault Code 1699 inactive?</p> <p><b>YES</b></p>	4B
	<p>Fault Code 1699 inactive?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Return to the troubleshooting steps or contact a Cummins® Authorized Repair Location if all steps have been completed and checked again.</p>	1A

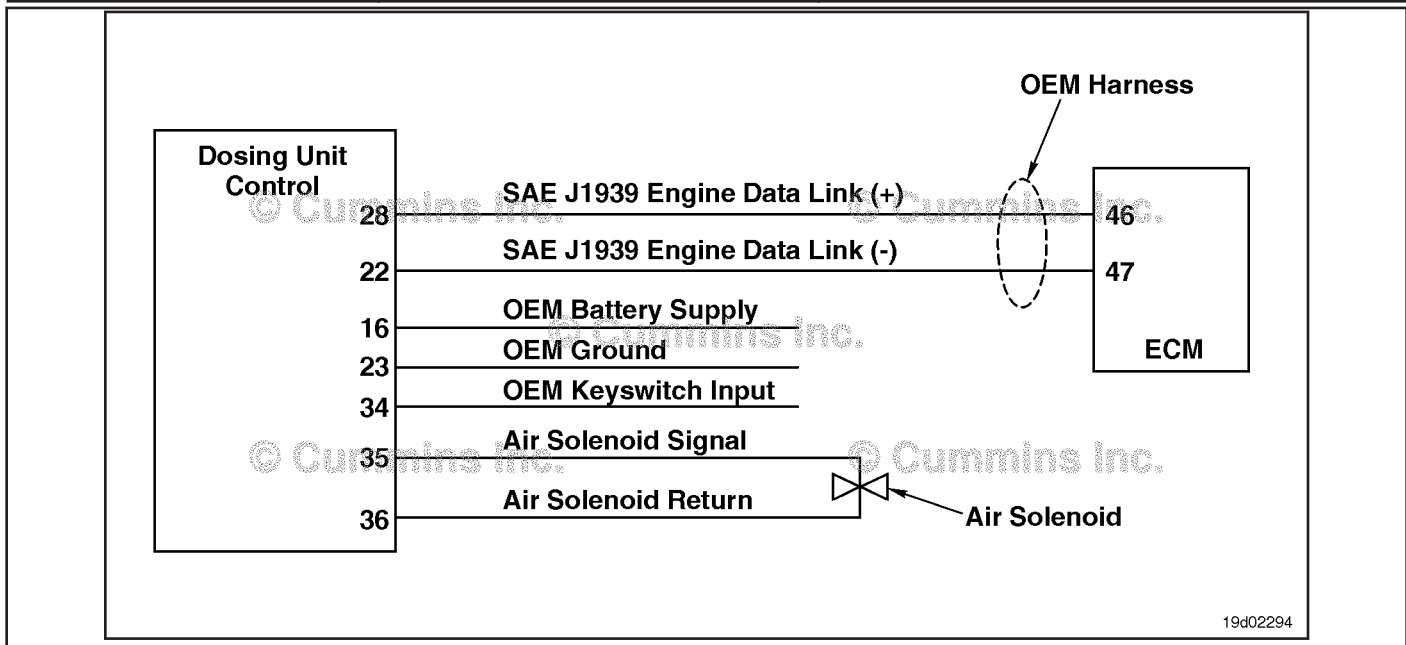
**STEP 4B: Clear the inactive fault codes.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Clear the inactive fault codes.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to verify the fault code is inactive.</li> </ul>	<p>All fault codes cleared?  <b>YES</b></p>	<p>Repair complete</p>
	<p>All fault codes cleared?  <b>NO</b>  <b>Repair:</b>                  Troubleshoot any remaining fault codes.</p>	<p>Appropriate troubleshooting steps</p>

## Fault Code 1711

### Dosing Control Unit Data Link — Abnormal Update Rate

CODES	REASON	EFFECT
Fault Code: 1711 PID(P), SID(S): SPN: 3361 FMI: 9 Lamp: Amber SRT:	Dosing Control Unit Data Link — Abnormal Update Rate. Data Link communications between the ECM and the Dosing Control Unit have been interrupted.	Catalyst solution injection into the aftertreatment system is disabled.



Circuit: Dosing Control Unit

#### Circuit Description:

The catalyst dosing unit communicates to the primary engine Electronic Control Module (ECM) through the J1939 public data link network. The Dosing Control Unit also receives battery supply, keyswitch input, and ground from the OEM vehicle.

#### Component Location:

The Dosing Control Unit location is OEM dependent. Refer to the OEM troubleshooting manual for more information.

#### Shop Talk:

Possible causes of this fault code include:

- Loss of battery voltage to the Dosing Control Unit
- Loss of battery ground to the Dosing Control Unit
- Loss of keyswitch input to the Dosing Control Unit
- Shorted or open J1939 data link wiring between the Dosing Control Unit and the primary engine ECM
- Failed Dosing Control Unit
- The external OEM controlling device has failed or can no longer transmit on the data link.

On-Board Diagnostics (OBD) Information (Euro 4 Certified Engines):

- The ECM illuminates the malfunction indicator lamp (MIL) when the diagnostic runs and fails.
- The ECM turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does **not** fail. The MIL lamp and fault code can also be cleared using the INSITE™ Electronic service tool.

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- The fault code will be cleared from memory after 40 consecutive drive cycles where the diagnostic runs and passes.
- On-Board Diagnostics (OBD) Information (Euro 4 Stage 1+ Certified Engines):
- The ECM illuminates the malfunction indicator lamp (MIL) when the diagnostic runs and fails.
  - An engine torque derate will be activated after 50 hours of engine operation with the fault code active.
  - The ECM turns OFF the malfunction indicator lamp (MIL) after 1 ignition cycle that the diagnostic runs and does **not** fail. The MIL lamp **cannot** be cleared using the INSITE™ Electronic service tool.
  - The fault code will be cleared from memory after 400 days or 9600 hours of engine operation.

**Refer to Troubleshooting Fault Code t05-1711**

FAULT CODE 1711 - dosing control unit Data Link - Abnormal Update Rate
TROUBLESHOOTING SUMMARY



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



To reduce the possibility of pin and harness damage, use the following test leads when taking a measurement: Part No. 3822758 - male Deutsch™/AMP™/Metri-Pack™ test lead Part No. 3822917 - female Deutsch™/AMP™/Metri-Pack™ test lead.

Table with 3 columns: STEPS, SPECIFICATIONS, SRT CODE. It lists troubleshooting steps from Step 1 to Step 5, including sub-steps like Step 1A, Step 2A, Step 2A-1, Step 2B, Step 3A, Step 4A, Step 4B, Step 4C, Step 5A, and Step 5B, with corresponding specifications and SRT codes.

### TROUBLESHOOTING STEP

**STEP 1: Check the fault codes.**

**STEP 1A: Check for an active fault code.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for an active fault code. • Use INSITE™ electronic service tool to read the fault codes.	Fault code 1711 is active? <b>YES</b>	2A
	Fault code 1711 is active? <b>NO</b>	Use the following procedure for an inactive or intermittent fault code. Refer to Procedure 019-362 in Section 19.

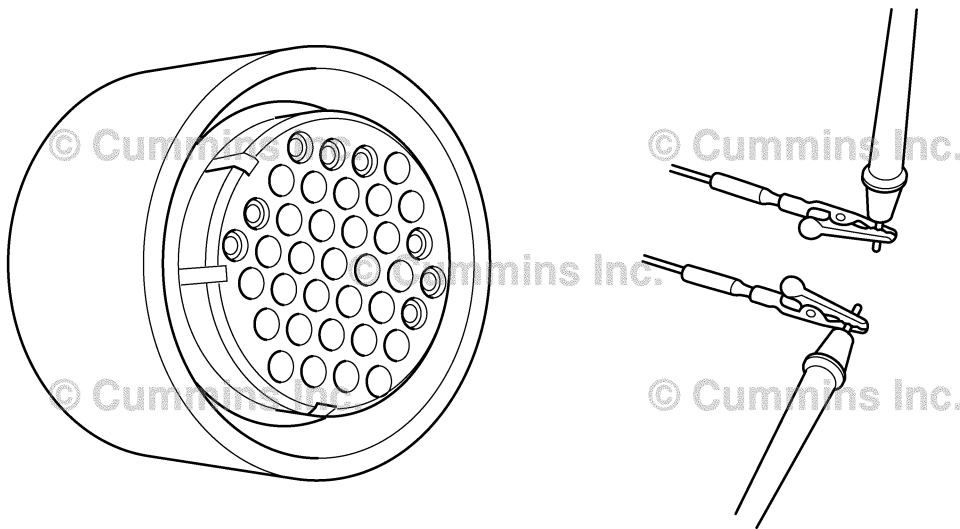
**STEP 2: Check the battery supply and ground circuits.**

**STEP 2A: Check the battery supply to the dosing control unit.**

**Condition:**

- Turn keyswitch OFF
- Disconnect the wiring harness from the dosing control unit
- Turn keyswitch ON.

Action	Specification/Repair	Next Step
Check the voltage to the dosing control unit. <ul style="list-style-type: none"> <li>• Measure the voltage between the dosing control unit OEM battery supply and the dosing control unit OEM ground.</li> </ul> Refer to the wiring diagram or circuit diagram for connector pin identification.	Voltage greater than +24-VDC? <b>YES</b>	2B
	Voltage greater than +24-VDC? <b>NO</b>	2A-1



19d02290



**STEP 2A-1: Check ground circuit.**

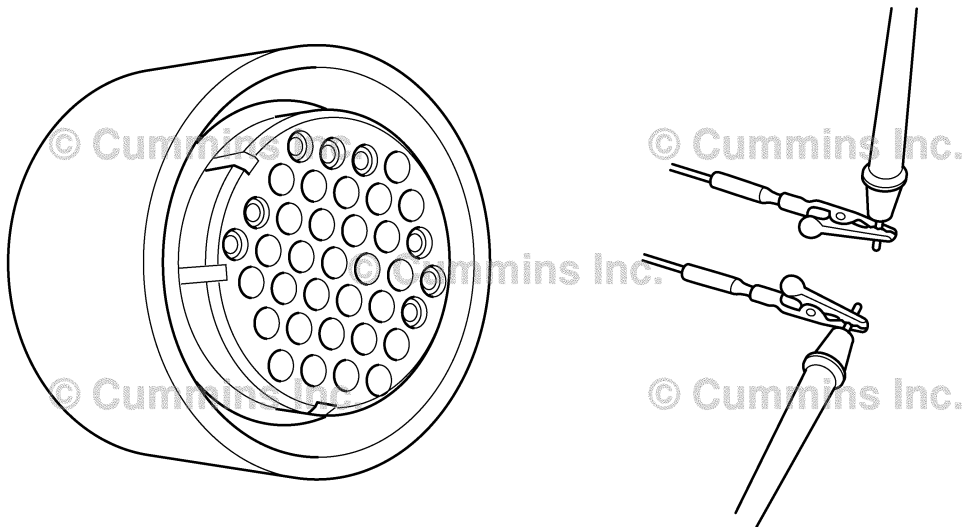
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF</li> <li>• Disconnect the wiring harness from the dosing control unit</li> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Measure resistance.</p> <ul style="list-style-type: none"> <li>• Measure the resistance from the dosing control unit OEM ground and engine block ground.</li> </ul>	<p>Less than 10 ohms?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>An open circuit in the OEM battery supply circuit has been detected.</p> <p>Repair or replace the OEM harness. Refer to OEM service manual.</p>	<p>5A</p>
	<p>Less than 10 ohms?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>An open circuit in the OEM ground circuit has been detected.</p> <p>Repair or replace the OEM harness. Refer to OEM service manual.</p>	<p>5A</p>

**STEP 2B: Check the keyswitch voltage to the dosing control unit.**

**Condition:**

- Turn keyswitch OFF
- Disconnect the wiring harness from the dosing control unit
- Turn keyswitch ON.

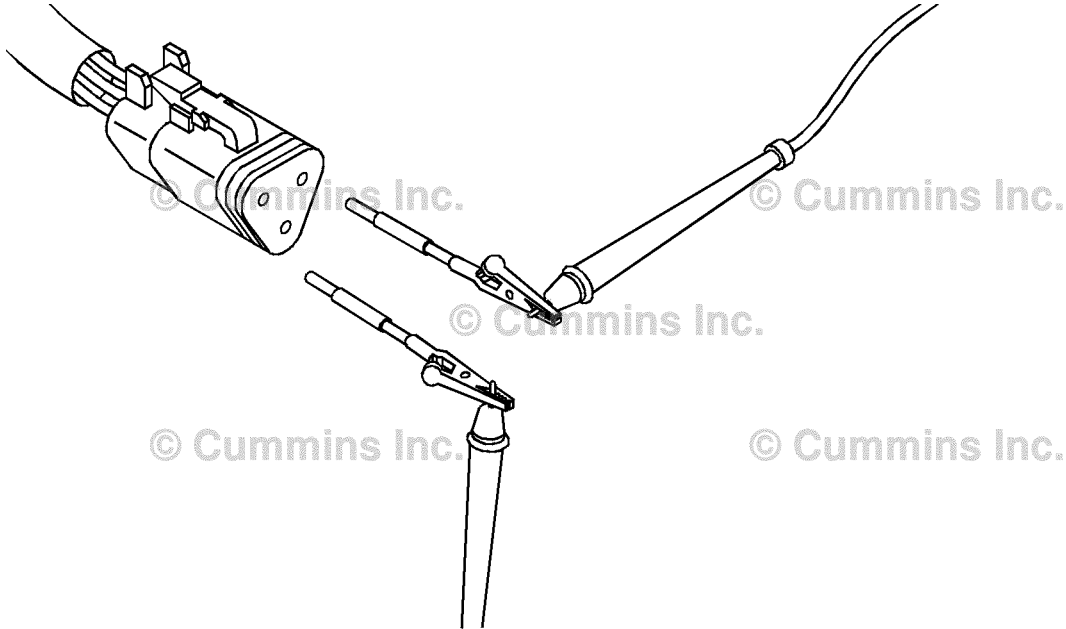
Action	Specification/Repair	Next Step
Check the keyswitch input voltage to the dosing control unit. <ul style="list-style-type: none"> <li>• Measure the voltage between the dosing control unit OEM keyswitch input and ground.</li> </ul>	Voltage greater than +24-VDC? <b>YES</b>	3A
	Voltage greater than +24-VDC? <b>NO</b> <b>Repair:</b> An open circuit or low keyswitch voltage input has been detected in the dosing control unit ground circuit. Repair or replace the OEM harness. Refer to OEM service manual.	3A



19d02290

**STEP 3: Check the data link harness.**

**STEP 3A: Check for an open or short circuit in the J1939 data link harness.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF</li> <li>• Disconnect the data link adapter from the service data link connector.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for an open or short circuit.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the SAE J1939 Data Link (+) wire and the SAE J1939 Data Link (-) wire on the service data link connector.</li> </ul> <p>Refer to the wiring diagram or circuit diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Resistance between 50 and 70 ohms? <b>YES</b></p>	<p>4A</p>
	<p>Resistance between 50 and 70 ohms? <b>NO</b></p> <p><b>Repair:</b></p> <p>An open or short has been detected on the service data link connector or harness connection to the J1939 data link backbone.</p> <p>Repair or replace the OEM harness. Refer to Procedure 019-071 in Section 19.</p>	<p>5A</p>
 <p>The diagram illustrates the process of measuring resistance between the SAE J1939 Data Link (+) and (-) wires on the service data link connector. It shows a multi-pin connector on the left and two test leads with alligator clips on the right. One lead is connected to the (+) pin and the other to the (-) pin. The diagram is watermarked with '© Cummins Inc.' in several locations.</p>		
<p>19c01125</p>		

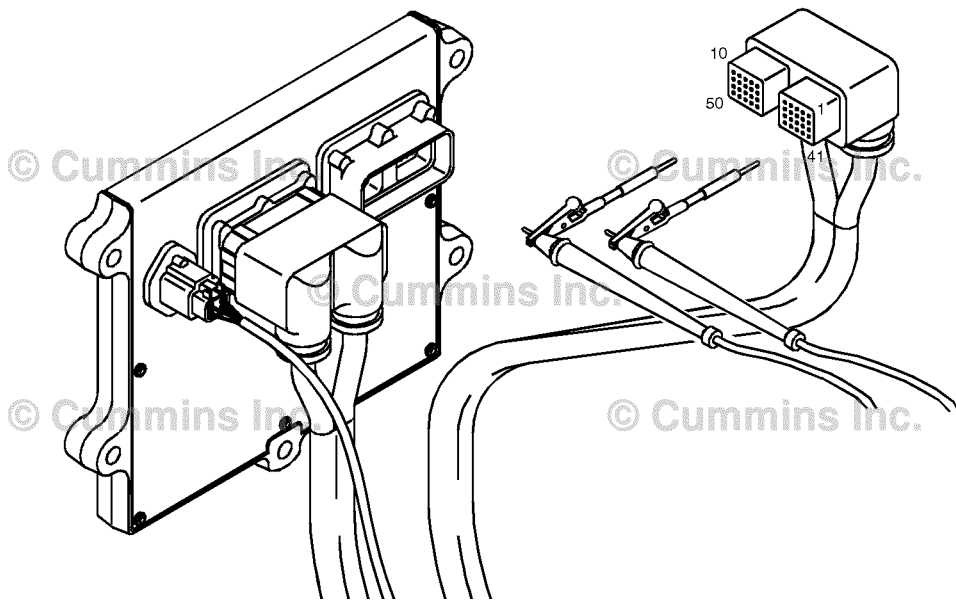
**STEP 4: Check the OEM harness.**

**STEP 4A: Check the ECM and OEM harness connector pins.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the OEM harness from the ECM.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the ECM data link harness connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A damaged connection to the Cummins® ECM has been detected in the J1939 data link connector or harness.</p> <p>Clean the connector and pins.</p> <p>Repair the damaged pins harness, connector, or pins, if possible.</p>	5A
	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	4B

**STEP 4B: Check for an open or short circuit in the ECM J1939 data link harness.**

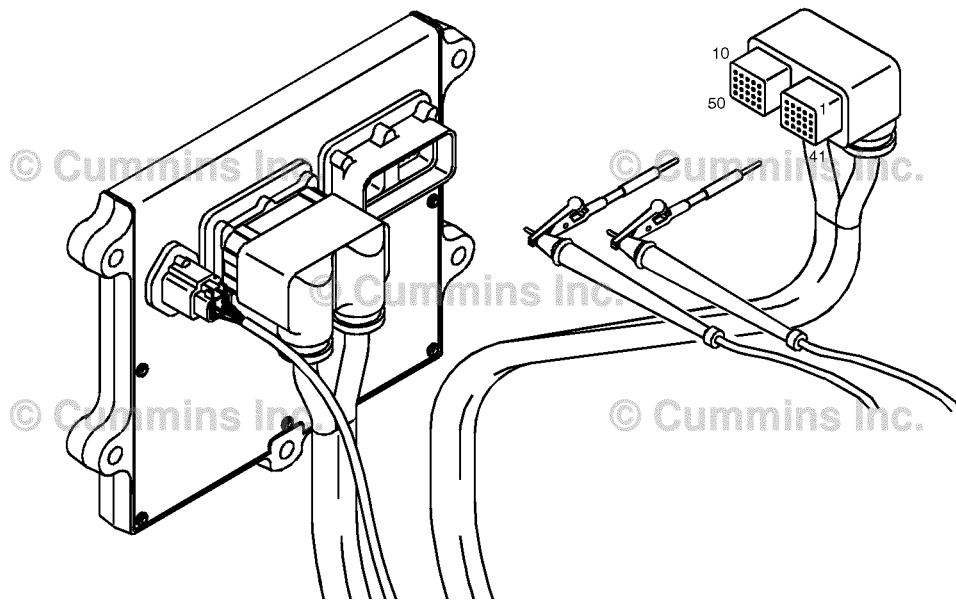
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF</li> <li>• Disconnect the OEM harness from the ECM.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for an open or short circuit.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the SAE J1939 Data Link (+) wire and the SAE J1939 Data Link (-) wire on the appropriate Cummins® ECM OEM connection to the J1939 data link harness connector.</li> </ul> <p>Refer to the wiring diagram or circuit diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Resistance between 50 and 70 ohms? <b>YES</b></p>	<p>4C</p>
	<p>Resistance between 50 and 70 ohms? <b>NO</b></p> <p><b>Repair:</b></p> <p>An open or short has been detected in the OEM harness.</p> <p>Repair or replace the OEM harness. Refer to Procedure 019-071 in Section 19.</p>	<p>5A</p>



19c01056

**STEP 4C: Check for a short circuit in the ECM J1939 data link harness.**

Action	Specification/Repair	Next Step
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF</li> <li>• Disconnect the OEM harness from the ECM.</li> </ul> <p>Check for an open or short circuit.</p> <ul style="list-style-type: none"> <li>• Measure the resistance and check for a short circuit between the SAE J1939 Data Link (+) wire and the SAE J1939 Data Link (-) wire on the appropriate Cummins® ECM OEM connection to the J1939 data link harness connector.</li> </ul> <p>NOTE: Disregard any resistance between 50 and 70 ohms between the SAE J1939 Data Link (+) and the SAE J1939 Data Link (-) pins.</p> <p>Refer to the wiring diagram or circuit diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Greater than 100K ohms?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A damaged dosing control unit has been detected.</p> <p>Replace the dosing control unit.</p> <p>Refer to OEM troubleshooting procedures.</p>	<p>5A</p>
	<p>Greater than 100K ohms?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>A short has been detected in the OEM harness.</p> <p>Repair or replace the OEM harness. Refer to Procedure 019-071 in Section 19.</p>	<p>5A</p>



19c01056

**STEP 5: Clear the fault code.**

**STEP 5A: Disable the fault code.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components</li> <li>• Turn keyswitch</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Disable the fault code.</p> <ul style="list-style-type: none"> <li>• Start the engine and idle for 1 minute</li> <li>• Use INSITE™ electronic service tool to verify that Fault Code is inactive.</li> </ul>	<p>Fault Code 1711 inactive? <b>YES</b></p>	5B
	<p>Fault Code 1711 inactive? <b>NO</b></p> <p><b>Repair:</b></p> <p>Return to the troubleshooting steps or contact a Cummins® Authorized Repair Location if all steps have been completed and checked a second time.</p>	1A

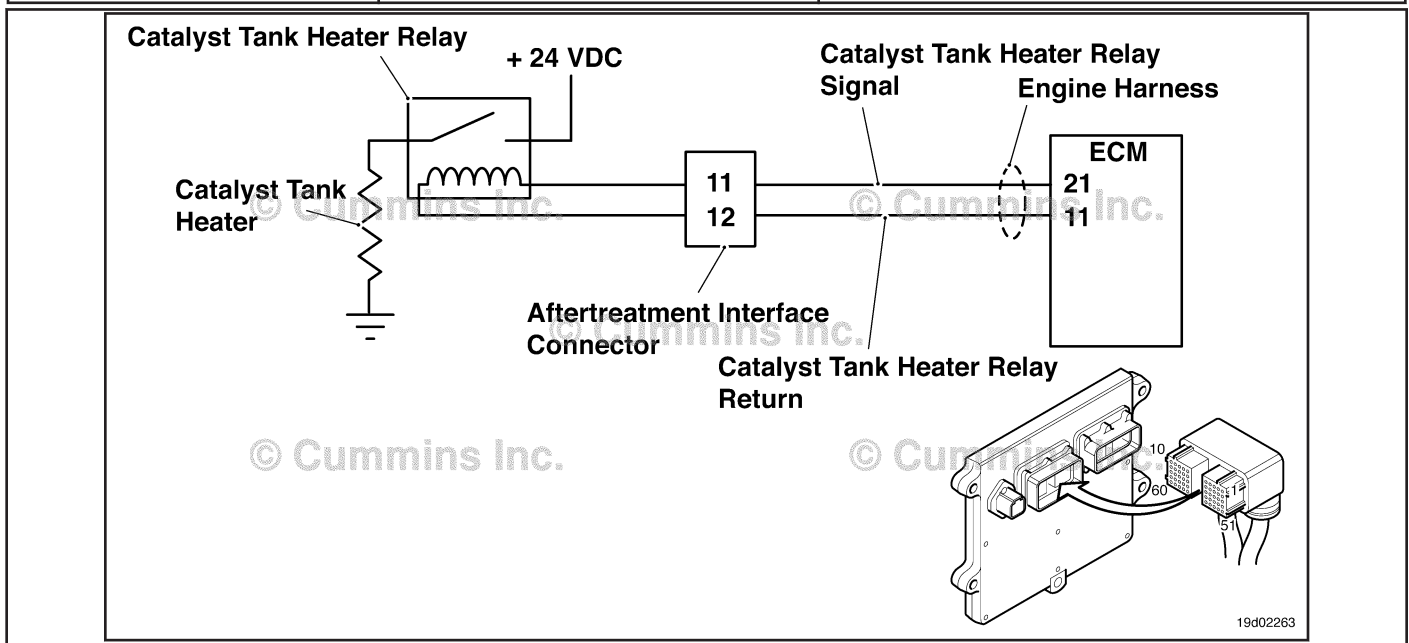
**STEP 5B: Clear the inactive fault code.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Clear the inactive fault codes.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to clear the inactive fault codes..</li> </ul>	<p>All fault codes cleared? <b>YES</b></p>	Repair complete.
	<p>All fault codes cleared? <b>NO</b></p> <p><b>Repair:</b></p> <p>Troubleshoot any remaining active fault codes.</p>	Appropriate troubleshooting steps

## Fault Code 1712

### Catalyst Tank Heater Circuit — Data Valid But Below Normal Operating Range — Moderately Severe Level

CODES	REASON	EFFECT
Fault Code: 1712 PID(P), SID(S): SPN: 3363 FMI: 1/18 Lamp: Amber SRT:	Catalyst Tank Heater Circuit — Data Valid But Below Normal Operating Range — Moderately Severe Level. The catalyst solution temperature did not increase when the catalyst tank heater was commanded on.	None on performance. Catalyst solution injection into the aftertreatment system may be disabled if the catalyst solution is frozen.



Circuit: Catalyst Tank Heater Relay

#### Circuit Description:

The catalyst tank heater keeps the catalyst solution from freezing in the catalyst tank. The catalyst heater element is powered by the catalyst tank heater relay.

#### Component Location:

The catalyst tank heater is located in the catalyst tank. The location of the catalyst tank heater relays will vary by OEM. Refer to Refer to Procedure Procedure 100-002 (Engine Diagrams) in Section E for a detailed component location view.

#### Shop Talk:

This fault code is triggered when the catalyst tank heater is commanded on by the engine ECM, but no corresponding temperature increase in the catalyst tank temperature was recorded by the catalyst temperature sensor.

Possible causes of this fault code include:

- Failed catalyst tank heater relay
- Faulty power supply to the catalyst tank heater
- Faulty ground circuit to the catalyst tank heater
- Faulty wiring between the catalyst tank heater relay and the catalyst tank heater
- Failed catalyst tank heater.



On-Board Diagnostics (OBD) Information (Euro 4 Certified Engines):

- The ECM illuminates the malfunction indicator lamp (MIL) when the diagnostic runs and fails.
- The ECM turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does **not** fail. The MIL lamp and fault code can also be cleared using the INSITE™ service tool.
- The fault code will be cleared from memory after 40 consecutive drive cycles where the diagnostic runs and passes.

On-Board Diagnostics (OBD) Information (Euro 4 Stage 1+ Certified Engines):

- The ECM illuminates the malfunction indicator lamp (MIL) when the diagnostic runs and fails.
- An engine torque derate will be activated after 50 hours of engine operation with the fault code active.
- The ECM turns OFF the malfunction indicator lamp (MIL) after 1 ignition cycle that the diagnostic runs and does **not** fail. The MIL lamp **cannot** be cleared using the INSITE™ service tool.
- The fault code will be cleared from memory after 400 days or 9600 hours of engine operation.

**Refer to Troubleshooting Fault Code t05-1712**

FAULT CODE 1712 - Catalyst Tank Heater Circuit - Data Valid But Below Normal Operating Range - Moderately Severe Level
TROUBLESHOOTING SUMMARY



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



To reduce the possibility of pin and harness damage, use the following test leads when taking a measurement: Part Number 3822758 - male Deutsch™/AMP™/Metri-Pack™ test lead and Part Number 3822917 - female Deutsch™/AMP™/Metri-Pack™ test lead.

Table with 3 columns: STEPS, SPECIFICATIONS, and SRT CODE. It lists troubleshooting steps from Step 1 to Step 4B, including actions like 'Check the fault codes', 'Inspect the catalyst tank heater relay', and 'Clear the fault code', along with their respective specifications and SRT codes.

**TROUBLESHOOTING STEP****STEP 1: Check the fault codes.****STEP 1A: Read the fault codes.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for catalyst tank heater or catalyst temperature sensor fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 1677, 1678, 1679, 1683, 1684 is active? <b>YES</b>	Appropriate fault code troubleshooting tree.
	Fault Code 1677, 1678, 1679, 1683, 1684 is active? <b>NO</b>	2A

**STEP 2: Check the catalyst tank heater relay and circuit.****STEP 2A: Inspect the catalyst tank heater relay and electrical connections.**

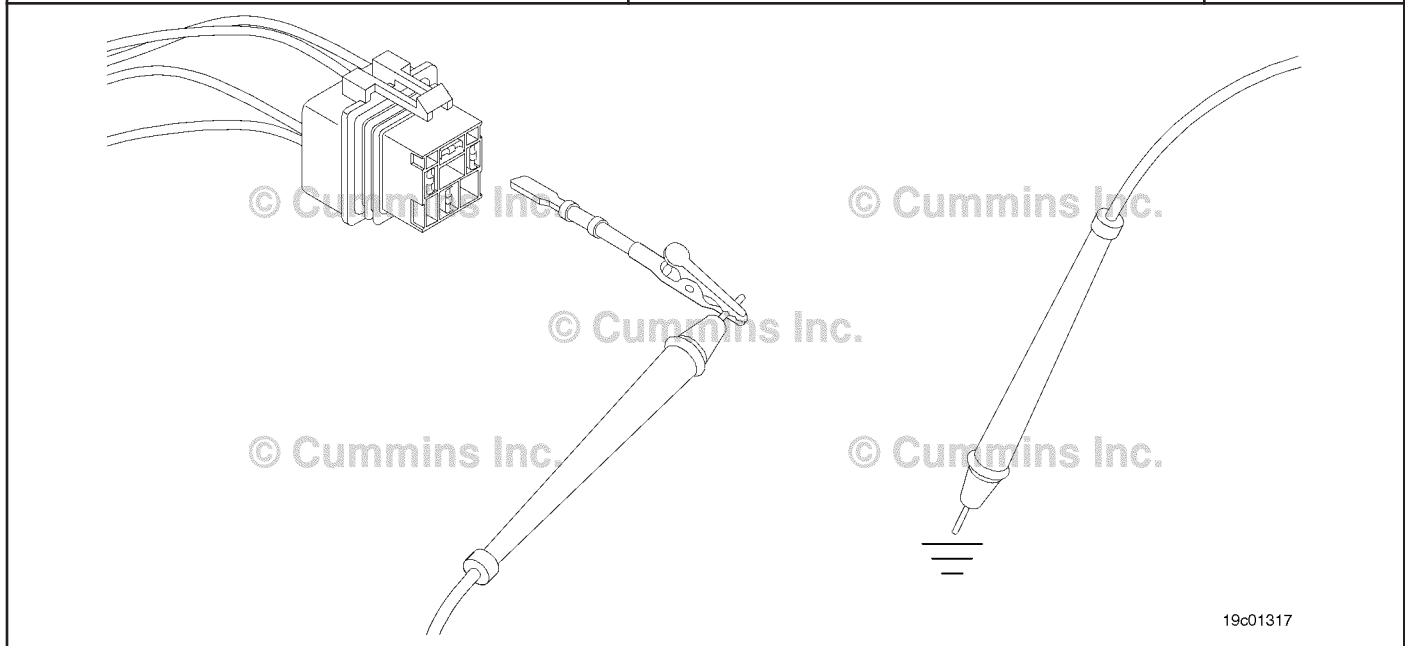
<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the catalyst tank heater relay from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
Inspect the engine harness and catalyst tank heater relay connector pins for the following: <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul>	Dirty or damaged pins? <b>YES</b> <b>Repair:</b> A damaged connection has been detected in the sensor or harness connector. <ul style="list-style-type: none"> <li>• Clean the connector and pins.</li> <li>• Repair the damaged harness, connector, or pins if possible.</li> </ul> Refer to Procedure 019-071 in Section 19.	4A
	Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.	Dirty or damaged pins? <b>NO</b>

**STEP 2B: Check for voltage to the catalyst tank heater relay.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the catalyst tank heater relays from the engine harness.

Action	Specification/Repair	Next Step
Check catalyst tank heater relay power supply. <ul style="list-style-type: none"> <li>• Measure the voltage between the catalyst tank heater power pin and block ground.</li> </ul>	Greater than 22-VDC? <b>YES</b>	2C
Refer to the wiring diagram for connector pin identification.	Greater than 22-VDC? <b>NO</b> <b>Repair:</b> The power supply to the catalyst tank heater is <b>not</b> correct. Repair or replace the OEM wiring to the catalyst tank heater relay. Refer to OEM service manual.	4A



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**STEP 2C: Check the wiring to the catalyst tank heater.**

<b>Condition:</b> • Turn keyswitch OFF.		
Action	Specification/Repair	Next Step
Check catalyst tank heater wiring between the catalyst tank heater relay and the catalyst tank heater. • Measure the resistance of the power supply wire between the catalyst tank heater relay and the catalyst tank heater.  Refer to the wiring diagram for connector pin identification.	Less than 10 ohms? <b>YES</b>	2D
	Less than 10 ohms? <b>NO</b> <b>Repair:</b> An open circuit exists between the catalyst tank heater relay and the catalyst tank heater.  Repair or replace the OEM wiring between the catalyst tank heater relay and the catalyst tank heater. Refer to OEM service manual.	4A

**STEP 2D: Perform the urea heater relay override test with INSITE™ electronic service tool.**

<b>Condition:</b> • Turn keyswitch OFF • Connect INSITE™ electronic service tool.		
Action	Specification/Repair	Next Step
Use INSITE™ electronic service tool to perform urea heater relay override test. • Enable the Urea Heater Relay Override test and listen for the catalyst solution tank heater relay operation. An audible click should be heard.	Is the catalyst solution tank heater relay operating correctly? <b>YES</b>	3A
	Is the catalyst solution tank heater relay operating correctly? <b>NO</b> <b>Repair:</b> Remove the catalyst tank heater relay from the wiring harness. Check the relay pins and check the relay for proper operation.  Replace the catalyst tank heater relay. Refer to OEM service manual.	4A

**STEP 3: Check the catalyst tank heater.**

**STEP 3A: Check the catalyst tank heater for an open circuit.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Remove the catalyst tank heater. Refer to OEM service manual.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check the catalyst tank heater for an open circuit.</p> <ul style="list-style-type: none"> <li>• Measure the resistance of the heater coil in the catalyst tank heater.</li> </ul>	<p>Less than 10 ohms?</p> <p><b>YES</b></p>	1A
	<p>Less than 10 ohms?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>An open circuit has been detected in the catalyst tank heater.</p> <p>Replace the catalyst tank heater. Refer to OEM service manual.</p>	4A

**STEP 4: Clear the fault codes.**

**STEP 4A: Verify the repair.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> <li>• Insert a thermometer in the catalyst solution tank.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Start the INSITE™ electronic service manual Data Monitor/Logger.</p> <ul style="list-style-type: none"> <li>• Compare the INSITE™ electronic service tool reading for the catalyst solution temperature with the thermometer.</li> </ul>	<p>Catalyst solution temperature and the thermometer are reading within 2.8°C or 5°F of each other?</p> <p><b>YES</b></p>	4B
	<p>Catalyst solution temperature and the thermometer are reading within 2.8°C or 5°F of each other?</p> <p><b>NO</b></p>	1A

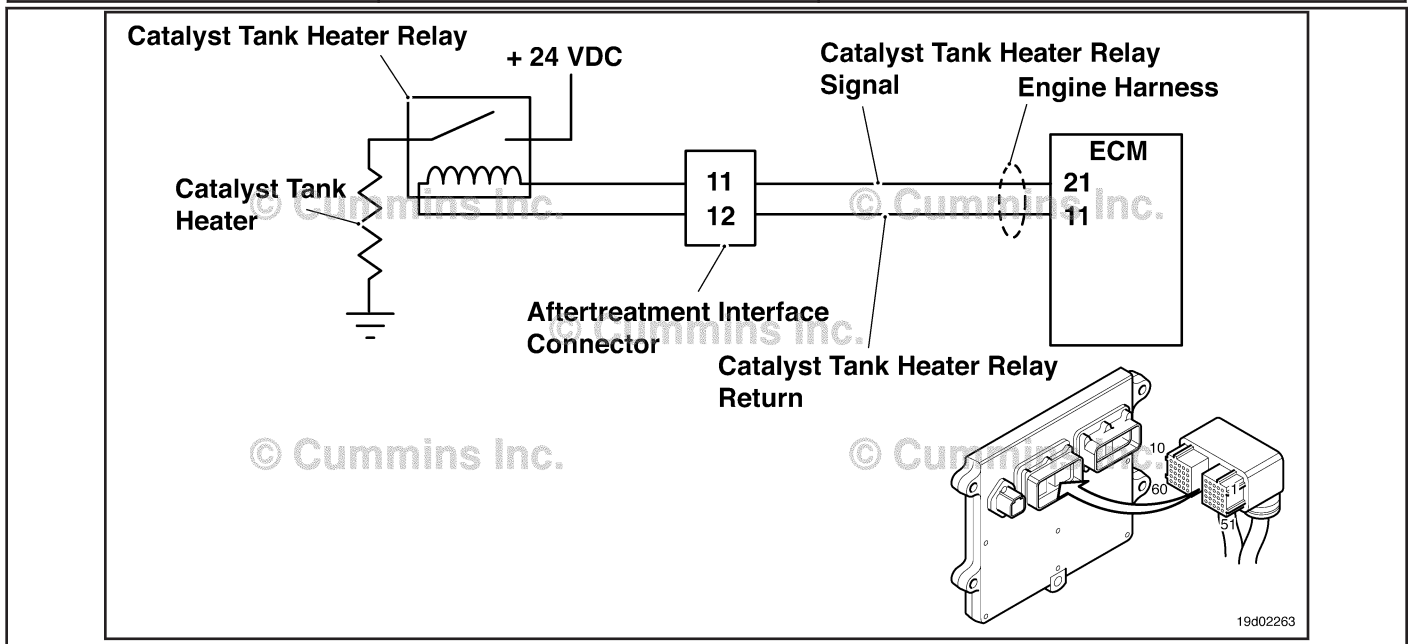
**STEP 4B: Clear the fault codes.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Clear the fault codes.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to erase all active and inactive fault codes.</li> </ul>	<p>All fault codes cleared?  <b>YES</b></p>	<p>Repair complete</p>
	<p>All fault codes cleared?  <b>NO</b></p>	<p>Appropriate troubleshooting steps</p>

## Fault Code 1713

### Catalyst Tank Heater Circuit - Data Valid But Above Normal Operating Range - Moderately Severe Level

CODES	REASON	EFFECT
Fault Code: 1713 PID(P), SID(S): SPN: 3363 FMI: 0/16 Lamp: Amber SRT:	Catalyst Tank Heater Circuit - Data Valid But Above Normal Operating Range - Moderately Severe Level. The catalyst tank heater is continuously in the on position.	None on performance.



Circuit: Catalyst Tank Heater Relay

#### Circuit Description:

The catalyst tank heater keeps the catalyst solution from freezing in the catalyst tank. The catalyst heater element is powered through the catalyst tank heater relay. The tank heater is activated once the temperature recorded by the OEM tank temperature/level sensor is below a temperature threshold.

#### Component Location:

The catalyst tank heater is located in the catalyst tank. The location of the catalyst tank heater relays will vary by OEM.

#### Shop Talk:

This fault code is triggered when the catalyst tank heater is determined to be in the on position when the engine ECM is commanding the heater to be in the off position. To determine if the temperature sensors are reading a sensible value, they can be compared to each other at keyswitch ON, after an 8-hour period with the engine **not** running. At this point, the engine TMAP sensor should display a similar temperature to the tank. For example: ambient air temperature.

Possible causes of this fault code include:

- Damaged catalyst solution OEM tank temperature/level sensor
- Damaged catalyst solution tank heater relay
- Failed ECM that is commanding the heater on continuously.



On-Board Diagnostics (OBD) Information:

- The ECM illuminates the appropriate amber or red fault code lamp when the diagnostic runs and fails
- The ECM turns OFF the appropriate fault lamp when the diagnostic runs and passes.

**Refer to Troubleshooting Fault Code t05-1713**

FAULT CODE 1713 - Catalyst Tank Heater Circuit - Data Valid But Above Normal Operating Range - Moderately Severe Level
TROUBLESHOOTING SUMMARY



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



To reduce the possibility of pin and harness damage, use the following test leads when taking a measurement: Part Number 3822758 - male Deutsch™/AMP™/Metri-Pack™ test lead and Part Number 3822917 - female Deutsch™/AMP™/Metri-Pack™ test lead.

Table with 3 columns: STEPS, SPECIFICATIONS, and SRT CODE. It lists troubleshooting steps from STEP 1 to STEP 3B, including sub-steps like STEP 1A, STEP 2A-E, and STEP 3A-B, with corresponding specifications and SRT codes.

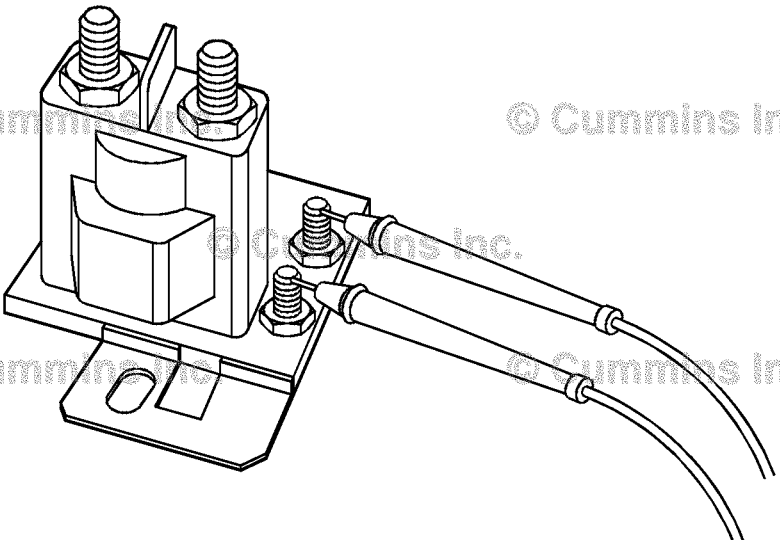
**TROUBLESHOOTING STEP****STEP 1: Check the fault codes.****STEP 1A: Read the fault codes.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for catalyst tank heater or catalyst temperature sensor fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 1677, 1678, 1679, 1683, or 1684 is active? <b>YES</b>	Appropriate fault code troubleshooting tree.
	Fault Code 1677, 1678, 1679, 1683, or 1684 is active? <b>NO</b>	2A

**STEP 2: Check the catalyst solution tank heater relay and circuit.****STEP 2A: Inspect the catalyst solution tank heater relay and electrical connections.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the catalyst tank heater relay from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
Inspect the engine harness and catalyst tank heater relay connections for the following: <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris on or in the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul>	Dirty or damaged pins? <b>YES</b> <b>Repair:</b> A damaged connection has been detected in the sensor or harness connector. Clean the connector and pins. Repair the damaged harness, connector, or pins if possible. Refer to Procedure 019-071 in Section 19.	4A
	Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.	Dirty or damaged pins? <b>NO</b>

**STEP 2B: Check the catalyst solution tank heater relay.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the catalyst tank heater relay from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check the catalyst solution tank heater relay resistance.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the catalyst solution tank heater relay SIGNAL pin and the catalyst solution tank heater RETURN pin at the catalyst solution tank heater relay.</li> </ul> <p>Refer to the wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Less than 10 ohms?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A stuck closed catalyst solution tank heater relay has been detected.</p> <p>Replace the catalyst solution tank heater relay. Refer to OEM service manual.</p>	4A
	<p>Less than 10 ohms?</p> <p><b>NO</b></p>	2C
 <p>The diagram shows a rectangular relay component with two large terminals on top and two smaller terminals on the side. Two electrical wires are connected to the side terminals. The relay is mounted on a base with a mounting bracket. The image is watermarked with '© Cummins Inc.' in several locations.</p>		

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**STEP 2C: Check the catalyst solution tank heater diagnostic voltage, supply line, and return circuit.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the catalyst solution tank heater relay from the engine harness.</li> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for catalyst solution tank heater supply voltage and return circuit.</p> <ul style="list-style-type: none"> <li>• Measure the voltage between the catalyst solution tank heater relay SIGNAL pin and the catalyst solution tank heater RETURN pin at the engine harness.</li> </ul> <p>Refer to the wiring diagram for connector pin identification.</p>	<p>Greater than 11-VDC?</p> <p><b>YES</b></p>	4A
	<p>Greater than 11-VDC?</p> <p><b>NO</b></p>	2D

**STEP 2D: Check the catalyst solution tank heater diagnostic voltage, supply line, and return circuit at the ECM.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the catalyst solution tank heater relay from the engine harness.</li> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for catalyst solution tank heater supply voltage and return circuit.</p> <ul style="list-style-type: none"> <li>• Measure the voltage the catalyst solution tank heater relay SIGNAL pin and the catalyst solution tank heater RETURN pin at the ECM.</li> </ul> <p>Refer to the wiring diagram for connector pin identification.</p>	<p>Greater than 11-VDC?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A damaged ECM has been detected. Replace the ECM. Refer to Procedure 019-031 in Section 19.</p>	3A
	<p>Greater than 11-VDC?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>A short circuit to battery has been detected in the wiring harness. Replace the wiring harness. Refer to Procedure 019-043 in Section 19.</p>	3A

**STEP 2E: Perform the urea heater relay override test with INSITE™ electronic service tool.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Use INSITE™ electronic service tool to perform the urea heater relay override test.</p> <ul style="list-style-type: none"> <li>• Enable the Urea Heater Relay Override test and listen for the catalyst solution tank heater relay operation. An audible click should be heard.</li> </ul>	<p>Is the catalyst solution tank heater relay operating correctly?</p> <p><b>YES</b></p>	3A
	<p>Is the catalyst solution tank heater relay operating correctly?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Remove the catalyst tank heater relay from the wiring harness. Check the relay pins and check the relay for proper operation. Replace the catalyst tank heater relay. Refer to the OEM service manual.</p>	4A

**STEP 3: Clear the fault code.**

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

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Disable the fault code.</p> <ul style="list-style-type: none"> <li>• Start the engine and let it idle for 1 minute</li> <li>• Use INSITE™ electronic service tool to verify the fault code is inactive.</li> </ul>	<p>Fault code 1713 inactive?</p> <p><b>YES</b></p>	3B
	<p>Fault code 1713 inactive?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Return to the troubleshooting steps or contact a Cummins® Authorized Repair Location if all steps have been completed and checked again.</p>	1A

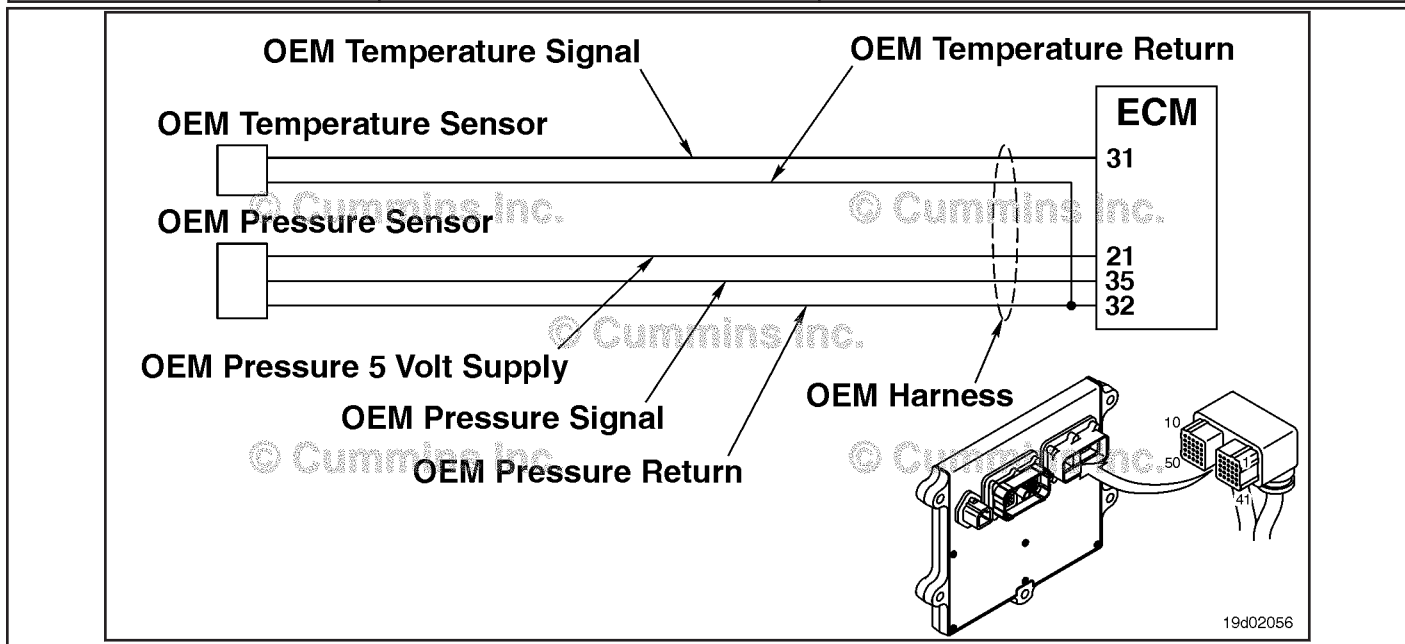
**STEP 3B: Clear the inactive fault codes.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Clear the inactive fault codes.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to clear the inactive fault codes.</li> </ul>	<p>All fault codes cleared?</p> <p><b>YES</b></p>	Repair complete
	<p>All fault codes cleared?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Troubleshoot any remaining active fault codes.</p>	Appropriate troubleshooting steps

## Fault Code 1716

### Auxiliary Temperature Sensor Input 1 Circuit - Root Cause Not Known

CODES	REASON	EFFECT
Fault Code: 1716 PID(P), SID(S): SPN: 411 FMI: 11 Lamp: None SRT:	Auxiliary Temperature Sensor Input 1 Circuit - Root Cause Not Known. High temperature detected by the OEM temperature sensor or by the engine coolant temperature sensor.	Possible engine power derate.



**Circuit Description:**

The OEM has the option of wiring a temperature sensor input to the Cummins® ECM. A specific calibration is then created to recognize this temperature sensor input. This fault code is activated when the temperature input from the OEM sensor exceeds the engine protection limit defined by the OEM. Depending on OEM requirements, an Engine Protection derate may be associated with this fault code. This fault code can also be used to indicate high engine coolant temperature on certain applications.

**Component Location:**

The OEM pressure or temperature sensor input will vary depending on application. Refer to the OEM troubleshooting manual for sensor location. The engine coolant temperature sensor is located on the thermostat housing. Refer to Procedure Procedure 100-002 (Engine Diagrams), in Section E for a detailed component location view.

**Shop Talk:**

This fault code indicates that coolant temperature has exceeded the engine protection limits for high coolant temperature. Refer to Engine Coolant Temperature Above Normal symptom troubleshooting tree.

On-Board Diagnostics (OBD) information:

- The ECM illuminates the appropriate amber or red fault lamp when the diagnostic runs and fails
- The ECM turns off the appropriate fault lamp when the diagnostic runs and passes.

**Refer to Troubleshooting Fault Code t05-1716**



## FAULT CODE 1716 - Auxiliary Temperature Sensor Input 1 Circuit - Root Cause Not Known

### TROUBLESHOOTING SUMMARY

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1:</b> Check the fault codes.		
<b>STEP 1A:</b> Check for Fault Code 1716.	Active or inactive counts of Fault Code 1716?	

### TROUBLESHOOTING STEP

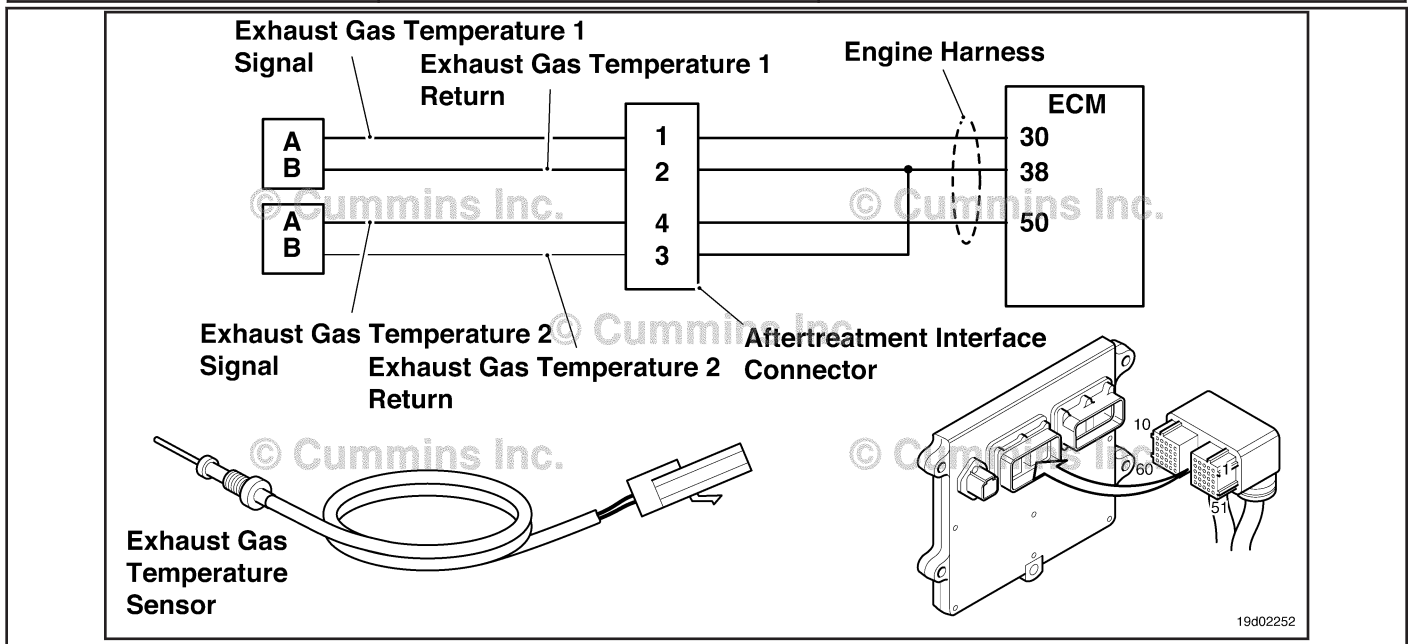
**STEP 1:** Check the fault codes.  
**STEP 1A:** Check for Fault Code 1716.

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for an inactive fault code. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Active or inactive counts of Fault Code 1716? <b>YES</b> <b>Repair:</b> The engine protection limit has been exceeded. <ul style="list-style-type: none"> <li>• Refer to the Engine Coolant Temperature Above Normal symptom tree in ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418, or refer to the OEM service manual.</li> </ul>	Appropriate troubleshooting symptom tree.
	Active or inactive counts of Fault Code 1716? <b>NO</b>	Repair complete

## Fault Code 1717

### Exhaust Gas Temperature 1 — Data Valid but Above Normal Operational Range — Least Severe Level

CODES	REASON	EFFECT
Fault Code: 1717 PID(P), SID(S): SPN: 3241 FMI: 0/15 Lamp: None SRT:	Exhaust Gas Temperature 1 — Data Valid but Above Normal Operational Range — Least Severe Level. High catalyst inlet temperature has been detected.	Possible engine derate.



**Circuit Description:**

The exhaust gas temperature #1 sensor is used by the electronic control module (ECM) to monitor the engine exhaust temperature entering the catalyst unit. The ECM monitors the voltage on the signal pin and converts this to a temperature value.

**Component Location:**

The exhaust gas temperature #1 sensor is located in the aftertreatment system. It is located between the turbocharger outlet and the catalyst unit inlet in the exhaust system.

**Shop Talk:**

This fault is triggered when the temperature at the catalyst inlet exceeds the maximum allowable temperature for a given engine rating. Leaks in the charge air system or a faulty turbocharger can cause high exhaust gas temperature.

On-Board Diagnostics (OBD) Information:

- The ECM illuminates the appropriate amber or red fault lamp when the diagnostic runs and fails.
- The ECM turns OFF the appropriate fault lamp when the diagnostic runs and passes.

**Refer to Troubleshooting Fault Code t05-1717**

## FAULT CODE 1717 - Exhaust Gas Temperature 1 - Data Valid but Above Normal Operational Range - Least Severe Level

### TROUBLESHOOTING SUMMARY



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



To reduce the possibility of pin and harness damage, use the following test leads when taking a measurement: Part Number 3822758 - male Deutsch™/AMP™/Metri-Pack™ test lead and Part Number 3822917 - female Deutsch™/AMP™/Metri-Pack™ test lead.

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1: Check for sensor circuit fault codes.</b>		
<u>STEP 1A:</u> Check for fault codes 1665 and 1666.	Fault Code 1665 or 1666 is active?	
<b>STEP 2: Check the air handling system for correct operation.</b>		
<u>STEP 2A:</u> Check the charge air cooler, clamps, hoses, and piping.	Air leak present or clamps loose?	
<u>STEP 2B:</u> Inspect turbocharger compressor and turbine blades.	Damage found on turbocharger blades?	
<b>STEP 3: Inspect the exhaust gas temperature #1 sensor.</b>		
<u>STEP 3A:</u> Inspect the exhaust gas temperature #1 sensor.	Damage found on exhaust gas temperature #1 sensor?	
<b>STEP 4: Clear the fault codes.</b>		
<u>STEP 4A:</u> Disable the fault code.	Fault code 1717 inactive?	
<u>STEP 4B:</u> Clear the fault codes.	All fault codes cleared?	

### TROUBLESHOOTING STEP

**STEP 1: Check for sensor circuit fault codes.**

**STEP 1A: Check for fault codes 1665 and 1666.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for active fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 1665 or 1666 is active? <b>YES</b>	Fault code 1665 or 1666 troubleshooting tree.
	Fault Code 1665 or 1666 is active? <b>NO</b>	2A

**STEP 2: Check the air handling system for correct operation.**

**STEP 2A: Check the charge air cooler, clamps, hoses, and piping.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> </ul>		
Action	Specification/Repair	Next Step
Check the charge air cooler, hoses, and piping for leaks. <ul style="list-style-type: none"> <li>• Check the clamps for adequate torque.</li> </ul>	Air leaks present or clamps loose? <b>YES</b>	2B
	Air leaks present or clamps loose? <b>NO</b> <b>Repair:</b> Repair the air leak.	4A

**STEP 2B: Inspect turbocharger compressor and turbine blades.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF</li> <li>• Remove the inlet and exhaust connections from the turbocharger.</li> </ul>		
Action	Specification/Repair	Next Step
Inspect the turbocharger compressor and turbine blades for damage. <ul style="list-style-type: none"> <li>• Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 010-033 in Section 19.</li> </ul>	Damage found on turbocharger blades? <b>YES</b>	3A
	Damage found on turbocharger blades? <b>NO</b> <b>Repair:</b> Replace the turbocharger. Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 010-033 in Section 19.	4A

**STEP 3: Inspect the exhaust gas temperature #1 sensor.****STEP 3A: Inspect the exhaust gas temperature #1 sensor.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF</li> <li>• Remove the exhaust gas temperature #1 sensor from the exhaust system.</li> </ul>		
Action	Specification/Repair	Next Step
Inspect the exhaust gas temperature #1 sensor. <ul style="list-style-type: none"> <li>• Inspect the exhaust gas temperature #1 sensor for damage or signs of excessively high temperature.</li> </ul>	Damage found on exhaust gas temperature #1 sensor? <b>YES</b>	4A
	Damage found on exhaust gas temperature #1 sensor? <b>NO</b> <b>Repair:</b> Replace the exhaust gas temperature #1 sensor. Refer to Procedure 019-013 in Section 19.	4A

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

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> <li>• Start the engine and let it idle for 1 minute</li> <li>• Use INSITE™ electronic service tool to verify that the fault code is inactive.</li> </ul>	Fault code 1717 inactive? <b>YES</b>	4B
	Fault code 1717 inactive? <b>NO</b>	1A

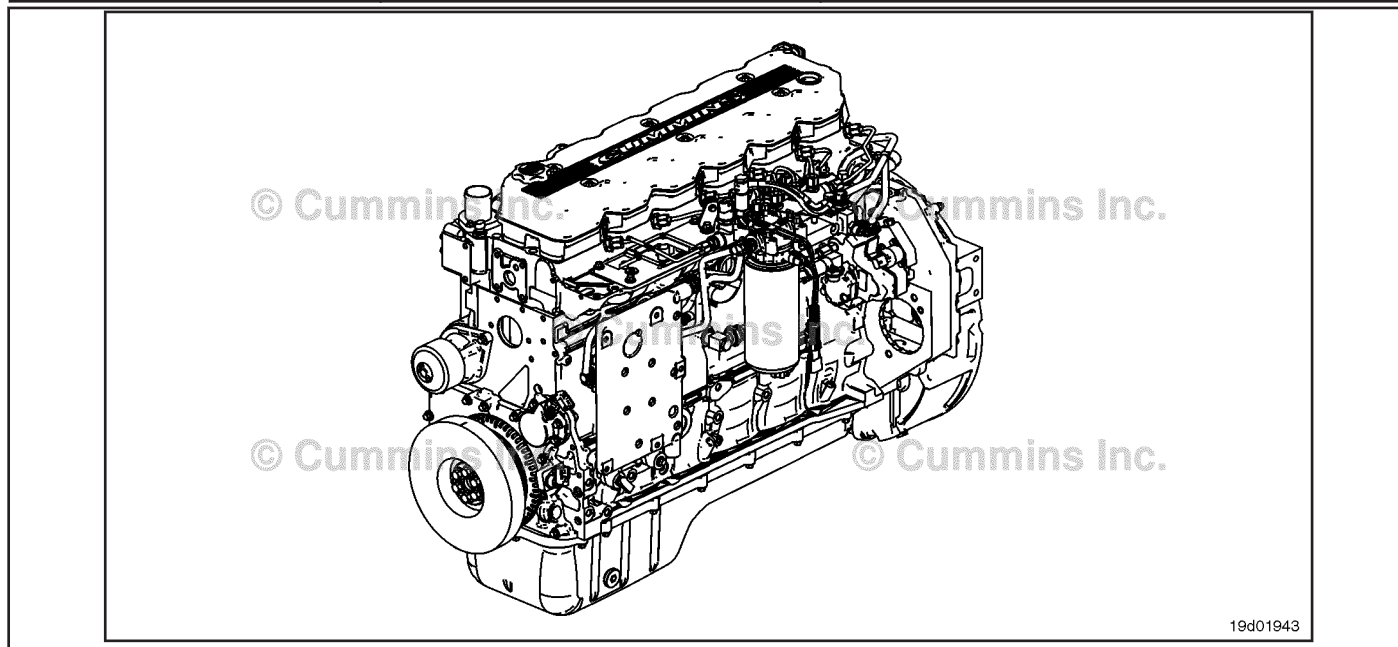
**STEP 4B: Clear the inactive fault codes.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to erase the inactive fault codes.</li> </ul>	All fault codes cleared? <b>YES</b>	Repair complete
	All fault codes cleared? <b>NO</b>	Appropriate troubleshooting steps

## Fault Code 1718

### Engine Misfire for Multiple Cylinders — Condition Exists.

CODES	REASON	EFFECT
Fault Code: 1718 PID(P), SID(S): SPN: 1322 FMI: 11/31 Lamp: Amber SRT:	Engine Misfire for Multiple Cylinders — Condition Exists. Engine misfire has been detected in multiple cylinder numbers.	Possible low power, rough idle, or misfire.



Circuit

#### **Circuit Description:**

An algorithm in the ECM calibration monitors engine speed as each injector fires while the engine is at idle. If a cylinder has high or low contribution to engine speed, this fault will become active. The intention of this fault is to assist in troubleshooting performance complaints such as engine misfire and low power.

#### **Component Location:**

The ECM is located on the intake side of the engine. 100-002 (Engine Diagrams) in section E for a detailed component location view.

#### **Shop Talk:**

If Fault Code 1718 is inactive in the ECM memory and there is no complaint such as “low power” or “engine misfire”, it is possible that an intermittent event such as air entering the fuel system following a filter change caused the fault. Inactive counts of Fault Code 1718 should be disregarded unless other performance symptoms are present. The engine coolant temperature must be greater than 160°F before this diagnostic will run.

Causes of cylinder misfire can include:

- Valve lash out of specification (compare actual valve lash to reset limits)
- Cylinder failure (check for high blowby when the engine is loaded)
- Valve failure or valve held open (listen for intake valve “chirping” noise in the intake)
- Cylinder head or gasket failure (look for signs of oil, coolant, or casting flash in the intake or exhaust passages)
- Extreme camshaft wear (inspect the camshaft lobes for wear)

- Extra, missing, or damaged sealing washer under an injector
- Injector failures (“swap” injectors to see if the problem “follows” the indicated injector).

On-Board Diagnostic (OBD) Information:

- The ECM illuminates the malfunction indicator lamp (MIL) when the diagnostic runs and fails
- The ECM turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does **not** fail. The MIL lamp and fault code can also be cleared using the INSITE™ service tool
- The fault code will be cleared from the memory after 40 consecutive drive cycles when the diagnostic runs and passes.

**Refer to Troubleshooting Fault Code t05-1718**

## FAULT CODE 1718 - Engine Misfire for Multiple Cylinders - Condition Exists

### TROUBLESHOOTING SUMMARY



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



To reduce the possibility of pin and harness damage, use the following test leads when taking a measurement: Part Number 3822758 - male Deutsch™/AMP™/Metri-Pack™ test lead and Part Number 3822917 - female Deutsch™/AMP™/Metri-Pack™ test lead.

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1: Check the fault codes.</b>		
<b>STEP 1A:</b> Read the fault codes.	Fuel system related fault codes active or have accumulated inactive counts?	
<b>STEP 1B:</b> Check for cylinder misfire.	Cylinder misfire detected?	
<b>STEP 2: Perform diagnostic tests.</b>		
<b>STEP 2A:</b> Perform the cylinder cutout test.	Cylinder misfire detected and isolated to injector?	
<b>STEP 3: Clear the fault code.</b>		
<b>STEP 3A:</b> Verify the repair	Cylinder misfire present?	
<b>STEP 3B:</b> Clear the fault codes.	All faults cleared?	

### TROUBLESHOOTING STEP

**STEP 1: Check the fault codes.**

**STEP 1A: Read the fault codes.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>Connect INSITE™ electronic service tool.</li> <li>Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
Read the fuel system fault codes. <ul style="list-style-type: none"> <li>Start the engine and let it idle for 1 minute</li> <li>Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fuel system related fault codes active or have accumulated inactive counts? <b>YES</b>	Appropriate fault code troubleshooting tree.
	Fuel system related fault codes active or have accumulated inactive counts? <b>NO</b>	1B



**STEP 1B: Check for cylinder misfire.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Start the engine and run at low idle.</li> </ul>		
Action	Specification/Repair	Next Step
Check for smoke, engine stumble, rough idle or misfire. <ul style="list-style-type: none"> <li>• Check for black or white smoke, engine stumble, rough idle, or misfire at low idle, high idle and during snap throttle accelerations.</li> </ul>	Cylinder misfire detected? <b>YES</b>	2A
	Cylinder misfire detected? <b>NO</b>	3A

**STEP 2: Perform diagnostic tests.**

**STEP 2A: Perform the cylinder cutout test**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn the keyswitch ON</li> <li>• Allow the engine to run at idle speed</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Use INSITE™ electronic service tool cylinder cutout test to determine if multiple cylinders are misfiring. <ul style="list-style-type: none"> <li>• Cutout individual cylinders to locate the misfiring cylinder.</li> </ul>	Cylinder misfire detected and isolated to the injector? <b>YES</b> <b>Repair:</b> A damaged injector has been detected Replace the injector. Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 006-026 in Section 6.	3A
	Cylinder misfire detected and isolated to the injector? <b>NO</b> <b>Repair:</b> Check for other sources of cylinder misfire such as: valve lash out of adjustment, cylinder damage, valve damage, cylinder head or gasket damage, or extreme camshaft wear.	Appropriate troubleshooting procedures.

**STEP 3: Clear the fault code.**

**STEP 3A: Verify the repair.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components</li> <li>• Turn the keyswitch ON</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Verify cylinder misfire is no longer present. <ul style="list-style-type: none"> <li>• Start the engine and verify the cylinder misfire is no longer present.</li> </ul>	Cylinder misfire is present? <b>YES</b>	1A
	Cylinder misfire is present? <b>NO</b>	3B

**STEP 3B: Clear the fault codes.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components</li> <li>• Turn the keyswitch ON</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Clear the fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to erase all active and inactive fault codes.</li> </ul>	All faults cleared? <b>YES</b>	Repair complete?
	All faults cleared? <b>NO</b>	Appropriate troubleshooting steps.

## Fault Code 1845

### Water-in-Fuel Indicator Sensor Circuit - Voltage Above Normal or Shorted to High Source (For Generator Engines Only)

CODES	REASON	EFFECT
Fault Code: 1845 PID(P), SID(S): SPN: 97 FMI: 3 Lamp: Maintenance SRT:	Water-in-Fuel Indicator Sensor Circuit - Voltage Above Normal or Shorted to High Source (For Generator Engines <b>Only</b> ). High voltage detected at the water-in-fuel indicator circuit.	None on performance. No water-in-fuel warning available.

#### Circuit Description:

The water-in-fuel indicator sensor is attached to the first stage fuel filter. The water-in-fuel indicator sensor sends a signal to the electronic control module (ECM) when a set volume of water has accumulated in the fuel filter. The water-in-fuel indicator sensor circuit contains two wires: A water-in-fuel indicator RETURN (sensor return 1) ground wire and a water-in-fuel indicator SIGNAL wire.

#### Component Location:

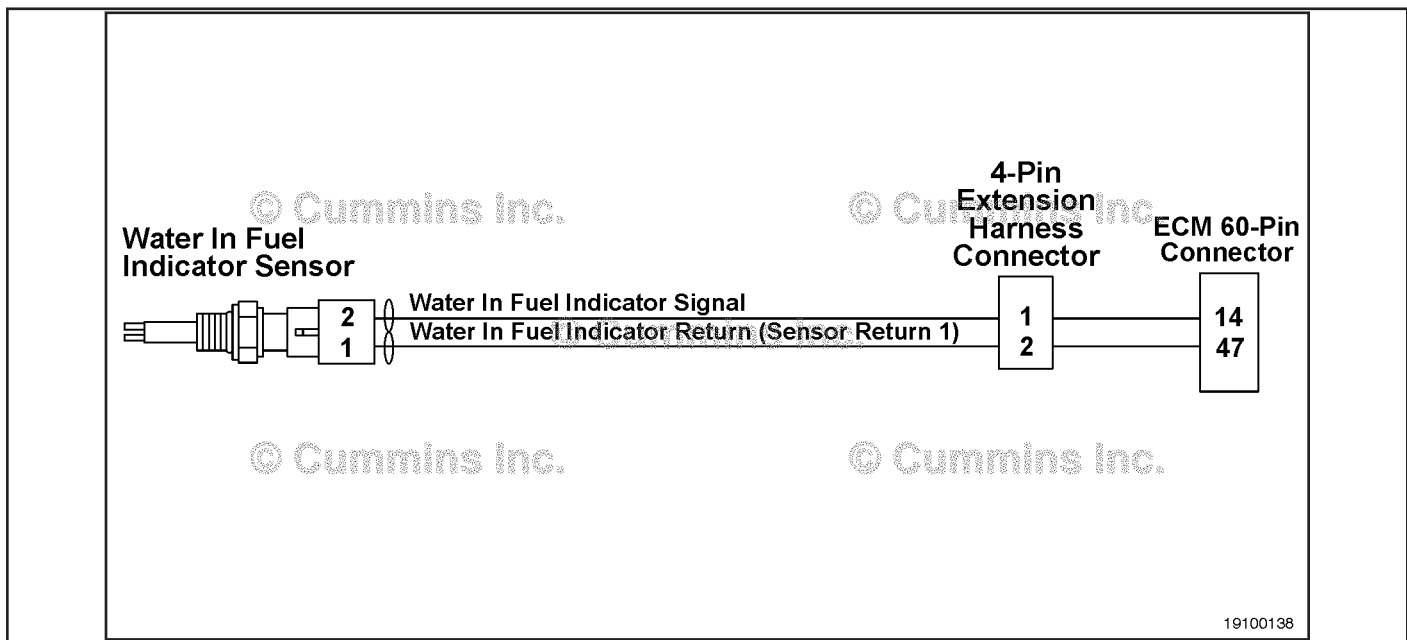
The water-in-fuel indicator sensor is integrated into the bottom of the suction fuel filter. The first stage fuel filter is located on the intake side of the engine.

#### Shop Talk:

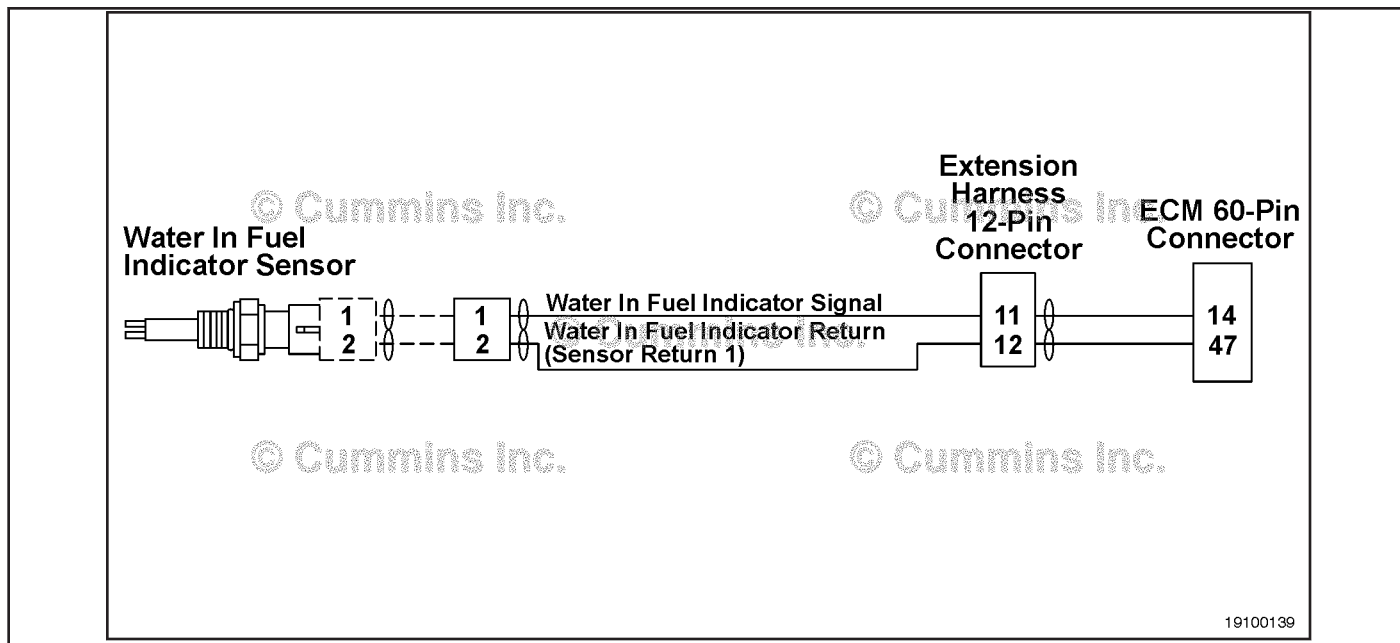
The water-in-fuel sensor is located in the Stage 1 filter housing. It is a serviceable part.

Possible causes of this fault code include:

- Open return or signal circuit in the harness, connectors, or sensor.
- SIGNAL wire shorted to sensor supply or battery voltage.



Water-in-Fuel Indicator Sensor Circuit - Power Generation



Water-in-Fuel Indicator Sensor Circuit - Marine

Refer to Troubleshooting Fault Code t05-1845.

## Fault Code 1845 - Water-in-Fuel Indicator Sensor Circuit - Voltage Above Normal or Shorted to High Source (For Generator Engines Only)

### TROUBLESHOOTING SUMMARY

#### ⚠CAUTION⚠

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

#### ⚠CAUTION⚠

To reduce the possibility of pin and harness damage, use the following test lead when taking a measurement: Part Number 3822758 - male Deutsch™/AMP™/Metri-Pack™ test lead.

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1: Check the fault codes.</b>		
<b>STEP 1A:</b> Check for an active fault code.	Fault Code 1845 active?	
<b>STEP 2: Check the water-in-fuel sensor and circuit.</b>		
<b>STEP 2A:</b> Inspect the engine harness and the water-in-fuel sensor and connector pins.	Dirty or damaged pins?	
<b>STEP 2B:</b> Check the water-in-fuel sensor resistance.	Greater than 200k ohms?	
<b>STEP 2C:</b> Check the fault codes and verify water-in-fuel sensor condition.	Fault Code 1845 active?	
<b>STEP 3: Check the ECM and engine harness.</b>		
<b>STEP 3A:</b> Inspect the ECM and engine harness connector pins.	Dirty or damaged pins?	
<b>STEP 3B:</b> Check the ECM response.	Fault Code 1846 active and Fault Code 1845 inactive?	
<b>STEP 3C:</b> Check for an open circuit in the engine harness.	Less than 10 ohms?	
<b>STEP 3C-1:</b> Check for an open circuit in the engine harness.	Less than 10 ohms?	
<b>STEP 3D:</b> Check for a pin-to-pin short circuit in the engine harness.	Greater than 100k ohms?	
<b>STEP 3E:</b> Check for an inactive fault code.	Fault Code 1845 inactive?	
<b>STEP 4: ECM calibration and clear fault codes.</b>		
<b>STEP 4A:</b> Check if an ECM calibration update is available.	If a calibration update for this fault code is available, does the ECM contain that revision or higher?	
<b>STEP 4B:</b> Disable the fault code.	Fault code inactive?	

## TROUBLESHOOTING STEP

### STEP 1: Check the fault codes.

#### STEP 1A: Check for an active fault code.

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for an active fault code. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 1845 active? <b>YES</b>	2A
	Fault Code 1845 active? <b>NO</b>	Use the following procedure for an inactive or intermittent fault code. Refer to Procedure 019-362 in Section 19.

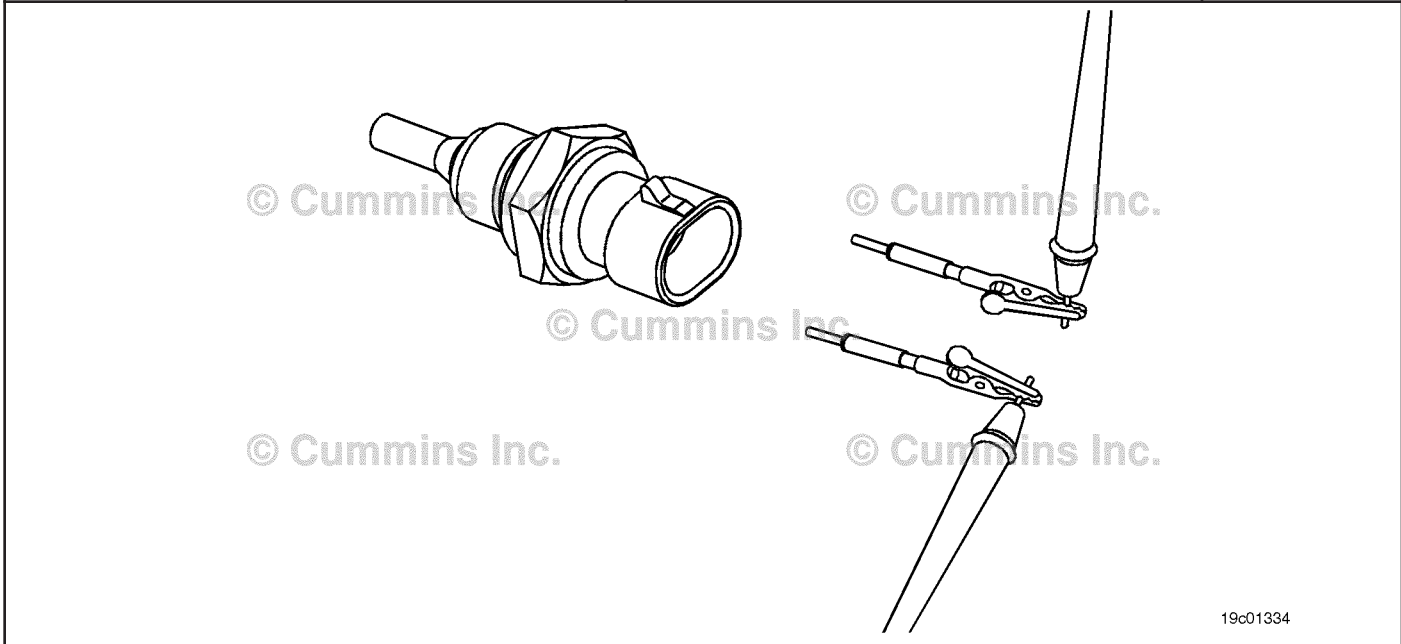
### STEP 2: Check the water-in-fuel sensor and circuit.

#### STEP 2A: Inspect the engine harness and the water-in-fuel sensor and connector pins.

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the water-in-fuel sensor connector from the engine harness connector.</li> </ul>		
Action	Specification/Repair	Next Step
Inspect the engine harness and water-in-fuel sensor connector pins for the following: <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris on or in the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.	Dirty or damaged pins? <b>YES</b> <b>Repair:</b> A damaged connection has been detected in the water-in-fuel indicator sensor or harness connector. Clean the connector and pins. Replace the damaged section of harness or damaged water-in-fuel indicator sensor. <ul style="list-style-type: none"> <li>• Refer to the circuit diagram or wiring diagram for all harness interconnections.</li> <li>• Refer to Procedure 019-043 in Section 19.</li> <li>• Refer to Procedure 019-205 in Section 19.</li> <li>• Refer to Procedure 019-127 in Section 19.</li> </ul>	4A
	Dirty or damaged pins? <b>NO</b>	2B

**STEP 2B: Check the sensor resistance.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the water-in-fuel sensor from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check the sensor resistance.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the water-in-fuel indicator SIGNAL pin and the water-in-fuel indicator RETURN (sensor return 1) pin at the water-in-fuel sensor connector.</li> </ul> <p>Refer to the circuit diagram or wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Greater than 200k ohms?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Replace the water-in-fuel indicator sensor. Refer to Procedure 019-127 in Section 19.</p>	<p>4A</p>
	<p>Greater than 200k ohms?</p> <p><b>NO</b></p>	<p>2C</p>



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**STEP 2C: Check the fault codes and verify sensor condition.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Connect the water-in-fuel sensor to the engine harness.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate circuit response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault Code 1845 active?</p> <p><b>YES</b></p>	3A
	<p>Fault Code 1845 active?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>None. The removal and installation of the connector corrected the fault.</p>	4A

**STEP 3: Check the ECM and engine harness.**

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

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness connector from the ECM 60-pin connector.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the engine harness and ECM connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris on or in the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A damaged connection has been detected in the ECM connector or harness connector.</p> <p>Clean the connector and pins.</p> <p>Replace the damaged section of harness or damaged connector.</p> <ul style="list-style-type: none"> <li>• Refer to the circuit diagram or wiring diagram for all harness interconnections.</li> <li>• Refer to Procedure 019-043 in Section 19.</li> <li>• Refer to Procedure 019-199 in Section 19.</li> <li>• Refer to Procedure 019-204 in Section 19.</li> </ul> <p>Replace the ECM. Refer to Procedure 019-031 in Section 19.</p>	4A
	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	3B



**STEP 3B: Check the ECM response.**

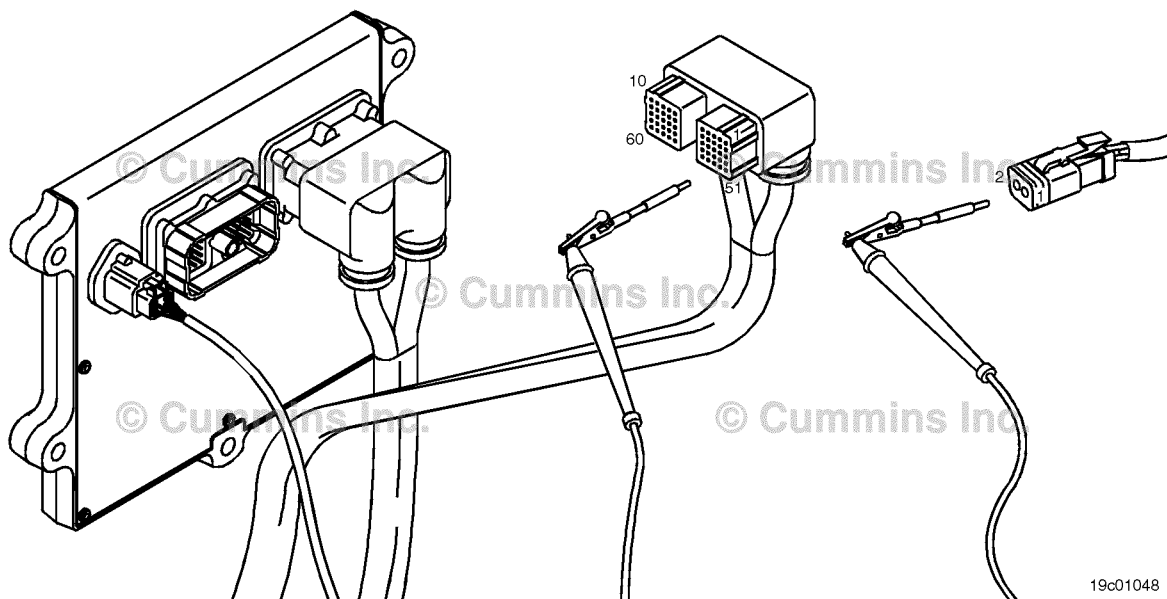
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness connector from the ECM.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate circuit response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul> <p>Refer to the circuit diagram or wiring diagram for connector pin identification.</p>	<p>Fault Code 1846 active and Fault Code 1845 inactive? <b>YES</b></p>	<p>3C</p>
	<p>Fault Code 1846 active and Fault Code 1845 inactive? <b>NO</b></p> <p><b>Repair:</b> Replace the ECM. Refer to Procedure 019-031 in Section 19.</p>	<p>4A</p>

**STEP 3C: Check for an open circuit in the engine harness.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine harness connector from the ECM 60-pin connector.
- Disconnect the water-in-fuel indicator sensor connector from the engine harness connector.

Action	Specification/Repair	Next Step
<p>Check for an open circuit.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the engine harness ECM 60-pin connector water-in-fuel indicator sensor RETURN (sensor return 1) pin and the engine harness water-in-fuel indicator sensor connector RETURN (sensor return 1) pin.</li> </ul> <p>Refer to the circuit diagram or wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Less than 10 ohms? <b>YES</b></p>	<p>3C-1</p>
	<p>Less than 10 ohms? <b>NO</b></p> <p><b>Repair:</b></p> <p>An open return circuit has been detected in the engine harness.</p> <p>Troubleshoot each section of the engine harness to determine which contains the open circuit.</p> <p>Replace the damaged section of the engine harness.</p> <ul style="list-style-type: none"> <li>• Refer to Procedure 019-043 in Section 19.</li> <li>• Refer to Procedure 019-199 in Section 19.</li> </ul>	<p>4A</p>



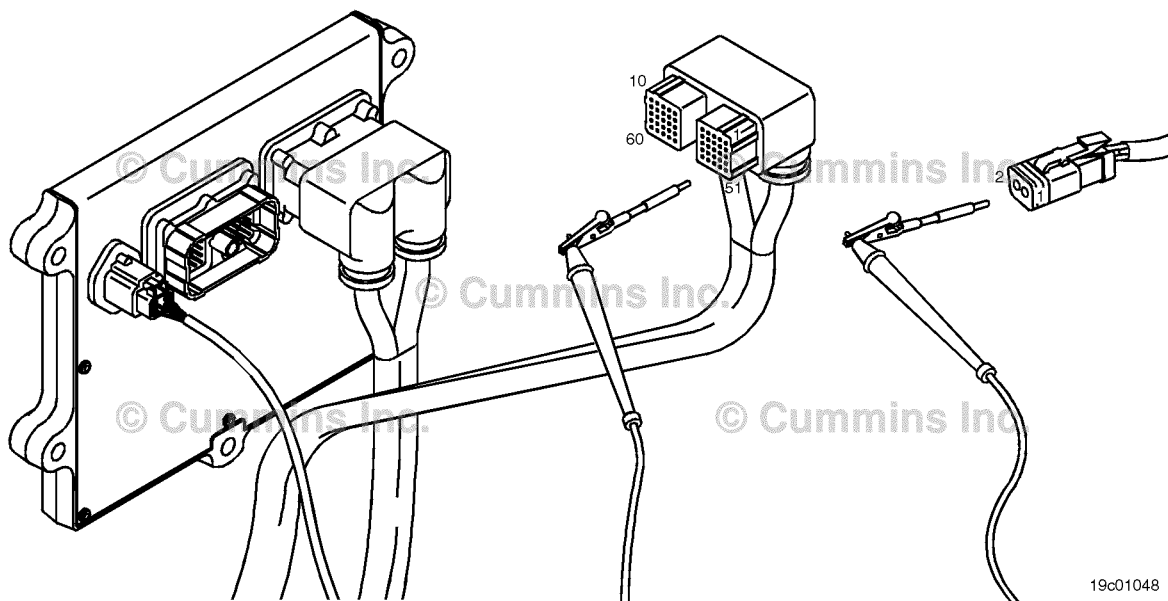
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**STEP 3C-1: Check for an open circuit in the engine harness.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine harness connector from the ECM 60-pin connector.
- Disconnect the water-in-fuel indicator sensor connector from the engine harness.

Action	Specification/Repair	Next Step
<p>Check for an open circuit.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the engine harness ECM connector water-in-fuel indicator SIGNAL pin and the water-in-fuel indicator SIGNAL pin.</li> </ul> <p>Refer to the circuit diagram or wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Less than 10 ohms? <b>YES</b></p>	<p>3D</p>
	<p>Less than 10 ohms? <b>NO</b></p> <p><b>Repair:</b></p> <p>An open signal circuit has been detected in the engine harness.</p> <p>Troubleshoot each section of the engine harness to determine which contains the open circuit.</p> <p>Replace the damaged section of the engine harness.</p> <ul style="list-style-type: none"> <li>• Refer to Procedure 019-043 in Section 19.</li> <li>• Refer to Procedure 019-199 in Section 19.</li> </ul>	<p>4A</p>

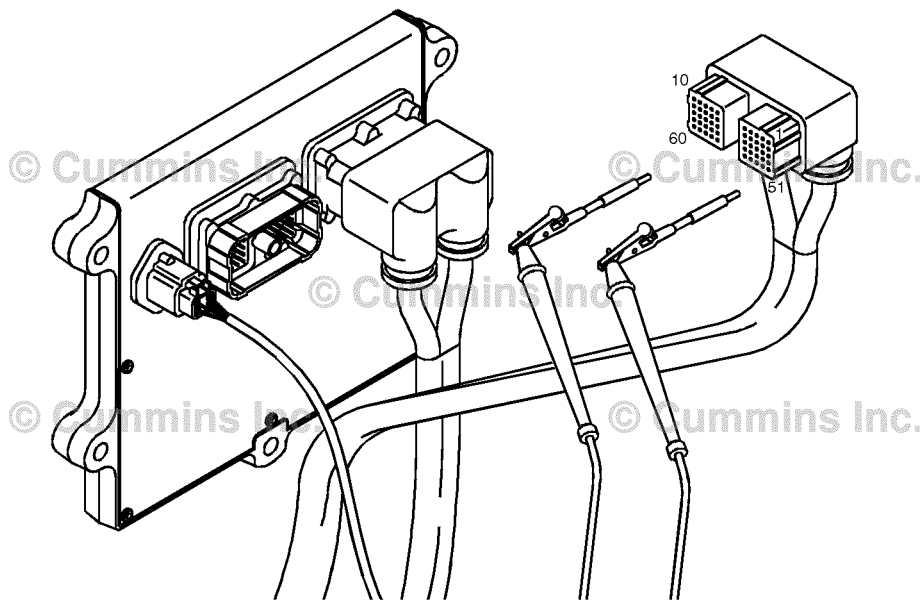


**STEP 3D: Check for a pin-to-pin short circuit in the engine harness.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine harness connector from the ECM 60-pin connector.
- Disconnect the water-in-fuel indicator sensor connector from the engine harness.

Action	Specification/Repair	Next Step
<p>Check for a pin-to-pin short.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the water in fuel indicator SIGNAL pin in the engine harness ECM connector and all other pins in the engine harness connector.</li> </ul> <p>Refer to the circuit diagram or wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Greater than 100k ohms? <b>YES</b></p>	3E
	<p>Greater than 100k ohms? <b>NO</b></p> <p><b>Repair:</b></p> <p>A pin-to-pin short circuit on the SIGNAL wire has been detected in the engine harness.</p> <p>Troubleshoot each section of the engine harness to determine which contains the pin-to-pin short.</p> <ul style="list-style-type: none"> <li>• Refer to the circuit diagram or wiring diagram for all harness interconnections.</li> <li>• Refer to Procedure 019-043 in Section 19.</li> <li>• Refer to Procedure 019-199 in Section 19.</li> </ul>	4A



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**STEP 3E: Check for an inactive fault code.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for the appropriate circuit response after 30 seconds. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 1845 inactive? <b>YES</b> <b>Repair:</b> None. The removal and installation of the connector corrected the fault.	4A
	Fault Code 1845 inactive? <b>NO</b> <b>Repair:</b> Troubleshooting procedures need to be repeated from the beginning. The cause of the failure should have been detected.	1A

**STEP 4: Check ECM calibration and clear fault codes.****STEP 4A: Check if an ECM calibration update is available.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Compare the ECM code and revision number in the ECM to the calibration revisions listed in the ECM Calibration Revision History for applicable changes related to this fault code. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to find the present ECM code and revision number in the ECM. The ECM code and revision number are found in the Calibration Information section of System ID and Data Plate in Features and Parameters.</li> </ul>	If a calibration update for this fault code is available, does the ECM contain that revision or higher? <b>YES</b>	4B
	If a calibration update for this fault code is available, does the ECM contain that revision or higher? <b>NO</b> <b>Repair:</b> If necessary, calibrate the ECM. Refer to Procedure 019-032 in Section 19.	4B

**STEP 4B: Disable the fault code.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Disable and clear the fault code.</p> <ul style="list-style-type: none"> <li>• Operate the engine within the "Conditions for Clearing the Fault Code" found in the summary section of this troubleshooting procedure.</li> </ul>	<p>Fault code inactive? <b>YES</b></p>	<p>Repair complete.</p>
	<p>Fault code inactive? <b>NO</b></p> <p><b>Repair:</b></p> <p>Return to the troubleshooting steps or contact a Cummins® Authorized Repair Location if all steps have been completed and checked again.</p>	<p>1A</p>

## Fault Code 1846

### Water-in-Fuel Indicator Sensor Circuit - Voltage Below Normal or Shorted to Low Source (For Generator Engines Only)

CODES	REASON	EFFECT
Fault Code: 1846 PID(P), SID(S): SPN: 97 FMI: 4 Lamp: Maintenance SRT:	Water-in-Fuel Indicator Sensor Circuit - Voltage Below Normal or Shorted to Low Source (For Generator Engines <b>Only</b> ). Low voltage detected at the water-in-fuel indicator circuit.	None on performance. No water-in-fuel warning available.

**Circuit Description:**

The water-in-fuel indicator sensor is attached to the first stage fuel filter. The water-in-fuel indicator sensor sends a signal to the electronic control module (ECM) when a set volume of water has accumulated in the fuel filter. The water-in-fuel indicator sensor circuit contains two wires: A water-in-fuel indicator RETURN (sensor return 1) ground wire and a water-in-fuel indicator SIGNAL wire.

**Component Location:**

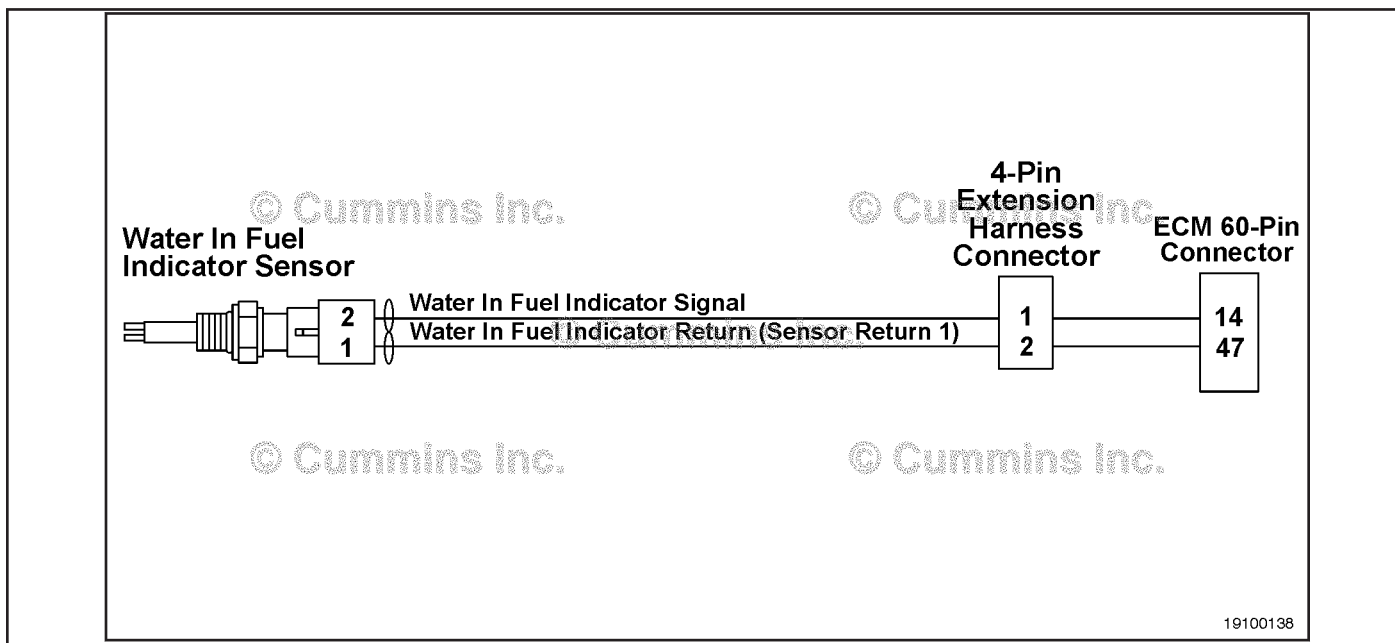
The water-in-fuel indicator sensor is integrated into the bottom of the suction fuel filter. The first stage fuel filter is located on the intake side of the engine.

**Shop Talk:**

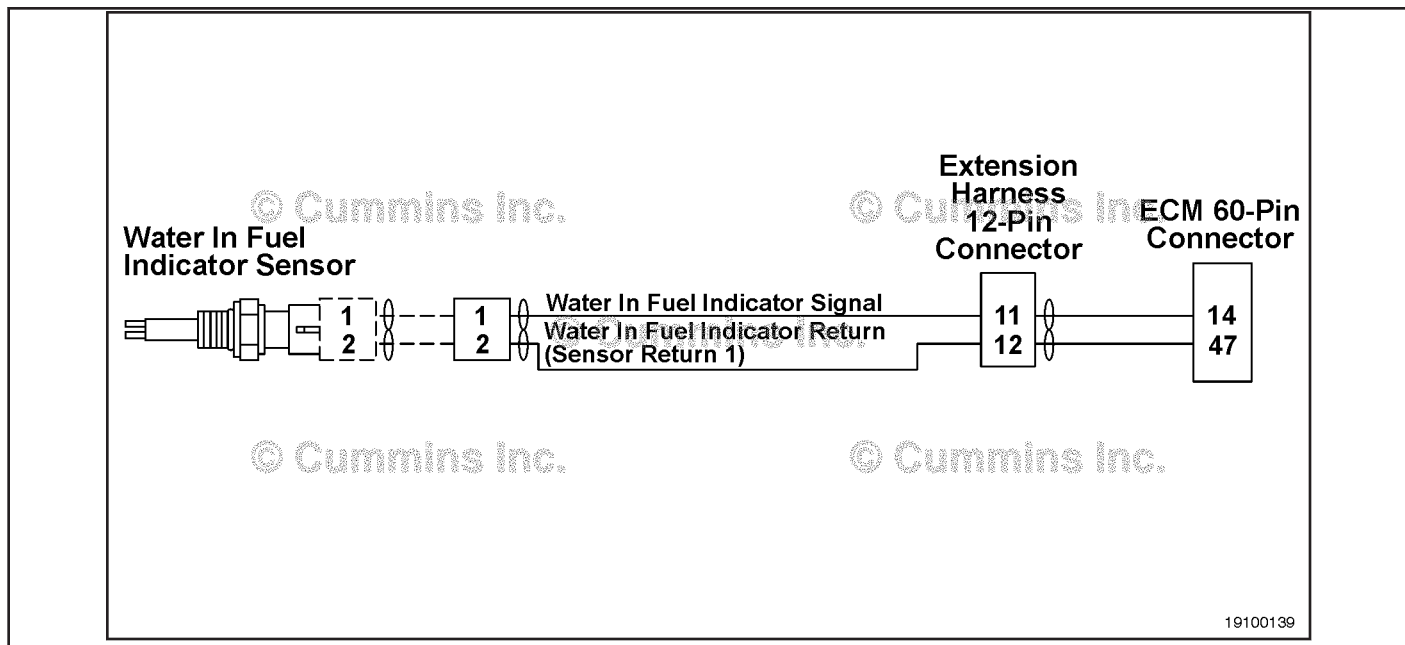
The water-in-fuel sensor is located in the Stage 1 filter housing. It is a serviceable part.

Possible causes of this fault code include:

- SIGNAL circuit shorted to ground in the harness, sensor, or connector.



Water-in-Fuel Indicator Sensor Circuit - Power Generation



Water-in-Fuel Indicator Sensor Circuit - Marine

Refer to Troubleshooting Fault Code t05-1846.



## Fault Code 1846 - Water-in-Fuel Indicator Sensor Circuit - Voltage Below Normal or Shorted to Low Source (For Generator Engines Only)

### TROUBLESHOOTING SUMMARY



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



To reduce the possibility of pin and harness damage, use the following test lead when taking a measurement: Part Number 3822758 - male Deutsch™/AMP™/Metri-Pack™ test lead.

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1:</b> Check the fault codes.		
<b>STEP 1A:</b> Check for an active fault code.	Fault Code 1846 active?	
<b>STEP 2:</b> Check the water-in-fuel indicator sensor and circuit.		
<b>STEP 2A:</b> Inspect the engine harness and sensor connector pins.	Dirty or damaged pins?	
<b>STEP 2B:</b> Check the circuit response.	Fault Code 1845 active and Fault Code 1846 inactive?	
<b>STEP 2C:</b> Check the fault codes and verify sensor condition.	Fault Code 1846 is active?	
<b>STEP 3:</b> Check the ECM and engine harness.		
<b>STEP 3A:</b> Inspect the ECM and engine harness connector pins.	Dirty or damaged pins?	
<b>STEP 3B:</b> Check the ECM response.	Fault Code 1845 active and Fault Code 1846 inactive?	
<b>STEP 3C:</b> Check for a pin-to-pin short circuit in the engine harness.	Greater than 200k ohms?	
<b>STEP 3C:</b> Check for a pin short circuit to ground.	Greater than 200k ohms?	
<b>STEP 3E:</b> Check for an inactive fault code.	Fault Code 1846 inactive?	
<b>STEP 4:</b> ECM calibration and clear fault codes.		
<b>STEP 4A:</b> Check if an ECM calibration update is available.	If a calibration update for this fault code is available, does the ECM contain that revision or higher?	
<b>STEP 4B:</b> Disable the fault code.	Fault code inactive?	

## TROUBLESHOOTING STEP

### STEP 1: Check the fault codes.

#### STEP 1A: Check for an active fault code.

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for an active fault code. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 1846 active? <b>YES</b>	2A
	Fault Code 1846 active? <b>NO</b>	Use the following procedure for an inactive or intermittent fault code. Refer to Procedure 019-362 in Section 19.

### STEP 2: Check the water-in-fuel indicator sensor and circuit.

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

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the water-in-fuel indicator sensor connector from the engine harness connector.</li> </ul>		
Action	Specification/Repair	Next Step
Inspect the engine harness and water-in-fuel indicator sensor connector pins for the following: <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris on or in the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.	Dirty or damaged pins? <b>YES</b> <b>Repair:</b> A damaged connection has been detected in the water-in-fuel indicator sensor or harness connector. <ul style="list-style-type: none"> <li>• Clean the connector and pins.</li> <li>• Replace the damaged section of harness or damaged water-in-fuel indicator sensor.</li> <li>• Refer to the circuit diagram or wiring diagram for all harness interconnections.</li> <li>• Refer to Procedure 019-043 in Section 19.</li> <li>• Refer to Procedure 019-205 in Section 19.</li> <li>• Refer to Procedure 019-127 in Section 19.</li> </ul>	4A
	Dirty or damaged pins? <b>NO</b>	2B

**STEP 2B: Check the circuit response.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the water-in-fuel indicator sensor connector from the engine harness connector.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate circuit response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault Code 1845 active and Fault Code 1846 inactive?</p> <p><b>YES</b></p>	2C
	<p>Fault Code 1845 active and Fault Code 1846 inactive?</p> <p><b>NO</b></p>	3A

**STEP 2C: Check the fault codes and verify water-in-fuel indicator sensor condition.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Connect the water-in-fuel indicator sensor connector to the engine harness connector.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate circuit response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault Code 1846 is active?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A damaged water-in-fuel indicator sensor has been detected.</p> <p>Replace the water-in-fuel indicator sensor. Refer to Procedure 019-127 in Section 19.</p>	4A
	<p>Fault Code 1846 is active?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>None. The removal and installation of the connector corrected the fault.</p>	4A

**STEP 3: Check the ECM and engine harness.**

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

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness connector from the ECM 60-pin connector.</li> <li>• Disconnect the engine harness from the water-in-fuel indicator sensor.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the engine harness, water-in-fuel indicator sensor, and ECM connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris on or in the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A damaged connection has been detected in the ECM connector or harness connector.</p> <ul style="list-style-type: none"> <li>• Clean the connector and pins.</li> <li>• Replace the damaged section of harness or damaged connector.</li> <li>• Refer to the circuit diagram or wiring diagram for all harness interconnections.</li> <li>• Refer to Procedure 019-043 in Section 19.</li> <li>• Refer to Procedure 019-199 in Section 19.</li> </ul> <p>Replace the ECM. Refer to Procedure 019-031 in Section 19.</p>	4A
	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	3B

**STEP 3B: Check the ECM response.**

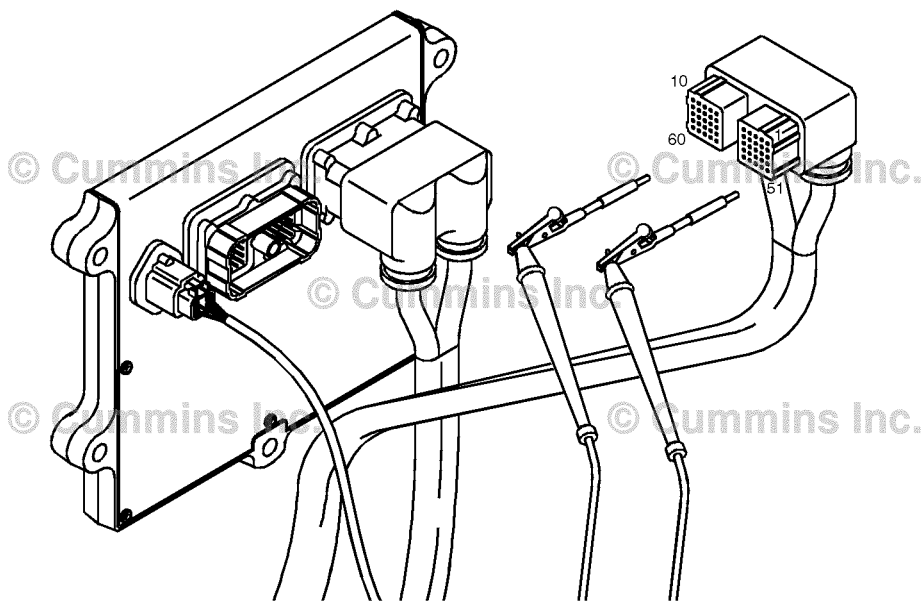
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness connector from the ECM 60-pin connector.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate circuit response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault Code 1845 active and Fault Code 1846 inactive?</p> <p><b>YES</b></p>	3C
	<p>Fault Code 1845 active and Fault Code 1846 inactive?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Replace the ECM. Refer to Procedure 019-031 in Section 19.</p>	4A

**STEP 3C: Check for a pin-to-pin short circuit in the engine harness.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine harness connector from the ECM 60-pin connector.
- Disconnect the water-in-fuel indicator sensor connector from the engine harness connector.

Action	Specification/Repair	Next Step
<p>Check for a pin-to-pin short.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the water-in-fuel indicator SIGNAL pin in the engine harness ECM connector and all other pins in the engine harness connector.</li> </ul> <p>Refer to the circuit diagram or wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Greater than 200k ohms? <b>YES</b></p>	<p>3D</p>
	<p>Greater than 200k ohms? <b>NO</b></p> <p><b>Repair:</b></p> <p>A pin-to-pin short circuit on the water-in-fuel indicator SIGNAL wire has been detected in the engine harness.</p> <ul style="list-style-type: none"> <li>• Troubleshoot each section of the engine harness to determine which contains the pin-to-pin short.</li> <li>• Refer to the circuit diagram or wiring diagram for all harness interconnections.</li> <li>• Refer to Procedure 019-043 in Section 19.</li> <li>• Refer to Procedure 019-199 in Section 19.</li> </ul>	<p>4A</p>



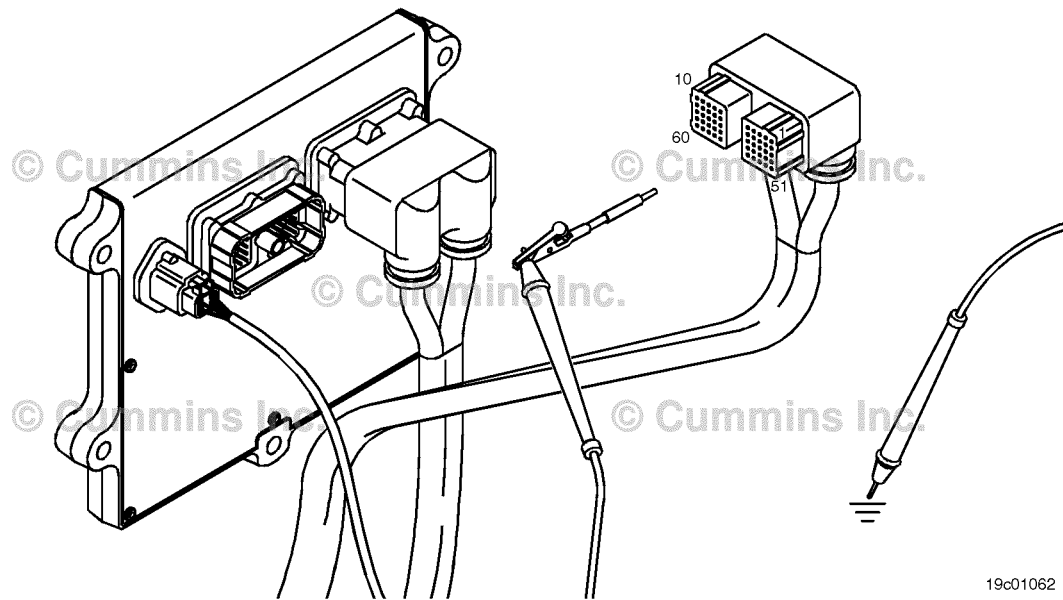
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**STEP 3D: Check for a pin short circuit to ground.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine harness connector from the ECM 60-pin connector.
- Disconnect the water-in-fuel indicator sensor connector from the engine harness connector.

Action	Specification/Repair	Next Step
<p>Check for a pin-to-ground short.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the water-in-fuel indicator SIGNAL pin in the engine harness ECM connector and ground.</li> </ul> <p>Refer to the circuit diagram or wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Greater than 200k ohms? <b>YES</b></p>	<p>3E</p>
	<p>Greater than 200k ohms? <b>NO</b></p> <p><b>Repair:</b></p> <p>A pin-to-ground short circuit on the SIGNAL wire has been detected in the engine harness.</p> <ul style="list-style-type: none"> <li>• Troubleshoot each section of the engine harness to determine which contains the short circuit to ground.</li> <li>• Refer to the circuit diagram or wiring diagram for all harness interconnections.</li> <li>• Refer to Procedure 019-043 in Section 19.</li> <li>• Refer to Procedure 019-199 in Section 19.</li> </ul>	<p>4A</p>



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**STEP 3E: Check for an inactive fault code.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate circuit response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault Code 1846 inactive?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>None. The removal and installation of the connector corrected the fault.</p>	4A
	<p>Fault Code 1846 inactive?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Troubleshooting procedures need to be repeated from the beginning. The cause of the failure should have been detected.</p>	1A

**STEP 4: Check ECM calibration and clear fault codes.**

**STEP 4A: Check if an ECM calibration update is available.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Compare the ECM code and revision number in the ECM to the calibration revisions listed in the ECM Calibration Revision History for applicable changes related to this fault code.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to find the present ECM code and revision number in the ECM. The ECM code and revision number are found in the Calibration Information section of System ID and Data Plate in Features and Parameters.</li> </ul>	<p>If a calibration update for this fault code is available, does the ECM contain that revision or higher?</p> <p><b>YES</b></p>	4B
	<p>If a calibration update for this fault code is available, does the ECM contain that revision or higher?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>If necessary, calibrate the ECM. Refer to Procedure 019-032 in Section 19.</p>	4B

**STEP 4B: Disable the fault code.**

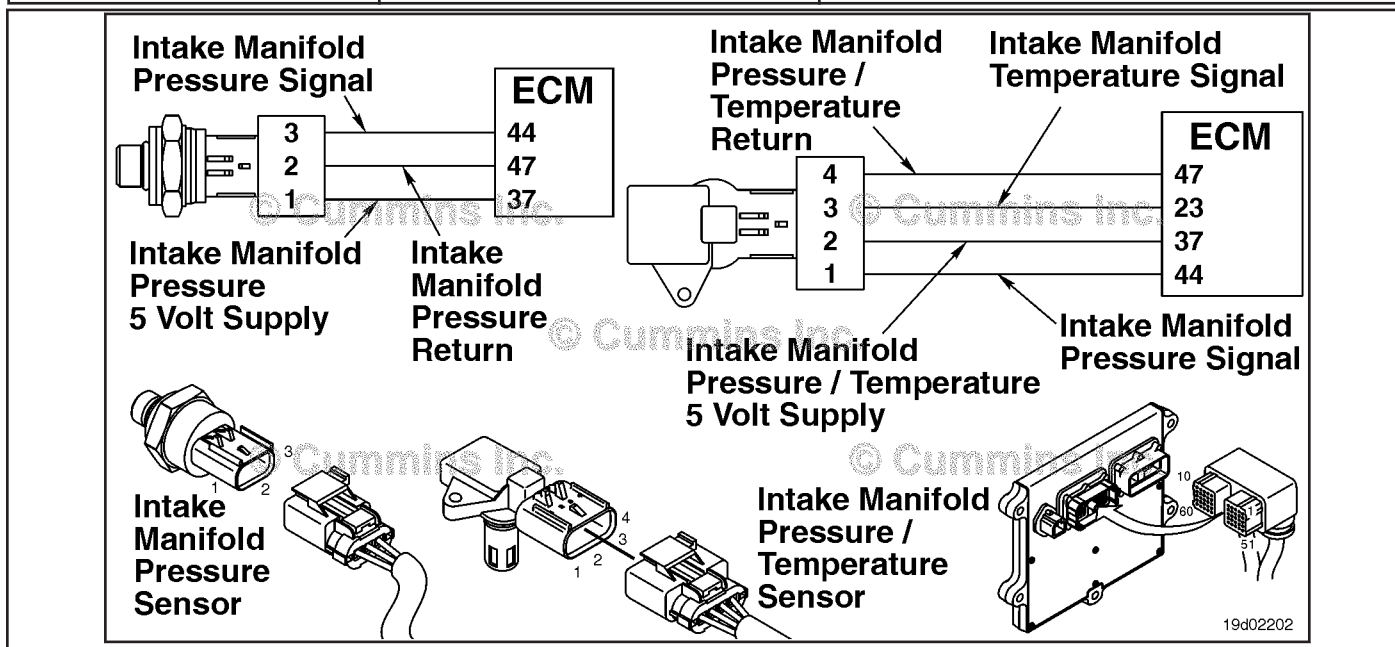
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Disable and clear the fault code.</p> <ul style="list-style-type: none"> <li>• Operate the engine within the "Conditions for Clearing the Fault Code" found in the summary section of this troubleshooting procedure.</li> </ul>	<p>Fault code inactive? <b>YES</b></p>	<p>Repair complete.</p>
	<p>Fault code inactive? <b>NO</b></p> <p><b>Repair:</b></p> <p>Return to the troubleshooting steps or contact a Cummins® Authorized Repair Location if all steps have been completed and checked again.</p>	<p>1A</p>



## Fault Code 1848

### Intake Manifold 1 Temperature — Abnormal Rate of Change

CODES	REASON	EFFECT
Fault Code: 1848 PID(P), SID(S): P105 SPN: 105 FMI: 10 Lamp: Amber SRT:	Intake Manifold 1 Temperature — Abnormal Rate of Change. The intake manifold temperature sensor is not responding to a change in engine operating conditions.	The ECM will estimate engine intake manifold temperature.



Circuit: Intake Manifold 1 Temperature

**Circuit Description:**

The engine intake manifold temperature sensor is used by the electronic control module (ECM) to monitor the engine intake manifold temperature. The ECM monitors the voltage on the signal pin and converts this to a temperature value.

The engine intake manifold temperature value is used by the ECM for the engine protection system and engine emission control.

**Component Location:**

The engine intake manifold temperature sensor is located in the air intake manifold. 100-002 (Engine Diagrams) in Section E for a detailed component location view.

**Shop Talk:**

The engine intake manifold temperature is monitored during engine warm-up. If the engine intake manifold temperature reading is not changing to match the engine operating conditions, the intake manifold temperature sensor is then determined to be stuck in-range and this fault code is logged. The ECM must **not** see engine speed for a period of eight hours before this diagnostic will run.

Possible causes of this fault code include:

- Stuck in-range engine intake manifold temperature sensor reading.
- High resistance in the engine intake manifold temperature sensor signal or return lines.

On-Board Diagnostics (OBD) Information (Euro 4 and Euro 4 Stage 1+ Certified Engines):

- The ECM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The ECM turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does **not** fail. The MIL lamp and fault code can also be cleared using the INSITE™ service tool.
- The fault code will be cleared from memory after 40 consecutive drive cycles where the diagnostic runs and passes.

**Refer to Troubleshooting Fault Code t05-1848**

## FAULT CODE 1849 - Exhaust Gas Temperature 1 - Abnormal Rate of Change TROUBLESHOOTING SUMMARY



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



To reduce the possibility of pin and harness damage, use the following test leads when taking a measurement: Part Number 3822758 - male Deutsch™/AMP™/Metri-Pack™ test lead and Part Number 3822917 - female Deutsch™/AMP™/Metri-Pack™ test lead.

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1: Check for sensor circuit fault codes.</b>		
<b>STEP 1A:</b> Check for active fault codes.	Fault code 1848 is active?	
<b>STEP 1B:</b> Check for fault codes.	Fault Codes 153 or 154 is active?	
<b>STEP 2: Check the engine intake manifold temperature sensor and circuit.</b>		
<b>STEP 2A:</b> Inspect the engine intake manifold temperature sensor and connector pins.	Dirty or damaged pins?	
<b>STEP 2B:</b> Check the circuit response.	Fault Code 153 active?	
<b>STEP 2C:</b> Check the circuit response.	Fault Code 154 active?	
<b>STEP 3: Check the ECM and engine harness.</b>		
<b>STEP 3A:</b> Inspect the ECM and engine harness connector pins.	Dirty or damaged pins?	
<b>STEP 3B:</b> Check the circuit response.	Fault Code 153 active?	
<b>STEP 3C:</b> Check the circuit response.	Fault Code 154 active?	
<b>STEP 4: Clear the fault codes.</b>		
<b>STEP 4A:</b> Verify the repair	Intake Manifold Temperature and Catalyst Inlet Temperature reading within 5.6°C or 10°F of each other?	
<b>STEP 4B:</b> Clear the fault codes.	All fault codes cleared?	

### TROUBLESHOOTING STEP

**STEP 1: Check for sensor circuit fault codes.**

**STEP 1A: Check for active fault codes.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for active fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 1848 is active? <b>YES</b>	1B
	Fault Code 1848 is active? <b>NO</b>	4A

**STEP 1B: Check for fault codes 153 and 154.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for active fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 153 or 154 is active? <b>YES</b>	Appropriate fault code troubleshooting tree.
	Fault Code 153 or 154 is active? <b>NO</b>	2A

**STEP 2: Check the engine intake manifold temperature sensor and circuit.**

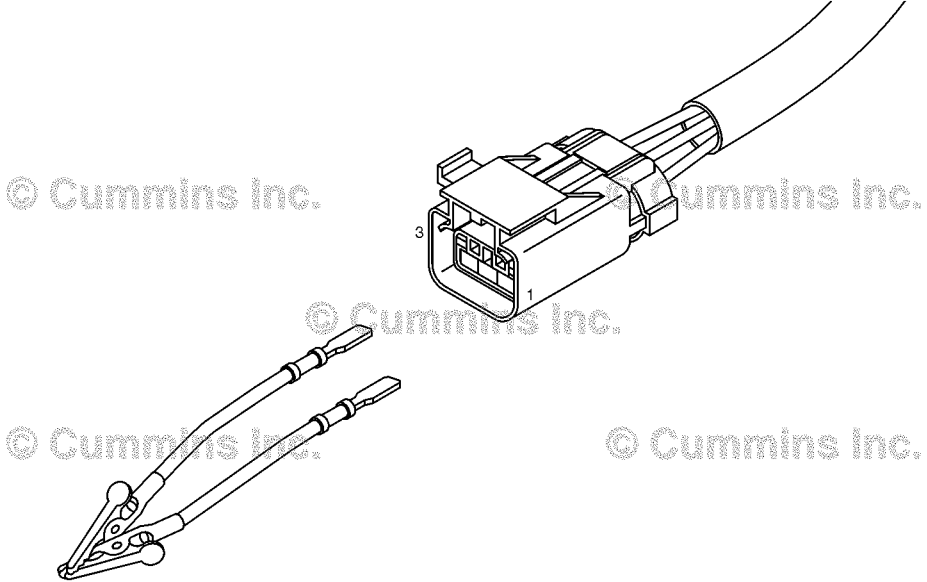
**STEP 2A: Inspect the engine intake manifold temperature sensor and connector pins.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine intake manifold temperature sensor from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
Inspect the engine harness and engine intake manifold temperature sensor connector pins for the following: <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.	Dirty or damaged pins? <b>YES</b> <b>Repair:</b> A damaged connection has been detected in the sensor or harness connector. Clean the connector and pins. Repair the damaged harness, connector, or pins if possible. Refer to Procedure 019-071 in Section 19.	4A
	Dirty or damaged pins? <b>NO</b>	2B

**STEP 2B: Check the circuit response.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine intake manifold temperature sensor from the engine harness.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate ECM response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul> <p>Note: Fault Code 123 will also be active when the intake manifold temperature sensor is disconnected.</p>	<p>Fault Code 153 active? <b>YES</b></p>	2C
	<p>Fault Code 153 active? <b>NO</b></p>	3A

**STEP 2C: Check the circuit response.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine intake manifold temperature sensor from the engine harness.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Place a jumper wire between the engine intake manifold temperature SIGNAL pin and the engine intake manifold temperature RETURN pin at the engine intake manifold temperature connector of the engine harness.</p> <p>Refer to the wiring diagram for connector pin identification.</p> <p>Check the appropriate circuit response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault Code 154 is active?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>An in-range malfunction of the intake manifold temperature sensor has been detected.</p> <p>Replace the engine intake manifold temperature sensor. Refer to Procedure Procedure 019-059 in Section 19.</p>	<p>4A</p>
	<p>Fault Code 154 is active?</p> <p><b>NO</b></p>	<p>3A</p>
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**STEP 3: Check the ECM and engine harness.**

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

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM connector.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the engine harness and ECM connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A damaged connection has been detected in the ECM connector or the engine harness connector.</p> <p>Clean the connector and pins.</p> <p>Repair the damaged harness, connector, or pins, if possible. Refer to Procedure 019-043 in Section 19.</p>	4A
	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	3B

**STEP 3B: Check the circuit response.**

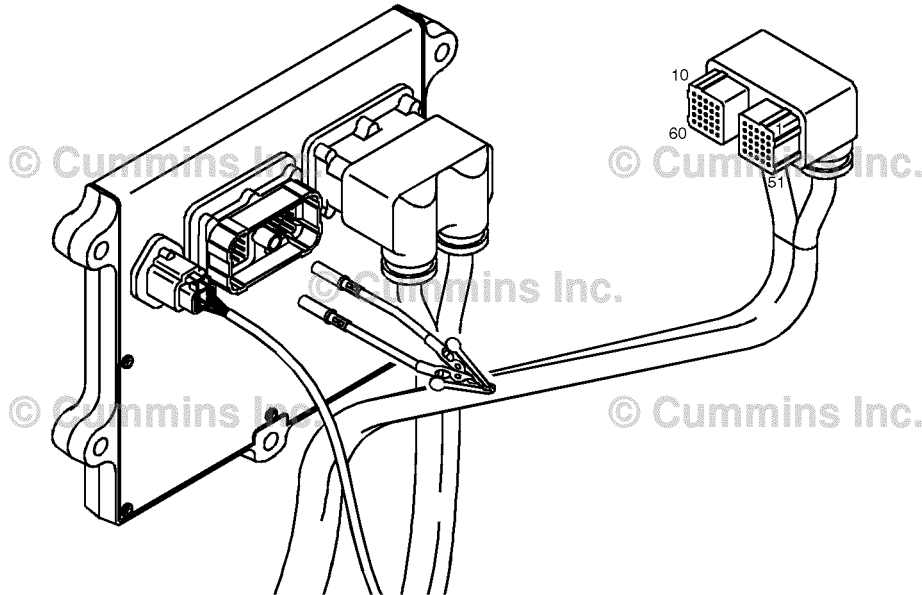
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate circuit response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault Code 153 is active?</p> <p><b>YES</b></p>	3C
	<p>Fault Code 153 is active?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Replace the ECM. Refer to Procedure 019-031 in Section 19.</p>	4A

**STEP 3C: Check the circuit response.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine harness from the ECM.
- Turn keyswitch ON.
- Connect INSITE™ electronic service tool.

Action	Specification/Repair	Next Step
Place a jumper wire between the engine intake manifold temperature SIGNAL pin and engine intake manifold temperature RETURN pin at the ECM connector.  Check for the appropriate circuit response after 30 seconds.  • Use INSITE™ electronic service tool to read the fault codes.	Fault Code 154 is active?  <b>YES</b>  <b>Repair:</b>  High resistance or a short circuit has been detected in the engine harness.  Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.	4A
	Fault Code 154 is active?  <b>NO</b>  <b>Repair:</b>  Replace the ECM. Refer to Procedure 019-031 in Section 19.	4A



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**STEP 4: Clear the fault code.**

**STEP 4A: Verify the repair.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Start the INSITE™ electronic service tool Data Monitor/Logger.</p> <ul style="list-style-type: none"> <li>• Compare the INSITE™ electronic service tool reading for Intake Manifold Temperature and Catalyst Inlet Temperature.</li> </ul>	<p>Intake Manifold Temperature and Catalyst Inlet Temperature reading within 5.6°C or 10°F of each other?</p> <p><b>YES</b></p>	4B
	<p>Intake Manifold Temperature and Catalyst Inlet Temperature reading within 5.6°C or 10°F of each other?</p> <p><b>NO</b></p>	1A

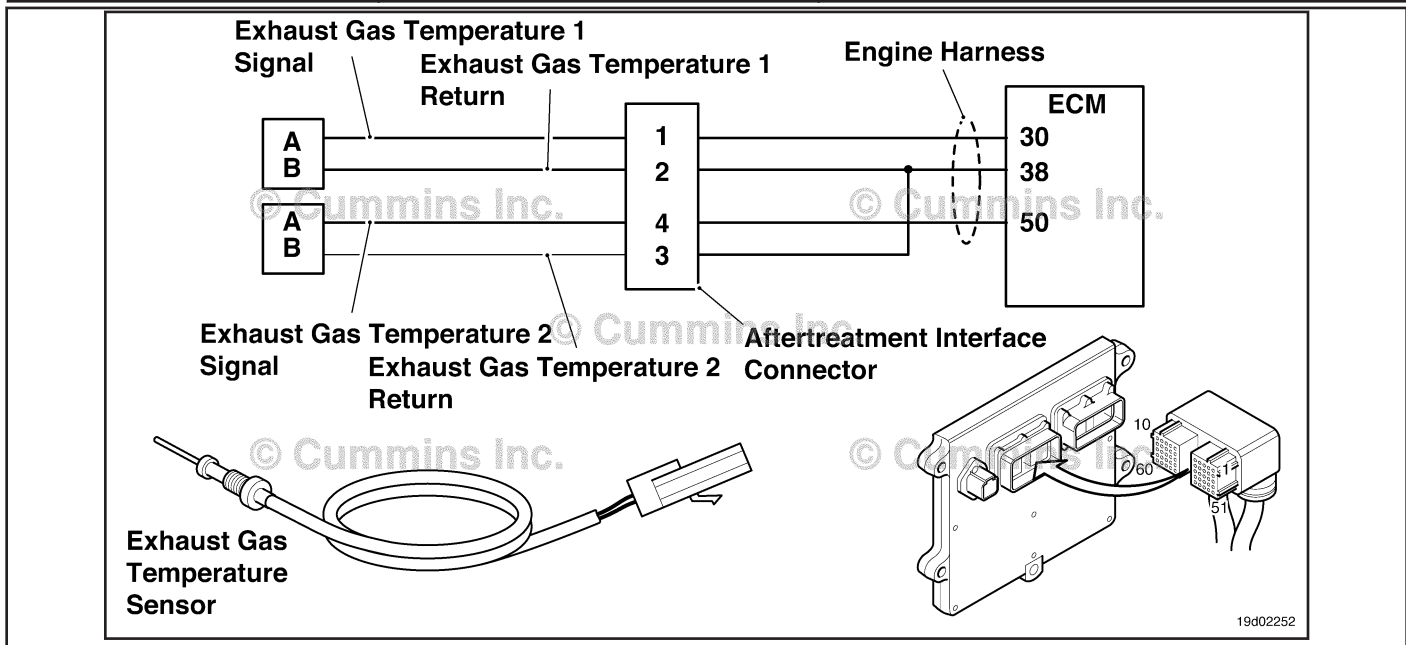
**STEP 4B: Clear the fault codes.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Clear the fault codes.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to erase all active and inactive fault codes.</li> </ul>	<p>All fault codes cleared?</p> <p><b>YES</b></p>	Repair complete
	<p>All fault codes cleared?</p> <p><b>NO</b></p>	Appropriate troubleshooting steps

## Fault Code 1849

### Exhaust Gas Temperature 1 — Abnormal Rate of Change

CODES	REASON	EFFECT
Fault Code: 1849 PID(P), SID(S): SPN: 3241 FMI: 10 Lamp: Amber SRT:	Exhaust Gas Temperature 1 — Abnormal Rate of Change. The catalyst inlet temperature sensor is not responding to a change in engine operating conditions.	Default temperature value used for catalyst inlet temperature.



**Circuit Description:**

The exhaust gas temperature #1 sensor is used by the electronic control module (ECM) to monitor the engine exhaust temperature entering the catalyst unit. The ECM monitors the voltage on the signal pin and converts this to a temperature value.

**Component Location:**

The catalyst inlet temperature #1 sensor is located in the aftertreatment system. It is located between the turbocharger outlet and the catalyst unit inlet in the exhaust system.

**Shop Talk:**

The exhaust gas temperature 1 is monitored during engine warm-up. If the exhaust gas temperature 1 reading is not changing to match the engine operating conditions, the exhaust gas temperature 1 sensor is then determined to be stuck in-range and this fault code is logged. The ECM must not see engine speed for a period of eight hours before this diagnostic will run.

Possible causes of this fault code include:

- Stuck in-range exhaust gas temperature #1 sensor reading.
- High resistance in the exhaust gas temperature #1 sensor signal or return lines.

On-Board Diagnostics (OBD) Information (Euro 4 and Euro 4 Stage 1+ Certified Engines):

- The ECM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The ECM turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does **not** fail. The MIL lamp and fault code can also be cleared using the INSITE™ service tool.
- The fault code will be cleared from memory after 40 consecutive drive cycles where the diagnostic runs and passes.

**Refer to Troubleshooting Fault Code t05-1849**

## FAULT CODE 1849 - Exhaust Gas Temperature 1 - Abnormal Rate of Change

### TROUBLESHOOTING SUMMARY



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



To reduce the possibility of pin and harness damage, use the following test leads when taking a measurement: Part Number 3822758 - male Deutsch™/AMP™/Metri-Pack™ test lead and Part Number 3822917 - female Deutsch™/AMP™/Metri-Pack™ test lead.

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1: Check for sensor circuit fault codes.</b>		
<b>STEP 1A:</b> Check for Fault Codes 1665 and 1666.	Fault Code 1665 or 1666 is active?	
<b>STEP 2: Check the exhaust gas temperature #1 sensor and circuit.</b>		
<b>STEP 2A:</b> Inspect the exhaust gas temperature #1 sensor and connector pins.	Dirty or damaged pins?	
<b>STEP 2B:</b> Check the circuit response.	Fault Code 1666 active?	
<b>STEP 2C:</b> Check the circuit response.	Fault Code 1665 active?	
<b>STEP 3: Check the ECM and engine harness.</b>		
<b>STEP 3A:</b> Inspect the ECM and engine harness connector pins.	Dirty or damaged pins?	
<b>STEP 3B:</b> Check the circuit response.	Fault Code 1666 active?	
<b>STEP 3C:</b> Check the circuit response.	Fault Code 1665 active?	
<b>STEP 4: Clear the fault codes.</b>		
<b>STEP 4A:</b> Verify the repair	Catalyst Inlet Temperature and Catalyst Outlet Temperature reading within 13.9°C or 25°F of each other?	
<b>STEP 4B:</b> Clear the fault codes.	All fault codes cleared?	

### TROUBLESHOOTING STEP

**STEP 1: Check for sensor circuit fault codes.**

**STEP 1A: Check for Fault Codes 1665 and 1666.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for active fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 1665 or 1666 is active? <b>YES</b>	Fault Code 1665 or 1666 troubleshooting tree.
	Fault Code 1665 or 1666 is active? <b>NO</b>	2A

**STEP 2: Check the exhaust gas temperature #1 sensor and circuit.****STEP 2A: Inspect the exhaust gas temperature #1 sensor and connector pins.**

<b>Condition:</b>		
<ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the exhaust gas temperature #1 sensor from the engine harness.</li> </ul>		
<b>Action</b>	<b>Specification/Repair</b>	<b>Next Step</b>
Inspect the engine harness and exhaust gas temperature #1 sensor connector pins for the following: <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.	Dirty or damaged pins? <b>YES</b> <b>Repair:</b> A damaged connection has been detected in the sensor or harness connector. Clean the connector and pins. Repair the damaged harness, connector, or pins if possible. Refer to Procedure 019-071 in Section 19.	4A
	Dirty or damaged pins? <b>NO</b>	2B

**STEP 2B: Check the circuit response.**

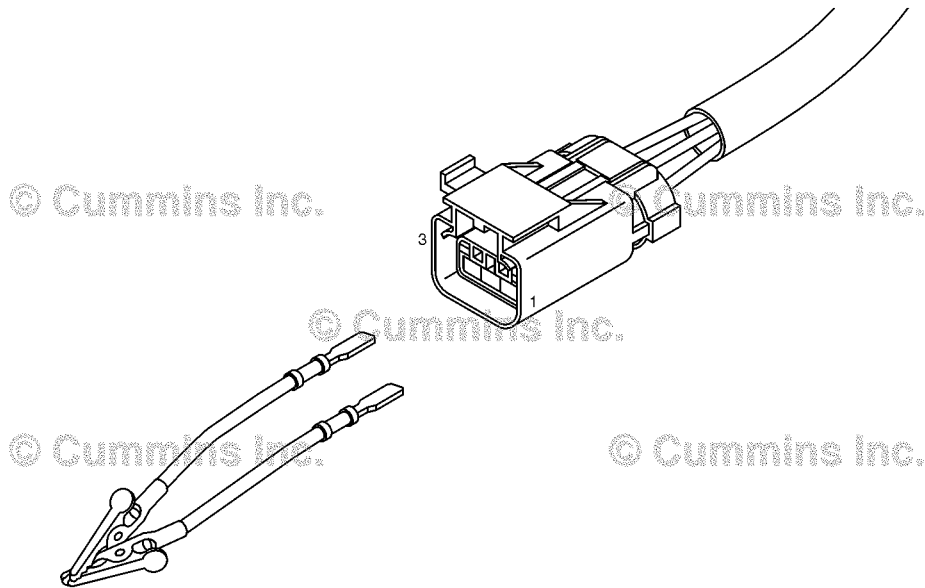
<b>Condition:</b>		
<ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the exhaust gas temperature #1 sensor from the engine harness.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
<b>Action</b>	<b>Specification/Repair</b>	<b>Next Step</b>
Check for the appropriate ECM response after 30 seconds. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 1666 active? <b>YES</b>	2C
	Fault Code 1666 active? <b>NO</b>	3A

**STEP 2C: Check the circuit response.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the exhaust gas temperature #1 sensor from the engine harness.
- Turn keyswitch ON.
- Connect INSITE™ electronic service tool.

Action	Specification/Repair	Next Step
Place a jumper wire between the exhaust gas temperature #1 SIGNAL pin and the exhaust gas temperature #1 RETURN pin at the exhaust gas temperature #1 connector of the engine harness. Refer to the wiring diagram for connector pin identification. Check the appropriate circuit response after 30 seconds.	Fault Code 1665 is active? <b>YES</b> <b>Repair:</b> Replace the exhaust gas temperature #1 sensor. Refer to Procedure 019-013 in Section 19.	4A
Check the appropriate circuit response after 30 seconds. • Use INSITE™ electronic service tool to read the fault codes.	Fault Code 1665 is active? <b>NO</b>	3A



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

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM connector.</li> </ul>		
Action	Specification/Repair	Next Step
Inspect the engine harness and ECM connector pins for the following: <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.	Dirty or damaged pins? <b>YES</b> <b>Repair:</b> A damaged connection has been detected in the ECM connector or the engine harness connector. Clean the connector and pins. Repair the damaged harness, connector, or pins if possible. Refer to Procedure 019-043 in Section 19.	4A
	Dirty or damaged pins? <b>NO</b>	3B

**STEP 3B: Check the circuit response.**

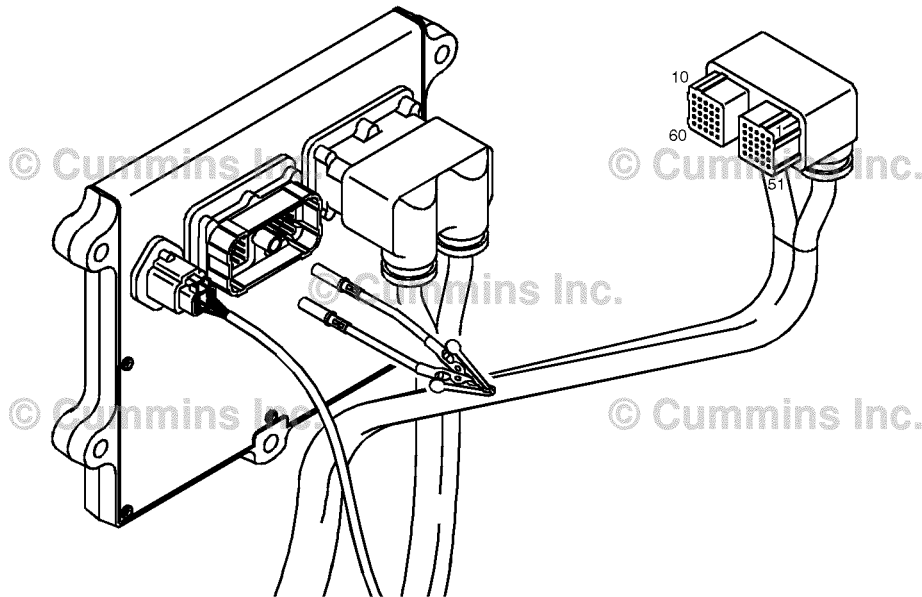
<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for the appropriate circuit response after 30 seconds. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 1666 is active? <b>YES</b>	3C
	Fault Code 1666 is active? <b>NO</b> <b>Repair:</b> Replace the ECM. Refer to Procedure 019-031 in Section 19.	4A

**STEP 3C: Check the circuit response.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine harness from the ECM.
- Turn keyswitch ON.
- Connect INSITE™ electronic service tool.

Action	Specification/Repair	Next Step
Place a jumper wire between the exhaust gas temperature #1 SIGNAL pin and exhaust gas temperature #1 RETURN pin at the ECM connector.  Check for the appropriate circuit response after 30 seconds.  • Use INSITE™ electronic service tool to read the fault codes.	Fault Code 1665 is active?  <b>YES</b>  <b>Repair:</b>  High resistance or a short circuit has been detected in the engine harness.  Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.	4A
	Fault Code 1665 is active?  <b>NO</b>  <b>Repair:</b>  Replace the ECM. Refer to Procedure 019-031 in Section 19.	4A





**STEP 4: Clear the fault code.**

**STEP 4A: Verify the repair.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Start the INSITE™ electronic service tool Data Monitor/Logger.</p> <ul style="list-style-type: none"> <li>• Compare the INSITE™ electronic service tool reading for Catalyst Inlet Temperature and Catalyst Outlet Temperature.</li> </ul>	<p>Catalyst Inlet Temperature and Catalyst Outlet Temperature reading within 13.9°C or 25°F of each other?</p> <p><b>YES</b></p>	4B
	<p>Catalyst Inlet Temperature and Catalyst Outlet Temperature reading within 13.9°C or 25°F of each other?</p> <p><b>NO</b></p>	1A

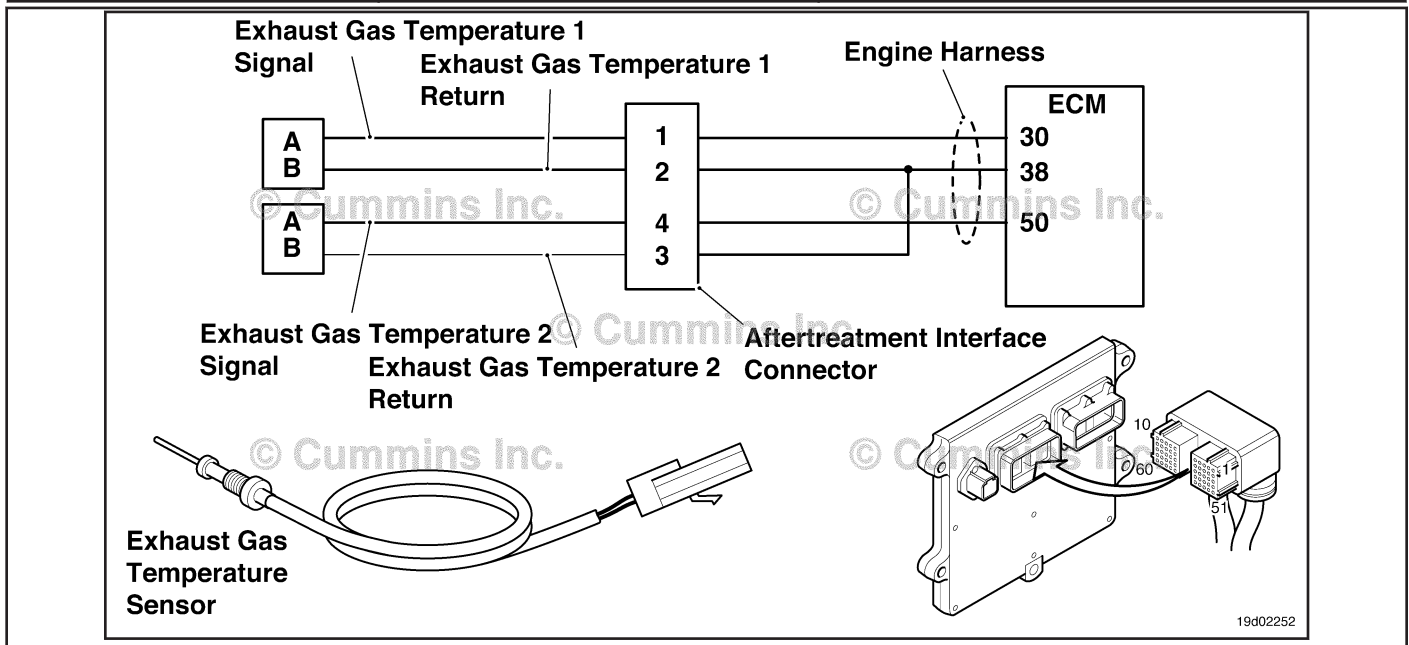
**STEP 4B: Clear the fault codes.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Clear the fault codes.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to erase all active and inactive fault codes.</li> </ul>	<p>All fault codes cleared?</p> <p><b>YES</b></p>	Repair complete
	<p>All fault codes cleared?</p> <p><b>NO</b></p>	Appropriate troubleshooting steps

## Fault Code 1851

### Exhaust Gas Temperature 2 — Abnormal Rate of Change

CODES	REASON	EFFECT
Fault Code: 1851 PID(P), SID(S): SPN: 3249 FMI: 10 Lamp: Amber SRT:	Exhaust Gas Temperature 2 — Abnormal Rate of Change. The catalyst outlet temperature sensor is not responding to a change in engine operating conditions.	Default temperature value used for catalyst outlet temperature.



Circuit: Exhaust Gas Temperature 2

#### Circuit Description:

The exhaust gas temperature #2 sensor is used by the electronic control module (ECM) to monitor the engine exhaust temperature entering the catalyst unit. The ECM monitors the voltage on the signal pin and converts this to a temperature value.

#### Component Location:

The catalyst inlet temperature #2 sensor is located in the aftertreatment system. It is located between the turbocharger exhaust and the catalyst unit exhaust in the exhaust system.

#### Shop Talk:

The exhaust gas temperature #2 is monitored during engine warm-up. If the exhaust gas temperature 2 reading is not changing to match the engine operating conditions, the exhaust gas temperature 2 sensor is then determined to be stuck in-range and this fault code is logged. The ECM must not see engine speed for a period of eight hours before this diagnostic will run.

Possible causes of this fault code include:

- Stuck in-range exhaust gas temperature #2 sensor reading
- High resistance in the exhaust gas temperature #2 sensor signal or return lines.

On-Board Diagnostics (OBD) Information (Euro 4 and Euro 4 Stage 1+ Certified Engines):

- The ECM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The ECM turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does **not** fail. The MIL lamp and fault code can also be cleared using the INSITE™ service tool.
- The fault code will be cleared from memory after 40 consecutive drive cycles where the diagnostic runs and passes.

**Refer to Troubleshooting Fault Code t05-1851**

## FAULT CODE 1851 - Exhaust Gas Temperature 2 - Abnormal Rate of Change

### TROUBLESHOOTING SUMMARY



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



To reduce the possibility of pin and harness damage, use the following test leads when taking a measurement: Part Number 3822758 - male Deutsch™/AMP™/Metri-Pack™ test lead and Part Number 3822917 - female Deutsch™/AMP™/Metri-Pack™ test lead.

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1: Check for sensor circuit fault codes.</b>		
<b>STEP 1A:</b> Check for Fault Codes 1674 and 1675.	Fault Code 1674 or 1675 is active?	
<b>STEP 2: Check the exhaust gas temperature #2 sensor and circuit.</b>		
<b>STEP 2A:</b> Inspect the exhaust gas temperature #2 sensor and connector pins.	Dirty or damaged pins?	
<b>STEP 2B:</b> Check the circuit response.	Fault Code 1675 active?	
<b>STEP 2C:</b> Check the circuit response.	Fault Code 1674 active?	
<b>STEP 3: Check the ECM and engine harness.</b>		
<b>STEP 3A:</b> Inspect the ECM and engine harness connector pins.	Dirty or damaged pins?	
<b>STEP 3B:</b> Check the circuit response.	Fault Code 1675 active?	
<b>STEP 3C:</b> Check the circuit response.	Fault Code 1674 active?	
<b>STEP 4: Clear the fault codes.</b>		
<b>STEP 4A:</b> Verify the repair	Catalyst Inlet Temperature and Catalyst Outlet Temperature reading within 13.9°C or 25°F of each other?	
<b>STEP 4B:</b> Clear the fault codes.	All fault codes cleared?	

### TROUBLESHOOTING STEP

**STEP 1: Check for sensor circuit fault codes.**

**STEP 1A: Check for fault codes.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for active fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 1674 or 1675 is active? <b>YES</b>	Fault Code 1674 or 1675 troubleshooting tree.
	Fault Code 1674 or 1675 is active? <b>NO</b>	2A

**STEP 2: Check the exhaust gas temperature #2 sensor and circuit.**

**STEP 2A: Inspect the exhaust gas temperature #2 sensor and connector pins.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the exhaust gas temperature #2 sensor from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the engine harness and exhaust gas temperature #2 sensor connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A damaged connection has been detected in the sensor or harness connector.</p> <p>Clean the connector and pins.</p> <p>Repair the damaged harness, connector, or pins if possible. Refer to Procedure 019-071 in Section 19.</p>	4A
	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	2B

**STEP 2B: Check the circuit response.**

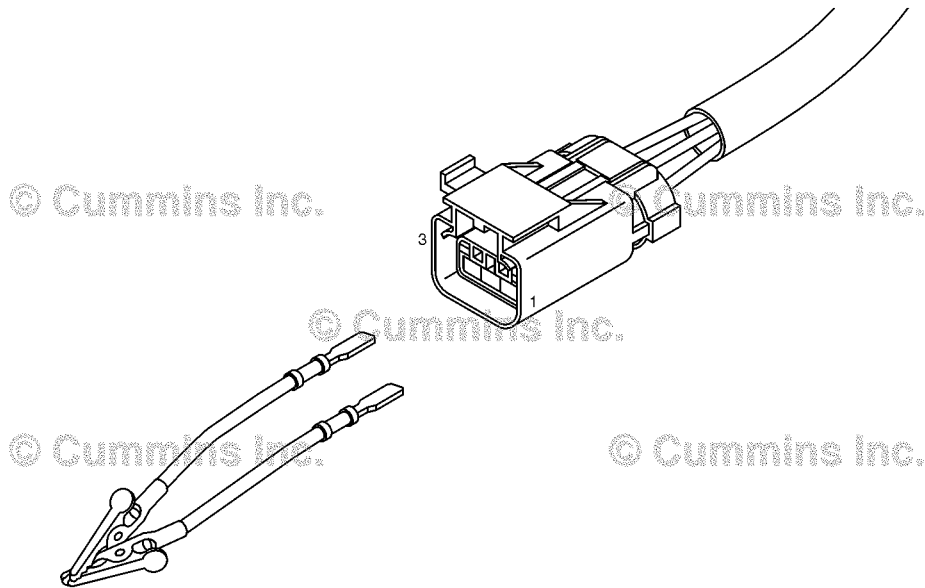
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the exhaust gas temperature #2 sensor from the engine harness.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate ECM response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault Code 1675 active?</p> <p><b>YES</b></p>	2C
	<p>Fault Code 1675 active?</p> <p><b>NO</b></p>	3A

**STEP 2C: Check the circuit response.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the exhaust gas temperature #2 sensor from the engine harness.
- Turn keyswitch ON.
- Connect INSITE™ electronic service tool.

Action	Specification/Repair	Next Step
Place a jumper wire between the exhaust gas temperature #2 SIGNAL pin and the exhaust gas temperature #2 RETURN pin at the exhaust gas temperature #2 connector of the engine harness. Refer to the wiring diagram for connector pin identification. Check the appropriate circuit response after 30 seconds.	Fault Code 1674 is active? <b>YES</b> <b>Repair:</b> Replace the exhaust gas temperature #2 sensor. Refer to Procedure 019-013 in Section 19.	4A
Check the appropriate circuit response after 30 seconds. • Use INSITE™ electronic service tool to read the fault codes.	Fault Code 1674 is active? <b>NO</b>	3A



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

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM connector.</li> </ul>		
Action	Specification/Repair	Next Step
Inspect the engine harness and ECM connector pins for the following: <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.	Dirty or damaged pins? <b>YES</b> <b>Repair:</b> A damaged connection has been detected in the ECM connector or the engine harness connector. Clean the connector and pins. Repair the damaged harness, connector, or pins if possible. Refer to Procedure 019-043 in Section 19.	4A
	Dirty or damaged pins? <b>NO</b>	3B

**STEP 3B: Check the circuit response.**

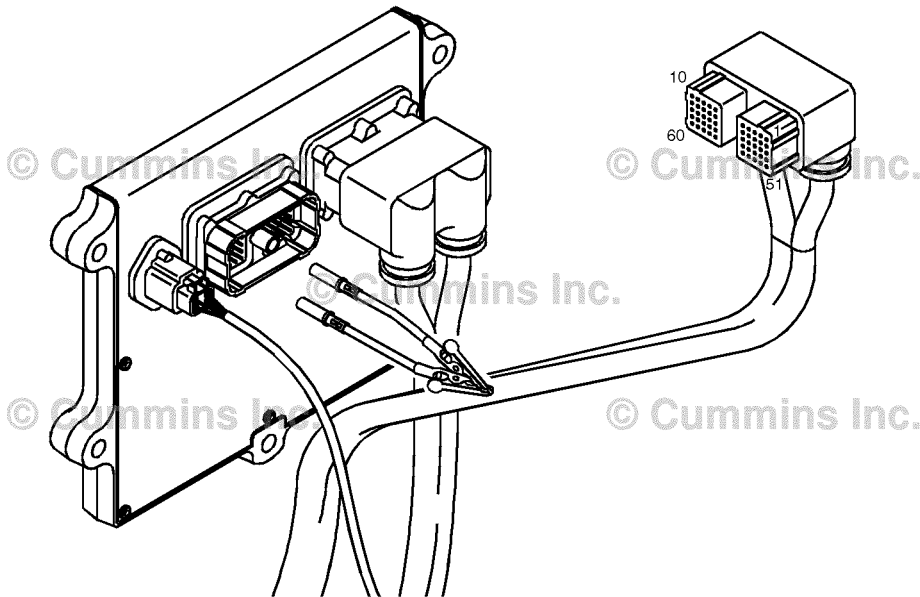
<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for the appropriate circuit response after 30 seconds. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 1675 is active? <b>YES</b>	3C
	Fault Code 1675 is active? <b>NO</b> <b>Repair:</b> Replace the ECM. Refer to Procedure 019-031 in Section 19.	4A

**STEP 3C: Check the circuit response.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine harness from the ECM.
- Turn keyswitch ON.
- Connect INSITE™ electronic service tool.

Action	Specification/Repair	Next Step
Place a jumper wire between the exhaust gas temperature #2 SIGNAL pin and exhaust gas temperature #2 RETURN pin at the ECM connector.  Check for the appropriate circuit response after 30 seconds.  • Use INSITE™ electronic service tool to read the fault codes.	Fault Code 1674 is active?  <b>YES</b>  <b>Repair:</b>  High resistance or a short circuit has been detected in the engine harness.  Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.	4A
	Fault Code 1674 is active?  <b>NO</b>  <b>Repair:</b>  Replace the ECM. Refer to Procedure 019-031 in Section 19.	4A



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**STEP 4: Clear the fault code.**

**STEP 4A: Verify the repair.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Start the INSITE™ electronic service tool Data Monitor/Logger.</p> <ul style="list-style-type: none"> <li>• Compare the INSITE™ electronic service tool reading for Catalyst Inlet Temperature and Catalyst Outlet Temperature.</li> </ul>	<p>Catalyst Inlet Temperature and Catalyst Outlet Temperature reading within 13.9°C or 25°F of each other?</p> <p><b>YES</b></p>	4B
	<p>Catalyst Inlet Temperature and Catalyst Outlet Temperature reading within 13.9°C or 25°F of each other?</p> <p><b>NO</b></p>	1A

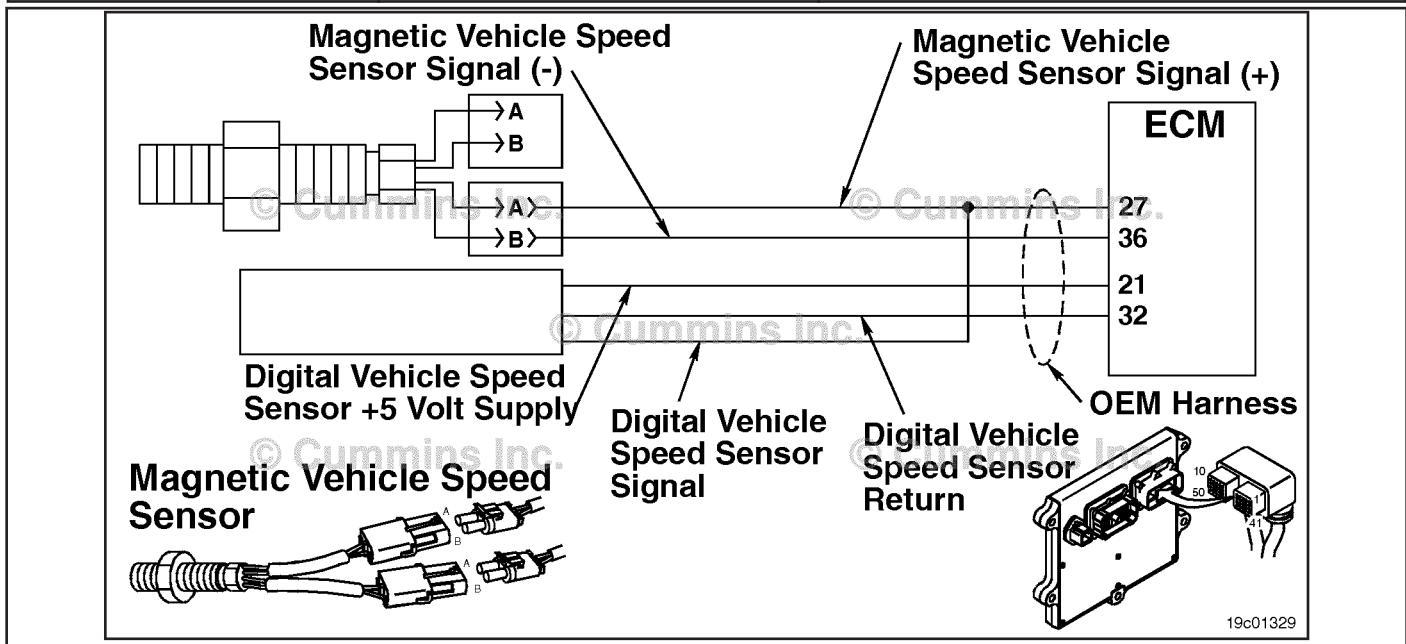
**STEP 4B: Clear the fault codes.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Clear the fault codes.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to erase all active and inactive fault codes.</li> </ul>	<p>All fault codes cleared?</p> <p><b>YES</b></p>	Repair complete
	<p>All fault codes cleared?</p> <p><b>NO</b></p>	Appropriate troubleshooting steps

## Fault Code 1892

### Wheel-Based Vehicle Speed — Data Valid but Below Normal Operational Range — Moderately Severe Level

CODES	REASON	EFFECT
Fault Code: 1892 PID(P), SID(S): P84 SPN: 84 FMI: 1/18 Lamp: Amber SRT:	Wheel-Based Vehicle Speed — Data Valid but Below Normal Operational Range — Moderately Severe Level. The ECM lost the vehicle speed signal.	Engine speed limited to Maximum Engine Speed without VSS parameter value. Cruise control, Gear-Down Protection, and Road Speed Governor will <b>not</b> work.



**Circuit Description:**

The vehicle speed sensor senses the speed of the tailshaft gear on the vehicle's transmission. This speed signal is then transmitted to the engine electronic control module (ECM) and converted into a vehicle speed.

**Component Location:**

The vehicle speed sensor is located in the rear of the vehicle transmission. Refer to the OEM troubleshooting and repair manual.

**Shop Talk:**

There are multiple types of vehicle speed sensors. Various types include magnetic pickup, data link, digital, and tachograph. Refer to your OEM for the specific type installed on the vehicle.

This fault is set active when the ECM loses a vehicle speed signal when other engine conditions indicate the vehicle is moving. The fault can also become active if there is a series of clutch, service brake or throttle movements with no vehicle movement. The fault is set inactive when the ECM receives a vehicle speed signal greater than zero.

Since the vehicle speed sensor is an OEM installed component, this troubleshooting procedure will **not** catch all failures of the circuit due to components **not** under Cummins Inc. control. Sensor resistance values, data link speed sensors and tachographs are **not** fully covered under this procedure. For more information on those components, please refer to the OEM troubleshooting and repair manual.

On-Board Diagnostics (OBD) Information:

- The ECM illuminates the malfunction indicator lamp (MIL) when the diagnostic runs and fails.
- The ECM turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does **not** fail. The MIL lamp and fault code can also be cleared using the INSITE™ service tool.
- The fault code will be cleared from memory after 40 consecutive drive cycles where the diagnostic runs and passes.

**Refer to Troubleshooting Fault Code t05-1892**

FAULT CODE 1892 - Wheel-Based Vehicle Speed - Data Valid but Below Normal Operational Range - Moderately Severe Level
TROUBLESHOOTING SUMMARY



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



To reduce the possibility of pin and harness damage, use the following test leads when taking a measurement: Part Number 3822758 - male Deutsch/AMP/Metri-Pack test lead and Part Number 3822917 - female Deutsch/AMP/Metri-Pack test lead.

Table with 3 columns: STEPS, SPECIFICATIONS, and SRT CODE. It lists troubleshooting steps from STEP 1 to STEP 4, including sub-steps like STEP 1A, STEP 2A-E, STEP 3A-B, and STEP 4A-B, with corresponding specifications and SRT codes.

**TROUBLESHOOTING STEP****STEP 1: Check the vehicle speed sensor setting in INSITE™ electronic service tool.****STEP 1A: Verify that the vehicle speed sensor and the setting in INSITE™ electronic service tool match.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Use INSITE™ electronic service tool, go to the Vehicle Speed Source feature under Adjustments, Features and Parameters. <ul style="list-style-type: none"> <li>• Verify that the vehicle speed sensor type parameter in INSITE™ electronic service tool matches the physical sensor type on the vehicle.</li> </ul>	The setting in INSITE™ electronic service tool matches the speed sensor type on the vehicle? <b>YES</b>	2A
	The setting in INSITE™ electronic service tool matches the speed sensor type on the vehicle? <b>NO</b> <b>Repair:</b> Change the setting in the ECM with INSITE™ electronic service tool to match the vehicle speed sensor type.	4A

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

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the OEM harness from the vehicle speed sensor.</li> </ul>		
Action	Specification/Repair	Next Step
Inspect the OEM harness and sensor connector pins for the following: <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.	Dirty or damaged pins? <b>YES</b> <b>Repair:</b> A damaged connection has been detected in the sensor or harness connector. <ul style="list-style-type: none"> <li>• Clean the connector and pins.</li> <li>• Repair the damaged harness, connector or pins, if possible.</li> </ul> Refer to Procedure 019-071 in Section 19.	4A
		Dirty or damaged pins? <b>NO</b>

**STEP 2B: Inspect the OEM harness connector pins at the ECM.**

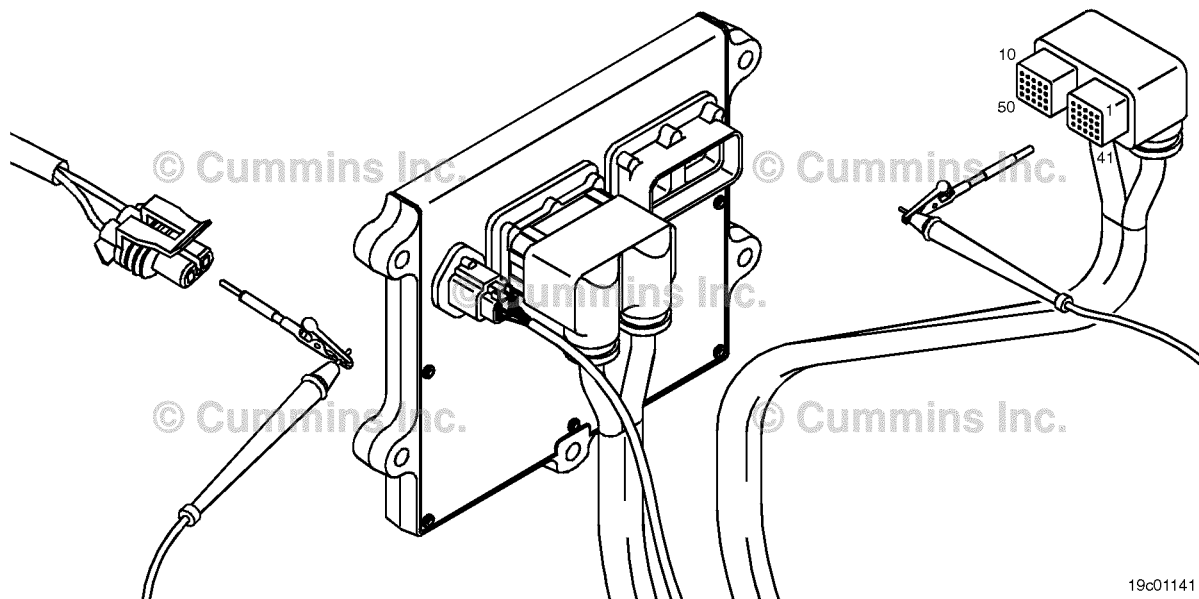
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the OEM harness from the ECM.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the OEM harness and the ECM connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A damaged connection has been detected in the sensor or harness connector.</p> <ul style="list-style-type: none"> <li>• Clean the connector and pins.</li> <li>• Repair the damaged harness, connector or pins, if possible.</li> </ul> <p>Refer to Procedure 019-071 in Section 19.</p>	<p>4A</p>
<p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	<p>2C</p>

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

**Condition:**

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

Action	Specification/Repair	Next Step
<p>Use a multimeter, check for an open circuit in the OEM harness.</p> <ul style="list-style-type: none"> <li>• Measure the resistance of the magnetic vehicle speed sensor SIGNAL (+) wire between the OEM harness ECM connector and the OEM harness magnetic vehicle speed sensor connector.</li> <li>• Measure the resistance of the magnetic vehicle speed sensor SIGNAL (-) wire between the OEM harness ECM connector and the OEM harness magnetic vehicle speed sensor connector.</li> </ul> <p>Refer to the wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Less than 10 ohms? <b>YES</b></p>	<p>2D</p>
	<p>Less than 10 ohms? <b>NO</b></p> <p><b>Repair:</b> An open circuit has been detected in the OEM harness. Repair or replace the OEM harness. Refer to Procedure 019-071 in Section 19.</p>	<p>4A</p>



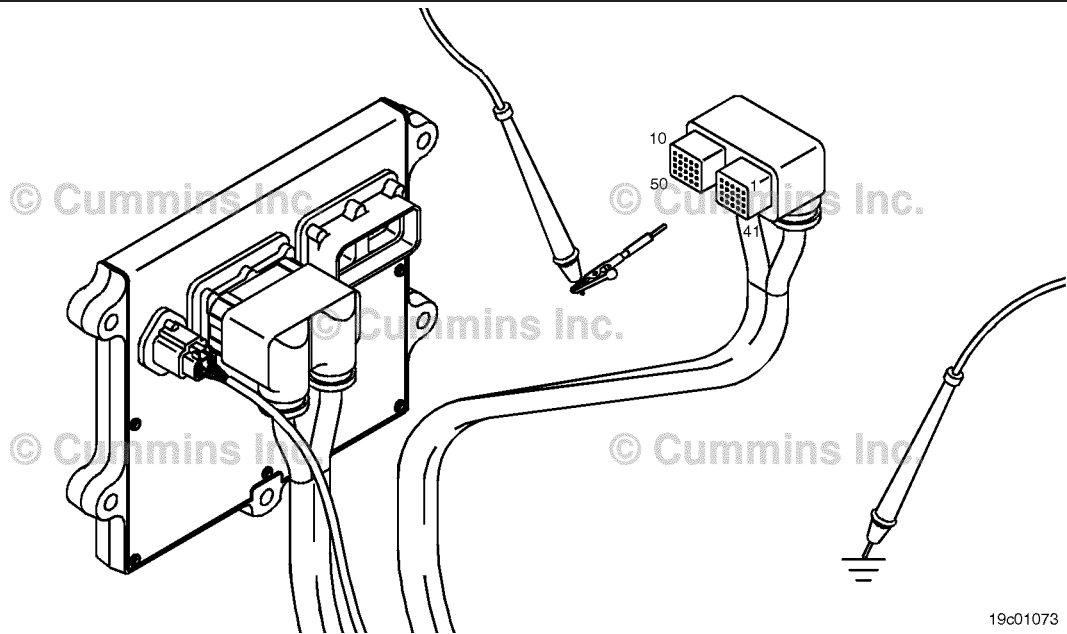
19c01141

**STEP 2D: Check for a short circuit to ground in the OEM harness.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the OEM harness connector from the ECM.
- Disconnect the OEM harness from the vehicle speed sensor.

Action	Specification/Repair	Next Step
<p>Check for a short circuit to ground on the magnetic vehicle speed sensor SIGNAL (+) and magnetic vehicle speed sensor SIGNAL (-) circuit in the OEM harness.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the magnetic vehicle speed sensor SIGNAL (+) at the ECM connector to engine block ground.</li> <li>• Measure the resistance between the magnetic vehicle speed sensor SIGNAL (-) at the ECM connector to engine block ground.</li> </ul> <p>Refer to the circuit diagram or wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>More than 100k ohms? <b>YES</b></p>	<p>2E</p>
	<p>More than 100k ohms? <b>NO</b></p> <p><b>Repair:</b></p> <p>A short circuit has been detected in the OEM harness.</p> <p>Repair or replace the OEM harness. Refer to Procedure 019-071 in Section 19.</p>	<p>4A</p>

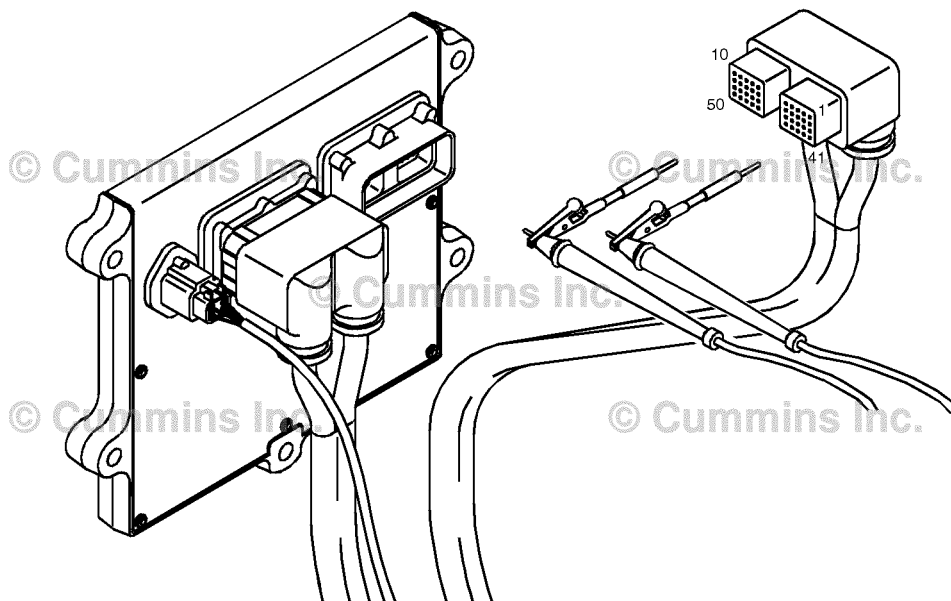


19c01073



**STEP 2E: Check for a pin-to-pin short circuit in the OEM harness.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the OEM harness from the ECM.</li> <li>• Disconnect the OEM harness from the vehicle speed sensor.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Use a multimeter, check for a pin-to-pin short circuit in the OEM harness.</p> <ul style="list-style-type: none"> <li>• Measure the resistance and check for a short circuit between the magnetic vehicle speed sensor SIGNAL (+) pin at the OEM harness ECM connector and all other pins in the connector.</li> <li>• Measure the resistance and check for a short circuit between the magnetic vehicle speed sensor SIGNAL (-) pin at the OEM harness ECM connector and all other pins in the connector.</li> </ul> <p>Refer to the wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>More than 100k ohms? <b>YES</b></p>	<p>3A</p>
	<p>More than 100k ohms? <b>NO</b></p> <p><b>Repair:</b></p> <p>A short circuit has been detected in the OEM harness.</p> <p>Repair or replace the OEM harness. Refer to Procedure 019-071 in Section 19.</p>	<p>4A</p>



19c01056

**STEP 3: Check for additional OEM devices.**

**STEP 3A: Check the vehicle speed sensor circuit for additional devices.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> </ul>		
Action	Specification/Repair	Next Step
Inspect the vehicle speed sensor circuit for any additional or extra devices that can interfere with the speed signal. -	Extra devices? <b>YES</b> <b>Repair:</b> Remove the device or contact an OEM representative.	4A
	Extra devices? <b>NO</b>	3B

**STEP 3B: Check for the gear slipping on the shaft.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Remove the vehicle speed sensor from the transmission.</li> </ul>		
Action	Specification/Repair	Next Step
Inspect the gear or tone wheel on the rear of the transmission where the speed sensor picks up the speed signal. Make sure the gear or tone wheel is not damaged or slipping on the shaft. -	Gear or tone wheel damaged or slips? <b>YES</b> <b>Repair:</b> Repair or replace the gear or tone wheel. Refer to the OEM service manual.	4A
	Gear or tone wheel damaged or slips? <b>NO</b>	4A

**STEP 4: Clear the fault codes.**

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

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> <li>• Start the engine and move the vehicle so that the ECM can read a vehicle speed.</li> <li>• Use INSITE™ electronic service tool to verify that Fault Code 1892 is inactive.</li> </ul>	Fault Code 1892 inactive? <b>YES</b>	4B
	Fault Code 1892 inactive? <b>NO</b> <b>Repair:</b> Return to the troubleshooting steps or contact your local Cummins® Authorized Repair Location or OEM dealer if all the steps have been completed and checked again.	1A

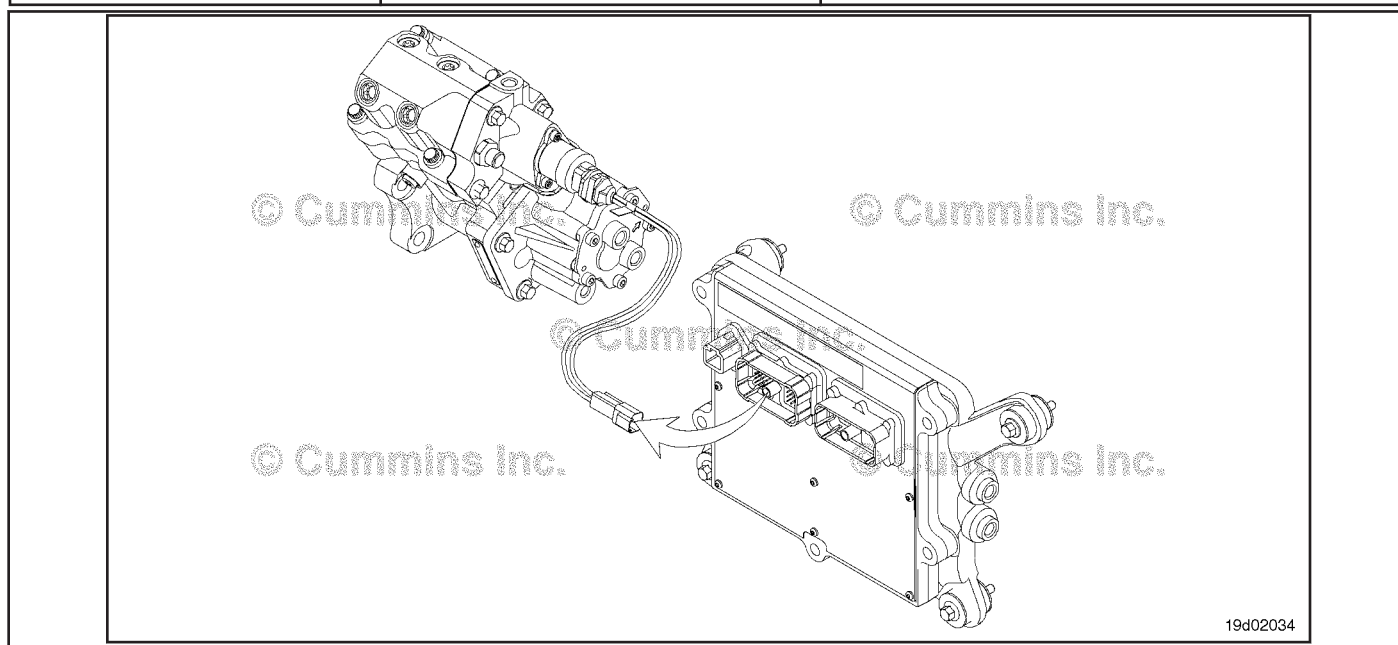
**STEP 4B: Clear the inactive fault codes.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to erase the inactive fault codes.</li> </ul>	All fault codes cleared? <b>YES</b>	Repair complete
	All fault codes cleared? <b>NO</b> <b>Repair:</b> Troubleshoot any remaining fault codes.	Appropriate troubleshooting steps

## Fault Code 1911

### Injector Metering Rail Number 1 Pressure - Data Valid But Above Normal Operating Range - Most Severe Level

CODES	REASON	EFFECT
Fault Code: 1911 PID(P), SID(S): P157 SPN: 157 FMI: 0 Lamp: Amber SRT:	Injector Metering Rail Number 1 Pressure - Data Valid But Above Normal Operating Range - Most Severe Level. Fuel pressure signal indicates that fuel pressure has exceeded the maximum limit for the given engine rating.	None, or possible engine noise associated with higher injection pressure (especially at idle or light load). Engine power is reduced.



Fuel System

#### **Circuit Description:**

The electronic control module (ECM) monitors engine-operating conditions, including the reading of rail fuel pressure, and changes the flow command to either increase (OPEN the fuel pump actuator) or decrease (CLOSE the fuel pump actuator) the fuel supply to the high-pressure pump.

#### **Component Location:**

The fuel pump actuator is installed on the high-pressure fuel pump.

#### **Shop Talk:**

Fault Code 1911 is activated when the sensed rail fuel pressure reaches the opening pressure of the rail fuel pressure relief valve. Sensed pressure has exceeded system target range.

In normal engine operation, the ECM calibration varies the flow commanded to the fuel pump actuator to achieve the correct fuel rail pressure. System issues that result in a loss of pressure control can cause the rail pressure to exceed the normal operating pressures and open the pressure relief valve. If the ECM detects that the fuel rail pressure relief valve is open without detection of a fuel pump actuator circuit error, Fault Code 1911 will become active. On certain applications, the ECM will attempt to reset automatically causing a momentary loss of power for less than 1 second.

Conditions that can cause Fault Code 1911:

- Purging air through the fuel system can cause a pressure overshoot, therefore causing Fault Code 1911 to log. A few bubbles exiting the line during the air in fuel test is expected. A foamy appearance is an indication of a leak that allows air to enter, a severe inlet restriction that causes cavitation, or a system that is **not** yet primed. If fuel inlet restriction is **not** excessive, the source of air entry should be isolated to one of the following: Suction fuel lines, OEM fuel lines, suction-side fuel filter assemblies, or stand-pipe(s) in the fuel tank(s).
- Sustained periods of very low pressure under load are followed by pressure recovery overshoot. This can be caused by high restriction due to plugged filters (Fault Code 559), a tampered fuel pressure sensor that reads low, a biased pressure sensor, or a poor electrical connection.
- If an intermittent electrical circuit problem with the fuel pump actuator circuit exists, it is possible for Fault Code 1911 to become active, then inactive during normal engine operation. ECM Fault Code 2311 is designed to detect electrical circuit issues with the actuator. Therefore, it is **only** necessary to inspect for bad connectors or harness issues for Fault Code 1911 if no other fault codes exist. An electric fuel control actuator with excessive leakage will result in high rail fuel pressures at idle or light load.
- Other conditions include ECM wiring harness issues such as poor grounds, battery voltage spikes, electrical noise, low alternator output, and large disturbances of battery voltage, as when jump-starting the vehicle.
- The fuel rail pressure sensor should also be checked. When checking the fuel rail pressure sensor accuracy, make sure the high-pressure fuel rail is **not** pressurized. The fuel pump, high-pressure fuel lines, and fuel rail contain very high-pressure fuel. Do **not** loosen any fittings while the engine is operating. Wait at least 10 minutes after shutting down the engine before loosening any fittings in the high-pressure fuel system to allow pressure to decrease to a lower level. There could be a significant amount of time waiting for the rail to depressurize to zero on some engines. In such cases, it may be necessary to manually relieve the pressure from the high-pressure fuel rail.

**Refer to Troubleshooting Fault Code 1911.**

FAULT CODE 1911 - Injector Metering Rail Number 1 Pressure - Data Valid But Above Normal Operating Range - Most Severe Level
TROUBLESHOOTING SUMMARY

Table with 3 columns: STEPS, SPECIFICATIONS, and SRT CODE. It lists troubleshooting steps from STEP 1 to STEP 6, including sub-steps like STEP 1A, STEP 2A, etc., and their corresponding specifications.

**STEP 6D:** Check for an intermittent engine harness failure. Fault Codes 2311, 271, and/or 272 become active?

**STEP 7:** Clear the fault codes.

**STEP 7A:** Disable the fault code. Fault codes inactive?

**STEP 7B:** Clear the inactive fault codes. All fault codes cleared?

### TROUBLESHOOTING STEP

**STEP 1: Check the fault codes.**

**STEP 1A: Read the fault codes.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>Connect INSITE™ electronic service tool.</li> <li>Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
Read the fault codes. <ul style="list-style-type: none"> <li>Start the engine and let it idle for 1 minute.</li> <li>Use INSITE™ electronic service tool to read the fault codes.</li> <li>Check for fault codes related to the fuel pump actuator shorted low or high.</li> </ul>	Fault Code(s) 271, 272, 559, 2311, or 1117 active or high inactive counts? <b>YES</b>	Appropriate Troubleshooting Tree
	Fault Code(s) 271, 272, 559, 2311, or 1117 active or high inactive counts? <b>NO</b>	2A

**STEP 2: Check the rail fuel pressure sensor.**

**STEP 2A: Verify that the rail fuel pressure sensor reads in-range.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>Connect INSITE™ electronic service tool.</li> <li>Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
Verify the sensor reads in-range.	Pressure 0 ± 40 bar [0 ± 580 psi]? <b>YES</b>	2B
	Pressure 0 ± 40 bar [0 ± 580 psi]? <b>NO</b> <b>Repair:</b> The fuel pressure sensor is incorrectly reading a fuel pressure. Replace the rail fuel pressure sensor. Refer to Procedure 019-115 in Section 19.	7A

**STEP 2B: Inspect the fuel pressure sensor SIGNAL wire and connector pins.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect ECM from engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the fuel pressure sensor SIGNAL wire and connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris on or in the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A damaged connection has been detected in the sensor or harness connector.</p> <ul style="list-style-type: none"> <li>• Clean the connector and pins.</li> <li>• Repair the damaged harness, connector, or pins.</li> </ul> <p>Refer to Procedure 019-043 in Section 19.</p>	<p>7A</p>
<p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p> <p>Note: A bad connection on the fuel pressure sensor SIGNAL wire can cause the signal reading to fluctuate and cause this fault code to become active on an intermittent basis.</p>	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	<p>3A</p>



**STEP 3: Perform preliminary fuel system checks.**

**STEP 3A: Check the fuel inlet restriction.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Operate the engine.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check the fuel inlet restriction.</p> <ul style="list-style-type: none"> <li>• Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 006-020 in Section 6.</li> <li>• Use the following procedure in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4, and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418. Refer to Procedure 006-020 in Section 6.</li> </ul>	<p>Fuel inlet restriction within the specifications outlined in Procedure 006-020 in Section 6?</p> <p><b>YES</b></p>	3B
	<p>Fuel inlet restriction within the specifications outlined in Procedure 006-020 in Section 6?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>If inlet restriction is excessive, search for the root cause:</p> <ul style="list-style-type: none"> <li>• Suction side fuel filters plugged</li> <li>• Fuel heater valves are restricted</li> <li>• OEM fuel lines pinched or restricted</li> <li>• Fuel tank stand pipes restricted</li> </ul> <p>If the fuel inlet restriction is too high, check the OEM fuel lines from the tank for proper size. Make certain there are no kinks or bends in the fuel lines and the fuel lines are <b>not</b> clogged.</p> <p>Check the OEM fuel supply tanks for debris (plastic , paper, etc.) that could intermittently block the fuel pickup tubes.</p> <p>Check the OEM fuel lines for internal damage, such as damaged wall linings, that could intermittently block fuel flow.</p> <p>Make sure there are no clogged OEM fuel strainers, filters, or malfunctioning check valves.</p> <p>If no issues are found, replace the suction side fuel filter and prime the fuel system.</p> <ul style="list-style-type: none"> <li>• Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 006-015 in Section 6.</li> <li>• Use the following procedure in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4, and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418. Refer to Procedure 006-015 in Section 6.</li> </ul>	7A

**STEP 3B: Check the fuel filter pressure drop.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Operate the engine.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check the fuel pressure drop across the filter.</p> <ul style="list-style-type: none"> <li>• Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 006-015 in Section 6.</li> <li>• Use the following procedure in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4, and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418. Refer to Procedure 006-015 in Section 6.</li> </ul>	<p>Fuel pressure drop within the specifications outlined in Procedure 006-015?</p> <p><b>YES</b></p>	<p>3C</p>
	<p>Fuel pressure drop within the specifications outlined in Procedure 006-015?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Make sure the filter pump pressure into the filter is within specification.</p> <ul style="list-style-type: none"> <li>• Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 006-015 in Section 6.</li> <li>• Use the following procedure in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4, and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418. Refer to Procedure 006-015 in Section 6.</li> </ul> <p>If the pump meets specifications, replace the fuel filter and prime the fuel system.</p> <ul style="list-style-type: none"> <li>• Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 006-015 in Section 6.</li> <li>• Use the following procedure in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4, and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418. Refer to Procedure 006-015 in Section 6.</li> </ul>	<p>7A</p>

**STEP 3C: Check for air in the fuel.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Operate the engine.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for air in the fuel.</p> <ul style="list-style-type: none"> <li>• Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 006-003 in Section 6.</li> <li>• Use the following procedure in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4, and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418. Refer to Procedure 006-003 in Section 6.</li> </ul>	<p>Air in fuel?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A few bubbles exiting the line during the test is expected.</p> <p>A foamy appearance is an indication of a leak that allows air to enter, a severe inlet restriction that causes cavitation, or a system that is <b>not</b> yet primed.</p> <p>The source of air entry should be isolated to one for the following:</p> <ul style="list-style-type: none"> <li>• Suction fuel lines</li> <li>• OEM fuel lines</li> <li>• Suction-side fuel filter assemblies</li> <li>• Stand-pipe(s) in the fuel tank(s)</li> </ul>	<p>7A</p>
	<p>Air in fuel?</p> <p><b>NO</b></p>	<p>4A</p>

**STEP 4: Check drain line restriction.**

**STEP 4A: Check drain line restriction.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Operate the engine.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for excessive fuel drain line restriction.</p> <ul style="list-style-type: none"> <li>• Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 006-012 in Section 6.</li> <li>• Use the following procedure in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4, and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418. Refer to Procedure 006-012 in Section 6.</li> </ul>	<p>Fuel drain line restriction is within the specifications outlined in Procedure 006-012?</p> <p><b>YES</b></p>	5A
	<p>Fuel drain line restriction is within the specifications outlined in Procedure 006-012?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Repair the source of the high fuel drain line restriction.</p> <ul style="list-style-type: none"> <li>• Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 006-012 in Section 6.</li> <li>• Use the following procedure in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4, and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418. Refer to Procedure 006-012 in Section 6.</li> </ul>	7A

**STEP 5: Check the fuel pump actuator.**

**STEP 5A: Check the fuel pump actuator and harness connector pins.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the fuel pump actuator from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the fuel pump actuator, pigtail wires, and harness connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris on or in the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <ul style="list-style-type: none"> <li>• Repair the connector and pins.</li> <li>• Repair the damaged harness, connectors, or pins, if possible.</li> </ul> <p>Refer to Procedure 019-043 in Section 19.</p>	7A
	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	5B

**STEP 5B: Check the fuel pump actuator resistance.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the fuel pump actuator from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check the fuel pump actuator resistance.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the fuel pump actuator SIGNAL pin and the fuel pump actuator RETURN pin at the actuator connector.</li> </ul> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Greater than 0 ohms and less than 5 ohms?</p> <p><b>YES</b></p>	5C
	<p>Greater than 0 ohms and less than 5 ohms?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Replace the fuel pump actuator. Refer to Procedure 019-117 in Section 19.</p>	7A

**STEP 5C: Check the fuel pump actuator for a short to ground.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the fuel pump actuator from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check the fuel pump actuator for a short to ground.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the fuel pump actuator SIGNAL pin and the engine block ground.</li> </ul>	<p>Greater than 100 ohms?</p> <p><b>YES</b></p>	5D
	<p>Greater than 100 ohms?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Replace the fuel pump actuator. Refer to Procedure 019-117 in Section 19.</p>	7A

**STEP 5D: Monitor the fuel rail pressure at idle.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> <li>• Start the engine.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Operate the engine at idle for at least 1 minute to purge air induced from the previous steps.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to monitor commanded fuel rail pressure and measured fuel rail pressure.</li> </ul>	<p>Does measured fuel rail pressure deviate more than 200 bar [2901 psi] and surge at idle?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Replace the fuel pump actuator. Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 005-007 in Section 5.</p>	7A
	<p>Does measured fuel rail pressure deviate more than 200 bar [2901 psi] and surge at idle?</p> <p><b>NO</b></p>	5E

**STEP 5E: Inspect the fuel pump actuator for damage.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Remove the fuel pump actuator. Refer to Procedure 019-117 in Section 19.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the fuel pump actuator o-rings for damage.</p> <p>-</p>	<p>O-rings on the fuel pump actuator damaged?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Replace the fuel pump actuator o-rings. Refer to Procedure 019-117 in Section 19.</p>	7A
	<p>O-rings on the fuel pump actuator damaged?</p> <p><b>NO</b></p>	6A

**STEP 6: Check the engine harness.**

**STEP 6A: Inspect the engine harness ECM connector pins.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the engine harness and ECM connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris on or in the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A damaged connection has been detected in the connector or engine harness connector.</p> <ul style="list-style-type: none"> <li>• Clean the connector and pins.</li> <li>• Repair the damaged harness, connector, or pins, if possible.</li> </ul> <p>Refer to Procedure 019-043 in Section 19.</p>	7A
	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	6B

**STEP 6B: Check the engine harness resistance.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Connect the fuel pump actuator to the engine harness.</li> <li>• Disconnect the engine harness from the ECM.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check the engine harness resistance.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the fuel pump actuator SIGNAL pin and the fuel pump actuator RETURN pin at the ECM connector of the engine harness.</li> </ul> <p>Refer to the wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Less than 5 ohms?</p> <p><b>YES</b></p>	6C
	<p>Less than 5 ohms?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.</p>	7A

**STEP 6C: Check the engine harness for a short to ground.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the fuel pump actuator from the engine harness.</li> <li>• Disconnect the engine harness from the ECM.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check the engine harness for a short to ground.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the fuel pump actuator SIGNAL pin and the ECM connector of the engine harness and engine block ground.</li> </ul>	<p>Greater than 100k ohms?</p> <p><b>YES</b></p>	6D
	<p>Greater than 100k ohms?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.</p>	7A

**STEP 6D: Check for an intermittent engine harness malfunction.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Engine operating at low idle.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check got an intermittent engine harness connection or malfunction.</p> <ul style="list-style-type: none"> <li>• Manipulate the engine harness, starting at the ECM engine harness connector and working to the fuel pump actuator.</li> </ul> <p>If the short or open circuit is induced while the engine is operating, the fuel rail pressure relief valve will open.</p>	<p>Fault Codes 2311, 271, and/or 272 become active?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>An intermittent connection has been detected in the engine harness.</p> <p>Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.</p>	7A
	<p>Fault Codes 2311, 271, and/or 272 become active?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Replace the fuel pump actuator. Refer to Procedure 019-117 in Section 19.</p>	7A



**STEP 7: Clear the fault codes.**

**STEP 7A: Disable the fault code.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Connect INSITE™ electronic service tool.</li> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to verify the fault codes are inactive.</li> </ul>	Fault codes inactive? <b>YES</b>	7B
	Fault codes inactive? <b>NO</b> <b>Repair:</b> Return to the troubleshooting steps or contact a Cummins® Authorized Repair Location if all steps have been completed and checked again.	1A

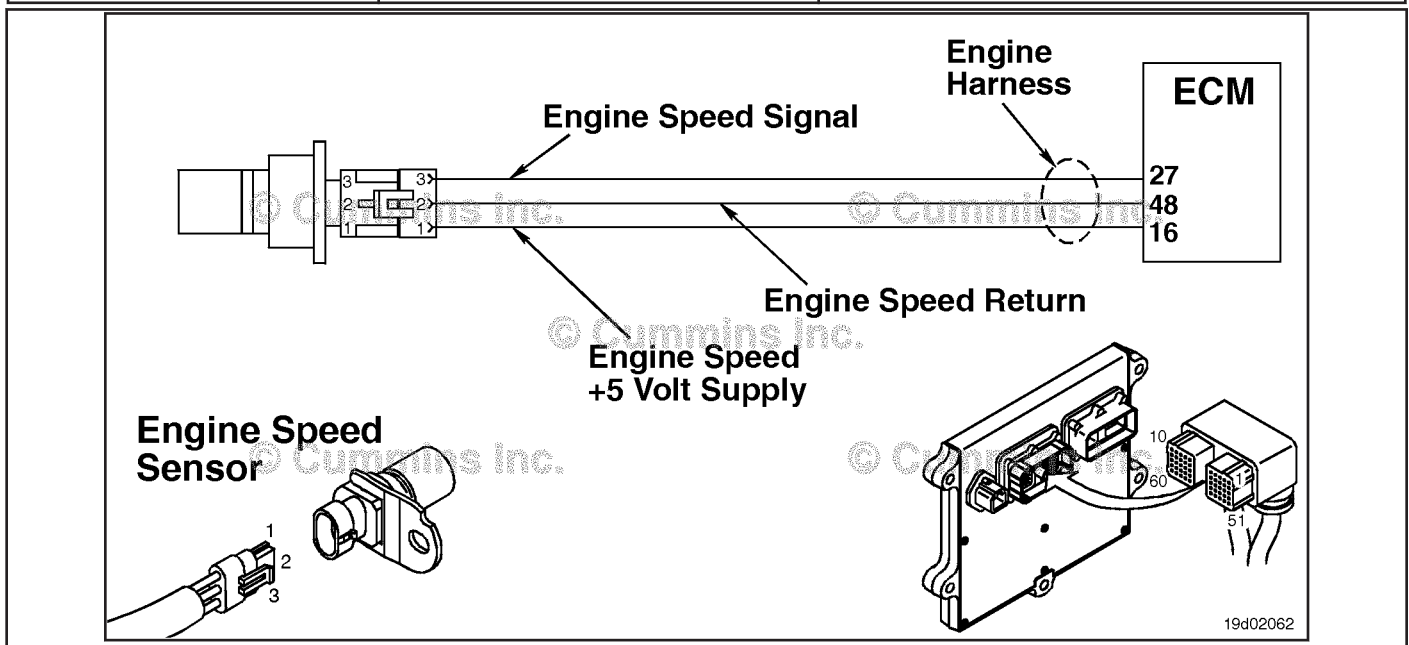
**STEP 7B: Clear the inactive fault codes.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Connect INSITE™ electronic service tool.</li> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to clear the inactive fault codes.</li> </ul>	All fault codes cleared? <b>YES</b>	Repair complete
	All fault codes cleared? <b>NO</b> <b>Repair:</b> Troubleshoot any remaining active fault codes.	Appropriate troubleshooting steps

## Fault Code 1992

### Engine Crankshaft Speed/Position - Data Valid but Above Normal Operational Range - Moderately Severe Level

CODES	REASON	EFFECT
Fault Code: 1992 PID(P), SID(S): SPN: 190 FMI: 0/16 Lamp: Red SRT:	Engine Crankshaft Speed/Position - Data Valid but Above Normal Operational Range - Moderately Severe Level. Engine crankshaft speed/position SIGNAL indicates engine speed above engine protection limit.	Engine shutdown.



Engine Crankshaft Speed/Position Sensor Circuit

**Circuit Description:**

The engine crankshaft speed/position sensor and the engine camshaft speed/position sensor provide engine speed and position information to the ECM through the engine harness.

**Component Location:**

The engine crankshaft speed/position sensor is located on the ECM side of the engine, behind the oil filters. The engine camshaft speed/position sensor is located above the fuel pump, in back of the gear housing. Refer to Procedure 100-002 (Engine Diagrams) in Section E for a detailed component location view.

**Shop Talk:**

This fault code is **only** applicable to engines powering generator sets.

Possible causes of this fault code include:

- External fuel sources drawn into the intake air passage
- Reverse powering (motoring) of the engine
- Tampering of the engine crankshaft speed/position and engine camshaft speed/position sensors.

Inspect the intake manifold for sources of flammable vapors. Check the turbocharger seals to verify that there are no oil leaks. Inspect the engine crankshaft speed/position and engine camshaft speed/position sensors for damage or tampering.

**Refer to Troubleshooting Fault Code t05-1992**

FAULT CODE 1992 - Engine Crankshaft Speed/Position - Data Valid but Above Normal Operational Range - Moderately Severe Level
TROUBLESHOOTING SUMMARY



DO NOT OPERATE A DIESEL ENGINE WHERE THERE ARE OR CAN BE COMBUSTIBLE VAPORS. These vapors can be sucked through the air intake system and cause engine acceleration and overspeeding that can result in a fire, an explosion, and extensive property damage. Numerous safety devices are available, such as air intake shutoff devices, to minimize the risk of overspeeding where an engine, due to its application, might operate in a combustible environment, such as due to a fuel spill or gas leak. Remember, Cummins Inc. has no way of knowing the use you have for your engine. THE EQUIPMENT OWNER AND OPERATOR ARE RESPONSIBLE FOR SAFE OPERATION IN A HOSTILE ENVIRONMENT. CONSULT YOUR CUMMINS AUTHORIZED REPAIR LOCATION FOR FURTHER INFORMATION.



If the engine speed stays above 15 percent of rated speed, the engine must be shut off immediately or engine generator equipment damage can occur.



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

Table with 3 columns: STEPS, SPECIFICATIONS, and SRT CODE. It lists troubleshooting steps from STEP 1 to STEP 2B, including actions like 'Identify the reason for the overspeed' and 'Clear the fault codes' with corresponding specifications and SRT codes.

**TROUBLESHOOTING STEP****STEP 1: Identify the reason for the overspeed.****STEP 1A: Check for an alternate fuel source.**

<b>Condition:</b> • Turn keyswitch OFF.		
<b>Action</b>	<b>Specification/Repair</b>	<b>Next Step</b>
Check for an alternate fuel source. • Check if a fuel-controlled event occurred where the engine rapidly accelerated to or past 15 percent above rated speed, followed by moderate deceleration to 15 percent above rated speed.	Alternate fuel source? <b>YES</b> <b>Repair:</b> Locate any alternate fuel sources, such as operating the engine near flammable vapors, blown turbocharger seals, etc.	2A
	Alternate fuel source? <b>NO</b>	1B

**STEP 1B: Check the engine rpm with INSITE™ electronic service tool.**

<b>Condition:</b> • Connect INSITE™ electronic service tool • Turn keyswitch ON • Engine is running.		
<b>Action</b>	<b>Specification/Repair</b>	<b>Next Step</b>
Check the engine rpm with INSITE™ electronic service tool.  NOTE: Compare the engine crankshaft speed/position sensor reading with INSITE™ electronic service tool to a mechanical tachometer or the dash tachometer.	Correct rpm reading? <b>YES</b>	1C
	Correct rpm reading? <b>NO</b> <b>Repair:</b> Inspect the engine crankshaft speed/position sensor and engine camshaft speed/position sensor as outlined in Fault Codes 689 and 1376.	Fault Codes 689 and 1376.

**STEP 1C: Inspect the engine harness and engine crankshaft speed/position sensor connector pins.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF</li> <li>• Disconnect the engine harness connector from the engine crankshaft speed/position sensor connector.</li> </ul>		
Action	Specification/Repair	Next Step
Inspect the OEM harness and engine crankshaft speed/position sensor connector pins for the following: <ul style="list-style-type: none"> <li>• Loose connections</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damaged</li> <li>• Damaged connector locking tab.</li> </ul> Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.	Dirty or damaged pins? <b>YES</b> <b>Repair:</b> A damaged connection has been detected in the engine crankshaft speed/position sensor or harness connector. Clean the connector and pins. Replace the damaged section of harness or damaged engine crankshaft speed/position sensor. Refer to the circuit diagram or wiring diagram for all engine harness interconnections. <ul style="list-style-type: none"> <li>• Refer to Procedure 019-043 in Section 19.</li> <li>• Refer to Procedure 019-199 in Section 19.</li> <li>• Refer to Procedure 019-218 in Section 19.</li> </ul>	2A
	Dirty or damaged pins? <b>NO</b>	1D

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

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
Check for active Fault Code 1992 when the engine is not running above 15 percent above rated speed. <ul style="list-style-type: none"> <li>• Check for active Fault Code 1992 when the engine is <b>not</b> running above 15 percent above rated speed.</li> </ul>	Inactive fault code at low rpm? <b>YES</b>	1E
	Inactive fault code at low rpm? <b>NO</b> <b>Repair:</b> Replace the ECM. Refer to Procedure 019-031 in Section 19.	2A

**STEP 1E: Test the engine.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
Test the engine to check if the overspeed condition is still present. <ul style="list-style-type: none"> <li>Test the engine to check if the overspeed condition is still present.</li> </ul>	Fault Code 1992 inactive? <b>YES</b>	2A
	Fault Code 1992 inactive? <b>NO</b> <b>Repair:</b> Return to the troubleshooting steps or contact a Cummins® Authorized Repair Location if all the steps have been completed and checked again.	1A

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

<b>Condition:</b> <ul style="list-style-type: none"> <li>Connect all components</li> <li>Connect INSITE™ electronic service tool</li> <li>Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> <li>Use INSITE™ electronic service tool to verify that the fault code is inactive.</li> </ul>	Fault Code 1992 inactive? <b>YES</b>	2B
	Fault Code 1992 inactive? <b>NO</b>	1A

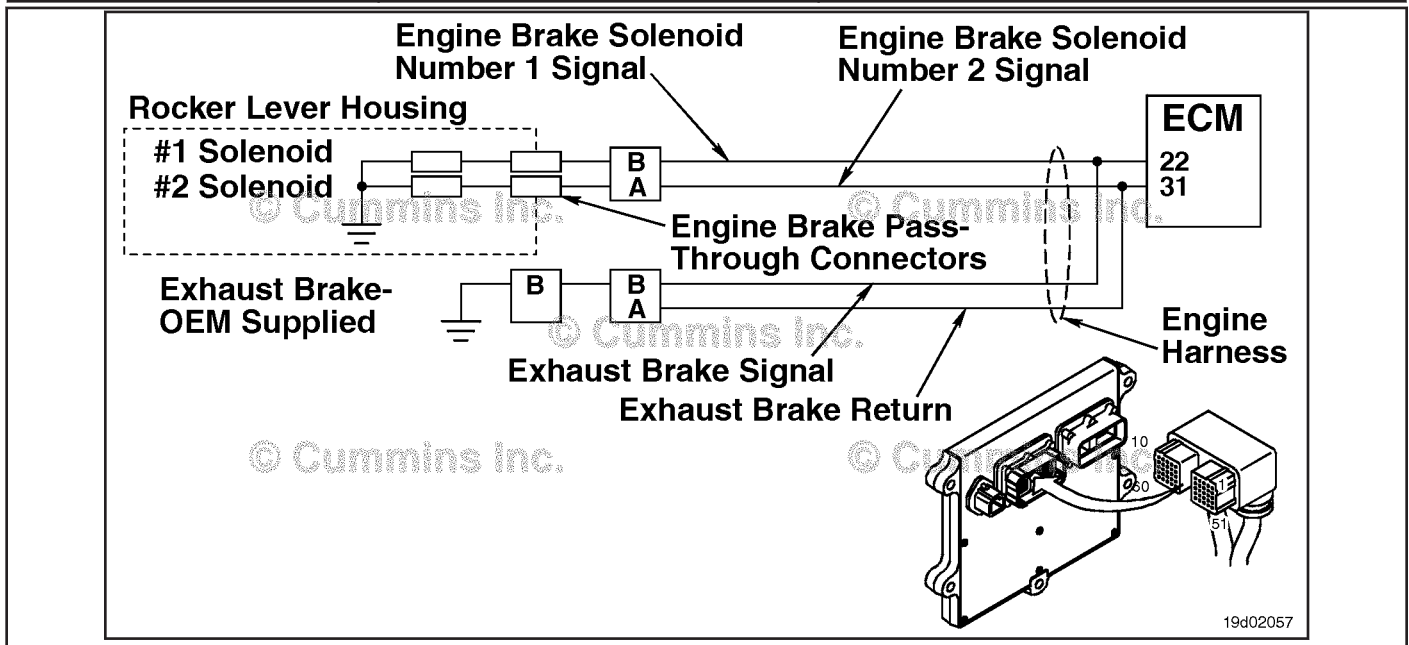
**STEP 2B: Clear the inactive fault codes.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>Connect all components</li> <li>Connect INSITE™ electronic service tool</li> <li>Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> <li>Use INSITE™ electronic service tool to clear the inactive fault codes.</li> </ul>	All fault codes cleared? <b>YES</b>	Repair complete.
	All fault codes cleared? <b>NO</b> <b>Repair:</b> Troubleshoot any remaining active fault codes.	Appropriate troubleshooting steps.

## Fault Code 2183

### Engine Brake Actuator Driver 1 Circuit - Voltage Below Normal or Shorted to Low Source

CODES	REASON	EFFECT
Fault Code: 2183 PID(P), SID(S): S028 SPN: 1072 FMI: 4 Lamp: Amber SRT:	Engine Brake Actuator Driver 1 Circuit - Voltage Below Normal or Shorted to Low Source. Low voltage detected at the engine brake solenoid number 1 signal circuit.	Engine brake on cylinders 1,2, and 3 can <b>not</b> be activated or exhaust brake will <b>not</b> operate.



Engine Brake Circuit

#### Circuit Description:

This circuit can be used to control either an exhaust brake or an engine brake depending on the application. The ECM controls engine brakes on cylinders 1, 2, and 3 by sending a signal on the engine brake solenoid number 1 signal circuit. If an exhaust brake is installed, the exhaust brake is driven by the engine brake solenoid number 1 signal line. A 2-pin Weather Pack connector is located near the number 3 injector pass-through connector at the back of the engine. If an engine brake is installed, there will be a jumper harness from this connector to the engine brake pass-through connectors on the rocker lever housing. If an exhaust brake is installed, the OEM will connect one wire to the 2-pin Weather Pack connector for the exhaust brake relay.

#### Component Location:

The engine brake solenoids are located under the valve cover. The engine brake solenoids are controlled through the engine harness from the ECM. The exhaust brake is an optional feature that is mounted in the exhaust system by the OEM.

#### Shop Talk:

Possible causes of this fault code include a short circuit to ground in the engine harness, connector, or engine brake solenoids.

On-Board Diagnostics (OBD) Information:

- The ECM illuminates the appropriate amber or red lamp when the diagnostic runs and fails.
- The ECM turns OFF the appropriate fault lamp when the diagnostic runs and passes.



**Refer to Troubleshooting Fault Code t05-2183**

FAULT CODE 2183 - Engine Brake Actuator Driver 1 Circuit - Voltage Below Normal or Shorted to Low Source
TROUBLESHOOTING SUMMARY



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



To reduce the possibility of pin and harness damage, use the following test leads when taking a measurement: Part Number 3822758 - male Deutsch/AMP/Metri-Pack test lead, Part Number 3822917 - female Deutsch/AMP/Metri-Pack test lead, Part Number 3823995 - male Weather-Pack test lead, and Part Number 3823996 - female Weather-Pack test lead.

Table with 3 columns: STEPS, SPECIFICATIONS, and SRT CODE. It lists troubleshooting steps from STEP 1 to STEP 4, including sub-steps like STEP 1A, 1B, 2A, 2B, 2C, 3A, 3B, 3C, 3D, 3E, and 3E-1, with corresponding specifications and SRT codes.

### TROUBLESHOOTING STEP

**STEP 1: Check the fault codes.**

**STEP 1A: Check for an inactive fault code.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for an inactive fault code. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 2183 is inactive? <b>YES</b>	Use the following procedure for an inactive or intermittent fault code. Refer to Procedure 019-362 in Section 19.
	Fault Code 2183 is inactive? <b>NO</b>	1B

**STEP 1B: Determine engine brake type.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> </ul>		
Action	Specification/Repair	Next Step
Determine if the engine is equipped with a compression brake or exhaust brake. -	Is the engine equipped with a compression brake? <b>YES</b>	2A
	Is the engine equipped with a compression brake? <b>NO</b> <b>Repair:</b> The engine is equipped with an exhaust brake.	3A

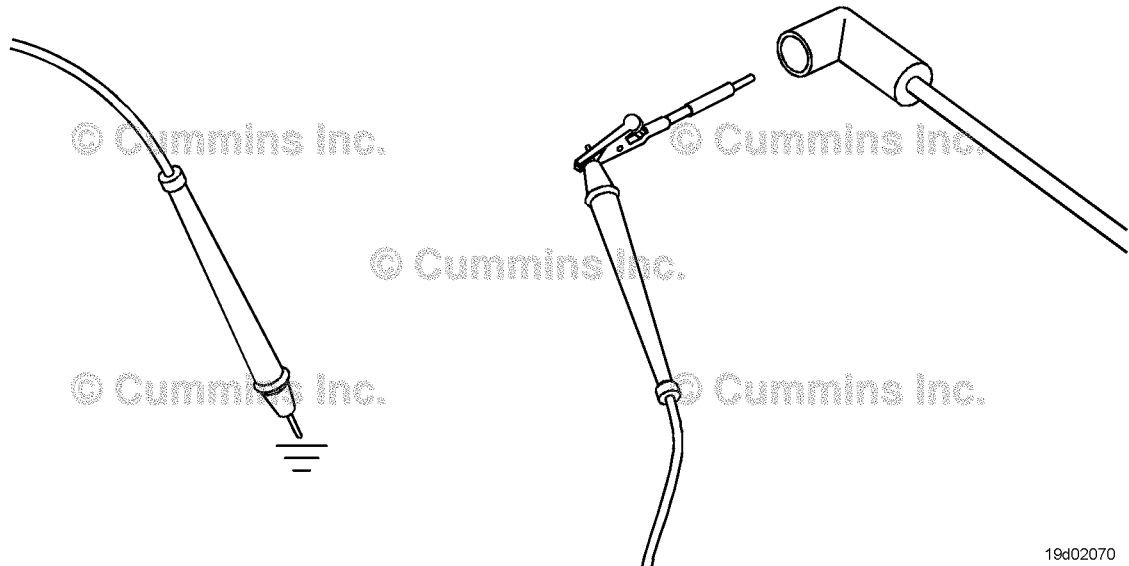
**STEP 2: Check the engine brake solenoid and circuit.**

**STEP 2A: Check the diagnostic signal voltage at the engine brake pass-through connector.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine brake solenoid number 1 wire from the pass-through connector on the rocker lever housing.
- Turn keyswitch ON.

Action	Specification/Repair	Next Step
Check the engine brake solenoid number 1 diagnostic supply voltage. <ul style="list-style-type: none"> <li>• Measure the voltage between the engine harness engine brake solenoid number 1 SIGNAL pin and ground.</li> </ul> Refer to the wiring diagram for connector pin identification.	Greater than 3.75-VDC? <b>YES</b>	2B
	Greater than 3.75-VDC? <b>NO</b>	3A



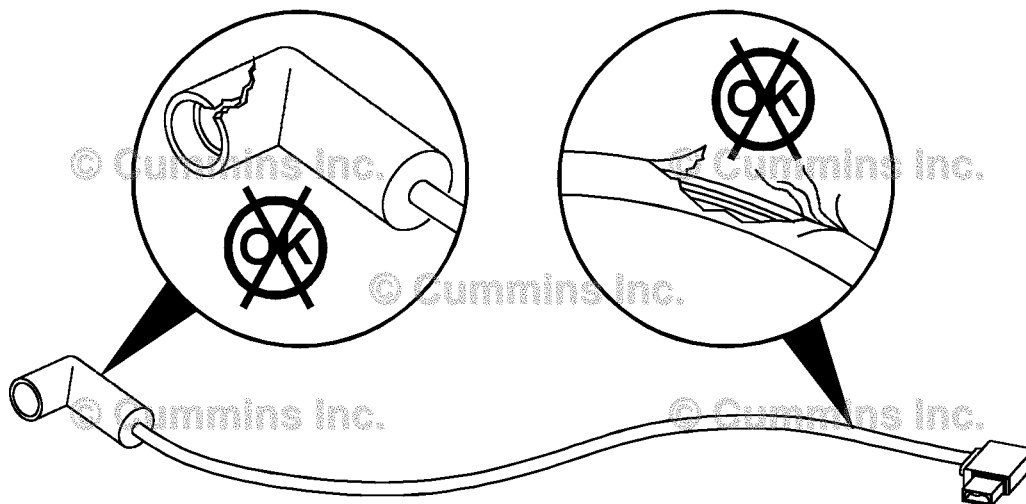
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**STEP 2B: Check the engine brake wiring harness for damage.**

**Condition:**

- Turn keyswitch OFF.
- Remove the rocker lever cover. Use the following procedure in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418. Refer to Procedure 003-011 in Section 19.
- Remove the engine brake jumper harness between that pass-through connector and the engine brake solenoid.

Action	Specification/Repair	Next Step
Inspect the internal engine brake jumper harness for the following: <ul style="list-style-type: none"> <li>• Bent or broken pins</li> <li>• Wire insulation damaged</li> <li>• Connector shell broken.</li> </ul> Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.	Damaged connectors or wire insulation? <b>YES</b> <b>Repair:</b> Repair or replace the engine brake harness. Refer to Procedure 019-043 in Section 19.	4A
	Damaged connectors or wire insulation? <b>NO</b>	2C



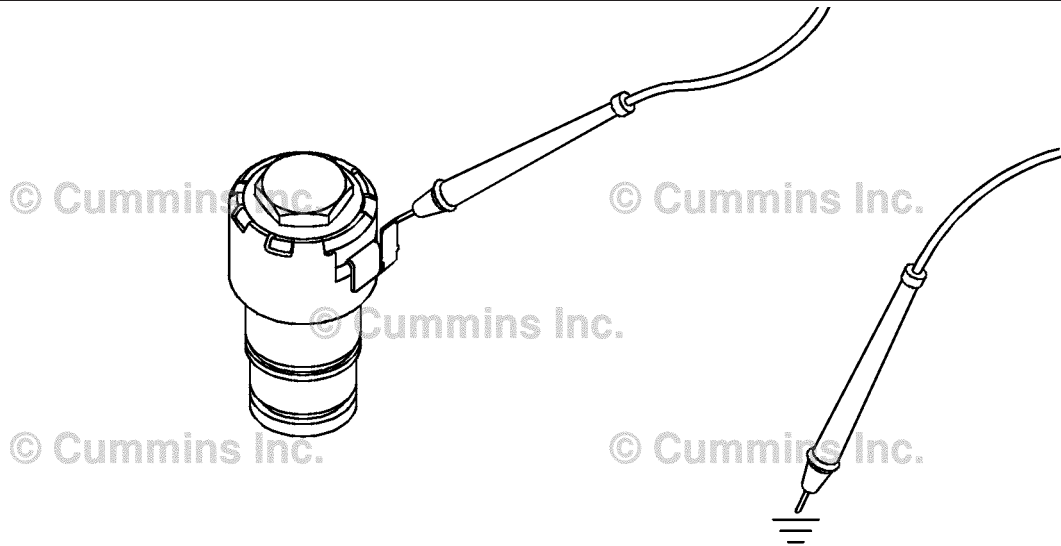
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**STEP 2C: Check the engine brake solenoid for a short to ground.**

**Condition:**

- Turn keyswitch OFF.
- Remove the rocker lever cover. Use the following procedure in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418. Refer to Procedure 003-011 in Section 3.
- Disconnect the engine brake harness from engine brake solenoid number 1.

Action	Specification/Repair	Next Step
Check the resistance of the solenoid. <ul style="list-style-type: none"> <li>• Measure the resistance from engine brake number 1 solenoid terminal pin to ground.</li> </ul>	5 ohms or greater? <b>YES</b>	3A
Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.	5 ohms or greater? <b>NO</b> <b>Repair:</b> Replace the engine brake solenoid. Use the following procedure in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418. Refer to Procedure 020-012 in Section 20. 020-012 in	4A



19c01106

**STEP 3: Check the ECM and engine harness.**

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

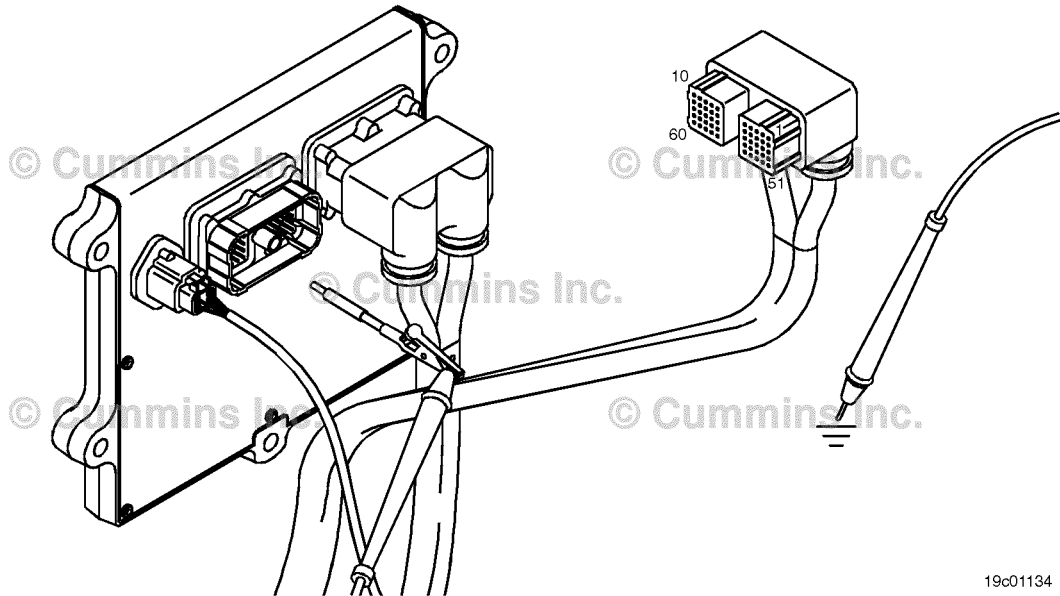
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness form the ECM.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the engine harness and ECM connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A damaged connection has been detected in the ECM or engine harness connector.</p> <p>Clean the connector and pins.</p> <p>Repair the damaged harness, connector or pins if possible. Refer to Procedure 019-043 in Section 19.</p>	<p>4A</p>
<p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	<p>3B</p>

**STEP 3B: Check the engine brake solenoid number 1 diagnostic supply voltage.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine harness from the ECM.
- Turn keyswitch ON.

Action	Specification/Repair	Next Step
Check the engine brake solenoid number 1 diagnostic supply voltage. <ul style="list-style-type: none"> <li>• Measure the voltage between the engine brake solenoid number 1 SIGNAL pin and ground at the ECM connector.</li> </ul> Refer to the wiring diagram for connector pin identification.	Greater than 3.75-VDC? <b>YES</b>	3C
	Greater than 3.75-VDC? <b>NO</b> <b>Repair:</b> Replace the ECM. Refer to Procedure 019-031 in Section 19.	4A



19c01134

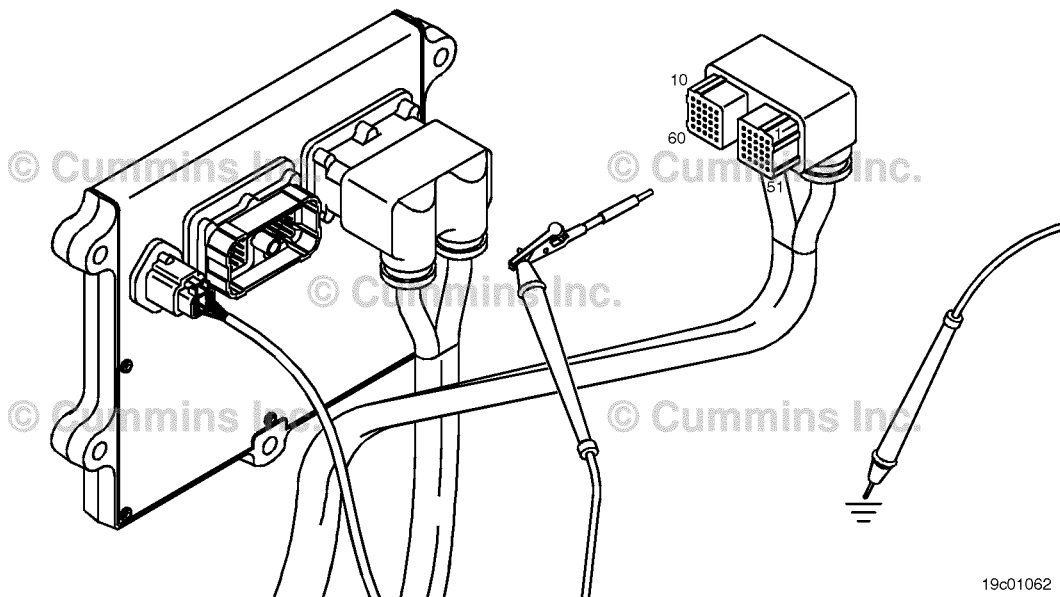


**STEP 3C: Check for a pin short circuit to ground.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine harness from the ECM.
- If equipped with engine brakes, disconnect the engine brake solenoid number 1 from the engine brake pass-through connector.
- If equipped with an exhaust brake, disconnect the 2-pin Weather Pack™ connector at the back of the engine between the number 5 and 6 high pressure fuel lines.

Action	Specification/Repair	Next Step
<p>Check for a pin-to-ground short.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the engine brake solenoid number 1 SIGNAL pin in the engine harness ECM connector and ground.</li> </ul> <p>Refer to the wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Greater than 100k ohms? <b>YES</b></p>	<p>3D</p>
	<p>Greater than 100k ohms? <b>NO</b></p> <p><b>Repair:</b></p> <p>A pin-to-ground short circuit on engine brake actuator SIGNAL line has been detected in the engine harness.</p> <p>Troubleshoot each harness connected in series to determine which contains the shorted supply circuit to ground.</p> <p>Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.</p>	<p>4A</p>



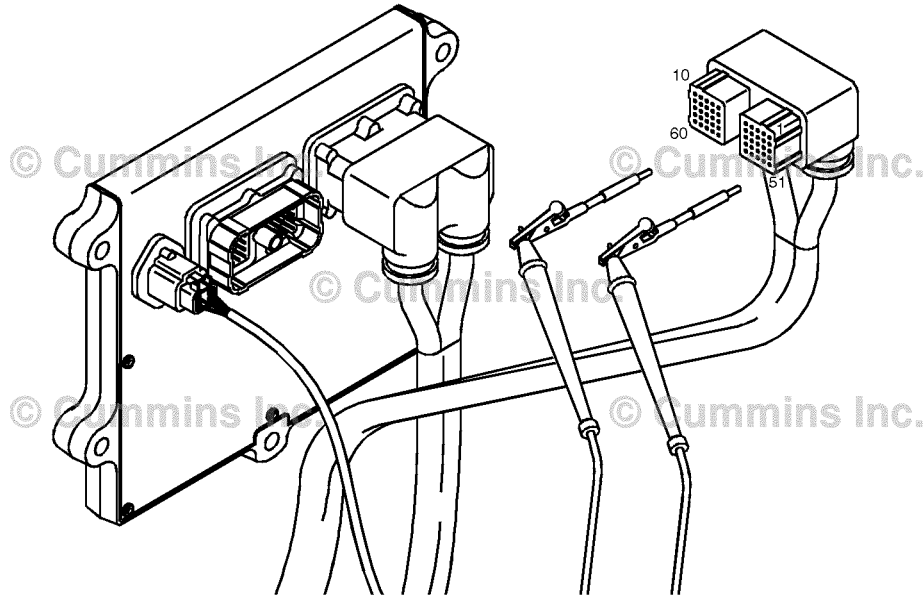
19c01062

**STEP 3D: Check for a pin-to-pin short circuit in the engine harness.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine harness from the ECM.
- If equipped with engine brakes, disconnect the engine brake solenoid number 1 from the engine brake pass-through connector.
- If equipped with an exhaust brake, disconnect the 2-pin Weather Pack™ connector at the back of the engine between the number 5 and 6 high pressure fuel lines.

Action	Specification/Repair	Next Step
Check for a pin-to-pin short. <ul style="list-style-type: none"> <li>• Measure the resistance between the engine brake solenoid number 1 SIGNAL pin in the engine harness ECM connector and all other pins in the ECM connector.</li> </ul> Refer to the wiring diagram for connector pin identification. Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.	Greater than 100k ohms? <b>YES</b>	3E
	Greater than 100k ohms? <b>NO</b> <b>Repair:</b> A pin-to-pin short circuit on the engine brake solenoid number 1 SIGNAL line has been detected in the engine harness. Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.	4A



19c01046

**STEP 3E: Check for an inactive fault code.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for the appropriate circuit response after 30 seconds. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 2183 inactive? <b>YES</b> <b>Repair:</b> None. The removal and installation of the connector corrected the fault.	4A
	Fault Code 2183 inactive? <b>NO</b>	3E-1

**STEP 3E-1: Check for exhaust brake installation.**

<b>Condition:</b> -		
Action	Specification/Repair	Next Step
Check if the engine is equipped with an exhaust brake. -	Is the engine equipped with an exhaust brake? <b>YES</b> <b>Repair:</b> Refer to the OEM service manual to check the wiring and circuitry between the Cummins® wiring harness and the exhaust brake.	OEM service manual
	Is the engine equipped with an exhaust brake? <b>NO</b> <b>Repair:</b> All the wiring has been checked and found to be OK. The ECM has malfunctioned. Replace the ECM. Refer to Procedure 019-031 in Section 19.	4A

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

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to verify that the fault code is inactive.</li> </ul>	Fault Code 2183 inactive? <b>YES</b>	4B
	Fault Code 2183 inactive? <b>NO</b>	1A

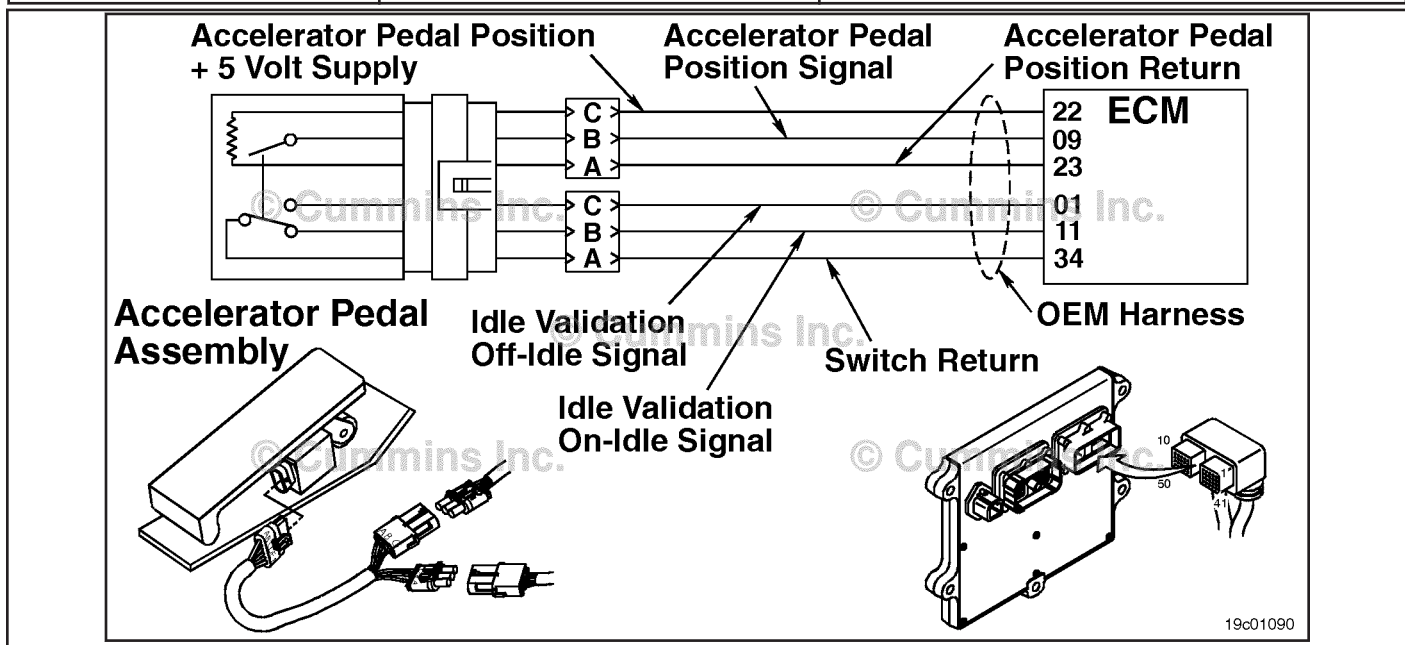
**STEP 4B: Clear the inactive fault codes.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to erase the inactive fault codes.</li> </ul>	All fault codes cleared? <b>YES</b>	Repair complete
	All fault codes cleared? <b>NO</b>	Appropriate troubleshooting steps

## Fault Code 2185

### Sensor Supply Voltage 4 Circuit - Voltage Above Normal or Shorted to High Source

CODES	REASON	EFFECT
Fault Code: 2185 PID(P), SID(S): S232 FMI: 3/3 Lamp: Amber SRT:	Sensor Supply Voltage 4 Circuit - Voltage Above Normal or Shorted to High Source. High voltage detected at +5 volt sensor supply circuit to the accelerator pedal position sensor.	Engine will <b>only</b> idle.



Accelerator Pedal or Lever Position Sensor Supply Voltage Circuit

#### Circuit Description:

The electronic control module (ECM) supplies the accelerator pedal or lever position sensor with +5 volts.

#### Component Location:

The accelerator pedal or lever assembly is located in the cab.

#### Shop Talk:

This fault is logged when the ECM senses more than +5.25 volts on the accelerator pedal or lever position +5 volt supply line. This can be caused by a short circuit to a voltage source in the OEM harness or a short circuit to an actuator signal circuit that is greater than +5 volts.

#### Refer to Troubleshooting Fault Code t05-2185

## FAULT CODE 2185 - Sensor Supply Voltage 4 Circuit - Voltage Above Normal or Shorted to High Source TROUBLESHOOTING SUMMARY



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



To reduce the possibility of pin and harness damage, use the following test leads when taking a measurement: Part Number 3164133 - male Deutsch™/AMP™/Metri-Pack™ test lead, Part Number 3822758 - male Deutsch™/AMP™/Metri-Pack™ test lead, and Part Number 3822917 - female male Deutsch™/AMP™/Metri-Pack™ test lead.

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1:</b> Check the fault codes.		
<b>STEP 1A:</b> Check for an active fault code.	Fault Code 2185 active?	
<b>STEP 2:</b> Check the ECM and OEM harness.		
<b>STEP 2A:</b> Inspect the ECM and OEM harness connector pins.	Dirty or damaged pins?	
<b>STEP 2B:</b> Check for a pin-to-pin short circuit in the OEM harness.	Greater than 100k ohms?	
<b>STEP 2C:</b> Check for a pin-to-pin short circuit in the unswitched battery supply OEM harness.	Greater then 100K ohms?	
<b>STEP 3:</b> Clear the fault codes.		
<b>STEP 3A:</b> Disable the fault code.	Fault Code 2185 inactive?	
<b>STEP 3B:</b> Clear the inactive fault codes.	All fault codes cleared?	

### TROUBLESHOOTING STEP

**STEP 1: Check the fault codes.**  
**STEP 1A: Check for an active fault code.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for an active fault code. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 2185 active? <b>YES</b>	2A
	Fault Code 2185 active? <b>NO</b>	Use the following procedure for an inactive or intermittent fault code. Refer to Procedure 019-362 in Section 19.

**STEP 2: Check the ECM and OEM harness.**

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

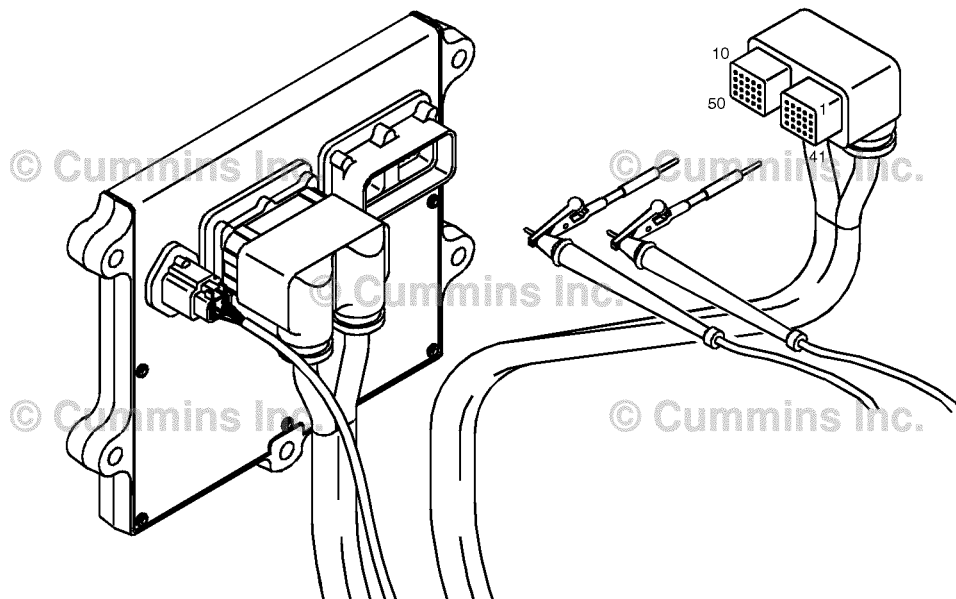
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the OEM harness from the ECM.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the OEM harness and ECM connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Clean the connector and pins.</p> <p>Repair the damaged harness, connector, or pins if possible. Refer to Procedure 019-071 in Section 19.</p>	<p>3A</p>
	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	<p>2B</p>

**STEP 2B: Check for a pin-to-pin short circuit in the OEM harness.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the OEM harness from the ECM.
- Disconnect the accelerator pedal or lever position sensor from the OEM harness.

Action	Specification/Repair	Next Step
Check for a pin-to-pin short. Measure the resistance between the accelerator pedal +5-VDC SUPPLY pin in the OEM harness ECM connector and all other pins in the OEM connector. Refer to the circuit diagram or the wiring diagram for connector pin identification. Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.	Greater than 100k ohms? <b>YES</b>	2C
	Greater than 100k ohms? <b>NO</b> <b>Repair:</b> A short circuit has been detected in the accelerator pedal +5-VDC SUPPLY wire. Repair or replace the OEM harness. Refer to Procedure 019-071 in Section 19.	3A



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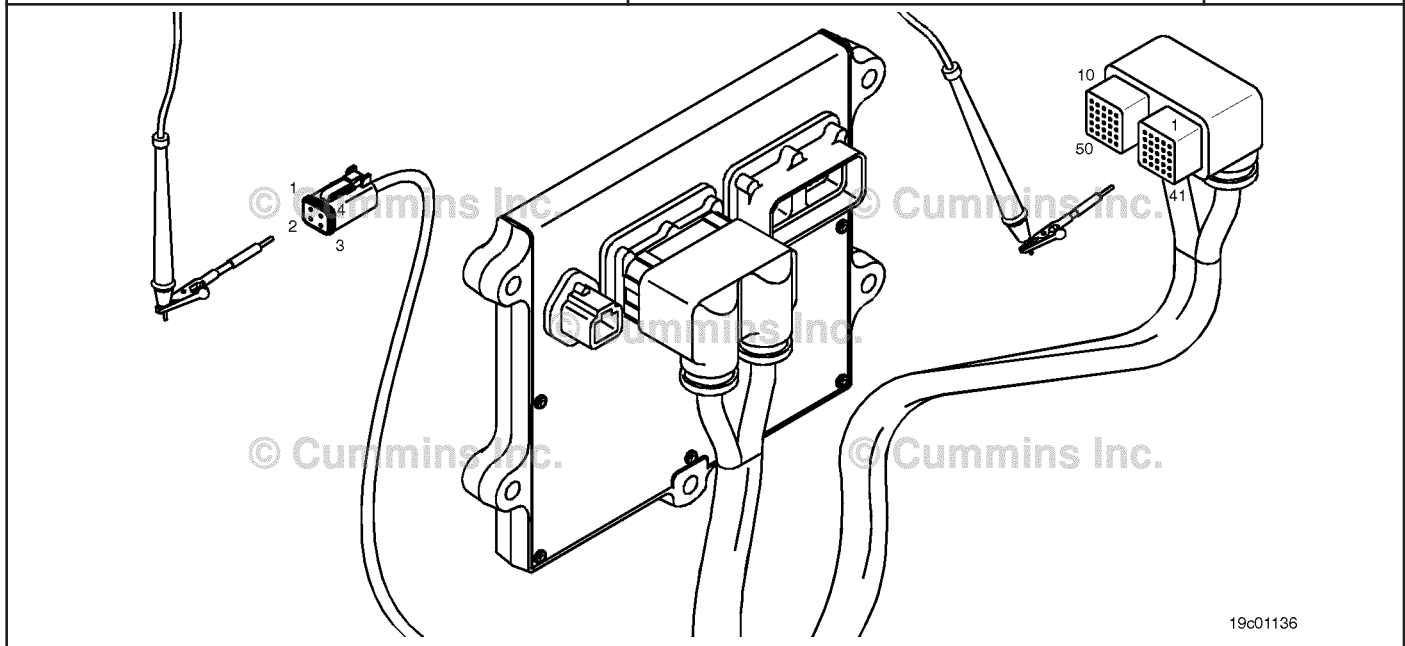


**STEP 2C: Check for a short circuit in the unswitched battery supply OEM harness**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the OEM harness from the ECM.
- Disconnect the accelerator pedal or lever position sensor from the OEM harness.
- Disconnect the OEM power harness from the ECM.

Action	Specification/Repair	Next Step
<p>Check for a short circuit to battery.</p> <p>Measure the resistance between the accelerator pedal SUPPLY pin in the OEM harness ECM connector and the ECM battery SUPPLY (+) pin of the power harness ECM connector.</p> <p>Refer to the circuit diagram or the wiring diagram for connector pin identification.</p>	<p>Greater than 100k ohms?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Replace the ECM. Refer to Procedure 019-031 in Section 19.</p>	<p>3A</p>
<p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Greater than 100k ohms?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Repair or replace the OEM harness. Refer to Procedure 019-071 in Section 19.</p>	<p>3A</p>



19c01136

**STEP 3: Clear the fault codes.**

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

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Disable the fault code.</p> <ul style="list-style-type: none"> <li>• Start the engine and let it idle for one minute.</li> <li>• Use INSITE™ electronic service tool to verify the fault code is inactive.</li> </ul>	<p>Fault Code 2185 inactive?  <b>YES</b></p>	3B
	<p>Fault Code 2185 inactive?  <b>NO</b>  <b>Repair:</b>                      Return to the troubleshooting steps or contact a local Cummins® Authorized Repair Location if all steps have been completed and checked again.</p>	1A

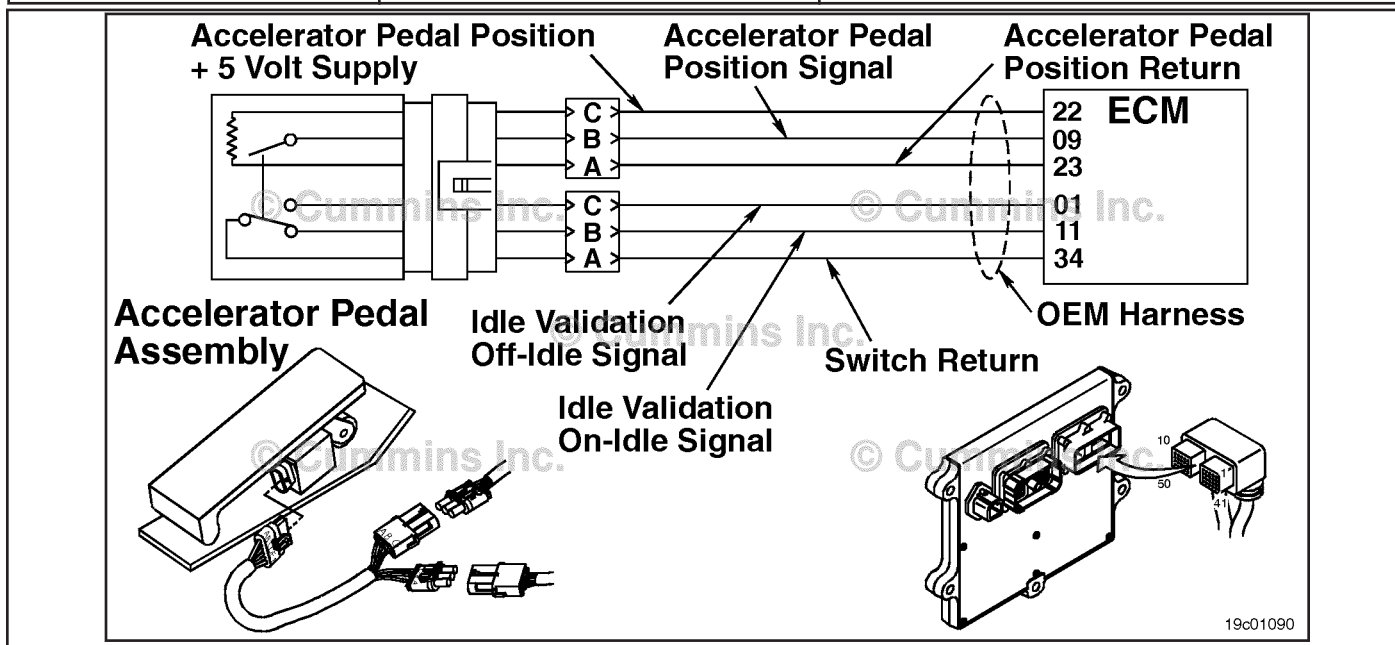
**STEP 3B: Clear the inactive fault codes.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Clear the inactive fault codes.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to erase the inactive fault codes.</li> </ul>	<p>All fault codes cleared?  <b>YES</b></p>	Repair complete
	<p>All fault codes cleared?  <b>NO</b>  <b>Repair:</b>                      Troubleshoot any remaining active fault codes.</p>	Appropriate troubleshooting steps

## Fault Code 2186

### Sensor Supply Voltage 4 Circuit - Voltage Below Normal or Shorted to Low Source

CODES	REASON	EFFECT
Fault Code: 2186 PID(P), SID(S): S232 FMI: 4/4 Lamp: Amber SRT:	Sensor Supply Voltage 4 Circuit - Voltage Below Normal or Shorted to Low Source. Low voltage detected at +5 VDC sensor supply circuit to the accelerator pedal position sensor.	Automotive: Engine will <b>only</b> die. Marine: Severe derate in engine speed. Limp home capability <b>only</b> idle. Marine: Severe derate in engine speed. Limp home capability <b>only</b> .



Accelerator Pedal or Lever Position Sensor Supply Voltage Circuit

#### Circuit Description:

The electronic control module (ECM) supplies the accelerator with +5 VDC. If the supply circuit to the accelerator is damaged, the accelerator will **not** work correctly.

#### Component Location:

The accelerator pedal or lever is located in the cab. For Marine application, the accelerator lever is typically located in the engine room or at the helm.

#### Shop Talk:

For Marine application, the accelerator lever is typically located in the engine room or at the helm.

Low voltage on the +5 VDC supply line can be caused by a short circuit to ground in the supply line, a short circuit between the supply line and return circuit, a failed accelerator, or a failed ECM power supply.

#### **Refer to Troubleshooting Fault Code t05-2186**

FAULT CODE 2186 - Sensor Supply Voltage 4 Circuit - Voltage Below Normal or Shorted to Low Source
TROUBLESHOOTING SUMMARY



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



To reduce the possibility of pin and harness damage, use the following test leads when taking a measurement: Part Number 3822758 - male Deutsch™/AMP™/Metri-Pack™ test lead and Part Number 3822917 - female Deutsch™/AMP™/Metri-Pack™ test lead.

Table with 3 columns: STEPS, SPECIFICATIONS, SRT CODE. It lists troubleshooting steps from Step 1 to Step 4, including sub-steps like Step 1A, Step 2A, Step 2B, Step 3A, Step 3B, and Step 3B-1, with corresponding specifications and SRT codes.

**TROUBLESHOOTING STEP****STEP 1: Check the fault codes.****STEP 1A: Check for an active fault code.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
<b>Action</b>	<b>Specification/Repair</b>	<b>Next Step</b>
Check for an active fault code. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 2186 active? <b>YES</b>	2A
	Fault Code 2186 active? <b>NO</b>	Use the following procedure for an inactive or intermittent fault code. Refer to Procedure 019-362 in Section 19.

**STEP 2: Check the sensors and circuits connected to the sensor supply and return.****STEP 2A: Inspect the accelerator pedal or lever position sensor and circuit connected to the sensor supply and return.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the accelerator pedal or lever position sensor from the OEM harness.</li> </ul>		
<b>Action</b>	<b>Specification/Repair</b>	<b>Next Step</b>
Inspect the OEM harness and ECM connector pins for the following: <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.	Dirty or damaged pins? <b>YES</b> <b>Repair:</b> A damaged connection has been detected. <ul style="list-style-type: none"> <li>• Clean the connector and pins.</li> <li>• Repair the damaged harness, connector, or pins if possible.</li> </ul> Refer to Procedure 019-071 in Section 19.	4A
	Dirty or damaged pins? <b>NO</b>	2B

**STEP 2B: Check the circuit response.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the accelerator pedal or lever position sensor from the OEM harness.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate ECM response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault Code 2186 active?</p> <p><b>YES</b></p>	3A
	<p>Fault Code 2186 active?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Replace the accelerator pedal or lever position sensor. Refer to the OEM service manual.</p>	4A

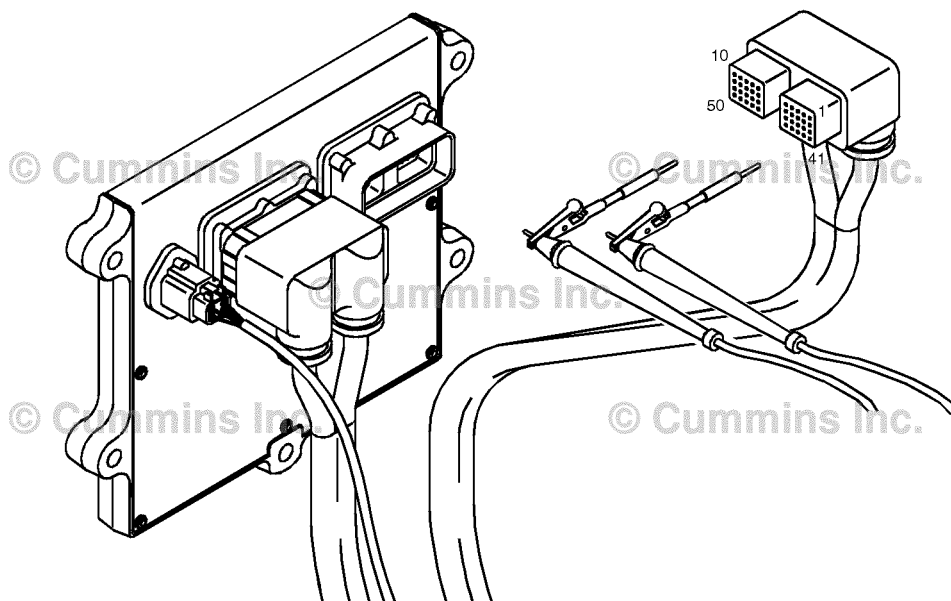
**STEP 3: Check the ECM and OEM harness.**

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

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the OEM harness from the ECM.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the OEM harness and ECM connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A damaged connection has been detected.</p> <ul style="list-style-type: none"> <li>• Clean the connector and pins.</li> <li>• Repair the damaged harness, connector, or pins if possible.</li> </ul> <p>Refer to Procedure 019-071 in Section 19.</p>	4A
		<p>Dirty or damaged pins?</p> <p><b>NO</b></p>

**STEP 3B: Check for a pin-to-pin short circuit in the OEM harness.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the OEM harness from the ECM.</li> <li>• Disconnect the accelerator pedal or lever position sensor from the OEM harness.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for a pin-to-pin short.</p> <p>Measure the resistance between the accelerator pedal +5-VDC SUPPLY pin in the OEM harness ECM connector and all other pins in the OEM connector.</p> <p>Refer to the circuit diagram or the wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Greater than 100k ohms? <b>YES</b></p>	<p>3B-1</p>
	<p>Greater than 100k ohms? <b>NO</b></p> <p><b>Repair:</b></p> <p>A short circuit has been detected in the accelerator pedal +5-VDC supply wire.</p> <p>Repair or replace the OEM harness. Refer to Procedure 019-071 in Section 19.</p>	<p>4A</p>



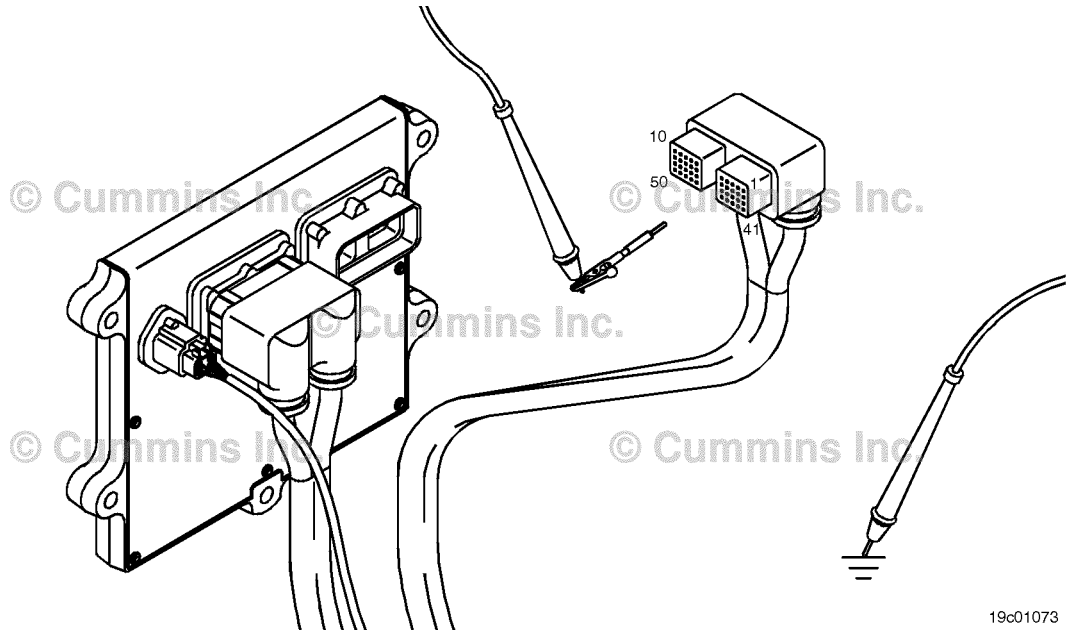
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**STEP 3B-1: Check for a pin short circuit to ground in the OEM harness.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the OEM harness from the ECM.
- Disconnect the accelerator pedal or lever position sensor from the OEM harness.

Action	Specification/Repair	Next Step
Check for a short to ground. Measure the resistance between the accelerator pedal +5-VDC SUPPLY pin in the OEM harness ECM connector and ground. Refer to the circuit diagram or the wiring diagram for connector pin identification. Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.	Greater than 100k ohms? <b>YES</b>	4A
	Greater than 100k ohms? <b>NO</b> <b>Repair:</b> A short circuit has been detected in the accelerator pedal +5-VDC SUPPLY wire. Repair or replace the OEM harness. Refer to Procedure 019-071 in Section 19.	4A



19c01073



**STEP 4: Clear the fault codes.**

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

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Disable the fault code.</p> <ul style="list-style-type: none"> <li>• Start the engine and let it idle for 1 minute.</li> <li>• Use INSITE™ electronic service tool to verify that the fault code is inactive.</li> </ul>	<p>Fault Code 2186 inactive? <b>YES</b></p>	4B
	<p>Fault Code 2186 inactive? <b>NO</b></p> <p><b>Repair:</b></p> <p>Return to the troubleshooting steps or contact a local Cummins® Authorized Repair location if all steps have been completed and checked again.</p>	1A

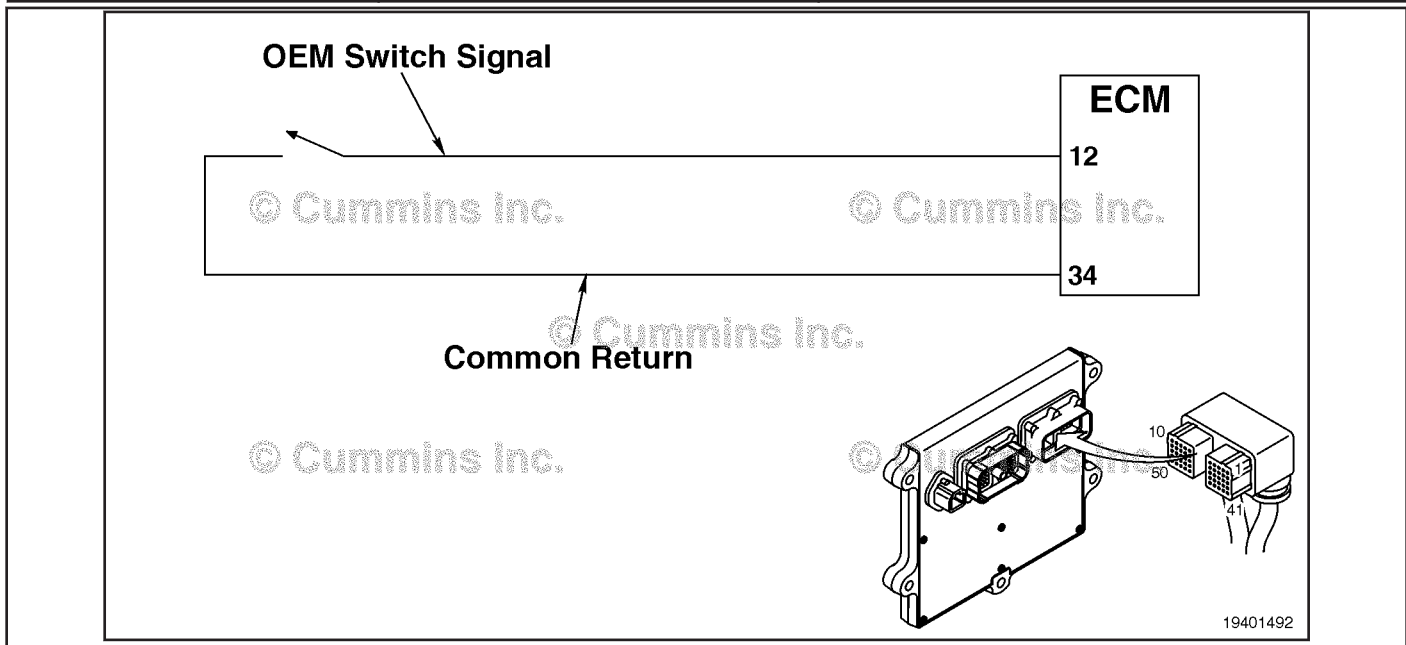
**STEP 4B: Clear the inactive fault codes.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Clear the inactive fault codes.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to erase the inactive fault codes.</li> </ul>	<p>All fault codes cleared? <b>YES</b></p>	Repair complete
	<p>All fault codes cleared? <b>NO</b></p>	Appropriate troubleshooting steps

## Fault Code 2195

### Auxiliary Equipment Sensor Input 3 Engine Protection Critical - Special Instructions

CODES	REASON	EFFECT
Fault Code: 2195 PID(P), SID(S): S051 SPN: 703 FMI: 14 (J1939) Lamp: Red SRT:	Auxiliary Equipment Sensor Input Engine Protection Critical - Special Instructions. OEM switch signal on the OEM harness indicates engine protection condition.	Speed derate and possible engine shutdown if engine protection shutdown feature is enabled.



#### **Circuit Description:**

The OEM switch is used by the electronic control module (ECM) to monitor an OEM-specific switch. The ECM monitors the signal on pin 12 for the engine/vehicle protection system.

#### **Component Location:**

The OEM switch is located in different locations, depending on the OEM and equipment model. Refer to the OEM service manual.

#### **Shop Talk:**

Verify the engine control module (ECM) calibration is correct. Check the calibration revision history found on QuickServe™ Online for applicable fixes to the calibration stored in the ECM. If necessary, calibrate the ECM. Refer to Procedure 019-032 in Section 19.

Verify with the driver the engine operating condition when the fault occurs. Depending on the engine speed and load, the OEM switch can detect a condition that falls below or exceeds the engine protection limit. Refer to the OEM service manual for more information.

#### **Refer to Troubleshooting Fault Code t05-2195.**

## FAULT CODE 2195 - Auxiliary Equipment Sensor Input 3 Engine Protection Critical - Special Instructions TROUBLESHOOTING SUMMARY

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1:</b> Check the sensor accuracy.		
<b>STEP 1A:</b> Verify the sensor accuracy by inspecting the OEM device.	Refer to the OEM service manual for specification	
<b>STEP 2:</b> Check the OEM harness.		
<b>STEP 2A:</b> Inspect the OEM harness and 50-pin connectors.	No damaged pins	
<b>STEP 3:</b> Clear the fault codes.		
<b>STEP 3A:</b> Disable the fault code.		
<b>STEP 3:</b> Clear the inactive fault codes.		
<b>STEP 3B:</b> Clear the inactive fault codes	Fault Code 2195 inactive	

### TROUBLESHOOTING STEP

**STEP 1: Check the sensor accuracy.**  
**STEP 1A: Verify the sensor accuracy by inspecting the OEM device.**

<b>Condition:</b> • Turn keyswitch ON.		
Action	Specification/Repair	Next Step
Verify the sensor accuracy by inspecting the OEM device. • Locate the OEM input device and what vehicle condition is being monitored with the sensor.	OEM device operating correctly? <b>YES</b>	2A
	OEM device operating correctly? <b>NO</b> <b>Repair:</b> A damaged OEM sensor has been detected. Replace the sensor. Refer to the OEM service manual.	3A

**STEP 2: Check the OEM harness.**

**STEP 2A: Inspect the OEM harness.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the OEM harness from the ECM at the 50-pin connector.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the OEM harness and 50-pin connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A damaged OEM harness connection has been detected.</p> <ul style="list-style-type: none"> <li>• Flush the dirt, debris, or moisture from the connector pins, use electronic contact cleaner, Part Number 3824510.</li> <li>• Install the appropriate connector seal if it is damaged or missing.</li> </ul> <p>Repair or replace the OEM harness. Refer to the OEM service manual.</p>	3A
	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	1A

**STEP 3: Clear the fault code.**

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

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Disable the fault code.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to verify that the fault code 2195 is inactive.</li> </ul>	<p>Fault Code 2195 inactive?</p> <p><b>YES</b></p>	3B
	<p>Fault Code 2195 inactive?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Return to the troubleshooting steps or contact a Cummins® Authorized Repair Location if all steps have been completed and checked again.</p>	1A

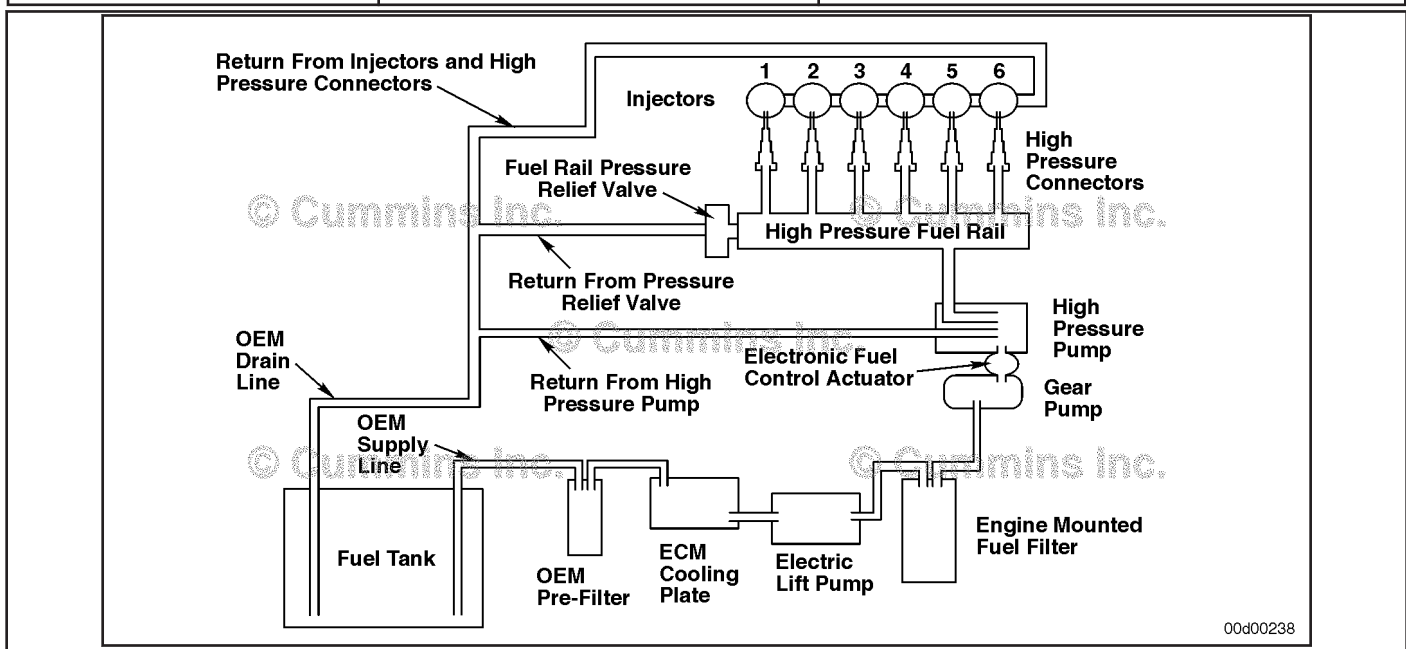
**STEP 3B: Clear the inactive fault code.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components</li> <li>• Turn keyswitch ON</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Clear the inactive fault codes.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to clear the inactive fault codes.</li> </ul>	<p>All fault codes cleared? <b>YES</b></p>	<p>Repair complete</p>
	<p>All fault codes cleared? <b>NO</b></p> <p><b>Repair:</b> Troubleshoot any remaining active fault codes.</p>	<p>Appropriate troubleshooting steps</p>

## Fault Code 2215 (ISB/QSB Automotive, Industrial, or Marine Application)

### Fuel Pump Delivery Pressure - Data Valid But Below Normal Operational Range - Moderately Severe Level

CODES	REASON	EFFECT
Fault Code: 2215 PID(P), SID(S): P94 SPN: 94 FMI: 1 Lamp: Amber SRT: TF-215	Fuel Pump Delivery Pressure - Data Valid but Below Normal Operational Range - Moderately Severe Level. The ECM has detected the fuel pressure in the fuel rail is lower than the commanded performance.	Possibly hard to start; low power; possible engine smoke. Engine can possibly <b>not</b> start.



Fuel System

#### Circuit Description:

The fuel pressure control loop relies on fuel pressure supplied to the high-pressure pump by the electric lift pump and low-pressure gear pump. The ECM monitors rail fuel pressure and engine operating conditions and changes the flow command to maintain the proper rail fuel pressure. Changes to the flow command result in opening (or closing) of the fuel pump actuator to supply more (or less) fuel to the high-pressure pump.

The fuel flow circuit includes, in the following order of fuel flow:

- Fuel tank
- OEM fuel supply line
- OEM filter
- ECM cooling plate
- Electric lift pump
- Fuel filter
- Gear pump
- Fuel pump actuator
- High-pressure fuel pump
- Rail fuel (includes fuel pressure relief valve and pressure sensor)
- High-pressure fuel lines
- High-pressure fuel connectors
- Injectors
- Return to tank.

### Component Location:

The fuel pump is located at the rear of the engine, on the intake side of the engine. Refer to Procedure 100-002 in Section E for a detailed component location view.

### Shop Talk:

General Information:

Fault Code 2215 logs when measured rail fuel pressure remains at least 10 MPa [1450 psi] less than commanded rail fuel pressure. Once detected, Fault Code 2215 will remain active until the engine is turned off or until the measured rail fuel pressure matches the commanded rail fuel pressure. When a condition exists that causes Fault Code 2215 to become active, it is typical for the fault code to become active when the engine is heavily loaded and become inactive when the engine is lightly loaded.

Fault Code 2292 sets when the ECM commands the fuel pump actuator to open more than expected to maintain rail pressure.

When Fault Code 2215 occurs, the fuel system has lost its ability to maintain rail fuel pressure. Causes of this fault can include:

- Fuel inlet restrictions
- Fuel filter plugging
- Excessive air in the fuel
- Loss of prime during cranking
- Low fuel lift pump pressure (automotive/marine engines)
- Stuck or restricted electronic fuel control actuator
- System return (excessive return flow from the injectors, high-pressure pump, or rail pressure relief valve)
- Tampering.

If the drain line is restricted completely, the high pressure fuel pump will fail, causing internal leakage. Prior to a pump malfunction, fault codes indicative of drain line restriction will occur. The fault codes are Fault Code 2216, 2293, or 449. Following the malfunction, these fault codes will go inactive and Fault Code 2215, which is indicative of leakage, will be active. If troubleshooting Fault Code 2215 results in replacement of the pump and there are inactive counts of Fault Codes 2216, 2293, or 449, the drain line **must** be inspected and measured for restriction to prevent repeat high pressure pump malfunctions.

Inactive Fault Code:

Troubleshooting inactive Fault Code 2215 can be very difficult. The fault code **must** be active for any of the outlined procedures in which the engine is operated during the test. For engines with high counts of inactive Fault Code 2215, operate the engine on a chassis dynamometer or a diagnostic road test to duplicate the fault code. The most common causes of intermittent Fault Code 2215 that are difficult to recreate are leaking high pressure connectors that **only** leak when the engine is hot and the fuel is hot, and intermittent fuel supply restriction, such as debris floating in the fuel tank.

If Fault Code 2215 is inactive and there are no existing performance complaints, it is possible the engine ran out of fuel or the fault became active if the engine was **not** primed following a fuel filter replacement. Clear the inactive fault codes.

Engine No Start:

If the engine will **not** start and Fault Code 2215 becomes active during cranking, but no speed sensor fault codes exist, monitor rail fuel pressure with INSITE™ electronic service tool. If the rail fuel pressure is low, check the following:

- Fuel system prime (make sure there is fuel in the tanks and the system is primed)
- Fuel lift pump pressure. See the ISBe and ISB Common Rail Fuel System Series Engines Service Manual, Bulletin 4021271. Refer to Procedure 005-045 in Section 5
- Injector and pressure relief valve leakage
- Fuel pump discharge test.

Lift Pump:

When measuring the voltage at the electric lift pump, the lift pump **must** be connected to the engine harness during the test. The positive and negative probes of the digital volt ohm multimeter **must** be connected to the circuit. This connection can be made with a 2-pin Deutsch™ breakout cable, Part Number 3163531.

24 volt applications that use a 24 volt Lift Pump Wiring Harness:

Some 24 volt applications use an additional component in the lift pump circuit. The 24 volt lift pump wiring harness consists of a relay and voltage regulator. Power supplied by the ECM engages the relay. An OEM-supplied +24-VDC

power source is then delivered to the voltage regulator through the relay. The voltage regulator reduces the +24-VDC to +12-VDC, which is then supplied to the lift pump.

The regulator is load-dependant. In order for the regulator to reduce the +24-VDC to +12-VDC, the lift pump **must** be plugged in and running in diesel fuel. Also, the multimeter test leads **must** be connected to the lift pump SUPPLY and RETURN wires. This can be achieved with a breakout harness. If the voltage is measured with the lift pump disconnected, the meter will display system voltage (+24-VDC). If the multimeter ground test lead is placed on the cylinder block or anywhere else other than the lift pump RETURN wire, the display will read system voltage (+24-VDC).

With the lift pump plugged in and running in diesel fuel, the voltage measurement should **not** exceed +14-VDC. If the voltage is greater than +14-VDC, the regulator is damaged.

**Refer to Troubleshooting Fault Code t05-2215**



## FAULT CODE 2215 (ISB/QSB Automotive, Industrial, or Marine Application) - Fuel Pump Delivery Pressure - Data Valid But Below Normal Operating Range - Moderately Severe Level TROUBLESHOOTING SUMMARY

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1:</b> Check the fault codes.		
<b>STEP 1A:</b> Check for active fault codes.	Fault Code 2215 active?	
<b>STEP 2:</b> Preliminary checks.		
<b>STEP 2A:</b> Check for adequate fuel supply.	The equipment/vehicle has an adequate fuel supply?	
<b>STEP 2B:</b> Inspect for external fuel leaks.	Fuel leak present?	
<b>STEP 2C:</b> Check the system voltage.	Voltage within the specified range?	
<b>STEP 2D:</b> Check for lift pump operation at key ON.	Lift pump operates at key on?	
<b>STEP 3:</b> Check the fuel supply to the fuel injection pump.		
<b>STEP 3A:</b> Lift pump volume test.	Lift pump meets minimum flow specification and has no air in the fuel?	
<b>STEP 3A-1:</b> Air in the fuel.	Was there air in the fuel during step 3A?	
<b>STEP 3B:</b> Check the fuel filter restriction.	Lift pump meets minimum flow specification?	
<b>STEP 3C:</b> Check the fuel inlet restriction.	Lift pump inlet restriction meets specifications?	
<b>STEP 3D:</b> Check lift pump voltage (determine configuration).	Is the engine a 12 volt automotive or marine configuration?	
<b>STEP 3E:</b> Check lift pump voltage (determine configuration).	Is the engine a 24 volt automotive configuration?	
<b>STEP 3F:</b> Check lift pump voltage (+24-VDC marine).	Is the lift pump voltage within specification?	
<b>STEP 3G:</b> Check lift pump voltage (+12-VDC automotive and marine).	Is the lift pump voltage within specification?	
<b>STEP 3H:</b> Check lift pump voltage (+24-VDC automotive).	Is the lift pump voltage greater than +16-VDC?	
<b>STEP 3I:</b> Test the +24-VDC voltage regulator (24 volt automotive).	Is the lift pump voltage greater than +10-VDC?	
<b>STEP 3J:</b> Test the +24-VDC voltage regulator (24 volt automotive).	Does the voltage regulator function?	
<b>STEP 4:</b> Check the fuel injectors.		
<b>STEP 4A:</b> Check the injector return flow.	Injector return flow within specifications?	
<b>STEP 4B:</b> Check the high-pressure connector (HPC) torque.	Injector high-pressure connector torque meets specifications?	

- STEP 4C:** Check for individual leaking injectors. Is fuel injector return flow within specification with an injector capped off?
- STEP 5:** Check the high-pressure fuel rail.
- STEP 5A:** Verify rail fuel pressure sensor accuracy. Is the fuel rail pressure (measured) less than 30 bar [435 psi]?
- STEP 5B:** Measure the high-pressure fuel rail return flow. Fuel return flow meets specifications?
- STEP 6:** Check the high-pressure injection pump.
- STEP 6A:** High-pressure injection pump flow test. Fuel pump flow meets the specification?
- STEP 6B:** Check drain line restriction. Fuel drain line restriction within specification?
- STEP 7:** Clear the fault code.
- STEP 7A:** Disable the fault code. Fault Code 2215 inactive?
- STEP 7B:** Clear the inactive fault codes. All fault codes cleared?

### TROUBLESHOOTING STEP

- STEP 1:** Check the fault codes.  
**STEP 1A:** Check for active fault code.

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for an active fault code. Use INSITE™ electronic service tool to read the fault codes.	Fault Code 2215 active? <b>YES</b>	2A
	Fault Code 2215 active? <b>NO</b>	Fault Code 2215 <b>must</b> be recreated in order to properly troubleshoot. If it can <b>not</b> be recreated, see the Shop Talk section.

**STEP 2: Preliminary checks.**

**STEP 2A: Check for adequate fuel supply.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Engine OFF.</li> </ul>		
Action	Specification/Repair	Next Step
Check for adequate fuel supply. <ul style="list-style-type: none"> <li>• Check the equipment/vehicle fuel gauge.</li> <li>• Inspect the fuel tank if there is any doubt about the accuracy of the fuel gauge.</li> </ul>	The equipment/vehicle has an adequate fuel supply? <b>YES</b>	2B
	The equipment/vehicle has an adequate fuel supply? <b>NO</b> <b>Repair:</b> Add fuel to the fuel tank.	7A

**STEP 2B: Inspect for external fuel leaks.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Operate engine (if it will start).</li> </ul>		
Action	Specification/Repair	Next Step
Check for external fuel leaks. <ul style="list-style-type: none"> <li>• Start the engine and allow it to idle.</li> <li>• Inspect for external fuel leaks.</li> </ul>	Fuel leak present? <b>YES</b> <b>Repair:</b> Repair the fuel leak. See ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271.	7A
	Fuel leak present? <b>NO</b>	2C

**STEP 2C: Check the system voltage.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Operate engine (if it will start).</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check the system voltage.</p> <ul style="list-style-type: none"> <li>• Monitor battery voltage in INSITE™ electronic service tool data monitor.</li> <li>• Connect a digital volt ohm multimeter to the batteries and monitor battery voltage.</li> </ul>	<p>Voltage within the specified range?</p> <p>+12-VDC System: Voltage +10-15-VDC +24-VDC System: Voltage +22-28-VDC</p> <p><b>YES</b></p>	2D
	<p>Voltage within the specified range?</p> <p>+12-VDC System: Voltage +10-15-VDC +24-VDC System: Voltage +22-28-VDC</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Troubleshoot the cause of low battery voltage. See the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271.</p>	7A

**STEP 2D: Check for lift pump operation at key ON.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Do <b>not</b> operate engine.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for lift pump operation at key ON.</p> <ul style="list-style-type: none"> <li>• Turn the keyswitch ON, then listen and feel for lift pump operation.</li> <li>• Note: The lift pump will operate for 60 seconds after keyswitch ON, then switch OFF.</li> </ul>	<p>Lift pump operates at key ON?</p> <p><b>YES</b></p>	3A
	<p>Lift pump operates at key ON?</p> <p><b>NO</b></p>	3D

**STEP 3: Check the fuel supply to the fuel injection pump.**

**STEP 3A: Lift pump volume test.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Service tool, Part Number 3824842 (Compuchek™ fitting) and Part Number 3164621 (orifice with drain hose), connected to the fuel filter OUTLET test port.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Perform the lift pump volume test.</p> <ul style="list-style-type: none"> <li>• Install service tool, Part Number 3824842 and Part Number 3164621, to the fuel filter OUTLET test port, place the fuel line in an empty bucket, and turn the keyswitch ON. Allow the fuel lift pump to operate for the full cycle of 60 seconds. See the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, for measuring the lift pump flow. Refer to Procedure 005-045 in Section 5.</li> <li>• Check for signs of air in the fuel.</li> </ul>	<p>Lift pump meets minimum flow specification and has <b>no</b> air in the fuel?</p> <p>Fuel flow rate for lift pump (do <b>not</b> operate engine) - greater than 600 ml in 60 seconds or fill a 12-ounce can in 36 seconds or less.</p> <p>Air in the fuel consists of large bubbles or aerated fuel after the system has been primed.</p> <p><b>YES</b></p>	4A
	<p>Lift pump meets minimum flow specification and has <b>no</b> air in the fuel?</p> <p>Fuel flow rate for lift pump (do <b>not</b> operate engine) - greater than 600 ml in 60 seconds or fill a 12-ounce can in 36 seconds or less.</p> <p>Air in the fuel consists of large bubbles or aerated fuel after the system has been primed.</p> <p><b>NO</b></p>	3A-1

**STEP 3A-1: Air in the fuel.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for air in the fuel.</p>	<p>Was there air in the fuel during step 3A?</p> <p>Air in the fuel consists of large bubbles or aerated fuel after the system has been primed.</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Determine the source of the air and repair. See the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271 or see the OEM manual. Refer to Procedure Refer to the Procedure 006-003 in Section 6.</p>	7A
	<p>Was there air in the fuel during step 3A?</p> <p>Air in the fuel consists of large bubbles or aerated fuel after the system has been primed.</p> <p><b>NO</b></p>	3B

**STEP 3B: Check the fuel filter restriction.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Service tool, Part Number 3824842 (Compuchek™ fitting) and Part Number 3164621 (Orifice with drain hose), connected to the fuel filter INLET test port.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Perform the lift pump volume test.</p> <ul style="list-style-type: none"> <li>• Remove service tool, Part Number 3824842 and Part Number 3164621, from the fuel filter outlet and connect to the fuel filter INLET test port, place the fuel line in an empty bucket, and turn the keyswitch ON. Allow the fuel lift pump to operate for the full cycle of 60 seconds. Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271, to measure the lift pump flow. Refer to Procedure 005-045 in Section 5.</li> <li>• Check for signs of air in the fuel.</li> </ul>	<p>Lift pump meets minimum flow specification?</p> <p>Fuel flow rate for lift pump (do <b>not</b> operate engine) - greater than 600 ml in 60 seconds or fill a 12-ounce can in 36 seconds or less.</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Replace or repair the pressure side fuel filter/housing. Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 006-015 in Section 6.</p>	<p>7A</p>
	<p>Lift pump meets minimum flow specification?</p> <p>Fuel flow rate for lift pump (do <b>not</b> operate engine) - greater than 600 ml in 60 seconds or fill a 12-ounce can in 36 seconds or less.</p> <p><b>NO</b></p>	<p>3C</p>

**STEP 3C: Check the fuel inlet restriction.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Service tool, Part Number 3824842, connected to the fuel filter INLET test port.</li> <li>• Restriction gauge connected at the inlet of the fuel lift pump.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check fuel inlet restriction.</p> <ul style="list-style-type: none"> <li>• Install an M12 x 1/8 inch NPT banjo screw, Part Number 4918413, into the inlet of the fuel lift pump.</li> <li>• Install a vacuum gauge into the back of the banjo screw (gauge range of at least 0 to 67.7 kPa [0 to 20 in-Hg]).</li> <li>• Connect service tool, Part Number 3824842 and Part Number 3164621, to the fuel filter housing INLET test port.</li> <li>• Turn the keyswitch ON and operate the lift pump.</li> <li>• Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271, for measuring the lift pump flow. Refer to Procedure 006-020 in Section 6.</li> </ul>	<p>Lift pump inlet restriction meets specifications?</p> <p>Allowable fuel inlet restriction at full lift pump flow: Vehicle Applications MAX: 20.3 kPa [6.0 in-Hg]; Marine Applications MAX: 13.5 kPa [4.0 in-Hg]</p> <p><b>YES</b></p>	3D
	<p>Lift pump inlet restriction meets specifications?</p> <p>Allowable fuel inlet restriction at full lift pump flow: Vehicle Applications MAX: 20.3 kPa [6.0 in-Hg]; Marine Applications MAX: 13.5 kPa [4.0 in-Hg]</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Inspect the OEM fuel lines, OEM pre-filter, and fuel tank pickup tube for restrictions or damage. Refer to the OEM service manual.</p>	7A

**STEP 3D: Check lift pump voltage (determine configuration).**

<p><b>Condition:</b></p>		
Action	Specification/Repair	Next Step
<p>Determine lift pump configuration.</p> <ul style="list-style-type: none"> <li>• 12 volt Automotive/Marine</li> <li>• 24 volt Automotive</li> <li>• 24 volt Marine.</li> </ul>	<p>Is the engine a 12 volt automotive or marine configuration?</p> <p><b>YES</b></p>	3G
	<p>Is the engine a 12 volt automotive or marine configuration?</p> <p><b>NO</b></p>	3E

**STEP 3E: Check lift pump voltage (determine configuration).**

<b>Condition:</b>		
<b>Action</b>	<b>Specification/Repair</b>	<b>Next Step</b>
Determine lift pump configuration. <ul style="list-style-type: none"> <li>• 12 volt Automotive/Marine</li> <li>• 24 volt Automotive</li> <li>• 24 volt Marine.</li> </ul>	Is the engine a 24 volt automotive configuration? <b>YES</b>	3H
	Is the engine a 24 volt automotive configuration? <b>NO</b>	3F

**STEP 3F: Check lift pump voltage (24 volt marine).**

<b>Condition:</b>		
<ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> <li>• Lift pump override test active.</li> </ul>		
<b>Action</b>	<b>Specification/Repair</b>	<b>Next Step</b>
Measure lift pump voltage. <ul style="list-style-type: none"> <li>• Install the Deutsch™ 2-pin breakout cable, Part Number 3163531, and measure the lift pump voltage with the override test active.</li> </ul> Voltage will <b>only</b> be present when the lift pump is commanded ON and when the lift pump is connected to the harness. Use INSITE™ electronic service tool lift pump override test and a breakout cable between the lift pump and the engine harness to measure the lift pump voltage.	Is the lift pump voltage within specification? Minimum: +21-VDC Maximum: +28-VDC <b>YES</b> <b>Repair:</b> Replace the lift pump. Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 005-045 in Section 5.	7A
	Is the lift pump voltage within specification? Minimum: +21-VDC Maximum: +28-VDC <b>NO</b> <b>Repair:</b> Check the ECM and engine harnesses. See Section 19.	7A



**STEP 3G: Check lift pump voltage (12 volt automotive and marine).**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> <li>• Lift pump override test active.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Measure lift pump voltage.</p> <ul style="list-style-type: none"> <li>• Install the Deutsch™ 2-pin breakout cable, Part Number 3163531, and measure the lift pump voltage with the override test active.</li> </ul> <p>Voltage will <b>only</b> be present when the lift pump is commanded ON and when the lift pump is connected to the harness. To measure the lift pump voltage, use INSITE™ electronic service tool lift pump override test and a breakout cable between the lift pump and the engine harness.</p>	<p>Is the lift pump voltage within specification?</p> <p>Minimum: +9-VDC</p> <p>Maximum: +16- VDC</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Replace the lift pump. Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 005-045 in Section 5.</p>	7A
	<p>Is the lift pump voltage within specification?</p> <p>Minimum: +9-VDC</p> <p>Maximum: +16-VDC</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Check the ECM and engine harnesses. See Section 19.</p>	7A

**STEP 3H: Check lift pump voltage (24 volt automotive).**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> <li>• Lift pump override test active.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Measure lift pump voltage.</p> <ul style="list-style-type: none"> <li>• Install the Deutsch™ 2-pin breakout cable, Part Number 3163531, and measure the lift pump voltage with the override test active.</li> </ul> <p>Voltage will <b>only</b> be present when the lift pump is commanded ON and when the lift pump is connected to the harness. To measure the lift pump voltage, use INSITE™ electronic service tool lift pump override test and a breakout cable between the lift pump and the engine harness.</p>	<p>Is the lift pump voltage greater than +16-VDC?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Replace the lift pump and voltage regulator. Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 005-045 in Section 5.</p>	7A
	<p>Is the lift pump voltage greater than +16-VDC?</p> <p><b>NO</b></p>	3I

**STEP 3I: Test the 24 volt voltage regulator (24 volt automotive).**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> <li>• Lift pump override test active.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Measure lift pump voltage.</p> <ul style="list-style-type: none"> <li>• Install the Deutsch™ 2-pin breakout cable, Part Number 3163531, and measure the lift pump voltage with the override test active.</li> </ul> <p>Voltage will <b>only</b> be present when the lift pump is commanded ON and when the lift pump is connected to the harness. To measure the lift pump voltage, use INSITE™ electronic service tool lift pump override test and a breakout cable between the lift pump and the engine harness.</p>	<p>Is the lift pump voltage greater than +10-VDC?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Replace the lift pump. Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 005-045 in Section 5.</p>	7A
	<p>Is the lift pump voltage greater than +10-VDC?</p> <p><b>NO</b></p>	3J

**STEP 3J: Test the 24 volt voltage regulator (24 volt automotive).**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> <li>• Lift pump override test active.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Test the 24 volt voltage regulator (24 volt automotive).</p> <ul style="list-style-type: none"> <li>• Fuse</li> <li>• Relay</li> <li>• Supply voltage from the ECM</li> <li>• Supply voltage from the OEM.</li> </ul> <p>Reference the wiring diagram, Bulletin 4021347. Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271, for details about the voltage regulator. Refer to Procedure 005-045 in Section 5.</p>	<p>Does the voltage regulator function?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>No repair. Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 005-045 in Section 5.</p>	7A
	<p>Does the voltage regulator function?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Replace the voltage regulator.</p>	7A

**STEP 4: Check the fuel injectors.**  
**STEP 4A: Check the injector return flow.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Install test fittings, Part Number 3164618 banjo adapter with drain hose, to measure the fuel return from the injectors and high-pressure connectors.</li> <li>• Operate engine at idle.</li> <li>• INSITE™ electronic service tool Fuel System Leakage Test ACTIVE, if available.</li> </ul>		
Action	Specification/Repair	Next Step
Check for excessive fuel leakage from the injectors and high-pressure connectors. <ul style="list-style-type: none"> <li>• Attach service tool, Part Number 3164618, to the injector return line. Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 006-026 in Section 6.</li> </ul>	Injector return flow within specifications? Flow Specifications: <ul style="list-style-type: none"> <li>• INSITE™ electronic service tool fuel system leakage test active: 4-Cylinder: 200 ml/minute maximum [6.8 fl-oz per minute]; 6-Cylinder: 300 ml/minute maximum [10.1 fl-oz per minute]</li> <li>• Standard Idle Conditions: 4-Cylinder: 120 ml/minute maximum [4 fl-oz per minute]; 6-Cylinder: 180 ml/minute maximum [6 fl-oz per minute]</li> <li>• Engine Cranking: 4 and 6 - Cylinder: 90 ml/minute maximum [3.04 fl-oz per minute]</li> </ul> Do <b>not</b> overheat the starter. <b>YES</b>	5A
	Injector return flow within specifications? Flow Specifications: <ul style="list-style-type: none"> <li>• INSITE™ electronic service tool fuel system leakage test active: 4-Cylinder: 200 ml/minute maximum [6.8 fl-oz per minute]; 6-Cylinder: 300 ml/minute maximum [10.1 fl-oz per minute]</li> <li>• Standard Idle Conditions: 4-Cylinder: 120 ml/minute maximum [4 fl-oz per minute]; 6-Cylinder: 180 ml/minute maximum [6 fl-oz per minute]</li> <li>• Engine Cranking: 4 and 6 - Cylinder: 90 ml/minute maximum [3.04 fl-oz per minute]</li> </ul> Do <b>not</b> overheat the starter. <b>NO</b>	4B

**STEP 4B: Check the high-pressure connector (HPC) torque.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check the injector high pressure connector torque.</p> <ul style="list-style-type: none"> <li>• Check the injector high-pressure connector torque. Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 006-052 in Section 6.</li> </ul>	<p>Injector high-pressure connector torque meets specifications?</p> <p><b>YES</b></p>	4C
	<p>Injector high-pressure connector torque meets specifications?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Inspect the high pressure connector for damage and replace, if necessary. Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 006-052 in Section 6.</p>	7A

**STEP 4C: Check for individual leaking injectors.**

**Condition:**

- Turn keyswitch ON.
- Install test fittings to measure the fuel return from the injectors and high-pressure connectors.
- Operate engine at idle.
- INSITE™ electronic service tool Fuel System Leakage Test ACTIVE, if available.
- Tools: Part Number 3164618 banjo adapter with drain hose, Part Number 3164325 injector isolation.

Action	Specification/Repair	Next Step
<p>Check for fuel leak rate at individual injectors.</p> <ul style="list-style-type: none"> <li>• Cap off each injector one at a time with the injector leakage isolation tool, Part Number 3164325. The service tool <b>must</b> be installed with the engine OFF.</li> <li>• With each injector capped off, repeat the injector leakage test.</li> </ul> <p>Injector isolation tool use: Isolate each injector using the tool and compare the injector return flows. The cylinder having the highest reduction effect (causes the most difference) is the source of the leak.</p> <p>Any injector causing a 20 percent or greater reduction in return volume is suspect. If the engine would <b>not</b> start, but does with an injector isolated, operate the engine for 1 minute to determine if the code changes to inactive. If so, replace that injector and continue the isolation test. Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 006-026 in section 6. Refer to Procedure 006-052 in Section 6.</p>	<p>Is fuel injector return flow within specification with an injector capped off?</p> <p>Flow Specification: Standard Idle Conditions: 4-cylinder: 120 ml/minute maximum or <b>not</b> more than 4 fl-oz per minute; 6-cylinder: 180 ml/minute maximum or <b>not</b> more than 6 fl-oz per minute</p> <p>Flow Specification: Engine Cranking: 4 and 6 - cylinder: 90 ml/minute maximum [3.04 fl-oz per minute]</p> <p>Do <b>not</b> overheat the starter.</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Replace the injector of the cylinder that is contributing to the high return flow. For ISB CM800, CM850, CM2150, CM2150 SN, CM2250 and QSB CM850 and CM2250 engines, inspect the high pressure connector for damage and <b>only</b> replace the high pressure connector if necessary. Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 006-026 in Section 6. Refer to Procedure 006-052 in Section 6.</p>	<p>7A</p>
	<p>Is fuel injector return flow within specification with an injector capped off?</p> <p>Flow Specification: Standard Idle Conditions: 4-cylinder: 120 ml/minute maximum or <b>not</b> more than 4 fl-oz per minute; 6-cylinder: 180 ml/minute maximum or <b>not</b> more than 6 fl-oz per minute</p> <p>Flow Specification: Engine Cranking: 4 and 6 - cylinder: 90 ml/minute maximum [3.04 fl-oz per minute]</p> <p>Do <b>not</b> overheat the starter.</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Cap off additional injectors to identify the source of high injector return flow. For the cylinders that are causing the high injector return flow, replace the injectors. For ISB CM800, CM850, CM2150, CM2150 SN, CM2250 and QSB CM850 and CM2250 engines, inspect the high pressure connector for damage and <b>only</b> replace the high pressure connector if necessary. Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 006-026 in Section 6. Refer to Procedure 006-052 in Section 6.</p>	<p>7A</p>

**STEP 5: Check the high-pressure fuel rail.**

**STEP 5A: Verify rail fuel pressure sensor accuracy.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> <li>• INSITE™ Monitor.</li> <li>• Do <b>not</b> operate the engine.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Monitor the fuel rail pressure.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to measure fuel rail pressure.</li> </ul>	<p>Is the fuel rail pressure (measured) less than 30 bar [435 psi]?</p> <p><b>YES</b></p>	<p>5B</p>
	<p>Is the fuel rail pressure (measured) less than 30 bar [435 psi]?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Replace the rail fuel pressure sensor. Refer to Procedure 019-115 in Section 19.</p>	<p>7A</p>

**STEP 5B: Measure the high-pressure fuel rail return flow.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Install a test fitting Part Number 3164617 (adapter with drain hose) on the high-pressure rail relief valve.</li> <li>• Operate engine at idle.</li> <li>• INSITE™ electronic service tool Fuel System Leakage Test ACTIVE, if available.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for excessive fuel return from the high-pressure fuel rail.</p> <ul style="list-style-type: none"> <li>• Attach the appropriate service tool to the high-pressure rail relief valve. Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 006-061 in Section 6.</li> </ul>	<p>Fuel return flow meets specifications?</p> <p>Specification:</p> <p>At Idle: No flow</p> <p>INSITE™ electronic service tool Override: Maximum: 1 drop per second (16 ml [0.5 oz] per 60 seconds).</p> <p><b>YES</b></p>	6A
	<p>Fuel return flow meets specifications?</p> <p>Specification:</p> <p>At Idle: No flow</p> <p>INSITE™ electronic service tool Override: Maximum: 1 drop per second (16 ml [0.5 oz] per 60 seconds).</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <ul style="list-style-type: none"> <li>• Replace the rail fuel pressure relief valve. Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 006-061 in Section 6.</li> <li>• Determine the reason why the fuel rail pressure relief valve has been tripping. If <b>not</b> done, this could result in repeat malfunctions.</li> </ul> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Operation with the electronic fuel control valve unplugged.</li> <li>• Operation with a plugged fuel filter or excessive inlet restriction.</li> </ul>	7A

**STEP 6: Check the high-pressure injection pump.**

**STEP 6A: High-pressure injection pump flow test.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Engine cranking.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check the high-pressure injection pump fuel flow.</p> <ul style="list-style-type: none"> <li>• Disconnect the high-pressure fuel line from to the fuel rail from the high-pressure injection pump.</li> <li>• Connect a clear hose to the outlet of the high-pressure injection pump.</li> <li>• Run the high pressure fuel line into an empty bucket.</li> <li>• Crank the engine for 30 seconds and measure the fuel pump flow.</li> <li>• Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 005-016 in Section 5.</li> </ul>	<p>Fuel pump flow meets the specification?</p> <p>Minimum fuel pump flow is 75 ml [2.5 oz] in 30 seconds at 125 rpm or 90 ml [3.04 oz] in 30 seconds at 150 rpm.</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Replace the EFC actuator valve. Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 005-007 in Section 5.</p>	6B
	<p>Fuel pump flow meets the specification?</p> <p>Minimum fuel pump flow is 75 ml [2.5 oz] in 30 seconds at 125 rpm or 90 ml [3.04 oz] in 30 seconds at 150 rpm.</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Replace the high pressure fuel pump. Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 005-016 in Section 5.</p>	6B



**STEP 6B: Check drain line restriction.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Install test fittings to measure the fuel drain line restriction.</li> <li>• Operate engine at high idle no load.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for excessive fuel drain line restriction.</p> <ul style="list-style-type: none"> <li>• Install test fittings to measure fuel drain line restriction.</li> <li>• Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 006-012 in Section 6.</li> </ul>	<p>Fuel drain line restriction within specification?</p> <p>Maximum fuel drain line restriction at high idle no load is 18.6 kPa [2.7 psi]</p> <p><b>YES</b></p>	7A
	<p>Fuel drain line restriction within specification?</p> <p>Maximum fuel drain line restriction at high idle no load is 18.6 kPa [2.7 psi]</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <ul style="list-style-type: none"> <li>• Repair the source of the high fuel drain line restriction. Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 006-013 in Section 6.</li> </ul>	7A

**STEP 7: Clear the fault codes.**

**STEP 7A: Disable the fault code.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Disable the fault code.</p> <ul style="list-style-type: none"> <li>• Start the engine and let it idle for 1 minute.</li> <li>• Use INSITE™ electronic service tool to verify that the fault codes are inactive.</li> </ul>	<p>Fault Code 2215 inactive?</p> <p><b>YES</b></p>	7B
	<p>Fault Code 2215 inactive?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Return to the troubleshooting steps or contact a Cummins® Authorized Repair Location if all steps have been completed and checked again.</p>	1A

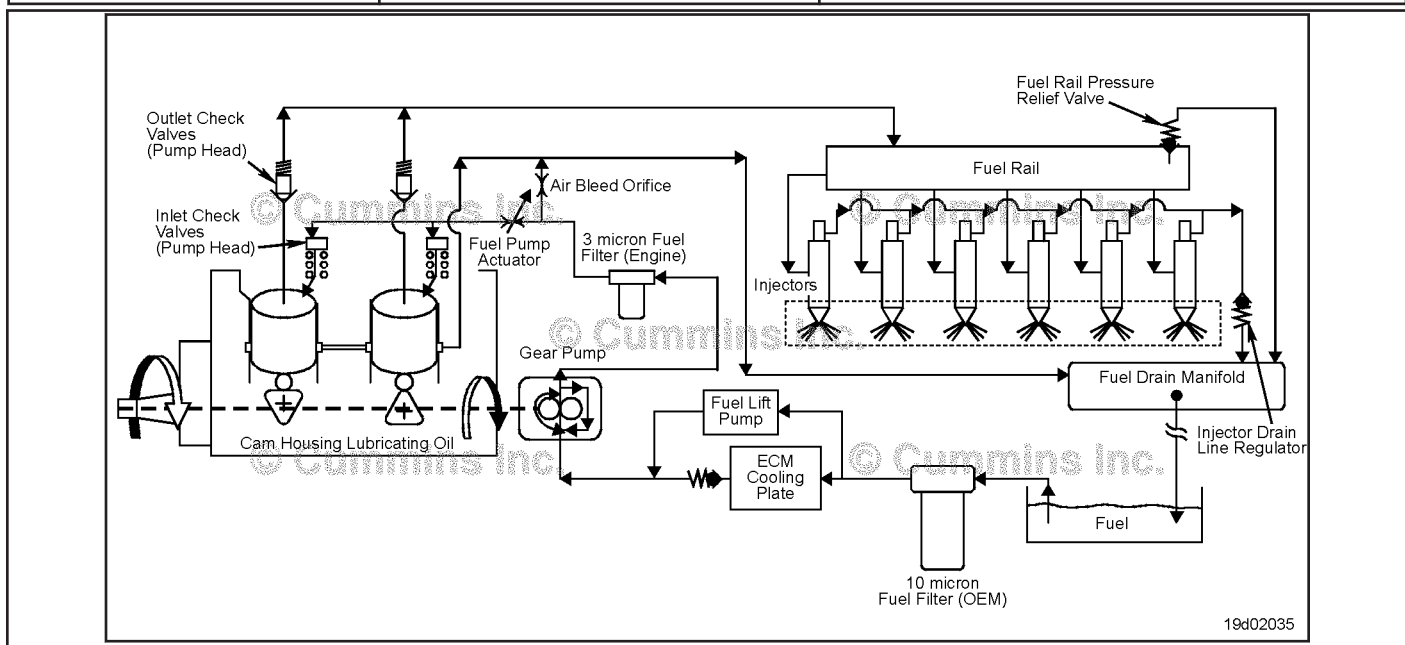
**STEP 7B: Clear the inactive fault codes.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Do <b>not</b> operate the engine.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Clear the inactive fault codes.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to clear the inactive fault codes.</li> </ul>	<p>All fault codes cleared? <b>YES</b></p>	<p>Repair complete</p>
	<p>All fault codes cleared? <b>NO</b></p> <p><b>Repair:</b> Troubleshoot any remaining active fault codes.</p>	<p>Appropriate troubleshooting steps</p>

## Fault Code 2215 (ISC/QSC/ISL/QSL Automotive, Industrial, or Marine Application)

### Fuel Pump Delivery Pressure Low - Data Valid but Below Normal Operational Range - Moderately Severe Level

CODES	REASON	EFFECT
Fault Code: 2215 PID(P), SID(S): P94 SPN: 94 FMI: 0/18 Lamp: Yellow SRT:	Fuel Pump Delivery Pressure Low - Data Valid but Below Normal Operational Range - Moderately Severe Level. The ECM has detected that fuel pressure is lower than commanded pressure.	Possibly hard to start, low power, or engine smoke.



Fuel Flow Diagram

#### Circuit Description:

The pressure control loop relies on fuel pressure supplied to the high-pressure pump by the fuel gear pump. The electronic control module (ECM) monitors rail fuel pressure and engine operating conditions and changes the flow command to maintain the proper rail fuel pressure. Changes to the flow command result in opening (or closing) of the fuel pump actuator to supply more (or less) fuel to the high-pressure pump.

The fuel flow circuit includes, in the following order:

- OEM fuel tank
- OEM fuel supply line
- Water stripping fuel filter (10 micron, water stripping, suction side fuel filter)
- Engine mounted OEM fuel connection
- Fuel supply tube to ECM cooling plate
- ECM cooling plate
- Fuel supply tube to the low-pressure gear pump
- Fuel supply tube to the pressure-side fuel filter
- Primary fuel filter (3 micron pressure-side fuel filter)
- Fuel supply tube to the high-pressure pump
- High-pressure pump
- High-pressure system (including fuel rail and fuel rail pressure relief valve), injectors, and high-pressure lines.

Component Location:

The high-pressure fuel pump is mounted to the gear housing on the intake side of the engine. Refer to Procedure 100-002 in Section E.

Shop Talk:

If the engine will not start and Fault Code 2215 becomes active during cranking, but no speed sensor fault codes exist, monitor the fuel rail pressure with INSITE™ electronic service tool. If the rail pressure is low, check the following:

- Fuel system prime (make sure there is fuel in the tanks and the system is primed)
Fuel lift pump pressure; Use the procedure in the Troubleshooting and Repair Manual, ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Engines, Bulletin 4021418: Refer to Procedure 005-045 in Section 5.
Fuel gear pump pressure; Use the procedure in the Troubleshooting and Repair Manual, ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Engines, Bulletin 4021418: Refer to Procedure 005-025 in Section 5.

If the gear pump pressure is OK, test for system leakage:

- High-pressure pump leakage; Use the procedure in the Troubleshooting and Repair Manual, ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Engines, Bulletin 4021418: Refer to Procedure 005-227 in Section 5.
Injector leakage; Use the procedure in the Troubleshooting and Repair Manual, ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Engines, Bulletin 4021418: Refer to Procedure 006-026 in Section 6.
Fuel rail pressure relief valve.

If Fault Code 2215 is inactive and there are no existing performance complaints, it is possible the vehicle was run out of fuel or the engine was not primed following fuel filter replacement. Clear the inactive fault code.

Fault Code 2215 sets when the engine is running and measured rail fuel rail pressure remains at least 10 Mpa [1450 psi] less than commanded pressure. Once detected, Fault Code 2215 will remain active until the engine is turned off or until the measured fuel rail pressure matches the commanded fuel rail pressure. When a condition exists that causes Fault Code 2215 to become active, it is typical for the fault code to become active when the engine is heavily loaded and become inactive when the engine is lightly loaded.

When Fault Code 2215 occurs, the fuel system has lost its ability to maintain fuel rail pressure. Causes of this fault include:

- Excessive fuel inlet restriction
Fuel filter plugging
Air in the fuel system
Fuel gear pump output low
Fuel gear pump pressure regulator sticking or leaking
High-pressure pump capacity decay (high leakage to drain from the high-pressure pump)
Fuel rail pressure relief valve leaks to drain
Fuel rail pressure relief valve opens at too low a pressure
Injector fuel circuit leaks to drain
Pressure sensor reads more than 10 Mpa [1450 psi] lower than actual pressure.

Intermittent ECM power supply connections can cause Fault Code 2215. If the engine is running with an active Fault Code 2215 and Fault Codes 449 or 2311 are not present, check the ECM power supply for intermittent connections. Fault Code 1117 can also be active if this fault condition exists.

Inactive Fault Code:

Troubleshooting inactive Fault Code 2215 can be very difficult. The fault code must be active for any of the outlined procedures in which the engine is operated during the test. For engines with high counts of inactive Fault Code 2215, operate the engine on a chassis dynamometer or a diagnostic road test to duplicate the fault code. The most common causes of intermittent Fault Code 2215 that are difficult to create are leaking high-pressure connectors that only leak when the engine and the fuel are hot, and intermittent fuel supply restrictions, such as debris floating in the fuel tank. Check the High Pressure Connector (HPC) and connector torque and torque to specification if necessary. Operate the engine on a chassis dynamometer or conduct a diagnostic road test to duplicate the fault code.

Refer to Troubleshooting Fault Code t05-2215

**FAULT CODE 2215 (ISC/QSC/ISL/QSL Automotive, Industrial, or Marine Application) - Fuel Pump Delivery Pressure Low - Data Valid But Below Normal Operating Range - Moderately Severe Level**  
**TROUBLESHOOTING SUMMARY**

<b>STEPS</b>	<b>SPECIFICATIONS</b>	<b>SRT CODE</b>
<b>STEP 1: Check the fault codes.</b>		
<b>STEP 1A:</b> Read the fault codes.	Fault Code 275, 449, 1117, or 2311 active or high inactive counts?	
<b>STEP 1B:</b> Inspect for external fuel leaks.	Fuel leaks present?	
<b>STEP 1C:</b> Verify the rail fuel pressure sensor accuracy.	Fuel rail pressure +/- 43 bar [ +/- 624 psi]?	
<b>STEP 2: Check engine operation.</b>		
<b>STEP 2A:</b> Attempt to start the engine.	Engine start?	
<b>STEP 2B:</b> Check the fuel supply.	Adequate amount of fuel in the tank?	
<b>STEP 3: Check the low-pressure fuel system. (Engine not operating)</b>		
<b>STEP 3A:</b> Check the fuel lift pump pressure.	Fuel lift pump pressure within specifications?	
<b>STEP 3B:</b> Measure the fuel gear pump pressure.	Fuel gear pump pressure greater than specifications?	
<b>STEP 4: Check the low-pressure fuel system. (Engine operating)</b>		
<b>STEP 4A:</b> Check for external fuel leak.	Any external fuel leaks?	
<b>STEP 4B:</b> Check for air in the high-pressure pump fuel supply.	Air present in the fuel supply?	
<b>STEP 4C:</b> Measure inlet restriction at the original equipment manufacturer (OEM) connection point.	OEM inlet restriction above specification?	
<b>STEP 4D:</b> Measure inlet restriction at the gear pump inlet.	Gear pump inlet restriction above specification?	
<b>STEP 4E:</b> Measure the gear pump pressure.	Gear pump pressure above specification?	
<b>STEP 4F:</b> Measure the fuel filter restriction.	Fuel filter pressure drop above specification?	
<b>STEP 5: Check the high-pressure fuel system.</b>		
<b>STEP 5A:</b> Measure the fuel pump head flow.	Fuel pump head flow greater than 100 cc [3.4 oz] in 30 seconds of cranking?	
<b>STEP 5B:</b> Check for excessive fuel return from the fuel injector drain line.	Fuel injector leakage excessive?	
<b>STEP 5C:</b> Check for excessive fuel return from the high-pressure pump.	Fuel pump leakage excessive?	
<b>STEP 5D:</b> Check for excessive leakage from the rail fuel pressure relief valve.	Rail fuel pressure relief valve leaking more than 30 drops per minute?	

**STEP 6: Verify the repair is complete.**

- STEP 6A:** Disable the fault code. Fault Code 2215 becomes active during loaded engine operation?
- STEP 6B:** Clear the inactive fault codes. All fault codes cleared?

**TROUBLESHOOTING STEP**

**STEP 1: Check the fault codes.**

**STEP 1A: Read the fault codes.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>Turn keyswitch ON.</li> <li>Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Read the fault codes. <ul style="list-style-type: none"> <li>Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 275, 449, 1117, or 2311 active or high inactive counts? <b>YES</b>	Appropriate troubleshooting tree
	Fault Code 275, 449, 1117, or 2311 is active or high inactive counts? <b>NO</b>	1B

**STEP 1B: Inspect for external fuel leaks.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>Turn keyswitch OFF.</li> </ul>		
Action	Specification/Repair	Next Step
Check for external fuel leaks. <ul style="list-style-type: none"> <li>Look for fuel leaking from loose fuel fittings and damaged fuel lines, or damaged components.</li> </ul>	Fuel leaks present? <b>YES</b> <b>Repair:</b> Repair the fuel leak. <ul style="list-style-type: none"> <li>Use the procedure in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418: Refer to Procedure 006-024 in Section 6.</li> </ul>	6A
	Fuel leaks present? <b>NO</b>	1C

**STEP 1C: Verify the rail fuel pressure sensor accuracy.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> <li>• Monitor INSITE™ electronic service tool.</li> <li>• Do <b>not</b> operate the engine.</li> </ul>		
Action	Specification/Repair	Next Step
Make sure the correct sensor part number is installed in the high pressure fuel rail. Monitor the fuel rail pressure. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to measure fuel rail pressure.</li> </ul>	Fuel rail pressure 0 +/- 43 bar [0 +/- 624 psi]? <b>YES</b>	2A
	Fuel rail pressure 0 +/- 43 bar [0 +/- 624 psi]? <b>NO</b> <b>Repair:</b> Replace the rail fuel pressure sensor. <ul style="list-style-type: none"> <li>• Refer to Procedure 019-115 in Section 19.</li> </ul>	6A

**STEP 2: Check engine operation.**

**STEP 2A: Check to see if the engine will start.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
Attempt to start the engine.	Engine start? <b>YES</b>	4A
	Engine start? <b>NO</b>	2B

**STEP 2B: Check the fuel supply.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> </ul>		
Action	Specification/Repair	Next Step
Check the fuel tank for fuel.	Adequate amount of fuel in the tank? <b>YES</b>	3A
	Adequate amount of fuel in the tank? <b>NO</b> <b>Repair:</b> Fill the tank with fuel.	6A

**STEP 3: Check the low-pressure fuel system (engine not operating).**

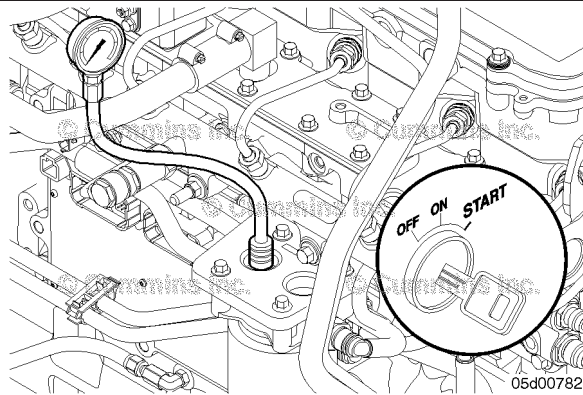
**STEP 3A: Check the fuel lift pump pressure.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Measure the fuel lift pump output pressure.</p> <p>Use the procedure in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418: Refer to Procedure 005-045 in Section 5.</p>	<p>Fuel lift pump pressure within the specifications outlined in Procedure 005-045, in Section 5 of the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418?</p> <p><b>YES</b></p>	3B
	<p>Fuel lift pump pressure within the specifications outlined in Procedure 005-045, in Section 5 of the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Determine the cause of the low lift pump pressure. Use the procedure in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418: Refer to Procedure 005-045 in Section 5.</p>	6A



**STEP 3B: Measure fuel gear pump pressure.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Measure the gear pump pressure during cranking.</p> <p>Use the procedure in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418: Refer to Procedure 005-025 in Section 5.</p>	<p>Fuel gear pump pressure greater than the specifications outlined in Procedure 005-025, in Section 5 of the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418?</p> <p><b>YES</b></p>	<p>5A</p>
	<p>Fuel gear pump pressure greater than the specifications outlined in Procedure 005-025, in Section 5 of the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Replace the fuel gear pump module.</p> <p>Use the procedure in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418: Refer to Procedure 005-025 in Section 5.</p>	<p>6A</p>



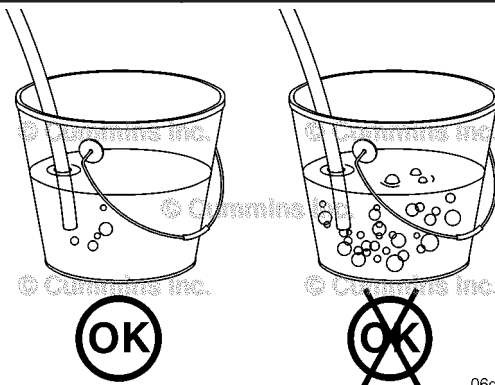
**STEP 4: Check the low-pressure fuel system (engine operating).**

**STEP 4A: Check for external fuel leak.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>Operate engine.</li> </ul>		
Action	Specification/Repair	Next Step
Check for external fuel leaks. <ul style="list-style-type: none"> <li>Start the engine and allow it to idle.</li> <li>Inspect for external fuel leaks.</li> </ul>	Any external fuel leaks? <b>YES</b> <b>Repair:</b> Repair all fuel leaks. Reference Section 6 in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418.	6A
	Any external fuel leaks? <b>NO</b>	4B

**STEP 4B: Check for air in the high-pressure pump fuel supply.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>Operate engine.</li> </ul>		
Action	Specification/Repair	Next Step
Check for air in the fuel. Use the procedure in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418: Refer to Procedure 006-003 in Section 6.	Air present in the fuel supply? <b>YES</b> <b>Repair:</b> <ul style="list-style-type: none"> <li>Locate and correct the cause of air ingestion in the fuel supply system.</li> <li>Sources of air ingestion include loose fuel filters, loose fuel line fittings, loose or cracked fuel tank stand pipes, or severe restrictions in the fuel supply lines and filters.</li> </ul>	6A
	Air present in the fuel supply? <b>NO</b>	4C



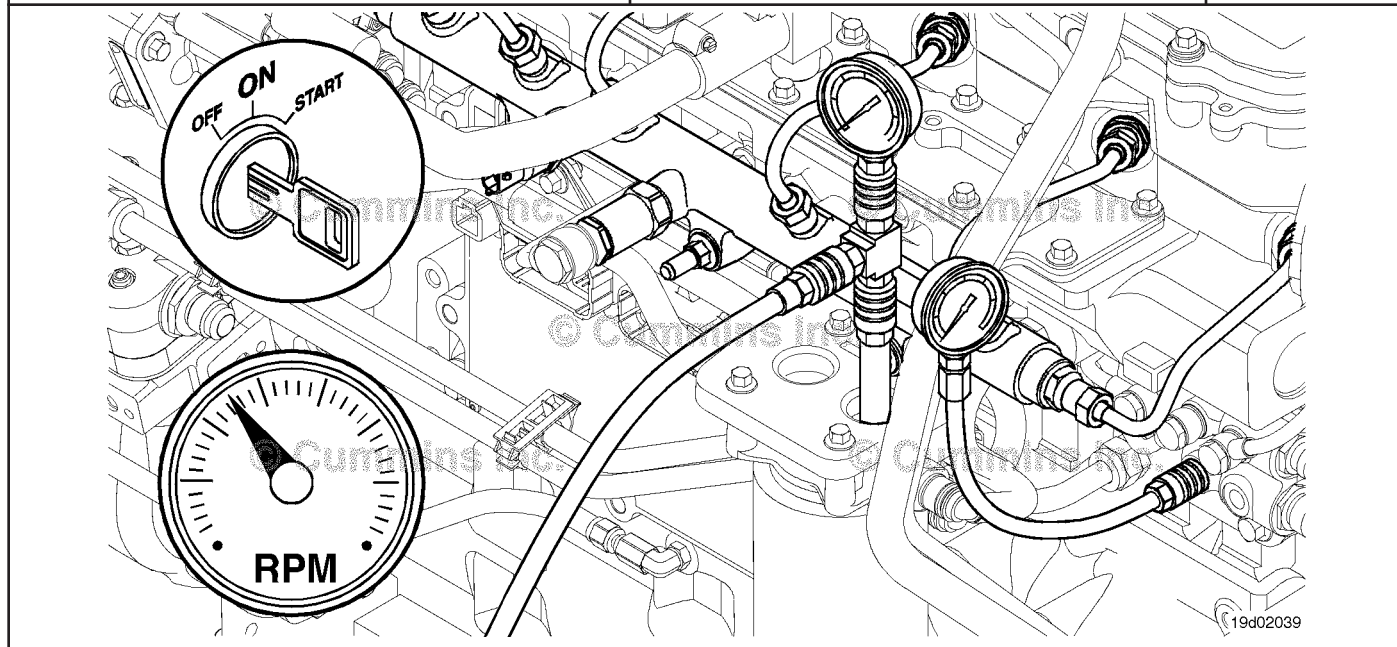
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**STEP 4C: Measure the inlet restriction at the OEM connection point.**

**Condition:**

- Operate engine.

Action	Specification/Repair	Next Step
<p>Measure the fuel inlet restriction.</p> <ul style="list-style-type: none"> <li>• Use the procedure in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418: Refer to Procedure 006-020 in Section 6.</li> </ul> <p>If the engine will <b>not</b> start or the engine starts and stalls, be sure fuel is primed to the gear pump. This test is <b>only</b> valid if the engine is operating.</p>	<p>OEM inlet restriction above specification outlined in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418? Refer to Procedure 006-020 in Section 6.</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A fuel restriction exists upstream of the OEM connection point. Refer to the OEM service manual.</p>	<p>6A</p>
	<p>OEM inlet restriction above specification outlined in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418? Refer to Procedure 006-020 in Section 6.</p> <p><b>NO</b></p>	<p>4D</p>

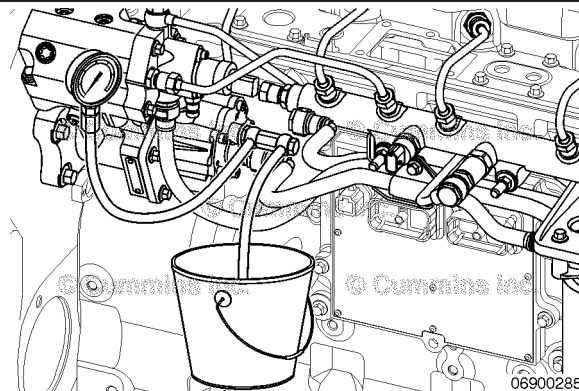


**STEP 4D: Measure the inlet restriction at the gear pump inlet.**

**Condition:**

- Turn keyswitch OFF.

Action	Specification/Repair	Next Step
<p>Measure the fuel inlet restriction.</p> <ul style="list-style-type: none"> <li>• Use the procedure in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418. Refer to Procedure 006-020 in Section 6</li> </ul> <p>If the engine will <b>not</b> start or the engine starts and stalls, be sure fuel is primed to the gear pump. This test is <b>only</b> valid if the engine is operating.</p>	<p>Gear pump inlet restriction above specification outlined in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418? Refer to Procedure 006-020 in Section 6.</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A restriction may exist between the OEM connection and the gear pump inlet.</p> <p>Inspect the engine control module ( ECM) cooling plate check valve as described in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418.</p> <p>Refer to Procedure 006-006 in Section 6.</p>	<p>6A</p>
	<p>Gear pump inlet restriction above specification outlined in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418? Refer to Procedure 006-020 in Section 6.</p> <p><b>NO</b></p>	<p>4E</p>

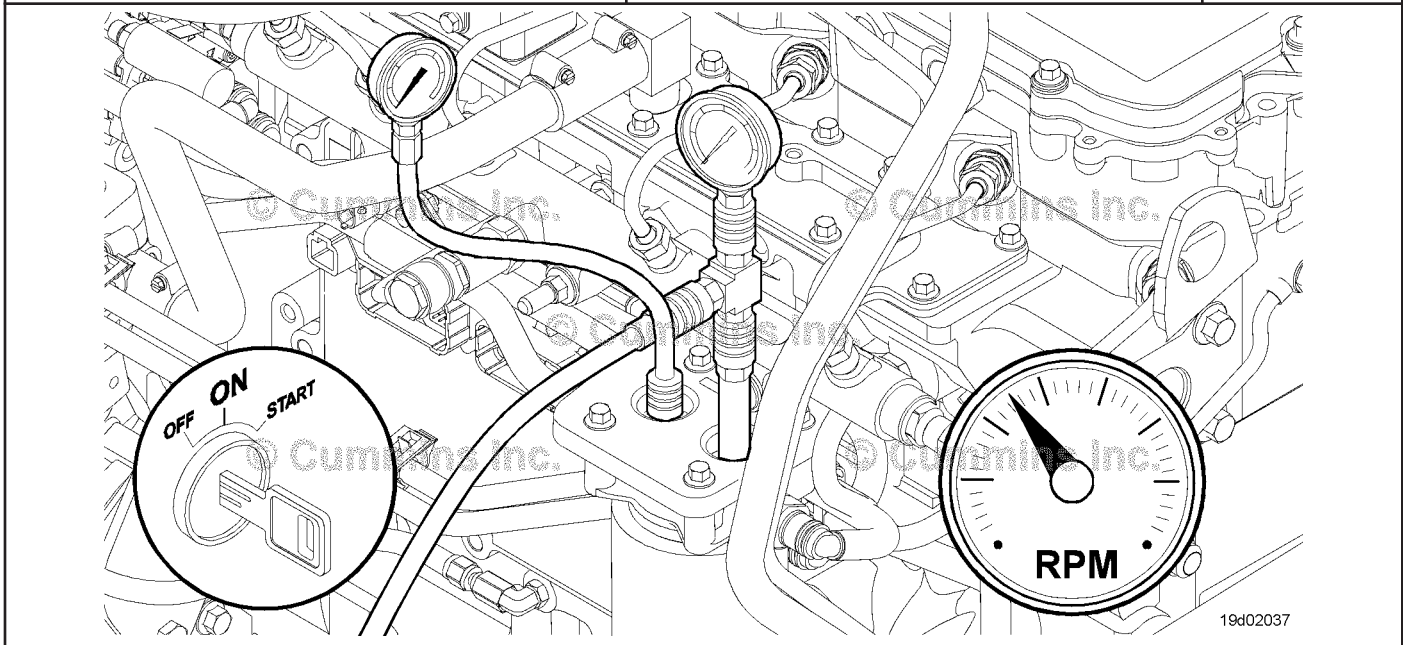


**STEP 4E: Measure the gear pump pressure.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Measure the gear pump pressure.</p> <ul style="list-style-type: none"> <li>• Use the Initial Check procedure in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418. Refer to Procedure 005-025 in Section 5.</li> </ul>	<p>Gear pump pressure above specification outlined in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418? Refer to Procedure 005-025 in Section 5.</p> <p><b>YES</b></p>	<p>4F</p>
	<p>Gear pump pressure above specification outlined in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418? Refer to Procedure 005-025 in Section 5.</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>The gear pump pressure is low. The gear pump is worn.</p> <p>Replace the gear pump. Use the procedure in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Troubleshooting and Repair Manual, Bulletin 402141.</p> <p>Refer to Procedure 005-025 in Section 5.</p>	<p>6A</p>

**STEP 4F: Measure the fuel filter restriction.**

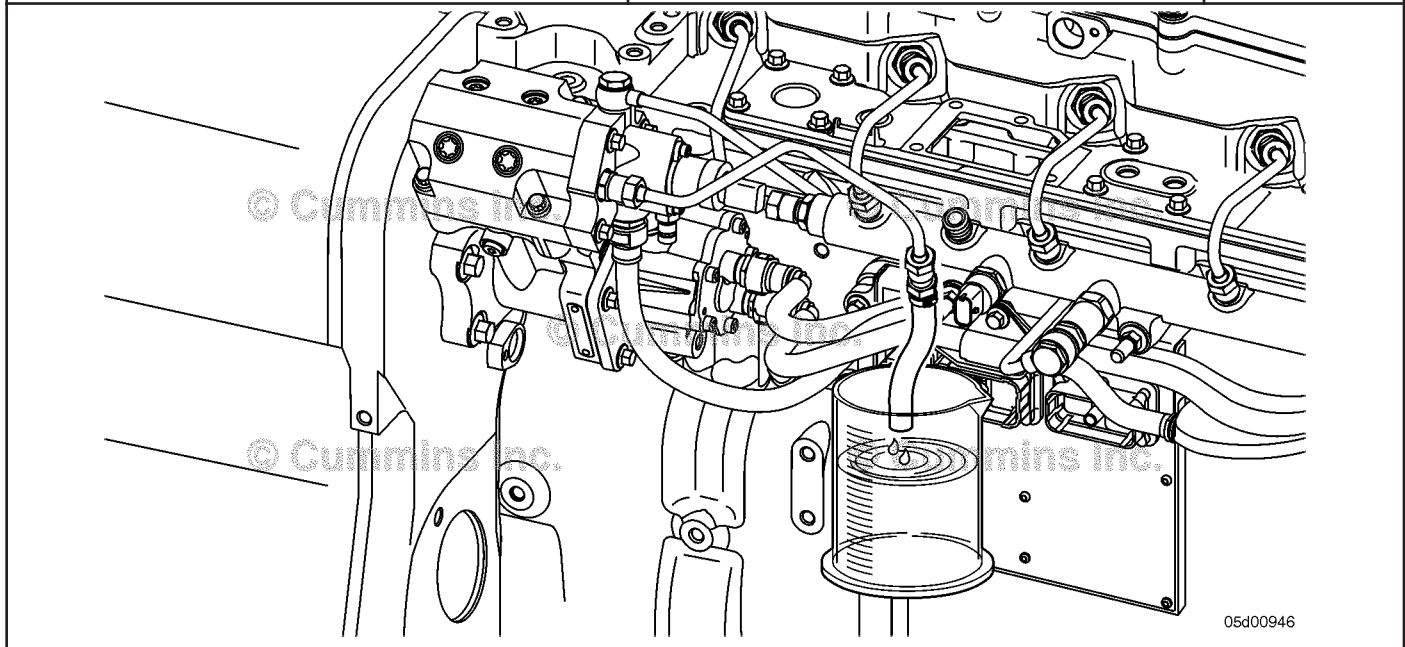
<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Measure the pressure at the inlet to the pressure-side fuel filter.</p> <ul style="list-style-type: none"> <li>• Use the procedure in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418. Refer to Procedure 006-015 in Section 6.</li> </ul> <p>Measure the pressure at the outlet of the pressure-side fuel filter.</p> <ul style="list-style-type: none"> <li>• Use the procedure in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418.</li> </ul> <p>Refer to Procedure 006-015 in Section 6.</p>	<p>Fuel filter pressure drop above specification.?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>The fuel filter is plugged.</p> <p>Replace the pressure-side fuel filter. Use the procedure in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418.</p> <p>Refer to Procedure 006-015 in Section 6.</p>	6A
	<p>Fuel filter pressure drop above specification.?</p> <p><b>NO</b></p>	5A



**STEP 5: Check the high-pressure fuel system**

**STEP 5A: Measure the fuel pump head flow.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Disconnect the high-pressure fuel line from the rail.</li> <li>• Clamp a hose to the end of the fuel line.</li> <li>• Route a hose from the test fitting into a clean, graduated cylinder.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Crank the engine fo 30 seconds.</p> <ul style="list-style-type: none"> <li>• Measure the fuel pump head flow.</li> </ul>	<p>Fuel pump head flow greater than 100 cc [3.4 oz] in 30 seconds of cranking?</p> <p><b>YES</b></p>	5B
	<p>Fuel pump head flow greater than 100 cc [3.4 oz] in 30 seconds of cranking?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Replace the fuel pump head.</p> <p>If ceramic debris is present from plunger damage, replace the entire pump.</p> <p>Use the procedure in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418. Refer to Procedure 005-227 in Section 5.</p>	6A



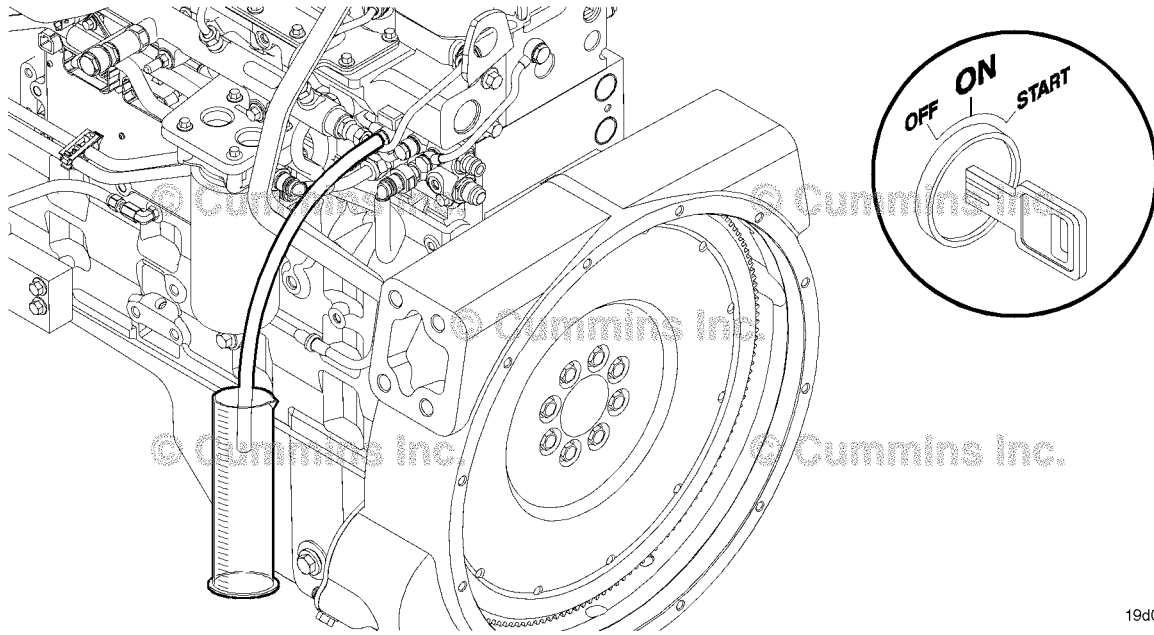


**STEP 5B: Check for excessive fuel return from the fuel injector drain line.**

**Condition:**

- Turn keyswitch OFF.
- Use the procedure in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418: Refer to Procedure 006-026 in Section 6.

Action	Specification/Repair	Next Step
<p>Start the engine.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool high-pressure test to raise the fuel rail pressure.</li> <li>• Measure the fuel leakage from the fuel injector return line.</li> </ul> <p>If the engine will <b>not</b> start, perform this test while cranking the engine. Use the procedure in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418. Refer to Procedure 006-026 in Section 6.</p>	<p>Fuel injector leakage excessive?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Isolate the injector high-pressure connector(s) that are the cause of the excessive leakage.</p> <p>Tighten the loose high-pressure fuel connectors.</p> <p>Use the procedure in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418. Refer to Procedure 006-026 in Section 6.</p>	<p>6A</p>
	<p>Fuel injector leakage excessive?</p> <p><b>NO</b></p>	<p>5C</p>



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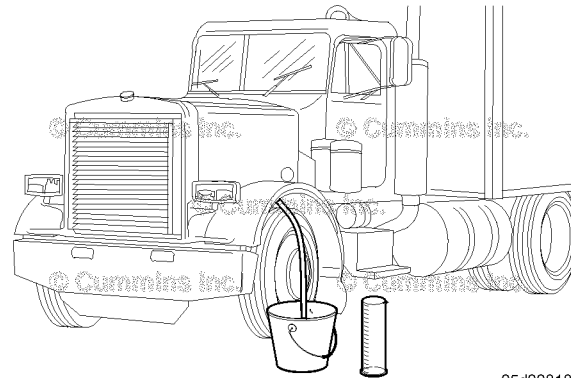


**STEP 5C: Check for excessive fuel return from the high-pressure pump.**

**Condition:**

- Turn keyswitch OFF.
- Install test fittings to measure the fuel drain from the fuel pump head. Use the procedure in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418: Refer to Procedure 005-227 in Section 5.
- Route a hose from the test fitting into a clean graduated cylinder.
- Operate engine.
- Connect INSITE™ electronic service tool.

Action	Specification/Repair	Next Step
<p>Start the engine.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool High-Pressure Control Relief Pressure Test to raise the fuel rail pressure.</li> <li>• Measure the fuel leakage from the fuel pump head.</li> </ul> <p>If the engine will <b>not</b> start, perform this test while cranking the engine. Use the procedure in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418. Refer to Procedure 005-227 in Section 5.</p>	<p>Fuel pump leakage excessive? <b>YES</b></p> <p><b>Repair:</b> Replace the fuel pump head.</p> <p>Use the procedure in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418. Refer to Procedure 005-227 in Section 5.</p>	<p>6A</p>
	<p>Fuel pump leakage excessive? <b>NO</b></p>	<p>5D</p>



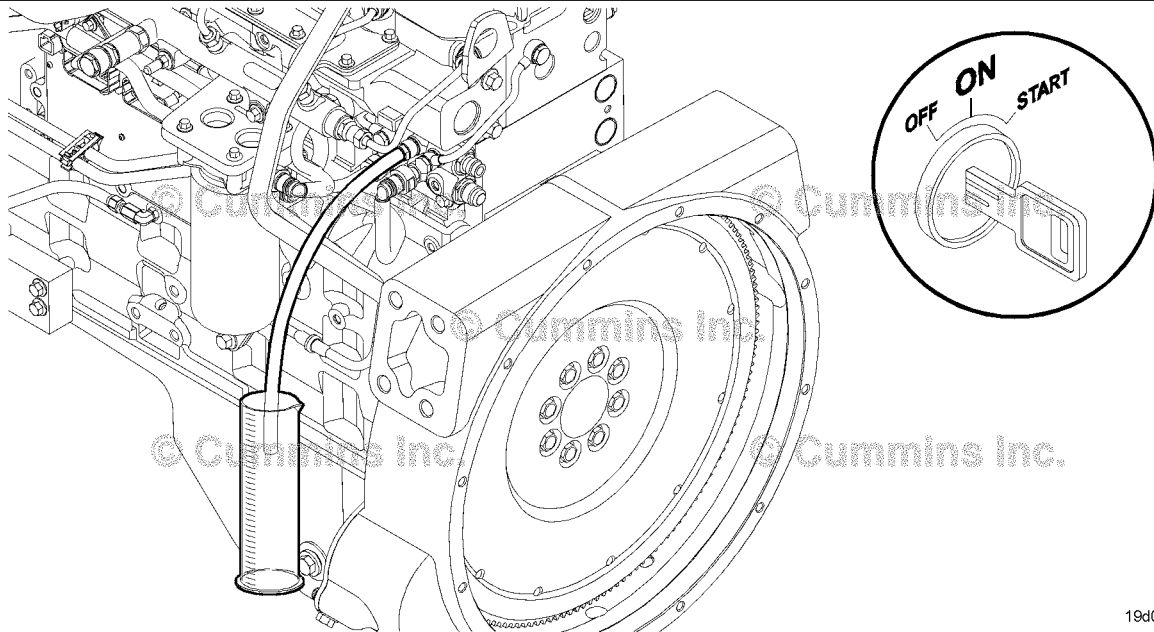
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**STEP 5D: Check for excessive fuel return from the rail fuel pressure relief valve.**

**Condition:**

- Turn keyswitch OFF.
- Install test fittings to measure the fuel drain from the rail fuel pressure relief valve. Use the procedure in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418: Refer to Procedure 006-061 in Section 6.

Action	Specification/Repair	Next Step
Start the engine. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool High-Pressure Control Relief Pressure Test to raise the fuel rail pressure.</li> <li>• Measure the fuel leakage from the fuel rail pressure relief valve.</li> </ul> If the engine will <b>not</b> start, perform this test while cranking the engine. Use the procedure in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418. Refer to Procedure 006-061 in Section 6.	Fail fuel pressure relief valve leaking more than 30 drops per minute? <b>YES</b> <b>Repair:</b> Replace the rail fuel pressure relief valve.  Use the procedure in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418. Refer to Procedure 006-061 in Section 6.	6A
	Fail fuel pressure relief valve leaking more than 30 drops per minute? <b>NO</b>	6A



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**STEP 6: Verify the repair is complete.**

**STEP 6A: Disable the fault code.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>Operate engine.</li> <li>Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Use INSITE™ electronic service tool to clear the fault code.</p> <ul style="list-style-type: none"> <li>Road test the engine.</li> <li>Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault Code 2215 become active during loaded engine operation?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Return to the troubleshooting steps or contact a Cummins® Authorized Repair Location if all steps have been completed and checked again.</p>	1A
	<p>Fault Code 2215 become active during loaded engine operation?</p> <p><b>NO</b></p>	6B

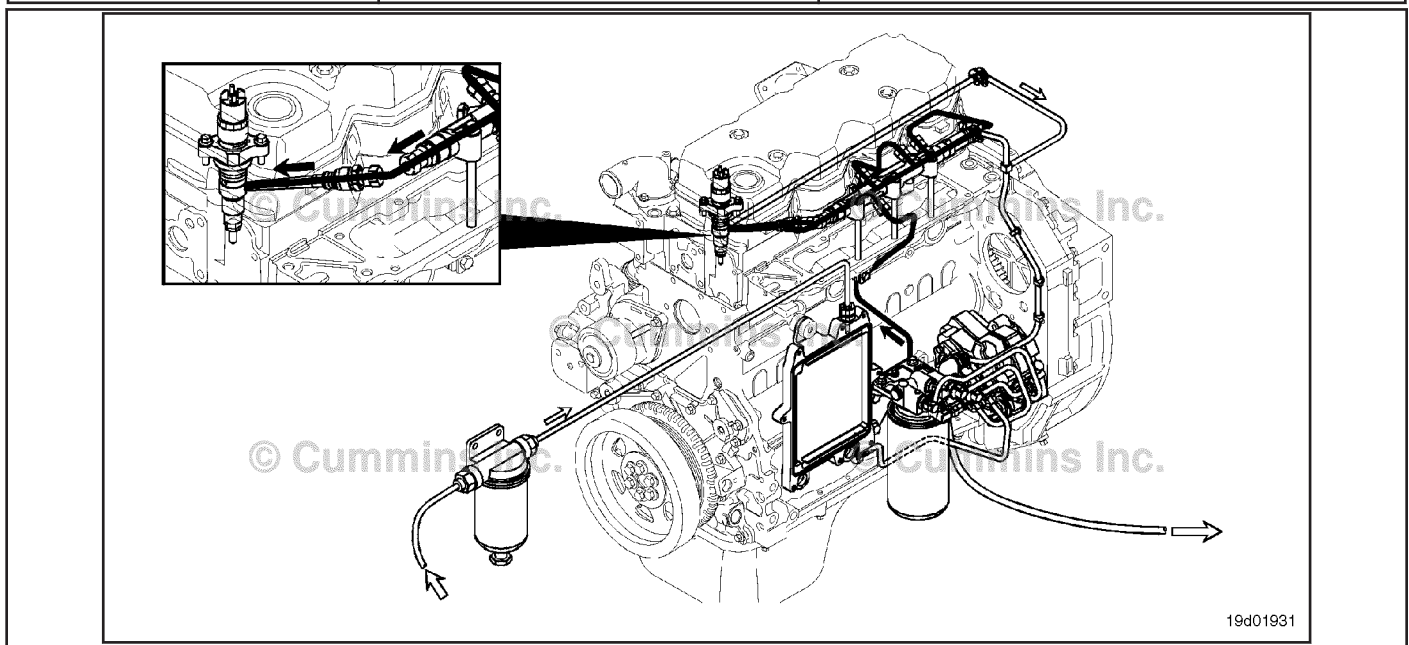
**STEP 6B: Clear the inactive fault codes.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>Connect all components.</li> <li>Turn keyswitch ON.</li> <li>Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Clear the inactive fault codes.</p> <ul style="list-style-type: none"> <li>Use INSITE™ electronic service tool to clear the inactive fault codes.</li> </ul>	<p>All fault codes cleared?</p> <p><b>YES</b></p>	Repair complete
	<p>All fault codes cleared?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Troubleshoot any remaining fault codes.</p>	Appropriate troubleshooting trees

## Fault Code 2216 (ISB/QSB Automotive or Industrial Application)

### Fuel Pump Delivery Pressure - Data Valid but Above Normal Operational Range - Moderately Severe Level

CODES	REASON	EFFECT
Fault Code: 2216 PID(P), SID(S): P94 SPN: 94 FMI: 0 Lamp: Amber SRT:	Fuel pump delivery pressure - data valid but above normal operational range - moderately severe level. The ECM has detected fuel pressure in the fuel rail that is higher than the commanded pressure.	None or possible engine noise associated with higher injection pressures (especially at idle or light load). Engine power is reduced.



Fuel System

#### **Circuit Description:**

The electronic control module (ECM) monitors engine operating conditions, including the reading of rail fuel pressure, and changes the flow command either to increase (OPEN the electronic fuel control actuator) or to decrease (CLOSE the electronic fuel control actuator) the fuel supply to the high-pressure pump.

#### **Component Location:**

The electronic fuel control actuator is installed on the high-pressure fuel pump. Refer to Procedure 100-002 for a detailed component location view.

#### **Shop Talk:**

An electronic fuel control actuator with excessive leakage will result in high rail fuel pressures at idle or light load, and Fault Code 2216 will be logged. A restriction in the fuel-drain-to-tank return line can prevent excess fuel from exiting the high-pressure fuel pump. This excess drain fuel can enter the pumping chamber and pressurize the rail. Check the fuel drain line restriction. High resistance or an open circuit in the electronic fuel control actuator can cause this fault to log. Air in the fuel can result in pressure changes that would cause this fault to log. High low-pressure pump output pressure could cause this fault to log, as could tampering with the rail fuel pressure sensor.

Fault Code 2216 is activated whenever the engine is loaded (nonzero fueling) and measured fuel pressure is higher than the commanded fuel pressure.

If the drain line is restricted completely, the high-pressure fuel pump will fail, causing internal leakage. Prior to pump failure, fault codes indicative of a drain line restriction will occur. The Fault Codes are 449, 2216, or 2293. Following the failure, these fault codes will go inactive and Fault Code 2215, which is indicative of leakage, will be active. If troubleshooting Fault Code 2215 results in replacement of the pump and there are inactive counts of Fault Codes 449, 2216, or 2293, the drain line **must** be inspected and measured for restriction. This is to prevent repeat high-pressure pump failures.

**Refer to Troubleshooting Fault Code t05-2216**

## FAULT CODE 2216 (ISB/QSB Automotive or Industrial Application) - Fuel Pump Delivery Pressure - Data Valid But Above Normal Operating Range - Moderately Severe Level

### TROUBLESHOOTING SUMMARY

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1: Check the fault codes.</b>		
<b>STEP 1A:</b> Read the fault codes.	Fault Code 271, 272, and/or 2311 inactive?	
<b>STEP 1B:</b> Verify the vehicle configuration and the settings in INSITE™ electronic service tool match.	Settings in INSITE™ electronic service tool match the vehicle configuration?	
<b>STEP 2: Check the rail fuel pressure sensor.</b>		
<b>STEP 2A:</b> Verify the rail fuel pressure sensor reads in range.	Pressure is 0 ± 40 bar?	
<b>STEP 3: Check for drain line restriction.</b>		
<b>STEP 3A:</b> Check for excessive drain line restriction.	Fuel return within specification?	
<b>STEP 4: Check the high-pressure injection pump.</b>		
<b>STEP 4A:</b> High-pressure injection pump flow test.	Fuel pump flow meets specification?	
<b>STEP 5: Check for damage to the fuel rail pressure relief valve.</b>		
<b>STEP 5A:</b> Check for leakage from the fuel rail pressure relief valve.	Fuel return within specification?	
<b>STEP 6: Clear the fault code.</b>		
<b>STEP 6A:</b> Disable the fault code.	Fault Code 2216 inactive?	
<b>STEP 6B:</b> Clear the inactive fault codes.	All fault codes cleared?	

### TROUBLESHOOTING STEP

**STEP 1: Check the fault codes.**

**STEP 1A: Read the fault codes.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect INSITE™ electronic service tool.</li> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
Read the fault codes. <ul style="list-style-type: none"> <li>• Start the engine and let it idle for 1 minute.</li> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> <li>• Check for fault codes related to the electronic fuel control actuator shorted low or high.</li> </ul>	Fault Code 271, 272, and/or 2311 inactive? <b>YES</b>	1B
	Fault Code 271, 272, and/or 2311 inactive? <b>NO</b> <b>Repair:</b> Troubleshoot applicable fault codes for ECF actuator.	Applicable Fault Code 271, 272, and/or 2311

**STEP 1B: Verify the vehicle configuration and the settings in INSITE™ electronic service tool match.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Use INSITE™ electronic service tool. Go to Features and Parameters and verify the following parameters match the vehicle configuration.</p> <ul style="list-style-type: none"> <li>• Transmission Setup –Transmission Type</li> </ul>	<p>Settings in INSITE™ electronic service tool match the vehicle configuration?</p> <p><b>YES</b></p>	2A
	<p>Settings in INSITE™ electronic service tool match the vehicle configuration?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Change the settings in the engine control module (ECM) with INSITE™ electronic service tool to match the vehicle configuration.</p>	5A

**STEP 2: Check the rail fuel pressure sensor.**

**STEP 2A: Verify the rail fuel pressure sensor reads in range.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect INSITE™ electronic service tool.</li> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Use INSITE™ electronic service tool to read the rail fuel pressure.</p> <p>-</p>	<p>Pressure is 0 ± 40 bar?</p> <p><b>YES</b></p>	3A
	<p>Pressure is 0 ± 40 bar?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Replace the sensor or repair the engine harness.</p> <ul style="list-style-type: none"> <li>• Use the following procedure to replace the sensor. Refer to Procedure 019-115 in Section 19.</li> <li>• Use the following procedure to repair the engine harness. Refer to Procedure 019-360 in Section 19.</li> </ul>	6A

**STEP 3: Check for drain line restriction.**

**STEP 3A: Check for excessive drain line restriction.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Install test fittings to measure the fuel drain line restriction.</li> <li>• Operate the engine at high idle no load.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for excessive drain line restriction.</p> <ul style="list-style-type: none"> <li>• Install test fittings to measure fuel drain line restriction.</li> </ul> <p>Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 006-012 in Section 6.</p>	<p>Fuel return within specification?</p> <p>Maximum fuel drain line restriction at high idle no load is 18.6 kPa [2.7 psi]</p> <p><b>YES</b></p>	<p>4A</p>
	<p>Fuel return within specification?</p> <p>Maximum fuel drain line restriction at high idle no load is 18.6 kPa [2.7 psi]</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <ul style="list-style-type: none"> <li>• Repair the source of the high fuel drain line restriction. Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 006-013 in Section 6.</li> </ul>	<p>5A</p>



**STEP 4: Check the high-pressure injection pump.**

**STEP 4A: High-pressure injection pump flow test.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check the high-pressure injection pump fuel flow.</p> <ul style="list-style-type: none"> <li>• Disconnect the high-pressure fuel line to the fuel rail from the high-pressure injection pump.</li> <li>• Connect a clear hose to the outlet of the high-pressure injection pump.</li> <li>• Route the high-pressure fuel line into an empty bucket.</li> <li>• Crank the engine for 30 seconds and measure the fuel pump flow.</li> </ul> <p>Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 005-016 in Section 6.</p>	<p>Fuel pump flow meets specification?</p> <p>Minimum fuel pump flow is 75 ml [2.5 oz] in 30 seconds at 125 rpm or 90 ml [3.04 oz] in 30 seconds at 150 rpm.</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>The electronic fuel control actuator is damaged.</p> <p>Replace the electronic fuel control actuator. Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 005-007 in Section 5.</p>	5A
	<p>Fuel pump flow meets specification?</p> <p>Minimum fuel pump flow is 75 ml [2.5 oz] in 30 seconds at 125 rpm or 90 ml [3.04 oz] in 30 seconds at 150 rpm.</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>The high-pressure injection pump is damaged.</p> <p>Replace the high-pressure injection pump. Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 005-016 in Section 5.</p>	5A

**STEP 5: Check for damage to the fuel rail pressure relief valve.**

**STEP 5A: Check for leakage from the fuel rail pressure relief valve.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Install test fittings to measure the fuel return from the rail fuel pressure relief valve.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for leakage from the fuel rail pressure relief valve.</p> <ul style="list-style-type: none"> <li>• Install test fittings to measure the fuel return.</li> <li>• Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 006-061 in Section 6.</li> </ul> <p>NOTE: Excessive fuel rail pressure can possibly cause damage to the fuel rail pressure relief valve.</p> <p>Specification at idle: No flow.</p> <p>INSITE™ electronic service tool override: One drop per second 16 ml [0.5 oz] per minute.</p> <p>NOTE: If the return flow from the rail pressure relief valve is greater than specification, restart the engine and bring to high idle. The engine will attempt to reseat the valve.</p> <p>NOTE: If Fault Code 272, 449, 553, 2311, or 2216 is active, do <b>not</b> replace the fuel rail pressure relief valve without first determining the cause of the fault code condition. See the appropriate troubleshooting symptom tree.</p> <p>If the valve does <b>not</b> reseat, replace valve.</p>	<p>Fuel return within specification?</p> <p><b>YES</b></p>	6A
	<p>Fuel return within specification?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Replace the fuel rail pressure relief valve. Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 006-061 in Section 6.</p>	6A

**STEP 6: Clear the fault code.**

**STEP 6A: Disable the fault code.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Disable the fault code.</p> <ul style="list-style-type: none"> <li>• Start the engine and let it idle for 1 minute.</li> <li>• Use INSITE™ electronic service tool to verify Fault Code 2216 is inactive.</li> </ul>	<p>Fault Code 2216 inactive?</p> <p><b>YES</b></p>	6B
	<p>Fault Code 2216 inactive?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Return to the troubleshooting steps or contact a Cummins® Authorized Repair Location if all steps have been completed and checked again.</p>	1A

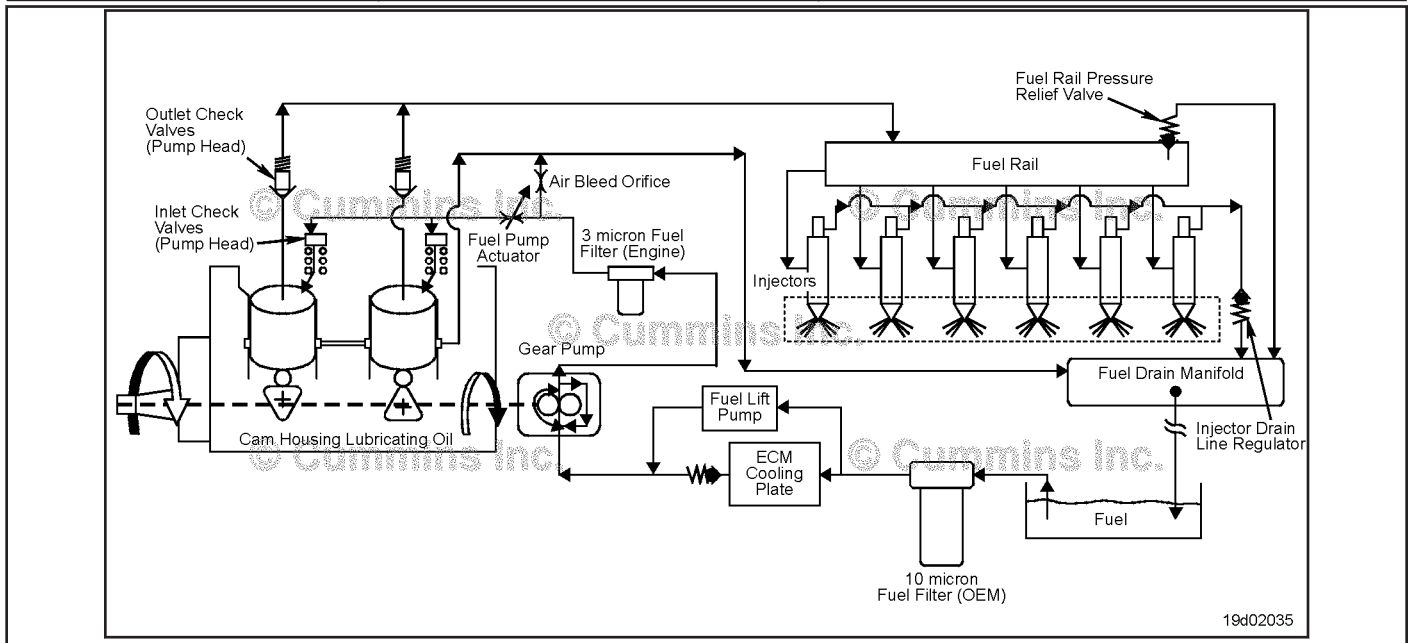
**STEP 6B: Clear the inactive fault codes.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Clear the inactive fault codes.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to clear the inactive fault codes.</li> </ul>	<p>All fault codes cleared? <b>YES</b></p>	<p>Repair complete</p>
	<p>All fault codes cleared? <b>NO</b></p>	<p>Appropriate troubleshooting charts</p>

## Fault Code 2216 (ISC/QSC/ISL/QSL Automotive, Industrial or Marine Application)

### Fuel Pump Delivery Pressure High - Data Valid but Above Normal Operational Range - Moderately Severe Level

CODES	REASON	EFFECT
Fault Code: 2216 PID(P), SID(S): P94 SPN: 94 FMI: 1 Lamp: Yellow SRT:	Fuel Pump Delivery Pressure High - Data Valid but Above Normal Operational Range - Moderately Severe Level. The ECM has detected that fuel pressure is higher than commanded pressure.	None or possible engine noise associated with higher injection pressures (especially at idle or light load).



High Pressure Pump

**Circuit Description:**

The electronic control module (ECM) monitors engine operating conditions, including the reading of fuel rail pressure, and changes the flow command to either increase (open the fuel pump actuator) or decrease (close the fuel pump actuator) the fuel supply to the high pressure pump.

**Component Location:**

The fuel pump actuator is installed in the adapter on the back of the high-pressure pump.

**Shop Talk:**

A fuel pump actuator with excessive leakage or a damaged inboard o-ring will result in high fuel rail pressures at idle or light load.

If the fuel pump actuator exhibits excessive leakage, it is possible that the fuel rail pressure will reach the opening pressure of the fuel rail pressure relief valve and Fault Code 449 may also become active.

**Refer to Troubleshooting Fault Code t05-2216**

## FAULT CODE 2216 (ISC/QSC/ISL/QSL Automotive, Industrial, or Marine Application) - Fuel Pump Delivery Pressure - Data Valid But Above Normal Operating Range - Moderately Severe Level

### TROUBLESHOOTING SUMMARY

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1: Check the fault codes.</b>		
<b>STEP 1A:</b> Read the fault codes.	Fault Code 271, 272, or 2311 active?	
<b>STEP 1B:</b> Verify that the vehicle configuration and the settings in INSITE™ electronic service tool match.	Settings in INSITE™ electronic service tool match the vehicle configuration?	
<b>STEP 2: Check the low-pressure fuel system.</b>		
<b>STEP 2A:</b> Check for excessive supply pump fuel pressure.	Pressure greater than 1207 kPa [175 psi]?	
<b>STEP 2B:</b> Check the fuel pump actuator.	Inboard o-ring cut or shaved?	
<b>STEP 3: Clear the fault code.</b>		
<b>STEP 3A:</b> Disable the fault code.	Fault codes inactive?	
<b>STEP 3B:</b> Clear the inactive fault codes.	All fault codes cleared?	

### TROUBLESHOOTING STEP

**STEP 1: Check the fault codes.**

**STEP 1A: Read the fault codes.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect INSITE™ electronic service tool.</li> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
Use INSITE™ electronic service tool to read the fault codes.	Fault Code 271, 272, or 2311 active? <b>YES</b>	Appropriate troubleshooting tree
	Fault Code 271, 272, or 2311 active? <b>NO</b>	1B

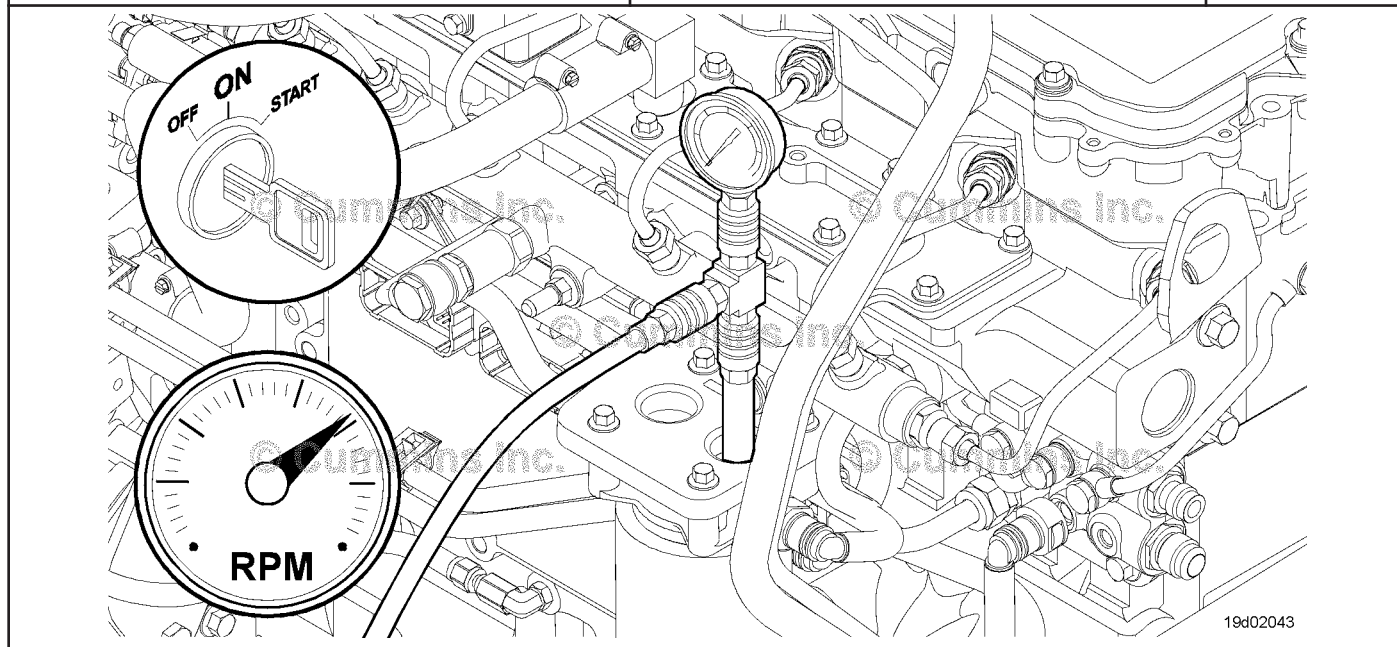
**STEP 1B: Verify the vehicle configuration and the settings in INSITE™ electronic service tool match.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Use INSITE™ electronic service tool. Go to Features and Parameters and verify the following parameters match the vehicle configuration.</p> <ul style="list-style-type: none"> <li>• Transmission Setup -Transmission Type</li> </ul>	<p>Settings in INSITE™ electronic service tool match the vehicle configuration?</p> <p><b>YES</b></p>	<p>2A</p>
	<p>Settings in INSITE™ electronic service tool match the vehicle configuration?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Change the settings in the engine control module (ECM) with INSITE™ electronic service tool to match the vehicle configuration.</p>	<p>5A</p>

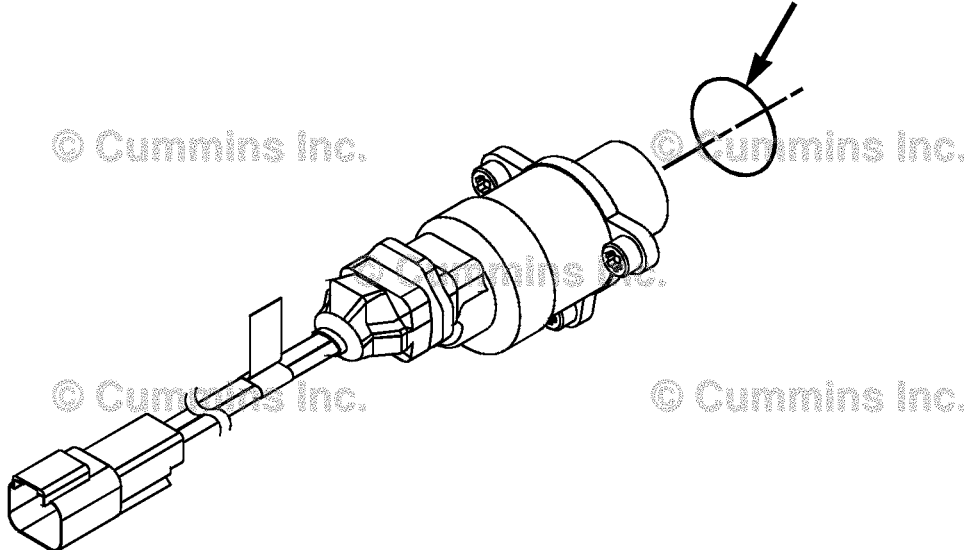
**STEP 2: Check the low-pressure fuel system**

**STEP 2A: Check for excessive supply pump fuel pressure.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>Operate the engine.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Install a M10 standard thread o-ring diagnostic fitting, Cummins® Part Number 3824842, at the pressure-side fuel filter outlet port.</p> <p>Install a 0 to 2068 kPa [0 to 300 psi] pressure gauge at the outlet of the pressure-side filter.</p> <ul style="list-style-type: none"> <li>Operate the engine at idle and measure the pressure at the gear pump outlet.</li> </ul> <p>Refer to Procedure 005-025 in the Troubleshooting and Repair Manual, ISC, QSC8.3, ISL, and QSL9 Engines, Bulletin 4021418.</p>	<p>Pressure greater than 1207 kPa [175 psi]?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Replace the fuel gear pump assembly.</p>	3A
	<p>Pressure greater than 1207 kPa [175 psi]?</p> <p><b>NO</b></p>	2B



**STEP 2B: Check the fuel pump actuator.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check the fuel pump actuator.</p> <ul style="list-style-type: none"> <li>• Remove the fuel pump actuator.</li> <li>• Inspect the fuel pump actuator inboard o-ring.</li> </ul> <p>Refer to Procedure 019-117 in the Troubleshooting and Repair Manual, ISC, QSC8.3, ISL, and QSL9 Engines, Bulletin 4021418.</p> <p>If this o-ring is cut or shaved, fuel may be permitted to bypass the fuel pump actuator and enter the high-pressure pump.</p>	<p>Inboard o-ring cut or shaved?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Replace the damaged o-ring.</p>	3A
	<p>Inboard o-ring cut or shaved?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Replace the fuel pump actuator.</p>	3A
		
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**STEP 3: Clear the fault code.**

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

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Disable the fault code.</p> <ul style="list-style-type: none"> <li>• Start the engine and let it idle for 1 minute.</li> <li>• Verify the fault codes are inactive.</li> </ul>	<p>Fault codes inactive?</p> <p><b>YES</b></p>	3B
	<p>Fault codes inactive?</p> <p><b>NO</b></p>	1A



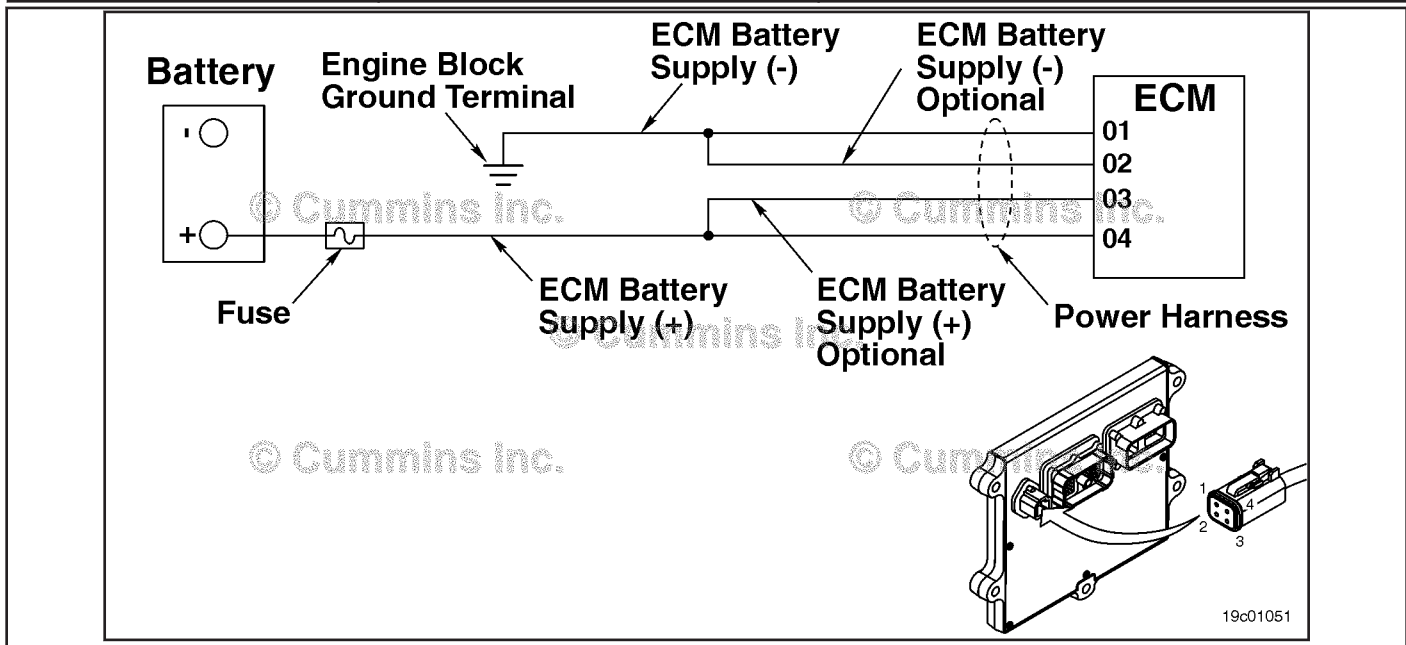
**STEP 3B: Clear the inactive fault codes.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Connect INSITE™ electronic service tool.</li> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Clear the inactive fault codes.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ to clear the inactive fault codes.</li> </ul>	<p>All fault codes cleared?  <b>YES</b></p>	<p>Repair complete</p>
	<p>All fault codes cleared?  <b>NO</b>  <b>Repair:</b>                  Troubleshoot any remaining active fault codes.</p>	<p>Appropriate troubleshooting steps</p>

## Fault Code 2217

### Engine Control Module Calibration Program Memory (RAM) Corruption - Condition Exists

CODES	REASON	EFFECT
Fault Code: 2217 PID(P), SID(S): S240 SPN: 630 FMI: 11/31 Lamp: Amber SRT:	Engine Control Module Calibration Program Memory (RAM) Corruption - Condition Exists. Severe loss of data from the ECM.	Possible no noticeable performance effects, engine dying or hard starting. Fault information, trip information, and maintenance monitor data can be inaccurate.



Unswitched Battery Supply Circuit

#### **Circuit Description:**

The Electronic Control Module (ECM) receives constant voltage from the batteries through the unswitched battery wires that are connected directly to the positive (+) battery post. There is a single 30-ampere 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. The battery return wires are connected directly to the negative (-) battery post. Pins 2 and 3 are optional circuits possibly **not** used by the OEM. Refer to the OEM wiring diagram for detailed information on the circuit.

#### **Component Location:**

The ECM is located on the left side of the engine, near the front of the engine. The ECM is connected to the battery by the ECM power harness. This direct link provides a constant power supply for the ECM. The location of the battery will vary with the OEM. Refer to the OEM troubleshooting and repair manual.

#### **Shop Talk:**

On-Board Diagnostics (OBD) Information (Euro 4 Certified Engines):

- The ECM illuminates the malfunction indicator lamp (MIL) when the diagnostic runs and fails.
- The ECM turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does **not** fail. The MIL lamp and fault code can also be cleared using the INSITE™ service tool.
- The fault code will be cleared from memory after 40 consecutive drive cycles where the diagnostic runs and passes.

On-Board Diagnostics (OBD) Information (Euro 4 Stage 1+ Certified Engines):

- The ECM illuminates the malfunction indicator lamp (MIL) when the diagnostic runs and fails.
- An engine torque derate will be activated after 50 hours of engine operation with the fault code active.
- The ECM turns OFF the malfunction indicator lamp (MIL) after 1 ignition cycle that the diagnostic runs and does **not** fail. The MIL lamp **cannot** be cleared using the INSITE™ service tool.
- The fault code will be cleared from memory after 400 days or 9600 hours of engine operation.

**Refer to Troubleshooting Fault Code t05-2217**

FAULT CODE 2217 - Engine Control Module Calibration Program Memory (RAM) Corruption - Condition Exists
TROUBLESHOOTING SUMMARY



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



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

Table with 3 columns: STEPS, SPECIFICATIONS, and SRT CODE. It lists troubleshooting steps from Step 1 to Step 6, including sub-steps like Step 1A, Step 2A, etc., with corresponding specifications and SRT codes.

### TROUBLESHOOTING STEP

**STEP 1: Check the fault codes.**

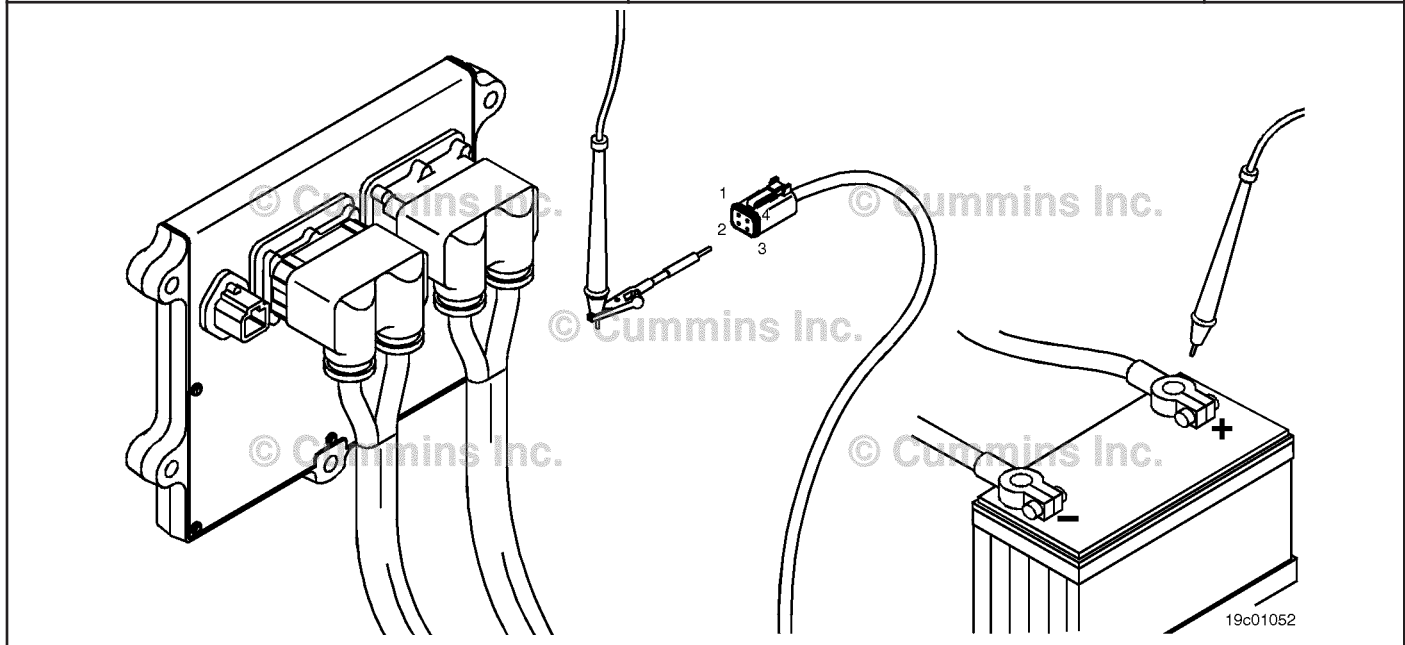
**STEP 1A: Check for an active fault code.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool to read the fault codes.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for an active fault code.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Are other fault codes active?  <b>YES</b>  <b>Repair:</b>                      Troubleshoot the active fault codes.</p>	<p>Go to appropriate fault code troubleshooting tree.</p>
	<p>Are other fault codes active?  <b>NO</b></p>	<p>2A</p>

**STEP 2: Check the batteries and the power connector.**

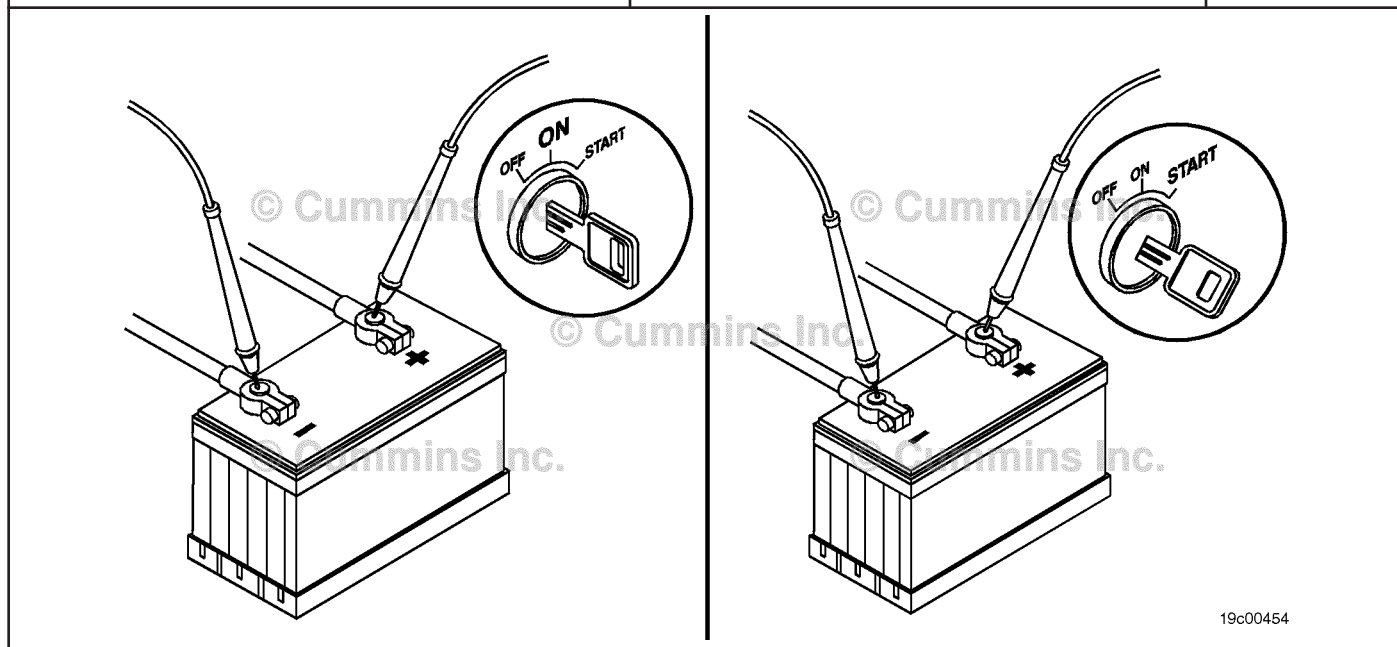
**STEP 2A: Check the resistance of the battery supply circuit.**

Condition:		
<ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the power harness connector from the ECM.</li> </ul>		
Action	Specification/Repair	Next Step
Check the resistance of the battery supply circuit. <ul style="list-style-type: none"> <li>• Using a multimeter, measure the resistance between the ECM battery SUPPLY (+) pin of the power harness ECM connector and the positive (+) battery terminal.</li> <li>• Using a multimeter, measure the resistance between the ECM battery SUPPLY (-) pin of the power harness ECM connector and the engine block ground.</li> </ul> Refer to the circuit diagram or the wiring diagram for connector pin identification. Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.	Less than 10 ohms? <b>YES</b>	2B
	Less than 10 ohms? <b>NO</b>	3A



**STEP 2B: Check the battery voltage.**

<b>Condition:</b> • Turn keyswitch ON.		
Action	Specification/Repair	Next Step
Check the battery voltage. • Place the positive (+) probe of the multimeter on the positive battery terminal. Touch the negative (-) probe of the multimeter to the negative battery terminal while trying to start the engine.	Normal conditions: At least (+) 12-VDC? (During cranking: At least (+) 6.2-VDC)? <b>YES</b>	2C
	Normal conditions: At least (+) 12-VDC? (During cranking: At least (+) 6.2-VDC)? <b>NO</b> <b>Repair:</b> Charge or replace the battery. Refer to the OEM service manual.	5A



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**STEP 2C: Check the battery connections.**

<b>Condition:</b> • Turn keyswitch OFF.		
Action	Specification/Repair	Next Step
Check the battery connections. • Inspect the battery terminal connections.	Are connections tight and corrosion-free? <b>YES</b>	4A
	Are connections tight and corrosion-free? <b>NO</b> <b>Repair:</b> Tighten the loose connections and clean the terminals. Refer to the OEM service manual.	5A

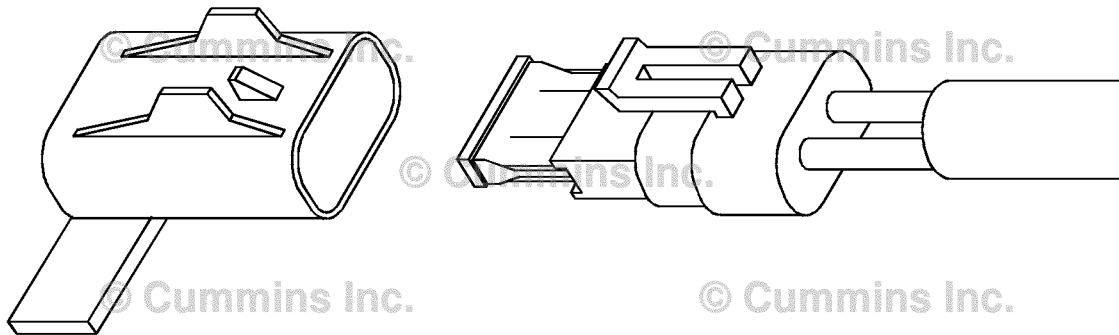
**STEP 3: Check the OEM fuses.**

**STEP 3A: Verify that the OEM fuses are installed correctly.**

**Condition:**

- Turn keyswitch OFF.

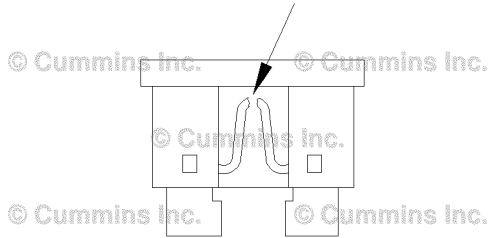
Action	Specification/Repair	Next Step
Inspect the OEM fuses for correct installation. -	Are fuses installed correctly? <b>YES</b>	3B
	Are fuses installed correctly? <b>NO</b> <b>Repair:</b> Install the fuses correctly. Refer to Procedure 019-198 in Section 19.	5A



19c00455



**STEP 3B: Verify that the OEM fuses are not blown.**

<b>Condition:</b> • Turn keyswitch OFF.		
Action	Specification/Repair	Next Step
Verify that the OEM fuses are not blown. -	Are any fuses blown? <b>YES</b> <b>Repair:</b> Replace the fuses.	5A
	Are any fuses blown? <b>NO</b> <b>Repair:</b> Repair or replace the OEM harness. Refer to Procedure 019-071 in Section 19.	5A
 <p>19800238</p>		

**STEP 4: Check the power connector.**

**STEP 4A: Check the add-on or the accessory wiring at positive (+) terminal of the battery.**

<b>Condition:</b> • Turn keyswitch OFF.		
Action	Specification/Repair	Next Step
Check the add-on or the accessory wiring at positive (+) terminal of the battery. • 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.	Are any wires damaged? <b>YES</b> <b>Repair:</b> Repair or replace the damaged wiring.	5A
	Are any wires damaged? <b>NO</b> <b>Repair:</b> Verify the OEM power supply wiring to the ECM is correct. Refer to the OEM service manual.	5A

**STEP 5: Recalibrate the ECM.**

**STEP 5A: Recalibrate the ECM.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> </ul>		
Action	Specification/Repair	Next Step
Recalibrate the ECM. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to recalibrate the ECM.</li> </ul>	Is Fault Code 2217 inactive? <b>YES</b>	6A
	Is Fault Code 2217 inactive? <b>NO</b>	6A

**STEP 6: Clear the fault codes.**

**STEP 6A: Disable the fault code.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> <li>• Turn keyswitch OFF and wait 30 seconds.</li> <li>• Turn keyswitch ON.</li> <li>• Use INSITE™ electronic service tool to verify Fault Code 2217 is inactive.</li> </ul>	Fault Code 2217 inactive? <b>YES</b>	5B
	Fault Code 2217 inactive? <b>NO</b> <b>Repair:</b> Return to the troubleshooting steps or contact your local Cummins® Authorized Repair Location if all the steps have been completed and checked again.	1A

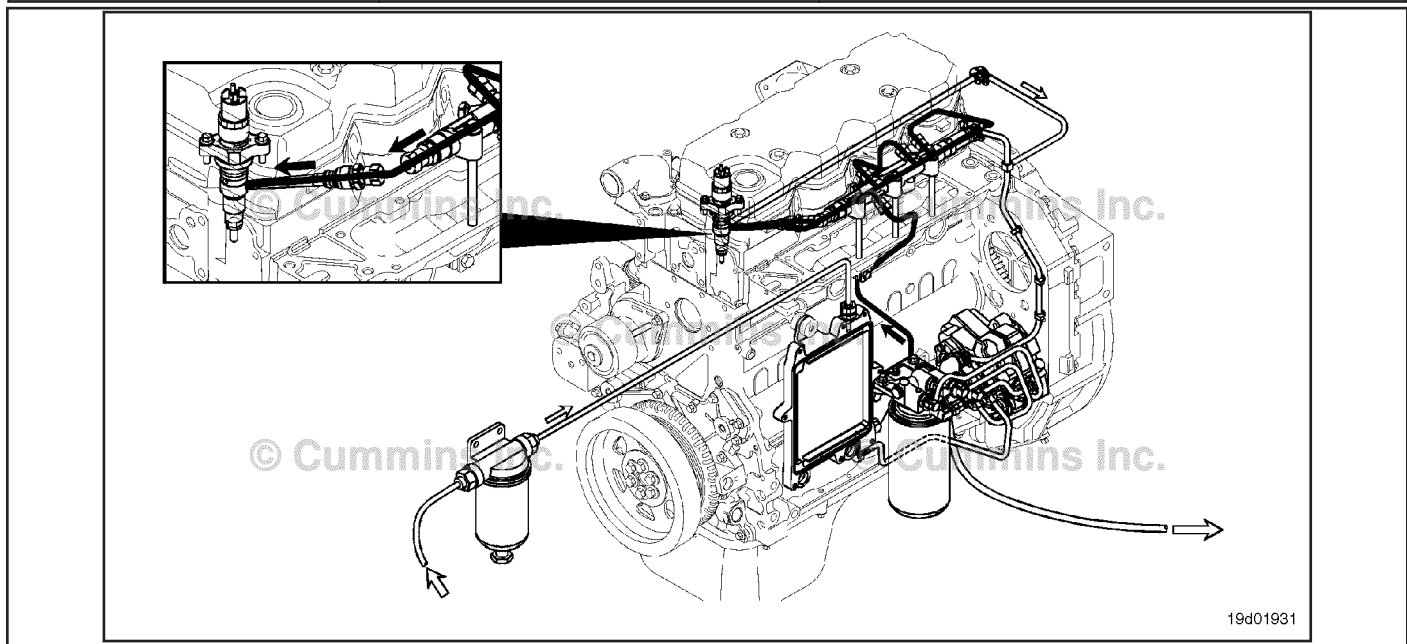
**STEP 5B: Clear the inactive fault codes.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to erase the inactive fault codes.</li> </ul>	All fault codes cleared? <b>YES</b>	Repair complete
	All fault codes cleared? <b>NO</b> <b>Repair:</b> Troubleshoot any remaining active fault codes	Appropriate troubleshooting steps

## Fault Code 2249

### Injector Metering Rail 1 Pressure - Data Valid but Below Normal Operational Range - Most Severe Level

CODES	REASON	EFFECT
Fault Code: 2249 PID(P), SID(S): P157 SPN: 157 FMI: 1 Lamp: Amber SRT:	Injector Metering Rail 1 Pressure - Data Valid but Below Normal Operational Range - Most Severe Level. The ECM has detected that fuel pressure is lower than commanded pressure.	Possibly hard to start, low power, or engine smoke.



Rail Fuel Pressure

#### **Circuit Description:**

The ECM monitors rail fuel pressure and engine operating conditions and changes the flow command to maintain the proper rail fuel pressure. Changes to the flow command result in opening (or closing) or the fuel pump actuator is supply more (or less) fuel to the high pressure pump.

#### **Component Location:**

Refer to Procedure 100-002 for a detailed component location view.

#### **Shop Talk:**

Fault Code 2249 is very similar to Fault Code 559 except that the fault triggers at a different fuel pressure threshold limit. If Fault Code 2249 is active, the troubleshooting procedures for Fault Code 559 **must** be followed.

#### **Refer to Troubleshooting Fault Code t05-2249**

### TROUBLESHOOTING SUMMARY

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1: Check the fault codes.</b>		
<b>STEP 1A: Check for fuel system fault codes.</b>	<b>Fault Code 2249 is active?</b>	

### TROUBLESHOOTING STEP

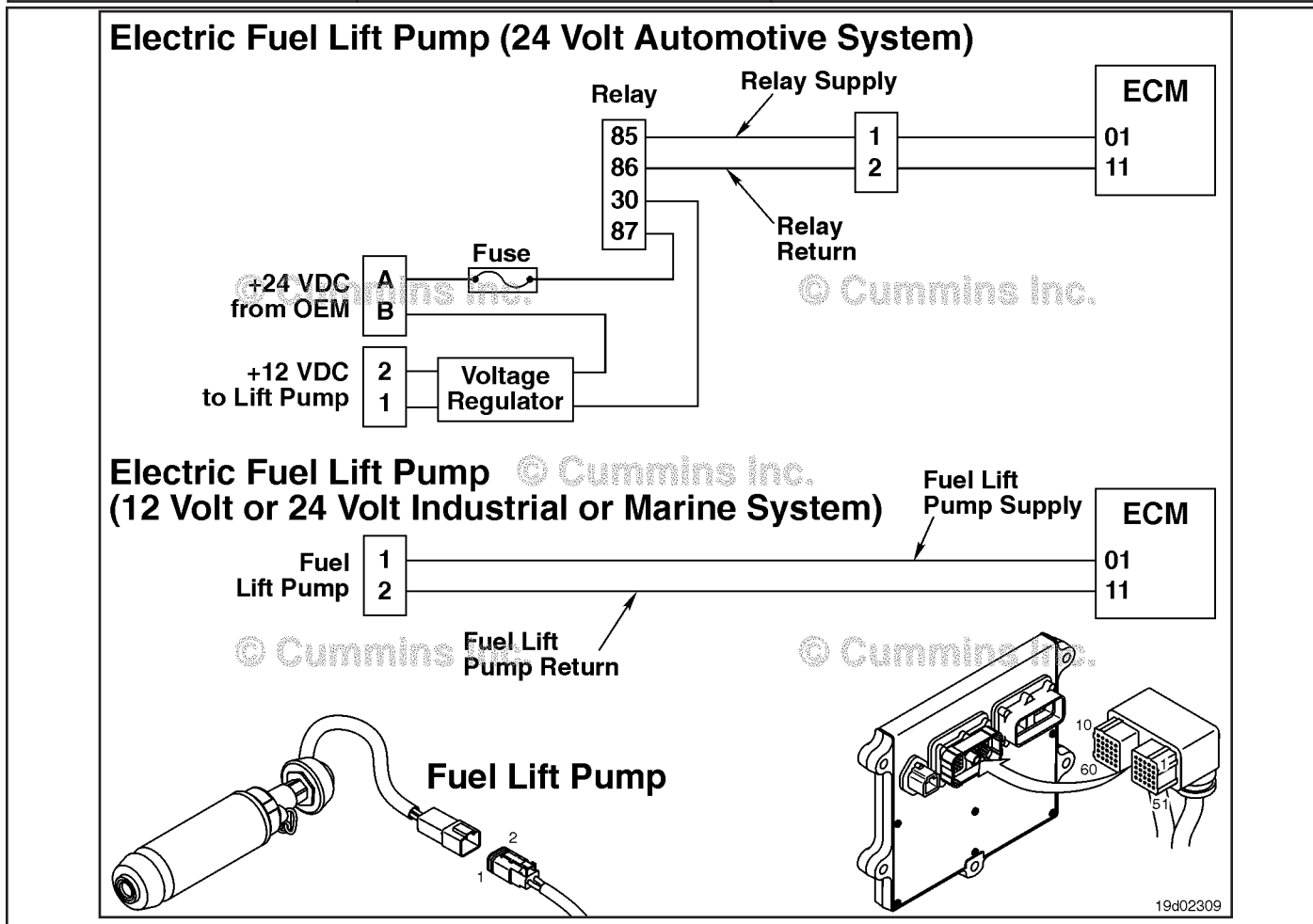
**STEP 1: Check the fault codes.**  
**STEP 1A: Check for fuel system fault codes.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for fuel system fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 2249 is active? <b>YES</b> <b>Repair:</b> Follow the troubleshooting procedures for Fault Code 559.	Fault Code 559 troubleshooting.
	Fault Code 2249 is active? <b>NO</b>	Repair complete.

## Fault Code 2265

### Electric Lift Pump for Engine Fuel Supply Circuit - Voltage Above Normal, or Shorted to High Source

CODES	REASON	EFFECT
Fault Code: 2265 PID(P), SID(S): S126 SPN: 1075 FMI: 3 Lamp: Amber SRT:	Electric Lift Pump for Engine Fuel Supply Circuit - Voltage Above Normal, or Shorted to High Source. High voltage or open detected at the fuel lift pump signal circuit.	Engine can be difficult to start.



Electric Fuel Lift Pump Circuit

#### Circuit Description:

On 12 VDC Automotive and 24 VDC Industrial or Marine systems, the circuit is a pulse width modulated driver in the electronic control module (ECM) that controls the electric fuel lift pump. The lift pump is grounded in the ECM.

On 24 VDC Automotive systems, the circuit is a pulse width modulated driver in the ECM that controls the electric fuel lift pump relay. The circuit includes two additional components, a relay and voltage regulator. The ECM controls voltage to the relay. When the relay is engaged, an OEM supplied power source delivers 24 VDC to the voltage regulator. The voltage regulator reduces the 24 VDC to 12 VDC, which is then delivered to the lift pump.

**Component Location:**

On both 12 and 24 VDC systems, the electric fuel lift pump is located behind the ECM cooling plate on the intake side of the engine. Refer to Procedure 100-002 for a detailed component location view.

On 24 VDC Automotive systems, the relay is located in the harness between the voltage regulator and the OEM power supply on the bottom edge of the ECM. The voltage regulator is located just below the ECM.

**Shop Talk:**

On 12 VDC Automotive and 24 VDC Industrial or Marine systems, this fault code becomes active if the ECM detects an open circuit at keyswitch ON. The cause of this fault code is an open circuit in the electric fuel lift pump circuit.

If the fault code is intermittent, look for causes of an intermittent open circuit, such as loose pins and bad connections. At keyswitch ON, the lift pump duty cycle ramps to 100 percent. This fault code can detect open circuit conditions **only** at keyswitch ON. If an open circuit condition is indicated after the engine is started (while the lift pump is already running), Fault Code 2265 will **not** become active.

On 24 VDC Automotive systems, this fault code becomes active if the ECM detects an open circuit at keyswitch ON. Causes of this fault code are an open circuit in the electric fuel lift pump wiring harness, relay, or engine harness. This fault code will **not** become active if the voltage regulator or electric fuel lift pump has failed.

**Refer to Troubleshooting Fault Code t05-2265**

## FAULT CODE 2265 - Electric Lift Pump for Engine Fuel Supply Circuit - Voltage Above Normal, or Shorted to High Source TROUBLESHOOTING SUMMARY

### ⚠CAUTION⚠

To reduce the possibility of damaging a new ECM, all other active fault codes must be investigated before replacing the ECM.

### ⚠CAUTION⚠

To reduce the possibility of pin and harness damage, use the following test leads when taking a measurement: Part Number 3822758 - male Deutsch™/AMP™/Metri-Pack™ test lead and Part Number 3823993 - male Deutsch™ test lead.

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1: Check the fault codes.</b>		
<b>STEP 1A:</b> Check for an inactive fault code.	Fault Code 2265 inactive?	
<b>STEP 1B:</b> Lift pump voltage regulator check.	Is a lift pump voltage regulator installed?	
<b>STEP 2: Check the electric fuel lift pump relay circuit.</b>		
<b>STEP 2A:</b> Inspect the engine harness and electric fuel lift pump relay connector pins.	Dirty or damaged pins?	
<b>STEP 2B:</b> Check for an open circuit in the electric fuel lift pump relay.	Less than 400 ohms?	
<b>STEP 2C:</b> Check the electric fuel lift pump relay diagnostic supply voltage.	Greater than 6.0 VDC? (for 12 VDC system) Greater than 18.0 VDC? (for 24 VDC system)	
<b>STEP 2D:</b> Check for an open circuit in the electric fuel lift pump relay return circuit.	Less than 10 ohms?	
<b>STEP 3: Check the electric fuel lift pump.</b>		
<b>STEP 3A:</b> Inspect the engine harness and electric fuel lift pump connector pins.	Dirty or damaged pins?	
<b>STEP 3B:</b> Check for an open circuit in the electric fuel lift pump.	Less than 20 ohms?	
<b>STEP 3C:</b> Check the electric fuel lift pump supply voltage and return circuit.	Greater than 6.0 VDC? (for 12 VDC system) Greater than 18.0 VDC? (for 24 VDC system)	
<b>STEP 3D:</b> Check for an open circuit in the electric fuel lift pump relay return circuit.	Less than 10 ohms?	
<b>STEP 4: Check the ECM and engine harness.</b>		
<b>STEP 4A:</b> Inspect the ECM and engine harness connector pins.	Dirty or damaged pins?	
<b>STEP 4B:</b> Check the ECM electric fuel lift pump diagnostic supply voltage.	Greater than 6.0 VDC? (for 12 VDC system) Greater than 18.0 VDC? (for 24 VDC system)	
<b>STEP 4C:</b> Check for an open circuit in the engine harness.	Less than 10 ohms?	

**STEP 4D:** Check for a pin-to-pin short circuit in the engine harness. **Greater than 100k ohms?**

**STEP 4E:** Check for an inactive fault code. **Fault Code 2265 inactive?**

**STEP 5: Clear the fault codes.**

**STEP 5A:** Disable the fault code. **Fault Code 2265 inactive?**

**STEP 5B:** Clear the inactive fault codes. **All fault codes cleared?**

**TROUBLESHOOTING STEP**

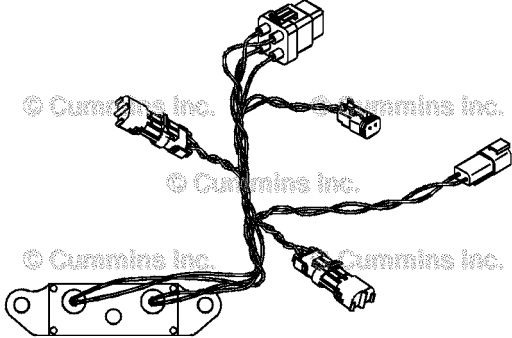
**STEP 1: Check the fault codes.**

**STEP 1A: Check for an inactive fault code.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for an inactive fault code. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 2265 inactive? <b>YES</b>	Use the following procedure for an inactive or intermittent fault code. Refer to Procedure 019-362 in Section 19.
	Fault Code 2265 inactive? <b>NO</b>	1B



**STEP 1B: Lift pump voltage regulator check.**

<b>Condition:</b> • Turn keyswitch OFF.		
Action	Specification/Repair	Next Step
Check the lift pump voltage regulator. -	Is a lift pump voltage regulator installed? <b>YES</b>	2A
	Is a lift pump voltage regulator installed? <b>NO</b>	3A
 <p>05d00766</p>		

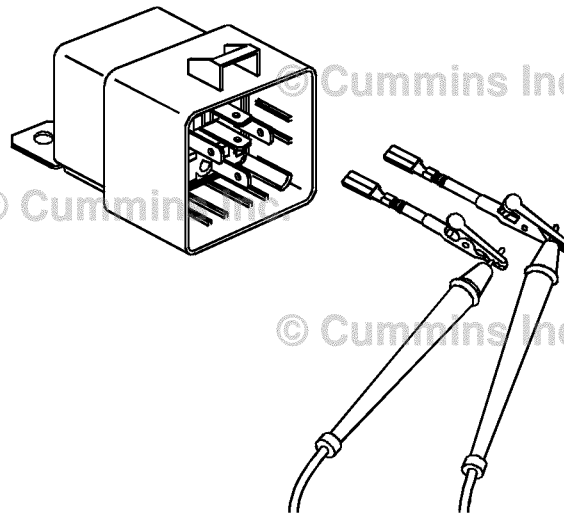
**STEP 2: Check the electric fuel lift pump relay circuit.**

**STEP 2A: Inspect the engine harness and electric fuel lift pump relay connector pins.**

<b>Condition:</b> • Turn keyswitch OFF. • Disconnect the electric fuel lift pump relay from the electric fuel lift pump wiring harness.		
Action	Specification/Repair	Next Step
Inspect the engine harness, electric fuel lift pump wiring harness, and relay connector pins for the following: <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.	Dirty or damaged pins? <b>YES</b> <b>Repair:</b> Clean the connector and pins. Repair the damaged harness, connector, or pins if possible.	5A
		Dirty or damaged pins? <b>NO</b>

**STEP 2B: Check for an open circuit in the electric fuel lift pump relay.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the electric fuel lift pump relay from the electric fuel lift pump wiring harness.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check the electric fuel lift pump relay resistance.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the electric fuel lift pump relay SUPPLY pin (85) and the electric fuel lift pump relay RETURN pin (86).</li> </ul> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Less than 400 ohms? <b>YES</b></p>	<p>2C</p>
	<p>Less than 400 ohms? <b>NO</b></p> <p><b>Repair:</b></p> <p>A damaged electric fuel lift pump relay has been detected.</p> <p>Replace the electric fuel lift pump relay. Refer to the OEM service manual.</p>	<p>5A</p>



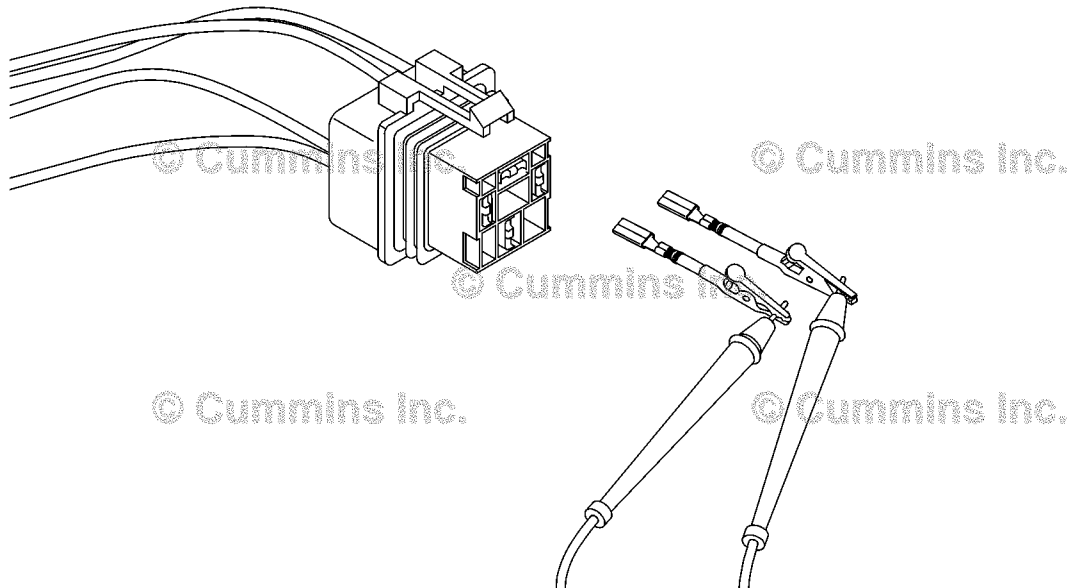
19c01174

**STEP 2C: Check the electric fuel lift pump relay diagnostic supply voltage.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the electric fuel lift pump relay from the electric fuel lift pump wiring harness.
- Turn keyswitch ON.

Action	Specification/Repair	Next Step
Check the supply voltage and return circuit. <ul style="list-style-type: none"> <li>• Measure the voltage between the electric fuel lift pump SUPPLY pin (85) and the electric fuel lift pump RETURN pin (86) at the electric fuel lift pump relay connector.</li> </ul>	Greater than 6.0 VDC? (for 12 VDC system) Greater than 18.0 VDC? (for 24 VDC system) <b>YES</b>	4D
	Greater than 6.0 VDC? (for 12 VDC system) Greater than 18.0 VDC? (for 24 VDC system) <b>NO</b>	2D



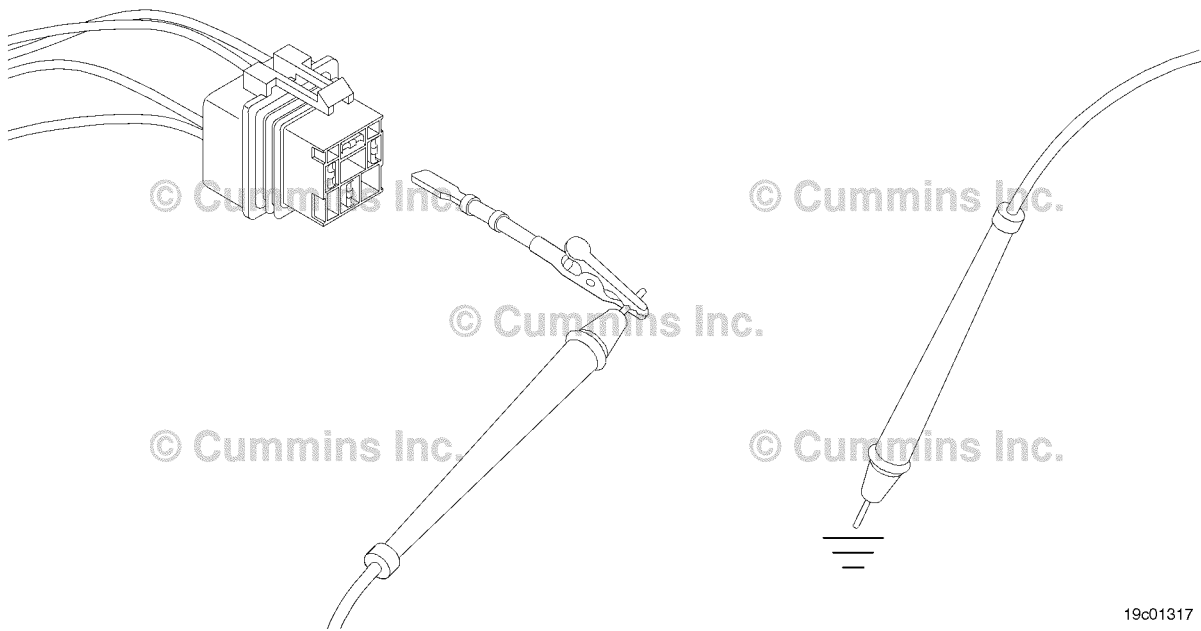
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**STEP 2D: Check for an open circuit in the electric fuel lift pump relay return circuit.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the electric fuel lift pump relay from the electric fuel lift pump wiring harness.

Action	Specification/Repair	Next Step
Check for an open circuit. <ul style="list-style-type: none"> <li>• Measure the resistance between the electric fuel lift pump relay RETURN pin (86) at the electric fuel lift pump relay connector to ground.</li> </ul> Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.	Less than 10 ohms? <b>YES</b>	4A
	Less than 10 ohms? <b>NO</b> <b>Repair:</b> An open circuit in the electric fuel lift pump relay circuit has been detected. Isolate the open circuit. Repair or replace the electric fuel lift pump wiring harness or the engine harness.	5A



19c01317

**STEP 3: Check the electric fuel lift pump.****STEP 3A: Inspect the engine harness and electric fuel lift pump connector pins.**

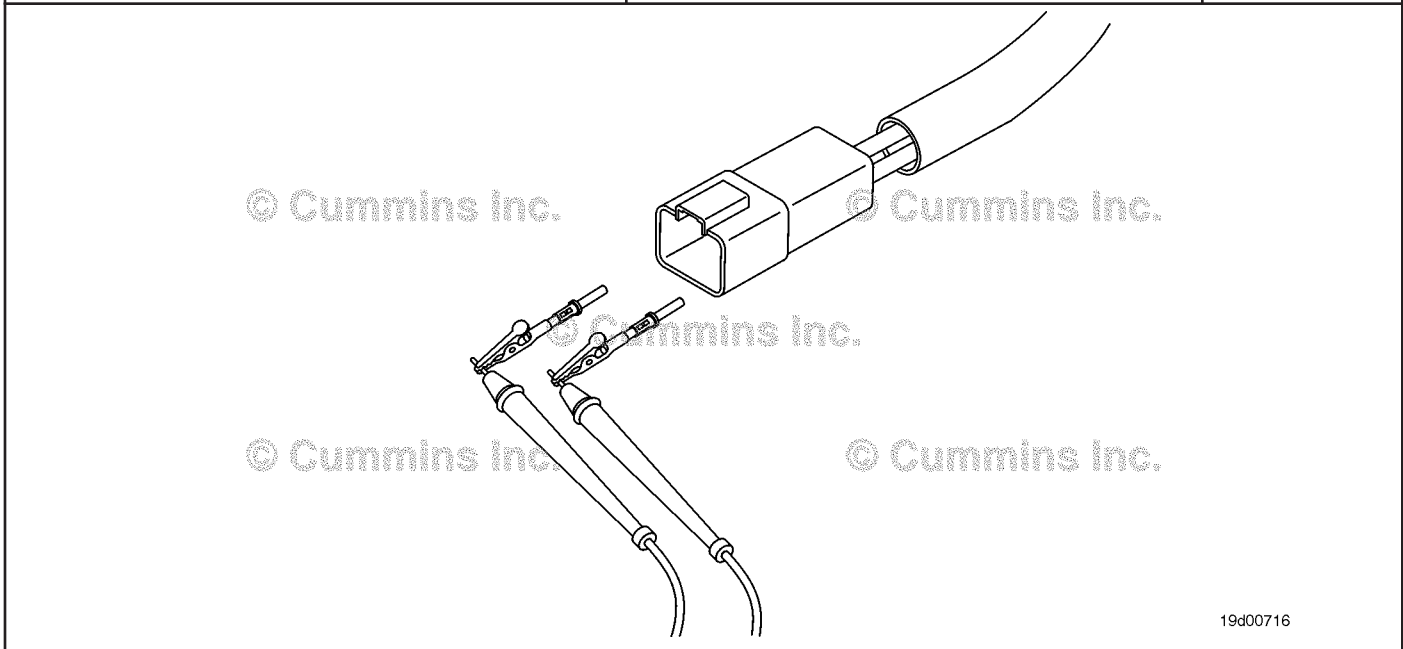
<b>Condition:</b>		
<ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the electric fuel lift pump.</li> </ul>		
<b>Action</b>	<b>Specification/Repair</b>	<b>Next Step</b>
Inspect the engine harness and electric fuel lift pump connector pins for the following: <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.	Dirty or damaged pins? <b>YES</b> <b>Repair:</b> Clean the connector and pins. Repair the damaged harness, connector, or pins if possible.	5A
	Dirty or damaged pins? <b>NO</b>	3B

**STEP 3B: Check for an open circuit in the electric fuel lift pump.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine harness from the electric fuel lift pump.

Action	Specification/Repair	Next Step
Check for an open circuit in the electric fuel lift pump. <ul style="list-style-type: none"> <li>• Measure the resistance between the electric fuel lift pump SUPPLY and the electric fuel lift pump RETURN pins at the electric fuel lift pump connector.</li> </ul> Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.	Less than 20 ohms? <b>YES</b>	3C
	Less than 20 ohms? <b>NO</b> <b>Repair:</b> A damaged electric fuel lift pump has been detected.  Replace the electric fuel lift pump. Use the following procedure in the ISC, QSC8.3, ISL, and QSL9 Series Engines Troubleshooting and Repair Manual, Bulletin 4021418 or the ISB Troubleshooting and Repair Manual, Bulletin 3666477. Refer to Procedure 005-045 in Section 5.	5A

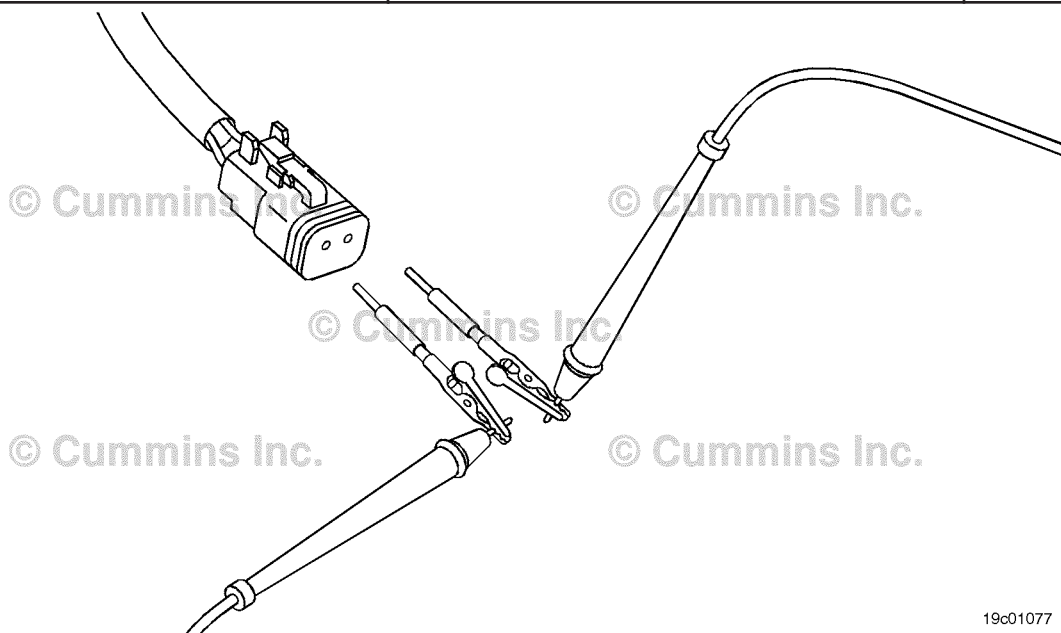


**STEP 3C: Check the electric fuel lift pump supply voltage and return circuit.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine harness from the electric fuel lift pump.
- Install the Deutsch™ 2-pin breakout tool, Part Number 3163531, in between the lift pump and the engine harness.
- Turn keyswitch ON.

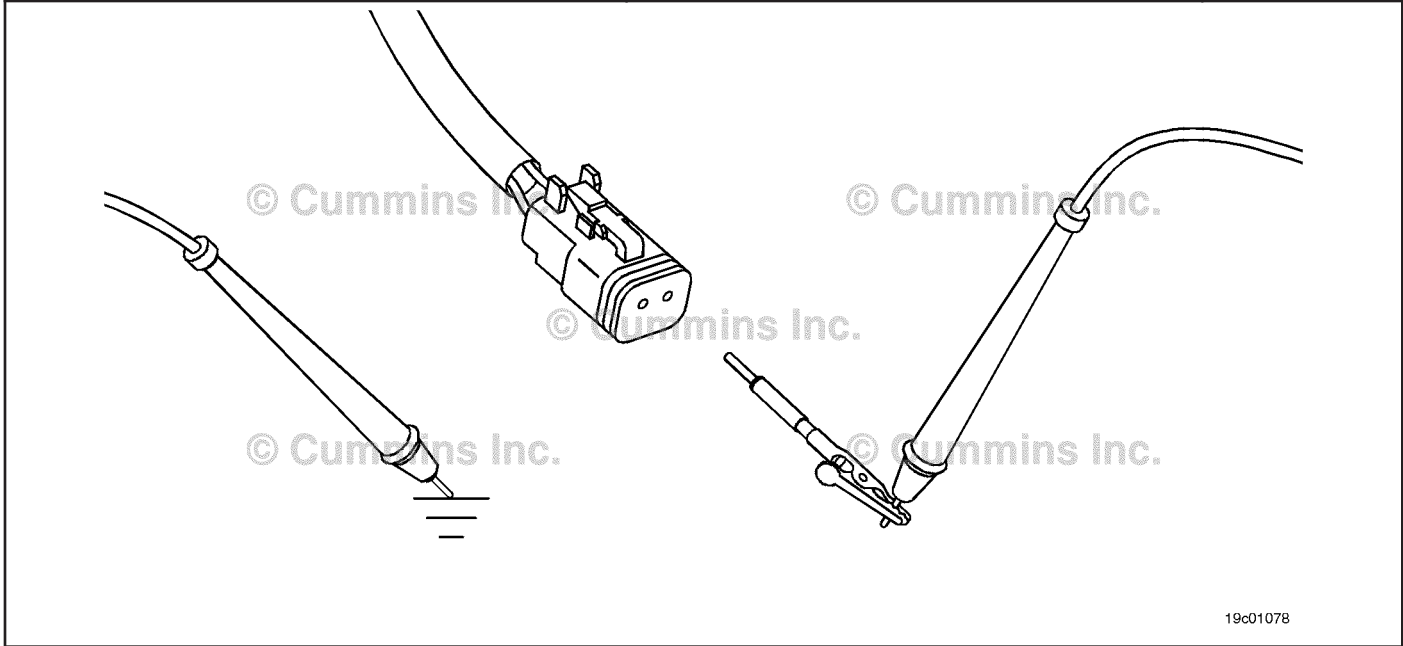
Action	Specification/Repair	Next Step
Check the supply voltage and return circuit. <ul style="list-style-type: none"> <li>• Measure the voltage between the electric fuel lift pump SUPPLY pin and the electric fuel lift pump RETURN pin using the Deutsch™ 2-pin breakout tool.</li> </ul>	Greater than 6.0 VDC? (for 12 VDC system) Greater than 18.0 VDC? (for 24 VDC system) <b>YES</b>	4D
	Greater than 6.0 VDC? (for 12 VDC system) Greater than 18.0 VDC? (for 24 VDC system) <b>NO</b>	3D



19c01077

**STEP 3D: Check for an open circuit in the electric fuel lift pump return circuit.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the electric fuel lift pump from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Measure the resistance between the engine harness electric fuel lift pump RETURN pin and ground.</p> <p>Refer to the circuit diagram or wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Less than 10 ohms? <b>YES</b></p>	<p>4A</p>
	<p>Less than 10 ohms? <b>NO</b></p> <p><b>Repair:</b></p> <p>An open circuit has been detected in the engine harness.</p> <p>Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.</p>	<p>5A</p>



19c01078



**STEP 4: Check the ECM and engine harness.**

**STEP 4A: Inspect the ECM and engine harness connector pins.**

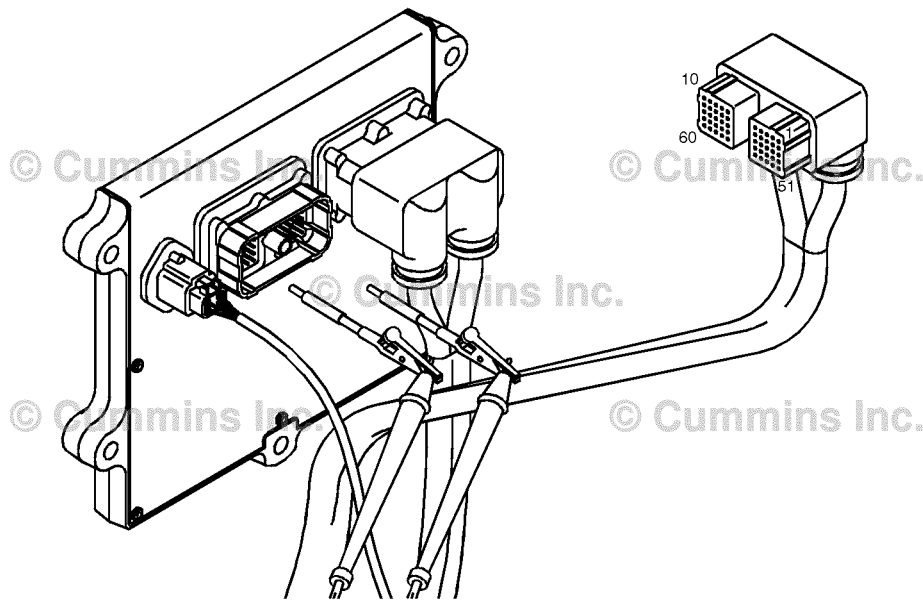
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the engine harness and ECM connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A damaged connection has been detected in the ECM connector or engine harness connector.</p> <p>Clean the connector pins.</p> <p>Repair the damaged harness or connector pins if possible. Refer to Procedure 019-043 in Section 19.</p>	<p>5A</p>
	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	<p>4B</p>

**STEP 4B: Check the ECM electric fuel lift pump diagnostic supply voltage.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine harness from the ECM.
- Turn keyswitch ON.

Action	Specification/Repair	Next Step
Check the supply voltage. <ul style="list-style-type: none"> <li>• Measure the voltage between the electric fuel lift pump SUPPLY pin (1) and the electric fuel lift pump RETURN pin (11) at the engine harness ECM connector port.</li> </ul>	Greater than 6.0 VDC? (for 12 VDC system) Greater than 18.0 VDC? (for 24 VDC system) <b>YES</b>	4C
Refer to the circuit diagram or wiring diagram for connector pin identification.	Greater than 6.0 VDC? (for 12 VDC system) Greater than 18.0 VDC? (for 24 VDC system) <b>NO</b> <b>Repair:</b> Replace the ECM. Refer to Procedure 019-031 in Section 19.	5A



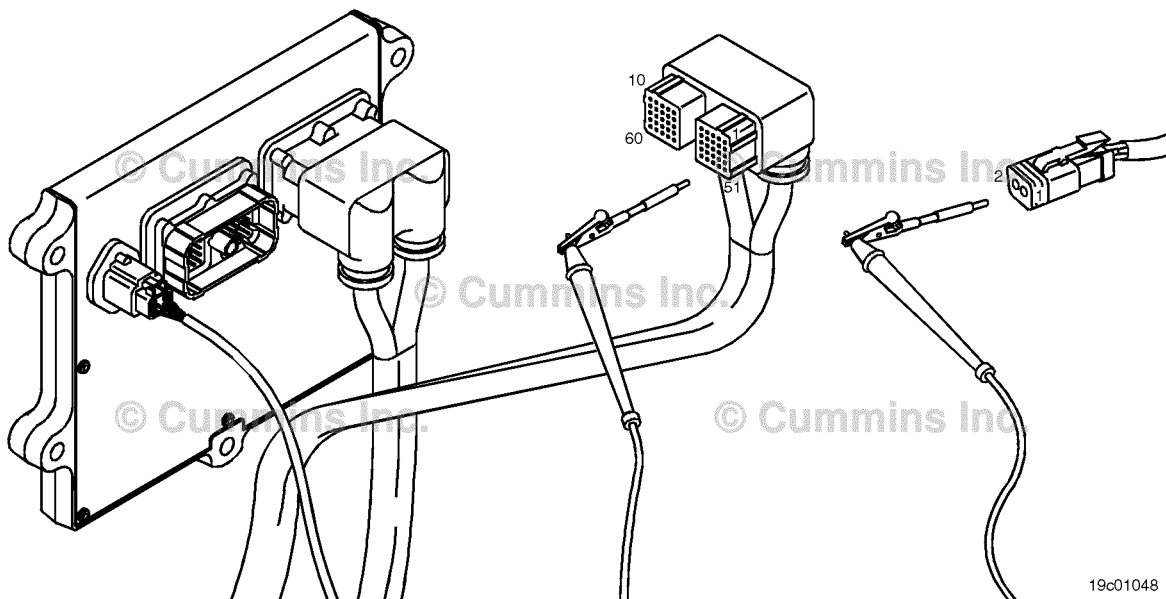
19c01079

**STEP 4C: Check for an open circuit in the engine harness.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine harness from the ECM.
- Disconnect the electric fuel lift pump from the engine harness. For 24 VDC Automotive systems with the lift pump harness, disconnect the engine harness from the electric fuel lift pump wiring harness.

Action	Specification/Repair	Next Step
<p>Check for an open circuit.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the electric fuel lift pump SUPPLY pin at the electric fuel lift pump connector and the electric fuel lift pump SUPPLY pin at the engine harness ECM connector.</li> </ul> <p>Refer to the circuit diagram or wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Less than 10 ohms? <b>YES</b></p>	<p>4D</p>
	<p>Less than 10 ohms? <b>NO</b></p> <p><b>Repair:</b></p> <p>An open circuit has been detected in the engine harness.</p> <p>Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.</p>	<p>5A</p>

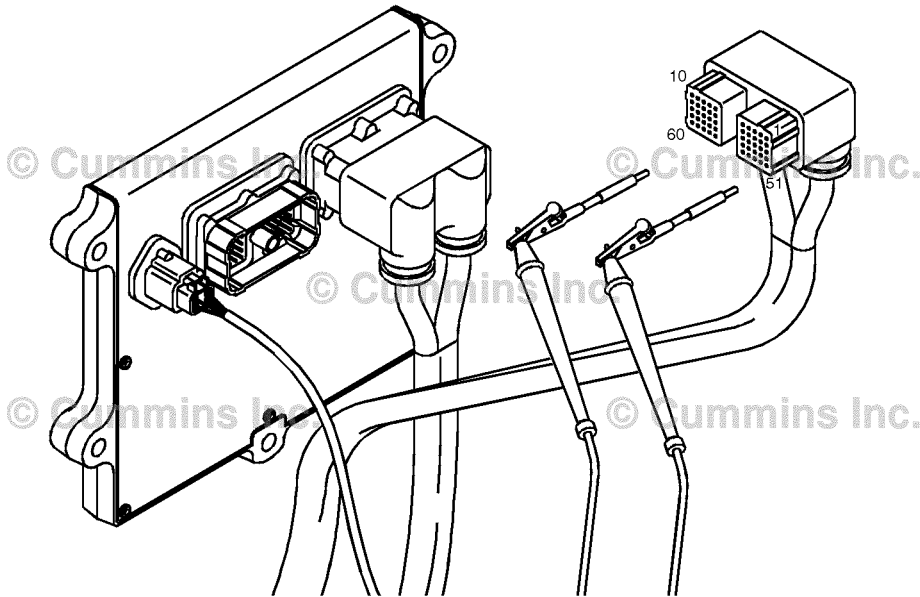


**STEP 4D: Check for a pin-to-pin short circuit in the engine harness.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine harness from the ECM.
- Disconnect the electric fuel lift pump from the ECM. For 24 VDC Automotive systems with the lift pump harness, disconnect the electric fuel lift pump relay from the electric fuel lift pump wiring harness.

Action	Specification/Repair	Next Step
Check for a pin-to-pin short. <ul style="list-style-type: none"> <li>• Measure the resistance between the electric fuel lift pump SUPPLY pin in the engine harness ECM connector and all other pins in the ECM connector.</li> </ul> Refer to the circuit diagram or wiring diagram for connector pin identification. Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.	Greater than 100k ohms? <b>YES</b>	4E
	Greater than 100k ohms? <b>NO</b> <b>Repair:</b> A pin-to-pin short circuit has been detected in the engine harness. Repair or replace the engine harness. If troubleshooting a 24 volt automotive system, isolate the interconnects. Refer to Procedure 019-043 in Section 19.	5A



19c01046

**STEP 4E: Check for an inactive fault code.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate circuit response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault Code 2265 inactive?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>None. The removal and installation of the connector corrected the problem.</p>	5A
	<p>Fault Code 2265 inactive?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Replace the ECM. Refer to Procedure 019-031 in Section 19.</p>	5A

**STEP 5: Clear the fault codes.**

**STEP 5A: Disable the fault code.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Disable the fault code.</p> <ul style="list-style-type: none"> <li>• Start the engine and let it idle for 1 minute.</li> <li>• Use INSITE™ electronic service tool to verify that the fault code is inactive.</li> </ul>	<p>Fault Code 2265 inactive?</p> <p><b>YES</b></p>	5B
	<p>Fault Code 2265 inactive?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Return to the troubleshooting steps or contact a Cummins® Authorized Repair Location if all steps have been completed and checked again.</p>	1A

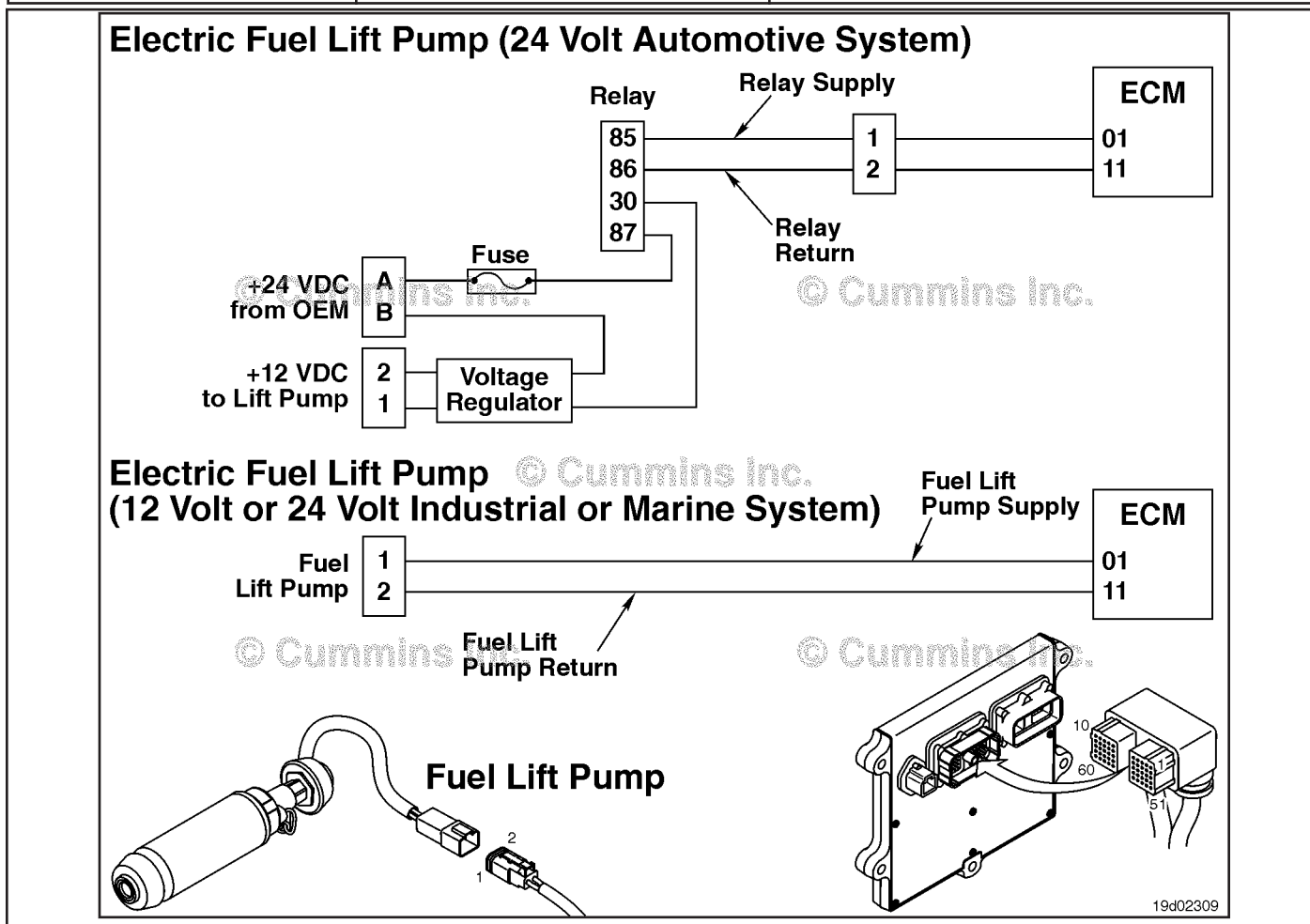
**STEP 5B: Clear the inactive fault codes.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Clear the inactive fault codes.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to erase the inactive fault codes.</li> </ul>	<p>All fault codes cleared?  <b>YES</b></p>	<p>Repair complete</p>
	<p>All fault codes cleared?  <b>NO</b>  <b>Repair:</b>                  Troubleshoot any remaining active fault codes.</p>	<p>Appropriate troubleshooting steps</p>

## Fault Code 2266

### Electric Lift Pump for Engine Fuel Supply Circuit - Voltage Below Normal, or Shorted to Low Source

CODES	REASON	EFFECT
Fault Code: 2266 PID(P), SID(S): S126 SPN: 1075 FMI: 4 Lamp: Amber SRT:	Electric Lift Pump for Engine Fuel Supply Circuit - Voltage Below Normal, or Shorted to Low Source. Low signal voltage detected at the fuel lift pump circuit.	Engine can be difficult to start.



Electric Fuel Lift Pump Circuit

#### Circuit Description:

On 12 VDC Automotive and 24 VDC Industrial or Marine systems, the circuit is a pulse width modulated driver in the electronic control module (ECM) that controls the electric fuel lift pump. The lift pump is grounded in the ECM.

On 24 VDC Automotive systems, the circuit is a pulse width modulated driver in the ECM that controls the electric fuel lift pump relay. The circuit includes two additional components, a relay and voltage regulator. The ECM controls voltage to the relay. When the relay is engaged, an OEM supplied power source delivers 24 VDC to the voltage regulator. The voltage regulator reduces the 24 VDC to 12 VDC, which is then delivered to the lift pump.

**Component Location:**

On both 12 and 24 VDC systems, the electric fuel lift pump is located behind the ECM cooling plate on the intake side of the engine. Refer to Procedure 100-002 for a detailed component location view.

On 24 Automotive VDC systems, the relay is located in the harness between the voltage regulator and the OEM power supply on the bottom edge of the ECM. The voltage regulator is located just below the ECM.

**Shop Talk:**

This fault code becomes active whenever the ECM detects a short circuit to ground or high current in the electric lift pump circuit. Causes for this fault code are short circuit to ground or low resistance.

On 12 VDC Automotive and 24 VDC Industrial or Marine systems during cold weather, gelled fuel can plug the lift pump and cause this fault code. Listen to the lift pump to be sure it is running during cold ambient temperatures (less than -29°C [-20°F]). This fault code can also become active if the lift pump rotor stalls or seizes. When the fault conditions are detected, the ECM driver to the lift pump is turned off to protect the circuit. It is necessary to cycle the keyswitch OFF and then back ON before the ECM will retest for the cause of the fault code. The ECM driver is re-enabled at keyswitch ON, and if the cause is no longer present, the fault code will become inactive and can be cleared.

On 24 VDC Automotive systems, the ECM driver to the lift pump relay is turned off when a short circuit to ground or high current in the electric fuel lift pump wiring harness relay circuit is detected. Causes of this fault code are a short circuit to ground or high current in the electric fuel lift pump wiring harness, relay or engine harness. This fault code will not become active if the voltage regulator or electric fuel lift pump has failed.

NOTE: On 12 VDC systems, this fault code will also become active if the priming pump motor stalls. Stall current for the priming pump motor is approximately 9 amperes. A good priming pump typically runs with less than 3 amperes. If the fault code is intermittent, observe the snapshot data priming pump measured current. If current was near 9 amperes when the fault condition occurred, conclude that the rotor has stalled and replace the electric priming pump.

**Refer to Troubleshooting Fault Code t05-2266**



## FAULT CODE 2266 - Electric Lift Pump for Engine Fuel Supply Circuit - Voltage Below Normal, or Shorted to Low Source TROUBLESHOOTING SUMMARY

### ⚠CAUTION⚠

To reduce the possibility of damaging a new ECM, all other active fault codes must be investigated before replacing the ECM.

### ⚠CAUTION⚠

To reduce the possibility of pin and harness damage, use the following test leads when taking a measurement: Part Number 3822758 - male Deutsch™/AMP™/Metri-Pack™ test lead and Part Number 3823993 - male Deutsch™ test lead.

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1: Check the fault codes.</b>		
<b>STEP 1A:</b> Check for an inactive fault code.	Fault Code 2266 inactive?	
<b>STEP 1B:</b> Lift Pump Voltage Regulator Check	Is a lift pump voltage regulator installed?	
<b>STEP 2: Check the electric fuel lift pump relay circuit.</b>		
<b>STEP 2A:</b> Inspect the engine harness and electric fuel lift pump relay connector pins.	Dirty or damaged pins?	
<b>STEP 2B:</b> Check the circuit response.	Fault Code 2265 is active and Fault Code 2266 is inactive?	
<b>STEP 2C:</b> Check the fault codes and verify sensor condition.	Fault Code 2266 is active?	
<b>STEP 3: Check the electric fuel lift pump.</b>		
<b>STEP 3A:</b> Inspect the engine harness and electric fuel lift pump connector pins.	Dirty or damaged pins?	
<b>STEP 3B:</b> Check the circuit response.	Fault Code 2265 is active and Fault Code 2266 is inactive?	
<b>STEP 3C:</b> Check the fault codes and verify sensor condition.	Fault Code 2266 is active?	
<b>STEP 4: Check the engine harness.</b>		
<b>STEP 4A:</b> Inspect the engine harness and ECM connector pins.	Dirty or damaged pins?	
<b>STEP 4B:</b> Check the ECM response.	Fault Code 2265 active and Fault Code 2266 inactive?	
<b>STEP 4C:</b> Check for a pin-to-pin short circuit in the engine harness.	Greater than 100k ohms?	
<b>STEP 4D:</b> Check for a pin short circuit to ground.	Greater than 100k ohms?	
<b>STEP 4E:</b> Check for an inactive fault code.	Fault Code 2266 is inactive?	
<b>STEP 5: Clear the fault codes.</b>		
<b>STEP 5A:</b> Disable the fault code.	Fault Code 2266 inactive?	
<b>STEP 5B:</b> Clear the inactive fault codes.	All fault codes cleared?	

## TROUBLESHOOTING STEP

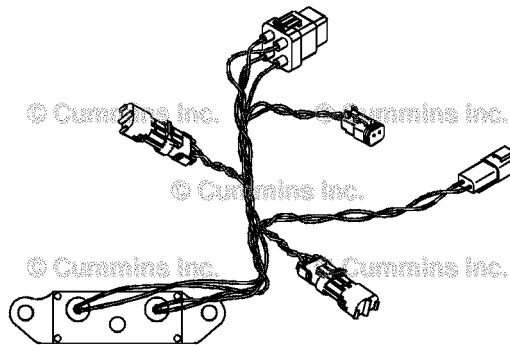
### STEP 1: Check the fault codes.

#### STEP 1A: Check for an inactive fault code.

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect the INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for an inactive fault code. <ul style="list-style-type: none"> <li>• Use the INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 2266 inactive? <b>YES</b>	Use the following procedure for an inactive or intermittent fault code. Refer to Procedure 019-362 in Section 19.
	Fault Code 2266 inactive? <b>NO</b>	1B

#### STEP 1B: Lift Pump Voltage Regulator Check

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> </ul>		
Action	Specification/Repair	Next Step
Check the lift pump voltage regulator.	Is a lift pump voltage regulator installed? <b>YES</b>	2A
	Is a lift pump voltage regulator installed? <b>NO</b>	3A



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**STEP 2: Check the electric fuel lift pump relay circuit.**

**STEP 2A: Inspect the engine harness and electric fuel lift pump relay connector pins.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the electric fuel lift pump relay from the electric fuel lift pump wiring harness.</li> <li>• Disconnect the engine harness from the electric fuel lift pump wiring harness.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the engine harness electric fuel lift pump wiring harness and relay connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Clean the connector and pins.</p> <p>Repair the damaged harness, connector, or pins if possible.</p>	5A
	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	2B

**STEP 2B: Check the circuit response.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the electric fuel lift pump relay.</li> <li>• Turn keyswitch On.</li> <li>• Connect the INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate circuit response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use the INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault Code 2265 is active and Fault Code 2266 is inactive?</p> <p><b>YES</b></p>	2C
	<p>Fault Code 2265 is active and Fault Code 2266 is inactive?</p> <p><b>NO</b></p>	4A

**STEP 2C: Check the fault codes and verify sensor condition.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Connect the electric fuel lift pump relay.</li> <li>• Turn keyswitch ON.</li> <li>• Connect the INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate circuit response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use the INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault Code 2266 is active?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A damaged electric fuel lift pump relay has been detected.</p> <p>Replace the electric fuel lift pump relay. Refer to the OEM service manual.</p>	5A
	<p>Fault Code 2266 is active?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>None. Removal and installation of the connector corrected the problem.</p>	5A

**STEP 3: Check the electric fuel lift pump.**

**STEP 3A: Inspect the engine harness and electric fuel lift pump connector pins.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the electric fuel lift pump.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the engine harness and electric fuel lift pump connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Clean the connector and pins.</p> <p>Repair the damaged harness, connector, or pins if possible. Refer to Procedure 019-043 in Section 19</p>	5A
	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	3B

**STEP 3B: Check the circuit response.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the electric fuel lift pump from the engine harness.</li> <li>• Turn keyswitch ON.</li> <li>• Connect the INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate circuit response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use the INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault Code 2265 is active and Fault Code 2266 is inactive?</p> <p><b>YES</b></p>	3C
	<p>Fault Code 2265 is active and Fault Code 2266 is inactive?</p> <p><b>NO</b></p>	4A

**STEP 3C: Check the fault codes and verify sensor condition.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Connect the electric fuel lift pump to the engine harness.</li> <li>• Turn keyswitch ON.</li> <li>• Connect the INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate circuit response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use the INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault Code 2266 is active?</p> <p>A damaged fuel lift pump has been detected.</p> <p>Replace the electric fuel lift pump. Use the following procedure in the ISC, QSC8.3, ISL, and QSL9 Series Engines Troubleshooting and Repair Manual, Bulletin 4021418 or the ISB Troubleshooting and Repair Manual, Bulletin 3666477. Refer to Procedure 005-045 in Section 5.</p> <p><b>YES</b></p>	5A
	<p>Fault Code 2266 is active?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>None. The removal and installation of the connector corrected the problem.</p>	5A

**STEP 4: Check the engine harness.**

**STEP 4A: Inspect the engine harness and ECM connector pins.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the engine harness and ECM connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Clean the connector and pins.</p> <p>Repair the damaged harness, connector, or pins if possible. Refer to Procedure 019-043 in Section 19.</p>	5A
	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	4B

**STEP 4B: Check the ECM response.**

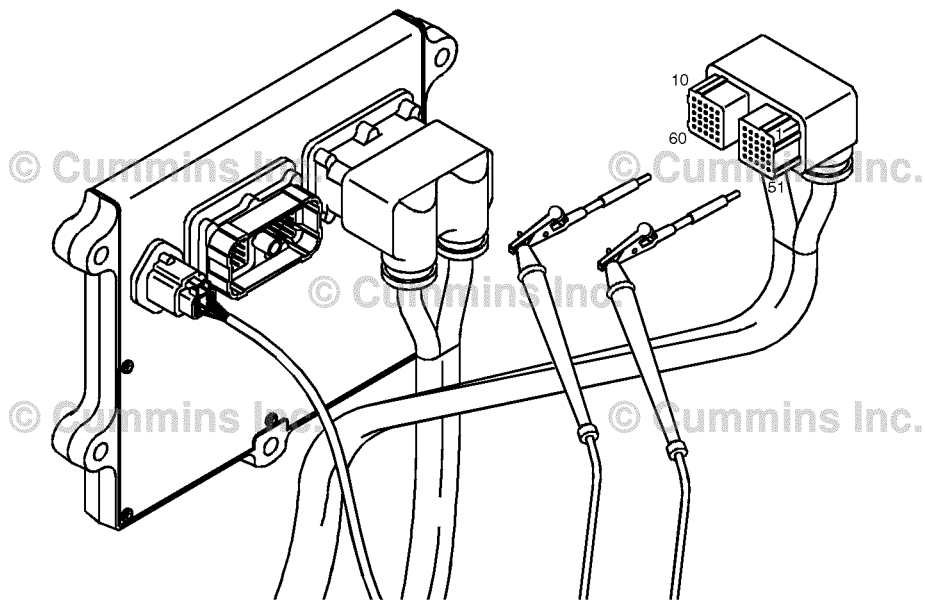
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> <li>• Turn keyswitch ON.</li> <li>• Connect the INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate circuit response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use the INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault Code 2265 is active and Fault Code 2266 is inactive?</p> <p><b>YES</b></p>	4C
	<p>Fault Code 2265 is active and Fault Code 2266 is inactive?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Replace the ECM. Refer to Procedure 019-031 in Section 19.</p>	5A

**STEP 4C: Check for a pin-to-pin short circuit in the engine harness.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine harness from the ECM.
- Disconnect the electric fuel lift pump from the engine harness. For 24 VDC Automotive systems, disconnect the electric fuel lift pump relay from the electric fuel lift pump wiring harness.

Action	Specification/Repair	Next Step
<p>Check for a pin-to-pin short.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the electric fuel lift pump SUPPLY pin in the engine harness ECM connector and all other pins in the engine harness ECM connector.</li> </ul> <p>Refer to the wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Greater than 100k ohms? <b>YES</b></p>	<p>4D</p>
	<p>Greater than 100k ohms? <b>NO</b></p> <p><b>Repair:</b></p> <p>A pin-to-pin short circuit on the SUPPLY line has been detected in the engine harness.</p> <p>Repair or replace the engine harness.</p> <p>For 24 VDC Automotive systems, isolate the short circuit. Repair or replace the electric fuel lift pump wiring harness or engine harness. Refer to Procedure 019-043 in Section 19.</p>	<p>5A</p>



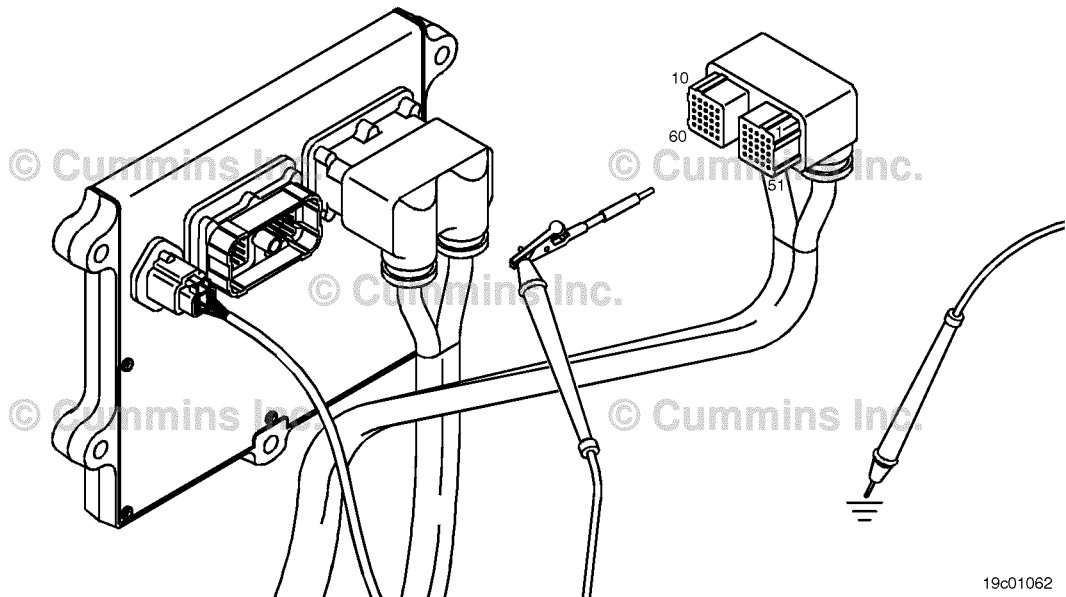
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**STEP 4D: Check for a pin short circuit to ground.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine harness from the ECM.
- Disconnect the electric fuel lift pump from the engine harness. For 24 VDC Automotive systems, disconnect the electric fuel lift pump relay from the electric fuel lift pump wiring harness.

Action	Specification/Repair	Next Step
Check for a pin-to-ground short. <ul style="list-style-type: none"> <li>• Measure the resistance between the electric fuel lift pump SUPPLY pin in the engine harness ECM connector and ground.</li> </ul> Refer to the wiring diagram for connector pin identification. Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.	Greater than 100k ohms? <b>YES</b>	4E
	Greater than 100k ohms? <b>NO</b> <b>Repair:</b> A pin-to-ground short circuit on the SUPPLY line has been detected in the engine harness. Repair or replace the engine harness. For 24 VDC Automotive systems, isolate the short circuit. Repair or replace the electric fuel lift pump wiring harness or engine harness. Refer to Procedure 019-043 in Section 19.	5A



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**STEP 4E: Check for an inactive fault code.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect the INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate circuit response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use the INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault Code 2266 is inactive?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>None. The removal and installation of the connector corrected the problem.</p>	5A
	<p>Fault Code 2266 is inactive?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Troubleshooting procedures need to be repeated from the beginning. A failure mode should have been detected.</p>	1A

**STEP 5: Clear the fault codes.**

**STEP 5A: Disable the fault code.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Disable the fault code.</p> <ul style="list-style-type: none"> <li>• Start the engine and let it idle for 1 minute.</li> <li>• Use the INSITE™ electronic service tool to verify the fault code is inactive.</li> </ul>	<p>Fault Code 2266 inactive?</p> <p><b>YES</b></p>	5B
	<p>Fault Code 2266 inactive?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Return to the troubleshooting steps or contact a local Cummins® Authorized Repair Location if all steps have been completed and checked again.</p>	1A

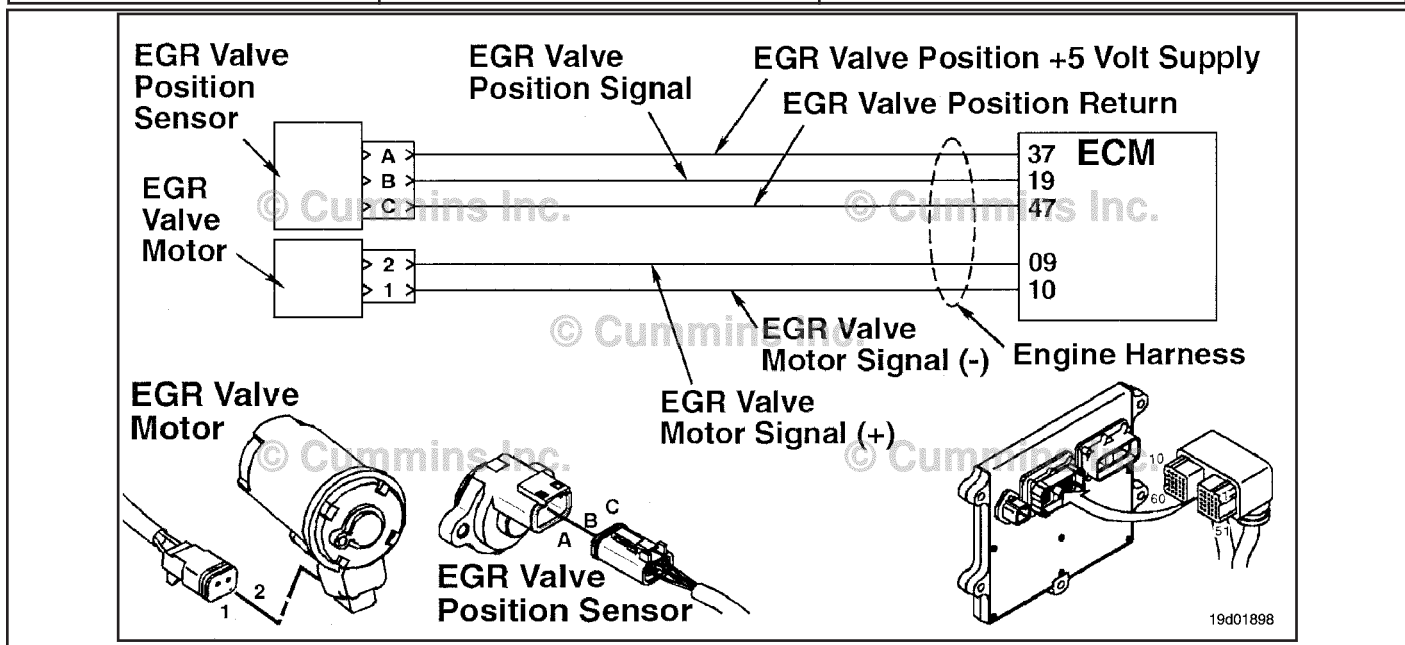
**STEP 5B: Clear the inactive fault codes.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Clear the inactive fault codes.</p> <ul style="list-style-type: none"> <li>• Use the INSITE™ electronic service tool to erase the inactive fault codes.</li> </ul>	<p>All fault codes cleared? <b>YES</b></p>	<p>Repair complete</p>
	<p>All fault codes cleared? <b>NO</b></p> <p><b>Repair:</b></p> <p>Troubleshoot any remaining active fault codes.</p>	<p>Appropriate troubleshooting steps</p>

## Fault Code 2271

### EGR Valve Position Sensor Circuit - Voltage Above Normal or Shorted to High Source

CODES	REASON	EFFECT
Fault Code: 2271 PID(P), SID(S): P027 SPN: 27 FMI: 3/3 Lamp: Amber SRT:	Exhaust Gas Recirculation (EGR) Valve Position Sensor Circuit - Voltage Above Normal or Shorted to High Source. High signal voltage detected at the EGR valve position sensor circuit.	Possible low power. Power will be removed from the EGR valve motor.



**Circuit Description:**

The exhaust gas recirculation (EGR) valve position sensor outputs a voltage signal to the electronic control module (ECM). The ECM converts this signal into a percentage value, 0 to 100, indicating valve position. A fully-open valve is equivalent to 100 percent.

**Component Location:**

The EGR valve position sensor is located on the EGR valve assembly. Refer to Procedure 100-002 for a detailed component location view.

**Shop Talk:**

The EGR valve position sensor shares Supply and Return wires in the engine harness with other sensors. Open circuits and short circuits in the engine harness can cause multiple fault codes to be active.

Possible causes of this fault code include:

- Open return in the harness, connectors, or sensor
- SIGNAL wire shorted to sensor supply or battery voltage
- Failed EGR valve position sensor
- Failed ECM.

**Refer to Troubleshooting Fault Code t05-2271.**

FAULT CODE 2271 - EGR Valve Position Sensor Circuit - Voltage Above Normal or Shorted to High Source
TROUBLESHOOTING SUMMARY



To reduce the possibility of damaging a new engine control module, all other active fault codes must be investigated prior to replacing the engine control module.



To reduce the possibility of pin and harness damage, use the following test leads when taking a measurement: Part Number 3822758 - male Deutsch/AMP/Metri-Pack test lead and Part Number 3822917 - female Deutsch/AMP/Metri-Pack test lead.

Table with 3 columns: STEPS, SPECIFICATIONS, and SRT CODE. It lists troubleshooting steps from Step 1 to Step 4, including sub-steps like Step 1A, 1B, 2A, 2B, 2C, 2D, 3A, 3B, 4A, and 4B, with corresponding specifications and SRT codes.

**TROUBLESHOOTING STEP****STEP 1: Check the fault codes.****STEP 1A: Check for sensor supply fault codes.**

<b>Condition:</b>		
<ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
<b>Action</b>	<b>Specification/Repair</b>	<b>Next Step</b>
Check for sensor supply fault codes. <ul style="list-style-type: none"> <li>• Start the engine and let it idle for 1 minute.</li> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 227 active? <b>YES</b> <b>Repair:</b> Troubleshoot Fault Code 227.	Fault Code 227
	Fault Code 227 active? <b>NO</b>	1B

**STEP 1B: Check for an active fault code.**

<b>Condition:</b>		
<ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
<b>Action</b>	<b>Specification/Repair</b>	<b>Next Step</b>
Check for an active fault code. <ul style="list-style-type: none"> <li>• Start the engine and let it idle for 1 minute.</li> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 2271 active? <b>YES</b>	2A
	Fault Code 2271 active? <b>NO</b>	Use the following procedure for an inactive or intermittent fault code. Refer to Procedure 019-362 in Section 19.

**STEP 2: Check the EGR valve position sensor and circuit.**

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

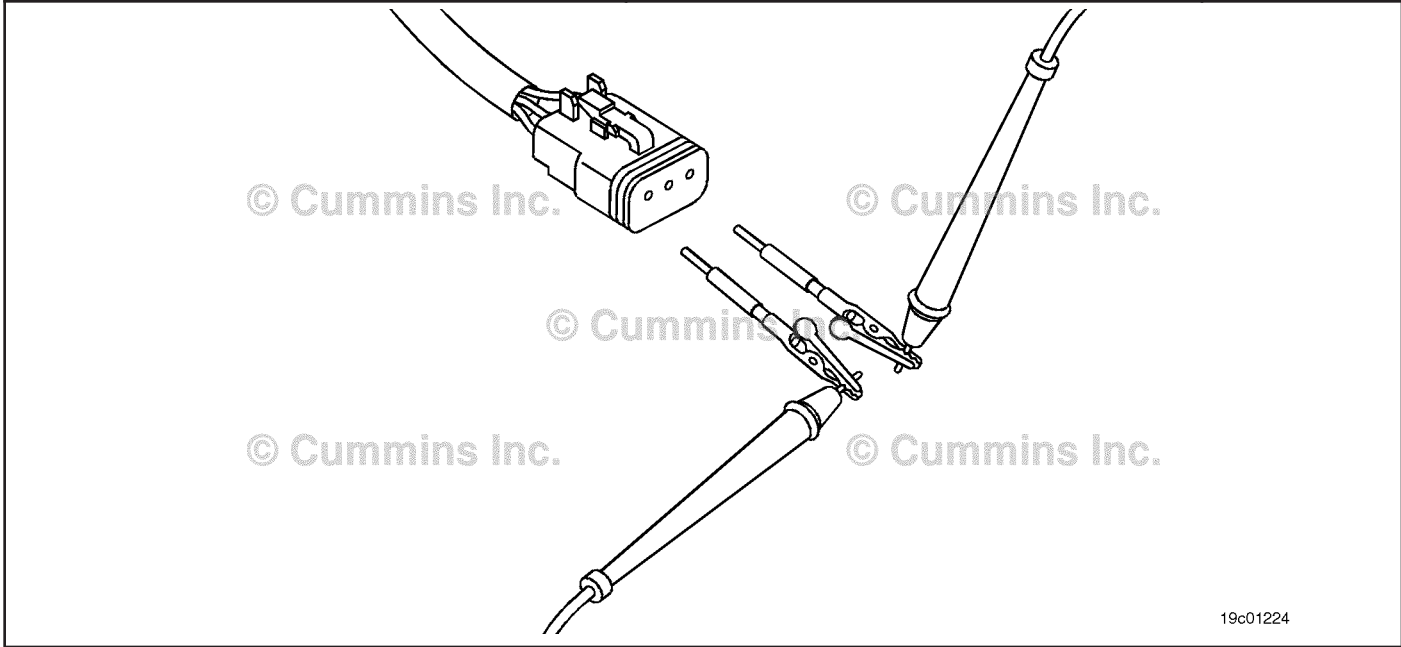
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the EGR valve position sensor from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the engine harness and sensor connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Clean the connector and pins.</p> <p>Repair the damaged harness, connectors, or pins if possible. Refer to Procedure 019-043 in Section 19.</p>	4A
	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	2B

**STEP 2B: Check the circuit response.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the EGR valve position sensor from the engine harness.</li> <li>• Connect INSITE™ electronic service tool.</li> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate engine control module response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault Code 2271 inactive and Fault Code 2272 active?</p> <p><b>YES</b></p>	2C
	<p>Fault Code 2271 inactive and Fault Code 2272 active?</p> <p><b>NO</b></p>	3A

**STEP 2C: Check the EGR valve position sensor supply and return circuit at the engine harness.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the EGR valve position sensor from the engine harness.</li> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check the EGR valve position sensor supply and return circuit at the engine harness.</p> <ul style="list-style-type: none"> <li>• Measure the voltage between the EGR valve position +5 VDC SUPPLY pin and the EGR valve position RETURN pin at the sensor connector of the engine harness.</li> </ul> <p>Use the wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>4.75 to 5.25-VDC?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Replace the EGR valve assembly. Refer to Procedure 019-372 in Section 19.</p>	4A
	<p>4.75 to 5.25-VDC?</p> <p><b>NO</b></p>	2D

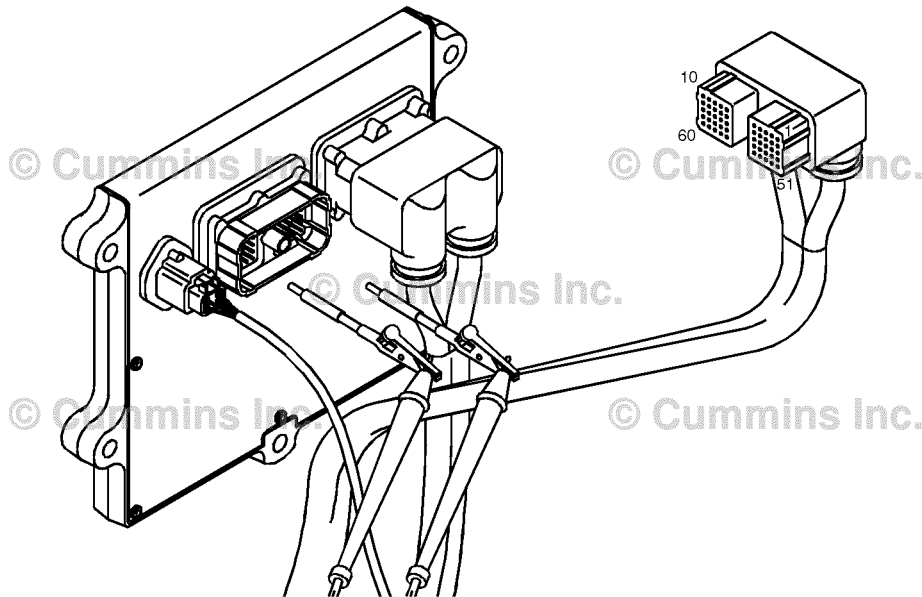


**STEP 2D: Check the EGR valve position sensor supply and return circuit at the engine control module.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine harness from the engine control module.
- Turn keyswitch ON.

Action	Specification/Repair	Next Step
Check the EGR valve position sensor supply and return circuit at the engine control module. <ul style="list-style-type: none"> <li>• Measure the voltage between the EGR valve position +5 VDC SUPPLY pin and the EGR valve position RETURN at the engine control module port.</li> </ul>	4.75 to 5.25-VDC? <b>YES</b> <b>Repair:</b> Repair or replace the engine harness.	4A
Use the wiring diagram for connector pin identification.  Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.	4.75 to 5.25-VDC? <b>NO</b> <b>Repair:</b> Replace the engine control module. Refer to Procedure 019-031 in Section 19.	4A



19c01079



**STEP 3: Check the engine control module.****STEP 3A: Inspect the engine harness and engine control module connector pins.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the engine control module.</li> </ul>		
Action	Specification/Repair	Next Step
Inspect the engine harness and engine control module connector pins for the following: <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.	Dirty or damaged pins? <b>YES</b> <b>Repair:</b> Clean the connector and pins. Repair the damaged harness, connectors, or pins if possible. Refer to Procedure 019-043 in Section 19.	4A
	Dirty or damaged pins? <b>NO</b>	3B

**STEP 3B: Check the engine control module response.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the engine control module.</li> <li>• Connect INSITE™ electronic service tool.</li> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
Check for the appropriate engine control module response. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read fault codes.</li> </ul>	Fault Code 2271 inactive and Fault Code 2272 active? <b>YES</b> <b>Repair:</b> Repair or replace the engine harness.	4A
	Fault Code 2271 inactive and Fault Code 2272 active? <b>NO</b> <b>Repair:</b> Replace the engine control module. Refer to Procedure 019-031 in Section 19.	4A

**STEP 4: Clear the fault codes.**

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

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Connect INSITE™ electronic service tool.</li> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Disable the fault code.</p> <ul style="list-style-type: none"> <li>• Start the engine and let it idle for 1 minute.</li> <li>• Use INSITE™ electronic service tool to verify Fault Code 2271 is inactive.</li> </ul>	<p>Fault Code 2271 inactive?</p> <p><b>YES</b></p>	4B
	<p>Fault Code 2271 inactive?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Return to the troubleshooting steps or contact a local Cummins® Authorized Repair Location if all steps have been completed and checked again.</p>	1A

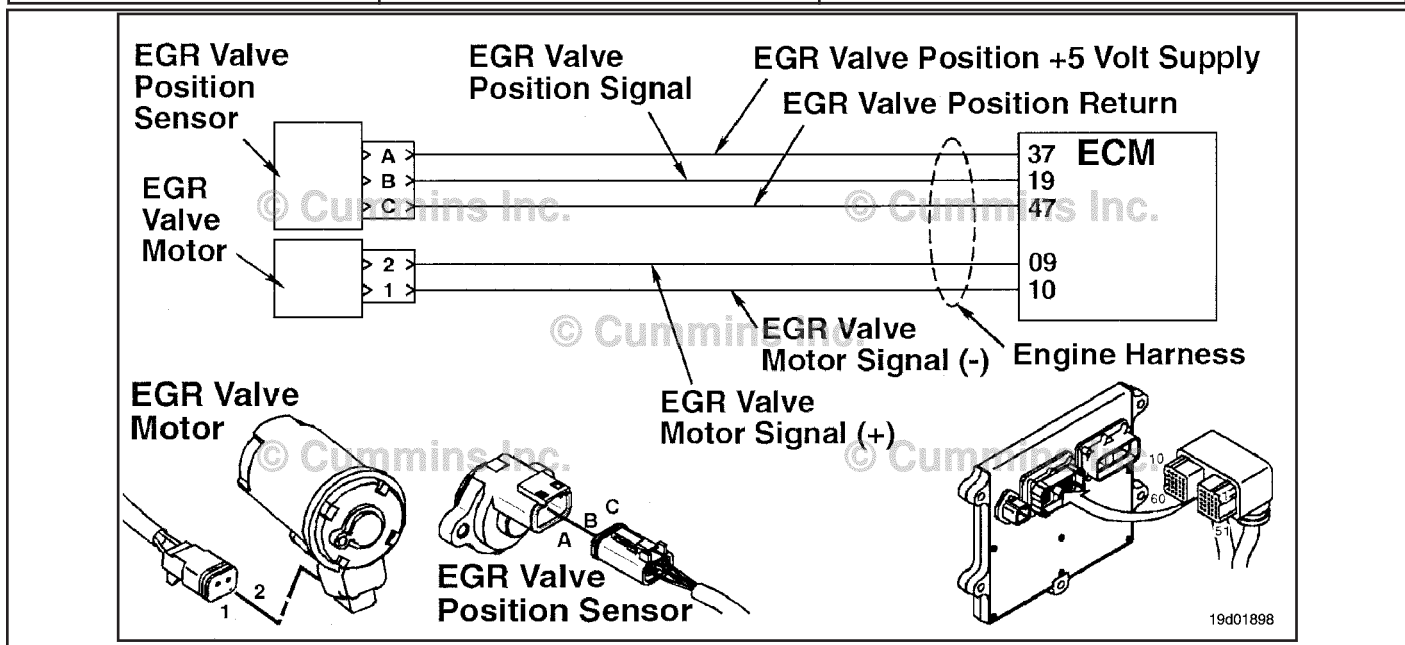
**STEP 4B: Clear the inactive fault codes.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Connect INSITE™ electronic service tool.</li> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Clear the inactive fault codes.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to clear the inactive fault codes.</li> </ul>	<p>All fault codes cleared?</p> <p><b>YES</b></p>	Repair complete
	<p>All fault codes cleared?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Troubleshoot any remaining active fault codes.</p>	Appropriate troubleshooting steps

## Fault Code 2272

### EGR Valve Position Sensor Circuit - Voltage Below Normal or Shorted to Low Source

CODES	REASON	EFFECT
Fault Code: 2272 PID(P), SID(S): P027 SPN: 027 FMI: 4/4 Lamp: Amber SRT:	Exhaust Gas Recirculation (EGR) valve position circuit - voltage below normal or shorted to low source. Low signal voltage detected at the EGR valve position sensor circuit.	Possible low power. Power will be removed from the EGR valve motor.



EGR Valve Position Sensor Circuit

**Circuit Description:**

The EGR valve position sensor outputs a voltage signal to the electronic control module (ECM). The ECM converts this signal into a percentage value, 0 to 100, indicating valve position. A fully-open valve is equivalent to 100 percent.

**Component Location:**

The EGR valve position sensor is located on the EGR valve assembly. 100-002 for a detailed component location view.

**Shop Talk:**

The EGR valve position sensor shares SUPPLY and RETURN wires in the engine harness with other sensors. Open circuits and short circuits in the engine harness can cause multiple fault codes to be active.

Possible causes for this fault code include:

- SIGNAL circuit open or shorted to ground
- SUPPLY circuit open or shorted to ground
- Sensor shorted to ground.

**Refer to Troubleshooting Fault Code t05-2272**

FAULT CODE 2272 - EGR Valve Position Sensor Circuit - Voltage Below Normal or Shorted to Low Source
TROUBLESHOOTING SUMMARY



To reduce the possibility of damaging a new engine control module, all other active fault codes must be investigated prior to replacing the engine control module.



To reduce the possibility of pin and harness damage, use the following test leads when taking a measurement: Part Number 3822758 - male Deutsch™/AMP™/Metri-Pack™ test lead and Part Number 3822917 - female Deutsch™/AMP™/Metri-Pack™ test lead.

Table with 3 columns: STEPS, SPECIFICATIONS, and SRT CODE. It lists troubleshooting steps from Step 1 to Step 4, including sub-steps like Step 1A, 1B, 2A, 2B, 2C, 2D, 3A, 3B, 4A, and 4B, with corresponding specifications and SRT codes.

**TROUBLESHOOTING STEP****STEP 1: Check the fault codes.****STEP 1A: Check for sensor supply fault codes.**

<b>Condition:</b>		
<ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
<b>Action</b>	<b>Specification/Repair</b>	<b>Next Step</b>
Check for sensor supply fault codes. <ul style="list-style-type: none"> <li>• Start the engine and let it idle for 1 minute.</li> <li>• Use INSITE™ electronic service tool to read fault codes.</li> </ul>	Fault Code 187 active? <b>YES</b> <b>Repair:</b> Troubleshoot Fault Code 187.	Refer to troubleshooting tree for Fault Code 187
	Fault Code 187 active? <b>NO</b>	1B

**STEP 1B: Check for an active fault code.**

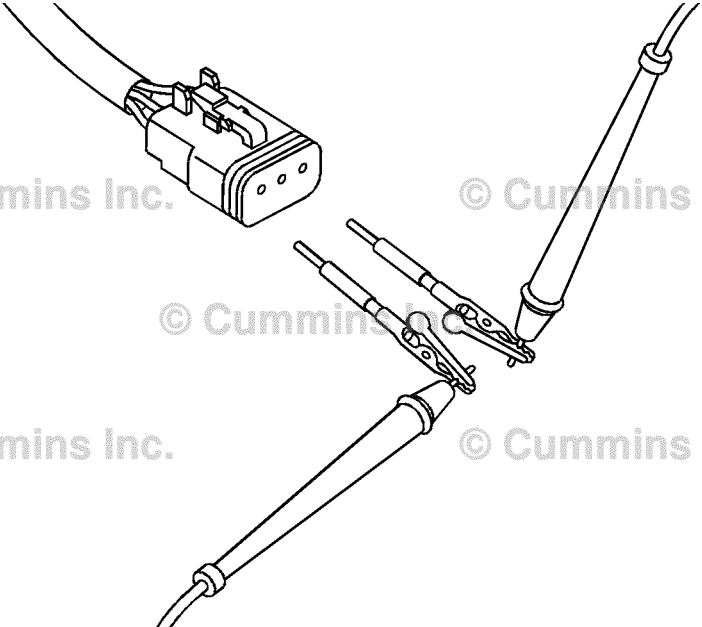
<b>Condition:</b>		
<ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
<b>Action</b>	<b>Specification/Repair</b>	<b>Next Step</b>
Check for an active fault code. <ul style="list-style-type: none"> <li>• Start the engine and let it idle for 1 minute.</li> <li>• Use INSITE™ electronic service tool to read fault codes.</li> </ul>	Fault Code 2272 active? <b>YES</b>	2A
	Fault Code 2272 active? <b>NO</b>	Use the following procedure for an inactive or intermittent fault code. Refer to Procedure 019-362 in Section 19.

**STEP 2: Check the EGR valve position sensor and circuit.**

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

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the EGR valve position sensor from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the engine harness and sensor connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Clean the connectors and pins.</p> <p>Repair the damaged harness, connectors, or pins if possible.</p>	4A
	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	2B

**STEP 2B: Check the EGR valve position sensor supply and return circuit at the engine harness.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the EGR valve position sensor from the engine harness.</li> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check the EGR valve position sensor supply and return circuit at the engine harness.</p> <ul style="list-style-type: none"> <li>• Measure the voltage between the EGR valve position +5 VDC SUPPLY pin and the EGR valve position RETURN pin at the sensor connector of the engine harness.</li> <li>• Refer to the circuit diagram or wiring diagram for connector pin identification.</li> <li>• Use the following procedure for multimeter usage. Refer to Procedure 019-359 in Section 19.</li> </ul>	<p>4.75 to 5.25-VDC? <b>YES</b></p>	<p>2C</p>
	<p>4.75 to 5.25 -VDC? <b>NO</b></p>	<p>3A</p>
		

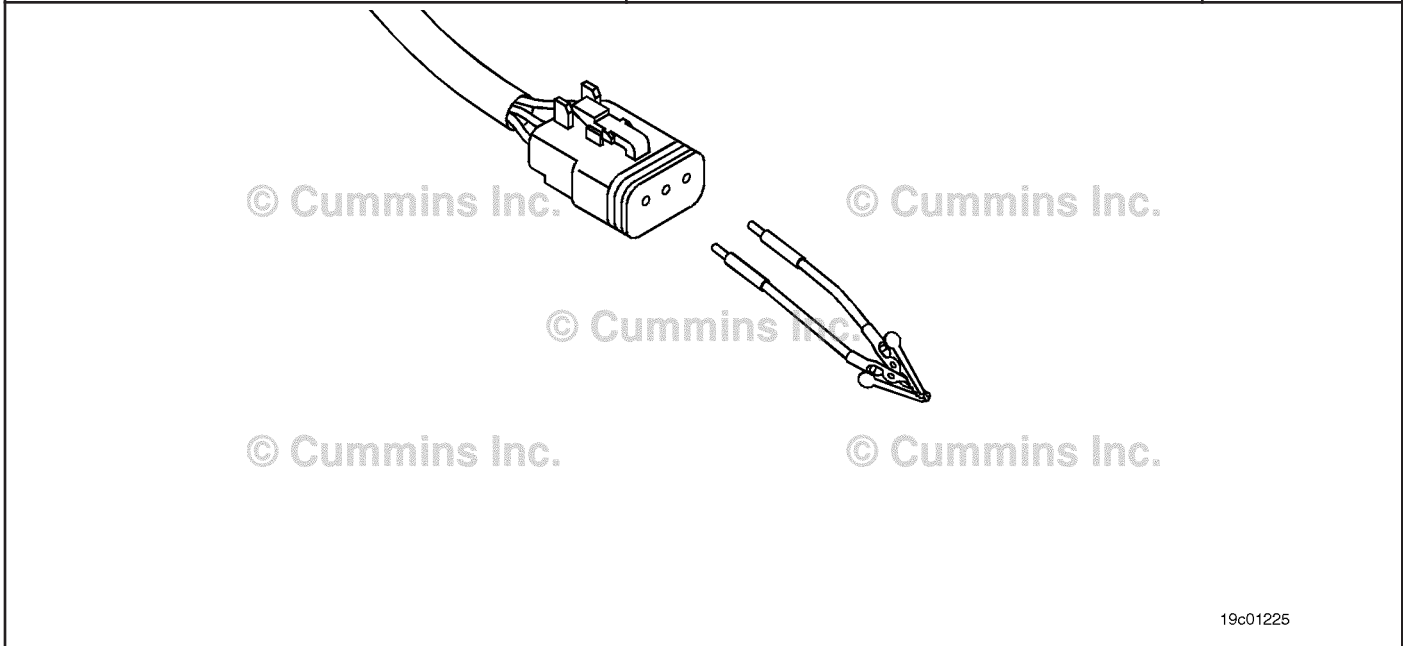
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**STEP 2C: Check the circuit response.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the EGR valve position sensor from the engine harness.
- Turn keyswitch ON.
- Connect INSITE™ electronic service tool.

Action	Specification/Repair	Next Step
Check the circuit response. <ul style="list-style-type: none"> <li>• Place a jumper wire between the EGR valve position +5 VDC SUPPLY pin and the EGR valve position SIGNAL pin at the sensor connector of the engine harness.</li> <li>• Refer to the circuit diagram or wiring diagram for connector pin identification.</li> <li>• Use INSITE™ electronic service tool to read the fault code and check if the fault code goes inactive.</li> </ul>	Fault Code 2272 inactive and Fault Code 2271 active? <b>YES</b> <b>Repair:</b> Replace the EGR valve assembly. Refer to Procedure 019-372 in Section 19.	4A
	Fault Code 2272 inactive and Fault Code 2271 active? <b>NO</b>	2D



19c01225

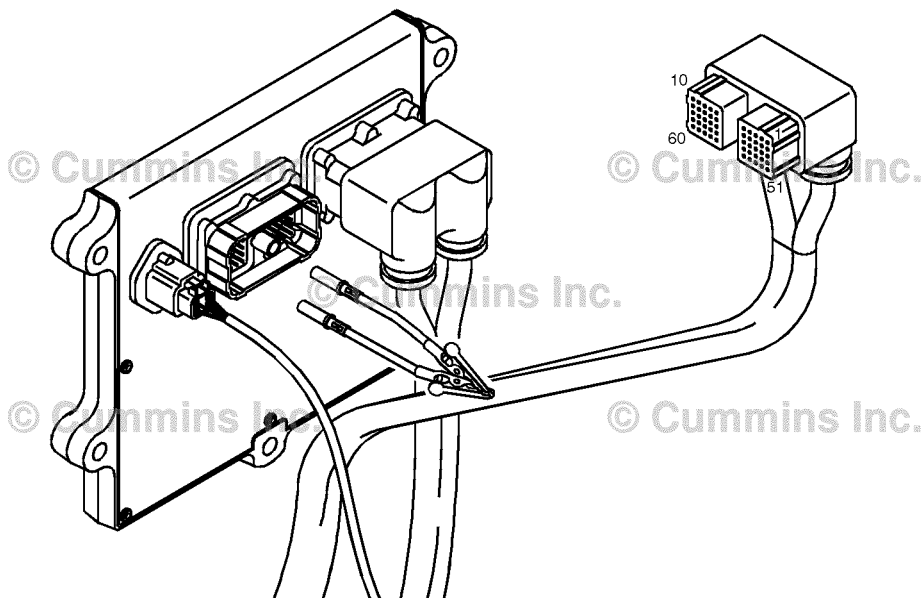


**STEP 2D: Check the engine control module response.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine harness from the engine control module.
- Turn keyswitch ON.
- Connect INSITE™ electronic service tool.

Action	Specification/Repair	Next Step
Check the engine control module response. <ul style="list-style-type: none"> <li>• Place a jumper wire between the EGR valve position +5-VDC SUPPLY pin and the EGR valve position SIGNAL pin at the engine control module port.</li> <li>• Refer to the circuit diagram or wiring diagram for connector pin identification.</li> <li>• Check for the appropriate engine control module response after 30 seconds.</li> <li>• Use INSITE™ electronic service tool to read fault codes.</li> </ul>	Fault Code 2272 inactive and Fault Code 2271 active? <b>YES</b> <b>Repair:</b> Repair or replace the engine harness.	4A
	Fault Code 2272 inactive and Fault Code 2271 active? <b>NO</b> <b>Repair:</b> Replace the engine control module. Refer to Procedure 019-031 in Section 19.	4A



19c01111

**STEP 3: Check the engine control module.**

**STEP 3A: Inspect the engine harness and engine control module connector pins.**

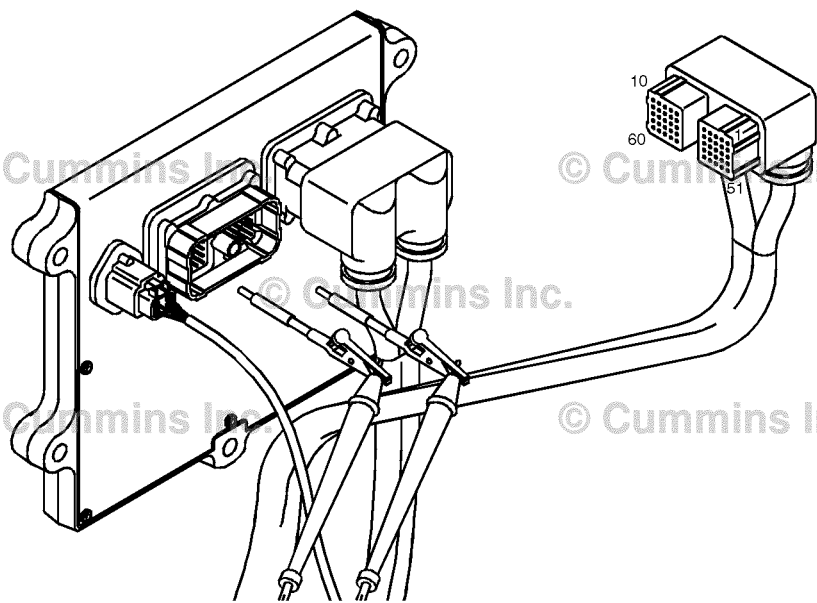
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the engine control module.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the engine harness and engine control module connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Clean the connectors and pins.</p> <p>Repair the damaged harness, connectors, or pins if possible.</p>	4A
	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	3B

**STEP 3B: Check the sensor supply voltage and return circuit.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine harness from the engine control module.
- Turn keyswitch ON.

Action	Specification/Repair	Next Step
Check the sensor supply voltage and return circuit at the engine control module. <ul style="list-style-type: none"> <li>• Measure the voltage between the turbocharger position +5 VDC SUPPLY pin and the turbocharger position RETURN pin at the engine control module port.</li> <li>• Refer to the circuit diagram or wiring diagram for connector pin identification.</li> <li>• Use the following procedure for multimeter usage. Refer to Procedure 019-359 in Section 19.</li> </ul>	4.75 to 5.25-VDC? <b>YES</b> <b>Repair:</b> Repair or replace the engine harness.	4A
	4.75 to 5.25-VDC? <b>NO</b> <b>Repair:</b> Replace the engine control module. Refer to Procedure 019-031 in Section 19.	4A



19c01079

**STEP 4: Clear the fault codes.**

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

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Connect INSITE™ electronic service tool.</li> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> <li>• Start the engine and let it idle for 1 minute.</li> <li>• Verify Fault Code 2272 is inactive.</li> </ul>	Fault Code 2272 inactive? <b>YES</b>	4B
	Fault Code 2272 inactive? <b>NO</b> <b>Repair:</b> Return to the troubleshooting steps or contact a local Cummins® Authorized Repair Location if all steps have been completed and checked again.	1A

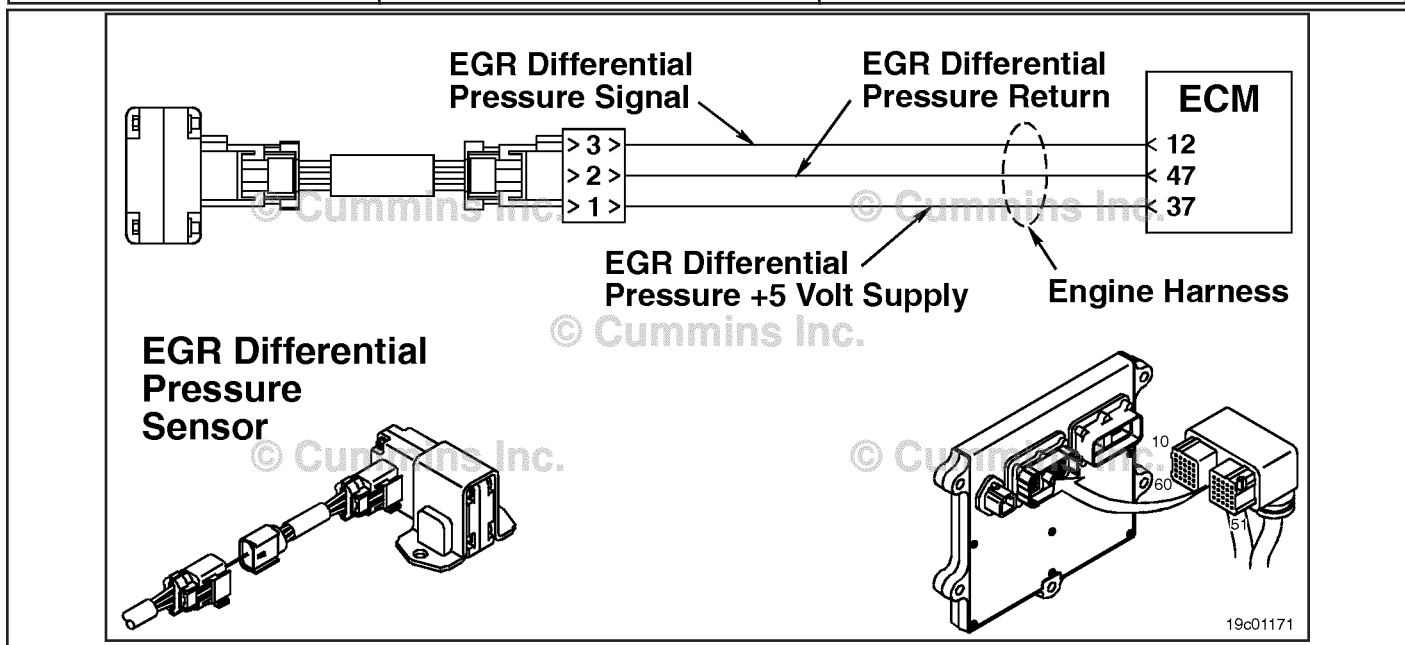
**STEP 4B: Clear the inactive fault codes.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Connect INSITE™ electronic service tool.</li> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to clear the inactive fault codes.</li> </ul>	All fault codes cleared? <b>YES</b>	Repair complete
	All fault codes cleared? <b>NO</b> <b>Repair:</b> Troubleshoot any remaining active fault codes.	Appropriate troubleshooting steps

## Fault Code 2273

### EGR Valve Differential Pressure Sensor Circuit - Shorted High

CODES	REASON	EFFECT
Fault Code: 2273 PID(P), SID(S): P411 SPN: 411 FMI: 3/3 Lamp: Amber SRT:	EGR valve differential pressure sensor circuit - shorted high. High voltage detected on the EGR differential pressure sensor circuit.	EGR valve will be closed.



EGR Valve Differential Pressure Sensor Circuit

#### Circuit Description:

The exhaust gas recirculation (EGR) differential pressure sensor has two ports that sense a pressure drop across the EGR gas entrance to the intake connection. The electronic control module (ECM) uses this pressure drop to calculate the amount of EGR gas entering the intake. This calculation helps to determine the commanded position of the EGR valve (and VG turbocharger) that will control the amount of EGR gas flow into the engine.

#### Component Location:

The EGR differential pressure sensor is mounted on the side of the intake air horn. Refer to Procedure 100-002 for a detailed component location view.

NOTE: The sensor is connected to the engine harness through a short pigtail harness. The pigtail harness is permanently affixed to the sensor. Do **not** try to remove the connector that is attached to the sensor body or damage to the sensor will occur.

#### Shop Talk:

The EGR differential pressure sensor shares supply and return wires in the engine harness with other sensors. Open circuits and short circuits in the engine harness can cause multiple fault codes to be active. Before troubleshooting Fault Code 2273, check for multiple faults. Possible causes of this fault code include:

- Open return in the harness, connectors, or sensor
- Signal circuit shorted to sensor supply or battery voltage
- Supply circuit shorted to battery voltage.

**Refer to Troubleshooting Fault Code t05-2273**

## FAULT CODE 2273 - EGR Valve Differential Pressure Sensor Circuit - Shorted High

### TROUBLESHOOTING SUMMARY



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



To reduce the possibility of pin and harness damage, use the following test leads when taking a measurement: Part Number 3822758 - male Deutsch™/AMP™/Metri-Pack™ test lead, Part Number 3822917 - female Deutsch™/AMP™/Metri-Pack™ test lead, and Part Number 3164596 - male Framatome™ test lead.

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1: Check the fault codes.</b>		
<b>STEP 1A:</b> Check for multiple fault codes.	Fault Code 227 active?	
<b>STEP 1B:</b> Read the fault codes.	Fault Code 2273 active?	
<b>STEP 2: Check the EGR differential pressure sensor and circuit.</b>		
<b>STEP 2A:</b> Inspect the engine harness and EGR differential pressure sensor connector pins.	Dirty or damaged pins?	
<b>STEP 2B:</b> Check the circuit response.	Fault Code 2273 inactive and Fault Code 2274 active?	
<b>STEP 2C:</b> Check the EGR differential pressure sensor supply and return circuit at the harness.	4.75 to 5.25 VDC?	
<b>STEP 2D:</b> Check the EGR differential pressure sensor supply and return circuit at the ECM.	4.75 to 5.25 VDC?	
<b>STEP 3: Check the ECM.</b>		
<b>STEP 3A:</b> Inspect the engine harness and ECM connector pins.	Dirty or damaged pins?	
<b>STEP 3B:</b> Check the ECM response.	Fault Code 2273 inactive and Fault Code 2274 active?	
<b>STEP 4: Clear the fault codes.</b>		
<b>STEP 4A:</b> Disable the fault code.	Fault Code 2273 inactive?	
<b>STEP 4B:</b> Clear the inactive fault codes.	All fault codes cleared?	

## TROUBLESHOOTING STEP

### STEP 1: Check the fault codes.

#### STEP 1A: Check for multiple fault codes.

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect the INSITE™ electronic service tool.</li> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
Check for multiple fault codes. <ul style="list-style-type: none"> <li>• Start the engine and let it idle for one minute.</li> <li>• Use INSITE™ electronic service tool, read the fault codes.</li> </ul>	Fault Code 227 active? <b>YES</b>  <b>Repair:</b> Troubleshoot Fault Code 227.	Fault Code 227
	Fault Code 227 active? <b>NO</b>	1B

#### STEP 1B: Read the fault codes.

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect the INSITE™ electronic service tool.</li> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
Read the fault codes. <ul style="list-style-type: none"> <li>• Start the engine and let it idle for one minute.</li> <li>• Use INSITE™ electronic service tool, read the fault codes.</li> </ul>	Fault Code 2273 active? <b>YES</b>	2A
	Fault Code 2273 active? <b>NO</b>	Use the following procedure for an inactive or intermittent fault code. Refer to Procedure 019-362 in Section 19.



**STEP 2: Check the EGR differential pressure sensor and circuit.****STEP 2A: Inspect the engine harness and sensor connector pins.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the EGR differential pressure sensor from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
Inspect the engine harness and EGR differential pressure sensor connector pins for the following: <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.	Dirty or damaged pins? <b>YES</b>  <b>Repair:</b> Clean the connector and pins.  Repair the damaged harness, connectors, or pins if possible.	4A
	Dirty or damaged pins? <b>NO</b>	2B

**STEP 2B: Check the circuit response.**

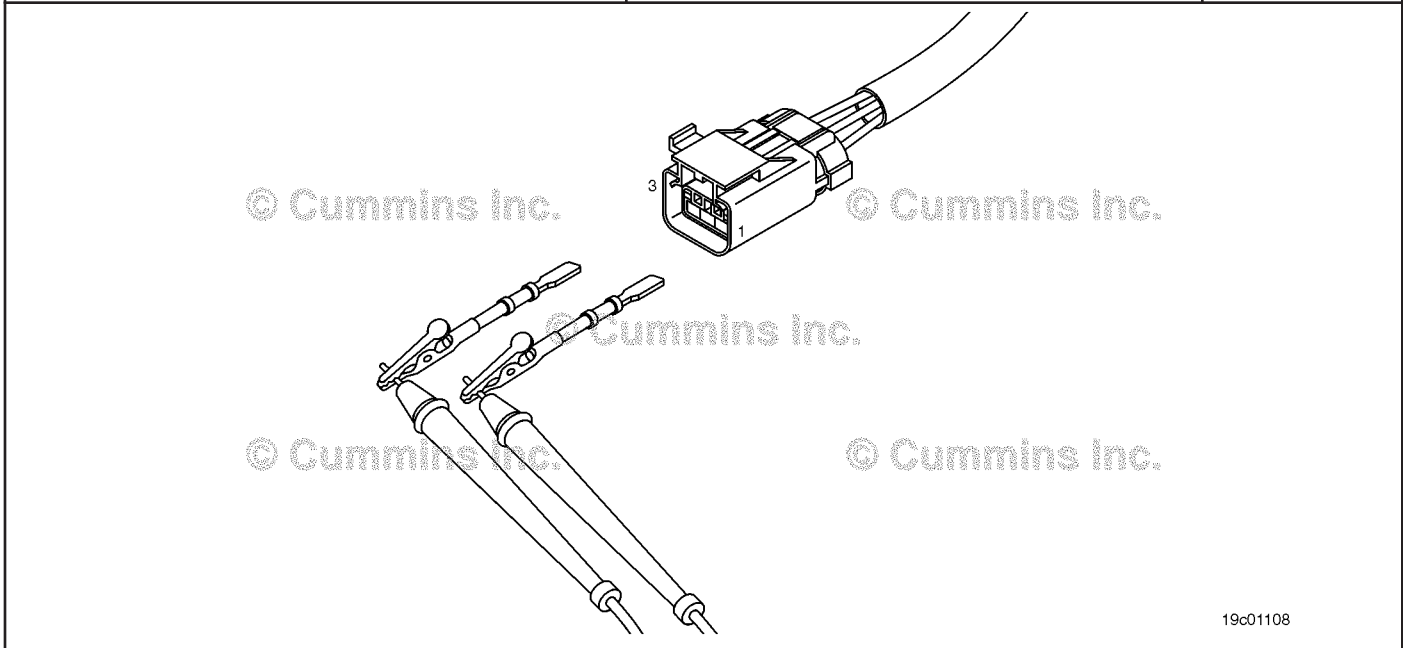
<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the EGR differential pressure sensor from the engine harness.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for the appropriate ECM response after 30 seconds. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 2273 inactive and Fault Code 2274 active? <b>YES</b>	2C
	Fault Code 2273 inactive and Fault Code 2274 active? <b>NO</b>	3A

**STEP 2C: Check the EGR differential pressure sensor supply and return circuit at the harness.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the EGR differential pressure sensor from the engine harness.
- Turn keyswitch ON.

Action	Specification/Repair	Next Step
Check the EGR differential pressure sensor supply and return circuit at the harness. <ul style="list-style-type: none"> <li>• Measure the voltage between the EGR differential pressure +5 VDC SUPPLY pin and the EGR differential pressure RETURN pin at the sensor connector of the engine harness.</li> </ul>	4.75 to 5.25 VDC? <b>YES</b> <b>Repair:</b> Replace the EGR differential pressure sensor. Refer to Procedure 019-370 in Section 19.	4A
	4.75 to 5.25 VDC? <b>NO</b>	2D



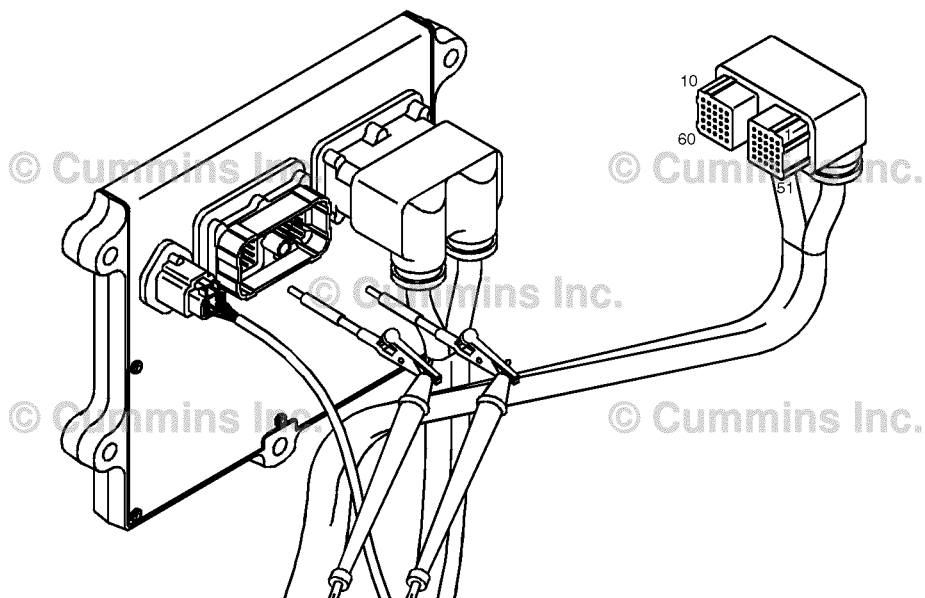
19c01108

**STEP 2D: Check the EGR differential pressure sensor supply and return circuit at the ECM.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine harness from the ECM.
- Turn keyswitch ON.

Action	Specification/Repair	Next Step
Check the EGR differential pressure sensor supply and return circuit at the ECM. • Measure the voltage between the EGR differential pressure +5 VDC SUPPLY pin and the EGR differential pressure RETURN pin at the ECM port.	4.75 to 5.25 VDC? <b>YES</b> <b>Repair:</b> Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.	4A
	4.75 to 5.25 VDC? <b>NO</b> <b>Repair:</b> Replace the ECM. Refer to Procedure 019-031 in Section 19.	4A



19c01079

**STEP 3: Check the ECM.**

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

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the engine harness and ECM connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Clean the connectors and pins.</p> <p>Repair the damaged harness, connectors, or pins if possible.</p>	4A
	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	3B

**STEP 3B: Check the ECM response.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate ECM response.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault Code 2273 inactive and Fault Code 2274 active?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.</p>	4A
	<p>Fault Code 2273 inactive and Fault Code 2274 active?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Replace the ECM. Refer to Procedure 019-031 in Section 19.</p>	4A

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

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> <li>• Start the engine and let it idle for one minute.</li> <li>• Verify that Fault Code 2273 is inactive.</li> </ul>	Fault Code 2273 inactive? <b>YES</b>	4B
	Fault Code 2273 inactive? <b>NO</b>	1A

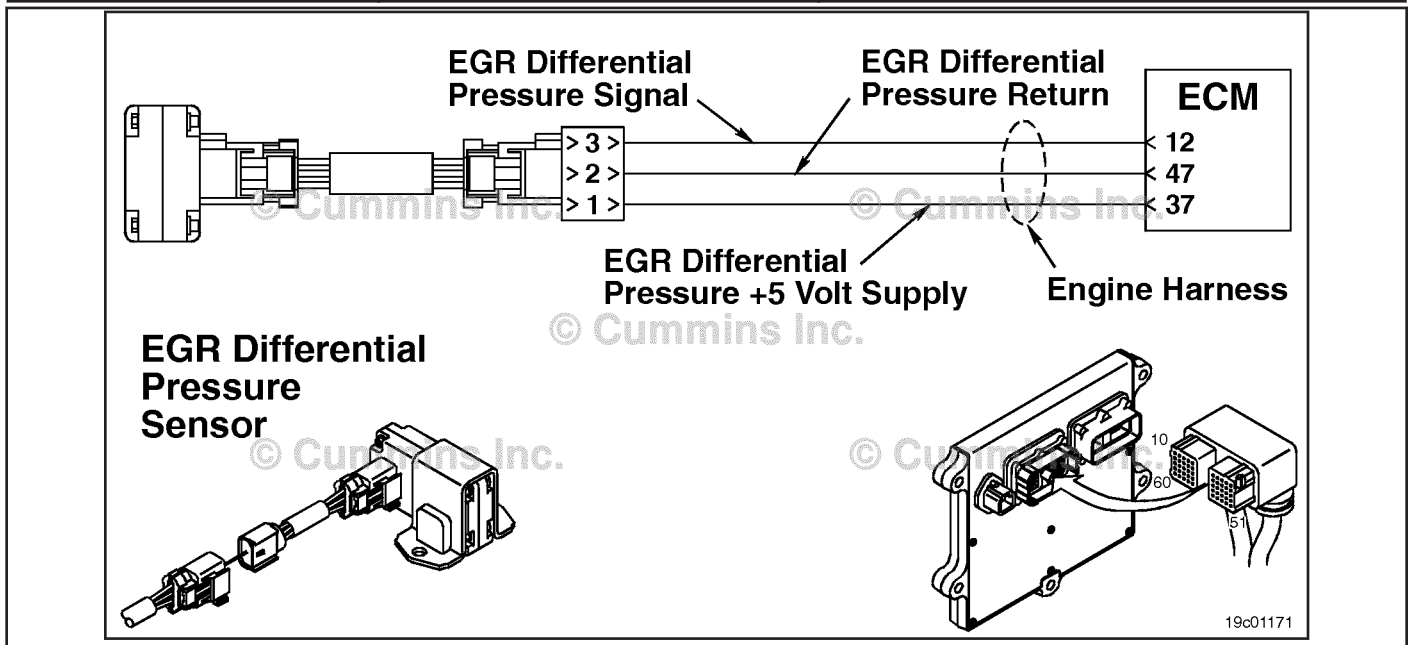
**STEP 4B: Clear the inactive fault codes.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool, erase the inactive fault codes .</li> </ul>	All fault codes cleared? <b>YES</b>	Repair complete
	All fault codes cleared? <b>NO</b>	Appropriate troubleshooting steps

## Fault Code 2274

### EGR Valve Differential Pressure Sensor Circuit - Shorted Low

CODES	REASON	EFFECT
Fault Code: 2274 PID(P), SID(S): P411 SPN: 411 FMI: 4/4 Lamp: Amber SRT:	EGR valve differential pressure sensor circuit - shorted low. Low signal voltage detected on the EGR valve differential pressure sensor circuit.	EGR valve will be closed.



#### Circuit Description:

The exhaust gas recirculation. (EGR) valve differential pressure sensor has two ports that sense a pressure drop across the EGR gas entrance to the intake connection. The electronic control module (ECM) uses this pressure drop to calculate the amount of EGR gas entering the intake. This calculation helps to determine the commanded position of the EGR valve (and VG turbocharger) that will control the amount of EGR gas flow into the engine.

#### Component Location:

The EGR valve differential pressure sensor is mounted on the side of the intake connection. Refer to Procedure 100-002 for a detailed component location view.

NOTE: The sensor is connected to the engine harness through a short pigtail harness. The pigtail harness is permanently affixed to the sensor. Do **not** try to remove the connector that is attached to the sensor body or damage to the sensor will occur.

#### Shop Talk:

The EGR valve differential pressure sensor shares supply and return wires in the engine harness with other sensors. Open circuits and short circuits in the engine harness can cause multiple fault codes to be active. Before troubleshooting Fault Code 2274, check for multiple faults.

- Open signal circuit in the engine harness, connections, or sensor
- Supply circuit open or shorted to ground
- Sensor shorted to ground.

**Refer to Troubleshooting Fault Code t05-2274**

## FAULT CODE 2274 - EGR Valve Differential Pressure Sensor Circuit - Shorted Low

### TROUBLESHOOTING SUMMARY



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



To reduce the possibility of pin and harness damage, use the following test lead when taking a measurement: Part Number 3164596 - male Framatome™ test lead.

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1: Check the fault codes.</b>		
<u>STEP 1A:</u> Check for multiple fault codes.	Fault Code 187 active?	
<u>STEP 1B:</u> Read the fault codes.	Fault Code 2274 active?	
<b>STEP 2: Check the EGR valve differential pressure sensor and circuit.</b>		
<u>STEP 2A:</u> Inspect the engine harness and sensor connector pins.	Dirty or damaged pins?	
<u>STEP 2B:</u> Check the sensor supply voltage.	4.75 to 5.25 VDC?	
<u>STEP 2C:</u> Check the circuit response.	Fault Code 2274 inactive and Fault Code 2273 active?	
<b>STEP 3: Check the ECM.</b>		
<u>STEP 3A:</u> Inspect the engine harness and ECM connector pins.	Dirty or damaged pins?	
<u>STEP 3B:</u> Check the ECM response.	Fault Code 2274 inactive and Fault Code 2273 active?	
<b>STEP 4: Clear the fault codes.</b>		
<u>STEP 4A:</u> Disable the fault code.	Fault Code 2274 inactive?	
<u>STEP 4B:</u> Clear the inactive fault codes.	All fault codes cleared?	

### TROUBLESHOOTING STEP

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

<b>Condition:</b> <ul style="list-style-type: none"> <li>Connect the INSITE™ electronic service tool.</li> <li>Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
Check for multiple fault codes. <ul style="list-style-type: none"> <li>Start the engine and let it idle for one minute.</li> <li>Use INSITE™ electronic service tool, read the fault codes.</li> </ul>	Fault Code 187 active? <b>YES</b> <b>Repair:</b> Troubleshoot Fault Code 187.	Fault Code 187
	Fault Code 187 active? <b>NO</b>	



**STEP 1B: Read the fault codes.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Read the fault codes.</p> <ul style="list-style-type: none"> <li>• Start the engine and let it idle for one minute.</li> <li>• Use INSITE™ electronic service tool, read the fault codes.</li> </ul>	<p>Fault Code 2274 active? <b>YES</b></p>	2A
	<p>Fault Code 2274 active? <b>NO</b></p>	<p>Use the following procedure for an inactive or intermittent fault code. Refer to Procedure 019-362 in Section 19.</p>

**STEP 2: Check the EGR valve differential pressure sensor and circuit.**

**STEP 2A: Inspect the EGR valve differential pressure sensor and connector pins.**

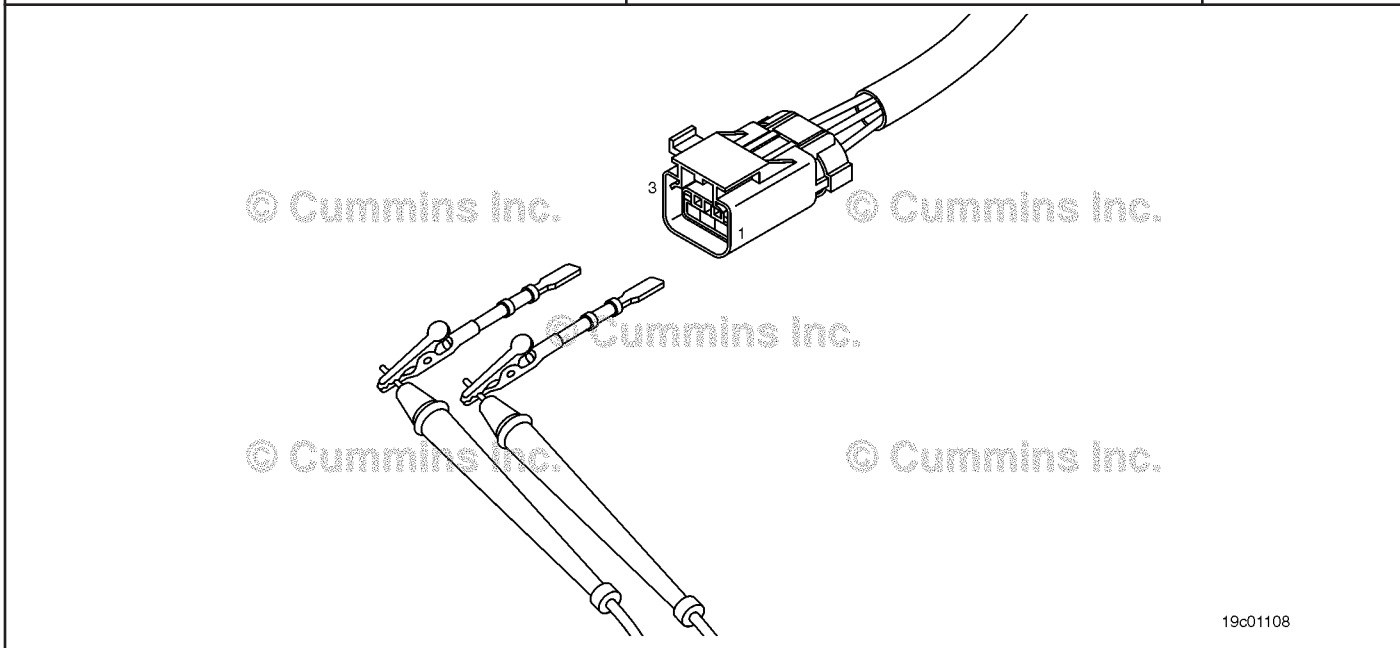
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the EGR valve differential pressure sensor from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the EGR differential pressure sensor and connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins? <b>YES</b></p> <p><b>Repair:</b> Clean the connectors and pins. Repair the damaged harness, connectors, or pins if possible.</p>	4A
	<p>Dirty or damaged pins? <b>NO</b></p>	2B

**STEP 2B: Check the sensor supply voltage.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the EGR valve differential pressure sensor from the engine harness.
- Turn keyswitch ON.

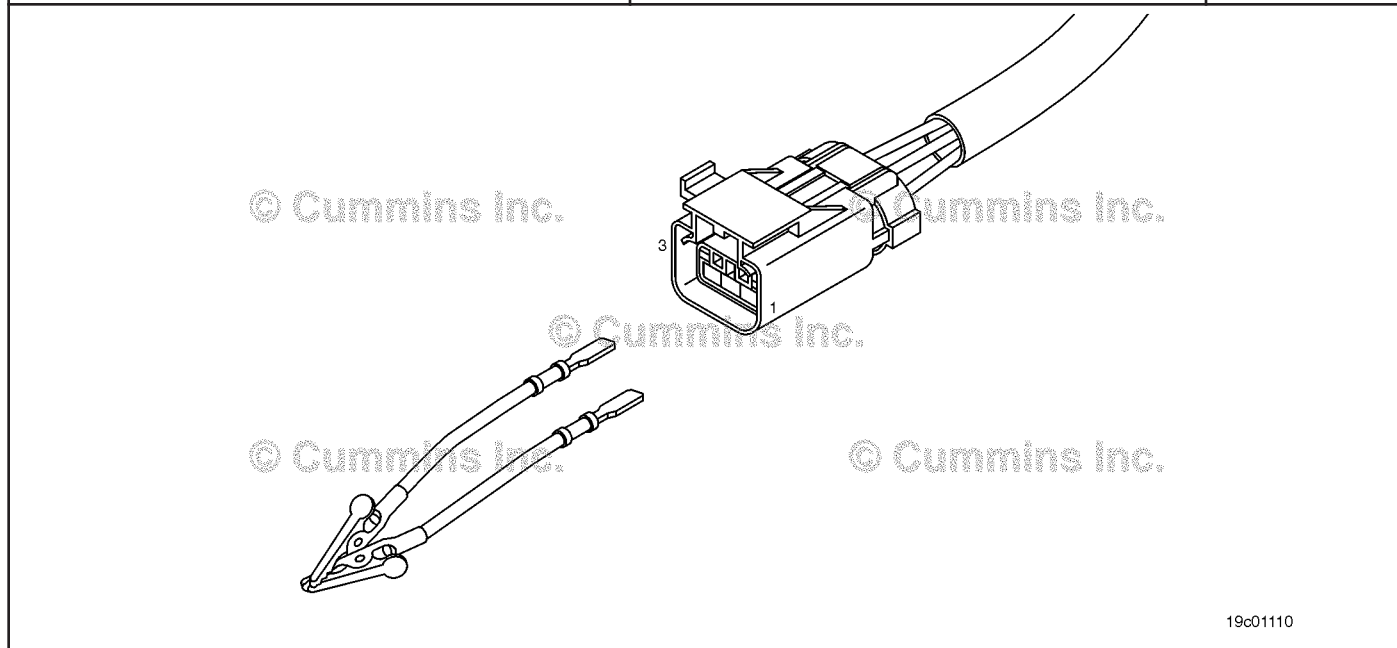
Action	Specification/Repair	Next Step
Check the sensor supply voltage. <ul style="list-style-type: none"> <li>• Measure the voltage between the EGR differential pressure +5 VDC SUPPLY pin and the EGR differential pressure RETURN pin at the sensor connector of the engine harness.</li> </ul>	4.75 to 5.25 VDC? <b>YES</b>	2C
	4.75 to 5.25 VDC? <b>NO</b>	3A



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**STEP 2C: Check the circuit response.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Disconnect the EGR valve differential pressure sensor from the engine harness.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check the circuit response.</p> <ul style="list-style-type: none"> <li>• Install a jumper wire between the EGR differential pressure +5 VDC SUPPLY pin and the EGR differential pressure SIGNAL pin at the sensor connector of the engine harness.</li> <li>• Check for the appropriate ECM response after 30 seconds.</li> <li>• Use INSITE™ electronic service tool, read the fault codes.</li> </ul>	<p>Fault Code 2274 inactive and Fault Code 2273 active?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Replace the EGR valve differential pressure sensor. Refer to Procedure 019-370 in Section 19.</p>	4A
	<p>Fault Code 2274 inactive and Fault Code 2273 active?</p> <p><b>NO</b></p>	3A



19c01110

**STEP 3: Check the ECM.**

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

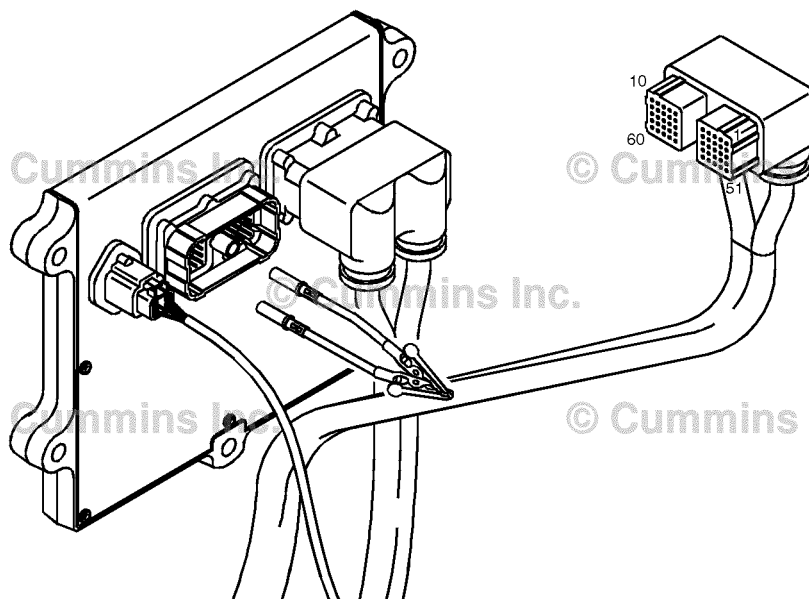
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the engine harness and ECM connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Clean the connectors and pins.</p> <p>Repair the damaged harness, connectors, or pins if possible.</p>	<p>4A</p>
	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	<p>3B</p>

**STEP 3B: Check the ECM response.**

**Condition:**

- Disconnect the engine harness from the ECM.
- Turn keyswitch ON.

Action	Specification/Repair	Next Step
Check for the appropriate ECM response. <ul style="list-style-type: none"> <li>• Install a jumper wire between the EGR differential pressure +5 VDC SUPPLY pin and the EGR differential pressure SIGNAL pin at the ECM port.</li> <li>• Check for the appropriate ECM response after 30 seconds.</li> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 2274 inactive and Fault Code 2273 active? <b>YES</b> <b>Repair:</b> Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.	4A
	Fault Code 2274 inactive and Fault Code 2273 active? <b>NO</b> <b>Repair:</b> Replace the ECM. Refer to Procedure 019-031 in Section 19.	Repair complete



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**STEP 4: Clear the fault codes.**

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

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> <li>• Start the engine and let it idle for one minute.</li> <li>• Verify that Fault Code 2274 is inactive.</li> </ul>	Fault Code 2274 inactive? <b>YES</b>	4B
	Fault Code 2274 inactive? <b>NO</b>	1A

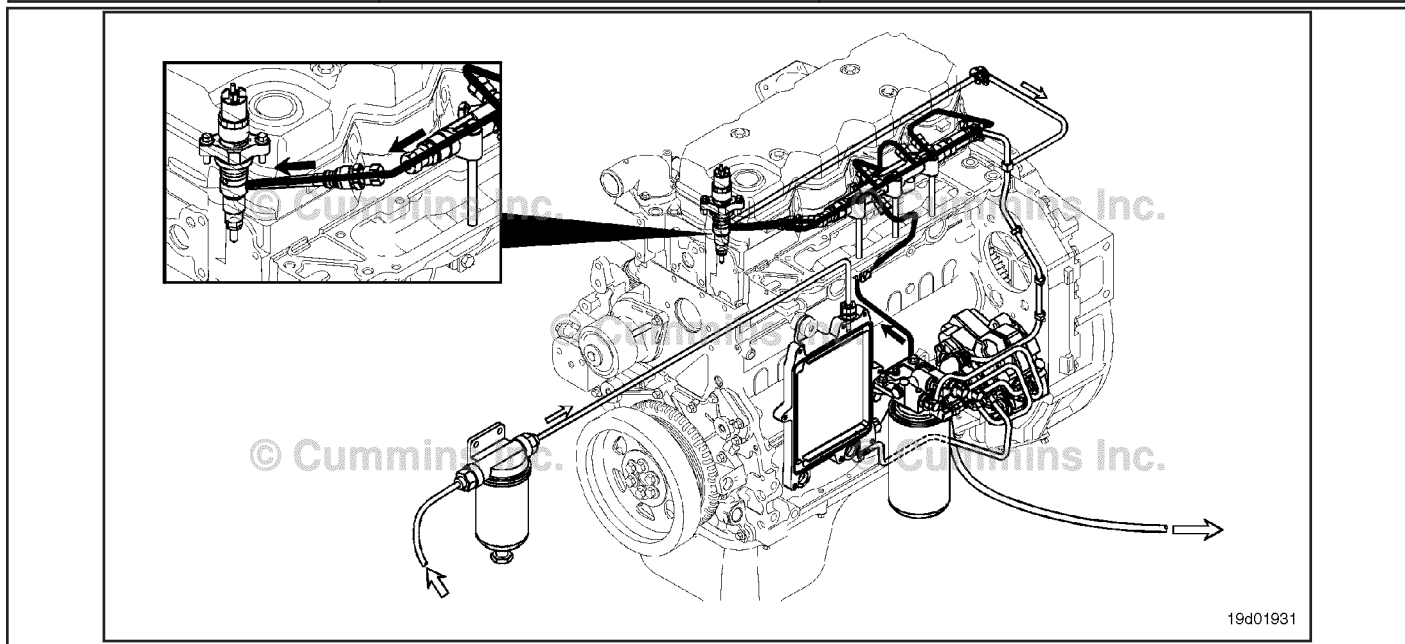
**STEP 4B: Clear the inactive fault codes.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON</li> </ul>		
Action	Specification/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool erase the inactive fault codes.</li> </ul>	All fault codes cleared? <b>YES</b>	Repair complete
	All fault codes cleared? <b>NO</b>	Appropriate troubleshooting steps

## Fault Code 2292

### Fuel Inlet Meter Device - Data Valid but Above Normal Operational Range - Moderately Severe Level

CODES	REASON	EFFECT
Fault Code: 2292 PID(P), SID(S): SPN: FMI: 16 Lamp: Amber SRT:	Fuel Inlet Meter Device - Data Valid but Above Normal Operational Range - Moderately Severe Level. The flow demand is higher than expected.	Possibly hard to start; low power; possible engine smoke. Engine power is derated.



Fuel System

#### **Circuit Description:**

The fuel pressure control loop relies on fuel pressure supplied to the high-pressure pump by the electric lift pump and low-pressure pump. The electronic control module (ECM) monitors rail fuel pressure and engine operating conditions and changes the flow command to maintain the proper rail fuel pressure. Changes to the flow command result in opening (or closing) of the electric fuel control actuator to supply more (or less) fuel to the high-pressure pump.

The fuel flow circuit includes, in the following order of fuel flow:

- Fuel tank
- OEM fuel supply line
- OEM 300 micron filter
- ECM cooling plate
- Electric lift pump
- Fuel filter
- Gear pump
- Electronic fuel control actuator
- High-pressure fuel pump
- Fuel rail (includes rail pressure relief valve and pressure sensor)
- High-pressure fuel lines
- High-pressure fuel connectors (HPCs)
- Injectors
- Return to tank.

**Component Location:**

The electronic fuel control actuator is located on the fuel pump. 100-002 (Engine Diagrams) in Section E for a detailed component location view.

**Shop Talk:**

Causes of this fault code include the following: High inlet restriction, plugged fuel filter, low lift pump pressure, low resistance to the electronic fuel control actuator, stuck or restricted electronic fuel control actuator, system return (excessive return flow from the injectors, high-pressure pump, or rail pressure relief valve), or tampering.

Fault Code 2292 sets when the ECM commands the electronic fuel control actuator to open more than expected to maintain rail pressure. Fault Code 2215 sets when the ECM opens the electronic fuel control actuator to fully open and rail pressure is still lower than commanded.

Once the repair has been made, this fault code will require approximately 15-20 minutes of road test or dynamometer run to be set inactive.

**Refer to Troubleshooting Fault Code t05-2292**



## FAULT CODE 2292 - Fuel Inlet Meter Device - Data Valid but Above Normal Operational Range - Moderately Severe Level TROUBLESHOOTING SUMMARY

STEPS	SPECIFICATIONS	SRT CODE
<b><u>STEP 1:</u></b> Check the fault codes.		
<b><u>STEP 1A:</u></b> Read the fault codes.	Fault Code 2215 or 2266 inactive?	
<b><u>STEP 2:</u></b> Check the operation of the low-pressure fuel system.		
<b><u>STEP 2A:</u></b> Check for external fuel leaks.	Fuel leaks present?	
<b><u>STEP 3:</u></b> Check the lift pump.		
<b><u>STEP 3A:</u></b> Measure the lift pump pressure.	Lift pump meets minimum specification?	
<b><u>STEP 3B:</u></b> Measure the lift pump inlet restriction.	Less than 152 mm Hg [6 in Hg]?	
<b><u>STEP 4:</u></b> Check the fuel filter restriction.		
<b><u>STEP 4A:</u></b> Measure the pressure drop across the fuel filter.	Drop in pressure less than 34 kPa [5 psi]?	
<b><u>STEP 5:</u></b> Check the high-pressure fuel system.		
<b><u>STEP 5A:</u></b> Check for leakage from the rail fuel pressure relief valve.	Fuel return within specification?	
<b><u>STEP 5B:</u></b> Check for excessive fuel return leak from the high-pressure fuel system, injectors, and high-pressure connectors.	Fuel leakage within specification?	
<b><u>STEP 5C:</u></b> Check for excessive fuel return from the high-pressure fuel pump.	Fuel return within specification?	
<b><u>STEP 6:</u></b> Clear the fault codes.		
<b><u>STEP 6A:</u></b> Disable the fault code.	Fault codes inactive?	
<b><u>STEP 6B:</u></b> Clear the inactive fault codes.	All fault codes cleared?	

## TROUBLESHOOTING STEP

### STEP 1: Check the fault codes.

#### STEP 1A: Read the fault codes.

<b>Condition:</b> <ul style="list-style-type: none"> <li>Connect the INSITE™ electronic service tool.</li> <li>Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
Read the fault codes. <ul style="list-style-type: none"> <li>Start the engine and let it idle for 1 minute.</li> <li>Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 2215 or 2266 inactive? <b>YES</b>	2A
	Fault Code 2215 or 2266 inactive? <b>NO</b> <b>Repair:</b> Troubleshoot applicable fault codes.	Applicable fault code

### STEP 2: Check the operation of the low-pressure fuel system.

#### STEP 2A: Check for external fuel leaks.

<b>Condition:</b> <ul style="list-style-type: none"> <li>Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
Check for external fuel leaks. <ul style="list-style-type: none"> <li>Start the engine and let it idle.</li> <li>Inspect for external fuel leaks.</li> </ul>	Fuel leaks present? <b>YES</b> <b>Repair:</b> Repair the fuel leaks.	6A
	Fuel leaks present? <b>NO</b>	3A

### STEP 3: Check the lift pump.

#### STEP 3A: Measure the lift pump pressure.

<b>Condition:</b> <ul style="list-style-type: none"> <li>Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
Measure the lift pump performance. <ul style="list-style-type: none"> <li>Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271, for measuring the lift pump flow. Refer to Procedure 005-045 in Section 5.</li> </ul>	Lift pump meets minimum specification? <b>YES</b>	4A
	Lift pump meets minimum specification? <b>NO</b>	3B

**STEP 3B: Measure the lift pump inlet restriction.**

<b>Condition:</b> • Turn keyswitch ON.		
<b>Action</b>	<b>Specification/Repair</b>	<b>Next Step</b>
Measure the lift pump inlet restriction. • Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 006-020 in Section 6.	Less than 152 mm Hg [6 in Hg]? <b>YES</b> <b>Repair:</b> Replace the electric lift pump.  Measure the fuel lift pump flow. Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 005-045 in Section 5.	6A
	Less than 152 mm Hg [6 in Hg]? <b>NO</b> <b>Repair:</b> Replace the OEM fuel filter or repair the cause of the inlet restriction.	6A

**STEP 4: Check the fuel filter restriction.****STEP 4A: Measure the pressure drop across the fuel filter.**

<b>Condition:</b> • Turn keyswitch ON. • Run the engine at rated condition.		
<b>Action</b>	<b>Specification/Repair</b>	<b>Next Step</b>
Measure the pressure drop across the fuel filter. • Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 006-015 in Section 6.	Drop in pressure less than 34 kPa [5 psi]? <b>YES</b>	5A
	Drop in pressure less than 34 kPa [5 psi]? <b>NO</b> <b>Repair:</b> Replace the pressure-side filter and verify the pressure-side fuel lines are <b>not</b> restricted.	6A

**STEP 5: Check high-pressure fuel system**

**STEP 5A: Check for leakage from the rail fuel pressure relief valve.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Install test fittings to measure the fuel return from the rail fuel pressure relief valve.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for leakage from the rail fuel pressure relief valve.</p> <ul style="list-style-type: none"> <li>• Install test fittings to measure the fuel return.</li> <li>• Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 006-061 in Section 6.</li> </ul>	<p>Fuel return within specification?  <b>YES</b></p>	5B
	<p>Fuel return within specification?  <b>NO</b>  <b>Repair:</b>                      Replace the rail fuel pressure relief valve. Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 006-061 in Section 6.</p>	6A

**STEP 5B: Check for excessive fuel return leak from the high-pressure fuel system, injectors, and high-pressure connectors.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Install test fittings to measure the fuel return from the injectors and high-pressure connectors.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for excessive fuel leakage from the injectors and high-pressure connectors.</p> <ul style="list-style-type: none"> <li>• Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 006-026 in Section 6.</li> </ul>	<p>Fuel leakage within specification?  <b>YES</b></p>	5C
	<p>Fuel leakage within specification?  <b>NO</b>  <b>Repair:</b>                      Isolate the source of the leak and repair it. Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 006-026 in Section 6.</p>	6A

**STEP 5C: Check for excessive fuel return from the high-pressure fuel pump.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Install test fittings to measure the fuel return from the high-pressure fuel pump.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for excessive fuel return from the high-pressure fuel pump.</p> <ul style="list-style-type: none"> <li>• Install test fittings to measure the fuel return from the fuel pump.</li> <li>• Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 005-016 in Section 5.</li> </ul>	<p>Fuel return within specification?</p> <p><b>YES</b></p>	6A
	<p>Fuel return within specification?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Replace the high-pressure fuel pump. Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 005-016 in Section 5.</p>	6A

**STEP 6: Clear the fault codes.**

**STEP 6A: Disable the fault code.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Disable the fault code.</p> <ul style="list-style-type: none"> <li>• Start the engine and let it idle for 1 minute.</li> <li>• Perform a 15 to 20 minute road test or run the engine on the dynamometer.</li> <li>• Verify the fault codes are inactive.</li> </ul>	<p>Fault codes inactive?</p> <p><b>YES</b></p>	6B
	<p>Fault codes inactive?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Return to the troubleshooting steps or contact a Cummins® Authorized Repair Location if all steps have been completed and checked again.</p>	1A

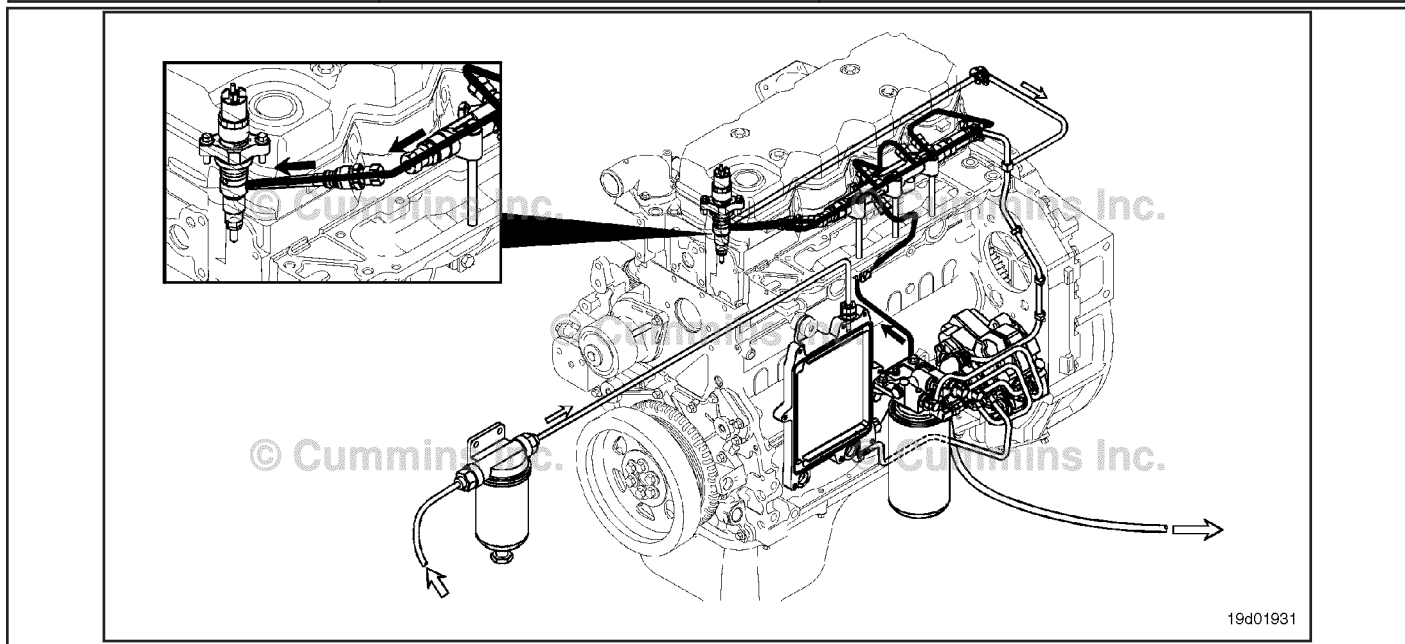
**STEP 6B: Clear the inactive fault codes.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Clear the inactive fault codes.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to clear the inactive fault codes.</li> </ul>	<p>All fault codes cleared?  <b>YES</b></p>	<p>Repair complete</p>
	<p>All fault codes cleared?  <b>NO</b>  <b>Repair:</b>                  Troubleshoot any remaining active fault codes.</p>	<p>Appropriate troubleshooting steps</p>

## Fault Code 2293

### Fuel Inlet Meter Device Flow Demand Lower Than Expected - Data Valid but Below Normal Operational Range - Moderately Severe Level

CODES	REASON	EFFECT
Fault Code: 2293 PID(P), SID(S): SPN: FMI: 18 Lamp: Amber SRT:	Fuel inlet meter device flow demand lower than expected - data valid but below normal operational range - moderately severe level. The flow demand is lower than expected.	None or possible engine noise associated with higher injection pressures (especially at idle or light load). Engine power is derated.



Fuel System

#### **Circuit Description:**

The electronic control module (ECM) monitors engine-operating conditions, including the reading of rail fuel pressure, and changes the flow command to either increase (OPEN the electronic fuel control actuator) or decrease (CLOSE the electronic fuel control actuator) the fuel supply to the high-pressure pump.

#### **Component Location:**

The electronic fuel control actuator is installed on the high-pressure fuel pump. Refer to Procedure 100-002 for a detailed component location view.

#### **Shop Talk:**

Fault Code 2293 is activated when the electronic fuel control actuator is closed more than expected to lower rail fuel pressure.

An electric fuel control actuator with excessive leakage can possibly result in high rail fuel pressures at idle or light load. A restriction in the fuel-drain-to-tank return line can prevent unneeded fuel from exiting the high-pressure fuel pump. This excess drain fuel can enter the pumping chamber and pressurize the rail. Check the fuel drain line restriction. High resistance or an open circuit in the electric fuel control actuator can cause this fault to log. Air in the fuel can result in pressure changes that would cause this fault to log. High lift pump delivery pressure could cause this fault to log, as could tampering with the rail fuel pressure sensor.

Once the repair has been made, this fault code will require approximately 15 to 20 minutes of road test or dynamometer run to be set inactive.

**Refer to Troubleshooting Fault Code t05-2293**



## FAULT CODE 2293 - Fuel Inlet Meter Device Flow Demand Lower Than Expected - Data Valid but Below Normal Operational Range - Moderately Severe Level

### TROUBLESHOOTING SUMMARY

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1: Check the fault codes.</b>		
<b>STEP 1A:</b> Read the fault codes.	Fault Code 271, 272, and/or 2311 inactive?	
<b>STEP 2: Check the rail fuel pressure sensor.</b>		
<b>STEP 2A:</b> Verify that the rail fuel pressure sensor reads in-range.	Pressure = 0 ±40 bar [0 ±580 psi]?	
<b>STEP 3: Check the operation of the low-pressure fuel system.</b>		
<b>STEP 3A:</b> Check for air in fuel.	Air present?	
<b>STEP 3B:</b> Check for excessive lift pump fuel pressure.	Less than 137 kPa [20 psi]?	
<b>STEP 4: Check for fuel return drain line restriction.</b>		
<b>STEP 4A:</b> Check the fuel return drain line for excessive restriction.	Less than 18 kPa [2.7 psi]?	
<b>STEP 5: Clear the fault codes.</b>		
<b>STEP 5A:</b> Disable the fault code.	Fault codes inactive?	
<b>STEP 5B:</b> Clear the inactive fault codes.	All fault codes cleared?	

### TROUBLESHOOTING STEP

#### STEP 1: Check the fault codes.

##### STEP 1A: Read the fault codes.

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect INSITE™ electronic service tool.</li> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
Read the fault codes. <ul style="list-style-type: none"> <li>• Start the engine and let it idle for one minute.</li> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> <li>• Check for fault codes related to the electronic fuel control actuator shorted low or high.</li> </ul>	Fault Code 271, 272, and/or 2311 inactive? <b>YES</b>	2A
	Fault Code 271, 272, and/or 2311 inactive? <b>NO</b> <b>Repair:</b> Troubleshoot applicable fault codes for electronic fuel control actuator.	Applicable Fault Code 271, 272, and/or 2311

**STEP 2: Check the rail fuel pressure sensor.**

**STEP 2A: Verify the rail fuel pressure sensor reads in range.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect INSITE™ electronic service tool.</li> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
Use INSITE™ electronic service tool to electronic service tool read the rail fuel pressure. -	Pressure = 0 ±40 bar? <b>YES</b>	3A
	Pressure = 0 ±40 bar? <b>NO</b> <b>Repair:</b> Replace the sensor or repair the engine harness. <ul style="list-style-type: none"> <li>• Use the following procedure to replace the sensor. Refer to Procedure 019-115 in Section 19.</li> <li>• Use the following procedure to repair the engine harness. Refer to Procedure 019-360 in Section 19.</li> </ul>	5A

**STEP 3: Check the operation of the low-pressure fuel system.**

**STEP 3A: Check for air in fuel.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect a test hose at the fuel filter head inlet and run a hose into a bucket.</li> <li>• Turn keyswitch ON. (The electric lift pump will run for approximately one minute.)</li> </ul>		
Action	Specification/Repair	Next Step
Check for air in fuel as lift pump runs. <ul style="list-style-type: none"> <li>• Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271, to perform the air-in-fuel test. Refer to Procedure 006-003 in Section 6.</li> </ul>	Air present? <b>YES</b> <b>Repair:</b> Repair the cause of the air in the fuel. Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 006-003 in Section 6.	5A
	Air present? <b>NO</b>	3B

**STEP 3B: Check for excessive lift pump fuel pressure.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
Check for excessive lift pump fuel pressure. <ul style="list-style-type: none"> <li>Install a pressure gauge at the inlet port of the fuel filter head with a MIO Compuchek™ fitting, Part Number 3824842.</li> <li>Start the engine and let it idle.</li> <li>Measure the pressure at the fuel filter head outlet.</li> </ul>	Less than 137 kPa [20 psi]? <b>YES</b>	4A
	Less than 137 kPa [20 psi]? <b>NO</b> <b>Repair:</b> The internal pressure regulator has malfunctioned.  Replace the electric fuel lift pump. Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 005-045 in Section 5.	5A

**STEP 4: Check for fuel return drain line restriction.****STEP 4A: Check the fuel return drain line for excessive restriction.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>Install a pressure gauge in the fuel return line banjo bolt at the high-pressure fuel pump drain manifold.</li> <li>Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
Check the fuel return drain line for excessive restriction. <ul style="list-style-type: none"> <li>Operate the engine at high idle speed.</li> <li>Measure the fuel return drain line restriction.</li> <li>Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 006-012 in Section 6.</li> </ul>	Less than 18 kPa [2.7 psi]? <b>YES</b> <b>Repair:</b> Test the electronic fuel control actuator circuit for high resistance or an open circuit. Replace the electronic fuel control actuator. Refer to Procedure 019-117 in Section 19.	5A
	Less than 18 kPa [2.7 psi]? <b>NO</b> <b>Repair:</b> Repair or replace the fuel return drain line. Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 006-013 in Section 6.	5A

**STEP 5: Clear the fault codes.**

**STEP 5A: Disable the fault code.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Disable the fault code.</p> <ul style="list-style-type: none"> <li>• Start the engine and let it idle for one minute.</li> <li>• Perform a 15 to 20 minute road test or run the engine on the dynamometer.</li> <li>• Verify fault codes are inactive.</li> </ul>	<p>Fault codes inactive?</p> <p><b>YES</b></p>	5B
	<p>Fault codes inactive?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Return to the troubleshooting steps or contact a local Cummins® Authorized Repair Location if all steps have been completed and checked again.</p>	1A

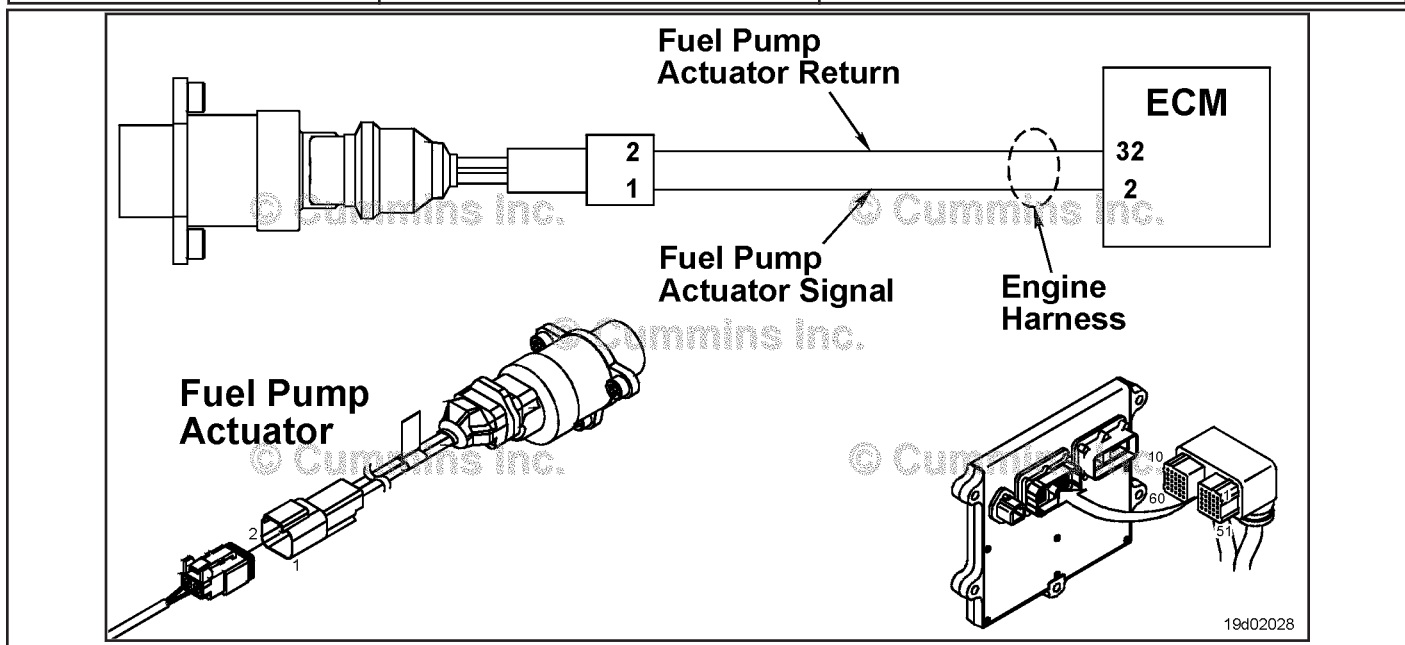
**STEP 5B: Clear the inactive fault codes.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Clear the inactive fault codes.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to erase the inactive fault codes .</li> </ul>	<p>All fault codes cleared?</p> <p><b>YES</b></p>	Repair complete
	<p>All fault codes cleared?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Troubleshoot any remaining active fault codes.</p>	Appropriate troubleshooting steps

## Fault Code 2311

### Fueling Actuator Number 1 Circuit Error Conditions Exists

CODES	REASON	EFFECT
Fault Code: 2311 PID(P), SID(S): S018 SPN: 633 FMI: 11/31 Lamp: Amber SRT:	Fueling Actuator Number 1 Circuit Error Conditions Exists. Fuel pump actuator circuit resistance too high or too low.	Possible low power.



#### Circuit Description:

The circuit is a pulse width modulation driver in the electronic control module (ECM) that controls the electronic fuel control actuator. The actuator is grounded in the ECM. The ECM varies the current to this valve to provide the correct fuel flow to the high-pressure pump based on engine operating conditions. The electronic fuel control actuator valve is a normally open valve. High circuit resistance may cause fuel pressure to be higher than commanded at light loads and Fault Code 2216 may be logged.

#### Component Location:

The fuel pump actuator valve is located on the engine-mounted fuel pump housing. Refer to Procedure 100-002 for a detailed component location view.

#### Shop Talk:

If this fault code occurs during road test or sea trial, verify that all connectors are clean and free of corrosion before replacing components. This fault code can become active for any of the following reasons:

- Fuel pump actuator high resistance
- Engine harness high resistance
- Loose, worn, or corroded connectors or pins
- Fuel pump actuator with low internal resistance
- Fuel pump actuator or engine harness that has shorted to ground

- Intermittent circuit failures that cause the fuel pressure to exceed the fuel rail pressure relief valve opening pressure.

If an intermittent electrical circuit problem of the fuel pump actuator circuit exists, it is possible for the fault code to become active then inactive during normal engine operation. For example, if a poor connection causes an intermittent open or short circuit, the normally open valve will open in a fraction of a second while the circuit is faulty causing the fuel rail pressure relief valve to open. Following the event that caused the fuel rail pressure relief valve to open, the ECM will attempt to reset the fuel rail pressure relief valve, provided the fuel pump actuator circuit is **not** still failed.

Following any event that opens the fuel rail pressure relief valve, the fuel rail pressure relief valve will regulate the fuel pressure at approximately 90 mPa [13053 psi]. If the ECM is still capable of controlling fuel pressure, the following will occur:

- The measured fuel pressure will reduce to 60 mPa [8702.3 psi] as the ECM prepares to re-seat the fuel rail pressure relief valve.
- Once pressure is 60 mPa [8702.3 psi] and engine speed is greater than 1200 rpm, the ECM will momentarily close the fuel pump actuator. This action will reduce the fuel rail pressure (to less than 2 mPa [290 psi] for a fraction of a second) so that the fuel rail pressure relief valve will reset. At light engine loads, especially if the engine is sped while the driveline is **not** engaged, engine power interruption will be noticeable while the ECM attempts to reset the fuel rail pressure relief valve.
- Once the ECM detects that the fuel rail pressure relief valve is reset, normal engine operation will resume and Fault Code 2311 will become inactive.

**Refer to Troubleshooting Fault Code t05-2311**

## FAULT CODE 2311 - Fueling Actuator Number 1 Circuit Error Conditions Exists TROUBLESHOOTING SUMMARY



To reduce the possibility of pin and harness damage, use the following test lead when taking a measurement:  
Part Number 3822758 - male Deutsch™/AMP™/Metri-Pack™ test lead.

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1:</b> Check the fault codes.		
<u>STEP 1A:</u> Read the fault codes.	Fault Codes 271 or 272 active or high inactive counts?	
<b>STEP 2:</b> Check the fuel pump actuator valve.		
<u>STEP 2A:</u> Inspect the fuel pump actuator and harness connector pins.	Dirty or damaged pins?	
<u>STEP 2B:</u> Check the fuel pump actuator resistance.	Less than 5 ohms?	
<u>STEP 2C:</u> Check the fuel pump actuator for a short to ground.	Greater than 100k ohms?	
<b>STEP 3:</b> Check the engine harness.		
<u>STEP 3A:</u> Inspect the engine harness and ECM connector pins.	Dirty or damaged pins?	
<u>STEP 3B:</u> Check the engine harness resistance.	Less than 5 ohms?	
<u>STEP 3C:</u> Check the engine harness for a short to ground.	Greater than 100k ohms?	
<u>STEP 3D:</u> Check for an intermittent engine harness failure.	Fault Codes 2311, 271, and/or 272 become active?	
<b>STEP 4:</b> Clear the fault codes.		
<u>STEP 4A:</u> Disable the fault code.	Fault Code 2311 inactive?	
<u>STEP 4B:</u> Clear the inactive fault codes.	All fault codes cleared?	

## TROUBLESHOOTING STEP

### STEP 1: Check the fault codes.

#### STEP 1A: Read the fault codes.

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Verify that the fuel pump actuator is connected to the engine harness.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Read the fault codes. <ul style="list-style-type: none"> <li>• Start the engine and let it idle for 1 minute.</li> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Codes 271 or 272 active or high inactive counts? <b>YES</b>	Appropriate Troubleshooting Tree
	Fault Codes 271 or 272 active or high inactive counts? <b>NO</b>	2A

### STEP 2: Check the fuel pump actuator.

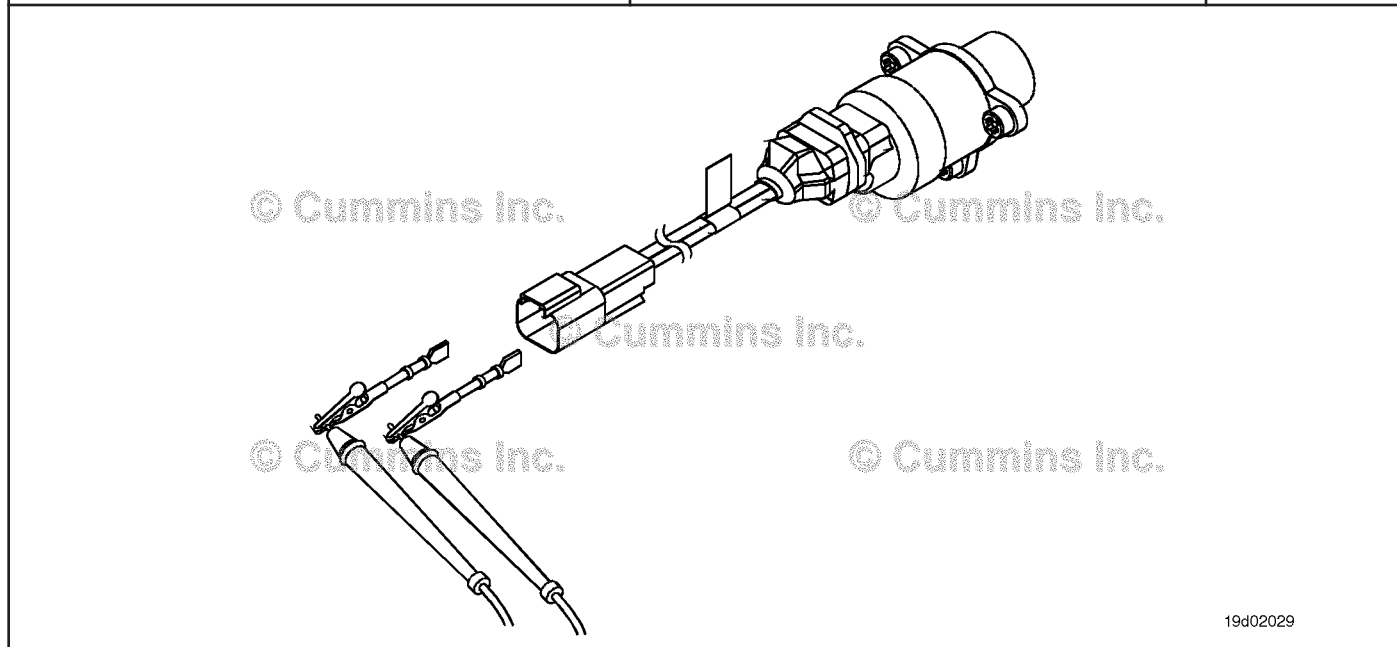
#### STEP 2A: Inspect the fuel pump actuator and harness connector pins.

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the fuel pump actuator from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
Inspect the fuel pump actuator, pigtail wires, and harness connector pins for the following: <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.	Dirty or damaged pins? <b>YES</b> <b>Repair:</b> <ul style="list-style-type: none"> <li>• Repair the connector and pins.</li> <li>• Repair the damaged harness, connectors, or pins if possible.</li> </ul> Refer to Procedure 019-043 in Section 19.	4A
	Dirty or damaged pins? <b>NO</b>	2B



**STEP 2B: Check the fuel pump actuator resistance.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the fuel pump actuator from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check the fuel pump actuator resistance.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the fuel pump actuator SIGNAL pin and the fuel pump actuator RETURN pin at the actuator connector.</li> </ul> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Less than 5 ohms? <b>YES</b></p>	<p>2C</p>
	<p>Less than 5 ohms? <b>NO</b></p> <p><b>Repair:</b></p> <p>Replace the fuel pump actuator. Refer to Procedure 019-117 in Section 19.</p>	<p>4A</p>

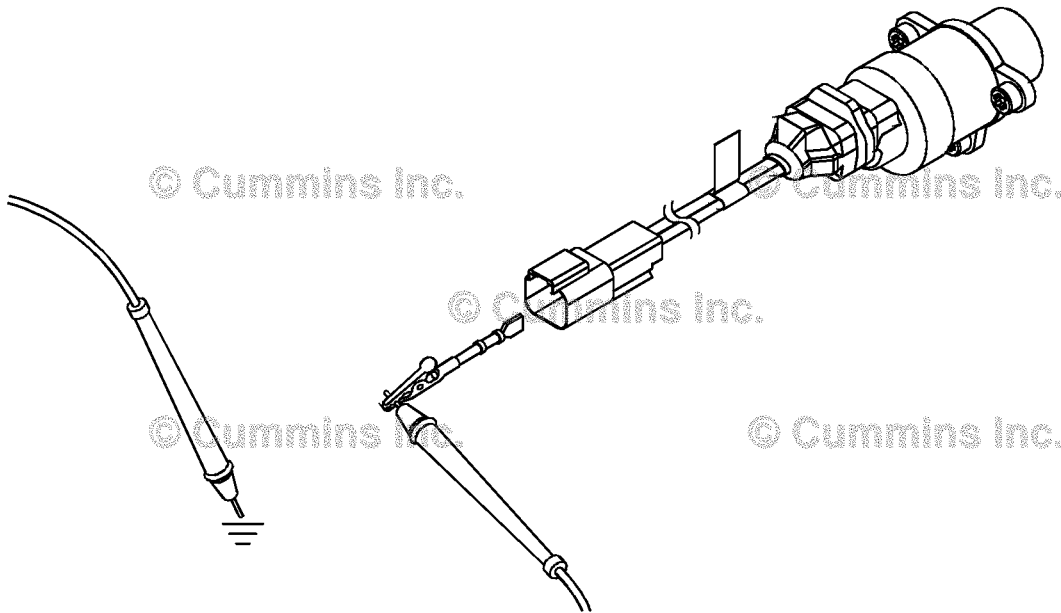


**STEP 2C: Check the fuel pump actuator for a short to ground.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the fuel pump actuator from the engine harness.

Action	Specification/Repair	Next Step
Check the fuel pump actuator resistance. <ul style="list-style-type: none"> <li>• Measure the resistance between the fuel pump actuator SIGNAL pin and the engine block ground.</li> </ul> Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.	Greater than 100k ohms? <b>YES</b>	3A
	Greater than 100k ohms? <b>NO</b> <b>Repair:</b> Replace the faulty electronic fuel control actuator.	4A



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**STEP 3: Check the engine harness.**

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

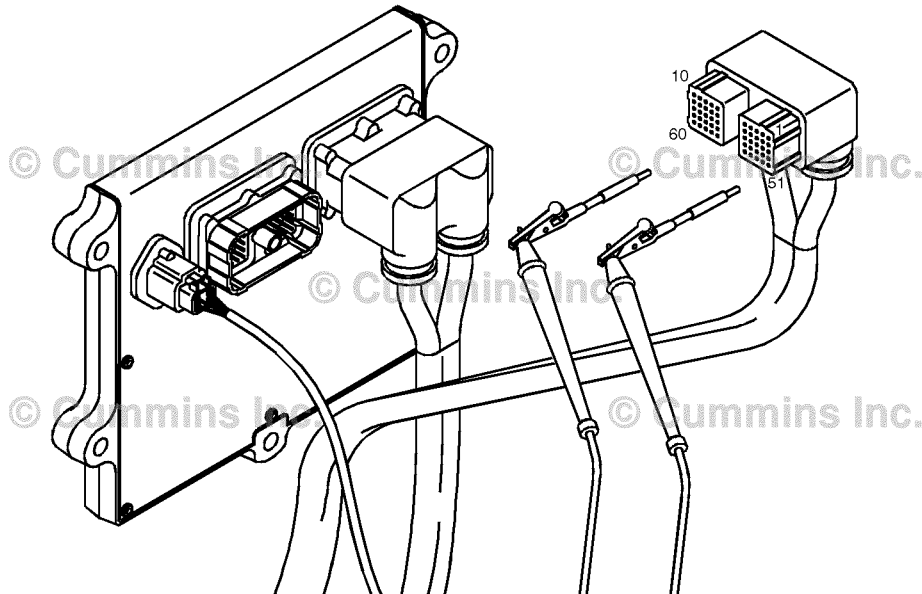
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF</li> <li>• Disconnect the engine harness from the ECM</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the engine harness and ECM connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A damaged connection has been detected in the ECM connector or engine harness connector.</p> <ul style="list-style-type: none"> <li>• Clean the connector pins.</li> <li>• Repair the damaged harness, connectors, or pins if possible.</li> </ul> <p>Refer to Procedure 019-043 in Section 19.</p>	4A
	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	3B

**STEP 3B: Check the engine harness resistance.**

**Condition:**

- Turn keyswitch OFF.
- Reconnect the fuel pump actuator to the engine harness.
- Disconnect the engine harness from the ECM.

Action	Specification/Repair	Next Step
Check the engine harness resistance. <ul style="list-style-type: none"> <li>• Measure the resistance between the fuel pump actuator SIGNAL pin and the fuel pump actuator RETURN pin at the ECM connector of the engine harness.</li> </ul> Refer to the wiring diagram for connector pin identification. Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.	Less than 5 ohms? <b>YES</b>	3C
	Less than 5 ohms? <b>NO</b> <b>Repair:</b> Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.	4A



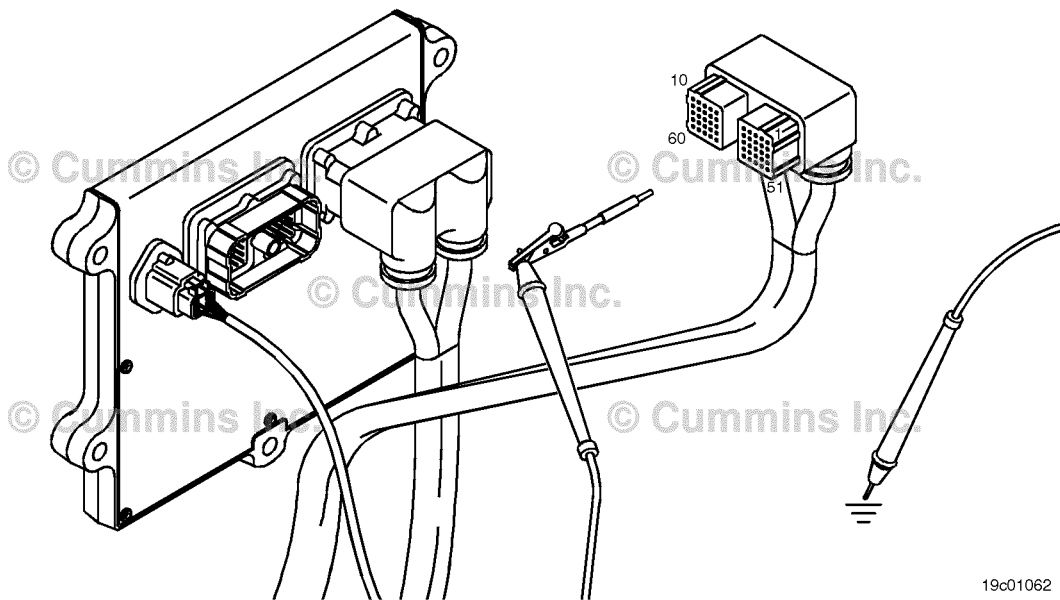
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**STEP 3C: Check the engine harness for a short to ground.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the fuel pump actuator from the engine harness.
- Disconnect the engine harness from the ECM.

Action	Specification/Repair	Next Step
Check the engine harness and fuel pump actuator resistance.	Greater than 100k ohms? <b>YES</b>	3D
<ul style="list-style-type: none"> <li>• Measure the resistance between the fuel pump actuator SIGNAL pin and the ECM connector of the engine harness and engine block ground.</li> </ul>	Greater than 100k ohms? <b>NO</b> <b>Repair:</b> Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.	4A



19c01062

**STEP 3D: Check for an intermittent engine harness failure.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Engine running at low idle.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for an intermittent engine harness connection or failure.</p> <ul style="list-style-type: none"> <li>• Manipulate the engine harness starting at the ECM engine harness connector and working to the fuel pump actuator.</li> </ul> <p>If a short or open circuit is induced while the engine is running, the fuel rail pressure relief valve will open.</p>	<p>Fault Codes 2311, 271, and/or 272 become active?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>An intermittent connection has been detected in the engine harness.</p> <p>Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.</p>	4A
	<p>Fault Codes 2311, 271, and/or 272 become active?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Replace the fuel pump actuator. Refer to Procedure 019-117 in Section 19.</p>	4A

**STEP 4: Clear the fault codes.**

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

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Disable the fault code.</p> <ul style="list-style-type: none"> <li>• Start the engine and let it idle for 1 minute.</li> <li>• Use INSITE™ electronic service tool to verify the fault code is inactive.</li> </ul>	<p>Fault Code 2311 inactive?</p> <p><b>YES</b></p>	4B
	<p>Fault Code 2311 inactive?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Return to the troubleshooting steps or contact a local Cummins® Authorized Repair Location if all steps have been completed and checked again.</p>	1A

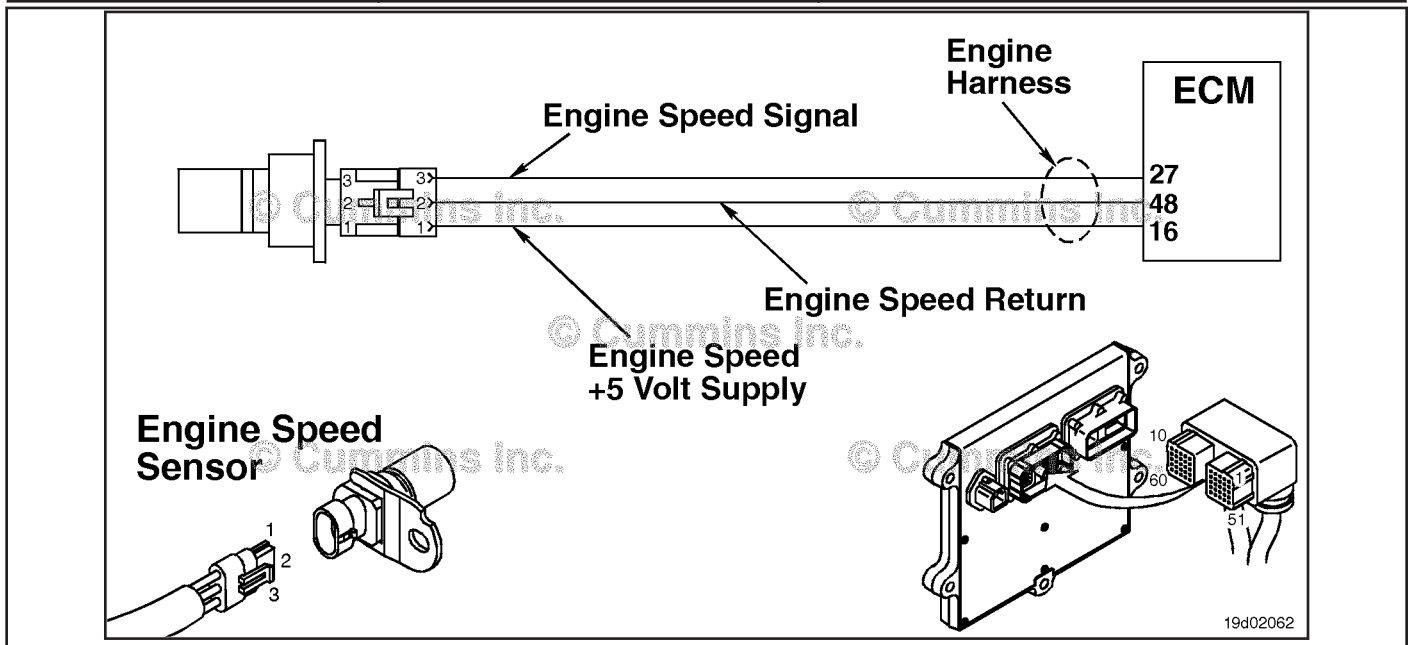
**STEP 4B: Clear the inactive fault codes.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Clear the inactive fault codes.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to erase the inactive fault codes.</li> </ul>	<p>All fault codes cleared?  <b>YES</b></p>	<p>Repair complete</p>
	<p>All fault codes cleared?  <b>NO</b>  <b>Repair:</b>                  Troubleshoot any remaining active fault codes.</p>	<p>Appropriate troubleshooting steps</p>

## Fault Code 2321

### Engine Crankshaft Speed/Position - Data Erratic, Intermittent, or Incorrect

CODES	REASON	EFFECT
Fault Code: 2321 PID(P), SID(S): P190 SPN: 190 FMI: 2 Lamp: None SRT:	Engine Crankshaft Speed/Position - Data Erratic, Intermittent, or Incorrect. Crankshaft engine speed sensor intermittent synchronization.	Automotive and marine applications: Engine can exhibit misfire as control switches from the primary to the backup speed sensor. Engine power is reduced while the engine operates on the backup speed sensor.



Engine Speed/Position Sensor Number 1 Circuit

**Circuit Description:**

The crankshaft engine speed sensor provides engine speed information to the electronic control module (ECM). The sensor is powered by +5 VDC. The sensor generates the signal by sensing the movement of target teeth machined into a tone wheel that is mounted to the crankshaft.

**Component Location:**

The engine speed sensor is located on the intake side of the engine between number 5 and number 6 cylinders at the crankshaft level. For ISB and QSB5.9 the crankshaft engine speed sensor is located on the intake side of the engine behind the vibration damper near the tone wheel. Refer to Procedure 100-002 for a detailed component location view.

**Shop Talk:**

During engine operation, the electronic control module (ECM) monitors the primary speed sensor (crankshaft speed sensor) signal. Fault Code 689 will become active and light the yellow lamp (marine does **not** use lamps) if the signal from the primary speed sensor is **not** present or degraded for more than three continuous seconds. Meanwhile, if the primary engine speed sensor signal is **not** present or is degraded for a moment (less than three seconds), the ECM will interrupt injection events based on the primary engine speed sensor and resume injection events using the backup engine speed sensor. Engine power will be reduced while the injection events are based on the backup speed sensor. If the primary speed sensor signal returns, the ECM will automatically interrupt injection events based on the backup speed sensor and resume injection events based on the primary speed sensor. If over a period of time, the ECM detects several incidents of a loss of the primary speed sensor signal, this fault code will become active.



A vehicle operator can notice an intermittent “misfire” if the injection events are interrupted while the ECM switches from control based on the primary and secondary speed sensors. Also, a vehicle operator can notice intermittent “low power” if a “glitch” in the primary speed sensor signal causes the engine to intermittently use the backup speed sensor for injection control.

This fault code becomes active whenever the ECM detects a persistent loss of the primary engine speed sensor signal over a short period of time.

This fault becomes inactive at each key-on or if the ECM does **not** detect a loss of the primary engine speed sensor signal for at least 20 minutes.

Failures that can cause this fault:

- Intermittent loss of primary speed sensor signal, the most likely cause is an intermittent open or short circuit can be experienced with speed sensor connector problems
- Sensor air gap that is marginally too small or too large.

Actions to take if this fault is intermittent:

- Look for intermittent engine harness connections in the primary engine speed sensor circuit
- Look for loose connections at the ECM connector where the pins can **not** be locked into the socket
- Look for places where the engine harness has worn into a nearby component causing an intermittent short circuit
- Look for pin wear at the speed sensor
- Inspect the target wheel for damage.

**Refer to Troubleshooting Fault Code t05-2321**

## FAULT CODE 2321 - Engine Crankshaft Speed/Position - Data Erratic, Intermittent, or Incorrect

### TROUBLESHOOTING SUMMARY

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1: Check the fault codes.</b>		
<b>STEP 1A:</b> Check for an active fault code.	Fault Code 689 active or has high number of inactive counts?	
<b>STEP 2: Check the primary speed sensor circuit (crankshaft sensor).</b>		
<b>STEP 2A:</b> Inspect the primary speed sensor connector pins (crankshaft sensor).	Dirty or damaged pins?	
<b>STEP 2B:</b> Inspect the engine harness.	Damaged wire insulation?	
<b>STEP 2C:</b> Inspect the primary speed sensor (crankshaft sensor) circuit at the engine harness ECM connector.	Dirty or damaged pins?	
<b>STEP 2D:</b> Inspect the engine harness.	Damaged wire insulation?	
<b>STEP 3: Vehicle test.</b>		
<b>STEP 3A:</b> Road test to determine if fault condition exists.	Does Fault Code 2321 become active during engine operation?	
<b>STEP 3B:</b> Inspect air gap and target wheel.	Is air gap within specification?	
<b>STEP 3C:</b> Manipulate the engine harness to test for an intermittent fault condition in the engine harness.	Does Fault Code 2321 status change from inactive to active while manipulating the engine harness?	
<b>STEP 4: Clear the fault codes.</b>		
<b>STEP 4A:</b> Disable the fault code.	Fault Code 2321 inactive?	
<b>STEP 4B:</b> Clear the inactive fault code.	All fault codes cleared?	

### TROUBLESHOOTING STEP

**STEP 1: Check the fault codes.**  
**STEP 1A: Check for an active fault code.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>Turn keyswitch ON.</li> <li>Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for an active fault code. <ul style="list-style-type: none"> <li>Use INSITE™ electronic service tool to read the fault codes.</li> </ul> If Fault Code 689 has number of inactive counts, there is most likely an intermittent circuit problem (short or open) in the circuit for the primary speed sensor.	Fault Code 689 is active or has high number of inactive counts? <b>YES</b>	Refer to Fault Code 689 troubleshooting tree
	Fault Code 689 is active or has high number of inactive counts? <b>NO</b>	2A

**STEP 2: Check the primary speed sensor circuit (crankshaft sensor).**

**STEP 2A: Inspect the primary speed sensor connector pins (crankshaft sensor).**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the primary speed sensor from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the engine harness and actuator connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A damaged connection has been detected in the sensor or harness connector.</p> <ul style="list-style-type: none"> <li>• Clear the connector and pins.</li> <li>• Repair the damaged harness, connector, or pins, if possible.</li> </ul> <p>Refer to Procedure 019-043 in Section 19.</p>	4A
	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	2B

**STEP 2B: Inspect the engine harness.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the primary speed sensor (crankshaft sensor) from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Closely inspect the engine harness near the primary speed sensor.</p> <ul style="list-style-type: none"> <li>• Look for places where the wire harness insulation is damaged allowing intermittent shorts to the block or nearby components.</li> </ul>	<p>Damaged wire insulation?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.</p>	4A
	<p>Damaged wire insulation?</p> <p><b>NO</b></p>	2C

**STEP 2C: Inspect the primary speed sensor (crankshaft sensor) circuit at the engine harness ECM connector.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the engine harness ECM connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A damaged connection has been detected in the ECM connector or engine harness connector.</p> <ul style="list-style-type: none"> <li>• Clean the connector and pins.</li> <li>• Repair the damaged harness, connector, or pins, if possible.</li> </ul> <p>Refer to Procedure 019-043 in Section 19.</p>	4A
	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	2D

**STEP 2D: Inspect the engine harness.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the primary speed sensor (crankshaft sensor) from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Closely inspect the engine harness near the ECM connector.</p> <ul style="list-style-type: none"> <li>• Look for places where the wire harness insulation is damaged allowing intermittent shorts to the engine block or nearby components.</li> </ul>	<p>Damaged wire insulation?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.</p>	4A
	<p>Damaged wire insulation?</p> <p><b>NO</b></p>	3A

**STEP 3: Vehicle test.****STEP 3A: Road test to determine if fault condition exists.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>Connect the primary speed sensor (crankshaft sensor) to the engine harness.</li> <li>Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
Start the engine. With the engine running, accelerate the engine several times. <ul style="list-style-type: none"> <li>Use INSITE™ electronic service tool to observe fault codes.</li> </ul>	Does Fault Code 2321 become active during engine operation? <b>YES</b>	3B
	Does Fault Code 2321 become active during engine operation? <b>NO</b>	4A

**STEP 3B: Inspect air gap and target wheel.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>Turn keyswitch OFF.</li> </ul>		
Action	Specification/Repair	Next Step
Measure the air gap at several points in the crankshaft's revolution. <ul style="list-style-type: none"> <li>Refer to Procedure 019-365 in Section 19.</li> </ul>	Is air gap within specifications? <ul style="list-style-type: none"> <li>Minimum Air Gap: 0.96 mm [0.038 in]</li> <li>Maximum Air Gap: 2.25 mm [0.089 in]</li> <li>Maximum Target Runout: 0.5 mm [0.02 in]</li> </ul> <b>YES</b>	3C
	Is air gap within specifications? <ul style="list-style-type: none"> <li>Minimum Air Gap: 0.96 mm [0.038 in]</li> <li>Maximum Air Gap: 2.25 mm [0.089 in]</li> <li>Maximum Target Runout: 0.5 mm [0.02 in]</li> </ul> <b>NO</b> <b>Repair:</b> Replace or shim the sensor if air gap is out of specification. If the target runout is excessive, replace the target.	4A

**STEP 3C: Manipulate the engine harness to test for an intermittent fault condition in the engine harness.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Use INSITE™ electronic service tool to monitor Fault Code 2321 status. <ul style="list-style-type: none"> <li>Start the engine and allow it to idle.</li> <li>Starting at the ECM connector, manipulate the engine harness manually. Work backwards from the ECM connector towards the engine speed sensor connector.</li> </ul>	Does Fault Code 2321 status change from inactive to active while manipulating the engine harness? <b>YES</b> <b>Repair:</b> An intermittent connection has been detected in the engine harness. Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.	4A
	Does Fault Code 2321 status change from inactive to active while manipulating the engine harness? <b>NO</b>	4A

**STEP 4: Clear the fault codes.**

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

<b>Condition:</b> <ul style="list-style-type: none"> <li>Connect all components.</li> <li>Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> <li>Start the engine and let it idle for one minute.</li> <li>Use INSITE™ electronic service tool to verify the fault code is inactive.</li> </ul>	Fault Code 2321 inactive? <b>YES</b>	4B
	Fault Code 2321 inactive? <b>NO</b> <b>Repair:</b> Return to the troubleshooting steps or contact a local Cummins® Authorized Repair Location if all steps have been completed and checked again.	1A

**STEP 4B: Clear the inactive fault code.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Clear the inactive fault codes.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to clear the inactive fault codes.</li> </ul>	<p>All fault codes cleared?  <b>YES</b></p>	<p>Repair complete</p>
	<p>All fault codes cleared?  <b>NO</b>  <b>Repair:</b>                  Troubleshoot any remaining active fault codes.</p>	<p>Appropriate troubleshooting trees</p>

## Fault Code 2322

### Backup Engine Speed/Position Sensor Number 2 - Data Erratic, Intermittent, or Incorrect

CODES	REASON	EFFECT
Fault Code: 2322 PID(P), SID(S): S64 SPN: 723 FMI: 2 Lamp: None SRT:	Backup Engine Speed/Position Sensor Number 2 - Data Erratic, Intermittent, or Incorrect. Camshaft engine speed sensor intermittent synchronization.	Automotive and marine applications: Possible low power.

#### Circuit Description:

The camshaft engine position sensor provides engine position information to the electronic control module (ECM). The sensor is powered by (+) 5-VDC. The sensor generates the signal by sensing the movement of target teeth machined into a tone wheel that is mounted to the camshaft.

#### Component Location:

The crankshaft speed sensor is located on the intake side of the engine near the number 6 cylinder at the crankshaft centerline. For ISB and QSB5.9, the crankshaft engine speed sensor is located on the intake side of the engine behind the vibration damper near the tone wheel. The camshaft speed sensor is located below the fuel pump in the back of the gear housing.

#### Shop Talk:

During engine operation, the ECM monitors the secondary speed sensor (camshaft speed sensor) signal. Fault Code 778 will become active and light the yellow lamp (marine does **not** use lamps) if the signal from the secondary speed sensor is **not** present or degraded for more than three continuous seconds. If over a period of time, the ECM detects several incidents of a loss of the secondary speed sensor signal but the signal loss is short in duration, this fault code will become active. Since the secondary engine speed signal is **not** used for normal engine operation, a vehicle operator should **not** notice any symptoms related to this problem.

This fault code becomes active whenever the ECM detects a persistent loss of the secondary engine speed sensor signal over a short period of time.

This fault becomes inactive at each key ON or if the ECM does **not** detect a loss of the secondary engine speed sensor signal for at least 20 minutes.

Causes for this fault code:

- Intermittent loss of primary speed sensor signal. The most likely cause is an intermittent open or short circuit as can be experienced with speed sensor connector problems
- Sensor air gap that is marginally too small or too large, or target wheel exhibits excessive runout.

Actions to take if this fault is intermittent:

- Look for intermittent engine harness connections in the secondary engine speed sensor circuit
- Look for loose connections at the ECM connector where the pins can **not** be locked into the socket
- Look for places where the engine harness has worn into a nearby component causing an intermittent short circuit
- Look for pin wear at the speed sensor
- Inspect the target wheel for damage.

The sensor return configuration for Euro 4 ISB engines has been changed for automotive wiring harnesses manufactured from February 2012 onward. The new style wiring harnesses can be identified using the method below:

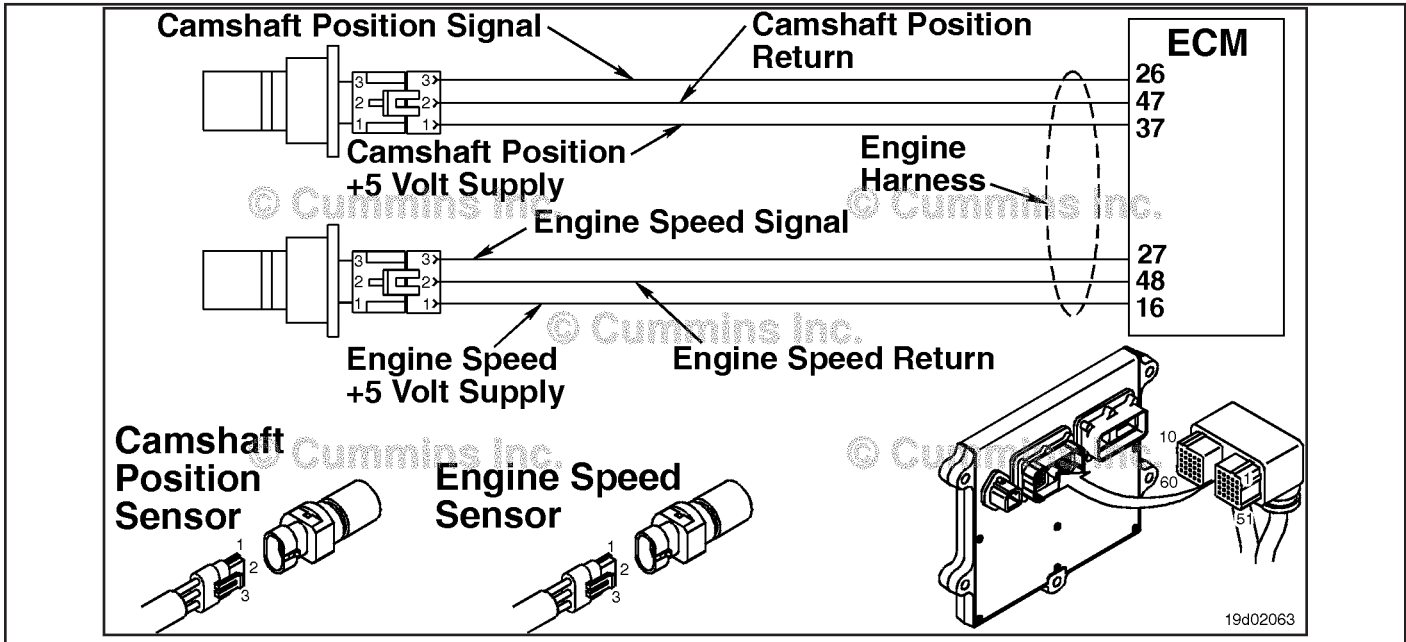
- Disconnect the ECM connector
- Disconnect the camshaft position sensor
- Disconnect the intake manifold pressure/temperature sensor
- Check for continuity between the intake manifold pressure/temperature sensor RETURN pin and the camshaft position sensor RETURN pin



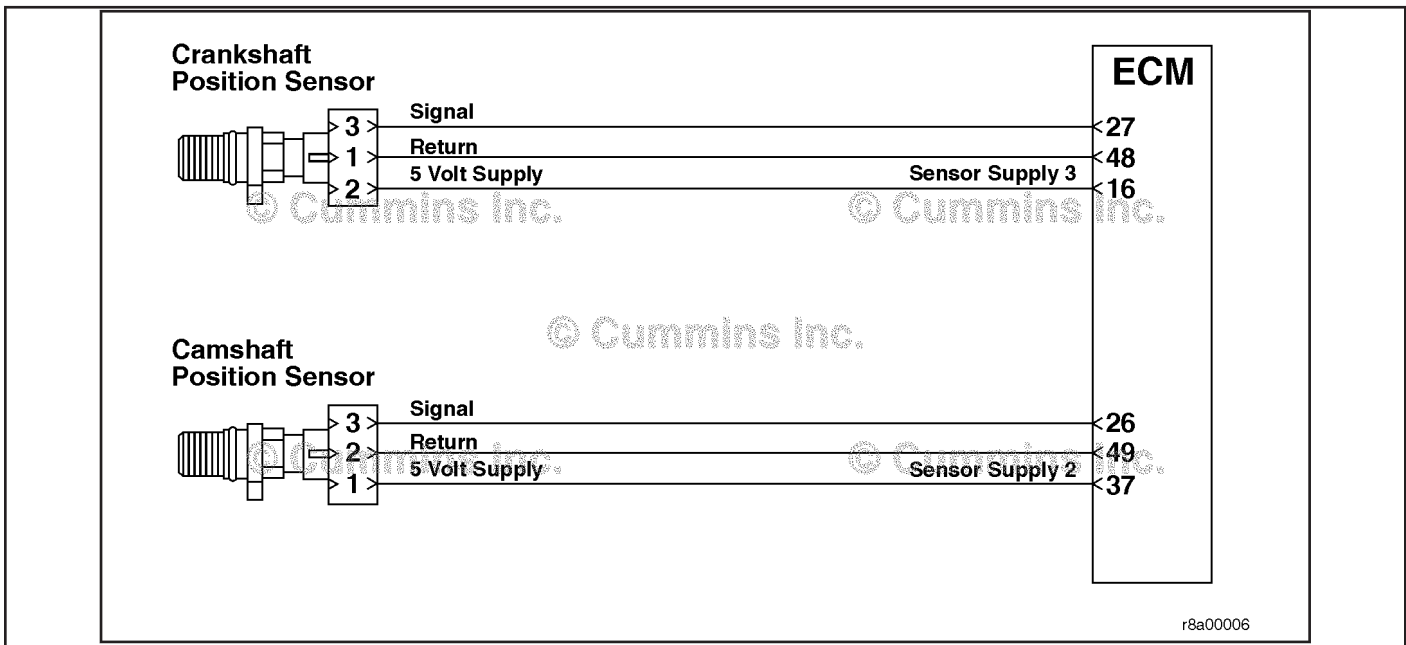
- Check for continuity between ECM pin 47 and the camshaft position sensor RETURN pin
- Use the table below to determine which harness is fitted to the engine.

Engine Harnesses			
From	To	New Harness	Old Harness
Intake manifold pressure/ temperature sensor RETURN pin	Camshaft position sensor RETURN pin	Open circuit	Short circuit
ECM pin 47	Camshaft position sensor RETURN pin	Open circuit	Short circuit

NOTE: QSB engines, all C series engines, and all L series engines are **not** affected by this change.



Original Wiring Harness - Backup Engine Speed/Position Sensor Number 2 Circuit



Revised Wiring Harness - Backup Engine Speed/Position Sensor Number 2 Circuit

Refer to Troubleshooting Fault Code t05-2322.

## FAULT CODE 2322 - Backup Engine Speed/Position Sensor Number 2 - Data Erratic, Intermittent, or Incorrect

### TROUBLESHOOTING SUMMARY

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1: Check the fault codes.</b>		
<b>STEP 1A:</b> Check for an active fault code.	Fault Code 778 is active or has high number of inactive counts?	
<b>STEP 2: Check the secondary speed sensor circuit (camshaft sensor).</b>		
<b>STEP 2A:</b> Inspect the secondary speed sensor (camshaft sensor) connector pins.	Dirty or damaged pins?	
<b>STEP 2B:</b> Inspect the engine harness.	Damaged wire insulation?	
<b>STEP 2C:</b> Inspect the secondary speed sensor (camshaft sensor) circuit at the engine harness connector.	Dirty or damaged pins?	
<b>STEP 2D:</b> Inspect the engine harness.	Damaged wire insulation?	
<b>STEP 3: Vehicle test.</b>		
<b>STEP 3A:</b> Road test to determine if fault condition exists.	Does Fault Code 2322 become active during engine operation?	
<b>STEP 3B:</b> Inspect air gap and target wheel.	Is air gap within specification?	
<b>STEP 3C:</b> Manipulate the engine harness to test for an intermittent fault condition in the engine harness.	Does Fault Code 2322 status change from inactive to active while manipulating the engine harness?	
<b>STEP 4: Clear the fault codes.</b>		
<b>STEP 4A:</b> Disable the fault code.	Fault Code 2322 inactive?	
<b>STEP 4B:</b> Clear the inactive fault code.	All fault codes cleared?	

### TROUBLESHOOTING STEP

**STEP 1: Check the fault codes.**  
**STEP 1A: Check for an active fault code.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for an active fault code. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul> If Fault Code 778 has number of inactive counts, there is most likely an intermittent circuit problem (short or open) in the circuit for the primary speed sensor.	Fault Code 778 is active or has high number of inactive counts? <b>YES</b>	Refer to Fault Code 778 troubleshooting tree
	Fault Code 689 is active or has high number of inactive counts? <b>NO</b>	2A

**STEP 2: Check the secondary speed sensor circuit (camshaft sensor).**

**STEP 2A: Inspect the secondary speed sensor (camshaft sensor) connector pins.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the secondary speed sensor from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the engine harness and actuator connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A damaged connection has been detected in the sensor or harness connector.</p> <ul style="list-style-type: none"> <li>• Clear the connector and pins.</li> <li>• Repair the damaged harness, connector, or pins if possible.</li> </ul> <p>Refer to Procedure 019-043 in Section 19.</p>	4A
	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	2B

**STEP 2B: Inspect the engine harness.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the secondary speed sensor from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Closely inspect the engine harness near the secondary speed sensor.</p> <p>Look for places where the wire harness insulation is damaged allowing intermittent shorts to the block or nearby components.</p>	<p>Damaged wire insulation?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.</p>	4A
	<p>Damaged wire insulation?</p> <p><b>NO</b></p>	2C

**STEP 2C: Inspect the secondary speed sensor (camshaft sensor) circuit at the engine harness ECM connector.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the engine harness ECM connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A damaged connection has been detected in the ECM connector or engine harness connector.</p> <ul style="list-style-type: none"> <li>• Clean the connector and pins.</li> <li>• Repair the damaged harness, connector, or pins if possible.</li> </ul> <p>Refer to Procedure 019-043 in Section 19.</p>	4A
	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	2D

**STEP 2D: Inspect the engine harness.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the secondary speed sensor from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Closely inspect the engine harness near the ECM connector.</p> <p>Look for places where the wire harness insulation is damaged allowing intermittent shorts to the engine block or nearby components.</p>	<p>Damaged wire insulation?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.</p>	4A
	<p>Damaged wire insulation?</p> <p><b>NO</b></p>	3A

**STEP 3: Vehicle test.****STEP 3A: Road test to determine if fault condition exists.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>Connect the secondary speed sensor (camshaft sensor) to the engine harness.</li> <li>Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
With the engine running, accelerate the engine several times. <ul style="list-style-type: none"> <li>Use INSITE™ electronic service tool to observe fault codes.</li> </ul>	Does Fault Code 2322 become active during engine operation? <b>YES</b>	3B
	Does Fault Code 2322 become active during engine operation? <b>NO</b>	4A

**STEP 3B: Inspect air gap and target wheel.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>Turn keyswitch OFF.</li> </ul>		
Action	Specification/Repair	Next Step
Remove the secondary engine speed sensor (camshaft sensor) from the gear housing and measure the air gap at several points in the crankshaft's revolution. <ul style="list-style-type: none"> <li>Refer to Procedure 019-363 in Section 19.</li> </ul>	Is air gap within specifications? <ul style="list-style-type: none"> <li>Minimum Air Gap: 0.96 mm [0.038 in]</li> <li>Maximum Air Gap: 2.25 mm [0.089 in]</li> <li>Maximum Target Runout: 0.5 mm [0.02 in]</li> </ul> <b>YES</b>	3C
	Is air gap within specifications? <ul style="list-style-type: none"> <li>Minimum Air Gap: 0.96 mm [0.038 in]</li> <li>Maximum Air Gap: 2.25 mm [0.089 in]</li> <li>Maximum Target Runout: 0.5 mm [0.02 in]</li> </ul> <b>NO</b> <b>Repair:</b> Replace or shim the sensor if air gap is out of specification. If the target runout is excessive, replace the target.	4A

**STEP 3C: Manipulate the engine harness to test for an intermittent fault condition in the engine harness.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Use INSITE™ electronic service tool to monitor Fault Code 2322 status. <ul style="list-style-type: none"> <li>Start the engine and allow it to idle.</li> <li>Starting at the ECM connector, manipulate the engine harness manually. Work backwards from the ECM connector towards the engine speed sensor connector.</li> </ul>	Does Fault Code 2322 status change from inactive to active while manipulating the engine harness? <b>YES</b> <b>Repair:</b> An intermittent connection has been detected in the engine harness.  Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.	4A
	Does Fault Code 2322 status change from inactive to active while manipulating the engine harness? <b>NO</b>	4A

**STEP 4: Clear the fault codes.**

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

<b>Condition:</b> <ul style="list-style-type: none"> <li>Connect all components.</li> <li>Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Disabel the fault code. <ul style="list-style-type: none"> <li>Start the engine and let it idle for 1 minute.</li> <li>Use INSITE™ electronic serivce tool to verify the fault code is inactive.</li> </ul>	Fault Code 2322 inactive? <b>YES</b>	4B
	Fault Code 2322 inactive? <b>NO</b> <b>Repair:</b> Return to the troubleshooting steps or contact a local Cummins® Authorized Repair Location if all steps have been completed and checked again.	1A

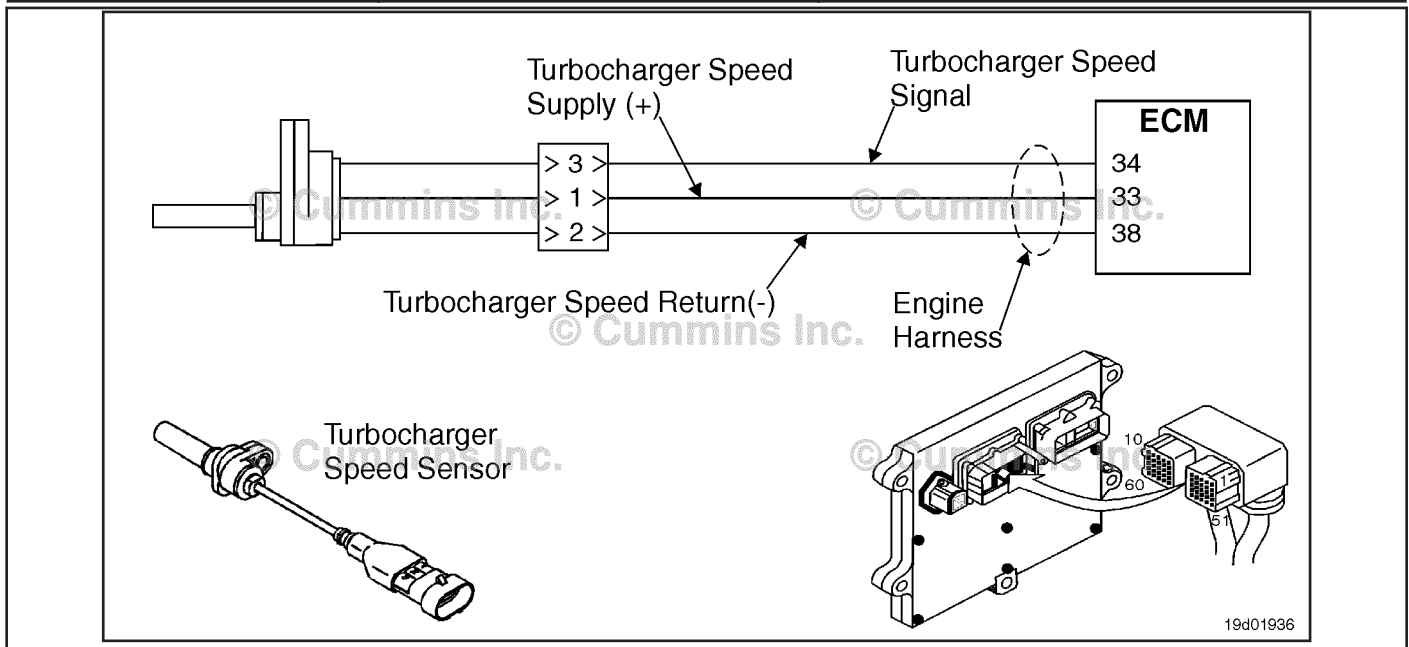
**STEP 4B: Clear the inactive fault code.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Clear the inactive fault codes.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to erase the inactive fault codes.</li> </ul>	<p>All fault codes cleared? <b>YES</b></p>	<p>Repair complete</p>
	<p>All fault codes cleared? <b>NO</b> <b>Repair:</b> Troubleshoot any remaining active fault codes.</p>	<p>Appropriate troubleshooting trees</p>

## Fault Code 2345 (ISB/QSB Automotive or Industrial Application)

### Turbocharger Speed - Invalid Rate of Change Detected

CODES	REASON	EFFECT
Fault Code: 2345 PID(P), SID(S): P103 SPN: 103 FMI: 10/10 Lamp: Amber SRT:	Turbocharger speed - invalid rate of change detected. The turbocharger speed sensor has detected an erroneous speed value.	Possible-low-power estimated turbocharger speed will be used.



Turbocharger Speed Sensor Circuit

#### **Circuit Description:**

The electronic control module (ECM) provides +5 VDC to the turbocharger speed sensor signal pin. Circuitry inside the turbocharger speed sensor detects the movement of the turbocharger compressor blades and produces a speed signal. This signal is used by the ECM for engine controls.

#### **Component Location:**

The turbocharger speed sensor is located in the turbocharger compressor housing. Refer to Procedure 100-002 for a detailed component location view.

#### **Shop Talk:**

This fault becomes active if the engine is running and the turbocharger speed signal rapidly changes faster than the capabilities of the turbocharger. This could be caused by a bent or missing compressor blade or a damaged compressor wheel.

#### **Refer to Troubleshooting Fault Code t05-2345**



## FAULT CODE 2345 (ISB/QSB Automotive or Industrial Application) - Turbocharger Speed - Invalid Rate of Change Detected

### TROUBLESHOOTING SUMMARY

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1: Check for additional fault codes.</b>		
<b>STEP 1A:</b> Check for active or inactive fault codes.	Fault Code 687, 595, 2387, 2386, 2385, 2384, 2383, 2382, and/or 2381 active or inactive?	
<b>STEP 2: Check the turbocharger.</b>		
<b>STEP 2A:</b> Check the turbocharger compressor wheel for damage.	Bent or damaged turbocharger compressor blades?	
<b>STEP 3: Clear the fault codes.</b>		
<b>STEP 3A:</b> Disable the fault code.	Fault Code 2345 inactive?	
<b>STEP 3B:</b> Clear the inactive fault codes.	All fault codes cleared?	

### TROUBLESHOOTING STEP

**STEP 1: Check for additional fault codes.**  
**STEP 1A: Check for active or inactive fault codes.**

<b>Condition:</b> • Turn keyswitch ON. • Connect INSITE™ electronic service tool.		
Action	Specification/Repair	Next Step
Check for active or inactive fault codes. • Use INSITE™ electronic service tool to read the fault codes.	Fault Code 687, 595, 2387, 2386, 2385, 2384, 2383, 2382, and/or 2381 active or inactive?  <b>YES</b>  <b>Repair:</b> Troubleshoot the fault codes starting with the fault code containing the highest number of counts.	Appropriate troubleshooting steps
	Fault Code 687, 595, 2387, 2386, 2385, 2384, 2383, 2382, and/or 2381 active or inactive?  <b>NO</b>	2A

**STEP 2: Check the turbocharger.**

**STEP 2A: Check the turbocharger compressor wheel for damage.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Remove the intake piping from the turbocharger compressor.</li> </ul>		
Action	Specification/Repair	Next Step
Inspect the turbocharger compressor wheel and blades. <ul style="list-style-type: none"> <li>• Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 010-033 in Section 10.</li> </ul>	Bent or damaged turbocharger compressor blades? <b>YES</b> <b>Repair:</b> Replace the turbocharger. Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 010-033 in Section 10.	3A
	Bent or damaged turbocharger compressor blades? <b>NO</b>	3A

**STEP 3: Clear the fault codes.**

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

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> <li>• Start the engine and let it idle for 1 minute.</li> <li>• Use INSITE™ electronic service tool to verify that the fault code is inactive.</li> </ul>	Fault Code 2345 inactive? <b>YES</b>	3B
	Fault Code 2345 inactive? <b>NO</b>	1A

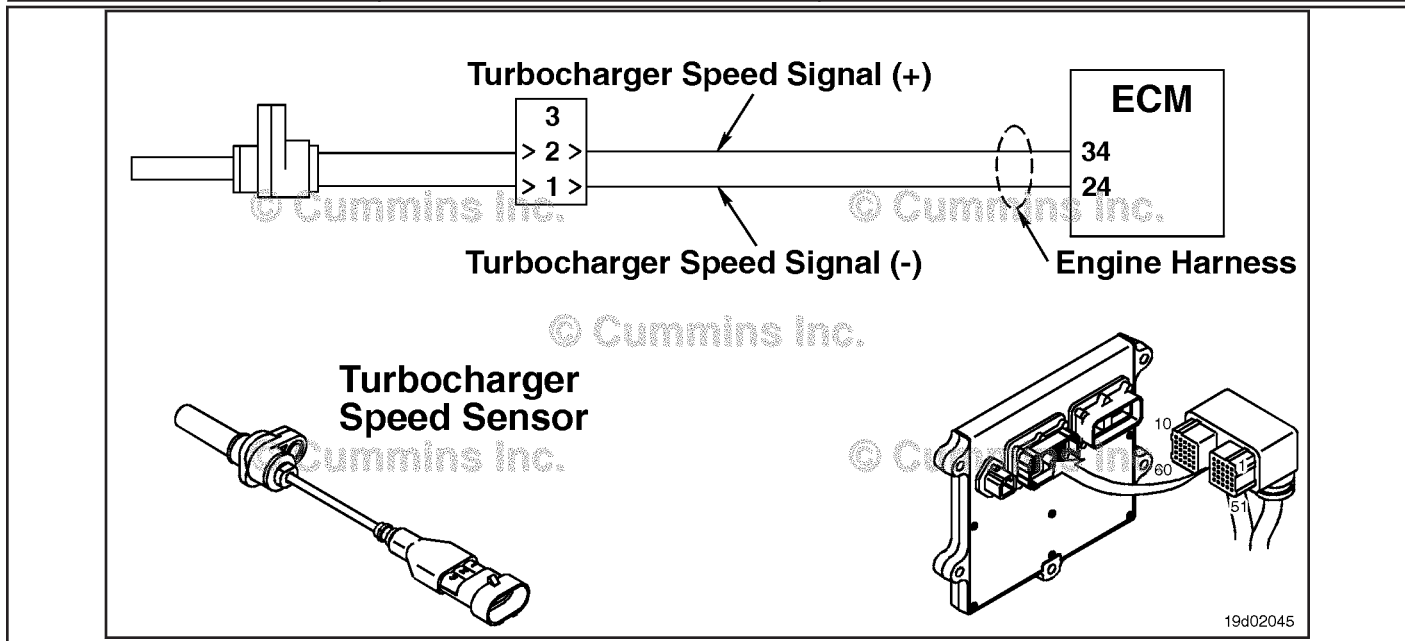
**STEP 3B: Clear the inactive fault codes.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to erase the inactive fault codes.</li> </ul>	All fault codes cleared? <b>YES</b>	Repair complete
	All fault codes cleared? <b>NO</b>	Appropriate troubleshooting steps

## Fault Code 2345 (ISC/QSC/ISL/QSL Automotive, Industrial, or Marine Application)

### Turbocharger Speed Invalid Rate of Change Detected - Abnormal Rate of Change

CODES	REASON	EFFECT
Fault Code: 2345 PID(P), SID(S): P103 SPN: 103 FMI: 10/10 Lamp: Amber SRT:	Turbocharger Speed Invalid Rate of Change Detected - Abnormal Rate of Change. The turbocharger speed sensor has detected an erroneous speed value.	Engine power derate.



Turbocharger Speed Sensor Circuit

#### Circuit Description:

The turbocharger speed sensor is a variable reluctance speed sensor. It consists of a coil of wire and an iron core. A signal is generated as the turbocharger shaft spins. The target on the turbocharger shaft is a ground flat in the center of the shaft.

#### Component Location:

The turbocharger speed sensor is located in the center housing of the turbocharger. Refer to Procedure 100-002 for a detailed component location view.

#### Shop Talk:

This fault becomes active if the engine is running and the turbocharger speed signal rapidly changes faster than the capabilities of the turbocharger. This fault code can be caused by an intermittent turbocharger speed sensor connection, incorrect turbocharger speed sensor air gap, or a faulty turbocharger speed sensor.

#### **Refer to Troubleshooting Fault Code t05-2345**

## FAULT CODE 2345 (ISC/QSC/ISL/QSL Automotive, Industrial, or Marine Application) - Turbocharger Speed Invalid Rate of Change Detected - Abnormal Rate of Change

### TROUBLESHOOTING SUMMARY

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1:</b> Check for additional fault codes.		
<b>STEP 1A:</b> Check for active or inactive fault codes.	Fault Code 595 and/or 687 active or inactive?	
<b>STEP 2:</b> Check the turbocharger.		
<b>STEP 2A:</b> Inspect the turbocharger speed sensor and electrical connections.	Dirty or damaged pins?	
<b>STEP 2B:</b> Inspect the turbocharge speed sensor.	Turbocharger speed sensor damage found?	
<b>STEP 2C:</b> Check for an inactive fault code.	Fault Code 2345 inactive?	
<b>STEP 3:</b> Clear the fault codes.		
<b>STEP 3A:</b> Disable the fault code.	Fault Code 2345 inactive?	
<b>STEP 3B:</b> Clear the inactive fault codes.	All fault codes cleared?	

### TROUBLESHOOTING STEP

**STEP 1:** Check for additional fault codes.  
**STEP 1A:** Check for active or inactive fault codes.

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for active or inactive fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 595 and/or 687 active or inactive? <b>YES</b> <b>Repair:</b> Troubleshoot fault codes starting with the fault code containing the highest number of counts.	Appropriate troubleshooting steps
	Fault Code 595 and/or 687 active or inactive? <b>NO</b>	2A

**STEP 2: Check the turbocharger.**

**STEP 2A: Inspect the turbocharger speed sensor and electrical connections.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the turbocharger speed sensor from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the engine harness and turbocharger speed sensor connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A damaged connection has been detected in the sensor or harness connector.</p> <ul style="list-style-type: none"> <li>• Clean the connector and pins.</li> <li>• Repair the damaged harness, connector, or pins if possible.</li> </ul> <p>Refer to Procedure 019-043 in Section 19.</p>	3A
	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	2B

**STEP 2B: Inspect the turbocharger speed sensor.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the turbocharger speed sensor from the engine harness.</li> <li>• Remove the turbocharger speed sensor from the turbocharger housing. Refer to Procedure 019-390 in Section 19.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the nose of the turbocharger speed sensor for the following:</p> <ul style="list-style-type: none"> <li>• Cuts or scratches on the nose of the sensor</li> <li>• Cuts or scratches on the sensor body</li> <li>• A cracked sensor mounting boss.</li> </ul>	<p>Turbocharger speed sensor damage found?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Replace the turbocharger speed sensor. Refer to Procedure 019-390 in Section 19.</p>	3A
	<p>Turbocharger speed sensor damage found?</p> <p><b>NO</b></p>	2C

**STEP 2C: Check for an inactive fault code.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for the appropriate circuit response after 30 seconds. Engine specific condition/action text. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 2345 inactive? <b>YES</b> <b>Repair:</b> None. The removal and installation of the connector corrected the fault.	3A
	Fault Code 2345 inactive? <b>NO</b>	Fault Code 595

**STEP 3: Clear the fault codes.**

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

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> <li>• Start the engine and let it idle for 1 minute.</li> <li>• Use INSITE™ electronic service tool to verify that the fault code is inactive.</li> </ul>	Fault Code 2345 inactive? <b>YES</b>	3B
	Fault Code 2345 inactive? <b>NO</b>	1A

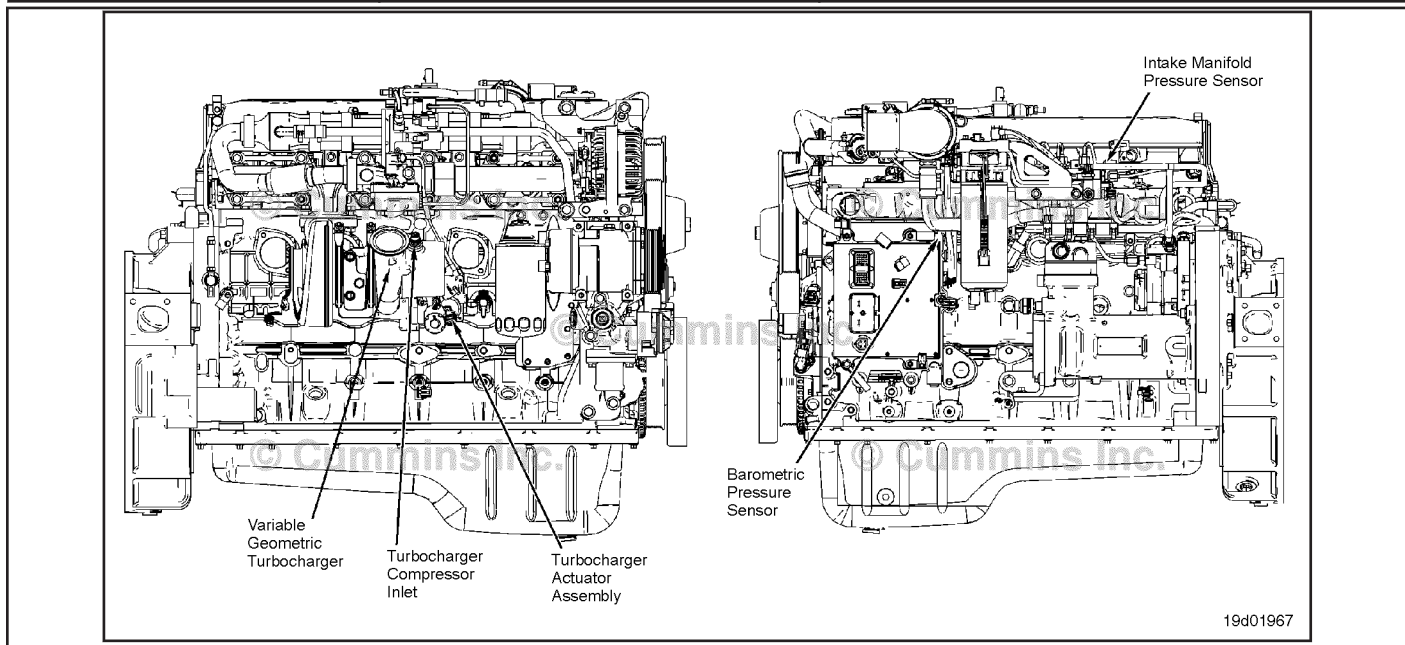
**STEP 3B: Clear the inactive fault codes.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to erase the inactive fault codes .</li> </ul>	All fault codes cleared? <b>YES</b>	Repair complete
	All fault codes cleared? <b>NO</b>	Appropriate troubleshooting steps

## Fault Code 2346 (ISB/QSB Automotive or Industrial Application)

### Exhaust Gas Temperature - Data Above Normal

CODES	REASON	EFFECT
Fault Code: 2346 PID(P), SID(S): SPN: 2789 FMI: 1/15 Lamp: Amber SRT:	Exhaust gas temperature - data above normal. High exhaust temperature has been calculated by the electronic control system.	Derate in power output of the engine in attempt to decrease the calculated exhaust gas temperature value.



#### **Circuit Description:**

Exhaust temperature is a calculated value that the electronic control module (ECM) derives based on engine operating conditions, such as intake manifold temperature and pressure, engine speed, fuel flow, and exhaust gas recirculation (EGR) valve pressure.

#### **Component Location:**

There is **not** a physical exhaust gas temperature sensor on the engine. The exhaust gas temperature is a calculation of the exhaust gas temperature before entering the turbocharger and is also known as the turbine inlet temperature.

#### **Shop Talk:**

The most common cause of this fault code is low boost. Low boost can be caused by several factors:

- Leaking charge air cooler
- Damaged charge air piping or hose
- Loose charge air cooler clamps
- Failed intake manifold pressure sensor
- Failed variable geometry turbocharger.

NOTE: This fault code will most likely **not** become active under conditions of the engine being unloaded and in the shop. The engine **must** be loaded to trip this fault code and to verify if the failure has been fixed.

#### **Refer to Troubleshooting Fault Code t05-2346**

## FAULT CODE 2346 (ISB/QSB Automotive or Industrial Application) - Exhaust Gas Temperature - Data Above Normal

### TROUBLESHOOTING SUMMARY

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1: Check the fault codes.</b>		
<b>STEP 1A:</b> Check for active fault codes.	Active fault codes present?	
<b>STEP 1B:</b> Check for inactive fault codes.	Fault Codes 153, 122, 2973, 2359, 2273, and 155 inactive?	
<b>STEP 2: Check the air handling system.</b>		
<b>STEP 2A:</b> Check the air intake for leaks.	Air leak present or clamps loose?	
<b>STEP 2B:</b> Inspect turbocharger compressor and turbine blades.	Damaged turbocharger blades?	
<b>STEP 2C:</b> Perform the INSITE™ electronic service tool turbocharger operational test.	Does the turbocharger operational test pass?	
<b>STEP 3: Clear the fault codes.</b>		
<b>STEP 3A:</b> Disable the fault code.	Fault Code 2346 inactive?	
<b>STEP 3B:</b> Clear the inactive fault codes.	All fault codes cleared?	

### TROUBLESHOOTING STEP

**STEP 1: Check the fault codes.**  
**STEP 1A: Check for active fault codes.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for active fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Active fault codes present? <b>YES</b>	Troubleshoot the active fault codes
	Active fault codes present? <b>NO</b>	1B



**STEP 1B: Check for inactive fault codes.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for inactive fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Codes 153, 122, 2973, 2359, 2273, and 155 inactive? <b>YES</b>	Troubleshoot the fault codes with the highest counts
	Fault Codes 153, 122, 2973, 2359, 2273, and 155 inactive? <b>NO</b>	2A

**STEP 2: Check the air handling system.****STEP 2A: Check the air intake for leaks.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> </ul>		
Action	Specification/Repair	Next Step
Check the air intake for leaks. <ul style="list-style-type: none"> <li>• Check the charge air cooler, hoses, and piping for leaks.</li> <li>• Check the clamps for adequate torque.</li> </ul>	Air leak present or clamps loose? <b>YES</b> <b>Repair:</b> Repair the air leak.	3A
	Air leak present or clamps loose? <b>NO</b>	2B

**STEP 2B: Inspect turbocharger compressor and turbine blades.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn engine off.</li> <li>• Turn keyswitch OFF.</li> <li>• Remove the intake and exhaust connections from the turbocharger.</li> </ul>		
Action	Specification/Repair	Next Step
Inspect the turbocharger compressor and turbine blades for damage or wear. -	Damaged turbocharger blades? <b>YES</b> <b>Repair:</b> Replace the turbocharger. Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 010-033 in Section 10.	3A
	Damaged turbocharger blades? <b>NO</b>	2C

**STEP 2C: Perform the INSITE™ electronic service tool turbocharger operational test.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Perform the INSITE™ electronic service tool turbocharger operational test. <ul style="list-style-type: none"> <li>• Start the engine and run at low idle.</li> <li>• Select the EGR/VGT Operational Test with INSITE™ electronic service tool.</li> </ul>	Does the turbocharger operational test pass? <b>YES</b>	3A
	Does the turbocharger operational test pass? <b>NO</b> <b>Repair:</b> Replace the turbocharger. Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 010-033 in Section 10.	3A

**STEP 3: Clear the fault codes.**

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

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> <li>• Start the engine and let it idle for 1 minute.</li> <li>• Use INSITE™ electronic service tool to verify that the fault code is inactive.</li> </ul>	Fault Code 2346 inactive? <b>YES</b>	3B
	Fault Code 2346 inactive? <b>NO</b>	1A

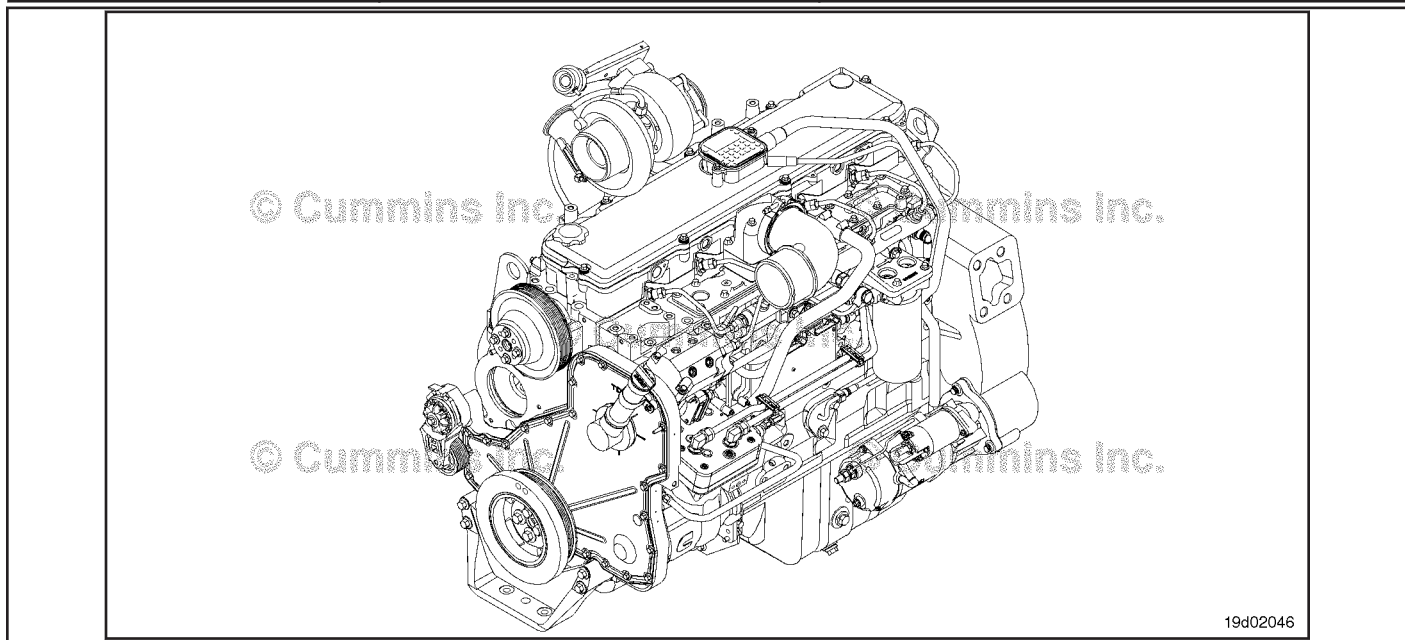
**STEP 3: Clear the inactive fault codes.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to erase the inactive fault codes.</li> </ul>	All fault codes cleared? <b>YES</b>	Repair complete
	All fault codes cleared? <b>NO</b>	Appropriate troubleshooting steps

## Fault Code 2346 (ISC/QSC/ISL/QSL Automotive, Industrial, or Marine Application)

### Turbocharger Turbine Inlet Temperature (Calculated) - Data Valid but Above Normal Operational Range - Least Severe Level

CODES	REASON	EFFECT
Fault Code: 2346 PID(P), SID(S): SPN: 2789 FMI: 0/15 Lamp: None SRT:	Turbocharger Turbine Inlet Temperature (Calculated) - Data Valid but Above Normal Operational Range - Least Severe Level. Turbocharger turbine inlet temperature has exceeded the engine protection limit.	Engine power derate.



Turbocharger Turbine Inlet Temperature (Calculated)

#### **Circuit Description:**

The exhaust gas temperature is calculated by the electronic control module (ECM). Exhaust gas temperature, or turbine inlet temperature, is derived by the electronic control module based on engine operating conditions such as intake manifold air temperature, engine speed, injection timing, intake manifold pressure, and fuel flow.

#### **Component Location:**

There is **not** a physical exhaust gas temperature sensor in the system. The exhaust gas temperature is a calculation of exhaust gas temperature before the turbocharger and is also known as turbine inlet temperature.

NOTE: Some OEM's have pyrometer gauges mounted in their chassis. Pyrometers measure turbine outlet temperature or the exhaust gas leaving the turbocharger and will **not** equal the value monitored with the exhaust gas temperature parameter in INSITE™ electronic service tool.

#### **Shop Talk:**

The most common cause of this fault code is low boost. Low boost can be caused by several factors: leaking charge air cooler, failed charge air cooler piping or hose, loose charge air cooler clamps, failed intake manifold pressure sensor, failed variable geometry turbocharger, or failed turbocharger control valve.

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NOTE: This code will most likely **not** be active with no load in the shop. The engine **must** be loaded to trip this fault code and to determine if the failure has been found and fixed.

**Refer to Troubleshooting Fault Code t05-2346**

## FAULT CODE 2346 (ISC/QSC/ISL/QSL Automotive, Industrial, or Marine Application) - Turbocharger Turbine Inlet Temperature (Calculated) - Data Valid but Above Normal Operational Range - Least Severe Level

### TROUBLESHOOTING SUMMARY

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1: Check the fault codes.</b>		
<b>STEP 1A:</b> Check for active fault codes.	Active fault codes present?	
<b>STEP 1B:</b> Check for inactive fault codes.	Fault Codes 2973 inactive?	
<b>STEP 2: Check the air handling system.</b>		
<b>STEP 2A:</b> Check the charge-air cooler, clamps, hoses, and piping.	Air leak present or clamps loose?	
<b>STEP 2B:</b> Inspect the turbocharger compressor and turbine blades.	Damage found on turbocharger blades?	
<b>STEP 2C:</b> Check the variable geometry actuator rod for correct travel.	Does the turbocharger actuator rod extend between 8 and 9 mm [0.321 and 0.36 in]?	
<b>STEP 2C-1:</b> Check for air leaks and inspect the air lines.	Air leaks found in the system?	
<b>STEP 2C-2:</b> Check for air pressure at the turbocharger control valve.	Is vehicle air tank pressure air pressure present at the turbocharger control valve outlet?	
<b>STEP 2C-3:</b> Check for air leaks at the turbocharger control valve outlet outlet.	Can air be heard escaping from the turbocharger control valve outlet?	
<b>STEP 2C-4:</b> Check for correct turbocharger actuator travel.	Does the turbocharger actuator rod travel at least 12 mm [0.472 in]?	
<b>STEP 3: Clear the fault codes.</b>		
<b>STEP 3A:</b> Disable the fault code.	Fault Code 2346 inactive?	
<b>STEP 3B:</b> Clear the inactive fault codes.	All fault codes cleared?	

### TROUBLESHOOTING STEP

**STEP 1: Check the fault codes.**  
**STEP 1A: Check for active fault codes.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect INSITE™ electronic service tool.</li> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
Check for active fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Active fault codes present? <b>YES</b>	Troubleshoot active fault codes
	Active fault codes present? <b>NO</b>	1B

**STEP 1B: Check for inactive fault codes.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect INSITE™ electronic service tool.</li> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
Check for inactive fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 2973 inactive? <b>YES</b>	Fault Code 2973
	Fault Code 2973 inactive? <b>NO</b>	2A

**STEP 2: Check the air handling system.**

**STEP 2A: Check the charge-air cooler, clamps, hoses, and piping.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> </ul>		
Action	Specification/Repair	Next Step
Check the charge air-cooler, hoses, and piping for leaks. Check the clamps for adequate torque.	Air leak present or clamps loose? <b>YES</b> <b>Repair:</b> Repair air leak.	3A
	Air leak present or clamps loose? <b>NO</b>	2B

**STEP 2B: Inspect the turbocharger compressor and turbine blades.**

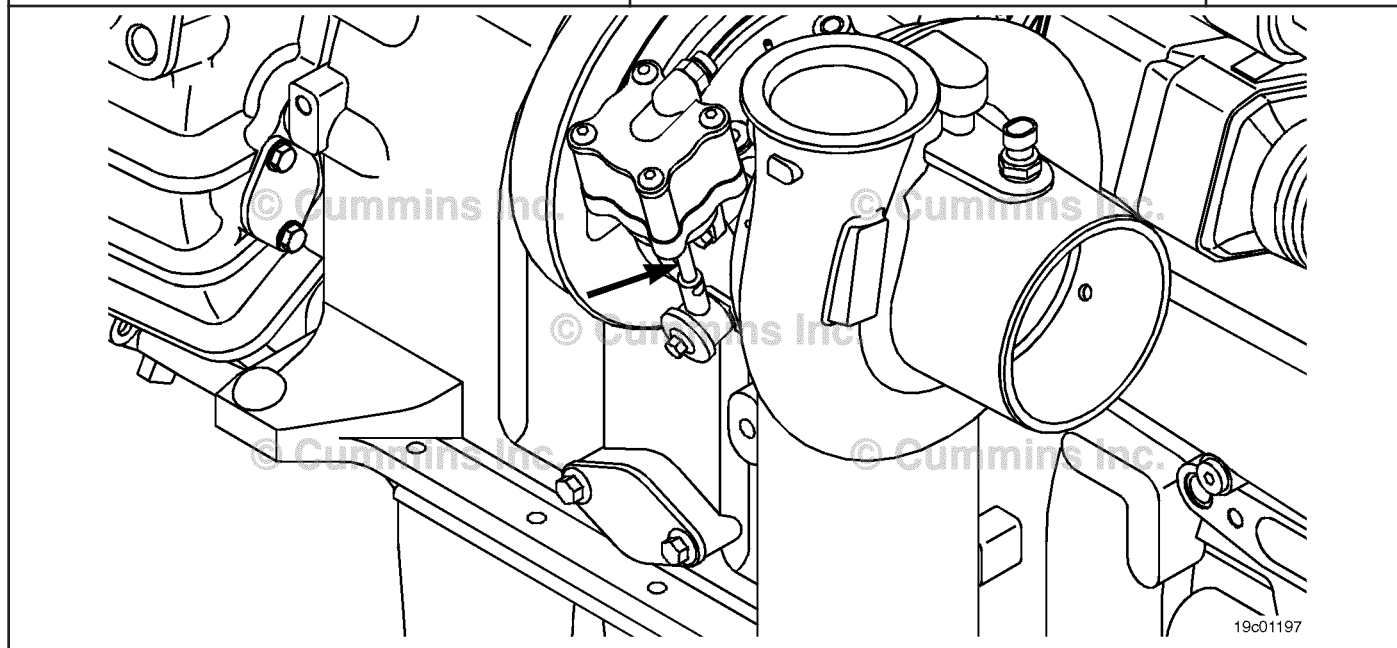
<b>Condition:</b> <ul style="list-style-type: none"> <li>• Engine OFF.</li> <li>• Turn keyswitch OFF.</li> <li>• Remove the intake and exhaust connections from the turbocharger.</li> </ul>		
Action	Specification/Repair	Next Step
Inspect the turbocharger compressor and turbine blades for damage or wear. -	Damage found on turbocharger blades? <b>YES</b> <b>Repair:</b> Replace the turbocharger. Use the following procedure in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418. Refer to Procedure 010-033 in Section 10.	3A
	Damage found on turbocharger blades? <b>NO</b>	2C

**STEP 2C: Check the variable geometry actuator rod for correct travel.**

**Condition:**

- Engine OFF.
- Turn keyswitch ON.
- Connect the INSITE™ electronic service tool.
- Verify vehicle air tanks are fully charged.

Action	Specification/Repair	Next Step
<p>Use INSITE™ electronic service tool to start the Turbocharger Actuator Test.</p> <ul style="list-style-type: none"> <li>• Adjust the delay timer in the Turbocharger Actuator Test so that the rod movement can be observed.</li> <li>• Select the Retract Actuator position with INSITE™ electronic service tool.</li> <li>• Mark or scribe the variable geometry actuator rod at the base of the actuator.</li> <li>• Select the Extend Actuator position with INSITE™ electronic service tool.</li> <li>• Measure the rod travel by measuring the distance from the base of the turbocharger actuator to the scribe mark.</li> </ul> <p>Note: The turbocharger actuator should move quickly and crisply. If the actuator rod movement is slow, there could be a problem with the air supply or mechanical problems with the variable geometry turbocharger assembly.</p>	<p>Does the turbocharger actuator rod extend between 8 and 9 mm [0.32 and 0.36 in]?</p> <p><b>YES</b></p>	<p>3A</p>
	<p>Does the turbocharger actuator rod extend between 8 and 9 mm [0.32 and 0.36 in]?</p> <p><b>NO</b></p>	<p>2C-1</p>



**STEP 2C-1: Check for air leaks and inspect air lines.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Engine OFF.</li> <li>• Turn keyswitch ON.</li> <li>• Connect the INSITE™ electronic service tool.</li> <li>• Verify vehicle air tanks are fully charged.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Use INSITE™ electronic service tool to perform the Turbocharger Actuator Test.</p> <p>Select the Extend Actuator position. Listen for air leaks at the following components:</p> <ul style="list-style-type: none"> <li>• Turbocharger control valve</li> <li>• Turbocharger control valve inlet connection</li> <li>• Turbocharger control valve outlet connection</li> <li>• Turbocharger actuator inlet connection</li> <li>• Turbocharger actuator</li> <li>• All air lines including OEM supply line to turbocharger control valve, and turbocharger control valve to turbocharger actuator.</li> </ul>	<p>Air leaks found in the system?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Repair air leaks.</p>	3A
	<p>Air leaks found in the system?</p> <p><b>NO</b></p>	2C-2

**STEP 2C-2: Check for air pressure at the turbocharger control valve outlet.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Engine OFF.</li> <li>• Turn keyswitch ON.</li> <li>• Connect the INSITE™ electronic service tool.</li> <li>• Verify vehicle air tanks are fully charged.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Remove the air line connection at the outlet of the turbocharger control valve.</p> <p>Install an M12 Compuchek™ fitting at the outlet of the turbocharger control valve.</p> <p>Install an air pressure gauge that is capable of reading at least 1034 kPa [150 psi].</p> <p>Perform the Turbocharger Actuator Test with the INSITE™ electronic service tool. Select the Extend Actuator position.</p>	<p>Is vehicle air tank pressure air pressure present at the turbocharger control valve outlet?</p> <p><b>YES</b></p>	2C-3
	<p>Is vehicle air tank pressure air pressure present at the turbocharger control valve outlet?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Repair the air supply from the OEM air tanks.</p>	3A



**STEP 2C-3: Check for air leaks at the turbocharger control valve outlet.**

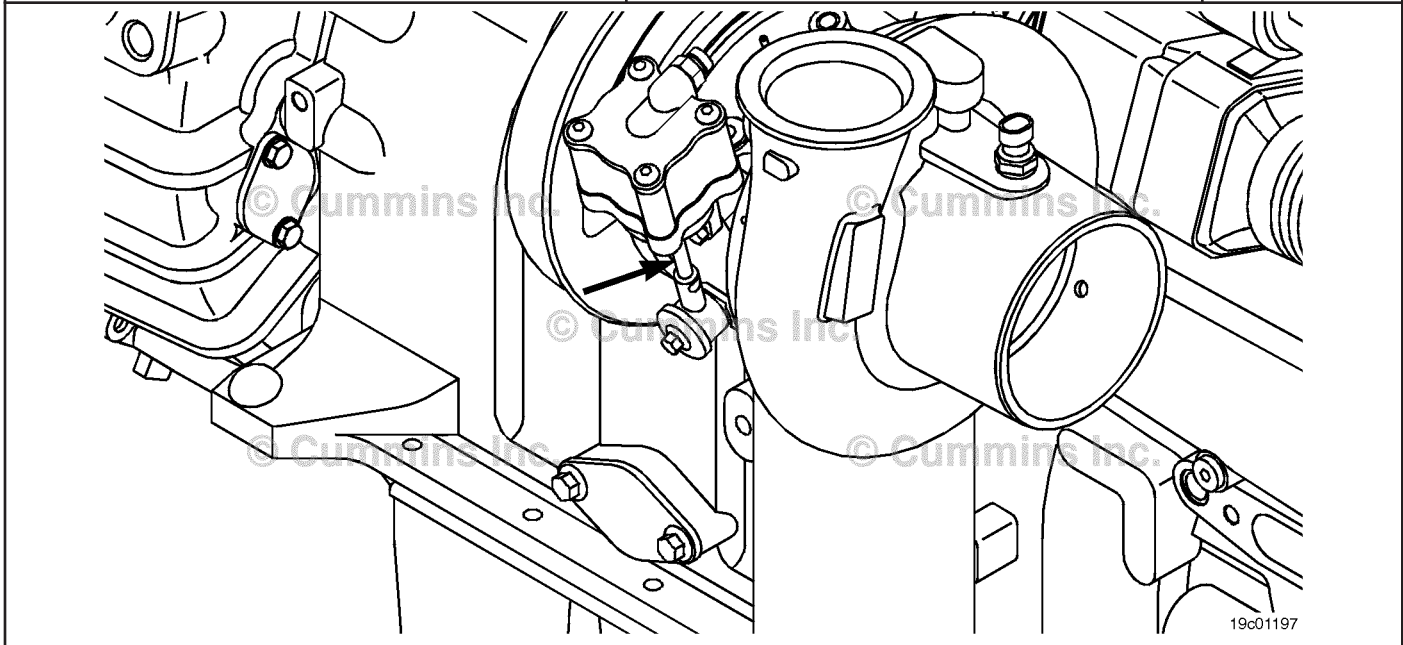
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Engine OFF.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> <li>• Verify vehicle air tanks are fully charged.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Use INSITE™ electronic service tool to perform the Turbocharger Actuator Test.</p> <ul style="list-style-type: none"> <li>• Select the Retract Actuator position.</li> <li>• Remove the air line connection at the outlet of the turbocharger control valve.</li> </ul>	<p>Can air be heard escaping from turbocharger control valve outlet?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Replace the turbocharger control valve. Refer to Procedure 019-388 in Section 19.</p>	<p>3A</p>
	<p>Can air be heard escaping from turbocharger control valve outlet?</p> <p><b>NO</b></p>	<p>2C-4</p>

**STEP 2C-4: Check for correct turbocharger actuator travel.**

**Condition:**

- Engine OFF.
- Remove the variable geometry actuator rod from the turbocharger.
- Turn keyswitch ON.
- Connect the INSITE™ electronic service tool.
- Verify vehicle air tanks are fully charged.

Action	Specification/Repair	Next Step
Use INSITE™ electronic service tool to perform the Turbocharger Actuator Test. <ul style="list-style-type: none"> <li>• Select the Extend Actuator position.</li> </ul>	Does the turbocharger actuator rod travel at least 12 mm [0.472 in]? <b>YES</b> <b>Repair:</b> Replace the turbocharger. Use the following procedure in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418. Refer to Procedure 010-033 in Section 10.	3A
	Does the turbocharger actuator rod travel at least 12 mm [0.472 in]? <b>NO</b> <b>Repair:</b> Replace the turbocharger actuator. Use the following procedure in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418. Refer to Procedure 010-113 in Section 10.	3A



**STEP 3: Clear the fault codes.**

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

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Disable the fault code.</p> <ul style="list-style-type: none"> <li>• Start the engine and let it idle for 1 minute.</li> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul> <p>Note: Unless the malfunction is a damaged barometric pressure or intake manifold pressure sensor, this code will most likely <b>not</b> be active with no load in the shop. The engine will most likely need to be loaded to trip this fault code, and to determine if the malfunction has been found and repaired.</p>	<p>Fault Code 2346 inactive? <b>YES</b></p>	3B
	<p>Fault Code 2346 inactive? <b>NO</b></p> <p><b>Repair:</b></p> <p>Return to troubleshooting steps or contact your local Cummins® Authorized Repair Location if all steps have been completed and checked again.</p>	1A

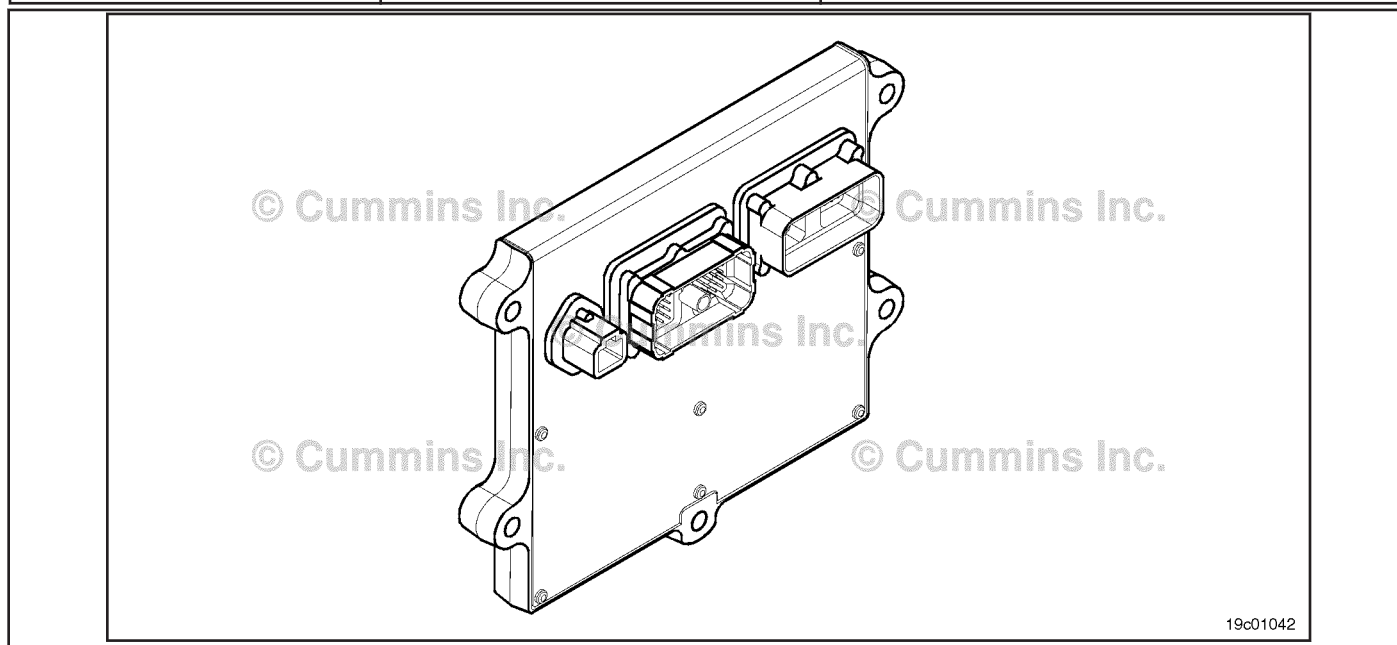
**STEP 3B: Clear the inactive fault codes.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Clear the inactive fault codes.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to clear the inactive fault codes.</li> </ul>	<p>All fault codes cleared? <b>YES</b></p>	Repair Complete
	<p>All fault codes cleared? <b>NO</b></p> <p><b>Repair:</b></p> <p>Troubleshoot any remaining active fault codes.</p>	Appropriate troubleshooting steps

## Fault Code 2347 (ISB/QSB Automotive or Industrial Application)

### Turbocharger Compressor Outlet Temperature - Data Above Normal

CODES	REASON	EFFECT
Fault Code: 2347 PID(P), SID(S): S151 SPN: 611 FMI: 0/15 Lamp: Amber SRT:	Turbocharger compressor outlet temperature - data above normal. High turbocharger compressor outlet temperature has been calculated by the ECM.	Fuel is limited in an attempt to decrease the calculated turbocharger compressor outlet temperature.



Turbocharger Compressor Inlet Air Temperature Sensor Circuit

#### **Circuit Description:**

The turbocharger compressor outlet temperature is calculated by the electronic control module (ECM) and based on engine operating conditions such as turbocharger compressor inlet temperature, barometric pressure, turbocharger speed, engine speed, intake manifold air temperature, and intake manifold pressure.

#### **Component Location:**

There is **not** a physical turbocharger compressor outlet temperature sensor on the engine. The turbocharger compressor outlet temperature is a calculation of the temperature of the air after it is compressed by the turbocharger but before Exhaust Gas Recirculation (EGR) is mixed into the system and before it enters the charge air cooler.

#### **Shop Talk:**

Possible causes for high turbocharger compressor outlet temperature include:

- Air intake leaks between the air filter and turbocharger, allowing warm underhood air to enter the turbocharger compressor inlet
- Incorrect turbocharger compressor inlet temperature sensor output
- Incorrect output of sensors used to calculate turbocharger compressor outlet temperature, such as ambient air pressure and turbocharger speed.

NOTE: This code will most likely **not** be active with no load in the shop. The engine **must** be loaded to trip this fault code and determine if the failure has been found and fixed.

**Refer to Troubleshooting Fault Code t05-2347**

## FAULT CODE 2347 (ISB/QSB Automotive or Industrial Application) - Turbocharger Compressor Outlet Temperature - Data Above Normal

### TROUBLESHOOTING SUMMARY

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1:</b> Check the fault codes.		
<b>STEP 1A:</b> Check for active fault codes.	Active fault codes present?	
<b>STEP 1B:</b> Check for inactive fault codes.	Fault Code 245, 295, 433, 488, 595, 2345, and/or 2973 inactive?	
<b>STEP 2:</b> Check the air intake system.		
<b>STEP 2A:</b> Check the air intake for leaks.	Air leak present?	
<b>STEP 2B:</b> Use INSITE™ electronic service tool to perform the turbocharger operational test.	Does the Turbocharger Operational Test pass?	
<b>STEP 3:</b> Check the turbocharger compressor inlet temperature sensor.		
<b>STEP 3A:</b> Compare the sensor reading with ambient conditions.	Turbocharger compressor inlet temperature sensor reads within 10 percent of the intake manifold temperature sensor and the ambient air temperature?	
<b>STEP 4:</b> Clear the fault codes.		
<b>STEP 4A:</b> Disable the fault code.	Fault Code 2347 inactive?	
<b>STEP 4B:</b> Clear the inactive fault codes.	All fault codes cleared?	

### TROUBLESHOOTING STEP

**STEP 1:** Check the fault codes.  
**STEP 1A:** Check for active fault codes.

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for active fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Active fault codes present? <b>YES</b>	Troubleshoot the active fault codes
	Active fault codes present? <b>NO</b>	1B

**STEP 1B: Check for inactive fault codes.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for inactive fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 245, 295, 433, 488, 595, 2345, and/or 2973 inactive? <b>YES</b>	Troubleshoot the inactive fault codes
	Fault Code 245, 295, 433, 488, 595, 2345, and/or 2973 inactive? <b>NO</b>	2A

**STEP 2: Check the air intake system.****STEP 2A: Check the air intake for leaks.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> </ul>		
Action	Specification/Repair	Next Step
Air intake leaks between the air filter and turbocharger can raise the turbocharger compressor inlet temperature. <ul style="list-style-type: none"> <li>• Check for air intake leaks between the air filter and turbocharger compressor inlet.</li> </ul>	Air leak present? <b>YES</b> <b>Repair:</b> Repair the air leaks.	4A
	Air leak present? <b>NO</b>	2B

**STEP 2B: Use INSITE™ electronic service tool to perform the turbocharger operational test.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> <li>• Start the engine and run at low idle.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Select the EGR/VGT Operational Test using the INSITE™ electronic service tool.</p> <ul style="list-style-type: none"> <li>• Run the Turbocharger Operational Test.</li> </ul>	<p>Does the Turbocharger Operational Test pass?</p> <p><b>YES</b></p>	3A
	<p>Does the Turbocharger Operational Test pass?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Replace the variable geometry turbocharger. Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 010-033 in Section 19.</p>	4A

**STEP 3: Check the turbocharger compressor inlet temperature sensor.**

**STEP 3A: Compare the sensor reading with ambient conditions.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Make sure the engine is cold.</li> <li>• Remove the turbocharger compressor inlet temperature sensor from the engine.</li> <li>• Connect the turbocharger compressor inlet temperature sensor to the engine harness.</li> <li>• Connect INSITE™ electronic service tool.</li> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Compare the sensor reading with ambient conditions.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool monitor/datalogger and compare the turbocharger compressor inlet temperature sensor reading to the intake manifold temperature sensor reading.</li> <li>• The turbocharger compressor inlet temperature sensor should read within 10 percent of the intake manifold temperature sensor and 10 percent of the ambient air temperature.</li> </ul>	<p>Turbocharger compressor inlet temperature sensor reads within 10 percent of the intake manifold temperature sensor and the ambient air temperature?</p> <p><b>YES</b></p>	4A
	<p>Turbocharger compressor inlet temperature sensor reads within 10 percent of the intake manifold temperature sensor and the ambient air temperature?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Replace the turbocharger compressor inlet temperature sensor. Refer to Procedure 019-395 in Section 19.</p>	4A



**STEP 4: Clear the fault codes.**

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

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> <li>• Start the engine and let it idle for one minute.</li> <li>• Use INSITE™ electronic service tool to verify that the fault code is inactive.</li> </ul>	Fault Code 2347 inactive? <b>YES</b>	4B
	Fault Code 2347 inactive? <b>NO</b>	1A

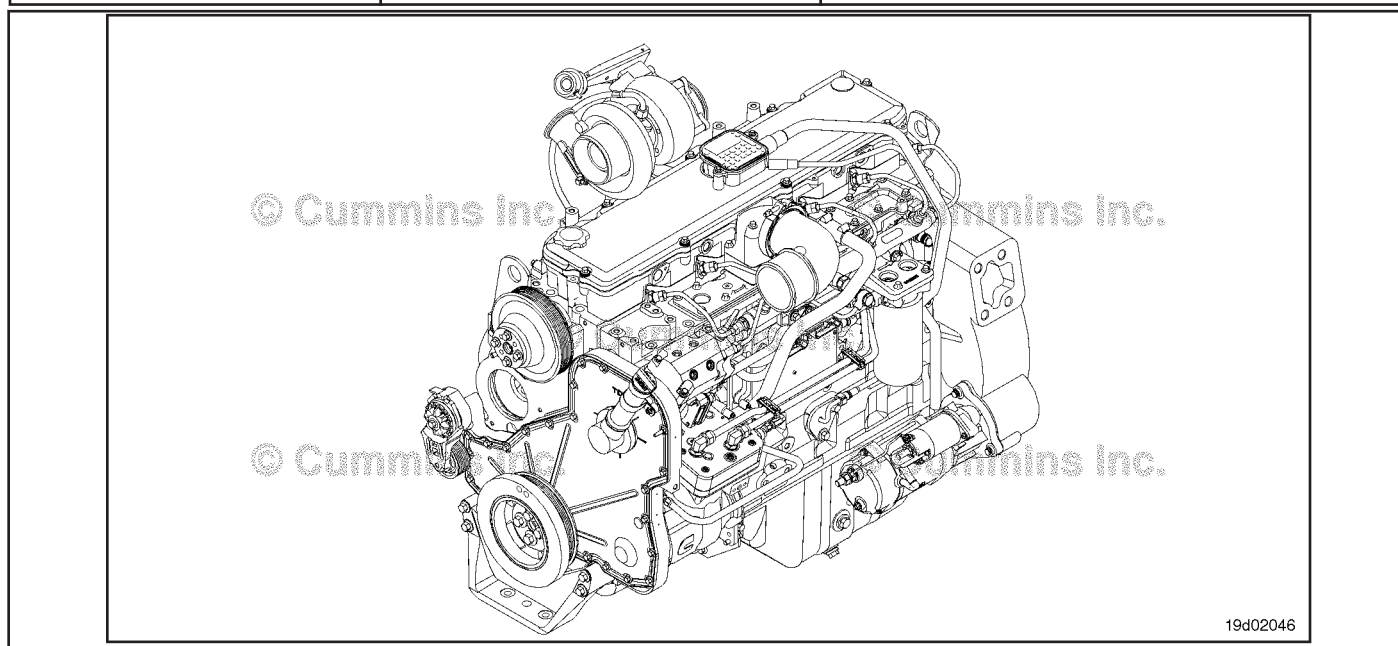
**STEP 4B: Clear the inactive fault codes.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to erase the inactive fault codes.</li> </ul>	All fault codes cleared? <b>YES</b>	Repair complete
	All fault codes cleared? <b>NO</b>	Appropriate troubleshooting steps

## Fault Code 2347 (ISC/QSC/ISL/QSL Automotive, Industrial, or Marine Application)

### Turbocharger Compressor Outlet Air Temperature (Calculated) - Data Valid but Above Normal Range

CODES	REASON	EFFECT
Fault Code: 2347 PID(P), SID(S): SPN: 2790 FMI: 0/15 Lamp: None SRT:	Turbocharger Compressor Outlet Air Temperature (Calculated) - Data Valid but Above Normal Range - least severe level.	Engine power derate.



Turbocharger Compressor Outlet Air Temperature

#### **Circuit Description:**

The turbocharger compressor outlet air temperature is calculated by the electronic control module (ECM). Turbocharger compressor outlet air temperature is calculated by the ECM based on engine operating conditions such as turbocharger compressor inlet air temperature, barometric pressure, turbocharger speed, engine speed, intake manifold air temperature, and intake manifold pressure.

#### **Component Location:**

There is **not** a physical turbocharger compressor outlet air temperature sensor in the system. The turbocharger compressor outlet air temperature is a calculation of the temperature of the air after it is compressed by the turbocharger compressor.

#### **Shop Talk:**

Possible causes of this fault code include:

- Air intake leaks allowing hot underhood air to enter the intake system
- Faulty intake manifold pressure readings
- High turbocharger speed readings
- Faulty barometric pressure readings
- Stuck turbocharger control valve

- Stuck variable geometry turbocharger.

NOTE: Unless the failure is a failed barometric pressure sensor or intake manifold pressure sensor, this fault code will most likely **not** be active with no load in the shop. The engine will most likely need to be loaded to trip this fault code, and to determine if the failure has been found and fixed.

**Refer to Troubleshooting Fault Code t05-2347**

## FAULT CODE 2347 (ISC/QSC/ISL/QSL Automotive, Industrial, or Marine Application) - Turbocharger Compressor Outlet Air Temperature (Calculated) - Data Valid but Above Normal Range

### TROUBLESHOOTING SUMMARY

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1:</b> Check the fault codes.		
<u>STEP 1A:</u> Check for active fault codes.	Are active fault codes present?	
<u>STEP 1B:</u> Check for inactive fault codes.	Are Fault Codes 595 or 2973 inactive?	
<b>STEP 2:</b> Check the air handling system.		
<u>STEP 2A:</u> Check the intake restriction to the turbocharger inlet.	Air intake restriction greater than 635 mm H <sub>2</sub> O [25 in H <sub>2</sub> O] for a used air filter or 254 mm H <sub>2</sub> O [10 in H <sub>2</sub> O] for a new filter?	
<u>STEP 2B:</u> Check the underhood air intake piping.	Damage found on the turbocharger air intake piping?	
<u>STEP 2C:</u> Check the charge-air cooler, clamps, hoses, and pipes.	Loose charge air cooler connection or malfunctioning charge-air cooler?	
<u>STEP 2D:</u> Inspect the turbocharger compressor and turbine blades.	Damage to turbocharger turbine or compressor blades?	
<u>STEP 2E:</u> Check the variable geometry actuator rod for correct travel.	Does the turbocharger actuator rod extend between 8 and 9 mm [0.32 and 0.36 in]?	
<u>STEP 2D-1:</u> Check for air leaks and inspect the air lines.	Air leaks found in the system?	
<u>STEP 2D-2:</u> Check for air leaks at the turbocharger control valve outlet.	Is vehicle air tank pressure air pressure present at the turbocharger control valve outlet?	
<u>STEP 2D-3:</u> Check for air pressure at the turbocharger control valve outlet.	Can air be heard escaping from the turbocharger control valve outlet?	
<u>STEP 2D-4:</u> Check for correct turbocharger actuator travel.	Does the turbocharger actuator rod travel at least 12 mm [0.472 in]?	
<b>STEP 3:</b> Clear the fault codes.		
<u>STEP 3A:</u> Disable the fault code.	Fault Code 2347 inactive?	
<u>STEP 3B:</u> Clear the inactive fault codes.	All fault codes cleared?	

### TROUBLESHOOTING STEP

**STEP 1: Check the fault codes.**

**STEP 1A: Check for active fault codes.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect the INSITE™ electronic service tool.</li> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
Check for active fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Are active fault codes present? <b>YES</b>	Troubleshoot active fault codes
	Are active fault codes present? <b>NO</b>	1B

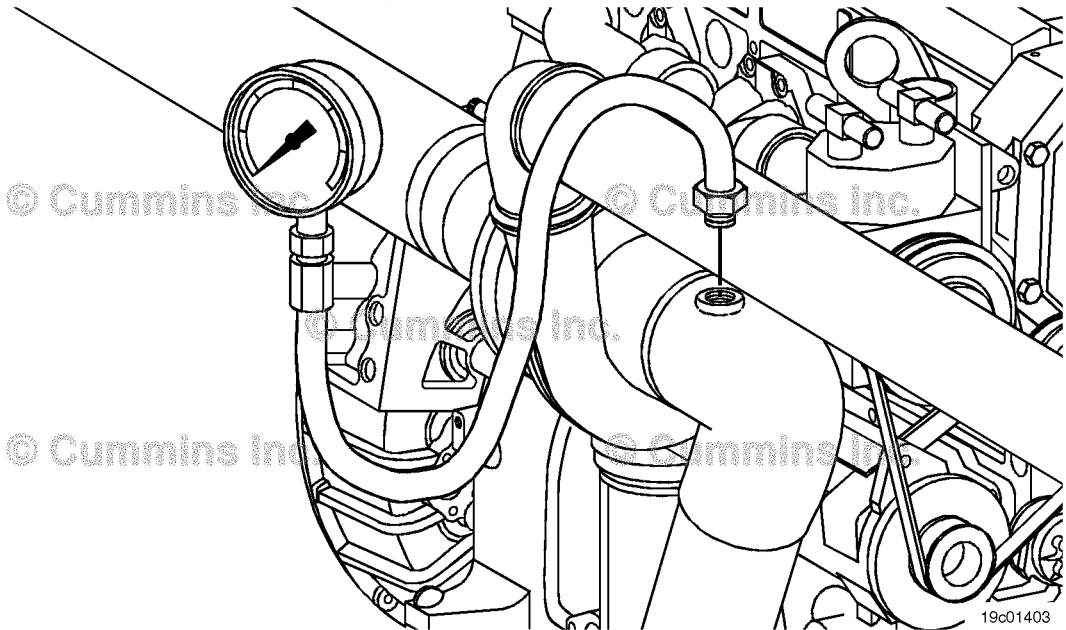
**STEP 1B: Check for inactive fault codes.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect the INSITE™ electronic service tool.</li> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
Check for inactive fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Are Fault Codes 595 or 2973 inactive? <b>YES</b>	Troubleshoot inactive fault codes starting with the fault code containing the highest number of counts
	Are Fault Codes 595 or 2973 inactive? <b>NO</b>	2B

**STEP 2: Check the air handling system.**

**STEP 2A: Check the intake restriction to the turbocharger inlet.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Operate the engine at advertised horsepower and rpm.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check the intake system restriction by installing a vacuum gauge into the air system.</p> <p>-</p>	<p>Is air intake restriction greater than 635 mm H<sub>2</sub>O [25 in H<sub>2</sub>O] for a used air filter or 254 mm H<sub>2</sub>O [10 in H<sub>2</sub>O] for a new filter?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Correct the cause of high intake air restriction. Check for plugged air filter or restricted air intake piping.</p>	Repair complete
	<p>Is air intake restriction greater than 635 mm H<sub>2</sub>O [25 in H<sub>2</sub>O] for a used air filter or 254 mm [10 in H<sub>2</sub>O] for a new filter.</p> <p><b>NO</b></p>	2B



**STEP 2B: Check the underhood air intake piping.**

<b>Condition:</b>		
<ul style="list-style-type: none"> <li>• Engine OFF.</li> <li>• Turn keyswitch OFF.</li> </ul>		
<b>Action</b>	<b>Specification/Repair</b>	<b>Next Step</b>
Inspect the turbocharger air inlet piping for damage or holes that would allow hot underhood air to enter the turbocharger intake. -	Damage found on the turbocharger air intake piping? <b>YES</b> <b>Repair:</b> Repair the air intake piping.	3A
	Damage found on the turbocharger air intake piping? <b>NO</b>	2C

**STEP 2C: Check the charge-air cooler, clamps, hoses, and piping.**

<b>Condition:</b>		
<ul style="list-style-type: none"> <li>• Engine OFF.</li> <li>• Turn keyswitch OFF.</li> </ul>		
<b>Action</b>	<b>Specification/Repair</b>	<b>Next Step</b>
Check the charge-air-cooler clamps, hoses, and pipes for signs of leaks. Pressure check the charge air cooler.	Loose charge-air cooler connection or malfunctioning charge-air cooler? <b>YES</b> <b>Repair:</b> Repair the charge-air cooler connections or charge-air cooler.	3A
	Loose charge air-cooler connection or malfunctioning charge air-cooler? <b>NO</b>	2D

**STEP 2D: Inspect the turbocharger compressor and turbine blades.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Engine OFF.</li> <li>• Turn keyswitch OFF.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Remove the turbocharger exhaust and intake connections.</p> <p>Inspect the turbocharger turbine and compressor blades for damage.</p> <p>Inspect the turbocharger compressor and turbine blades for damage or wear.</p>	<p>Damage to the turbocharger turbine or compressor blades?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Replace the turbocharger. Use the following procedure in ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418. Refer to Procedure 010-033 in Section 10.</p>	<p>3A</p>
	<p>Damage to the turbocharger turbine or compressor blades?</p> <p><b>NO</b></p>	<p>2E</p>

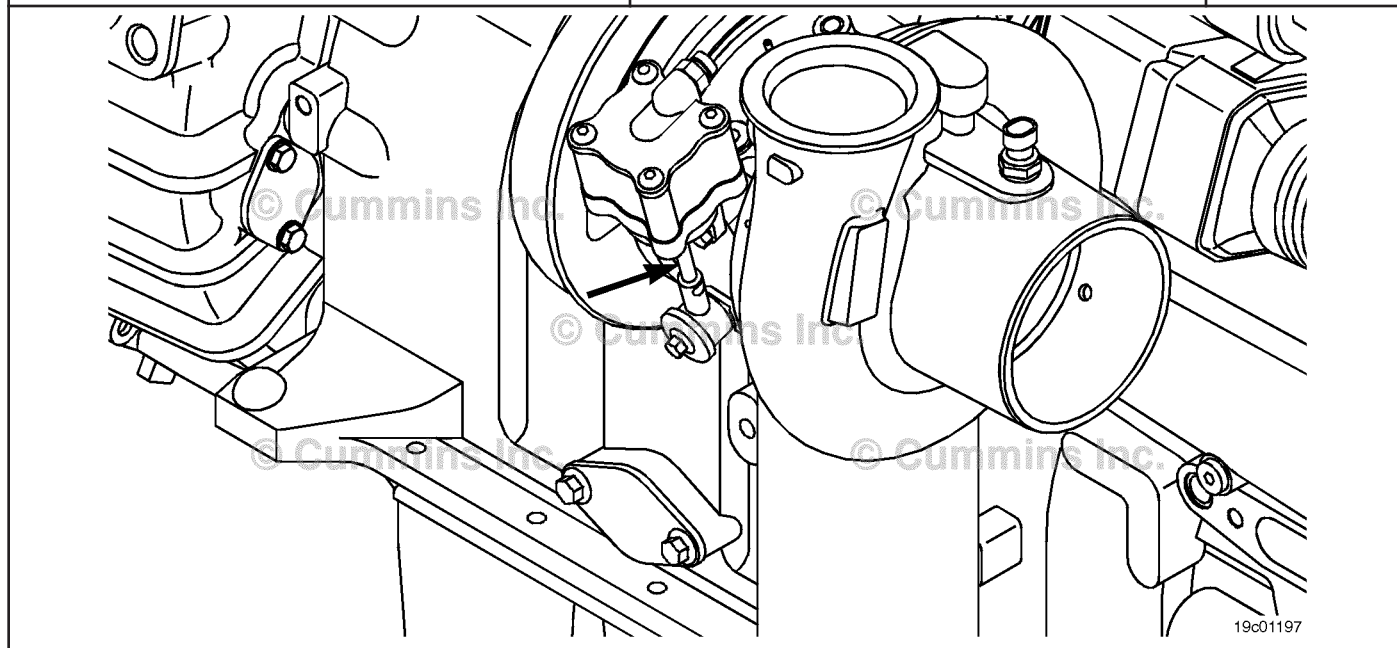


**STEP 2E: Check the variable geometry actuator rod for correct travel.**

**Condition:**

- Engine OFF.
- Turn keyswitch ON.
- Connect the INSITE™ electronic service tool.
- Verify vehicle air tanks are fully charged.

Action	Specification/Repair	Next Step
<p>Use INSITE™ electronic service tool. to start the Turbocharger Actuator Test.</p> <ul style="list-style-type: none"> <li>• Adjust the delay timer in the Turbocharger Actuator Test so the rod movement can be observed.</li> <li>• Select the Retract Actuator position with INSITE™ electronic service tool.</li> <li>• Mark or scribe the Variable Geometry actuator rod at the base of the actuator.</li> <li>• Select the Extend Actuator position with INSITE™ electronic service tool.</li> <li>• Measure the rod travel by measuring the distance from the base of the turbocharger actuator to the scribe mark.</li> </ul> <p>Note: The turbocharger actuator should move quickly and crisply. If the actuator rod movement is slow, there could be a problem with the air supply or mechanical problems with the variable geometry turbocharger assembly.</p>	<p>Does the turbocharger actuator rod extend between 8 and 9 mm [0.32 and 0.36 in]?</p> <p><b>YES</b></p>	<p>2F</p>
	<p>Does the turbocharger actuator rod extend between 8 and 9 mm [0.32 and 0.36 in]?</p> <p><b>NO</b></p>	<p>2E-1</p>



**STEP 2E-1: Check for air leaks and inspect air lines.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Engine OFF.</li> <li>• Turn keyswitch ON.</li> <li>• Connect the INSITE™ electronic service tool.</li> <li>• Verify vehicle air tanks are fully charged.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Use INSITE™ electronic service tool. to perform the Turbocharger Actuator Test.</p> <p>Select the Extend Actuator position. Listen for air leaks at the following components:</p> <ul style="list-style-type: none"> <li>• Turbocharger control valve</li> <li>• Turbocharger control valve inlet connection</li> <li>• Turbocharger control valve outlet connection</li> <li>• Turbocharger actuator inlet connection</li> <li>• Turbocharger actuator</li> <li>• All air lines, including the OEM supply line to turbocharger control valve, and turbocharger control valve to turbocharger actuator.</li> </ul>	<p>Air leaks found in the system?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Repair air leaks.</p>	3A
	<p>Air leaks found in the system?</p> <p><b>NO</b></p>	2E-2

**STEP 2E-2: Check for air pressure at the turbocharger control valve outlet.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Engine OFF.</li> <li>• Turn keyswitch ON.</li> <li>• Connect the INSITE™ electronic service tool.</li> <li>• Verify vehicle air tanks are fully charged.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Remove the air line connection at the outlet of the turbocharger control valve.</p> <p>Install an M12 Compuchek™ fitting at the outlet of the turbocharger control valve.</p> <p>Install an air pressure gauge that is capable of reading at least 1034 kPa [150 psi].</p> <p>Use INSITE™ electronic service tool to perform the Turbocharger Actuator Test. Select the Extend Actuator position.</p>	<p>Is vehicle air tank pressure air pressure present at the turbocharger control valve outlet?</p> <p><b>YES</b></p>	2E-3
	<p>Is vehicle air tank pressure air pressure present at the turbocharger control valve outlet?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Repair the air supply from the OEM air tanks.</p>	3A

**STEP 2E-3: Check for air leaks at the turbocharger control valve outlet.**

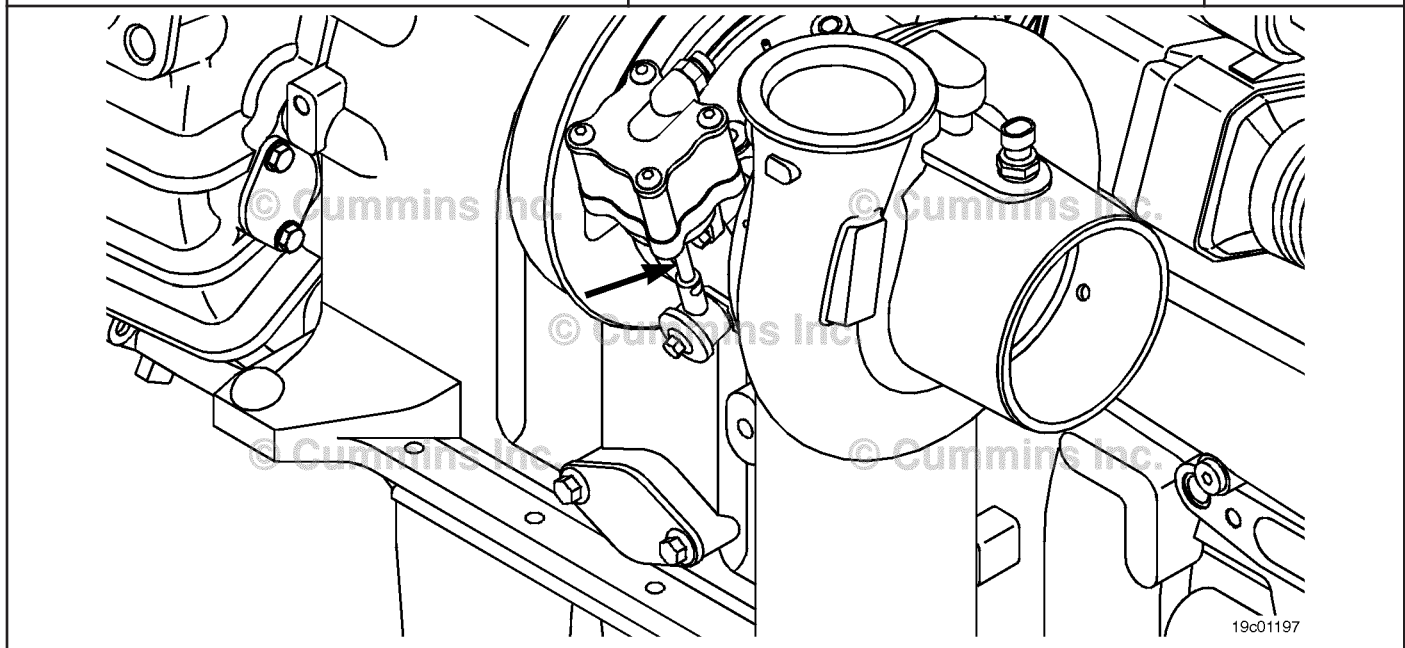
<b>Condition:</b>		
<ul style="list-style-type: none"> <li>• Engine OFF.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> <li>• Verify vehicle air tanks are fully charged.</li> </ul>		
<b>Action</b>	<b>Specification/Repair</b>	<b>Next Step</b>
Use INSITE™ electronic service tool to perform the Turbocharger Actuator Test. <ul style="list-style-type: none"> <li>• Select the Retract Actuator position.</li> <li>• Remove the air line connection at the outlet of the turbocharger control valve.</li> </ul>	Can air be heard escaping from the turbocharger control valve outlet?  <b>YES</b>  <b>Repair:</b> Replace the turbocharger control valve. Refer to Procedure 019-388 in Section 19.	3A
	Can air be heard escaping from the turbocharger control valve outlet?  <b>NO</b>	2E-4

**STEP 2E-4: Check for correct turbocharger actuator travel.**

**Condition:**

- Engine OFF.
- Disconnect the variable geometry actuator rod from the turbocharger cross-shaft.
- Turn keyswitch ON.
- Connect the INSITE™ electronic service tool.
- Verify vehicle air tanks are fully charged.

Action	Specification/Repair	Next Step
Use INSITE™ electronic service tool to perform the Turbocharger Actuator Test. <ul style="list-style-type: none"> <li>• Select the Extend Actuator position.</li> </ul>	Does the turbocharger actuator rod travel at least 12 mm [0.472 in]? <b>YES</b> <b>Repair:</b> Replace the turbocharger. Use the following procedure in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418. Refer to Procedure 010-033 in Section 10.	3A
	Does the turbocharger actuator rod travel at least 12 mm [0.472 in]? <b>NO</b> <b>Repair:</b> Replace the turbocharger actuator. Use the following procedure in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Troubleshooting and Repair Manual, Bulletin 4021418. Refer to Procedure 010-113 in Section 10.	3A



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**STEP 3: Clear the fault codes.**

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

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Connect the INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Disable the fault code.</p> <ul style="list-style-type: none"> <li>• Start the engine and let it idle for one minute.</li> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul> <p>Note: Unless the malfunction is a damaged barometric pressure or intake manifold pressure sensor, this code will most likely <b>not</b> be active with no load in the shop. The engine will most likely need to be loaded to trip this fault code, and to determine if the malfunction has been found and repaired.</p>	<p>Fault Code 2347 inactive? <b>YES</b></p>	3B
	<p>Fault Code 2347 inactive? <b>NO</b></p> <p><b>Repair:</b></p> <p>Return to troubleshooting steps or contact a local Cummins® Authorized Repair Location if all steps have been completed and checked again.</p>	1A

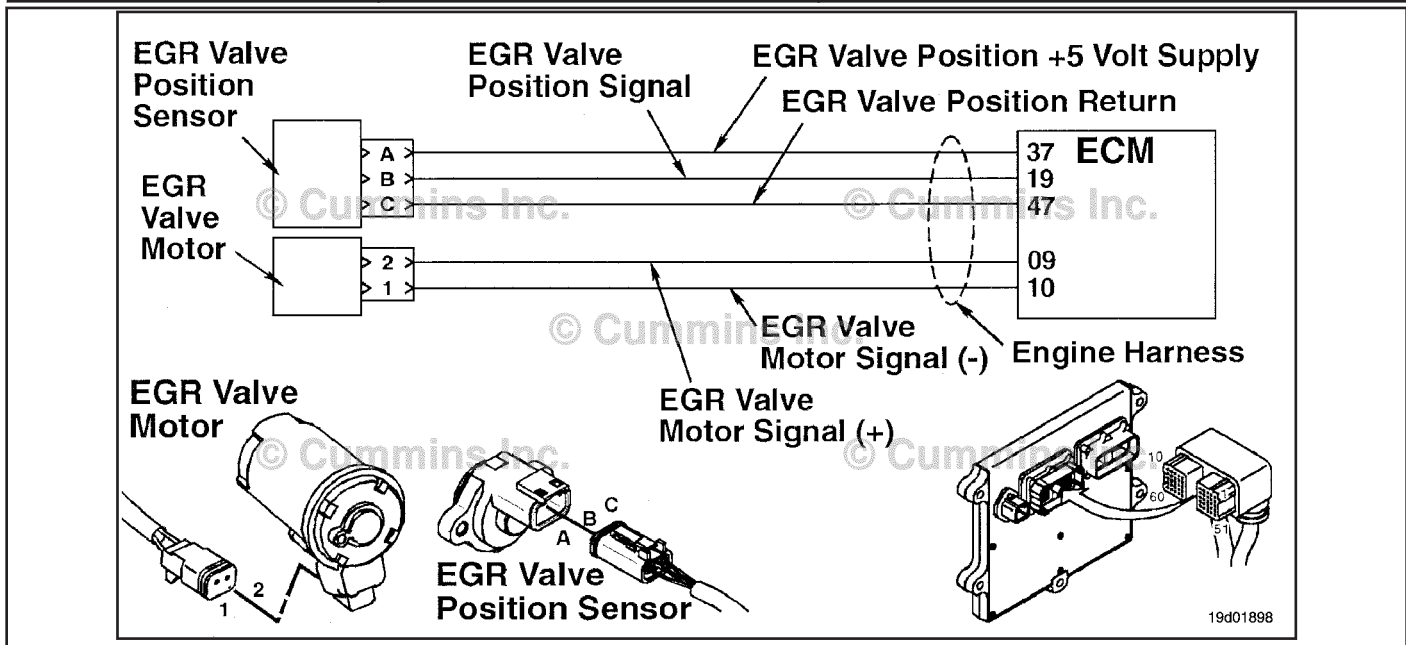
**STEP 3B: Clear the inactive fault codes.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect the INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Clear the inactive fault codes.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to clear the inactive fault codes.</li> </ul>	<p>All fault codes cleared? <b>YES</b></p>	Repair complete
	<p>All fault codes cleared? <b>NO</b></p> <p><b>Repair:</b></p> <p>Troubleshoot any remaining active fault codes.</p>	Appropriate troubleshooting steps

## Fault Code 2348

### EGR Valve Failed Automatic Calibration Procedure

CODES	REASON	EFFECT
Fault Code: 2348 PID(P), SID(S): P027 SPN: 27 FMI: 13/13 Lamp: Amber SRT:	EGR valve failed automatic calibration procedure - out of calibration.	Possible low power. Power will be removed from the EGR valve motor.



EGR Valve Circuit

**Circuit Description:**

The electronic control module (ECM) periodically checks and adjusts the zero position of the EGR valve position sensor when the EGR valve is closed. This self-calibrating feature adjusts for wear and unit-to-unit variation of position sensors and valve assemblies. This fault is logged if the position sensor reading is outside the self-calibration limit.

**Component Location:**

The EGR valve position sensor is located on the EGR valve assembly. The EGR valve assembly is located on the exhaust side of the engine, mounted to the exhaust manifold. Refer to Procedure 100-002 for a detailed component location view.

**Shop Talk:**

A possible cause of this fault could be an EGR valve assembly internal failure causing the EGR valve to **not** close fully.

When troubleshooting inactive counts of this fault code, running the EGR Valve Test in INSITE™ electronic service tool could help identify a stuck EGR valve.

**Refer to Troubleshooting Fault Code t05-2348**

## FAULT CODE 2348 - EGR Valve Failed Automatic Calibration Procedure TROUBLESHOOTING SUMMARY



To reduce the possibility of pin and harness damage, use the following test lead when taking a measurement: Part Number 3822758 - male Deutsch™/AMP™/Metri-Pack™ test lead.

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1: Check the engine harness.</b>		
<b>STEP 1A:</b> Inspect the ECM and engine harness connector pins.	Dirty or damaged pins?	
<b>STEP 1B:</b> Check the EGR valve position sensor signal for a short circuit.	Greater than 100k ohms?	
<b>STEP 2: Check the EGR valve position sensor.</b>		
<b>STEP 2A:</b> Inspect the EGR valve position sensor and harness connector pins.	Dirty or damaged pins?	
<b>STEP 2B:</b> Check the EGR valve position sensor signal voltage.	Less than 0.1 VDC?	
<b>STEP 3: Clear the fault codes.</b>		
<b>STEP 3A:</b> Disable the fault code.	Fault Code 2348 inactive?	
<b>STEP 3B:</b> Clear the inactive fault codes.	All fault codes cleared?	

### TROUBLESHOOTING STEP

**STEP 1: Check the engine harness.**  
**STEP 1A: Inspect the ECM and engine harness connector pins.**

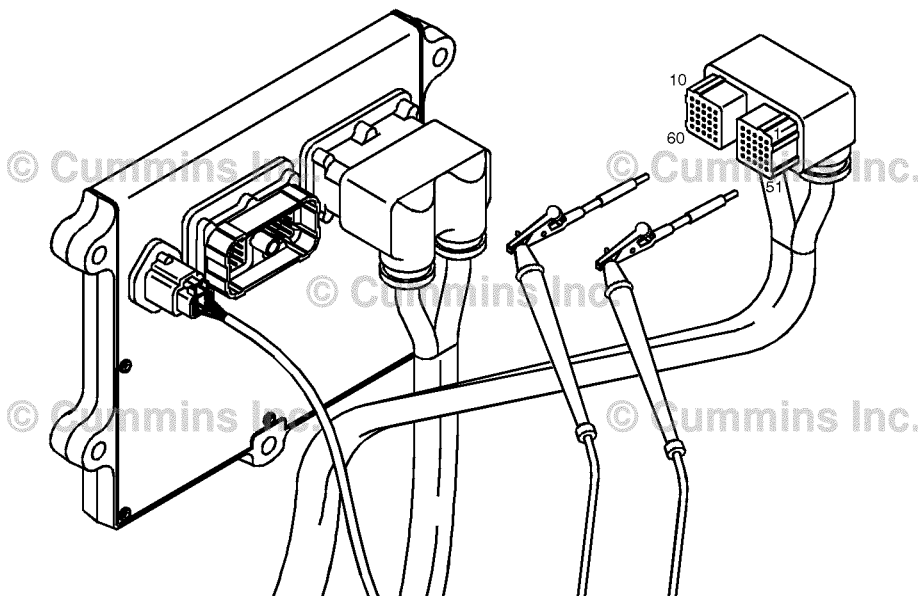
<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the ECM from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
Inspect the ECM and engine harness connector pins for the following: <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.	Dirty or damaged pins? <b>YES</b> <b>Repair:</b> Clean the connector and pins. Repair the damaged harness, connector, or pins if possible.	3A
		Dirty or damaged pins? <b>NO</b>

**STEP 1B: Check the EGR valve position sensor signal for a short circuit.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine harness from the ECM.
- Disconnect the EGR valve position sensor from the engine harness.

Action	Specification/Repair	Next Step
Check for a short circuit in the harness. <ul style="list-style-type: none"> <li>• Measure the resistance between the EGR Valve Position Signal pin at ECM connector of the engine harness and all other pins in the connector.</li> </ul> Refer to the circuit diagram or wiring diagram for connector pin identification. Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.	Greater than 100k ohms? <b>YES</b>	2A
	Greater than 100k ohms? <b>NO</b> <b>Repair:</b> Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.	3A



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**STEP 2: Check the EGR valve position sensor.****STEP 2A: Inspect the EGR valve position sensor and harness connector pins.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>Turn keyswitch OFF.</li> <li>Disconnect the EGR valve position sensor from engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
Inspect the EGR valve position sensor and harness connector pins for the following: <ul style="list-style-type: none"> <li>Loose connector</li> <li>Corroded pins</li> <li>Bent or broken pins</li> <li>Pushed back or expanded pins</li> <li>Moisture in or on the connector</li> <li>Missing or damaged connector seals</li> <li>Dirt or debris in or on the connector pins</li> <li>Connector shell broken</li> <li>Wire insulation damage</li> <li>Damaged connector locking tab.</li> </ul> Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.	Dirty or damaged pins? <b>YES</b> <b>Repair:</b> Clean the connector and pins. Repair the damaged harness, connector, or pins if possible.	3A
	Dirty or damaged pins? <b>NO</b>	2B

**STEP 2B: Check the EGR valve position sensor signal voltage.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>Turn keyswitch OFF.</li> <li>Disconnect the ECM from the engine harness.</li> <li>Turn keyswitch ON.</li> <li>Connect INSITE™ electronic service tool to the SAE J1939 or SAE J1970 OEM datalink connector.</li> </ul>		
Action	Specification/Repair	Next Step
Use INSITE™ electronic service tool Data Logger/Monitor to check the EGR valve position sensor signal voltage.	Less than 0.1 VDC? <b>YES</b> <b>Repair:</b> Replace the EGR valve assembly. Use the following procedure in the Troubleshooting and Repair Manual, ISBe, ISB and QSB5.9 (Common Rail Fuel System) Series, Bulletin 4021271. Refer to Procedure 011-022 in Section 11.	3A
	Less than 0.1 VDC? <b>NO</b> <b>Repair:</b> Replace the ECM. Refer to Procedure 019-031 in Section 19.	3A

**STEP 3: Clear the fault codes.**

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

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Connect the INSITE™ electronic service tool.</li> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> <li>• Start the engine and let it idle for one minute.</li> <li>• Use INSITE™ electronic service tool to verify that the fault code is inactive.</li> </ul>	Fault Code 2348 inactive? <b>YES</b>	3B
	Fault Code 2348 inactive? <b>NO</b>	1A

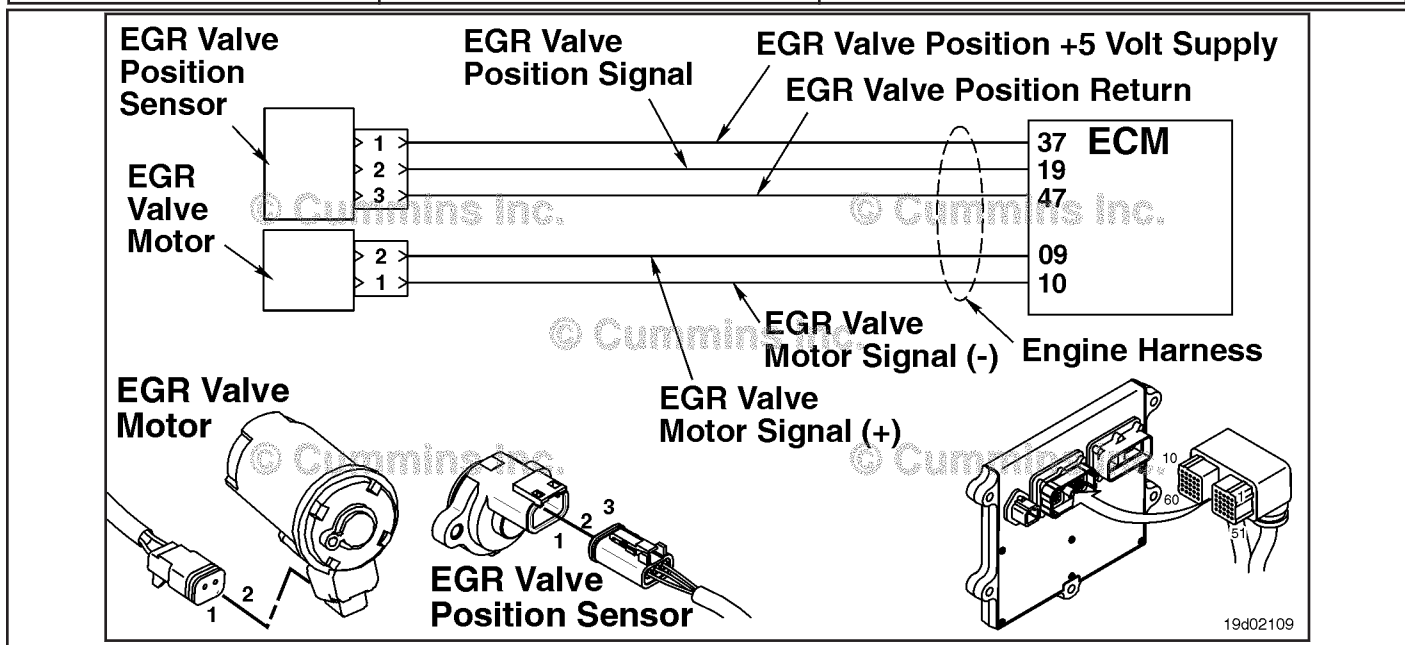
**STEP 3B: Clear the inactive fault codes.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Connect the INSITE™ electronic service tool.</li> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to erase the inactive fault codes.</li> </ul>	All fault codes cleared? <b>YES</b>	Repair complete
	All fault codes cleared? <b>NO</b>	Appropriate troubleshooting steps

## Fault Code 2349

### EGR Valve Control Circuit - Current Below Normal or Open Circuit

CODES	REASON	EFFECT
Fault Code: 2349 PID(P), SID(S): S146 SPN: 2791 FMI: 5/5 Lamp: Amber SRT:	EGR Valve Control Circuit - Current Below Normal or Open Circuit. High voltage or open circuit detected at the EGR valve motor circuit.	Possible low power. Power removed from EGR valve motor.



EGR Valve Control Circuit - Shorted High or Open

#### Circuit Description:

The electronic control module (ECM) controls the EGR valve, opening and closing it based on various operating conditions. The EGR valve is opened and closed by a DC motor that receives voltage from the ECM on the EGR valve motor signal (+) and EGR valve motor signal (-) circuits. To open the valve, the motor receives voltage on the EGR valve motor signal (+) circuit. To close the valve, the motor receives voltage on the EGR valve motor signal (-) circuit.

#### Component Location:

The EGR valve motor is located on the exhaust side of the engine and is attached to the EGR valve assembly, which is mounted on the exhaust manifold. Refer to Procedure 100-002 for a detailed component location view.

#### Shop Talk:

The ECM monitors the voltage level of this circuit and logs a fault code if the voltage level indicates an open circuit or if a short circuit to voltage source is present. This fault is **always** set inactive when the keyswitch is turned on. If the fault condition reoccurs while the keyswitch is in the ON position, the fault code will be set active. Since active faults are set inactive at key "ON," this troubleshooting tree should be used to troubleshoot active and inactive faults. Possible causes of this fault include:

- EGR valve motor output (+) or (-) leads shorted to a voltage source in the engine harness or ECM
- An open circuit in the engine harness, connectors, motor, or ECM.

NOTE: Do **not** supply voltage of any kind to the EGR valve motor. This circuit uses a pulse-width-modulated signal and direct voltage can permanently damage the motor.

**Refer to Troubleshooting Fault Code t05-2349**

## FAULT CODE 2349 - EGR Valve Control Circuit - Current Below Normal or Open Circuit

### TROUBLESHOOTING SUMMARY



To reduce the possibility of pin and harness damage, use the following test leads when taking a measurement: Part Number 3822758 - male Deutsch™/AMP™/Metri-Pack™ test lead and Part Number 3822917 - female Deutsch™/AMP™/Metri-Pack™ test lead.

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1:</b> Check the fault codes.		
<b>STEP 1A:</b> Read the fault codes.	Fault Code 2349 active?	
<b>STEP 2:</b> Check the EGR valve motor and circuit.		
<b>STEP 2A:</b> Inspect the EGR valve motor and connector pins.	Dirty or damaged pins?	
<b>STEP 2B:</b> Check for an open circuit in the EGR valve motor.	Less than 15 ohms?	
<b>STEP 3:</b> Check the engine harness.		
<b>STEP 3A:</b> Inspect the engine harness and ECM connector pins.	Dirty or damaged pins?	
<b>STEP 3B:</b> Check for an open circuit in the engine harness.	Less than 10 ohms?	
<b>STEP 3C:</b> Check for a short circuit from pin to pin in the engine harness.	Greater than 100k ohms?	
<b>STEP 3D:</b> Check for a short circuit to a voltage source in the engine harness.	Less than 1.5 VDC?	
<b>STEP 3E:</b> Check for an inactive fault code.	Fault Code 2349 inactive?	
<b>STEP 4:</b> Clear the fault codes.		
<b>STEP 4A:</b> Disable the fault code.	Fault Code 2349 inactive?	
<b>STEP 4B:</b> Clear the inactive fault codes.	All fault codes cleared?	

## TROUBLESHOOTING STEP

### STEP 1: Check the fault codes.

#### STEP 1A: Read the fault codes.

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for an active fault code. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool, read the fault codes.</li> </ul>	Fault Code 2349 active? <b>YES</b>	2A
	Fault Code 2349 active? <b>NO</b>	Use the following procedure for an inactive or intermittent fault code. Refer to Procedure 019-362 in Section 19.

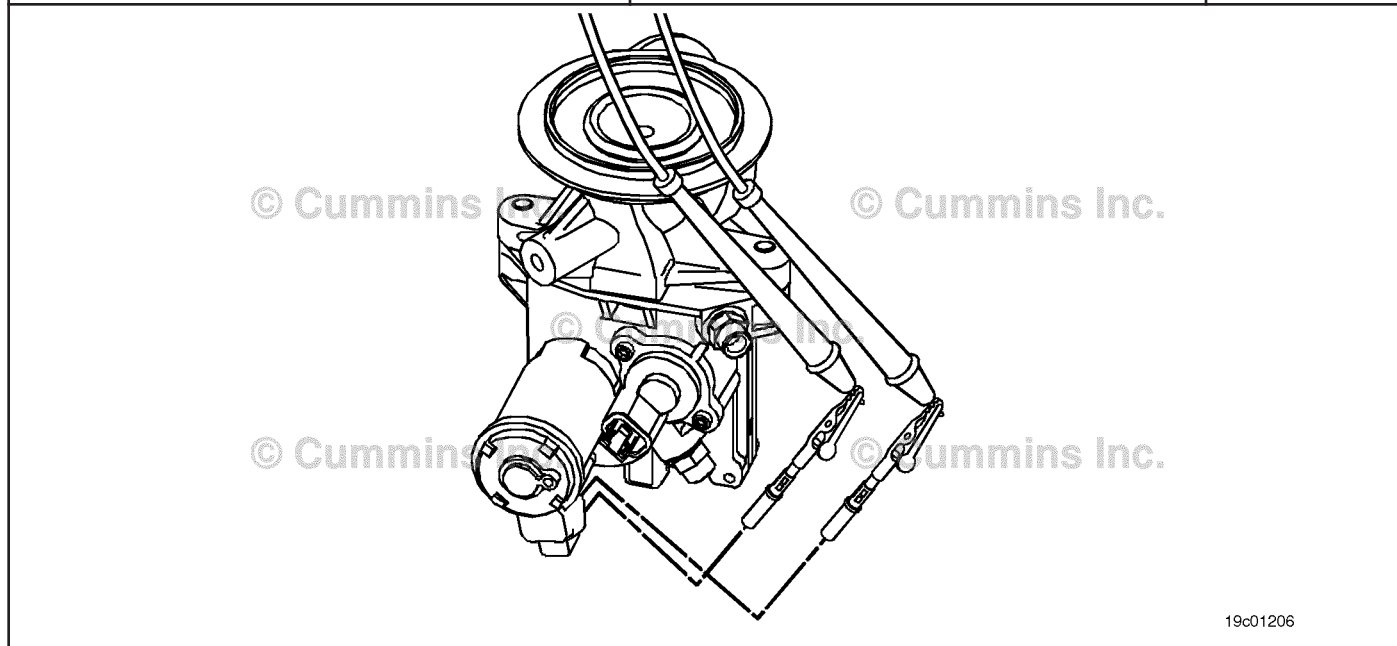
### STEP 2: Check the EGR valve motor and circuit.

#### STEP 2A: Inspect the EGR valve motor and connector pins.

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the EGR valve motor from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
Inspect the engine harness and EGR valve motor connector pins for the following: <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.	Dirty or damaged pins? <b>YES</b> <b>Repair:</b> Clean the connector and pins. Repair the damaged harness, connector, or pins if possible.	4A
	Dirty or damaged pins? <b>NO</b>	2B

**STEP 2B: Check for an open circuit in the EGR valve motor.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the EGR valve motor from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for an open circuit in the EGR valve motor.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the EGR valve motor SIGNAL (+) pin and the EGR valve motor SIGNAL (-) pin at the EGR valve motor connector.</li> </ul> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Less than 15 ohms? <b>YES</b></p>	3A
	<p>Less than 15 ohms? <b>NO</b></p> <p><b>Repair:</b></p> <p>Replace the EGR valve assembly. Use the following procedure in the Troubleshooting and Repair Manual, ISBe, ISB and QSB5.9 (Common Rail Fuel System) Series, Bulletin 4021271. Refer to Procedure 011-022 in Section 11.</p>	4A



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**STEP 3: Check the engine harness.**

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

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the engine harness and ECM connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Clean the connector and pins.</p> <p>Repair the damaged harness, connector, or pins if possible.</p>	4A
	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	3B

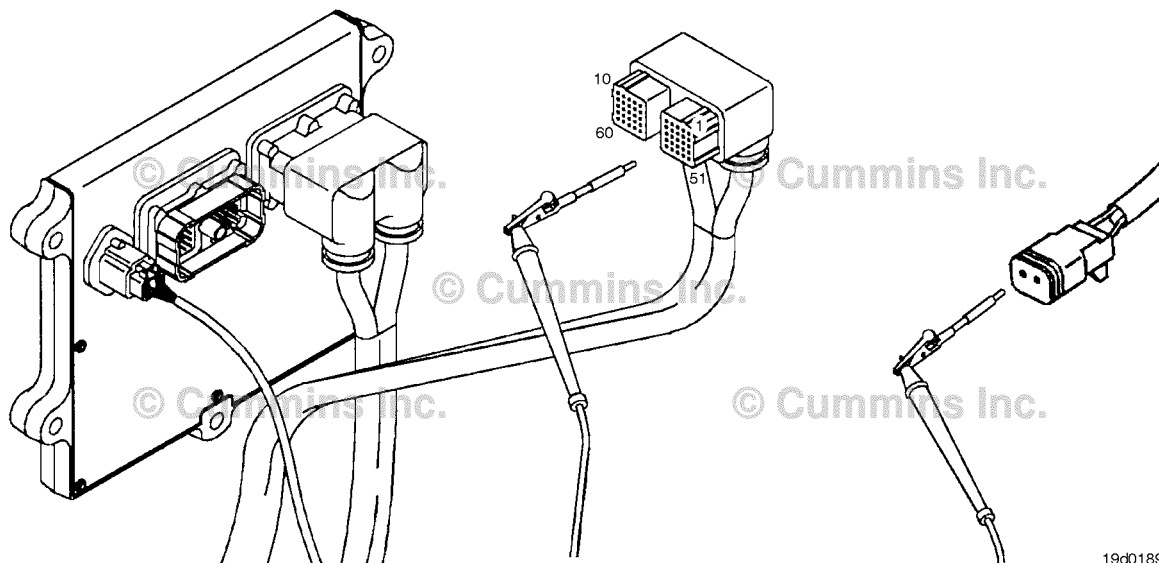


**STEP 3B: Check for an open circuit in the engine harness.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine harness from the ECM.
- Disconnect the engine harness from the EGR valve motor.

Action	Specification/Repair	Next Step
<p>Check for an open circuit in the engine harness.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the EGR valve motor SIGNAL (+) pin at the ECM connector of the engine harness and the EGR valve motor SIGNAL (+) pin at the EGR valve motor connector of the engine harness.</li> <li>• Measure the resistance between the EGR valve motor SIGNAL (-) pin at the ECM connector of the engine harness and the EGR valve motor SIGNAL (-) pin at the EGR valve motor connector of the engine harness.</li> </ul> <p>Refer to the circuit diagram or wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Less than 10 ohms? <b>YES</b></p>	<p>3C</p>
	<p>Less than 10 ohms? <b>NO</b></p> <p><b>Repair:</b> Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.</p>	<p>4A</p>

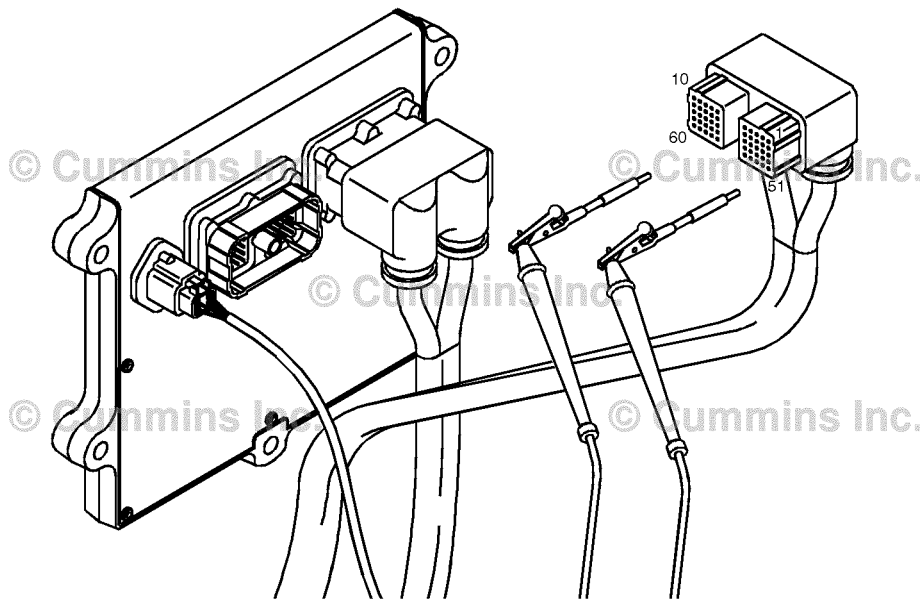


**STEP 3C: Check for a short circuit from pin to pin in the engine harness.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine harness from the ECM.
- Disconnect the engine harness from the EGR valve motor.

Action	Specification/Repair	Next Step
<p>Check for a short circuit from pin to pin.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the EGR valve motor SIGNAL (+) pin at the ECM connector of the engine harness and all other pins at the ECM connector.</li> <li>• Measure the resistance between the EGR valve motor SIGNAL (-) pin at the ECM connector of the engine harness and all other pins at the ECM connector.</li> </ul> <p>Refer to the circuit diagram or wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Greater than 100k ohms? <b>YES</b></p> <hr/> <p>Greater than 100k ohms? <b>NO</b></p> <p><b>Repair:</b> Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.</p>	<p>3D</p> <hr/> <p>4A</p>



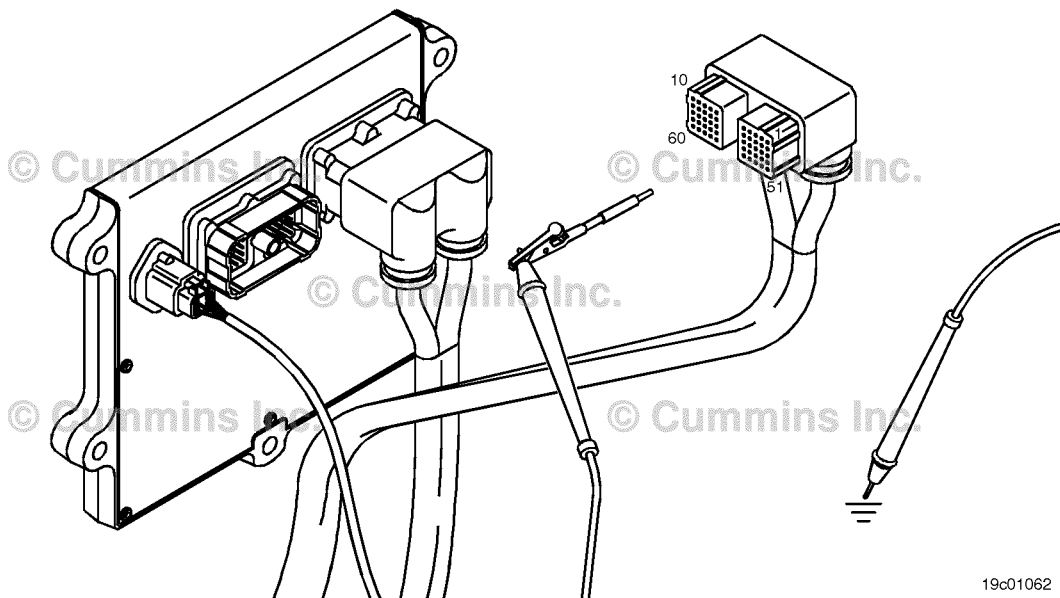
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**STEP 3D: Check for a short circuit to a voltage source in the engine harness.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine harness from the ECM.
- Connect the engine harness to the EGR valve motor.
- Turn keyswitch ON.

Action	Specification/Repair	Next Step
<p>Check for a short circuit to a voltage source in the engine harness.</p> <ul style="list-style-type: none"> <li>• Measure the voltage between the EGR valve motor SIGNAL (+) pin at the ECM connector of the engine harness and engine block ground.</li> <li>• Measure the voltage between the EGR valve motor SIGNAL (-) pin at the ECM connector of the engine harness and engine block ground.</li> </ul> <p>Refer to the circuit diagram or wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p> <p>Use the following procedure for multimeter usage. Refer to Procedure 019-359 in Section 19.</p>	<p>Less than 1.5 VDC? <b>YES</b></p>	<p>3E</p>
	<p>Less than 1.5 VDC? <b>NO</b></p> <p><b>Repair:</b> Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.</p>	<p>4A</p>



19c01062

**STEP 3E: Check for an inactive fault code.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for the appropriate circuit response after 30 seconds. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 2349 inactive? <b>YES</b> <b>Repair:</b> None. The removal and installation of the connector corrected the problem.	4A
	Fault Code 2349 inactive? <b>NO</b> <b>Repair:</b> Replace the ECM. Refer to Procedure 019-031 in Section 19.	4A

**STEP 4: Clear the fault codes.**

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

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Connect INSITE™ electronic service tool.</li> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> <li>• Start the engine and let it idle for one minute.</li> <li>• Use INSITE™ electronic service tool to verify that the fault code is inactive.</li> </ul>	Fault Code 2349 inactive? <b>YES</b>	4B
	Fault Code 2349 inactive? <b>NO</b>	1A

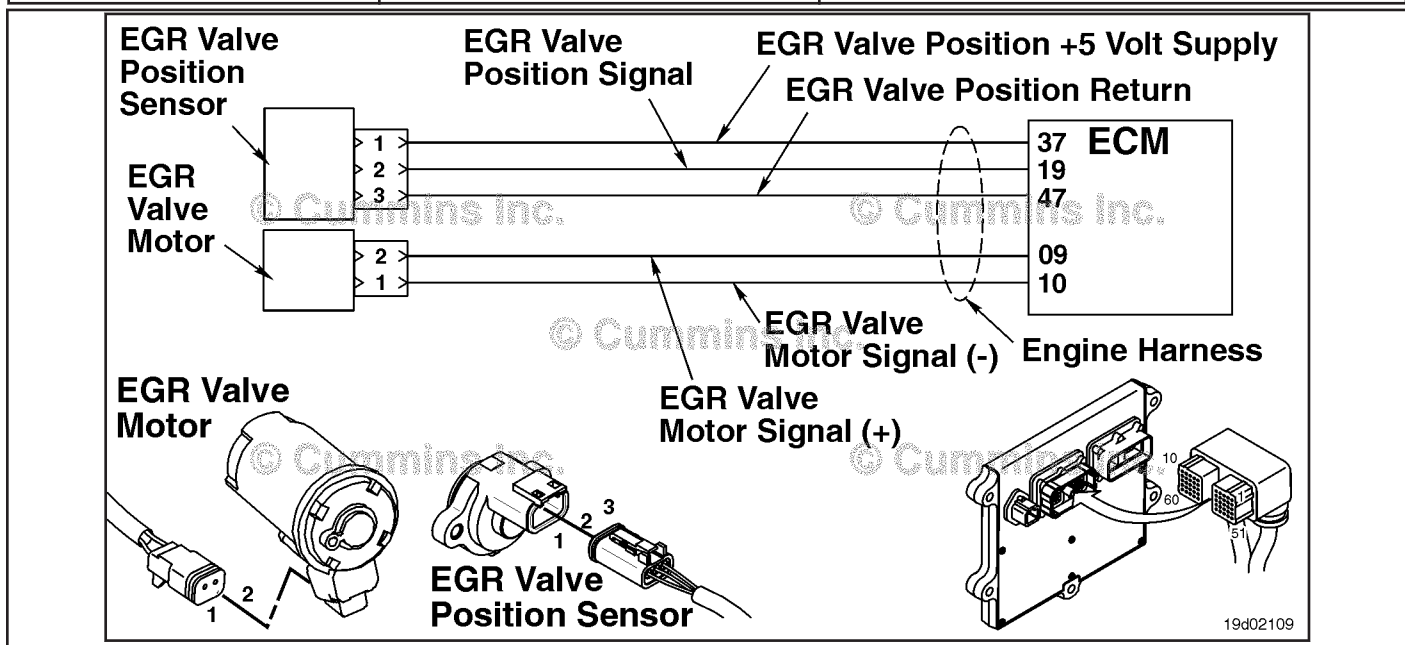
**STEP 4B: Clear the inactive fault codes.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Connect INSITE™ electronic service tool.</li> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to erase the inactive fault codes.</li> </ul>	All fault codes cleared? <b>YES</b>	Repair complete
	All fault codes cleared? <b>NO</b>	Appropriate troubleshooting steps

## Fault Code 2351

### EGR Valve Control Circuit - Voltage Below Normal or Shorted to Low Source

CODES	REASON	EFFECT
Fault Code: 2351 PID(P), SID(S): S146 SPN: 2791 FMI: 4/4 Lamp: Amber SRT:	EGR Valve Control Circuit - Voltage Below Normal or Shorted to Low Source. Low voltage detected at the EGR valve motor circuit.	Possible low power. Power removed from EGR valve motor.



#### Circuit Description:

The electronic control module (ECM) controls the EGR valve, opening and closing it based on various operating conditions. The EGR valve is opened and closed by a DC motor that receives voltage from the ECM on the EGR valve motor signal (+) and (-) circuits. To open the valve, the motor receives voltage on the EGR valve motor signal (+) circuit. To close the valve, the motor receives voltage on the EGR valve motor signal (-) circuit.

#### Component Location:

The EGR valve motor is located on the exhaust side of the engine and is attached to the EGR valve assembly, which is mounted to the exhaust manifold. Refer to Procedure 100-002 for a detailed component location view.

#### Shop Talk:

The ECM monitors the voltage level of the circuit and logs a fault code if the voltage level indicates a short to ground. This fault is always set inactive when the keyswitch is turned ON. If there is a failure of this circuit, the fault code will **not** be set active until the valve has been actuated. For these reasons, this troubleshooting tree **must** be used of both active and inactive fault codes. This also means that the **only** sufficient way for making sure that the repair is effective is to run the INSITE™ EGR Valve Test. Running the engine may **not** be enough to verify that the fix was effective.

A possible cause of this fault is EGR valve motor output (+ or -) leads shorted to ground in the harness, EGR valve motor, or ECM.

#### Refer to Troubleshooting Fault Code t05-2351

## FAULT CODE 2351 - EGR Valve Control Circuit - Voltage Below Normal or Shorted to Low Source

### TROUBLESHOOTING SUMMARY



To reduce the possibility of pin and harness damage, use the following test leads when taking a measurement: Part Number 3822758 - male Deutsch™/AMP™/Metri-Pack™ test lead and Part Number 3822917 - female Deutsch™/AMP™/Metri-Pack™ test lead.

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1: Check the EGR valve motor and circuit.</b>		
<b>STEP 1A:</b> Inspect the EGR valve motor and connector pins.	Dirty or damaged pins?	
<b>STEP 1B:</b> Check for a short circuit to ground in the EGR valve motor.	Greater than 100k ohms?	
<b>STEP 2: Check the engine harness.</b>		
<b>STEP 2A:</b> Inspect the engine harness and ECM connector pins.	Dirty or damaged pins?	
<b>STEP 2B:</b> Check for a short circuit to ground in the engine harness.	Greater than 100k ohms?	
<b>STEP 2C:</b> Check for a short circuit from pin to pin in the engine harness.	Greater than 100k ohms?	
<b>STEP 2D:</b> Check for an inactive fault code.	Fault Code 2351 inactive?	
<b>STEP 3: Clear the fault codes.</b>		
<b>STEP 3A:</b> Disable the fault code.	Fault Code 2351 inactive?	
<b>STEP 3B:</b> Clear the inactive fault codes.	All fault codes cleared?	

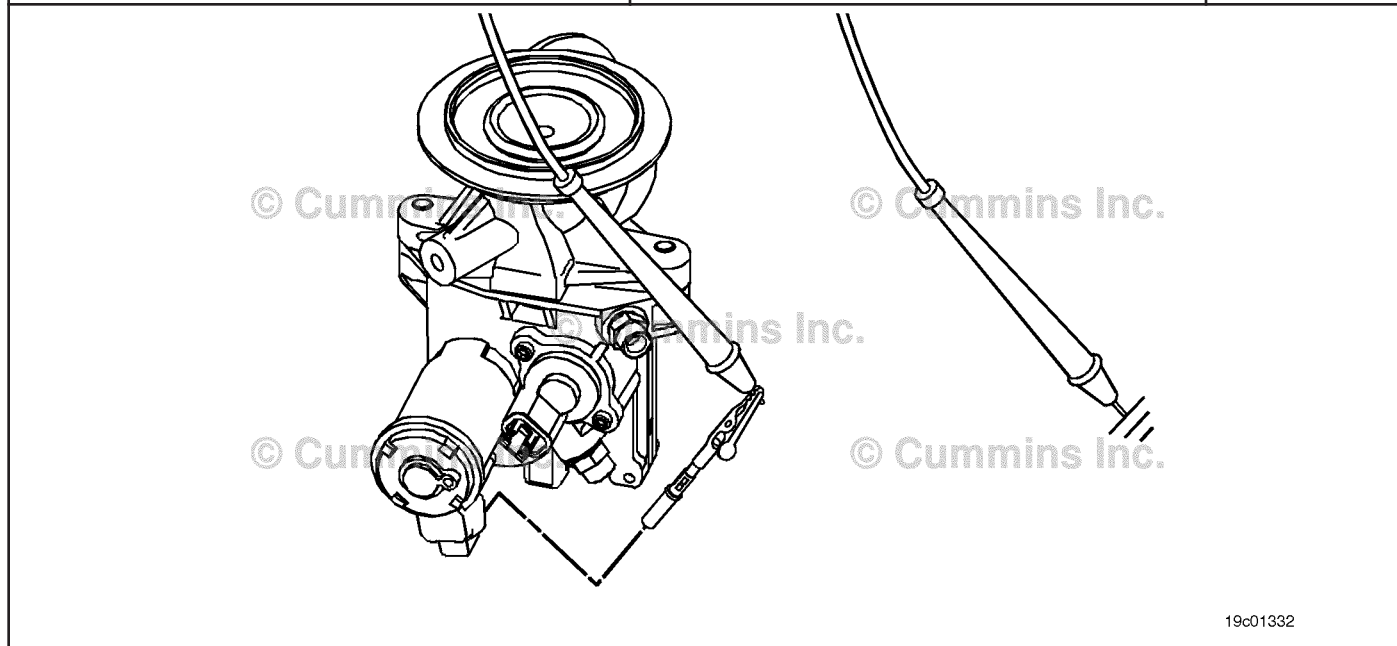
### TROUBLESHOOTING STEP

**STEP 1: Check the EGR valve motor and circuit.**  
**STEP 1A: Inspect the EGR valve motor and connector pins.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the EGR valve motor from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
Inspect the engine harness and EGR valve motor connector pins for the following: <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.	Dirty or damaged pins? <b>YES</b> <b>Repair:</b> Clean the connector and pins. Repair the damaged harness, connector, or pins if possible.	3A
		Dirty or damaged pins? <b>NO</b>

**STEP 1B: Check for a short circuit to ground in the EGR valve motor.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the EGR valve motor from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for a short circuit to ground in the EGR valve motor.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the EGR valve motor SIGNAL (+) pin and engine block ground.</li> <li>• Measure the resistance between the EGR valve motor SIGNAL (-) pin and engine block ground.</li> </ul> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Greater than 100k ohms? <b>YES</b></p>	2A
	<p>Greater than 100k ohms? <b>NO</b></p> <p><b>Repair:</b></p> <p>Replace the EGR valve assembly. Use the following procedure in the Troubleshooting and Repair Manual, ISBe, ISB and QSB5.9 (Common Rail Fuel System) Series, Bulletin 4021271. Refer to Procedure 011-022 in Section 11.</p>	3A



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**STEP 2: Check the engine harness.**

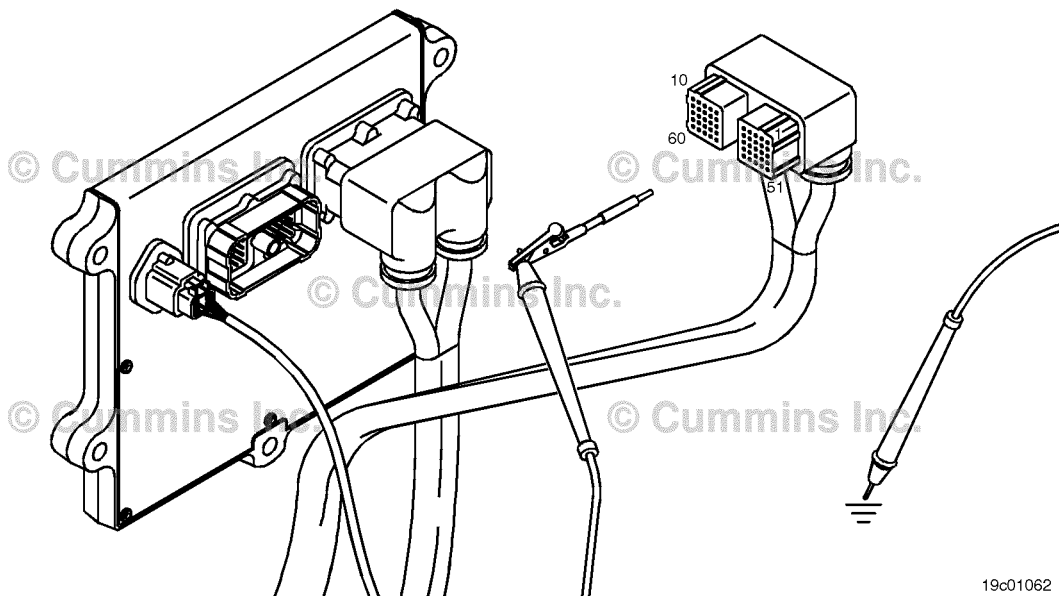
**STEP 2A: Inspect the engine harness and ECM connector pins.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the engine harness and ECM connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Clean the connector and pins.</p> <p>Repair the damaged harness, connector, or pins if possible.</p>	3A
	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	2B



**STEP 2B: Check for a short circuit to ground in the engine harness.**

Action	Specification/Repair	Next Step
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> <li>• Disconnect the engine harness from the EGR valve motor.</li> </ul> <p>Check for a short circuit to ground in the engine harness.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the EGR valve motor SIGNAL (+) pin at the ECM connector of the engine harness and engine block ground.</li> <li>• Measure the resistance between the EGR valve motor SIGNAL (-) pin at the ECM connector of the engine harness and engine block ground.</li> </ul> <p>Refer to the circuit diagram or wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Greater than 100k ohms? <b>YES</b></p>	<p>2C</p>
	<p>Greater than 100k ohms? <b>NO</b></p> <p><b>Repair:</b></p> <p>Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.</p>	<p>3A</p>



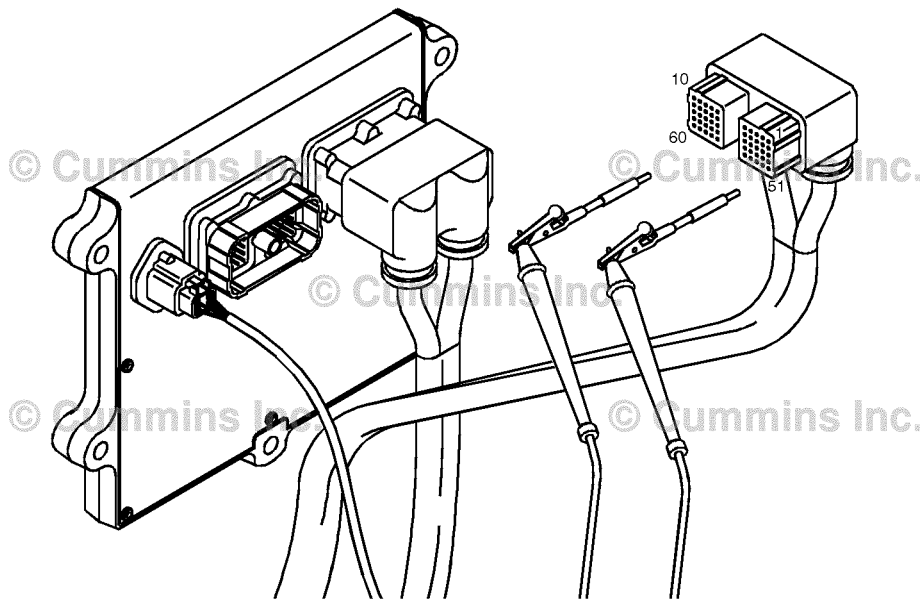
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**STEP 2C: Check for a short circuit from pin to pin in the engine harness.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine harness from the ECM.
- Disconnect the engine harness from the EGR valve motor.

Action	Specification/Repair	Next Step
Check for a short circuit from pin to pin. <ul style="list-style-type: none"> <li>• Measure the resistance between the EGR valve motor SIGNAL (+) pin at the ECM connector of the engine harness and all other pins at the ECM connector.</li> <li>• Measure the resistance between the EGR valve motor SIGNAL (-) pin at the ECM connector of the engine harness and all other pins at the ECM connector.</li> </ul> Refer to the circuit diagram or wiring diagram for connector pin identification. Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.	Greater than 100k ohms? <b>YES</b>	2D
	Greater than 100k ohms? <b>NO</b> <b>Repair:</b> Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.	3A



19c01046

**STEP 2D: Check for an inactive fault code.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate circuit response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault Code 2351 inactive?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>None. The removal and installation of the connector corrected the problem.</p>	3A
	<p>Fault Code 2351 inactive?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Replace the ECM. Refer to Procedure 019-031 in Section 19.</p>	3A

**STEP 3: Clear the fault codes.**

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

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> <li>• Engine coolant temperature above 82°C [180°F].</li> <li>• Engine <b>not</b> running.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Disable the fault code.</p> <p>Perform the INSITE™ electronic service tool EGR Valve Test.</p> <p>NOTE: Be sure to command the valve “open” and “closed”.</p> <p>NOTE: Running the engine to verify the repair was effective is <b>not</b> sufficient. The EGR Valve Test <b>must</b> be run to verify the repair was effective.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to verify that the fault code is inactive.</li> </ul>	<p>Fault Code 2351 inactive?</p> <p><b>YES</b></p>	3B
	<p>Fault Code 2351 inactive?</p> <p><b>NO</b></p>	1A

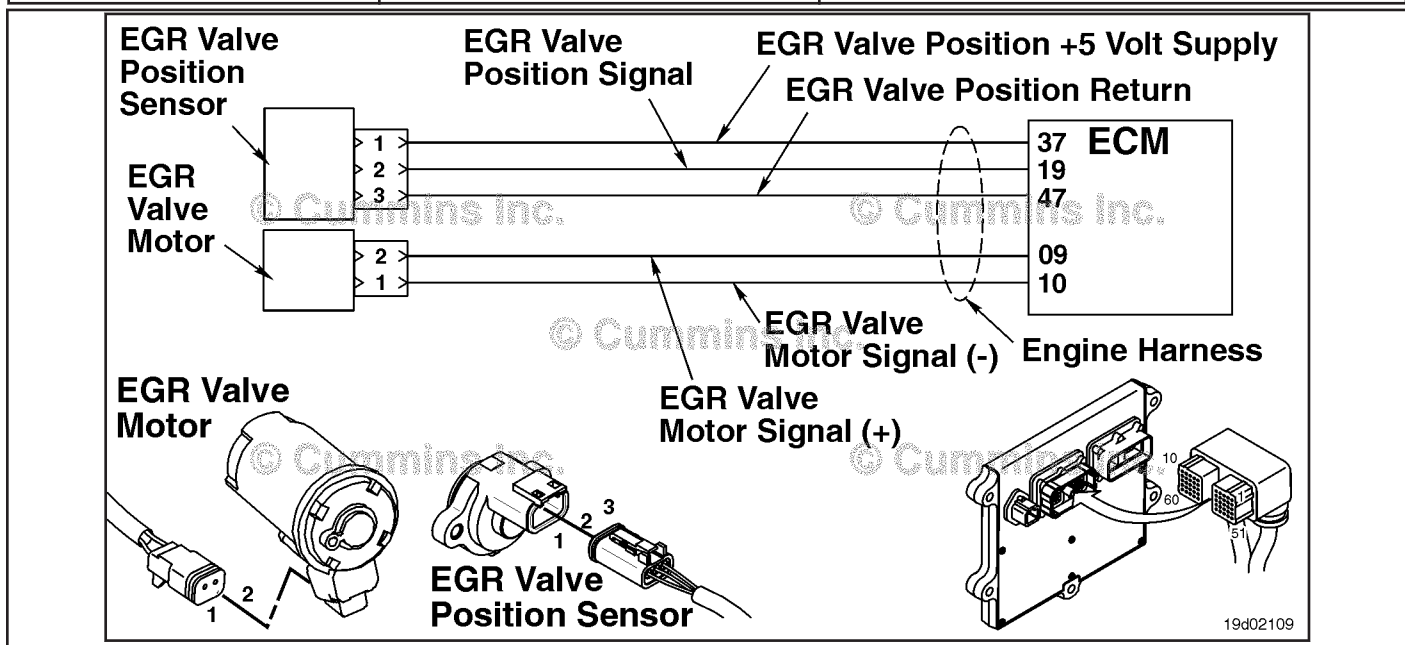
**STEP 3B: Clear the inactive fault codes.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Connect INSITE™ electronic service tool.</li> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Clear the inactive fault codes.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to erase the inactive fault codes.</li> </ul>	<p>All fault codes cleared? <b>YES</b></p>	<p>Repair complete</p>
	<p>All fault codes cleared? <b>NO</b></p>	<p>Appropriate troubleshooting steps</p>

## Fault Code 2352

### EGR Valve Control Circuit - Voltage Above Normal or Shorted to High Source

CODES	REASON	EFFECT
Fault Code: 2352 PID(P), SID(S): S146 SPN: 2791 FMI: 3/3 Lamp: Amber SRT:	EGR Valve Control Circuit - Voltage Above Normal or Shorted to High Source. High voltage detected at the EGR valve motor circuit.	Possible low power. Power will be removed from the EGR valve motor.



EGR Valve Control Circuit

**Circuit Description:**

The electronic control module (ECM) controls the EGR valve, opening and closing it based on various operating conditions. The EGR valve is opened and closed by a DC-motor that receives voltage from the ECM on the EGR valve motor signal (+) and (-) circuits. To open the valve, the motor receives voltage on the EGR valve motor signal (+) circuit. To close the valve, the motor receives voltage on the EGR valve motor signal (-) circuit.

**Component Location:**

The EGR valve motor is located on the exhaust side of the engine and is attached to the EGR valve assembly, which is mounted to the exhaust manifold. Refer to Procedure 100-002 for a detailed component location view.

**Shop Talk:**

The ECM monitors the voltage level of the circuit and logs a fault code if the voltage level indicates a short to ground. This fault is **always** set inactive when the keyswitch is turned ON. If there is a failure of this circuit, the fault code will **not** be set active until the valve has been actuated. For these reasons this troubleshooting tree **must** be used for both active and inactive fault codes. This also means that the **only** sufficient way for making sure that the repair is effective is to run the INSITE™ electronic service tool EGR Valve Test. Running the engine may **not** be enough to verify that the fix was effective.

Possible causes of this fault are that the EGR motor (+ or -) leads could be shorted to a voltage source in the harness or ECM.

**Refer to Troubleshooting Fault Code t05-2352**

## FAULT CODE 2352 - EGR Valve Control Circuit - Voltage Above Normal or Shorted to High Source

### TROUBLESHOOTING SUMMARY



To reduce the possibility of pin and harness damage, use the following test leads when taking a measurement: Part Number 3822758 - male Deutsch™/AMP™/Metri-Pack™ test lead and Part Number 3822917 - female Deutsch™/AMP™/Metri-Pack™ test lead.

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1: Check the engine harness.</b>		
<b>STEP 1A:</b> Inspect the engine harness and ECM connector pins.	Dirty or damaged pins?	
<b>STEP 1B:</b> Check for a short circuit to a voltage source.	Less than 1.5 VDC?	
<b>STEP 1C:</b> Check for a short circuit from pin to pin in the engine harness.	Greater than 100k ohms?	
<b>STEP 1D:</b> Check for an inactive fault code.	Fault Code 2352 inactive?	
<b>STEP 2: Clear the fault codes.</b>		
<b>STEP 2A:</b> Disable the fault code.	Fault Code 2352 inactive?	
<b>STEP 2B:</b> Clear the inactive fault codes.	All fault codes cleared?	

### TROUBLESHOOTING STEP

**STEP 1: Check the engine harness.**  
**STEP 1A: Inspect the engine harness and ECM connector pins.**

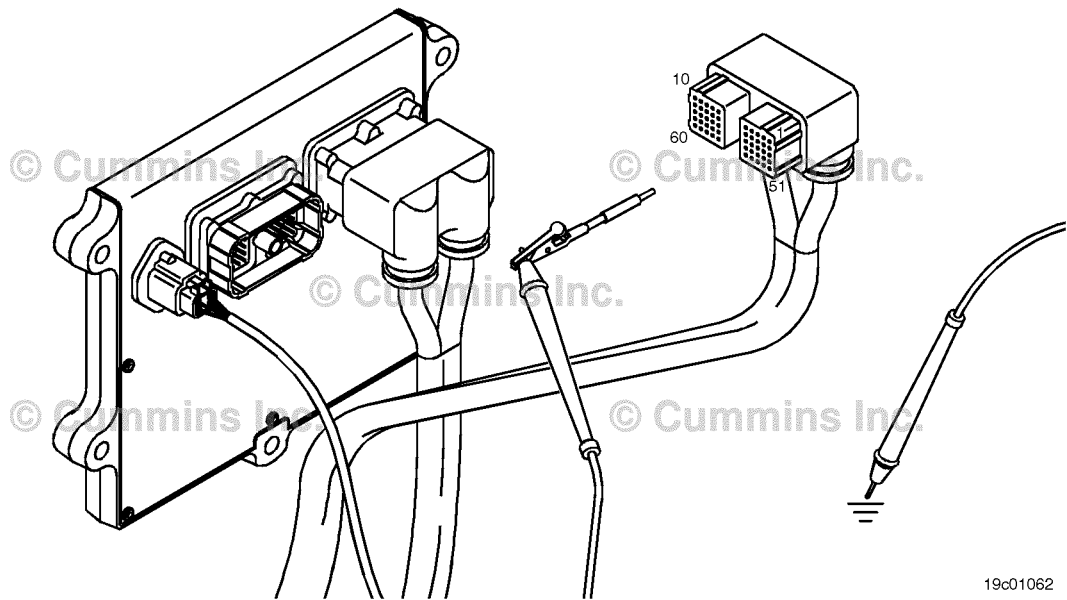
<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> </ul>		
Action	Specification/Repair	Next Step
Inspect the engine harness and ECM connector pins for the following: <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.	Dirty or damaged pins? <b>YES</b> <b>Repair:</b> Clean the connector and pins. Repair the damaged harness, connector, or pins if possible.	2A
		Dirty or damaged pins? <b>NO</b>

**STEP 1B: Check for a short circuit to a voltage source.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine harness from the ECM.
- Connect the engine harness to the EGR valve motor.
- Turn keyswitch ON.

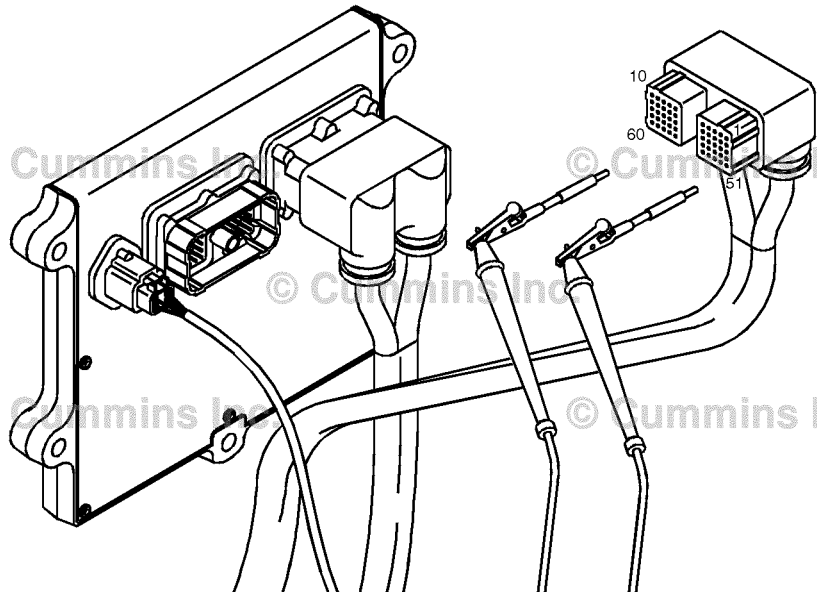
Action	Specification/Repair	Next Step
<p>Check for a short circuit to a voltage source.</p> <ul style="list-style-type: none"> <li>• Measure the voltage between the EGR valve motor SIGNAL (+) pin at the ECM connector of the engine harness and engine block ground.</li> <li>• Measure the voltage between the EGR valve motor SIGNAL (-) pin at the ECM connector of the engine harness and engine block ground.</li> </ul> <p>Refer to the circuit diagram or wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p> <p>Use the following procedure for multimeter usage. Refer to Procedure 019-359 in Section 19.</p>	<p>Less than 1.5 VDC? <b>YES</b></p>	<p>1C</p>
	<p>Less than 1.5 VDC? <b>NO</b></p> <p><b>Repair:</b></p> <p>Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.</p>	<p>2A</p>



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**STEP 1C: Check for a short circuit from pin to pin in the engine harness.**

Action	Specification/Repair	Next Step
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> <li>• Disconnect the engine harness from the EGR valve motor.</li> </ul> <p>Check for a short circuit from pin to pin.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the EGR valve motor SIGNAL (+) pin at the ECM connector of the engine harness and all other pins at the ECM connector.</li> <li>• Measure the resistance between the EGR valve motor SIGNAL (-) pin at the ECM connector of the engine harness and all other pins at the the ECM connector.</li> </ul> <p>Refer to the circuit diagram or wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Greater than 100k ohms? <b>YES</b></p> <p>Greater than 100k ohms? <b>NO</b></p> <p><b>Repair:</b> Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.</p>	<p>1D</p> <p>2A</p>
 <p>The diagram shows a detailed view of an engine harness connector assembly. It features a multi-pin connector with several wires extending from it. Two test leads are connected to the harness: one to pin 10 and another to pin 60. A third test lead is connected to pin 51. The diagram is overlaid with a '© Cummins Inc.' watermark.</p>		

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**STEP 1D: Check for an inactive fault code.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate circuit response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault Code 2352 inactive?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>None. The removal and installation of the connector corrected the problem.</p>	2A
	<p>Fault Code 2352 inactive?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Replace the ECM. Refer to Procedure 019-031 in Section 19.</p>	2A

**STEP 2: Clear the fault codes.**

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

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> <li>• Engine coolant temperature above 82°C [180°F].</li> <li>• Engine <b>not</b> running.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Disable the fault code.</p> <p>Perform the INSITE™ electronic service tool EGR Valve Test.</p> <p>NOTE: Be sure to command the valve “open” and “closed”.</p> <p>NOTE: Running the engine to verify the repair was effective is <b>not</b> sufficient. The EGR Valve Test <b>must</b> be run to verify the repair was effective.</p> <ul style="list-style-type: none"> <li>• Perform the INSITE™ electronic service tool EGR Valve Test.</li> <li>• Use INSITE™ electronic service tool to verify that the fault code is inactive.</li> </ul>	<p>Fault Code 2352 inactive?</p> <p><b>YES</b></p>	2B
	<p>Fault Code 2352 inactive?</p> <p><b>NO</b></p>	1A

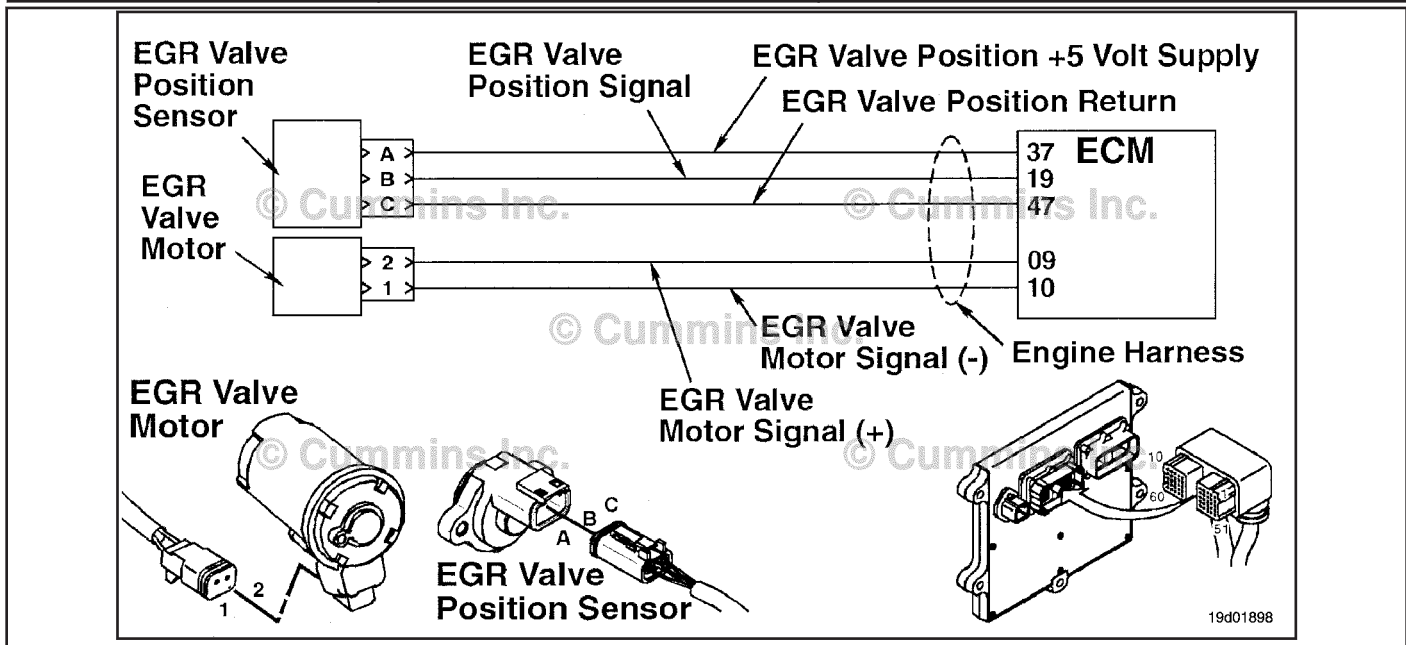
**STEP 2B: Clear the inactive fault codes.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Connect INSITE™ electronic service tool.</li> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Clear the inactive fault codes.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to rase the inactive fault codes.</li> </ul>	<p>All fault codes cleared? <b>YES</b></p>	<p>Repair complete</p>
	<p>All fault codes cleared? <b>NO</b></p>	<p>Appropriate troubleshooting steps</p>

## Fault Code 2353

### EGR Valve Control Circuit - Current Above Normal or Grounded Circuit

CODES	REASON	EFFECT
Fault Code: 2353 PID(P), SID(S): S146 SPN: 2971 FMI: 6/6 Lamp: Amber SRT:	Exhaust Gas Recirculation (EGR) valve control circuit - current above normal or grounded circuit. Excess current detected at the EGR valve motor output circuit.	Possible low power. Power will be removed from the EGR valve motor.



**Circuit Description:**

The Electronic Control Module (ECM) controls the EGR valve, opening and closing it based on various operating conditions. The EGR valve is opened and closed by a DC motor that receives voltage from the ECM on the EGR valve motor SIGNAL (+) and (-) circuits. To open the valve, the motor receives voltage on the EGR valve motor SIGNAL (+) circuit. To close the valve, the motor receives voltage on the EGR valve motor SIGNAL (-) circuit.

**Component Location:**

The EGR valve motor is located on the exhaust side of the engine and is attached to the EGR valve assembly, which is mounted to the exhaust manifold. Refer to Procedure 100-002 for a detailed component view.

**Shop Talk:**

The ECM monitors the current draw of this circuit. If the ECM detects excessive current for a calibrated period of time, it records this fault.

Possible causes of this fault include:

- EGR valve motor (+) or (-) leads shorted together in the engine harness, EGR valve motor, or ECM
- Low EGR valve motor internal resistance.

**Refer to Troubleshooting Fault Code t05-2353**

## FAULT CODE 2353 - EGR Valve Control Circuit - Current Above Normal or Grounded Circuit

### TROUBLESHOOTING SUMMARY



To reduce the possibility of pin and harness damage, use the following test lead when taking a measurement: Part Number 3822758 - male Deutsch™/AMP™/Metri-Pack™ test lead.

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1:</b> Check the fault codes.		
<b>STEP 1A:</b> Check for an active fault code.	Fault Code 2353 active?	
<b>STEP 2:</b> Check the EGR valve motor and circuit.		
<b>STEP 2A:</b> Inspect the engine harness and valve motor connector pins.	Dirty or damaged pins?	
<b>STEP 2B:</b> Check the resistance of the EGR valve motor.	Greater than 0.5 ohms?	
<b>STEP 3:</b> Check the engine harness.		
<b>STEP 3A:</b> Check for a short circuit in the engine harness.	Greater than 100k ohms?	
<b>STEP 4:</b> Check the EGR valve assembly.		
<b>STEP 4A:</b> Perform the INSITE™ electronic service tool EGR Valve Test.	EGR valve position 100 percent when open?	
<b>STEP 4B:</b> Perform the INSITE™ electronic service tool EGR Valve Test.	Is EGR valve position less than 10 percent when closed?	
<b>STEP 5:</b> Clear the fault codes.		
<b>STEP 5A:</b> Disable the fault code.	Fault Code 2353 inactive?	
<b>STEP 5B:</b> Clear the inactive fault codes.	All fault codes cleared?	

## TROUBLESHOOTING STEP

### STEP 1: Check the fault codes.

#### STEP 1A: Check for an active fault code.

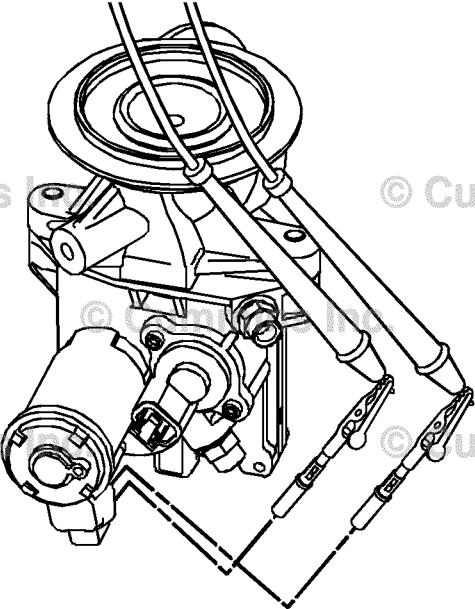
<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for an active fault code. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 2353 active? <b>YES</b>	2A
	Fault Code 2353 active? <b>NO</b>	Use the following procedure for an inactive or intermittent fault code. Refer to Procedure 019-362 in Section 19.

### STEP 2: Check the EGR valve motor and circuit.

#### STEP 2A: Inspect the engine harness and valve motor connector pins.

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the EGR valve motor from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
Inspect the engine harness and valve motor connector pins for the following: <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.	Dirty or damaged pins? <b>YES</b> <b>Repair:</b> Clean the connector and pins. Repair the damaged harness, connector, or pins if possible.	5A
	Dirty or damaged pins? <b>NO</b>	2B

**STEP 2B: Check the resistance of the EGR valve motor.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the EGR valve motor from the engine harness.</li> <li>• Make sure the multimeter is calibrated to zero before taking resistance measurements.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check the resistance of the EGR valve motor.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the EGR valve motor SIGNAL (+) pin and the EGR valve motor SIGNAL (-) pin at the EGR valve motor connector.</li> </ul> <p>Refer to the circuit diagram or wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Greater than 0.5 ohms? <b>YES</b></p> <hr/> <p>Greater than 0.5 ohms? <b>NO</b></p> <p><b>Repair:</b> Replace the EGR valve assembly. Used the following procedure in the ISB<sup>e</sup> and ISB (Common Rail Fuel System) Series Engines Troubleshooting and Repair Manual, Bulletin 4021271. Refer to Procedure 011-022 in Section 11.</p>	<p>3A</p> <hr/> <p>5A</p>
 <p>© Cummins Inc. © Cummins Inc. © Cummins Inc. © Cummins Inc.</p>		
<p>19c01206</p>		

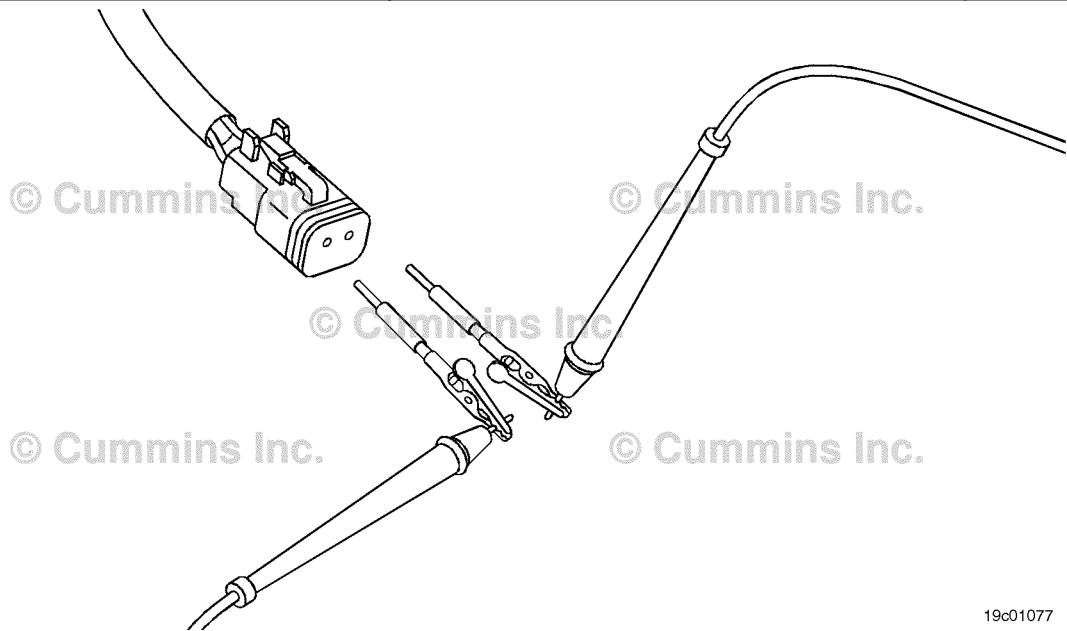
**STEP 3: Check the engine harness.**

**STEP 3A: Check for a short circuit in the engine harness.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the EGR valve motor from the engine harness.
- Disconnect the engine harness from the ECM.

Action	Specification/Repair	Next Step
Check for a short circuit in the engine harness. <ul style="list-style-type: none"> <li>• Measure the resistance between the EGR valve motor SIGNAL (+) pin and the EGR valve motor SIGNAL (-) pin at the EGR valve motor connector of the engine harness.</li> </ul> Refer to the circuit diagram or wiring diagram for connector pin identification. Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.	Greater than 100k ohms? <b>YES</b>	4A
	Greater than 100k ohms? <b>NO</b> <b>Repair:</b> Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.	5A



19c01077



**STEP 4: Check the EGR valve assembly.**

**STEP 4A: Perform the INSITE™ electronic service tool EGR Valve Test.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> <li>• Engine coolant temperature at least 82°C [180°F].</li> </ul>		
Action	Specification/Repair	Next Step
<p>Start the INSITE™ electronic service tool EGR Valve Test.</p> <ul style="list-style-type: none"> <li>• Open the EGR valve.</li> </ul>	<p>EGR valve position 100 percent when open?</p> <p><b>YES</b></p>	4B
	<p>EGR valve position 100 percent when open?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Replace the EGR valve assembly. Use the following procedure in the Troubleshooting and Repair Manual, ISBe, ISB and QSB5.9 (Common Rail Fuel System) Series, Bulletin 4021271. Refer to Procedure 011-022 in Section 11.</p>	5A

**STEP 4B: Perform the INSITE™ electronic service tool EGR Valve Test.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> <li>• Engine coolant temperature at least 82°C [180°F].</li> </ul>		
Action	Specification/Repair	Next Step
<p>Start the INSITE™ electronic service tool EGR Valve Test.</p> <ul style="list-style-type: none"> <li>• Close the EGR valve.</li> </ul>	<p>Is EGR valve position less than 10 percent when closed?</p> <p><b>YES</b></p>	5A
	<p>Is EGR valve position less than 10 percent when closed?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Replace the EGR valve assembly. Use the following procedure in the Troubleshooting and Repair Manual, ISBe, ISB and QSB5.9 (Common Rail Fuel System) Series, Bulletin 4021271. Refer to Procedure 011-022 in Section 11.</p>	5A

**STEP 5: Clear the fault codes.**

**STEP 5A: Disable the fault code.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Connect INSITE™ electronic service tool.</li> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Disable the fault code.</p> <ul style="list-style-type: none"> <li>• Start the engine and let it idle for one minute.</li> <li>• Use INSITE™ electronic service tool to verify fault code is inactive.</li> </ul>	<p>Fault Code 2353 inactive?</p> <p><b>YES</b></p>	5B
	<p>Fault Code 2353 inactive?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Return to the troubleshooting steps or contact a local Cummins® Authorized Repair Location if all steps have been completed and checked again.</p>	1A

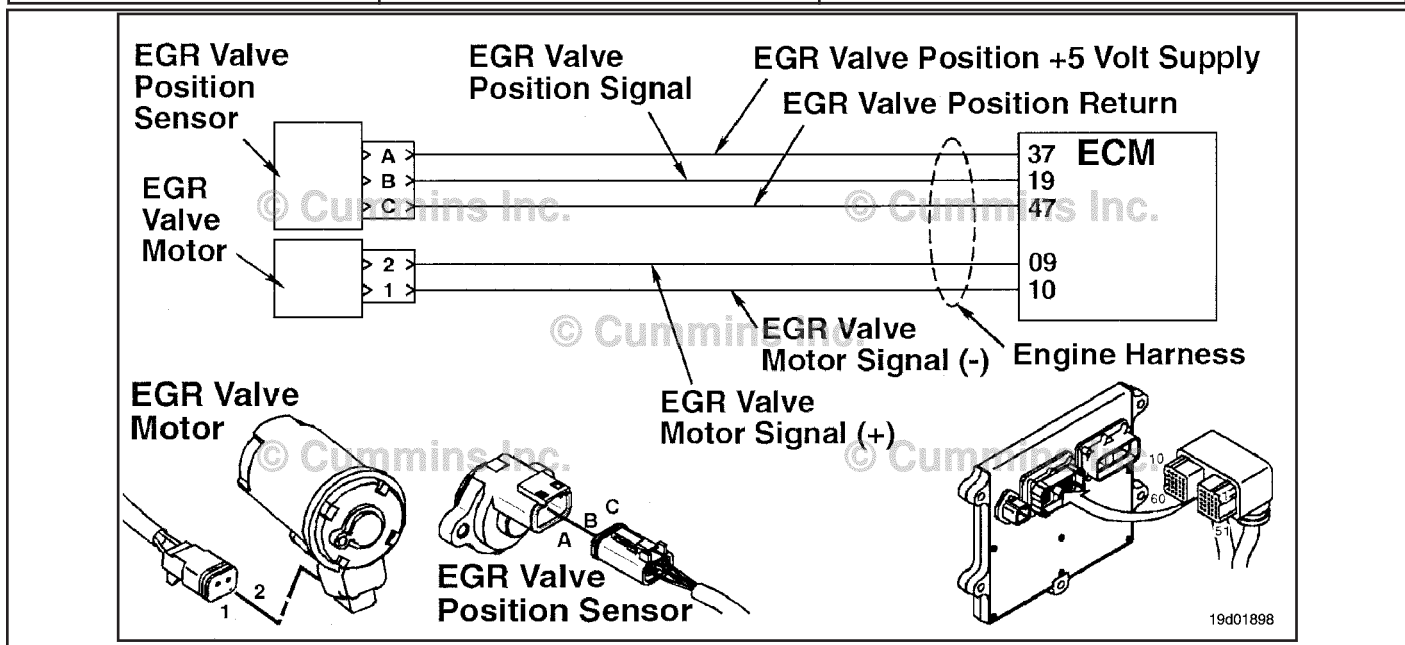
**STEP 5B: Clear the inactive fault codes.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Connect INSITE™ electronic service tool.</li> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Clear the inactive fault codes.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to erase the inactive fault codes.</li> </ul>	<p>All fault codes cleared?</p> <p><b>YES</b></p>	Repair complete
	<p>All fault codes cleared?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Troubleshoot any remaining active fault codes.</p>	Appropriate troubleshooting steps

## Fault Code 2357

### EGR Valve Control - Mechanical System Not Responding Properly or Out of Adjustment

CODES	REASON	EFFECT
Fault Code: 2357 PID(P), SID(S): S146 SPN: 2791 FMI: 7/7 Lamp: Amber SRT:	Exhaust Gas Recirculation (EGR) Valve Control - Mechanical System <b>Not</b> Responding Properly or Out of Adjustment. EGR valve motor does <b>not</b> respond or is slow to respond.	Possible low power. Power will be removed from the EGR valve motor.



EGR Valve Control Circuit

**Circuit Description:**

The electronic control module (ECM) controls the EGR valve, opening and closing it based on various operating conditions. The EGR valve is opened and closed by a DC motor that receives voltage from the ECM on the EGR valve motor SIGNAL (+) circuit. To open the valve, the motor receives voltage on the EGR valve motor SIGNAL (+) circuit. To close the valve, the motor receives voltage on the EGR valve motor SIGNAL (-) circuit.

**Component Location:**

The EGR valve motor is located on the exhaust side of the engine and is attached to the EGR valve assembly, which is mounted to the exhaust manifold. Refer to Procedure 100-002 for a detailed component location view.

**Shop Talk:**

The ECM monitors the duty cycle of the valve and logs a fault code if the duty cycle is too high. This fault is **always** set inactive when the keyswitch is turned ON. If there is a failure, the fault code will **not** be set active until the valve has been actuated. For these reasons, this troubleshooting tree **must** be used for both active and inactive fault codes. This also means the **only** sufficient way to make sure the repair is effective, is to run the INSITE™ EGR Valve Test. Running the engine may **not** be enough to verify the repair was effective.

Possible causes of this fault include:

- Failed EGR valve position sensor; mechanical or electrical failure
- EGR valve assembly failure requiring a high current to operate the valve, such as a stuck or sticking valve.

**Refer to Troubleshooting Fault Code t05-2357**

## FAULT CODE 2357 - EGR Valve Control - Mechanical System Not Responding Properly or Out of Adjustment

### TROUBLESHOOTING SUMMARY

#### ⚠CAUTION⚠

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

#### ⚠CAUTION⚠

To reduce the possibility of pin and harness damage, use the following test lead when taking a measurement: Part Number 3822758 - male Deutsch™/AMP™/Metri-Pack™ test lead.

STEPS	SPECIFICATIONS	SRT CODE
<b><u>STEP 1:</u></b> Check the engine harness.		
<b><u>STEP 1A:</u></b> Inspect the engine harness and ECM connector pins.	Dirty or damaged pins?	
<b><u>STEP 1B:</u></b> Check the EGR valve position sensor signal for a short circuit.	Greater than 100k ohms?	
<b><u>STEP 2:</u></b> Check the ECM.		
<b><u>STEP 2A:</u></b> Check the EGR valve position sensor signal voltage.	Less than 0.1 VDC?	
<b><u>STEP 3:</u></b> Check the EGR valve assembly.		
<b><u>STEP 3A:</u></b> Perform the INSITE™ electronic service tool EGR Valve Test.	EGR valve position 100 percent when open?	
<b><u>STEP 3B:</u></b> Perform the INSITE™ electronic service tool EGR Valve Test.	EGR valve position less than 10 percent when closed?	
<b><u>STEP 4:</u></b> Clear the fault codes.		
<b><u>STEP 4A:</u></b> Disable the fault code.	Fault Code 2357 inactive?	
<b><u>STEP 4B:</u></b> Clear the inactive fault codes.	All fault codes cleared?	

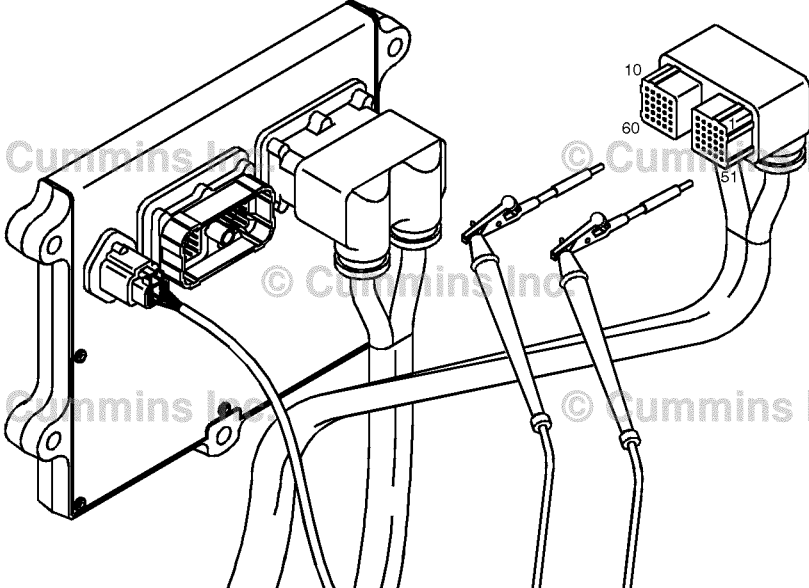
## TROUBLESHOOTING STEP

### STEP 1: Check the engine harness.

#### STEP 1A: Inspect the engine harness and ECM connector pins.

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> </ul>		
Action	Specification/Repair	Next Step
Inspect the engine harness and ECM connector pins for the following: <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.	Dirty or damaged pins? <b>YES</b> <b>Repair:</b> Clean the connector and pins. Repair the damaged harness, connector, or pins if possible.	3A
	Dirty or damaged pins? <b>NO</b>	1B

**STEP 1B: Check the EGR valve position sensor signal for a short circuit.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> <li>• Disconnect the EGR valve position sensor from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for a short circuit in the engine harness.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the EGR valve position SIGNAL pin at the engine harness ECM connector and all other pins in the connector.</li> </ul> <p>Refer to the circuit diagram or wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Greater than 100k ohms? <b>YES</b></p>	<p>2A</p>
	<p>Greater than 100k ohms? <b>NO</b></p> <p><b>Repair:</b></p> <p>Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.</p>	<p>3A</p>
		
<p>19c01046</p>		

**STEP 2: Check the ECM.**

**STEP 2A: Check the EGR valve position sensor signal voltage.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool to the SAE J1939 or SAE J1587 datalink connector.</li> </ul>		
Action	Specification/Repair	Next Step
Use the INSITE™ electronic service tool Data Logger/Monitor, to check the EGR valve position sensor signal voltage.	Less than 0.1 VDC? <b>YES</b>	3A
	Less than 0.1 VDC? <b>NO</b> <b>Repair:</b> Replace the ECM. Refer to Procedure 019-031 in Section 19.	3A

**STEP 3: Check the EGR valve assembly.**

**STEP 3A: Perform the INSITE™ electronic service tool EGR Valve Test.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> <li>• Engine coolant temperature above 82°C [180°F].</li> <li>• Engine <b>not</b> running.</li> </ul>		
Action	Specification/Repair	Next Step
Start the INSITE™ electronic service tool EGR Valve Test. <ul style="list-style-type: none"> <li>• Open the EGR valve.</li> </ul>	EGR valve position 100 percent when open? <b>YES</b>	3B
	EGR valve position 100 percent when open? <b>NO</b> <b>Repair:</b> Replace the EGR valve assembly. Use the following procedure in the Troubleshooting and Repair Manual, ISBe, ISB and QSB5.9 (Common Rail Fuel System) Series, Bulletin 4021271. Refer to Procedure 011-022 in Section 11.	4A



**STEP 3B: Perform the INSITE™ electronic service tool EGR Valve Test.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> <li>• Engine coolant temperature above 82°C [180°F].</li> <li>• Engine <b>not</b> running.</li> </ul>		
Action	Specification/Repair	Next Step
Start the INSITE™ electronic service tool EGR Valve Test. <ul style="list-style-type: none"> <li>• Close the EGR valve.</li> </ul>	EGR valve position less than 10 percent when closed? <b>YES</b>	4A
	EGR valve position less than 10 percent when closed? <b>NO</b> <b>Repair:</b> Replace the EGR valve assembly. Use the following procedure in the Troubleshooting and Repair Manual, ISBe, ISB and QSB5.9 (Common Rail Fuel System) Series, Bulletin 4021271. Refer to Procedure 011-022 in Section 11.	4A

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

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Connect INSITE™ electronic service tool.</li> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> <li>• Start the engine and let it idle for one minute.</li> <li>• Use INSITE™ electronic service tool to verify the fault code is inactive.</li> </ul>	Fault Code 2357 inactive? <b>YES</b>	4B
	Fault Code 2357 inactive? <b>NO</b> <b>Repair:</b> Return to the troubleshooting steps or contact a local Cummins® Authorized Repair Location if all steps have been completed and again.	1A

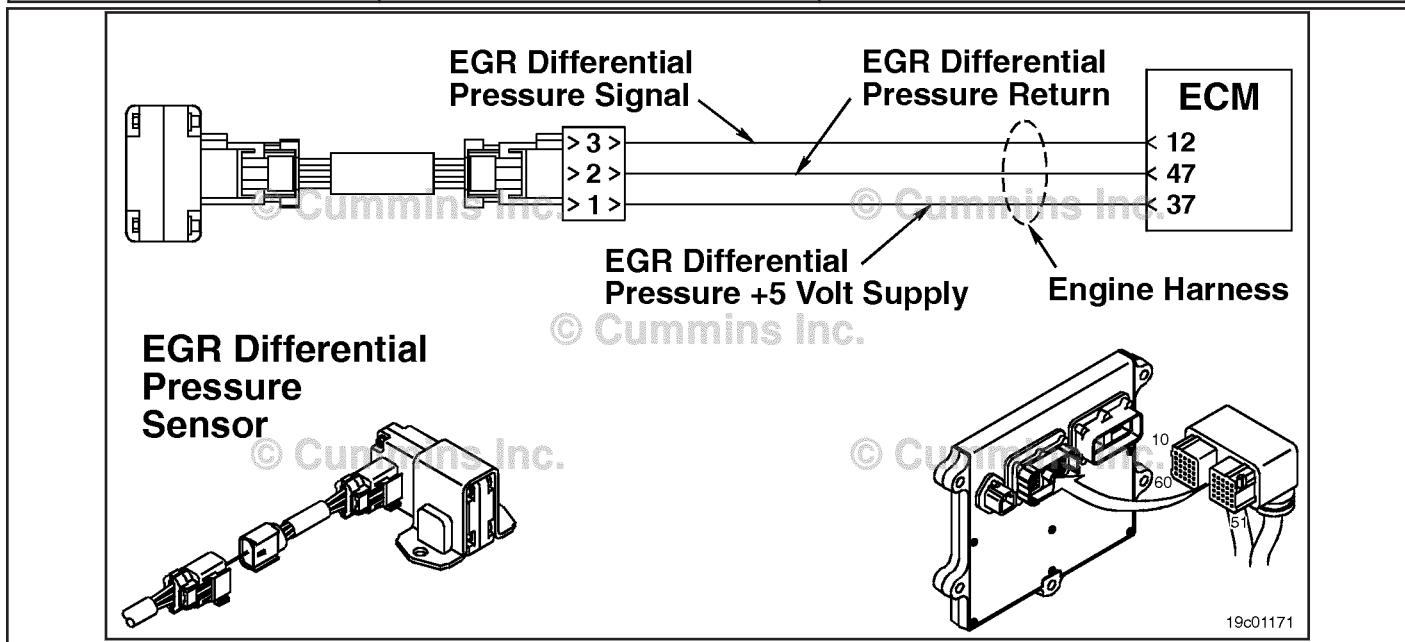
**STEP 4B: Clear the inactive fault codes.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Connect INSITE™ electronic service tool.</li> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Clear the inactive fault codes.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to erase the inactive fault codes.</li> </ul>	<p>All fault codes cleared? <b>YES</b></p>	<p>Repair complete</p>
	<p>All fault codes cleared? <b>NO</b></p> <p><b>Repair:</b></p> <p>Troubleshoot any remaining active fault codes.</p>	<p>Appropriate troubleshooting steps</p>

## Fault Code 2359

### EGR Differential Pressure Sensor - Data Valid But Above Normal Operating Range - Moderately Severe Level

CODES	REASON	EFFECT
Fault Code: 2359 PID(P), SID(S): P411 SPN: 411 FMI: 0/16 Lamp: Amber SRT:	Exhaust Gas Recirculation (EGR) Differential Pressure Sensor - Data Valid but Above Normal Operating Range - Moderately Severe Level. EGR differential pressure sensor failed automatic calibration procedure or EGR differential pressure reading <b>not</b> valid for engine operating conditions.	EGR valve will be closed.



**Circuit Description:**

The Exhaust Gas Recirculation (EGR) differential pressure sensor measures the exhaust gas pressure drop across the EGR differential pressure orifice. This pressure drop is used to calculate the amount of EGR flow into the intake manifold.

**Component Location:**

The EGR differential pressure sensor is mounted on the intake side of the engine on the air intake connection. Refer to Procedure 100-002 in Section E.

Note: The sensor is connected to the engine harness through a short pigtail harness. The pigtail harness is permanently affixed to the sensor. Do **not** try to remove the connector that is attached to the sensor body, or damage to the sensor will result.

**Shop Talk:**

Possible causes of this fault code include:

- A malfunctioning EGR differential pressure sensor

- A plugged or leaking low or high EGR differential pressure drilling
- A stuck open or closed EGR valve
- A damaged EGR connection tube hose
- A leak in the EGR connection tube hoses or tubes
- A damaged variable geometry turbocharger
- A damaged variable geometry actuator.

Note: If Fault Code 2359 is active after a key-cycle and the engine is **not** operating, it will be set inactive **only** if the following conditions are met:

- Engine coolant temperature is greater than 67°C [154°F]
- Intake manifold air temperature is greater than 16°C [60°F]
- Keyswitch transitions from ON to OFF
- EGR differential pressure sensor reading is within a set calibration threshold near zero.

**Refer to Troubleshooting Fault Code t05-2359**

## FAULT CODE 2359 - EGR Differential Pressure Sensor - Data Valid But Above Normal Operating Range - Moderately Severe Level

### TROUBLESHOOTING SUMMARY

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1:</b> Check for additional fault codes.		
<b>STEP 1A:</b> Check for active or inactive fault codes.	Fault Codes 1228, 1229, 2271, 2272, 2273, 2274, 2346, 2347, 2348, 2349, 2351, 2352, 2353, 2357, 2381, 2382, 2383, 2384, 2385, 2386, 2387, 2388, 9121, or 9122 active or inactive with high counts?	
<b>STEP 2:</b> Check the EGR differential pressure.		
<b>STEP 2A:</b> Verify the EGR differential pressure at key ON.	Fault Code 2359 active?	
<b>STEP 2A-1:</b> Check the EGR differential pressure drillings for plugging.	Debris plugging either drilling?	
<b>STEP 2B:</b> Verify the EGR differential pressure at key ON.	Fault Code 2359 active?	
<b>STEP 2C:</b> Verify the EGR differential pressure at key ON.	Fault Code 2359 active?	
<b>STEP 3:</b> Check the EGR differential pressure drillings and mounting surfaces for leaks or plugging debris.		
<b>STEP 3A:</b> Check the EGR differential pressure drillings for leaks.	Leaks detected at the EGR differential pressure sensor mounting surface?	
<b>STEP 3B:</b> Check the EGR differential pressure drillings for plugging.	Debris plugging either drilling?	
<b>STEP 4:</b> Check the air handling system.		
<b>STEP 4A:</b> Inspect the air handling system for intake manifold, charge air cooler, or EGR leaks.	Any leaks detected?	
<b>STEP 4B:</b> Perform the INSITE™ electronic service tool EGR Valve/Turbocharger Operational Test for variable geometry turbocharger.	EGR Valve/Turbocharger Operational Test passed?	
<b>STEP 4C:</b> Perform the Turbocharger Leak Test for wastegate actuated turbocharger.	Turbocharger Leak Test passed?	
<b>STEP 5:</b> Clear the fault codes.		
<b>STEP 5A:</b> Disable the fault code.	Fault Code 2359 inactive?	
<b>STEP 5B:</b> Clear the inactive fault codes.	All fault codes cleared?	
<b>STEP 6:</b> Clear the fault codes.		
<b>STEP 6A:</b> Verify the fault code does not become active under normal operation.	Fault Code 2359 becomes activated during loaded operation?	

**STEP 6B:** Clear the inactive fault codes.

All fault codes cleared?

### TROUBLESHOOTING STEP

**STEP 1: Check for additional fault codes.**

**STEP 1A: Check for active or inactive fault codes.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect INSITE™ electronic service tool.</li> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for active or high counts of inactive fault codes.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault Codes 1228, 1229, 2271, 2272, 2273, 2274, 2346, 2347, 2348, 2349, 2351, 2352, 2353, 2357, 2381, 2382, 2383, 2384, 2385, 2386, 2387, 2388, 9121, or 9122 active or inactive with high counts?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Troubleshoot fault codes starting with the fault code for which there is the highest number of counts.</p>	<p>Appropriate troubleshooting step</p>
	<p>Fault Codes 1228, 1229, 2271, 2272, 2273, 2274, 2346, 2347, 2348, 2349, 2351, 2352, 2353, 2357, 2381, 2382, 2383, 2384, 2385, 2386, 2387, 2388, 9121, or 9122 active or inactive with high counts?</p> <p><b>NO</b></p>	<p>2A</p>

**STEP 2: Check the EGR differential pressure.**

**STEP 2A: Verify the EGR differential pressure at key ON.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect INSITE™ electronic service tool.</li> <li>• Turn keyswitch ON.</li> <li>• Engine <b>not</b> operating.</li> <li>• Exhaust fans disconnected or turned OFF.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Verify the engine coolant temperature is greater than 67°C [154°F] and intake manifold air temperature is greater than 16°C [60°F].</p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF for 30 seconds.</li> </ul> <p>NOTE: The engine <b>must not</b> be operating before the keyswitch is turned OFF. If the engine is operating, turn the keyswitch OFF for 30 seconds, key ON for 30 seconds then back OFF again.</p> <ul style="list-style-type: none"> <li>• Turn keyswitch ON and wait 30 seconds.</li> <li>• Use INSITE™ electronic service tool to check the fault codes.</li> </ul>	<p>Fault Code 2359 active?</p> <p><b>YES</b></p>	<p>2A-1</p>
	<p>Fault Code 2359 active?</p> <p><b>NO</b></p>	<p>3A</p>

**STEP 2A-1: Check the EGR differential pressure drillings for plugging.**

<b>Condition:</b>		
<ul style="list-style-type: none"> <li>Turn Keyswitch OFF.</li> </ul>		
<b>Action</b>	<b>Specification/Repair</b>	<b>Next Step</b>
Remove the EGR differential pressure sensor. <ul style="list-style-type: none"> <li>Inspect the EGR differential pressure drillings for plugging.</li> </ul>	Debris plugging either drilling? <b>YES</b> <b>Repair:</b> Clear the debris. Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 010-080 in Section 10.	2B
	Debris plugging either drilling? <b>NO</b> <b>Repair:</b> Replace the EGR differential pressure sensor. Refer to Procedure 019-370 in Section 19.	5A

**STEP 2B: Verify the EGR differential pressure at key ON.**

<b>Condition:</b>		
<ul style="list-style-type: none"> <li>Connect all componets</li> <li>Connect INSITE™ electronic service tool.</li> <li>Turn keyswitch ON.</li> <li>Engine <b>not</b> operating.</li> <li>Exhaust fans disconnected or turned OFF.</li> </ul>		
<b>Action</b>	<b>Specification/Repair</b>	<b>Next Step</b>
Verify the engine coolant temperature is greater than 67°C [154°F] and intake manifold air temperature is greater than 16°C [60°F]. <ul style="list-style-type: none"> <li>Turn keyswitch OFF for 30 seconds.</li> </ul> NOTE: The engine <b>must not</b> be operating before the keyswitch is turned OFF. If the engine is operating, turn the keyswitch OFF for 30 seconds, key ON for 30 seconds then back OFF again. <ul style="list-style-type: none"> <li>Turn keyswitch ON and wait 30 seconds.</li> <li>Use INSITE™ electronic service tool to check the fault codes.</li> </ul>	Fault Code 2359 active? <b>YES</b> <b>Repair:</b> Replace the EGR differential pressure sensor. Refer to Procedure Procedure 019-370 in Section 19.	2C
	Fault Code 2359 active? <b>NO</b>	5B

**STEP 2C: Verify the EGR differential pressure at key ON.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all componets</li> <li>• Connect INSITE™ electronic service tool.</li> <li>• Turn keyswitch ON.</li> <li>• Engine <b>not</b> operating.</li> <li>• Exhaust fans disconnected or turned OFF.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Verify the engine coolant temperature is greater than 67°C [154°F] and intake manifold air temperature is greater than 16°C [60°F].</p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF for 30 seconds.</li> </ul> <p>NOTE: The engine <b>must not</b> be operating before the keyswitch is turned OFF. If the engine is operating, turn the keyswitch OFF for 30 seconds, key ON for 30 seconds then back OFF again.</p> <ul style="list-style-type: none"> <li>• Turn keyswitch ON and wait 30 seconds.</li> <li>• Use INSITE™ electronic service tool to check the fault codes.</li> </ul>	<p>Fault Code 2359 active?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Replace the air intake connection.</p>	5A
	<p>Fault Code 2359 active?</p> <p><b>NO</b></p>	5B

**STEP 3: Check the EGR differential pressure drillings and mounting surfaces for leaks or debris plugging.**

**STEP 3A: Check the EGR differential pressure drillings for leaks.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the EGR differential pressure sensor mounting surface for leaks.</p> <ul style="list-style-type: none"> <li>• Leaks should be easily detected by traces of soot.</li> </ul>	<p>Leaks detected at the EGR differential pressure sensor mounting surface?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Inspect the mounting surface and the EGR differential pressure sensor for the source of the leakage.</p> <p>Repair or replace the suspect components.</p>	6A
	<p>Leaks detected at the EGR differential pressure sensor mounting surface?</p> <p><b>NO</b></p>	3B



**STEP 3B: Check the EGR differential pressure drillings for plugging.**

<b>Condition:</b> • Turn keyswitch OFF.		
Action	Specification/Repair	Next Step
Remove the EGR differential pressure sensor. • Inspect the EGR differential pressure drillings for plugging.	Debris plugging either drilling? <b>YES</b> <b>Repair:</b> Clear the debris. Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 010-080 in Section 10.	2C
	Debris plugging either drilling? <b>NO</b>	4A

**STEP 4: Check the air handling system.**

**STEP 4A: Inspect the air handling system for intake manifold, charge-air cooler, or EGR leaks.**

<b>Condition:</b> • Turn keyswitch OFF.		
Action	Specification/Repair	Next Step
Inspect the air handling system for intake manifold, charge air cooler, or EGR leaks. Inspect the following for leaks: • Charge-air cooler - Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 010-027 in Section 10. • Air intake and exhaust - Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 010-024 in Section 10. • EGR connection tubes and hoses.	Any leaks detected? <b>YES</b> <b>Repair:</b> Repair leaks.	6A
	Any leaks detected? <b>NO</b>	Variable geometry turbocharger: 4B; Wastegate actuated turbocharger: 4C

**STEP 4B: Perform the INSITE™ electronic service tool EGR Valve/Turbocharger Operational Test for variable geometry turbocharger.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect the INSITE™ electronic service tool EGR Valve/Turbocharger Operational Test.</li> <li>• Start the engine and run at low idle.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Select the EGR/VGT Operational Test using the INSITE™ electronic service tool.</p> <ul style="list-style-type: none"> <li>• Choose All Components under Test Choices.</li> </ul>	<p>EGR Valve/Turbocharger Operational Test passed?</p> <p><b>YES</b></p>	6A
	<p>EGR Valve/Turbocharger Operational Test passed?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Repair or replace the suspect component. Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 011-022 in Section 11.</p>	6A

**STEP 4C: Perform the Turbocharger Leak Test for wastegate actuated turbocharger.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Perform the Turbocharger Leak Test for wastegate actuated turbocharger.</p> <ul style="list-style-type: none"> <li>• Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 010-050 in Section 10.</li> </ul>	<p>Turbocharger Leak Test passed?</p> <p><b>YES</b></p>	6A
	<p>Turbocharger Leak Test passed?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Repair or replace the suspect component. Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 010-033 in Section 10.</p>	6A

**STEP 5: Clear the fault codes.**

**STEP 5A: Disable the fault code.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Connect INSITE™ electronic service tool.</li> <li>• Turn keyswitch ON.</li> <li>• Engine coolant temperature is above 67°C [154°F].</li> <li>• Intake manifold air temperature is above 16°C [60°F].</li> <li>• Engine <b>not</b> operating.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Use INSITE™ electronic service tool to verify the engine coolant temperature is greater than 67°C [154°F] and the intake manifold air temperature is greater than 16°C [60°F].</p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF for 30 seconds.</li> <li>• Turn keyswitch ON.</li> <li>• Check the fault codes.</li> </ul>	<p>Fault Code 2359 inactive? <b>YES</b></p>	5B
	<p>Fault Code 2359 inactive? <b>NO</b></p> <p><b>Repair:</b> Return to the troubleshooting steps or contact a Cummins® Authorized Repair Location if all steps have been completed and checked again.</p>	1A

**STEP 5B: Clear the inactive fault codes.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Clear the inactive fault codes.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to erase the inactive fault codes.</li> </ul>	<p>All fault codes cleared? <b>YES</b></p>	Repair complete
	<p>All fault codes cleared? <b>NO</b></p> <p><b>Repair:</b> Troubleshoot any remaining active fault codes.</p>	Appropriate troubleshooting steps

**STEP 6: Clear the fault codes.**

**STEP 6A: Verify the fault code does not become active under normal operation.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Interview the driver to determine under what conditions and load the truck was being driven when this fault occurred. Try to duplicate those conditions to verify the fault does not become active.</p> <p>Run the engine under the same conditions and load identified by the driver and verify Fault Code 2359 does <b>not</b> become activated.</p> <p>Note: Certain malfunctions will cause Fault Code 2359 to be activated during normal operation and force the fault code to go inactive at key ON. This step is required to verify the correct component has been repaired or replaced.</p>	<p>Fault Code 2359 becomes activated during loaded operation?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Return to the troubleshooting steps or contact a Cummins® Authorized Repair Location if all steps have been completed and checked again.</p>	1A
	<p>Fault Code 2359 becomes activated during loaded operation?</p> <p><b>NO</b></p>	6B

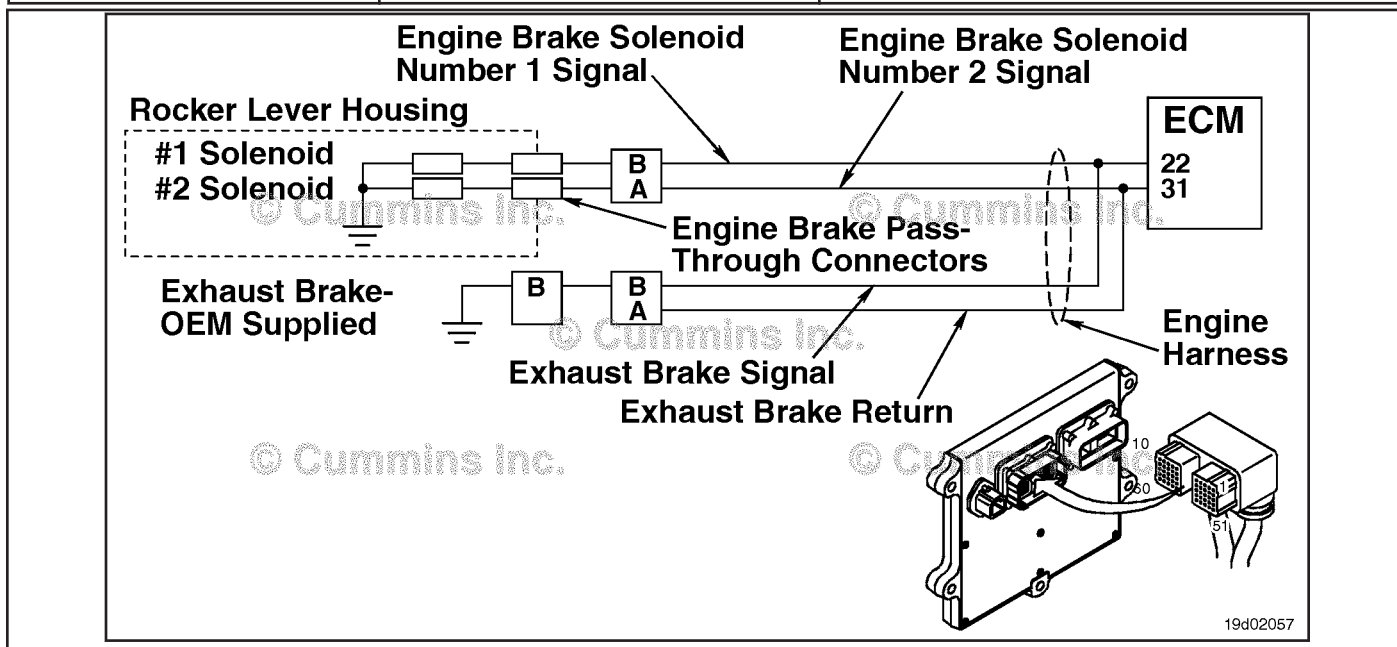
**STEP 6B: Clear the inactive fault codes.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Clear the inactive fault codes.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to clear the inactive fault codes.</li> </ul>	<p>All fault codes cleared?</p> <p><b>YES</b></p>	Repair complete
	<p>All fault codes cleared?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Troubleshoot any remaining active fault codes.</p>	Appropriate troubleshooting steps

## Fault Code 2362

### Engine Brake Actuator Circuit #1 - Voltage Below Normal or Shorted to Low Source

CODES	REASON	EFFECT
Fault Code: 2362 PID(P), SID(S): S028 SPN: 1072 FMI: 4 Lamp: Amber SRT:	Engine Brake Actuator Circuit #1 - Voltage Below Normal or Shorted to Low Source. Low voltage detected at the engine brake solenoid number 1 signal circuit.	Engine brake on cylinders 1,2, and 3 can <b>not</b> be activated or exhaust brake will <b>not</b> operate.



Engine Brake Circuit

#### Circuit Description:

This circuit can be used to control either an exhaust brake or an engine brake depending on the application. The ECM controls engine brakes on cylinders 1, 2, and 3 by sending a signal on the engine brake solenoid number 1 signal circuit. If an exhaust brake is installed, the exhaust brake is driven by the engine brake solenoid number 1 signal line. A 2-pin Weather Pack connector is located near the number 3 injector pass-through connector at the back of the engine. If an engine brake is installed, there will be a jumper harness from this connector to the engine brake pass-through connectors on the rocker lever housing. If an exhaust brake is installed, the OEM will connect one wire to the 2-pin Weather Pack connector for the exhaust brake relay.

#### Component Location:

The engine brake solenoids are located under the valve cover. The engine brake solenoids are controlled through the engine harness from the ECM. The exhaust brake is an optional feature that is mounted in the exhaust system by the OEM.

#### Shop Talk:

Possible causes of this fault code include a short circuit to ground in the engine harness, connector, or engine brake solenoids.

#### Refer to Troubleshooting Fault Code t05-2362

FAULT CODE 2362 - Engine Brake Actuator Circuit #1 - Voltage Below Normal or Shorted to Low Source
TROUBLESHOOTING SUMMARY



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



To reduce the possibility of pin and harness damage, use the following test leads when taking a measurement: Part Number 3822758 - male Deutsch™/AMP™/Metri-Pack™ test lead, Part Number 3822917 - female Deutsch™/AMP™/Metri-Pack™ test lead, Part Number 3823995 - male Weather-Pack™ test lead, and Part Number 3823996 - female Weather-Pack™ test lead.

Table with 3 columns: STEPS, SPECIFICATIONS, and SRT CODE. It lists troubleshooting steps from Step 1 to Step 4, including sub-steps like Step 1A, 1B, 2A, 2B, 2C, 3A, 3B, 3C, 3D, 3E, and 3E-1, with corresponding specifications and SRT codes.

### TROUBLESHOOTING STEP

**STEP 1: Check the fault codes.**

**STEP 1A: Check for an inactive fault code.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for an inactive fault code. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 2362 is inactive? <b>YES</b>	Use the following procedure for an inactive or intermittent fault code. Refer to Procedure 019-362 in Section 19.
	Fault Code 2362 is inactive? <b>NO</b>	1B

**STEP 1B: Determine engine brake type.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> </ul>		
Action	Specification/Repair	Next Step
Determine if the engine is equipped with a compression brake or exhaust brake. -	Is the engine equipped with a compression brake? <b>YES</b>	2A
	Is the engine equipped with a compression brake? <b>NO</b> <b>Repair:</b> The engine is equipped with an exhaust brake.	3A

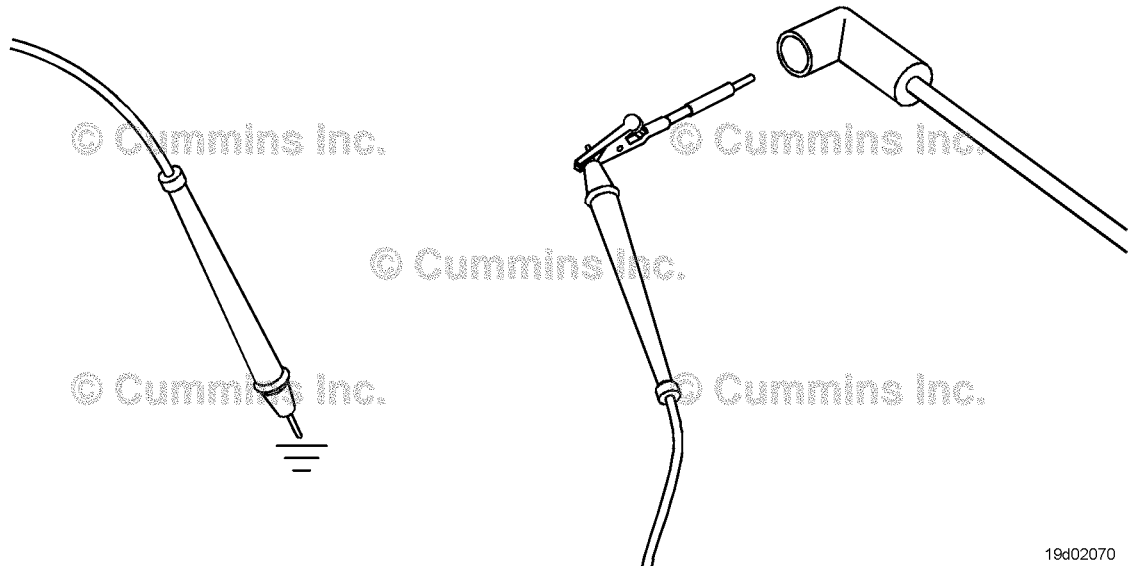
**STEP 2: Check the engine brake solenoid and circuit.**

**STEP 2A: Check the diagnostic signal voltage at the engine brake pass-through connector.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine brake solenoid number 1 wire from the pass-through connector on the rocker lever housing.
- Turn keyswitch ON.

Action	Specification/Repair	Next Step
Check the engine brake solenoid number 1 diagnostic supply voltage. <ul style="list-style-type: none"> <li>• Measure the voltage between the engine harness engine brake solenoid number 1 SIGNAL pin and ground.</li> </ul> Refer to the wiring diagram for connector pin identification.	Greater than 3.75 VDC? <b>YES</b>	2B
	Greater than 3.75 VDC? <b>NO</b>	3A



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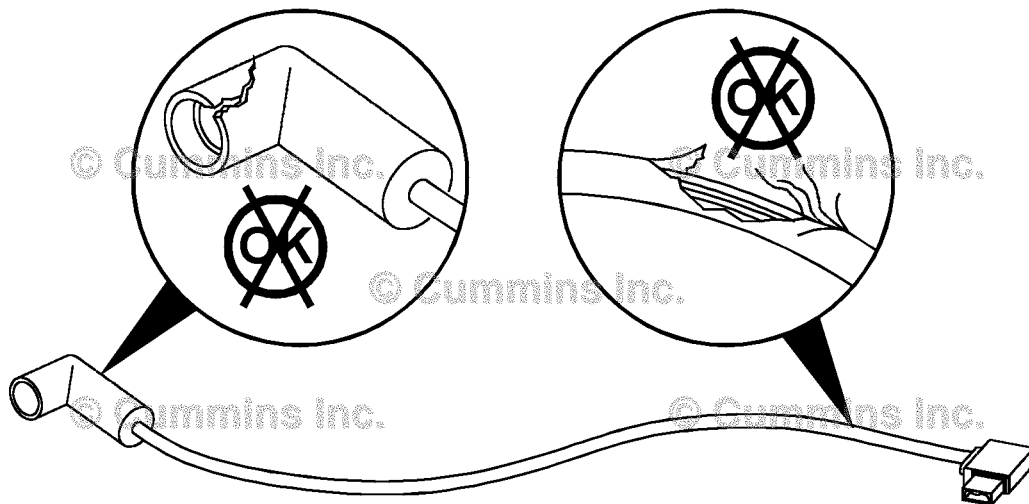


**STEP 2B: Check the engine brake wiring harness for damage.**

**Condition:**

- Turn keyswitch OFF.
- Remove the rocker lever cover. Use the following procedure in the Troubleshooting and Repair Manual, ISC, QSC8.3, ISL and QSL9 Engines, Bulletin 4021418. Refer to Procedure 003-011 in Section 3.
- Remove the engine brake jumper harness between the pass-through connector and the engine brake solenoid.

Action	Specification/Repair	Next Step
Inspect the internal engine brake jumper harness pins for the following: <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.	Damaged connectors or wire insulation? <b>YES</b> <b>Repair:</b> Repair or replace the engine brake harness. Refer to Procedure 019-043 in Section 19.	4A
	Damaged connectors or wire insulation? <b>NO</b>	2C



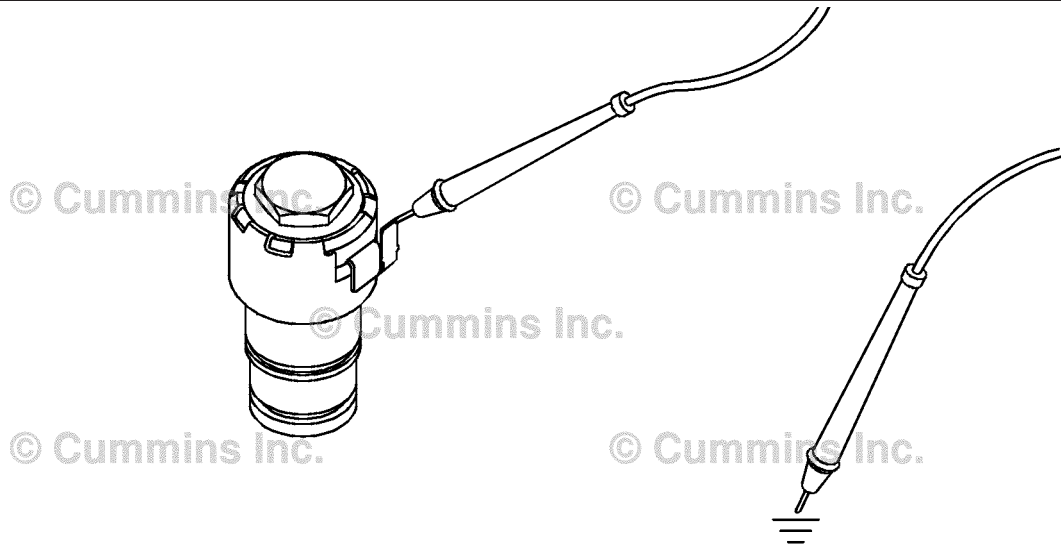
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**STEP 2C: Check the engine brake solenoid for a short to ground.**

**Condition:**

- Turn keyswitch OFF.
- Remove the rocker lever cover. Use the following procedure in the Troubleshooting and Repair Manual, ISC, QSC8.3, ISL and QSL9 Engines, Bulletin 4021418. Refer to Procedure 003-011 in Section 3.
- Disconnect the engine brake harness from engine brake solenoid number 1.

Action	Specification/Repair	Next Step
Check the resistance of the solenoid. <ul style="list-style-type: none"> <li>• Measure the resistance from engine brake number 1 solenoid terminal pin to ground.</li> </ul>	5 ohms or greater? <b>YES</b>	3A
Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.	5 ohms or greater? <b>NO</b> <b>Repair:</b> Replace the engine brake solenoid. Use the following procedure in the Troubleshooting and Repair Manual, ISC, QSC8.3, ISL and QSL9 Engines, Bulletin 4021418. Refer to Procedure 020-012 in Section 20.	4A



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

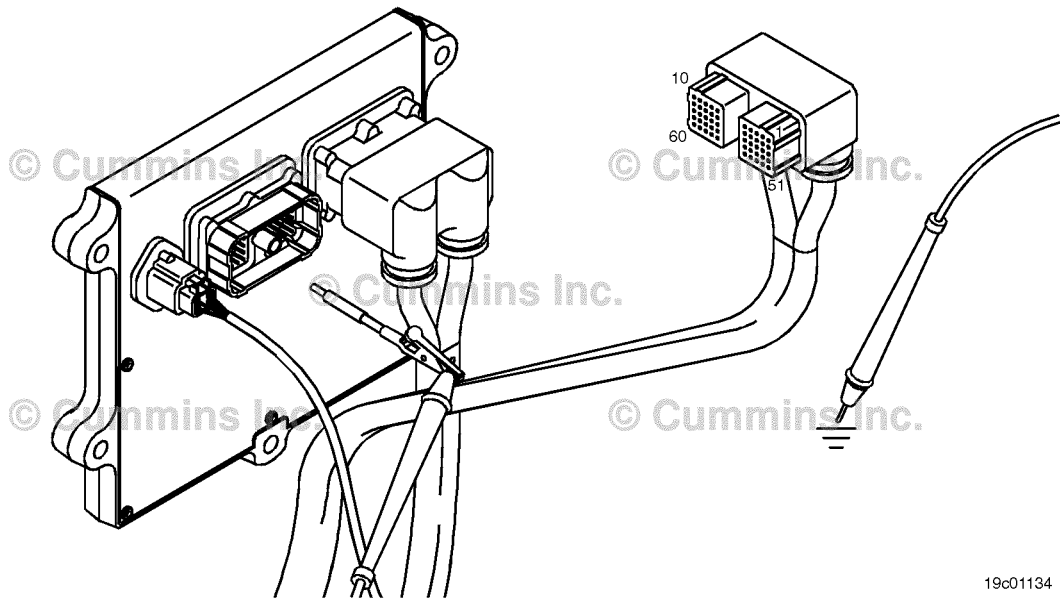
<b>Condition:</b>		
<ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness form the ECM.</li> </ul>		
<b>Action</b>	<b>Specification/Repair</b>	<b>Next Step</b>
Inspect the engine harness and ECM connector pins for the following: <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.	Dirty or damaged pins? <b>YES</b> <b>Repair:</b> A damaged connection has been detected in the ECM or engine harness connector. Clean the connector and pins. Repair the damaged harness, connector or pins if possible. Refer to Procedure 019-043 in Section 19.	4A
	Dirty or damaged pins? <b>NO</b>	3B

**STEP 3B: Check the engine brake solenoid number 1 diagnostic supply voltage.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine harness from the ECM.
- Turn keyswitch ON.

Action	Specification/Repair	Next Step
Check the engine brake solenoid number 1 diagnostic supply voltage. <ul style="list-style-type: none"> <li>• Measure the voltage between the engine brake solenoid number 1 SIGNAL pin and ground at the ECM connector.</li> </ul> Refer to the wiring diagram for connector pin identification.	Greater than 3.75 VDC? <b>YES</b>	3C
	Greater than 3.75 VDC? <b>NO</b> <b>Repair:</b> Replace the ECM. Refer to Procedure 019-031 in Section 19.	4A



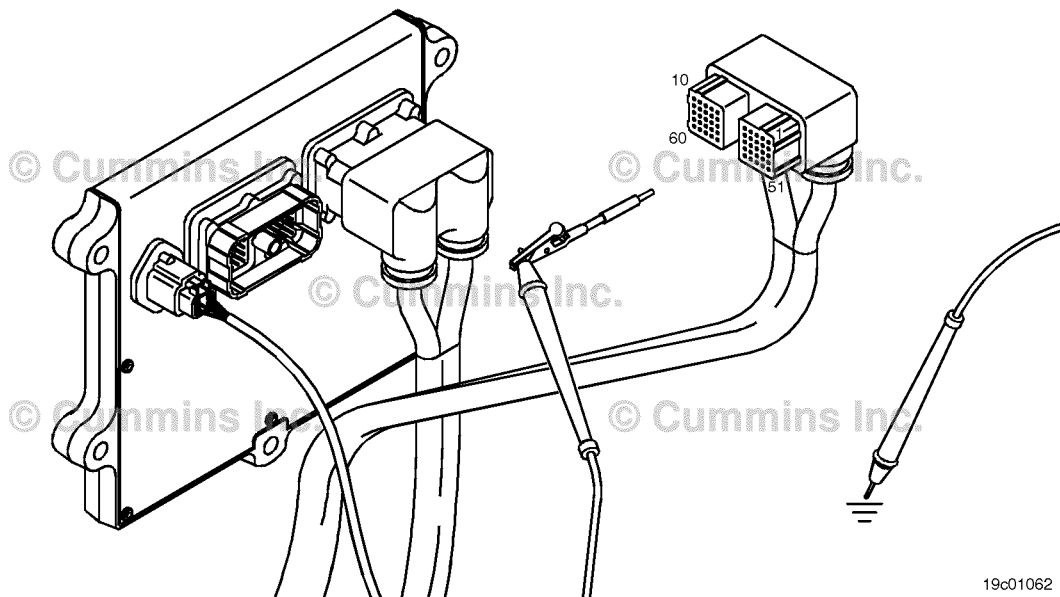
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**STEP 3C: Check for a pin short circuit to ground.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine harness from the ECM.
- If equipped with engine brakes, disconnect the engine brake solenoid number 1 from the engine brake pass-through connector.
- If equipped with an exhaust brake, disconnect the 2-pin Weather Pack™ connector at the back of the engine between the number 5 and 6 high pressure fuel lines.

Action	Specification/Repair	Next Step
<p>Check for a pin-to-ground short.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the engine brake solenoid number 1 SIGNAL pin in the engine harness ECM connector and ground.</li> </ul> <p>Refer to the wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Greater than 100k ohms? <b>YES</b></p>	<p>3D</p>
	<p>Greater than 100k ohms? <b>NO</b></p> <p><b>Repair:</b></p> <p>A pin-to-ground short circuit on engine brake actuator SIGNAL line has been detected in the engine harness.</p> <p>Troubleshoot each harness connected in series to determine which contains the shorted supply circuit to ground.</p> <p>Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.</p>	<p>4A</p>



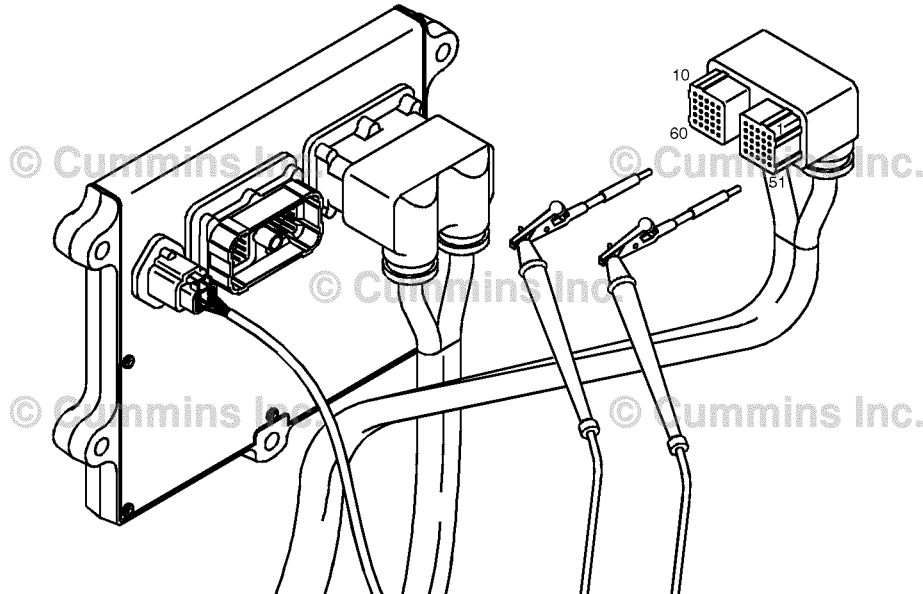
19c01062

**STEP 3D: Check for a pin-to-pin short circuit in the engine harness.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine harness from the ECM.
- If equipped with engine brakes, disconnect the engine brake solenoid number 1 from the engine brake pass-through connector.
- If equipped with an exhaust brake, disconnect the 2-pin Weather Pack™ connector at the back of the engine between the number 5 and 6 high pressure fuel lines.

Action	Specification/Repair	Next Step
Check for a pin-to-pin short. <ul style="list-style-type: none"> <li>• Measure the resistance between the engine brake solenoid number 1 SIGNAL pin in the engine harness ECM connector and all other pins in the ECM connector.</li> </ul> Refer to the wiring diagram for connector pin identification. Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.	Greater than 100k ohms? <b>YES</b>	3E
	Greater than 100k ohms? <b>NO</b> <b>Repair:</b> A pin-to-pin short circuit on the engine brake solenoid number 1 SIGNAL line has been detected in the engine harness. Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.	4A



19c01046

**STEP 3E: Check for an inactive fault code.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for the appropriate circuit response after 30 seconds. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 2362 inactive? <b>YES</b> <b>Repair:</b> None. The removal and installation of the connector corrected the problem.	4A
	Fault Code 2362 inactive? <b>NO</b>	3E-1

**STEP 3E-1: Check for exhaust brake installation.**

<b>Condition:</b> -		
Action	Specification/Repair	Next Step
Check if the engine is equipped with an exhaust brake. -	Is the engine equipped with an exhaust brake? <b>YES</b> <b>Repair:</b> Refer to the OEM service manual to check the wiring and circuitry between the Cummins® engine wiring harness and the exhaust brake.	OEM service manual
	Is the engine equipped with an exhaust brake? <b>NO</b> <b>Repair:</b> All the wiring has been checked and found to be OK. The ECM has malfunctioned. Replace the ECM. Refer to Procedure 019-031 in Section 19.	4A

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

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to verify that the fault code is inactive.</li> </ul>	Fault Code 2362 inactive? <b>YES</b>	4B
	Fault Code 2362 inactive? <b>NO</b>	1A

**STEP 4B: Clear the inactive fault codes.**

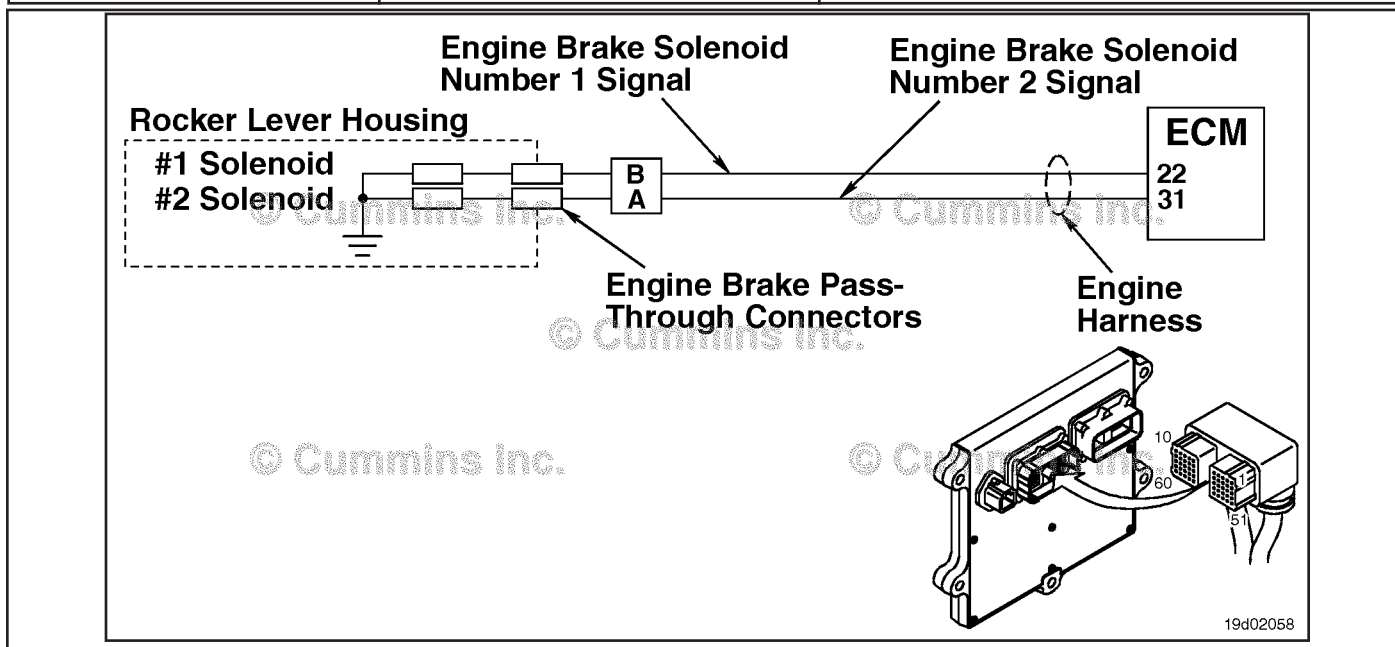
<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to erase the inactive fault codes.</li> </ul>	All fault codes cleared? <b>YES</b>	Repair complete
	All fault codes cleared? <b>NO</b>	Appropriate troubleshooting steps



## Fault Code 2363

### Engine Brake Actuator Circuit #2 - Voltage Below Normal or Shorted to Low Source

CODES	REASON	EFFECT
Fault Code: 2363 PID(P), SID(S): S029 SPN: 1073 FMI: 4 Lamp: Amber SRT:	Engine Brake Actuator Circuit #2 - Voltage Below Normal or Shorted to Low Source. Low voltage detected at the engine brake solenoid number 2 signal circuit.	Engine brake on cylinders 4, 5, and 6 can <b>not</b> be activated.



Engine Brake Actuator Circuit #1

#### **Circuit Description:**

The ECM controls engine brakes on cylinders 4, 5, and 6 by sending a signal on the engine brake solenoid number 2 signal circuit. A 2-pin Weather Pack connector is located near the number 3 injector pass-through connector at the back of the engine. There is a jumper harness from this connector to the engine brake pass-through connectors on the rocker lever housing.

#### **Component Location:**

The engine brake solenoids are located under the valve cover. The engine brake solenoids are controlled through the engine harness from the ECM.

#### **Shop Talk:**

Possible causes of this fault code include short circuit to ground in the engine harness, connectors, or engine brake solenoids.

#### **Refer to Troubleshooting Fault Code t05-2363**

FAULT CODE 2363 - Engine Brake Actuator Circuit #2 - Voltage Below Normal or Shorted to Low Source
TROUBLESHOOTING SUMMARY



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



To reduce the possibility of pin and harness damage, use the following test leads when taking a measurement: Part Number 3822758 - male Deutsch™/AMP™/Metri-Pack™ test lead, Part Number 3822917 - female Deutsch™/AMP™/Metri-Pack™ test lead, Part Number 3823995 - male Weather-Pack™ test lead, and Part Number 3823996 - female Weather-Pack™ test lead.

Table with 3 columns: STEPS, SPECIFICATIONS, and SRT CODE. It lists troubleshooting steps from Step 1 to Step 4, including sub-steps like Step 1A, Step 2A, Step 2B, Step 2C, Step 3A, Step 3B, Step 3C, Step 3D, Step 3E, Step 4A, and Step 4B, with corresponding specifications and SRT codes.

### TROUBLESHOOTING STEP

**STEP 1: Check the fault codes.**

**STEP 1A: Check for an inactive fault code.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for an inactive fault code.</p> <ul style="list-style-type: none"> <li>• Using INSITE™, read the fault codes.</li> </ul>	<p>Fault Code 2362 is inactive? <b>YES</b></p>	<p>Use the following procedure for an inactive or intermittent fault code. Refer to Procedure 019-362 in Section 19.</p>
	<p>Fault Code 2362 is inactive? <b>NO</b></p>	<p>2A</p>

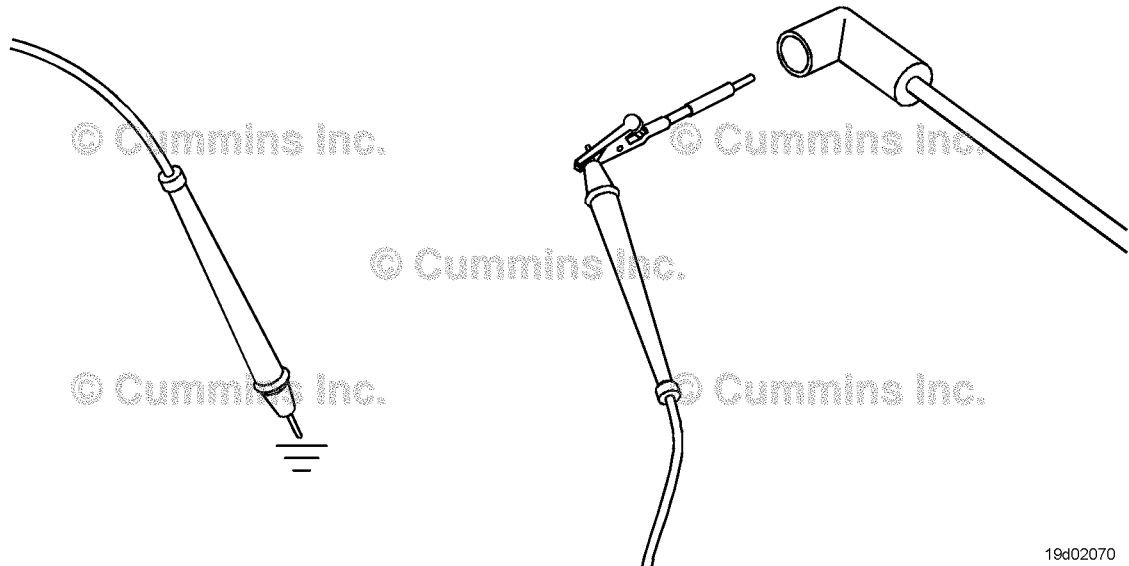
**STEP 2: Check the engine brake solenoid and circuit.**

**STEP 2A: Check the diagnostic signal voltage at the engine brake pass-through connector.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine brake solenoid number 2 wire from the pass-through connector on the rocker lever housing.
- Turn keyswitch ON.

Action	Specification/Repair	Next Step
Check the engine brake solenoid number 2 diagnostic supply voltage. <ul style="list-style-type: none"> <li>• Measure the voltage between the engine harness engine brake solenoid number 2 SIGNAL pin and ground.</li> </ul> Refer to the wiring diagram for connector pin identification.	Greater than 3.75-VDC? <b>YES</b>	2B
	Greater than 3.75-VDC? <b>NO</b>	3A



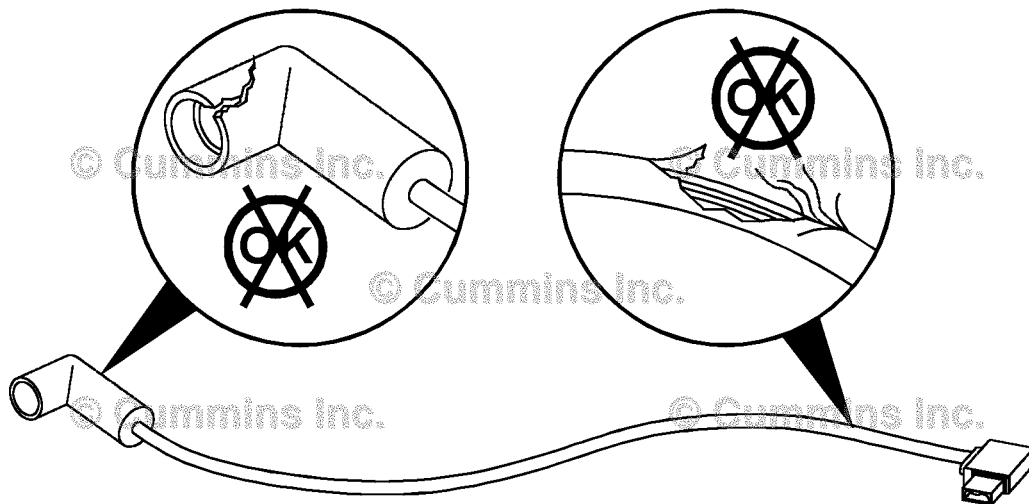
19d02070

**STEP 2B: Check the engine brake wiring harness for damage.**

**Condition:**

- Turn keyswitch OFF.
- Remove the rocker lever cover. Use the following procedure in the Troubleshooting and Repair Manual, ISC, QSC8.3, ISL and QSL9 Engines, Bulletin 4021418. Refer to Procedure 003-011 in Section 3.
- Remove the engine brake jumper harness between that pass-through connector and the engine brake solenoid.

Action	Specification/Repair	Next Step
Inspect the internal engine brake jumper harness connector pins for the following: <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.	Damaged connectors or wire insulation? <b>YES</b> <b>Repair:</b> Repair or replace the engine brake harness. Refer to Procedure 019-043 in Section 19.	4A
	Damaged connectors or wire insulation? <b>NO</b>	2C



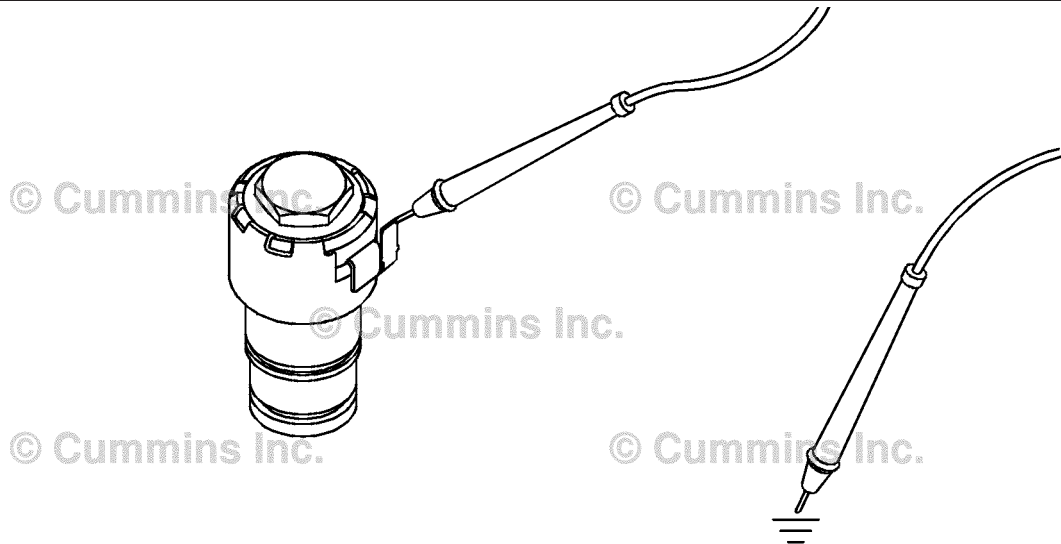
19d02071

**STEP 2C: Check the engine brake solenoid for a short to ground.**

**Condition:**

- Turn keyswitch OFF.
- Remove the rocker lever cover. Use the following procedure in the Troubleshooting and Repair Manual, ISC, QSC8.3, ISL and QSL9 Engines, Bulletin 4021418. Refer to Procedure 003-011 in Section 3.
- Disconnect the engine brake harness from engine brake solenoid number 2.

Action	Specification/Repair	Next Step
Check the resistance of the solenoid. <ul style="list-style-type: none"> <li>• Measure the resistance from engine brake number 2 solenoid terminal pin to ground.</li> </ul>	5 ohms or greater? <b>YES</b>	3A
Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.	5 ohms or greater? <b>NO</b> <b>Repair:</b> Replace the engine brake solenoid. Use the following procedure in the Troubleshooting and Repair Manual, ISC, QSC8.3, ISL and QSL9 Engines, Bulletin 4021418. Refer to Procedure 020-012 in Section 3.	4A



19c01106

**STEP 3: Check the ECM and engine harness.**

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

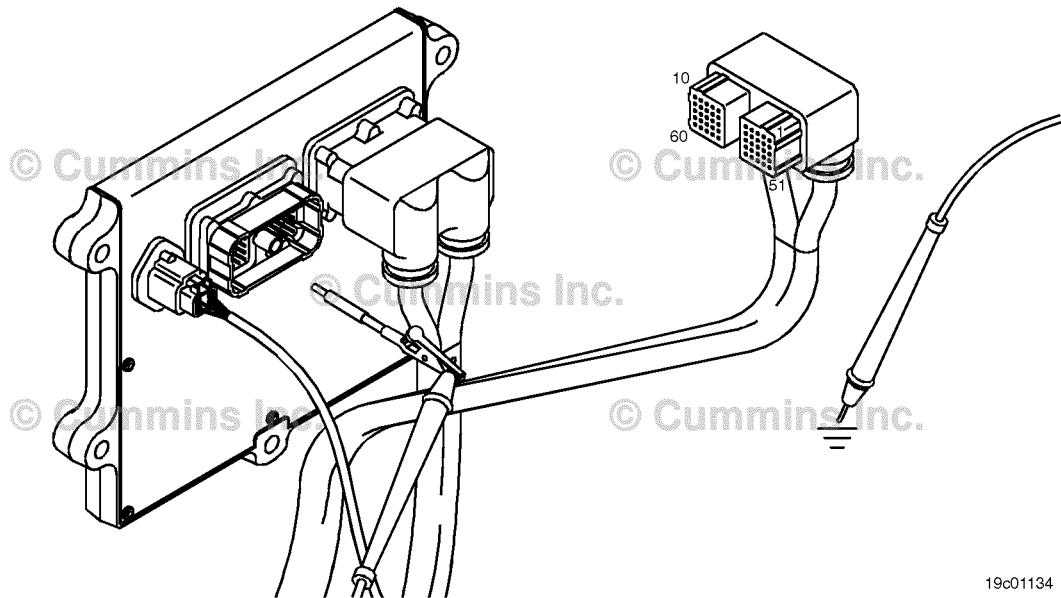
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness form the ECM.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the engine harness and ECM connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A damaged connection has been detected in the ECM or engine harness connector.</p> <p>Clean the connector and pins.</p> <ul style="list-style-type: none"> <li>• Repair the damaged harness, connector or pins if possible. Refer to Procedure 019-043 in Section 19.</li> </ul>	<p>4A</p>
<p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	<p>3B</p>

**STEP 3B: Check the engine brake solenoid number 2 diagnostic supply voltage.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine harness from the ECM.
- Turn keyswitch ON.

Action	Specification/Repair	Next Step
Check the engine brake solenoid number 2 diagnostic supply voltage. <ul style="list-style-type: none"> <li>• Measure the voltage between the engine brake solenoid number 2 SIGNAL pin and ground at the ECM connector.</li> </ul> Refer to the wiring diagram for connector pin identification.	Greater than 3.75-VDC? <b>YES</b>	3C
	Greater than 3.75-VDC? <b>NO</b> <b>Repair:</b> Replace the ECM. Refer to Procedure 019-031 in Section 19.	4A



19c01134

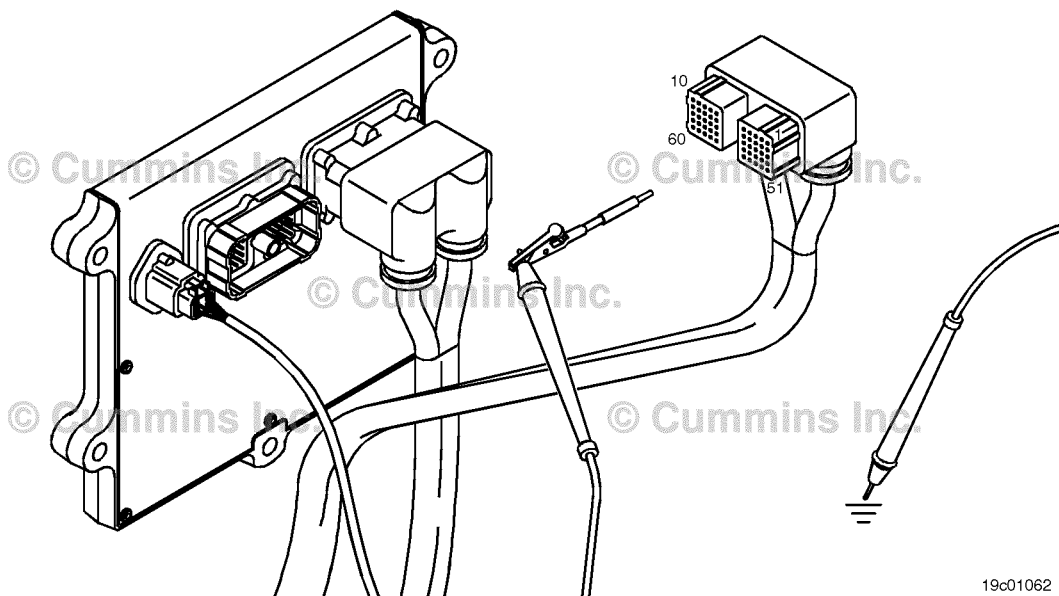


**STEP 3C: Check for a pin short circuit to ground.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine harness from the ECM.
- Disconnect the engine brake solenoid number 2 from the engine brake pass-through connector.

Action	Specification/Repair	Next Step
<p>Check for a pin-to-ground short.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the engine brake solenoid number 2 SIGNAL pin in the engine harness ECM connector and ground.</li> </ul> <p>Refer to the wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Greater than 100k ohms? <b>YES</b></p>	<p>3D</p>
	<p>Greater than 100k ohms? <b>NO</b></p> <p><b>Repair:</b></p> <p>A pin-to-ground short circuit on engine brake actuator SIGNAL line has been detected in the engine harness.</p> <p>Troubleshoot each harness connected in series to determine which contains the shorted supply circuit to ground.</p> <p>Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.</p>	<p>4A</p>



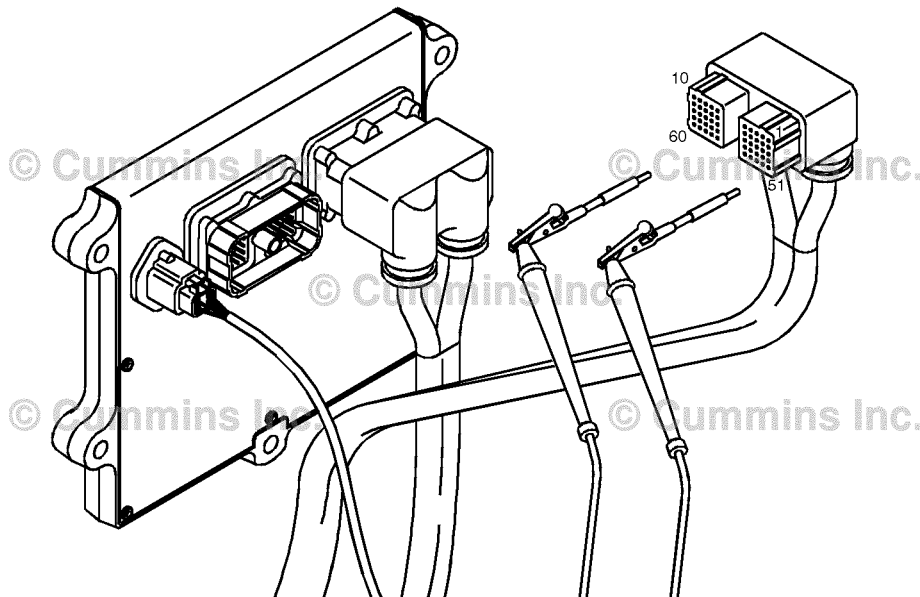
19c01062

**STEP 3D: Check for a pin-to-pin short circuit in the engine harness.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine harness from the ECM.
- Disconnect the engine brake solenoid number 2 from the engine brake pass-through connector.

Action	Specification/Repair	Next Step
<p>Check for a pin-to-pin short.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the engine brake solenoid number 2 SIGNAL pin in the engine harness ECM connector and all other pins in the ECM connector.</li> </ul> <p>Refer to the wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Greater than 100k ohms? <b>YES</b></p>	<p>3E</p>
	<p>Greater than 100k ohms? <b>NO</b></p> <p><b>Repair:</b></p> <p>A pin-to-pin short circuit on the engine brake solenoid number 2 SIGNAL line has been detected in the engine harness.</p> <p>Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.</p>	<p>4A</p>



19c01046

**STEP 3E: Check for an inactive fault code.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>Connect all components.</li> <li>Turn keyswitch ON.</li> <li>Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for the appropriate circuit response after 30 seconds. <ul style="list-style-type: none"> <li>Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 2363 inactive? <b>YES</b> <b>Repair:</b> None. The removal and installation of the connector corrected the fault.	4A
	Fault Code 2363 inactive? <b>NO</b> <b>Repair:</b> Replace the ECM. Refer to Procedure 019-031 in Section 19.	4A

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

<b>Condition:</b> <ul style="list-style-type: none"> <li>Connect all components.</li> <li>Turn keyswitch ON.</li> <li>Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> <li>Use INSITE™ electronic service tool to verify that the fault code is inactive.</li> </ul>	Fault Code 2363 inactive? <b>YES</b>	4B
	Fault Code 2363 inactive? <b>NO</b>	1A

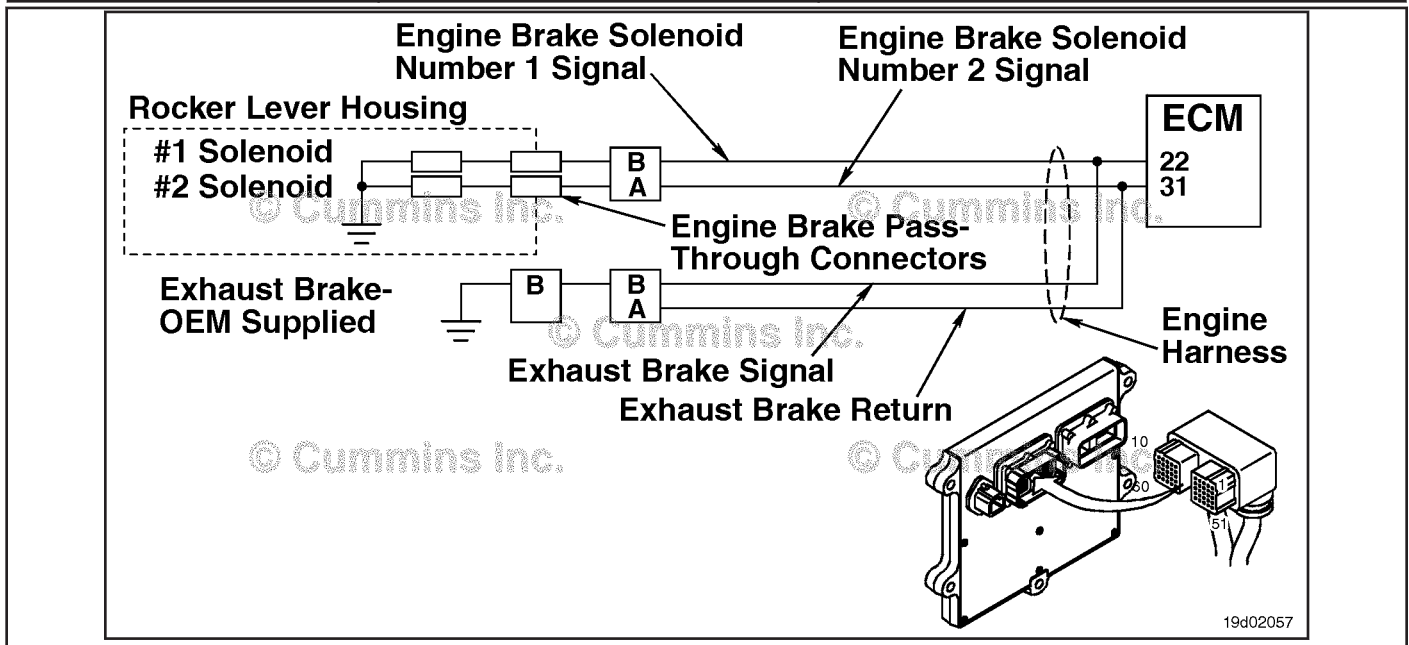
**STEP 4B: Clear the inactive fault codes.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>Connect all components.</li> <li>Turn keyswitch ON.</li> <li>Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> <li>Use INSITE™ electronic service tool to erase the inactive fault codes.</li> </ul>	All fault codes cleared? <b>YES</b>	Repair complete
	All fault codes cleared? <b>NO</b>	Appropriate troubleshooting steps

## Fault Code 2366

### Engine Brake Actuator Circuit #1 - Voltage Above Normal or Shorted to High Source

CODES	REASON	EFFECT
Fault Code: 2366 PID(P), SID(S): S028 SPN: 1072 FMI: 3 Lamp: Amber SRT:	Engine Brake Actuator Circuit #1 - Voltage Above Normal or Shorted to High Source. Open circuit or high voltage detected at the engine brake solenoid number 1 signal circuit.	Engine brake on cylinders 1, 2, and 3 can <b>not</b> be activated or exhaust brake will <b>not</b> operate.



#### Circuit Description:

This circuit can be used to control either an exhaust brake or an engine brake depending on the application. The ECM controls engine brakes on cylinders 1, 2, and 3 by sending a signal on the engine brake solenoid number 1 signal circuit. If an exhaust brake is installed, the exhaust brake is driven by the engine brake solenoid number 1 signal line. A 2-pin Weather Pack connector is located near the number 3 injector pass-through connector at the back of the engine. If an engine brake is installed, there will be a jumper harness from this connector to the engine brake pass-through connectors on the rocker lever housing. If an exhaust brake is installed, the OEM will connect one wire to the 2-pin Weather Pack connector for the exhaust brake relay.

#### Component Location:

The engine brake solenoids are located under the valve cover. The engine brake solenoids are controlled through the engine harness from the ECM. The exhaust brake is an optional feature that is mounted in the exhaust system by the OEM.

#### Shop Talk:

Possible causes of this fault code include:

- Open circuit in the engine harness, brake harness, or engine brake solenoids
- Short to voltage source in the engine harness
- Failed ECM.

**Refer to Troubleshooting Fault Code t05-2366**

FAULT CODE 2366 - Engine Brake Actuator Circuit #1 - Voltage Above Normal or Shorted to High Source
TROUBLESHOOTING SUMMARY



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



To reduce the possibility of pin and harness damage, use the following test leads when taking a measurement: Part Number 3822758 - male Deutsch™/AMP™/Metri-Pack™ test lead, Part Number 3822917 - female Deutsch™/AMP™/Metri-Pack™ test lead, Part Number 3823995 - male Weather-Pack™ test lead, and Part Number 3823996 - female Weather-Pack™ test lead.

Table with 3 columns: STEPS, SPECIFICATIONS, and SRT CODE. It lists troubleshooting steps from Step 1 to Step 4, including sub-steps like Step 1A, 1B, 2A, 2B, 3A, 3B, 3C, 3D, 3E, and 3E-1, with corresponding specifications and SRT codes.

### TROUBLESHOOTING STEP

**STEP 1: Check the fault codes.**

**STEP 1A: Check for an inactive fault code.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for an inactive fault code. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 2366 is inactive? <b>YES</b>	Use the following procedure for an inactive or intermittent fault code. Refer to Procedure 019-362 in Section 19.
	Fault Code 2366 is inactive? <b>NO</b>	1B

**STEP 1B: Determine engine brake type.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> </ul>		
Action	Specification/Repair	Next Step
Determine if the engine is equipped with a compression brake or exhaust brake. -	Is the engine equipped with a compression brake? <b>YES</b>	2A
	Is the engine equipped with a compression brake? <b>NO</b> <b>Repair:</b> The engine is equipped with an exhaust brake.	3A

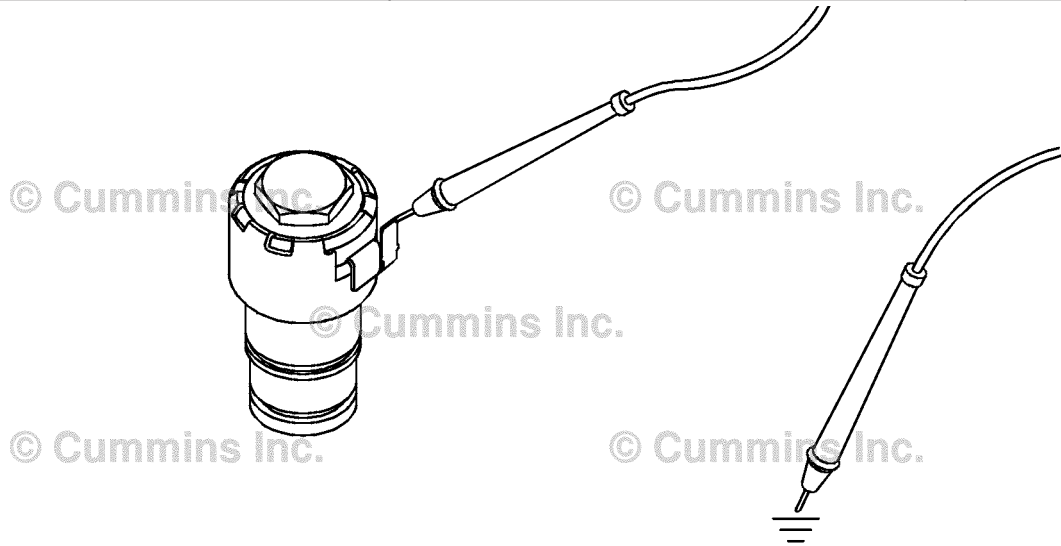
**STEP 2: Check the engine brake solenoid and circuit.**

**STEP 2A: Check the engine brake solenoid for an open circuit.**

**Condition:**

- Turn keyswitch OFF.
- Remove the rocker lever cover. use the following procedure in the Troubleshooting and Repair Manual, ISC, QSC8.3, ISL and QSL9 Engines, Bulletin 4021418. Refer to Procedure 003-011 in Section 3.
- Disconnect the engine brake harness from engine brake solenoid number 2.

Action	Specification/Repair	Next Step
Check the resistance of the solenoid. <ul style="list-style-type: none"> <li>• Measure the resistance from the solenoid terminal pin to ground.</li> </ul>	Between 5 and 15 ohms? <b>YES</b>	2B
Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.	Between 5 and 15 ohms? <b>NO</b> <b>Repair:</b> Replace the engine brake solenoid. Use the following procedure in the Troubleshooting and Repair Manual, ISC, QSC8.3, ISL and QSL9 Engines, Bulletin 4021418. Refer to Procedure 020-012 in Section 20.	4A



19c01106

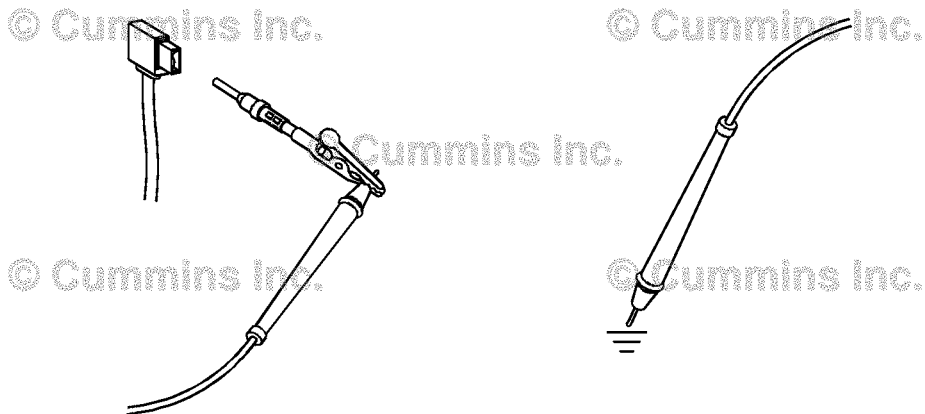


**STEP 2B: Check the diagnostic signal voltage at the engine brake actuator.**

**Condition:**

- Turn keyswitch OFF.
- Remove the rocker lever cover. Use the following procedure in the Troubleshooting and Repair Manual, ISC, QSC8.3, ISL and QSL9 Engines, Bulletin 4021418. Refer to Procedure 003-011 in Section 3.
- Disconnect the engine brake solenoid number 2 wire from the engine brake solenoid.
- Turn keyswitch ON.

Action	Specification/Repair	Next Step
Check the engine brake solenoid number 2 diagnostic supply voltage. • Measure the voltage between the engine harness engine brake solenoid number 2 SIGNAL pin and ground.  Refer to the wiring diagram for connector pin identification.	Greater than 3.75-VDC? <b>YES</b>	3D
	Greater than 3.75-VDC? <b>NO</b>	3A



19d02059

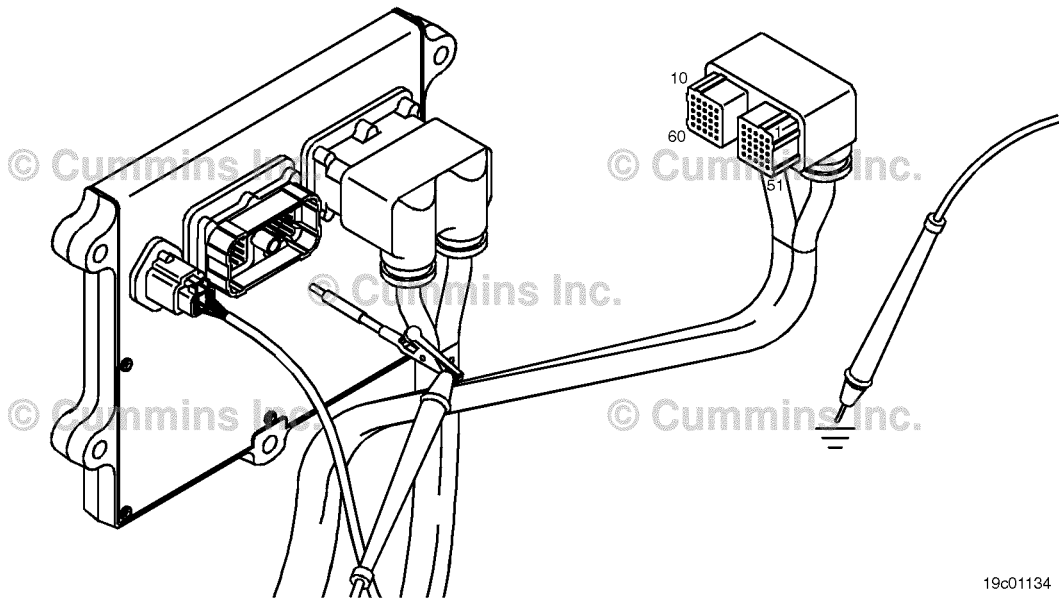
**STEP 3: Check the ECM and engine harness.**

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

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the engine harness and ECM connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A damaged connection has been detected in the ECM or engine harness connector.</p> <p>Clean the connector and pins.</p> <p>Repair the damaged harness, connector, or pins if possible. Refer to Procedure 019-043 in Section 19.</p>	4A
<p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	3B

**STEP 3B: Check the engine brake solenoid number 2 diagnostic supply voltage.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check the engine brake solenoid number 2 diagnostic supply voltage.</p> <ul style="list-style-type: none"> <li>• Measure the voltage between the engine brake solenoid number 2 SIGNAL pin and ground at the ECM connector.</li> </ul> <p>Refer to the wiring diagram for connector pin identification.</p>	<p>Greater than 3.75-VDC?</p> <p><b>YES</b></p>	3C
	<p>Greater than 3.75-VDC?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Replace the ECM. Refer to Procedure 019-031 in Section 19.</p>	4A

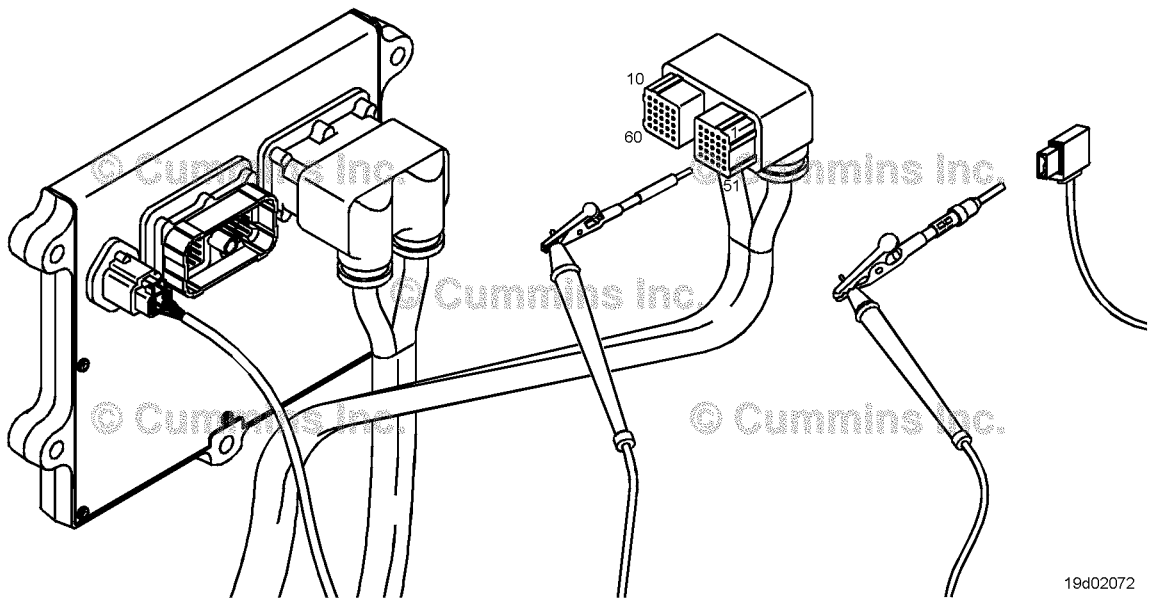


**STEP 3C: Check for an open circuit in the engine harness.**

**Condition:**

- Turn keyswitch OFF.
- Remove the rocker lever cover. use the following procedure in the Troubleshooting and Repair Manual, ISC, QSC8.3, ISL and QSL9 Engines, Bulletin 4021418. Refer to Procedure 003-011 in Section 3.
- If equipped with engine brakes, disconnect the engine brake solenoid number 2 wire from the engine brake solenoid.
- If equipped with an exhaust brake, disconnect the 2-pin Weather Pack™ connector at the back of the engine between the number 5 and 6 high-pressure fuel lines.
- Disconnect the engine harness from the ECM.

Action	Specification/Repair	Next Step
<p>Check for an open circuit.</p> <ul style="list-style-type: none"> <li>• If equipped with engine brakes, measure the resistance between the engine brake solenoid number 2 SIGNAL wire at the engine brake solenoid to the engine brake solenoid number 2 SIGNAL wire at the ECM connector.</li> <li>• If equipped with an exhaust brake, measure the resistance between the engine brake solenoid number 2 SIGNAL wire at the 2-pin Weather Pack™ connector to the engine brake solenoid number 2 SIGNAL wire at the ECM connector.</li> </ul> <p>Refer to the wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Less than 10 ohms? <b>YES</b></p> <hr/> <p>Less than 10 ohms? <b>NO</b></p> <p><b>Repair:</b></p> <p>An open engine brake solenoid number 2 SIGNAL circuit has been detected in the engine harness. The open circuit is in one of the following harnesses:</p> <ul style="list-style-type: none"> <li>• The main engine harness between the ECM and the 2-pin connector at the back of the engine</li> <li>• The engine brake jumper harness between the engine harness 2-pin connector at the back of the engine and the rocker lever housing</li> <li>• The internal engine brake harness between the rocker lever housing and the engine brake solenoid.</li> </ul> <p>Troubleshoot each harness connected in series to determine which contains the open circuit.</p> <p>Repair or replace the engine harness. Refer to Procedure 019-043.</p>	<p>3D</p> <hr/> <p>4A</p>

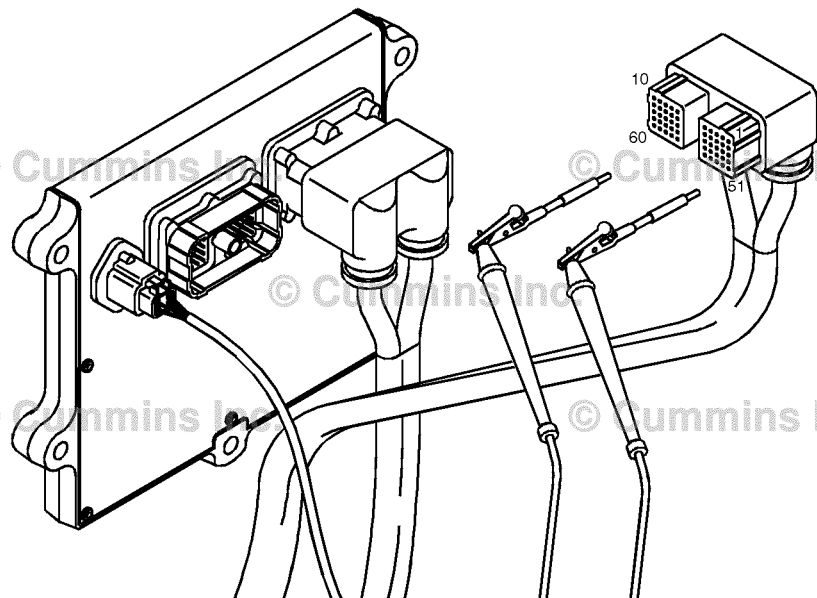


**STEP 3D: Check for a pin-to-pin short circuit in the engine harness.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine harness from the ECM.
- If equipped with engine brakes, disconnect the engine brake solenoid number 1 wire from the engine brake pass-through connector.
- If equipped with an exhaust brake, disconnect the 2-pin Weather Pack™ connector at the back of the engine between the number 5 and 6 high-pressure fuel lines.

Action	Specification/Repair	Next Step
Check for a pin-to-pin short. • Measure the resistance between the engine brake solenoid number 1 SIGNAL pin in the engine harness ECM connector and all other pins in the ECM connector.  Refer to the wiring diagram for connector pin identification.  Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.	Greater than 100k ohms? <b>YES</b>	3E
	Greater than 100k ohms? <b>NO</b> <b>Repair:</b> A pin-to-pin short circuit on the engine brake solenoid number 1 SIGNAL line has been detected in the engine.  Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.	4A



19c01046

**STEP 3E: Check for an inactive fault code.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for the appropriate circuit response after 30 seconds. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 2366 inactive? <b>YES</b> <b>Repair:</b> None. The removal and installation of the connector corrected the fault.	4A
	Fault Code 2366 inactive? <b>NO</b>	3E-1

**STEP 3E-1: Check for exhaust brake installation.**

<b>Condition:</b> -		
Action	Specification/Repair	Next Step
Check if the engine is equipped with an exhaust brake. -	Is the engine equipped with an exhaust brake? <b>YES</b> <b>Repair:</b> Refer to the OEM service manual to check the wiring and circuitry between the Cummins® wiring harness and the exhaust brake.	OEM service manual
	Is the engine equipped with an exhaust brake? <b>NO</b> <b>Repair:</b> All the wiring has been checked and found to be OK. The ECM is damaged. Replace the ECM. Refer to Procedure 019-031 in Section 19.	4A

**STEP 4: Clear the fault code.**

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

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to verify that the fault code is inactive.</li> </ul>	Fault Code 2366 inactive? <b>YES</b>	4B
	Fault Code 2366 inactive? <b>NO</b>	1A

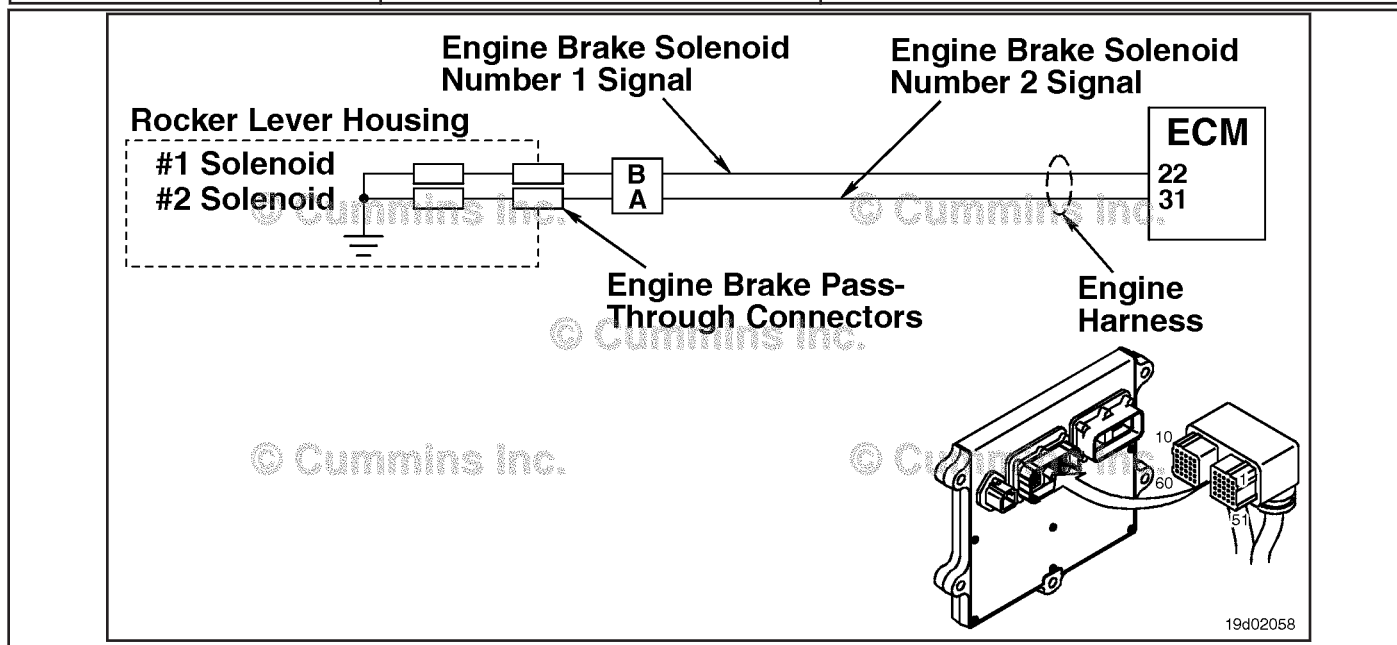
**STEP 4B: Clear the inactive fault codes.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to erase the inactive fault codes.</li> </ul>	All fault codes cleared? <b>YES</b>	Repair complete
	All fault codes cleared? <b>NO</b>	Appropriate troubleshooting steps

## Fault Code 2367

### Engine Brake Actuator Circuit #2 - Voltage Above Normal or Shorted to High Source

CODES	REASON	EFFECT
Fault Code: 2367 PID(P), SID(S): S029 SPN: 1073 FMI: 3 Lamp: Amber SRT:	Engine Brake Actuator Circuit #2 - Voltage Above Normal or Shorted to High Source. Open circuit or high voltage detected at the engine brake solenoid number 2 signal circuit.	Engine brake on cylinders 4, 5, and 6 can <b>not</b> be activated.



Engine Brake Circuit

#### **Circuit Description:**

The ECM controls engine brakes on cylinders 4, 5, and 6 by sending a signal on the engine brake solenoid number 2 signal circuit. A 2-pin Weather Pack connector is located near the number 3 injector pass-through connector at the back of the engine. There is a jumper harness from this connector to the engine brake pass-through connectors on the rocker lever housing.

#### **Component Location:**

The engine brake solenoids are located under the valve cover. The engine brake solenoids are controlled through the engine harness from the ECM.

#### **Shop Talk:**

Possible causes of this fault code include:

- Open circuit in the engine harness, brake harness, or engine brake solenoids
- Short to voltage source in the engine harness
- Failed ECM.

#### **Refer to Troubleshooting Fault Code t05-2367**



## FAULT CODE 2367 - Engine Brake Actuator Circuit #2 - Voltage Above Normal or Shorted to High Source TROUBLESHOOTING SUMMARY

### ⚠CAUTION⚠

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

### ⚠CAUTION⚠

To reduce the possibility of pin and harness damage, use the following test leads when taking a measurement: Part Number 3822758 - male Deutsch™/AMP™/Metri-Pack™ test lead, Part Number 3822917 - female Deutsch™/AMP™/Metri-Pack™ test lead, Part Number 3823995 - male Weather-Pack™ test lead, and Part Number 3823996 - female Weather-Pack™ test lead.

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1:</b> Check the fault codes.		
<u>STEP 1A:</u> Check for an inactive fault code.	Fault Code 2367 is inactive?	
<b>STEP 2:</b> Check the engine brake solenoid and circuit.		
<u>STEP 2A:</u> Check the engine brake solenoid for an open circuit.	Between 5 and 15 ohms?	
<u>STEP 2B:</u> Check the diagnostic signal voltage at the engine brake actuator.	Greater than 3.75-VDC?	
<b>STEP 3:</b> Check the ECM and engine harness.		
<u>STEP 3A:</u> Inspect the ECM and engine harness connector pins.	Dirty or damaged pins?	
<u>STEP 3B:</u> Check the engine brake solenoid number 2 diagnostic supply voltage.	Greater than 3.75-VDC?	
<u>STEP 3C:</u> Check for an open circuit in the engine harness.	Less than 10 ohms?	
<u>STEP 3D:</u> Check for a pin to pin short circuit in the engine harness.	Greater than 100k ohms?	
<u>STEP 3E:</u> Check for an inactive fault code.	Fault Code 2367 inactive?	
<b>STEP 4:</b> Clear the fault code.		
<u>STEP 4A:</u> Disable the fault code.	Fault Code 2367 inactive?	
<u>STEP 4B:</u> Clear the inactive fault codes.	All fault codes cleared?	

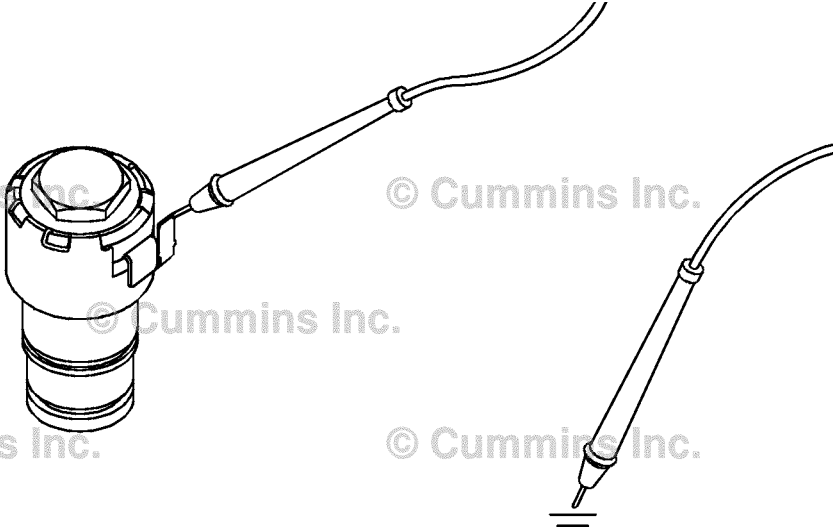
## TROUBLESHOOTING STEP

**STEP 1: Check the fault codes.**  
**STEP 1A: Check for an inactive fault code.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for an inactive fault code. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 2367 is inactive? <b>YES</b>	Use the following procedure for an inactive or intermittent fault code. Refer to Procedure 019-362 in Section 19.
	Fault Code 2367 is inactive? <b>NO</b>	2A

**STEP 2: Check the engine brake solenoid and circuit.**

**STEP 2A: Check the engine brake solenoid for an open circuit.**

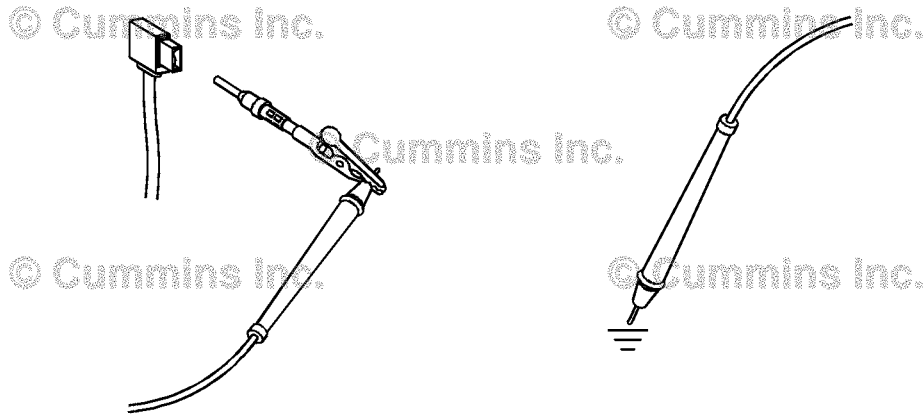
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Remove the rocker lever cover. Use the following procedure in the Troubleshooting and Repair Manual, ISC, QSC8.3, ISL and QSL9 Engines, Bulletin 4021418. Refer to Procedure 003-011 in Section 3.</li> <li>• Disconnect the engine brake harness from engine brake solenoid number 2.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check the resistance of the solenoid.</p> <ul style="list-style-type: none"> <li>• Measure the resistance from the solenoid terminal pin to ground.</li> </ul> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Between 5 and 15 ohms? <b>YES</b></p>	<p>2B</p>
	<p>Between 5 and 15 ohms? <b>NO</b></p> <p><b>Repair:</b></p> <p>Replace the engine brake solenoid. Use the following procedure in the Troubleshooting and Repair Manual, ISC, QSC8.3, ISL and QSL9 Engines, Bulletin 4021418. Refer to Procedure 020-012 in Section 20.</p>	<p>4A</p>
 <p>The diagram illustrates the electrical connection for testing the engine brake solenoid. On the left, a cylindrical solenoid is shown with a terminal pin. A wire is connected to this terminal pin. On the right, another wire is shown connected to a ground symbol, represented by three horizontal lines of decreasing width.</p>		
<p>19c01106</p>		

**STEP 2B: Check the diagnostic signal voltage at the engine brake actuator.**

**Condition:**

- Turn keyswitch OFF.
- Remove the rocker lever cover. Use the following procedure in the Troubleshooting and Repair Manual, ISC, QSC8.3, ISL and QSL9 Engines, Bulletin 4021418. Refer to Procedure 003-011 in Section 3.
- Disconnect the engine brake solenoid number 2 wire from the engine brake solenoid.
- Turn keyswitch ON.

Action	Specification/Repair	Next Step
Check the engine brake solenoid number 2 diagnostic supply voltage. <ul style="list-style-type: none"> <li>• Measure the voltage between the engine harness engine brake solenoid number 2 SIGNAL pin and ground.</li> </ul> Refer to the wiring diagram for connector pin identification.	Greater than 3.75-VDC? <b>YES</b>	3D
	Greater than 3.75-VDC? <b>NO</b>	3A



19d02059

**STEP 3: Check the ECM and engine harness.**

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

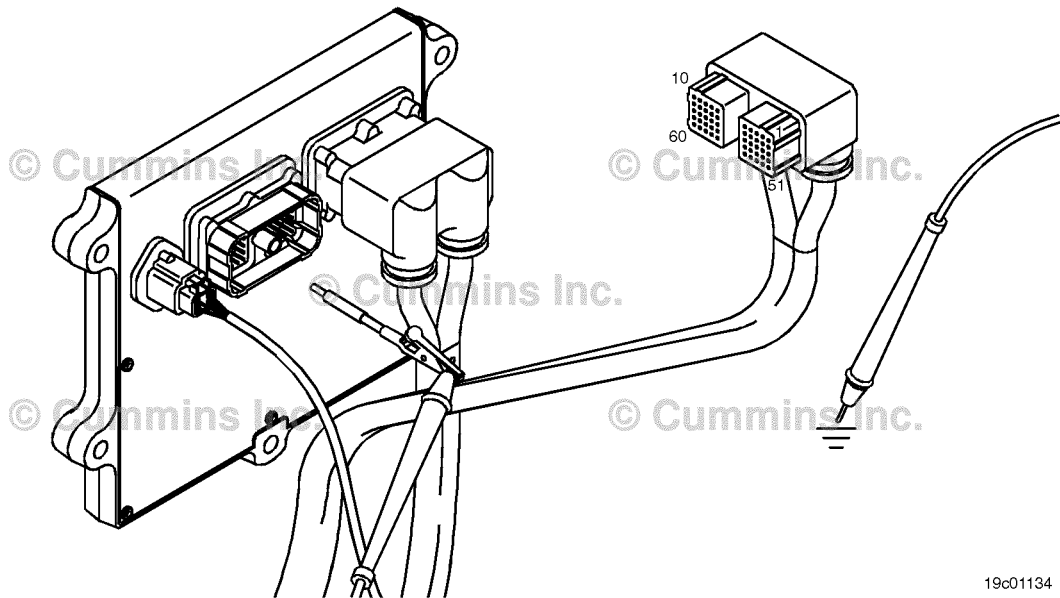
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the engine harness and ECM? connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A damaged connection has been detected in the ECM or engine harness connector.</p> <p>Clean the connector and pins.</p> <p>Repair the damaged harness, connector, or pins if possible. Refer to Procedure 019-043 in Section 19.</p>	4A
	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	3B

**STEP 3B: Check the engine brake solenoid number 2 diagnostic supply voltage.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine harness from the ECM.
- Turn keyswitch ON.

Action	Specification/Repair	Next Step
Check the engine brake solenoid number 2 diagnostic supply voltage. <ul style="list-style-type: none"> <li>• Measure the voltage between the engine brake solenoid number 2 SIGNAL pin and ground at the ECM connector.</li> </ul> Refer to the wiring diagram for connector pin identification.	Greater than 3.75-VDC? <b>YES</b>	3C
	Greater than 3.75-VDC? <b>NO</b> <b>Repair:</b> Replace the ECM. Refer to Procedure 019-031 in Section 19.	4A



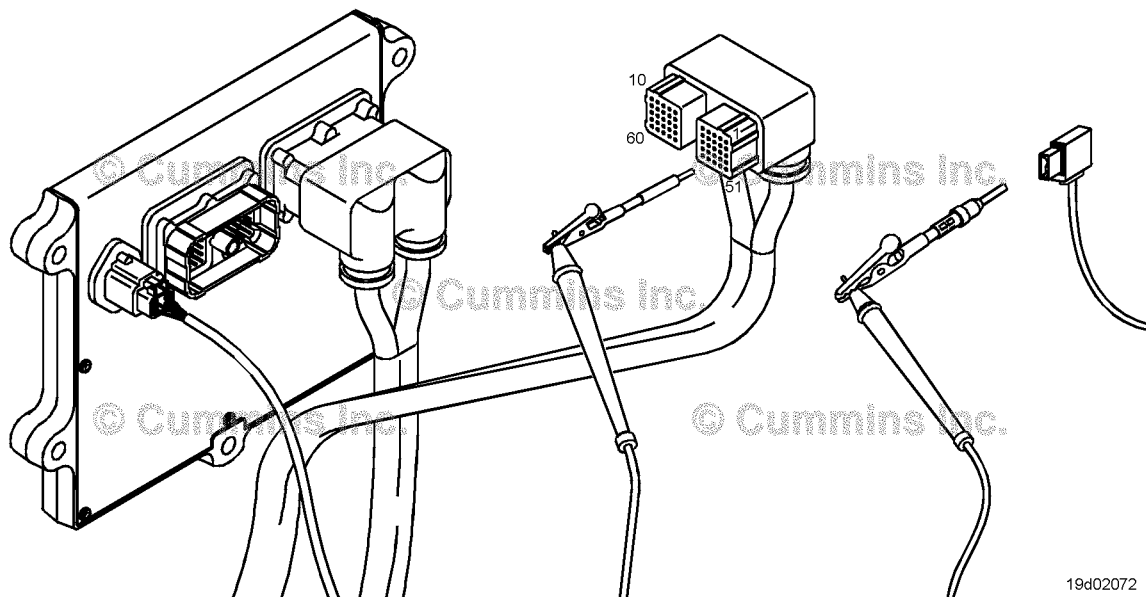
19c01134

**STEP 3C: Check for an open circuit in the engine harness.**

**Condition:**

- Turn keyswitch OFF.
- Remove the rocker lever cover. Use the following procedure in the Troubleshooting and Repair Manual, ISC, QSC8.3, ISL and QSL9 Engines, Bulletin 4021418. Refer to Procedure 003-011 in Section 3.
- Disconnect the engine harness from the ECM.
- Disconnect the engine brake solenoid number 2 wire from the engine brake solenoid.

Action	Specification/Repair	Next Step
<p>Check for an open circuit.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the engine brake solenoid number 2 SIGNAL wire at the engine brake solenoid to the engine brake solenoid number 2 SIGNAL wire at the ECM connector.</li> </ul> <p>Refer to the wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Less than 10 ohms? <b>YES</b></p>	<p>3D</p>
	<p>Less than 10 ohms? <b>NO</b></p> <p><b>Repair:</b></p> <p>An open engine brake solenoid number 2 SIGNAL circuit has been detected in the engine harness. The open circuit is in one of the following harnesses:</p> <ul style="list-style-type: none"> <li>• The main engine harness between the ECM and the 2-pin connector at the back of the engine</li> <li>• The engine brake jumper harness between the engine harness 2-pin connector at the back of the engine and the rocker lever housing</li> <li>• The internal engine brake harness between the rocker lever housing and the engine brake solenoid.</li> </ul> <p>Troubleshoot each harness connected in series to determine which contains the open circuit.</p> <p>Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.</p>	<p>4A</p>



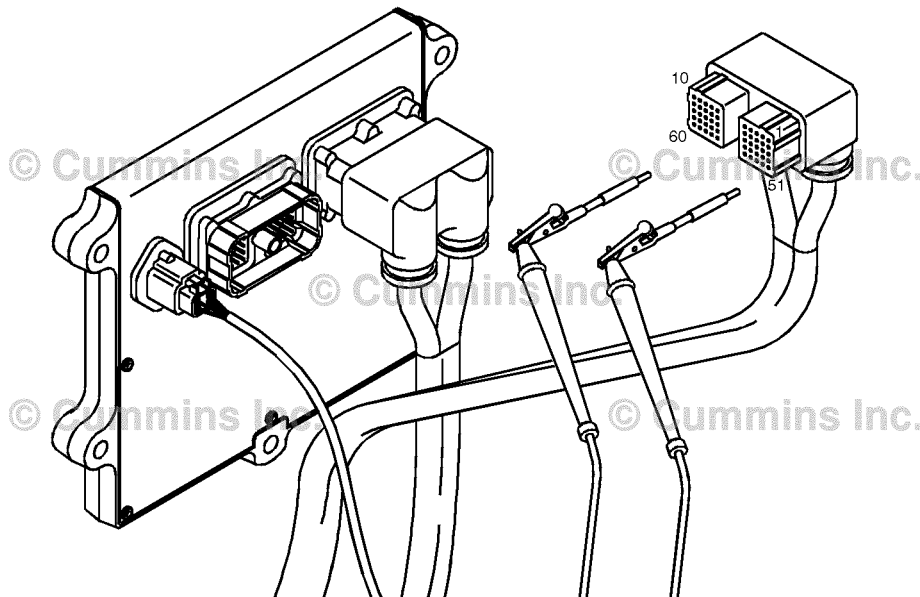
19d02072

**STEP 3D: Check for a pin-to-pin short circuit in the engine harness.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine harness from the ECM.
- Disconnect the engine brake solenoid number 2 from the engine brake pass-through connector.

Action	Specification/Repair	Next Step
Check for a pin-to-pin short. <ul style="list-style-type: none"> <li>• Measure the resistance between the engine brake solenoid number 2 SIGNAL pin in the engine harness ECM connector and all other pins in the ECM connector.</li> </ul> Refer to the wiring diagram for connector pin identification. Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.	Greater than 100k ohms? <b>YES</b>	3E
	Greater than 100k ohms? <b>NO</b> <b>Repair:</b> A pin-to-pin short circuit on the engine brake solenoid number 2 SIGNAL line has been detected in the engine. Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.	4A



19c01046



**STEP 3E: Check for an inactive fault code.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate circuit response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault Code 2367 inactive?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>None. The removal and installation of the connector corrected the fault.</p>	4A
	<p>Fault Code 2367 inactive?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Replace the ECM. Refer to Procedure 019-031 in Section 19.</p>	4A

**STEP 4: Clear the fault code.**

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

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Disable the fault code.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to verify that the fault code is inactive.</li> </ul>	<p>Fault Code 2367 inactive?</p> <p><b>YES</b></p>	4B
	<p>Fault Code 2367 inactive?</p> <p><b>NO</b></p>	1A

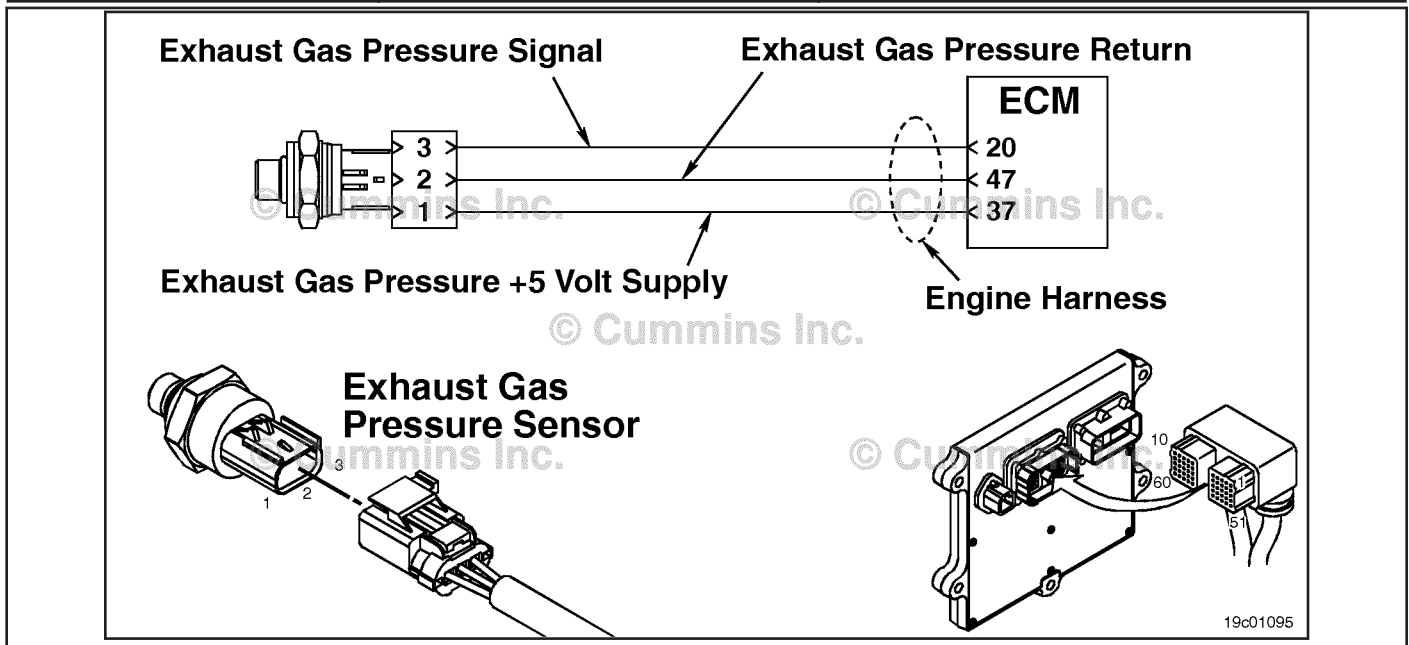
**STEP 4B: Clear the inactive fault codes.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Clear the inactive fault codes.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to erase the inactive fault codes.</li> </ul>	<p>All fault codes cleared?</p> <p><b>YES</b></p>	Repair complete
	<p>All fault codes cleared?</p> <p><b>NO</b></p>	Appropriate troubleshooting steps

## Fault Code 2373

### Exhaust Gas Pressure Sensor Circuit - Shorted High

CODES	REASON	EFFECT
Fault Code: 2373 PID(P), SID(S): P095 SPN: 1209 FMI: 3/3 Lamp: Amber SRT:	Exhaust gas pressure sensor circuit - shorted high. High voltage detected at the exhaust gas pressure sensor circuit.	Engine will be derated.



Exhaust Gas Pressure Sensor Circuit

#### Circuit Description:

The exhaust gas pressure sensor measures the pressure of the gas exhaust in the manifold and passes that information to the electronic control module (ECM) through the engine harness. This information is used by the ECM to control emissions and EGR valve operation. If the exhaust gas pressure becomes too high, it will cause a derate condition.

#### Component Location:

The exhaust gas pressure sensor is located on the EGR cooler on the exhaust side of the engine. Refer to Procedure 100-002 for a detailed component location view.

#### Shop Talk:

The exhaust gas pressure sensor shares supply and return wires in the engine harness with other sensors. Opens and shorts in the engine harness can cause multiple fault codes to become active.

Possible causes of this fault code include:

- Signal wire shorted to sensor supply or battery voltage
- Open return circuit in the engine harness, connectors, or sensor.

**Refer to Troubleshooting Fault Code t05-2373.**

## FAULT CODE 2373 - Exhaust Gas Pressure Sensor Circuit - Shorted High TROUBLESHOOTING SUMMARY

### ⚠ CAUTION ⚠

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

### ⚠ CAUTION ⚠

To reduce the possibility of pin and harness damage, use the following test leads when taking a measurement: Part Number 3164596 - male Framatome™ test lead, Part Number 3164597 - female Framatome™ test lead, and Part Number 3822917 - female Deutsch™/AMP™/Metri-Pack™ test lead.

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1: Check the fault codes.</b>		
<b>STEP 1A:</b> Check for sensor supply fault codes.	Fault Code 227 active?	
<b>STEP 1B:</b> Check for an active fault code.	Fault Code 2373 active?	
<b>STEP 2: Check the exhaust gas pressure sensor and circuit.</b>		
<b>STEP 2A:</b> Inspect the exhaust gas pressure sensor and connector pins.	Dirty or damaged pins?	
<b>STEP 2B:</b> Check the circuit response.	Fault Code 2374 active and Fault Code 2373 inactive?	
<b>STEP 2C:</b> Check the sensor supply voltage and return circuit at the engine harness.	4.75-VDC to 5.25-VDC?	
<b>STEP 2D:</b> Check the sensor supply voltage and return circuit at the ECM.	4.75-VDC to 5.25-VDC?	
<b>STEP 3: Check the ECM.</b>		
<b>STEP 3A:</b> Inspect the ECM and engine harness connector pins.	Dirty or damaged pins?	
<b>STEP 3B:</b> Check the ECM response.	Fault Code 2374 active and Fault Code 2373 inactive?	
<b>STEP 4: Clear the fault codes.</b>		
<b>STEP 4A:</b> Disable the fault code.	Fault Code 2373 inactive?	
<b>STEP 4B:</b> Clear the inactive fault codes.	All fault codes cleared?	

## TROUBLESHOOTING STEP

### STEP 1: Check the fault codes.

#### STEP 1A: Check for sensor supply fault codes.

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for sensor supply fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 227 active? <b>YES</b>	Fault Code 227
	Fault Code 227 active? <b>NO</b>	1B

#### STEP 1B: Check for an active fault code.

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for an active fault code. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 2373 active? <b>YES</b>	2A
	Fault Code 2373 active? <b>NO</b>	Use the following procedure for an inactive or intermittent fault code. Refer to Procedure 019-362 in Section 19.

**STEP 2: Check the exhaust gas pressure sensor and circuit.**

**STEP 2A: Inspect the exhaust gas pressure sensor and connector pins.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the exhaust gas pressure sensor from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the engine harness and sensor connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins? <b>YES</b></p> <p><b>Repair:</b> Clean the connector and pins. Repair the damaged harness, connector, or pins if possible.</p>	4A
	<p>Dirty or damaged pins? <b>NO</b></p>	2B

**STEP 2B: Check the circuit response.**

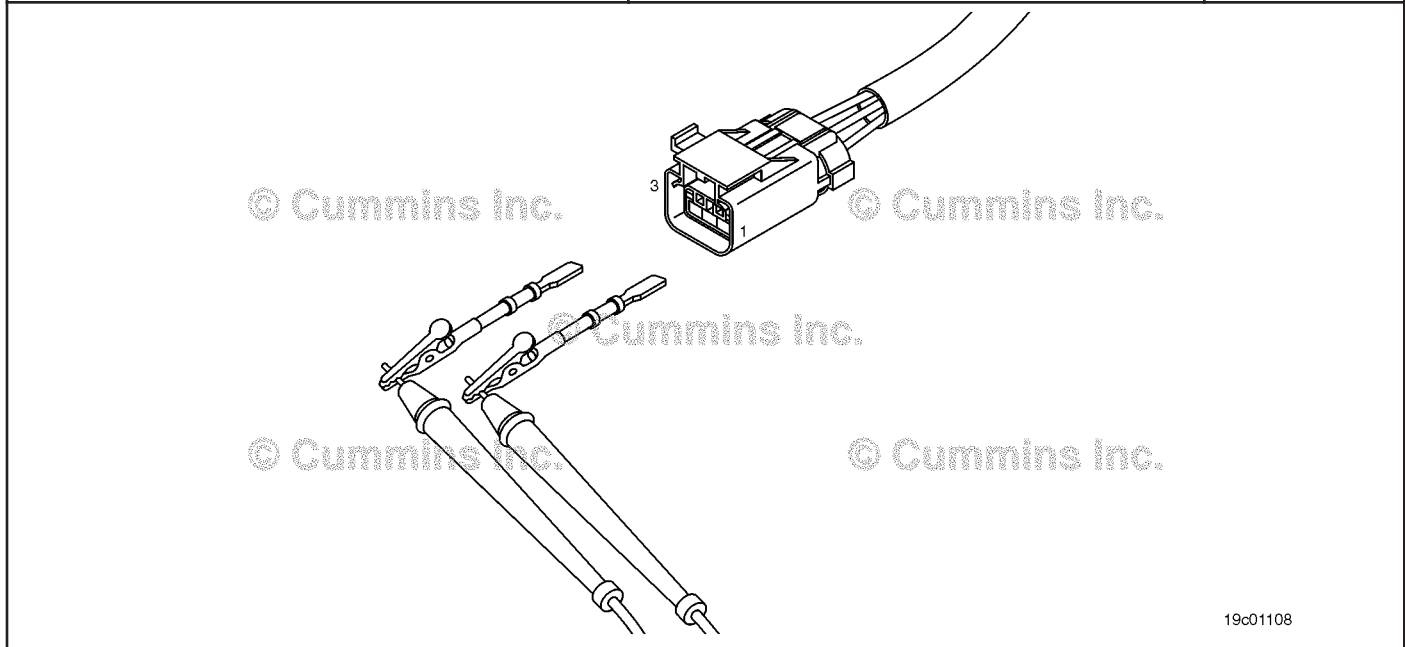
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the exhaust gas pressure sensor from the engine harness.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate ECM response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault Code 2374 active and Fault Code 2373 inactive? <b>YES</b></p>	2C
	<p>Fault Code 2374 active and Fault Code 2373 inactive? <b>NO</b></p>	3A

**STEP 2C: Check the sensor supply voltage and return circuit at the engine harness.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the exhaust gas pressure sensor from the engine harness.
- Turn keyswitch ON.

Action	Specification/Repair	Next Step
Check the supply voltage and return circuit. <ul style="list-style-type: none"> <li>• Measure the voltage from the exhaust gas pressure +5 volt SUPPLY pin to the exhaust gas pressure RETURN pin at the sensor connector of the engine harness.</li> </ul>	4.75-VDC to 5.25-VDC? <b>YES</b> <b>Repair:</b> Replace the exhaust gas pressure sensor. Refer to Procedure 019-376 in Section 19.	4A
	4.75-VDC to 5.25-VDC? <b>NO</b>	2D



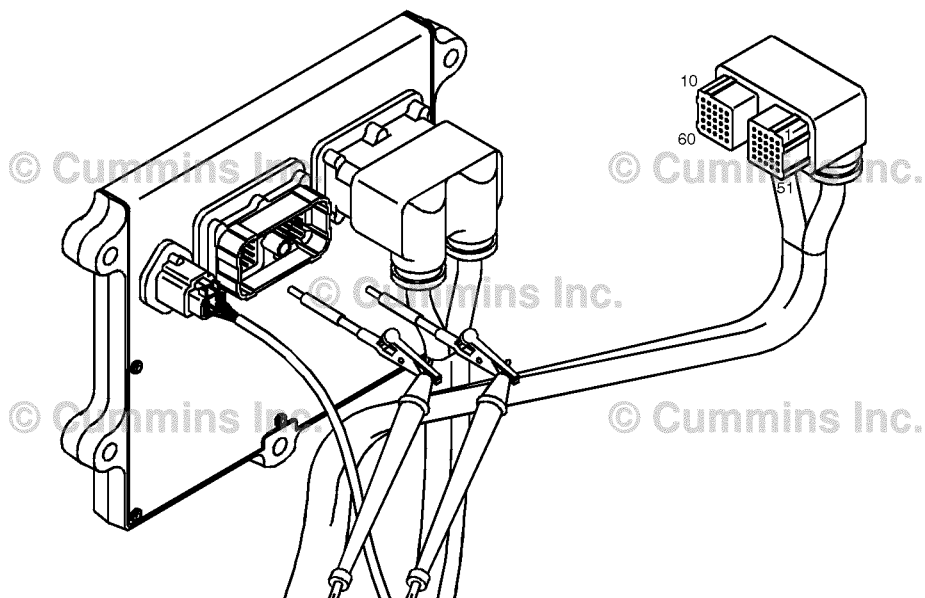
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**STEP 2D: Check the sensor supply voltage and return circuit at the ECM.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine harness from the ECM.
- Turn keyswitch ON.

Action	Specification/Repair	Next Step
Check the supply voltage and return circuit. <ul style="list-style-type: none"> <li>• Measure the voltage from the exhaust gas pressure +5 volt SUPPLY pin to the exhaust gas pressure RETURN pin at the ECM port.</li> </ul>	4.75-VDC to 5.25-VDC? <b>YES</b> <b>Repair:</b> Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.	4A
	4.75-VDC to 5.25-VDC? <b>NO</b> <b>Repair:</b> Replace the ECM. Refer to Procedure 019-031 in Section 19.	4A



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**STEP 3: Check the ECM.**

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

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the engine harness and ECM connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Clean the connector and pins.</p> <p>Repair the damaged harness, connector, or pins if possible.</p>	4A
	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	3B

**STEP 3B: Check the ECM response.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate ECM response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes .</li> </ul>	<p>Fault Code 2374 active and Fault Code 2373 inactive?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Repair or replace the engine harness.</p>	4A
	<p>Fault Code 2374 active and Fault Code 2373 inactive?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Replace the ECM. Refer to Procedure 019-031 in Section 19.</p>	4A



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

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> <li>• Start the engine and let it idle for one minute.</li> <li>• Use INSITE™ electronic service tool to verify that the fault code is inactive.</li> </ul>	Fault Code 2373 inactive? <b>YES</b>	4B
	Fault Code 2373 inactive? <b>NO</b>	1A

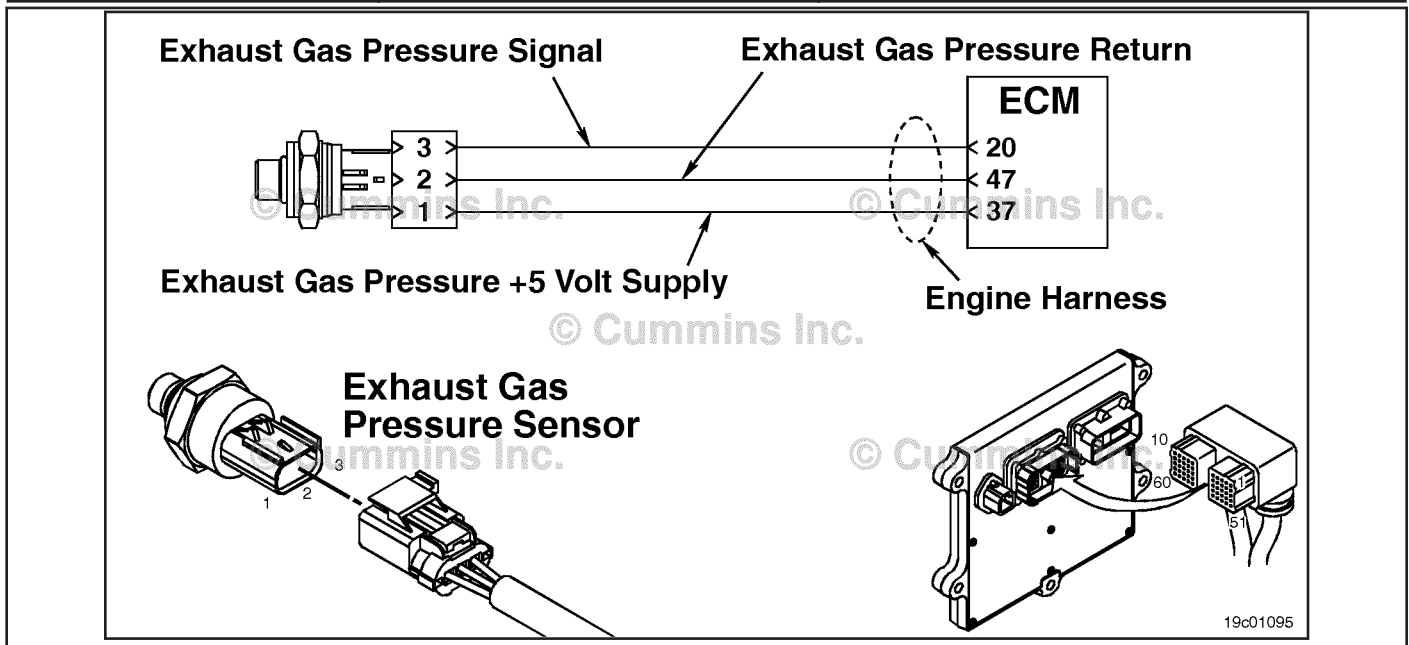
**STEP 4B: Clear the inactive fault codes.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to erase the inactive fault codes.</li> </ul>	All fault codes cleared? <b>YES</b>	Repair complete
	All fault codes cleared? <b>NO</b>	Appropriate troubleshooting steps

## Fault Code 2374

### Exhaust Gas Pressure Sensor Circuit - Shorted Low

CODES	REASON	EFFECT
Fault Code: 2374 PID(P), SID(S): P095 SPN: 1209 FMI: 4/4 Lamp: Amber SRT:	Exhaust gas pressure sensor circuit - shorted low. Low voltage detected on the exhaust gas pressure sensor exhaust circuit.	Engine power derate.



Exhaust Gas Pressure Sensor Circuit

#### **Circuit Description:**

The exhaust gas pressure sensor measures the pressure of the gas in the exhaust manifold and passes that information to the electronic control module (ECM) through the engine harness. This information is used by the ECM to control emissions and for valve operation. If the exhaust gas pressure becomes too low, it will cause a derate condition.

#### **Component Location:**

The exhaust gas pressure sensor is located on the EGR cooler on the exhaust side of the engine. Refer to Procedure 100-002 for a detailed component location view.

#### **Shop Talk:**

The exhaust gas pressure sensor shares supply and return wires in the engine harness with other sensors. Opens and shorts in the engine harness can cause multiple fault codes to become active.

Possible causes of this fault code include:

- Signal wire open or shorted to ground in the harness
- Supply line open or shorted to ground
- Sensor shorted to ground.

#### **Refer to Troubleshooting Fault Code t05-2374**

## FAULT CODE 2374 - Exhaust Gas Pressure Sensor Circuit - Shorted Low TROUBLESHOOTING SUMMARY



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



To reduce the possibility of pin and harness damage, use the following test lead when taking a measurement: Part Number 3164596 - male Framatome™ test lead.

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1: Check the fault codes.</b>		
<b>STEP 1A:</b> Check for sensor supply fault codes.	Fault Code 187 active?	
<b>STEP 1B:</b> Check for an active fault code.	Fault Code 2374 active?	
<b>STEP 2: Check the exhaust gas pressure sensor and circuit.</b>		
<b>STEP 2A:</b> Inspect the exhaust gas pressure sensor and connector pins.	Dirty or damaged pins?	
<b>STEP 2B:</b> Check the sensor supply voltage and return circuit.	4.75-VDC to 5.25-VDC?	
<b>STEP 2C:</b> Check the circuit response.	Fault Code 2373 active and Fault Code 2374 inactive?	
<b>STEP 2D:</b> Check the ECM response.	Fault Code 2373 active and Fault Code 2374 inactive?	
<b>STEP 3: Check the ECM.</b>		
<b>STEP 3A:</b> Inspect the ECM and engine harness connector pins.	Dirty or damaged pins?	
<b>STEP 3B:</b> Check the ECM response.	Fault Code 2373 active and Fault Code 2374 inactive?	
<b>STEP 4: Clear the fault codes.</b>		
<b>STEP 4A:</b> Disable the fault code.	Fault Code 2374 inactive?	
<b>STEP 4B:</b> Clear the inactive fault codes.	All fault codes cleared?	

### TROUBLESHOOTING STEP

**STEP 1: Check the fault codes.**  
**STEP 1A: Check for sensor supply fault codes.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for sensor supply fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 187 active? <b>YES</b>	Fault Code 187
	Fault Code 187 active? <b>NO</b>	1B

**STEP 1B: Check for an active fault code.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for an active fault code. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 2374 active? <b>YES</b>	2A
	Fault Code 2374 active? <b>NO</b> <b>Repair:</b> Use the following procedure for an inactive or intermittent fault code. Refer to Procedure 019-362 in Section 19.	4A

**STEP 2: Check the exhaust gas pressure sensor and circuit.**

**STEP 2A: Inspect the exhaust gas pressure sensor and connector pins.**

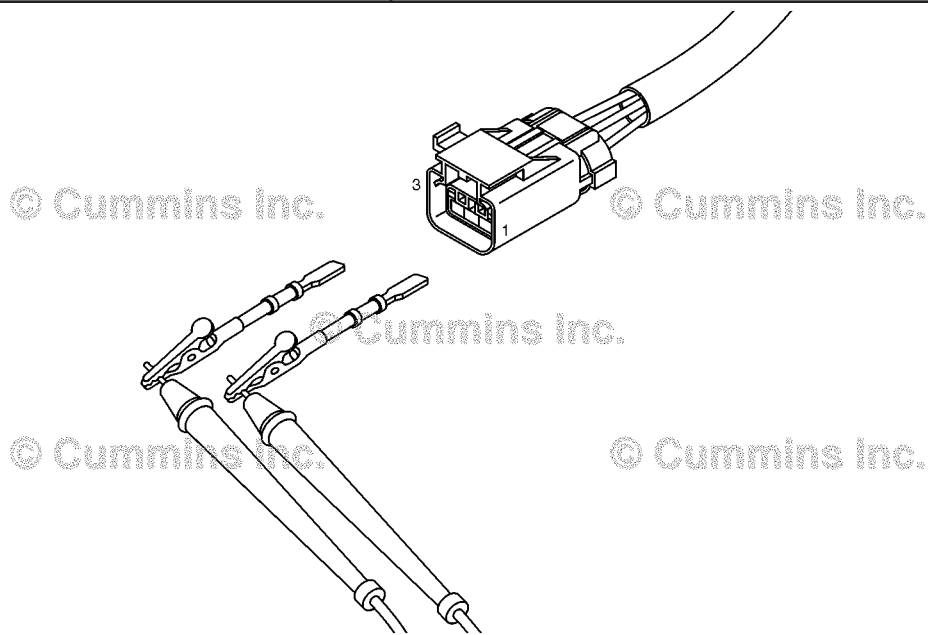
<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the exhaust gas pressure sensor from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
Inspect the engine harness and sensor connector pins for the following: <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.	Dirty or damaged pins? <b>YES</b> <b>Repair:</b> Clean the connector and pins. Repair the damaged harness, connector, or pins if possible.	4A
	Dirty or damaged pins? <b>NO</b>	2B

**STEP 2B: Check the sensor supply voltage and return circuit.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the exhaust gas pressure sensor from the engine harness.
- Turn keyswitch ON.

Action	Specification/Repair	Next Step
Check the supply voltage and return circuit.	4.75-VDC to 5.25-VDC? <b>YES</b>	2C
• Measure the voltage from the exhaust gas pressure +5 volt SUPPLY pin to the exhaust gas pressure RETURN pin at the sensor connector of the engine harness.	4.75-VDC to 5.25-VDC? <b>NO</b>	3A



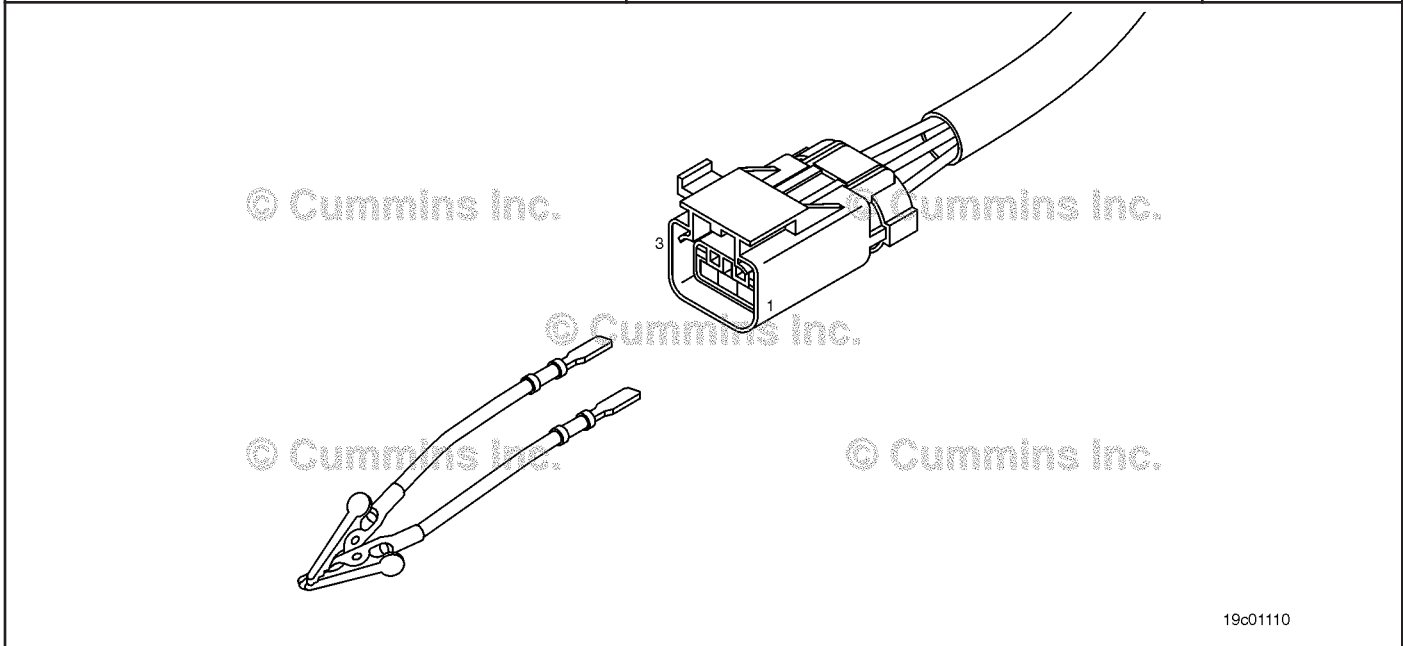
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**STEP 2C: Check the circuit response.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the exhaust gas pressure sensor from the engine harness.
- Turn keyswitch ON.
- Connect INSITE™ electronic service tool.

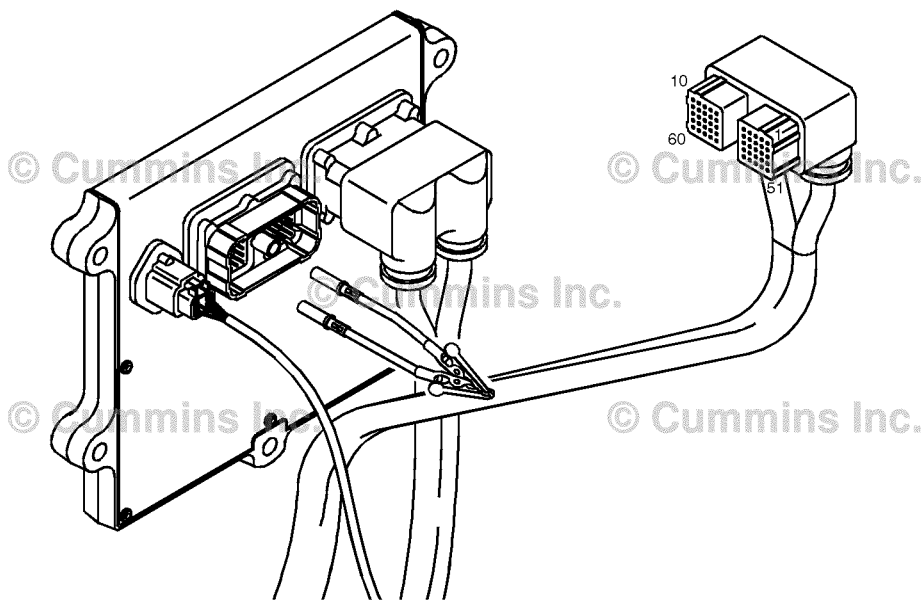
Action	Specification/Repair	Next Step
Check the circuit response. <ul style="list-style-type: none"> <li>• Place a jumper wire between the exhaust gas pressure +5 volt SUPPLY pin and the exhaust gas pressure SIGNAL pin at the sensor connector of the engine harness.</li> <li>• Check for the appropriate ECM response after 30 seconds.</li> <li>• Read the fault codes using INSITE™ electronic service tool.</li> </ul>	Fault Code 2373 active and Fault Code 2374 inactive? <b>YES</b> <b>Repair:</b> Replace the exhaust gas pressure sensor. Refer to Procedure 019-376 in Section 19.	4A
	Fault Code 2373 active and Fault Code 2374 inactive? <b>NO</b>	2D



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**STEP 2D: Check the ECM response.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check the ECM response.</p> <ul style="list-style-type: none"> <li>• Place a jumper wire between the exhaust gas pressure +5 volt SUPPLY pin and the exhaust gas pressure SIGNAL pin at the ECM port.</li> <li>• Check for the appropriate ECM response after 30 seconds.</li> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault Code 2373 active and Fault Code 2374 inactive?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.</p>	4A
	<p>Fault Code 2373 active and Fault Code 2374 inactive?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Replace the ECM. Refer to Procedure 019-031 in Section 19.</p>	4A



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**STEP 3: Check the ECM.**

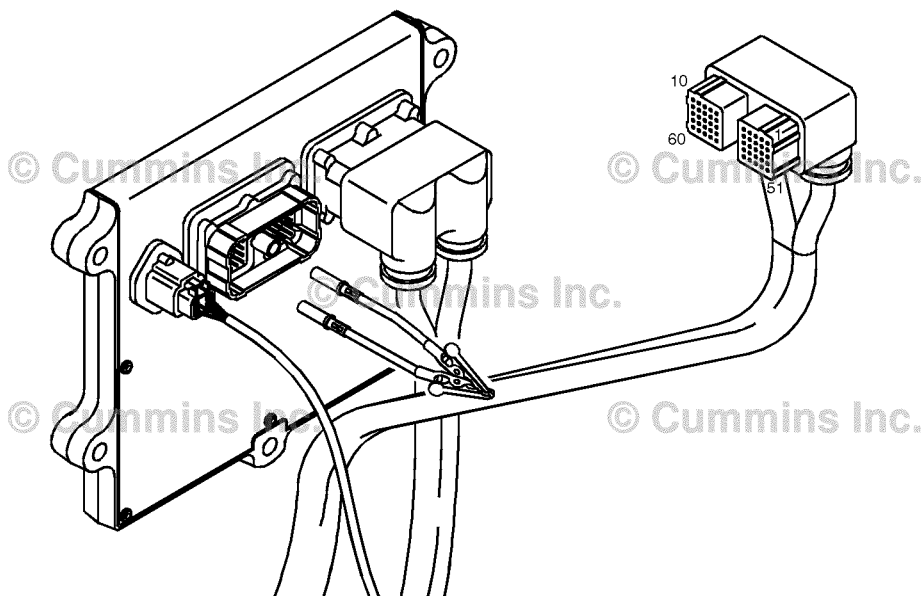
**STEP 3A: Inspect the ECM and engine harness connector pins.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the engine harness and ECM connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Clean the connector and pins.                      Repair the damaged harness, connector, or pins if possible.</p>	4A
	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	3B



**STEP 3B: Check the ECM response.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check the ECM response.</p> <ul style="list-style-type: none"> <li>• Place a jumper wire between the exhaust gas pressure +5 volt SUPPLY pin and exhaust gas pressure SIGNAL pin at the ECM port.</li> <li>• Check for the appropriate ECM response after 30 seconds.</li> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault Code 2373 active and Fault Code 2374 inactive?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.</p>	4A
	<p>Fault Code 2373 active and Fault Code 2374 inactive?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Replace the ECM. Refer to Procedure 019-031 in Section 19.</p>	4A



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**STEP 4: Clear the fault codes.**

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

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> <li>• Start the engine and let it idle for one minute.</li> <li>• Use INSITE™ electronic service tool to verify that the fault code is inactive.</li> </ul>	Fault Code 2374 inactive? <b>YES</b>	4B
	Fault Code 2374 inactive? <b>NO</b>	1A

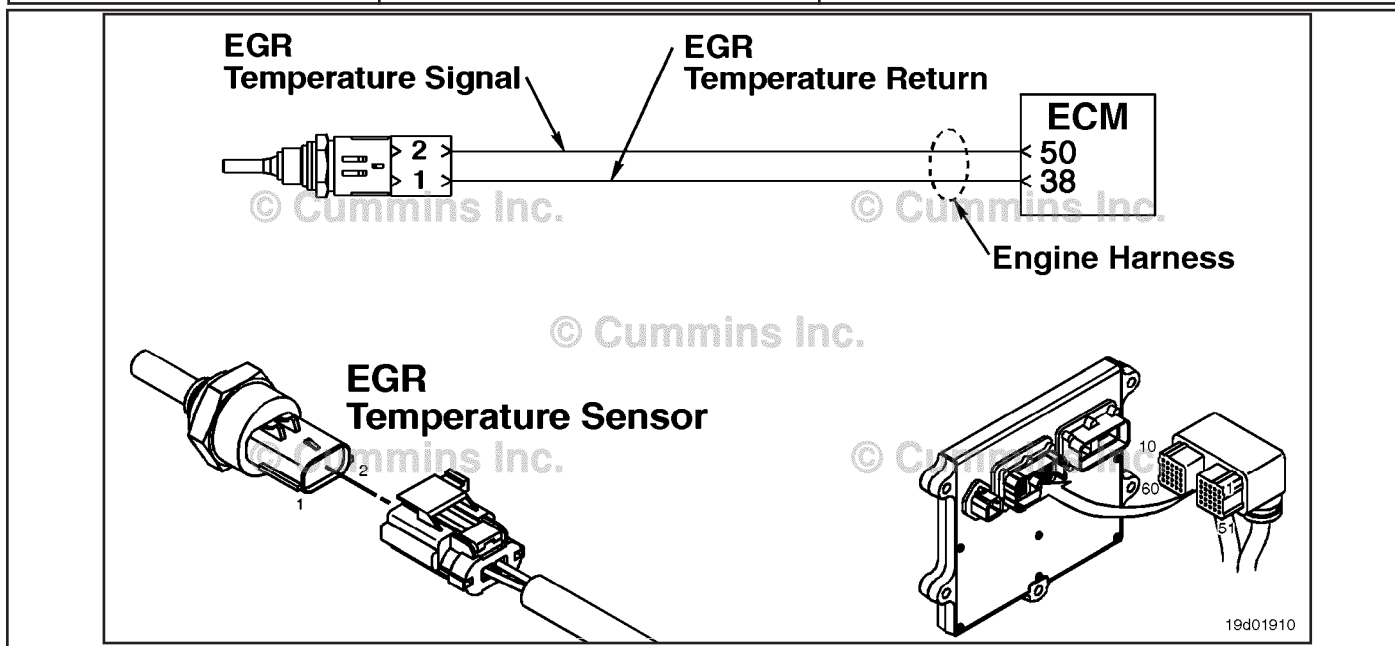
**STEP 4B: Clear the inactive fault codes.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to erase the inactive fault codes</li> </ul>	All fault codes cleared? <b>YES</b>	Repair complete
	All fault codes cleared? <b>NO</b>	Appropriate troubleshooting steps

## Fault Code 2375

### Exhaust Gas Recirculation (EGR) Temperature Sensor Circuit - Voltage Above Normal or Shorted to High Source

CODES	REASON	EFFECT
Fault Code: 2375 PID(P), SID(S): P412 SPN: 412 FMI: 3 Lamp: Amber SRT:	EGR Temperature Sensor Circuit - Voltage Above Normal or Shorted to High Source. High signal voltage detected at the EGR temperature sensor circuit.	EGR valve will be closed.



EGR Temperature Sensor Circuit

#### Circuit Description:

The EGR temperature sensor is used to measure the temperature of the exhaust gas that exits the EGR cooler. The electronic control module (ECM) uses this temperature to control emission levels of the engine.

#### Component Location:

The EGR temperature sensor is located in the intake air horn at the front of the engine. Refer to Procedure 100-002 for a detailed component location view.

#### Shop Talk:

This fault code is set active if the sensor signal voltage is above the normal operating range for the sensor and the ECM has commanded the EGR valve open. This fault code will **not** be set active if the ECM has commanded the EGR valve closed. However, once the fault code is set, it will remain active independent of whether the EGR valve is open or closed.

The EGR temperature sensor shares return wires in the engine harness with other sensors. An open return can cause multiple fault codes to be active. Before troubleshooting Fault Code 2375, check for multiple fault codes.

Possible causes of this fault code include:

- Open return circuit in the harness, connectors, sensor, or ECM
- Open signal circuit or shorted to a voltage source.

Temperature (°C)	Temperature (°F)	Resistance (ohms)
0	32	256k to 423k
20	68	99k to 154k
40	104	42k to 63k
100	212	5.5k to 7.1k
140	284	1.9k to 2.3k
200	392	520 to 580

**Refer to Troubleshooting Fault Code t05-2375**

## FAULT CODE 2375 - Exhaust Gas Recirculation (EGR) Temperature Sensor Circuit - Voltage Above Normal or Shorted to High Source TROUBLESHOOTING SUMMARY

### ⚠CAUTION⚠

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

### ⚠CAUTION⚠

To reduce the possibility of pin and harness damage, use the following test leads when taking a measurement: Part Number 3164596 - male Framatome™ test lead, Part Number 3164597 - female Framatome™ test lead, Part Number 3822758 - male Deutsch™/AMP™/Metri-Pack™ test lead, and Part Number 3822917 - female Deutsch™/AMP™/Metri-Pack™ test lead.

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1: Check the fault codes.</b>		
<b>STEP 1A:</b> Check for an inactive fault code.	Fault Code 2375 inactive?	
<b>STEP 2: Check the EGR temperature sensor and circuit.</b>		
<b>STEP 2A:</b> Inspect the EGR temperature sensor and connector pins.	Dirty or damaged pins?	
<b>STEP 2B:</b> Check the sensor resistance.	200 ohms to 2.4M ohms?	
<b>STEP 2C:</b> Check the fault codes and verify sensor condition.	Fault Code 2375 active?	
<b>STEP 3: Check the ECM and engine harness.</b>		
<b>STEP 3A:</b> Inspect the ECM and engine harness connector pins.	Dirty or damaged pins?	
<b>STEP 3B:</b> Check the ECM response.	Fault Code 2376 active and Fault Code 2375 inactive?	
<b>STEP 3C:</b> Check for an open circuit in the engine harness.	Less than 10 ohms?	
<b>STEP 3C-1:</b> Check for an open circuit in the engine harness.	Less than 10 ohms?	
<b>STEP 3D:</b> Check for a pin-to-pin short circuit in the engine harness.	Greater than 100k ohms?	
<b>STEP 3E:</b> Check for an inactive fault code.	Fault Code 2375 inactive?	
<b>STEP 4: Clear the fault codes.</b>		
<b>STEP 4A:</b> Disable the fault code.	Fault Code 2375 inactive?	
<b>STEP 4B:</b> Clear the inactive fault codes.	All fault codes cleared?	

## TROUBLESHOOTING STEP

### STEP 1: Check the fault codes.

#### STEP 1A: Check for an inactive fault code.

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for an active fault code. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 2375 inactive? <b>YES</b>	Use the following procedure for an inactive or intermittent fault code. Refer to Procedure 019-362 in Section 19.
	Fault Code 2375 inactive? <b>NO</b>	2A

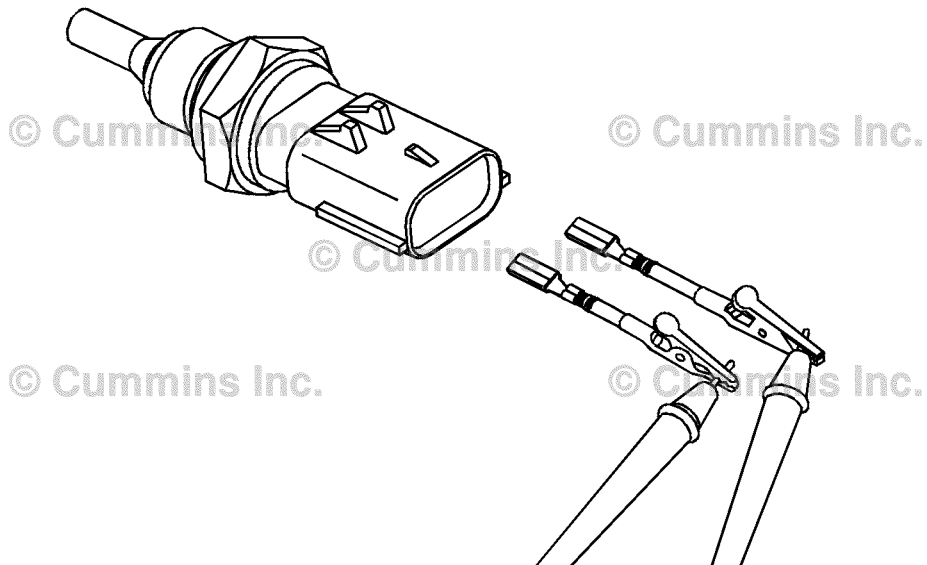
### STEP 2: Check the EGR temperature sensor and circuit.

#### STEP 2A: Inspect the EGR temperature sensor and connector pins.

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the EGR temperature sensor from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
Inspect the engine harness and sensor connector pins for the following: <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.	Dirty or damaged pins? <b>YES</b> <b>Repair:</b> A damaged connection has been detected in the sensor or harness connector. Clean the connector and pins. Repair the damaged harness, connector, or pins if possible. Refer to Procedure 019-043 in Section 19.	4A
	Dirty or damaged pins? <b>NO</b>	2B

**STEP 2B: Check the sensor resistance.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the EGR temperature sensor from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check the sensor resistance.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the EGR temperature sensor SIGNAL pin and the EGR temperature RETURN pin of the EGR temperature sensor.</li> </ul> <p>Refer to the circuit diagram or wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>200 ohms to 2.4M ohms?</p> <p><b>YES</b></p>	<p>2C</p>
	<p>200 ohms to 2.4M ohms?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Replace the EGR temperature sensor. Refer to Procedure 019-378 in Section 19.</p>	<p>4A</p>



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**STEP 2C: Check the fault codes and verify sensor condition.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Connect the EGR temperature sensor to the engine harness.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for the appropriate circuit response after 30 seconds. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 2375 active? <b>YES</b>	3A
	Fault Code 2375 active? <b>NO</b> <b>Repair:</b> None. The removal and installation of the connector corrected the fault.	4A

**STEP 3: Check the ECM and engine harness.**

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

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> </ul>		
Action	Specification/Repair	Next Step
Inspect the engine harness and ECM connector pins for the following: <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.	Dirty or damaged pins? <b>YES</b> <b>Repair:</b> A damaged connection has been detected in the ECM connector or the engine harness connector. Clean the connector and pins. Repair the damaged harness, connector, or pins if possible. Refer to Procedure 019-043 in Section 19.	4A
	Dirty or damaged pins? <b>NO</b>	3B

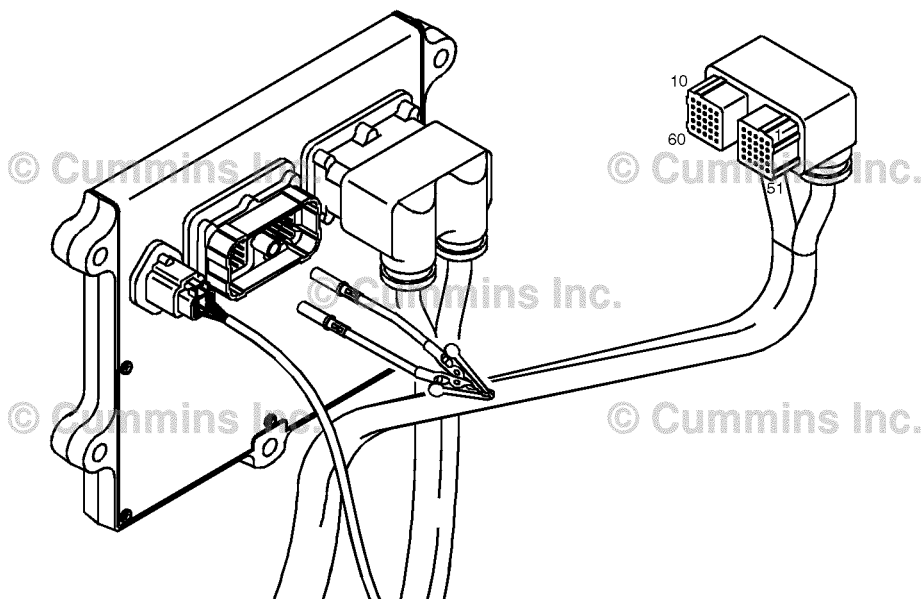


**STEP 3B: Check the ECM response.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine harness from the ECM.
- Turn keyswitch ON.
- Connect INSITE™ electronic service tool.

Action	Specification/Repair	Next Step
Place a jumper wire between the EGR temperature sensor SIGNAL pin and the EGR temperature sensor RETURN pin at the ECM connector.	Fault Code 2376 active and Fault Code 2375 inactive? <b>YES</b>	3C
<ul style="list-style-type: none"> <li>• Check for the appropriate circuit response after 30 seconds.</li> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul> Refer to the circuit diagram or wiring diagram for connector pin identification.  Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.	Fault Code 2376 active and Fault Code 2375 inactive? <b>NO</b>  <b>Repair:</b> Replace the ECM. Refer to Procedure 019-031 in Section 19.	4A



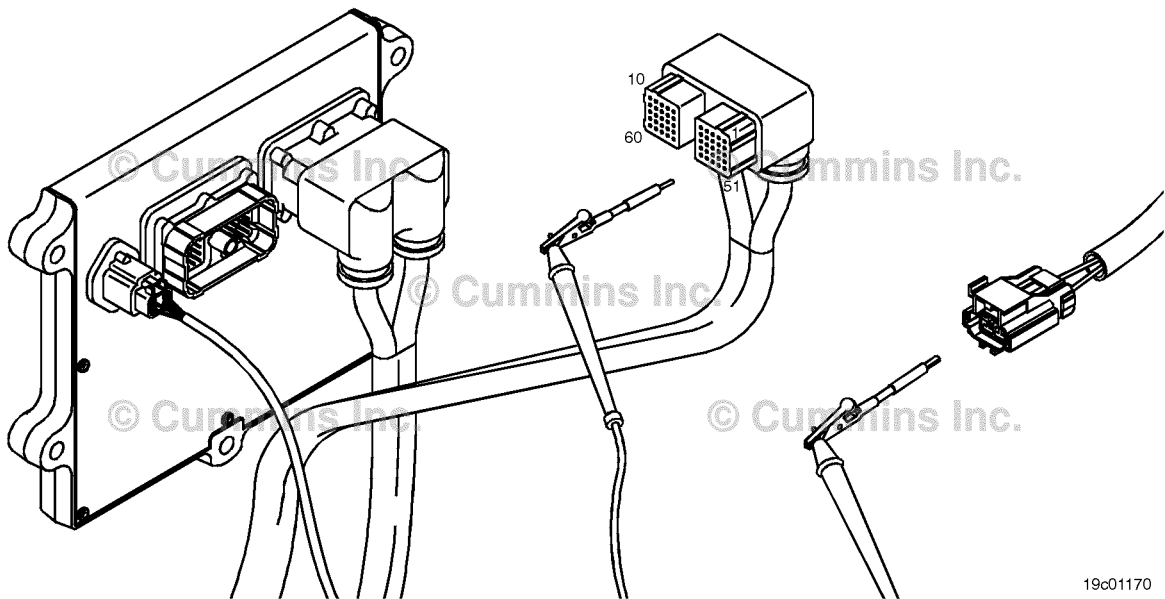
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**STEP 3C: Check for an open circuit in the engine harness(es).**

**Condition:**

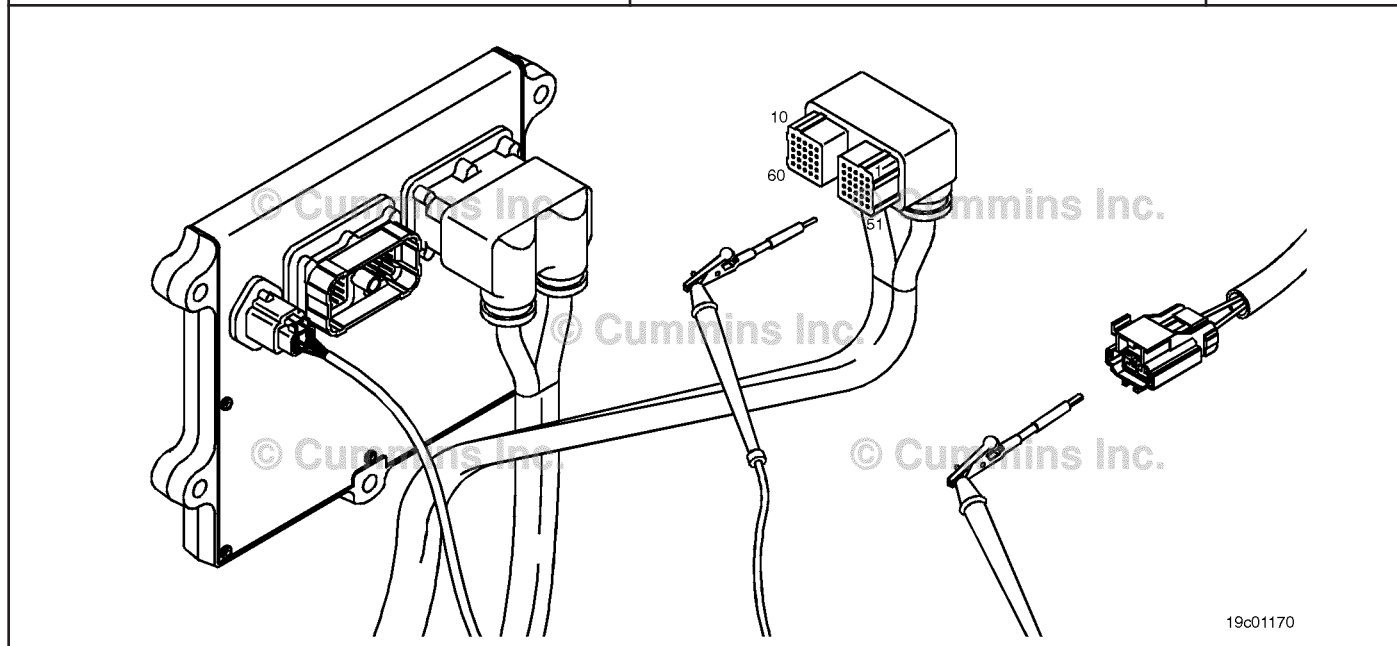
- Turn keyswitch OFF.
- Disconnect the engine harness from the ECM.
- Disconnect the EGR temperature sensor from the engine harness.

Action	Specification/Repair	Next Step
Check for an open circuit. <ul style="list-style-type: none"> <li>• Measure the resistance between the engine harness ECM connector EGR temperature sensor RETURN pin and the engine harness EGR temperature sensor connector RETURN pin.</li> </ul> Refer to the circuit diagram or wiring diagram for connector pin identification. Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.	Less than 10 ohms? <b>YES</b>	3C-1
	Less than 10 ohms? <b>NO</b> <b>Repair:</b> An open return circuit has been detected in the engine harness. Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.	4A



**STEP 3C-1: Check for an open circuit in the engine harness.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> <li>• Disconnect the EGR temperature sensor from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for an open circuit.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the engine harness ECM connector EGR temperature sensor SIGNAL pin and the engine harness EGR temperature sensor connector SIGNAL pin.</li> </ul> <p>Refer to the circuit diagram or wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Less than 10 ohms? <b>YES</b></p>	<p>3D</p>
	<p>Less than 10 ohms? <b>NO</b></p> <p><b>Repair:</b></p> <p>An open signal circuit has been detected in the engine harness.</p> <p>Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.</p>	<p>4A</p>

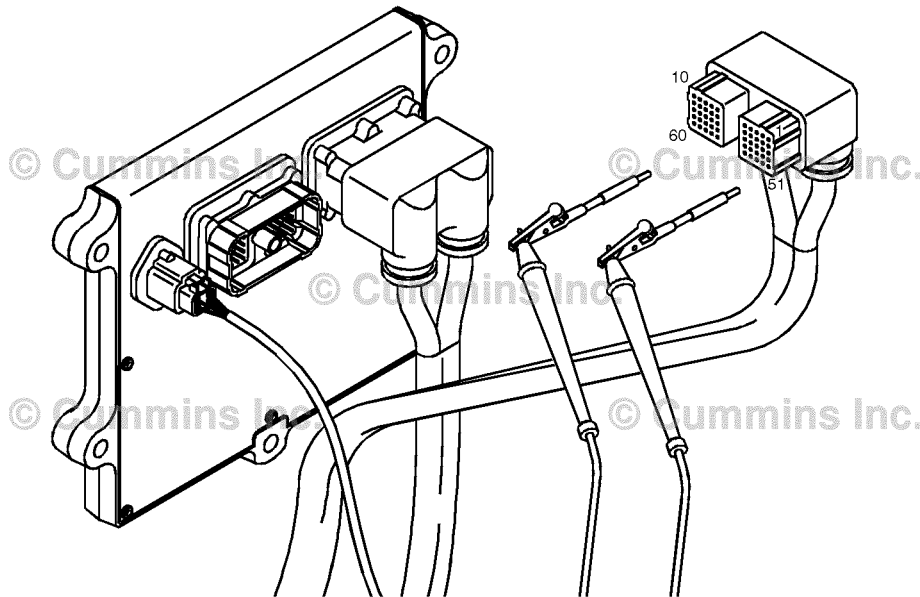


**STEP 3D: Check for a pin-to-pin short circuit in the engine harness.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine harness from the ECM.
- Disconnect the EGR temperature sensor from the engine harness.

Action	Specification/Repair	Next Step
Check for a pin-to-pin short. <ul style="list-style-type: none"> <li>• Measure the resistance between the EGR temperature sensor SIGNAL pin in the engine harness ECM connector and all other pins in the engine harness ECM connector.</li> </ul> Refer to the circuit diagram or wiring diagram for connector pin identification. Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.	Greater than 100k ohms? <b>YES</b>	3E
	Greater than 100k ohms? <b>NO</b> <b>Repair:</b> A pin-to-pin short circuit on the signal line has been detected in the engine harness. Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.	4A



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**STEP 3E: Check for an inactive fault code.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>Connect all components.</li> <li>Turn keyswitch ON.</li> <li>Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for the appropriate circuit response after 30 seconds. <ul style="list-style-type: none"> <li>Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 2375 inactive? <b>YES</b> <b>Repair:</b> None. The removal and installation of the connector corrected the fault.	4A
	Fault Code 2375 inactive? <b>NO</b> <b>Repair:</b> Troubleshooting procedures need to be repeated from the beginning. A failure mode should have been detected.	1A

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

<b>Condition:</b> <ul style="list-style-type: none"> <li>Connect all components.</li> <li>Turn keyswitch ON.</li> <li>Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> <li>Start the engine and let it idle for one minute.</li> <li>Use INSITE™ electronic service tool to verify the fault code is inactive.</li> </ul>	Fault Code 2375 inactive? <b>YES</b>	4B
	Fault Code 2375 inactive? <b>NO</b> <b>Repair:</b> Return to the troubleshooting steps or contact a local Cummins® Authorized Repair Location if all steps have been completed and checked again.	1A

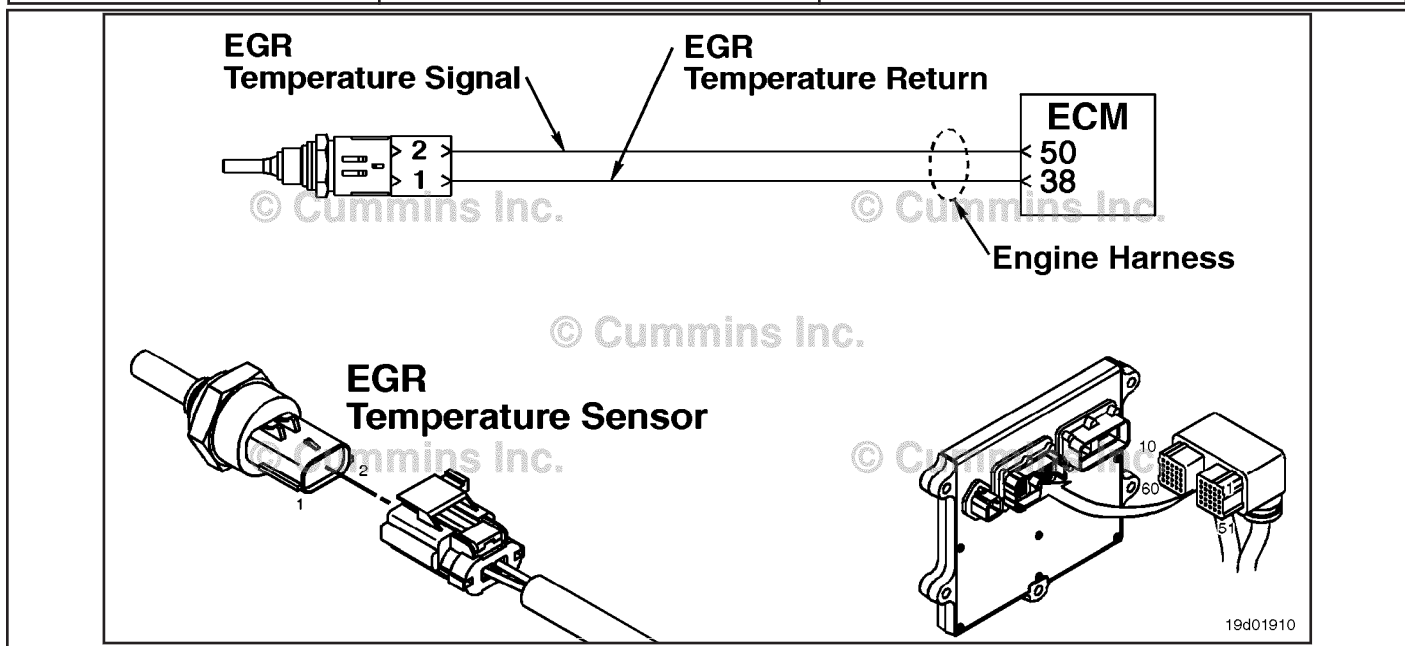
**STEP 4B: Clear the inactive fault codes.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Clear the inactive fault codes.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to erase the inactive fault codes.</li> </ul>	<p>All fault codes cleared?  <b>YES</b></p>	<p>Repair complete</p>
	<p>All fault codes cleared?  <b>NO</b>  <b>Repair:</b>                  Troubleshoot any remaining active fault codes.</p>	<p>Appropriate troubleshooting steps</p>

## Fault Code 2376

### Recirculation Exhaust Gas Temperature Sensor Circuit - Voltage Below Normal or Shorted to Low Source

CODES	REASON	EFFECT
Fault Code: 2376 PID(P), SID(S): P412 SPN: 412 FMI: 4/4 Lamp: Amber SRT:	Recirculation Exhaust Gas (EGR) Temperature Sensor Circuit - Voltage Below Normal or Shorted to Low Source. Low signal voltage detected at the EGR temperature circuit.	EGR valve will be closed.



EGR Temperature Sensor Circuit

#### Circuit Description:

The EGR temperature sensor is used to measure the temperature of the exhaust gas that exits the EGR cooler. The electronic control module (ECM) uses this temperature to control the emission levels of the engine.

#### Component Location:

The EGR temperature sensor is located in the intake air horn at the front of the engine. Refer to Procedure 100-002 for a detailed component location view.

#### Shop Talk:

This fault code is set active if the sensor signal voltage is below the normal operating range for the sensor and the electronic control module (ECM) has commanded the EGR valve open. This fault code will **not** be set active if the ECM has commanded the EGR valve closed. However, once the fault code is set, it will remain active independent of whether the EGR valve is open or closed.

The EGR temperature sensor shares return wires in the engine harness with other sensors. An shorted return can cause multiple fault codes to be active. Before troubleshooting Fault Code 2376, check for multiple fault codes.

Possible causes of this fault code include:

- Signal shorted to ground in the harness or ECM
- Signal shorted to return or ground in the sensor.

Temperature (°C)	Temperature (°F)	Resistance (ohms)
0	32	256k to 423k
20	68	99k to 154k
40	104	42k to 63k
100	212	5.5k to 7.1k
140	284	1.9k to 2.3k
200	392	520 to 580

**Refer to Troubleshooting Fault Code t05-2376**



## FAULT CODE 2376 - Recirculation Exhaust Gas Temperature Sensor Circuit - Voltage Below Normal or Shorted to Low Source TROUBLESHOOTING SUMMARY



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



To reduce the possibility of pin and harness damage, use the following test lead when taking a measurement: Part Number 3822758 - male Deutsch™/AMP™/Metri-Pack™ test lead.

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1:</b> Check the fault codes.		
<b>STEP 1A:</b> Check for an inactive fault code.	Fault Code 2376 inactive?	
<b>STEP 2:</b> Check the EGR temperature sensor and circuit.		
<b>STEP 2A:</b> Inspect the EGR temperature sensor and connector pins.	Dirty or damaged pins?	
<b>STEP 2B:</b> Check the circuit response.	Fault Code 2375 active and Fault Code 2376 inactive?	
<b>STEP 2C:</b> Check the fault codes and verify sensor condition.	Fault Code 2376 active?	
<b>STEP 3:</b> Check the ECM and engine harness.		
<b>STEP 3A:</b> Inspect the ECM and engine harness connector pins.	Dirty or damaged pins?	
<b>STEP 3B:</b> Check the ECM response.	Fault Code 2375 active and Fault Code 2376 inactive?	
<b>STEP 3C:</b> Check for a pin-to-pin short circuit in the engine harness.	Greater than 100k ohms?	
<b>STEP 3D:</b> Check for a pin short circuit to ground.	Greater than 100k ohms?	
<b>STEP 3E:</b> Check for an inactive fault code.	Fault Code 2376 inactive?	
<b>STEP 4:</b> Clear the fault codes.		
<b>STEP 4A:</b> Disable the fault code.	Fault Code 2376 inactive?	
<b>STEP 4B:</b> Clear the inactive fault codes.	All fault codes cleared?	

## TROUBLESHOOTING STEP

### STEP 1: Check the fault codes.

#### STEP 1A: Check for an inactive fault code.

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for an inactive fault code. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 2376 inactive? <b>YES</b>	Use the following procedure for an inactive or intermittent fault code. Refer to Procedure 019-362 in Section 19.
	Fault Code 2376 inactive? <b>NO</b>	2A

### STEP 2: Check the EGR temperature sensor and circuit.

#### STEP 2A: Inspect the EGR temperature sensor and connector pins.

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the EGR temperature sensor from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
Inspect the engine harness and sensor connector pins for the following: <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.	Dirty or damaged pins? <b>YES</b> <b>Repair:</b> A damaged connection has been detected in the sensor or harness connector. Clean the connector and pins. Repair the damaged harness, connector, or pins if possible. Refer to Procedure 019-043 in Section 19.	4A
	Dirty or damaged pins? <b>NO</b>	2B

**STEP 2B: Check the sensor resistance.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the EGR temperature sensor from the engine harness.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate ECM response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault Code 2375 active and Fault Code 2376 inactive?</p> <p><b>YES</b></p>	2C
	<p>Fault Code 2375 active and Fault Code 2376 inactive?</p> <p><b>NO</b></p>	3A

**STEP 2C: Check the fault codes and verify sensor condition.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Connect the EGR temperature sensor to the engine harness.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate circuit response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault Code 2376 active?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A damaged sensor has been detected. Replace the EGR temperature sensor. Refer to Procedure 019-378 in Section 19.</p>	4A
	<p>Fault Code 2376 active?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>None. The removal and installation of the connector corrected the fault.</p>	4A

**STEP 3: Check the ECM and engine harness.**

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

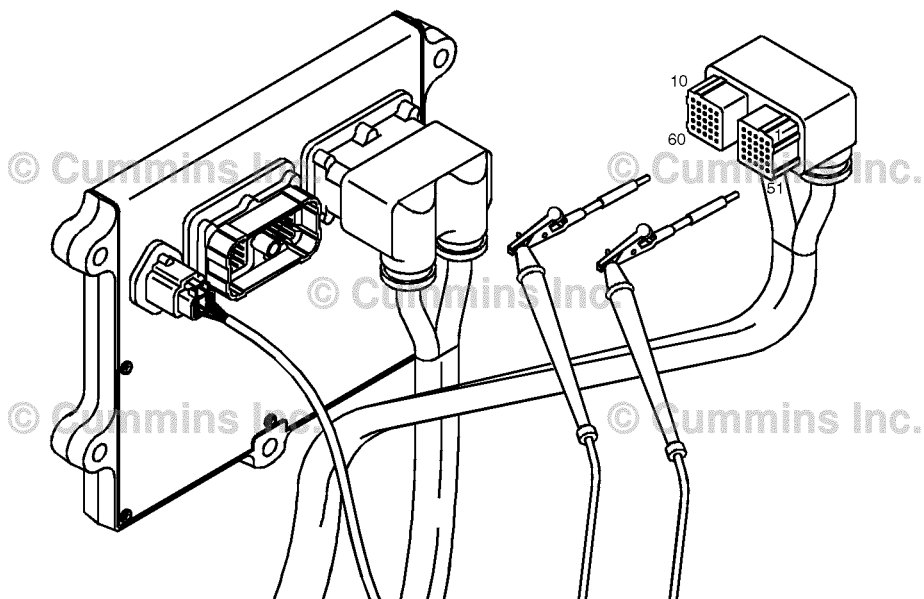
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the engine harness and ECM connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A damaged connection has been detected in the harness connector.</p> <p>Clean the connector and pins.</p> <p>Repair the damaged harness, connector, or pins if possible.</p> <p>Refer to Procedure 019-043 in Section 19.</p>	4A
	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	3B

**STEP 3B: Check the ECM response.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate ECM response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault Code 2375 active and Fault Code 2376 inactive?</p> <p><b>YES</b></p>	3C
	<p>Fault Code 2375 active and Fault Code 2376 inactive?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Replace the ECM. Refer to Procedure 019-031 in Section 19.</p>	4A

**STEP 3C: Check for a pin-to-pin short circuit in the engine harness.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> <li>• Disconnect the EGR temperature sensor from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for a pin-to-pin short.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the EGR temperature sensor SIGNAL pin in the engine harness ECM connector and all other pins in the engine harness ECM connector.</li> </ul> <p>Refer to the circuit diagram or wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Greater than 100k ohms? <b>YES</b></p>	<p>3D</p>
	<p>Greater than 100k ohms? <b>NO</b></p> <p><b>Repair:</b></p> <p>A pin-to-pin short circuit on the signal line has been detected in the engine harness.</p> <p>Repair or replace the engine harness.</p> <p>Refer to Procedure 019-043 in Section 19.</p>	<p>4A</p>

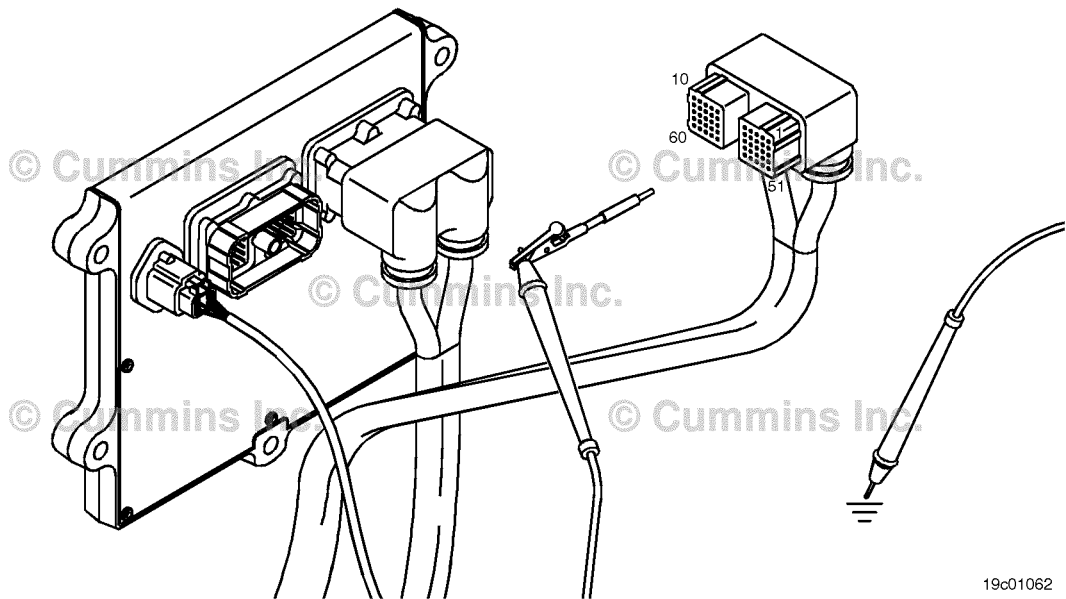


**STEP 3D: Check for a pin short circuit to ground.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine harness from the ECM.
- Disconnect the EGR temperature sensor from the engine harness.

Action	Specification/Repair	Next Step
Check for a pin-to-ground short. <ul style="list-style-type: none"> <li>• Measure the resistance between the EGR temperature sensor SIGNAL pin in the engine harness ECM connector and ground.</li> </ul> Refer to the circuit diagram or wiring diagram for connector pin identification. Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.	Greater than 100k ohms? <b>YES</b>	3E
	Greater than 100k ohms? <b>NO</b> <b>Repair:</b> A pin-to-ground short circuit on the signal line has been detected in the engine harness. Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.	4A



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**STEP 3E: Check for an inactive fault code.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate circuit response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault Code 2376 inactive?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>None. Removal and installation of the connector corrected the fault.</p>	4A
	<p>Fault Code 2376 inactive?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Troubleshooting procedures need to be repeated from the beginning. A failure mode should have been detected.</p>	1A

**STEP 4: Clear the fault codes.**

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

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Disable the fault code.</p> <ul style="list-style-type: none"> <li>• Start the engine and let it idle for one minute.</li> <li>• Use INSITE™ electronic service tool to verify the fault code is inactive.</li> </ul>	<p>Fault Code 2376 inactive?</p> <p><b>YES</b></p>	4B
	<p>Fault Code 2376 inactive?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Return to the troubleshooting steps or contact a local Cummins® Authorized Repair location if all steps have been completed and checked again.</p>	1A

**STEP 4B: Clear the inactive fault codes.**

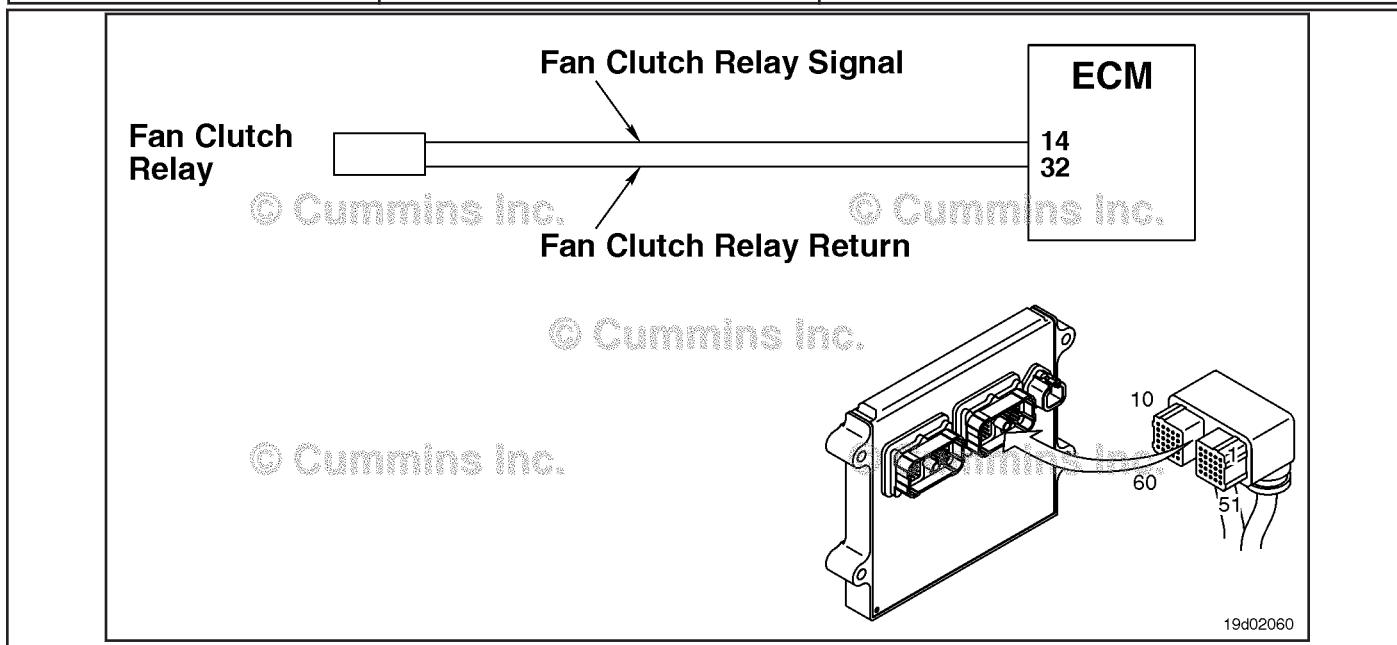
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Clear the inactive fault codes.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to erase the inactive fault codes.</li> </ul>	<p>All fault codes cleared?  <b>YES</b></p>	<p>Repair complete</p>
	<p>All fault codes cleared?  <b>NO</b>  <b>Repair:</b>                  Troubleshoot any remaining active fault codes.</p>	<p>Appropriate troubleshooting steps</p>



## Fault Code 2377

### Fan Control Circuit - Voltage Above Normal or Shorted to High Source

CODES	REASON	EFFECT
Fault Code: 2377 PID(P), SID(S): S033 SPN: 647 FMI: 3 Lamp: Amber SRT:	Fan Control Circuit - Voltage Above Normal or Shorted to High Source. Open circuit or high voltage detected at the fan control circuit.	The fan may stay on continuously or <b>not</b> run at all.



#### **Circuit Description:**

The electronic control module (ECM) provides a signal to the fan control solenoid to turn the engine fan on and off. There are two types of fans supported by this signal, variable speed and ON/OFF. The INSITE™ electronic service tool can be used to determine which fan type is currently set up for use. The fan control circuit varies by OEM. Certain OEMs may use a solenoid return that is wired to the ECM or may use a return that goes to engine block or chassis ground.

#### **Component Location:**

The fan clutch solenoid location varies by OEM. Refer to the appropriate OEM service literature to determine the location.

#### **Shop Talk:**

The ECM monitors the voltage level on this circuit. When the ECM commands the fan signal low, it expects the voltage level to be approximately 0 volts. If it detects a high voltage, this fault is recorded.

If Fault Code 2377 is still active after completing the following troubleshooting steps, consult the OEM service literature for procedures to check the fan clutch device for an open circuit or short circuit to ground.

Possible causes of this fault include:

- Open circuit in the engine harness or fan control solenoid
- Short circuit to voltage source in the OEM harness

- Failed ECM.

**Refer to Troubleshooting Fault Code t05-2377**

## FAULT CODE 2377 - Fan Control Circuit - Voltage Above Normal or Shorted to High Source

### TROUBLESHOOTING SUMMARY



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



To reduce the possibility of pin and harness damage, use the following test leads when taking a measurement: Part Number 3822758 - male Deutsch™/AMP™/Metri-Pack™ test lead and Part Number 3822917 - female Deutsch™/AMP™/Metri-Pack™ test lead.

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1:</b> Check the fault codes.		
<b>STEP 1A:</b> Check for an inactive fault code.	Fault Code 2377 is inactive?	
<b>STEP 2:</b> Check the fan control solenoid and circuit.		
<b>STEP 2A:</b> Inspect the fan control solenoid and connector pins.	Dirty or damaged pins?	
<b>STEP 2B:</b> Check for an open circuit in the fan control solenoid.	Less than 10k ohms?	
<b>STEP 2C:</b> Check the fan control solenoid diagnostic supply voltage, supply line and return circuit.	Greater than 5.0-VDC?	
<b>STEP 2D:</b> Check for an open circuit in the fan control solenoid return circuit.	Less than 10 ohms?	
<b>STEP 3:</b> Check the ECM and OEM harness.		
<b>STEP 3A:</b> Inspect the ECM and OEM harness connector pins.	Dirty or damaged pins?	
<b>STEP 3B:</b> Check for an open circuit in fan control signal circuit.	Less than 10 ohms?	
<b>STEP 3C:</b> Check for a pin-to-pin short circuit in the OEM harness.	Greater than 100k ohms?	
<b>STEP 3D:</b> Check for an inactive fault code.	Fault Code 2377 inactive?	
<b>STEP 4:</b> Clear the fault code.		
<b>STEP 4A:</b> Disable the fault code.	Fault Code 2377 inactive?	
<b>STEP 4B:</b> Clear the inactive fault codes.	All fault codes cleared?	

## TROUBLESHOOTING STEP

### STEP 1: Check the fault codes.

#### STEP 1A: Check for an inactive fault code.

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for an inactive fault code. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 2377 is inactive? <b>YES</b>	Use the following procedure for an inactive or intermittent fault code. Refer to Procedure 019-362 in Section 19.
	Fault Code 2377 is inactive? <b>NO</b>	2A

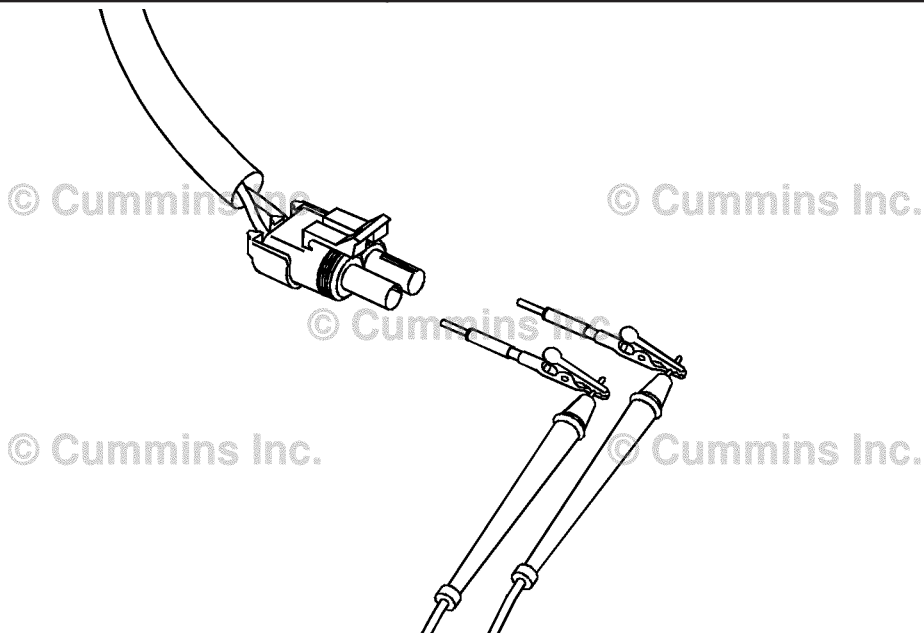
### STEP 2: Check the fan control solenoid and circuit.

#### STEP 2A: Inspect the fan control solenoid and connector pins.

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the fan solenoid from the OEM harness.</li> </ul>		
Action	Specification/Repair	Next Step
Inspect the OEM harness and fan solenoid connector pins for the following: <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.	Dirty or damaged pins? <b>YES</b> <b>Repair:</b> A damaged connection has been detected in the sensor or harness connector. Clean the connector and pins. Repair the damaged harness, connector, or pins if possible. Refer to Procedure 019-071 in Section 19.	4A
		Dirty or damaged pins? <b>NO</b>

**STEP 2B: Check for an open circuit in the fan control solenoid.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the fan control solenoid from the OEM harness.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check fan control solenoid resistance.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the fan control solenoid SIGNAL pin and the fan control solenoid RETURN pin at the fan control solenoid connector.</li> </ul> <p>Refer to the wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Less than 10k ohms? <b>YES</b></p>	<p>2C</p>
	<p>Less than 10k ohms? <b>NO</b></p> <p><b>Repair:</b></p> <p>An open circuit in the fan control solenoid has been detected.</p> <p>Replace the fan control solenoid. Refer to the OEM service manual.</p>	<p>4A</p>



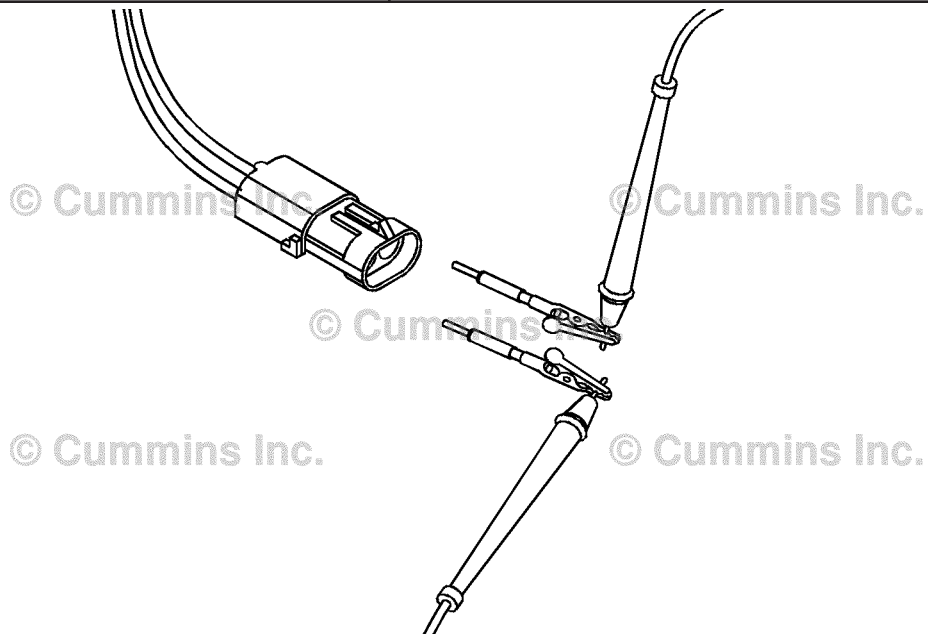
19c01133

**STEP 2C: Check the fan control solenoid diagnostic supply voltage, supply line and return circuit.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the fan control solenoid from the OEM harness.
- Turn keyswitch ON.

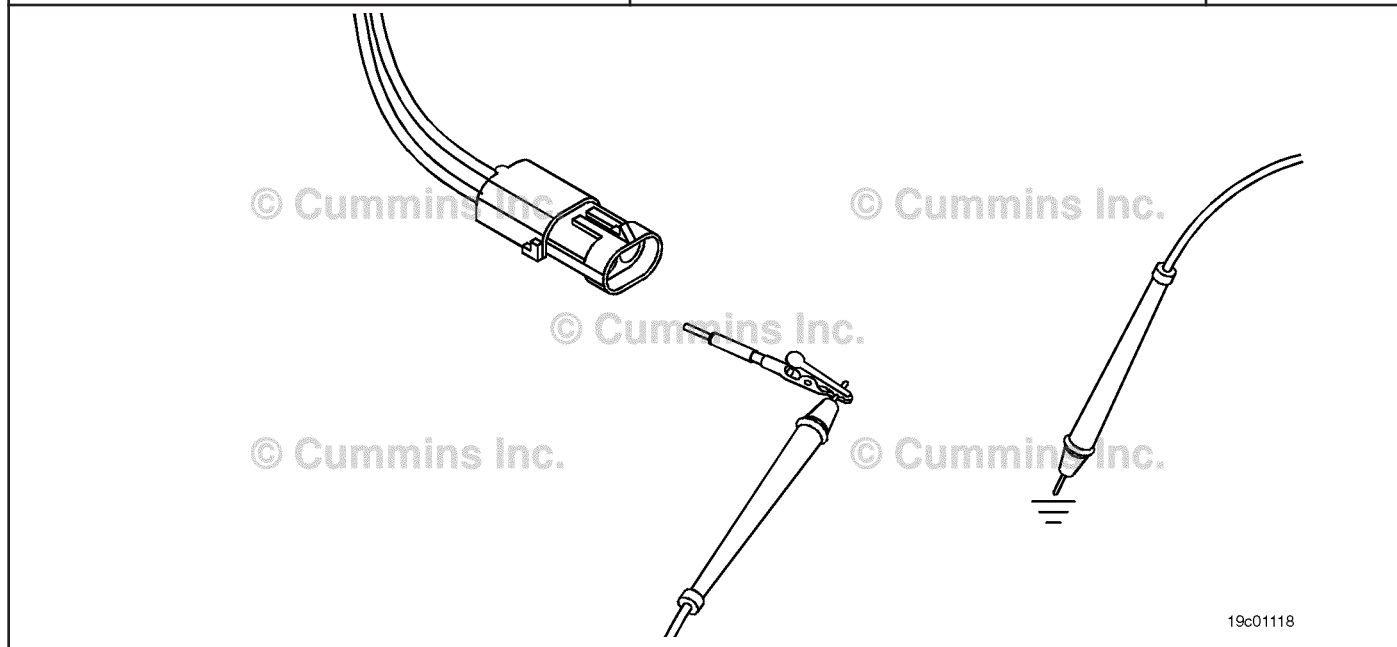
Action	Specification/Repair	Next Step
Check the fan control solenoid diagnostic supply voltage and return circuit.	Greater than 5.0-VDC? <b>YES</b>	3C
<ul style="list-style-type: none"> <li>• Measure the voltage between the fan control solenoid SIGNAL pin and the fan control solenoid RETURN pin at the fan control solenoid connector of the OEM harness.</li> </ul>	Greater than 5.0-VDC? <b>NO</b>	2D



19c01114

**STEP 2D: Check for an open circuit in the fan control solenoid return circuit.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the fan control solenoid from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for an open circuit.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the fan control solenoid RETURN pin in the engine harness and ground.</li> </ul> <p>Refer to the wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Less than 10 ohms? <b>YES</b></p>	<p>3A</p>
	<p>Less than 10 ohms? <b>NO</b></p> <p><b>Repair:</b></p> <p>An open circuit on the RETURN wire has been detected. Refer to the OEM wiring diagram for RETURN wire configuration.</p> <p>If the RETURN is wired to the ECM, repair or replace the OEM harness. Refer to Procedure 019-071 in Section 19.</p> <p>If the RETURN wire is grounded to the chassis or engine block ground, repair the source of the failed connection.</p> <p>Clean, repair or replace the OEM harness. Refer to Procedure 019-071 in Section 19.</p>	<p>4A</p>



19c01118

**STEP 3: Check the ECM and OEM harness.**

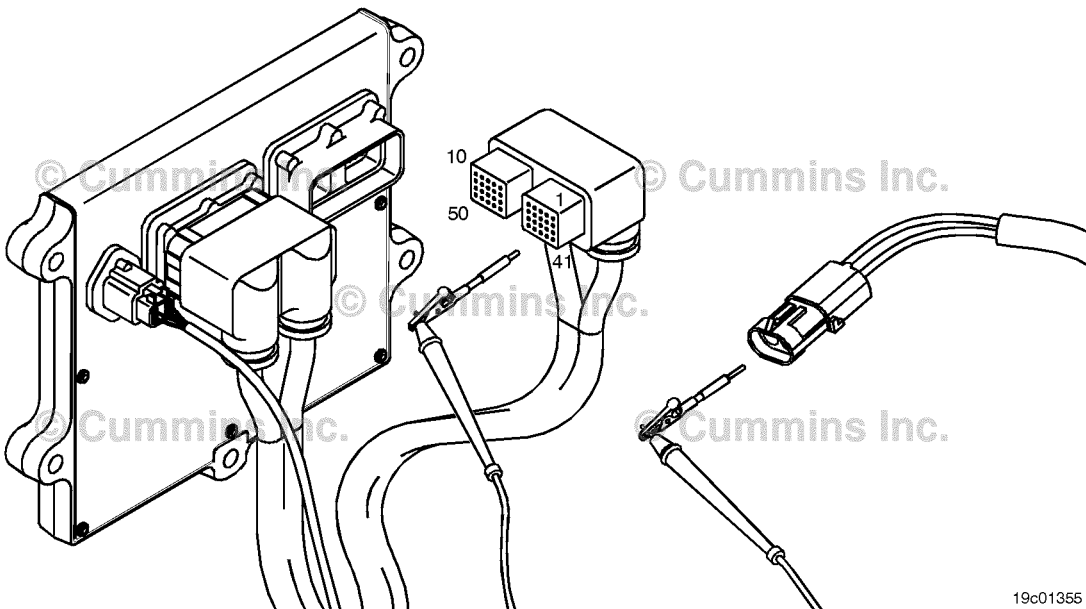
**STEP 3A: Inspect the ECM and OEM harness connector pins.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the OEM harness from the ECM.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the OEM harness and ECM connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A damaged connection has been detected in the ECM or OEM harness connector.</p> <p>Clean the connector and pins.</p> <p>Repair the damaged harness, connector, or pins if possible. Refer to Procedure 019-071 in Section 19.</p>	4A
	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	3B



**STEP 3B: Check for an open circuit in the fan control signal circuit.**

Action	Specification/Repair	Next Step
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the OEM harness from the ECM.</li> <li>• Disconnect the fan control solenoid from the OEM harness.</li> </ul> <p>Check for an open circuit.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the OEM harness ECM fan control solenoid SIGNAL pin and the OEM harness fan control solenoid connector fan control solenoid SIGNAL pin.</li> </ul> <p>Refer to the wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Less than 10 ohms? <b>YES</b></p>	<p>3C</p>
	<p>Less than 10 ohms? <b>NO</b></p> <p><b>Repair:</b></p> <p>An open fan control solenoid SIGNAL circuit has been detected in the OEM harness.</p> <p>Repair or replace the OEM harness. Refer to Procedure 019-071 in Section 19.</p>	<p>4A</p>



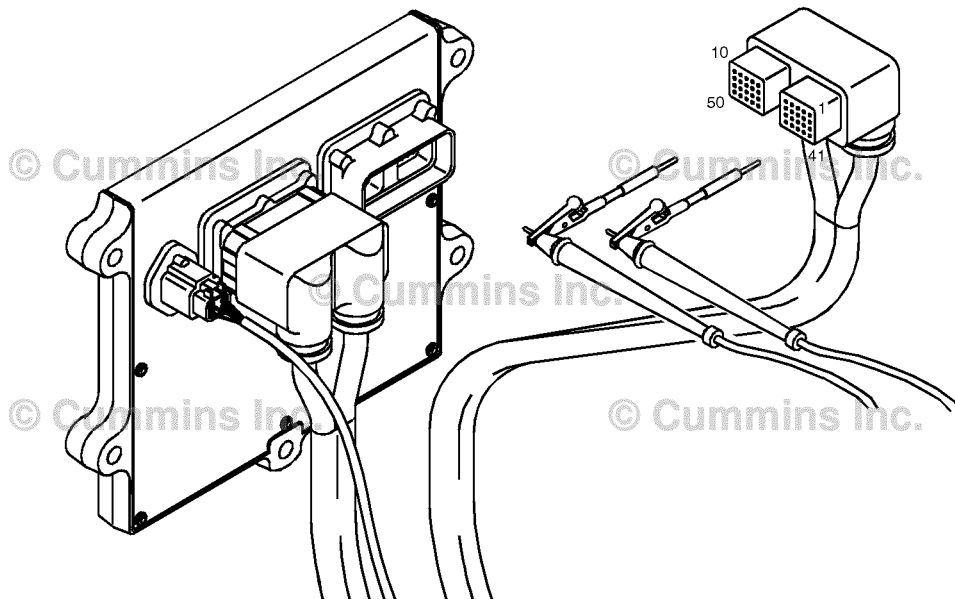
19c01355

**STEP 3C: Check for a pin-to-pin short circuit in the OEM harness.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the OEM harness from the ECM connector.
- Disconnect the fan control solenoid from the OEM harness.

Action	Specification/Repair	Next Step
Check for a pin-to-pin short. <ul style="list-style-type: none"> <li>• Measure the resistance between the fan control solenoid SIGNAL pin in the OEM harness ECM connector and all other pins in the OEM connector.</li> </ul> Refer to the wiring diagram for connector pin identification. Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.	Greater than 100k ohms? <b>YES</b>	3D
	Greater than 100k ohms? <b>NO</b> <b>Repair:</b> A pin-to-pin short circuit on the fan control solenoid SIGNAL line has been detected in the OEM harness. Repair or replace the OEM harness. Refer to Procedure 019-071 in Section 19.	4A



19c01056

**STEP 3D: Check for an inactive fault code.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for the appropriate circuit response after 30 seconds. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 2377 inactive? <b>YES</b> <b>Repair:</b> None. The removal and installation of the connector corrected the fault.	4A
	Fault Code 2377 inactive? <b>NO</b> <b>Repair:</b> Replace the ECM. Refer to Procedure 019-031 in Section 19.	4A

**STEP 4: Clear the fault code.**

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

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to verify that the fault code is inactive.</li> </ul>	Fault Code 2377 inactive? <b>YES</b>	4B
	Fault Code 2377 inactive? <b>NO</b>	1A

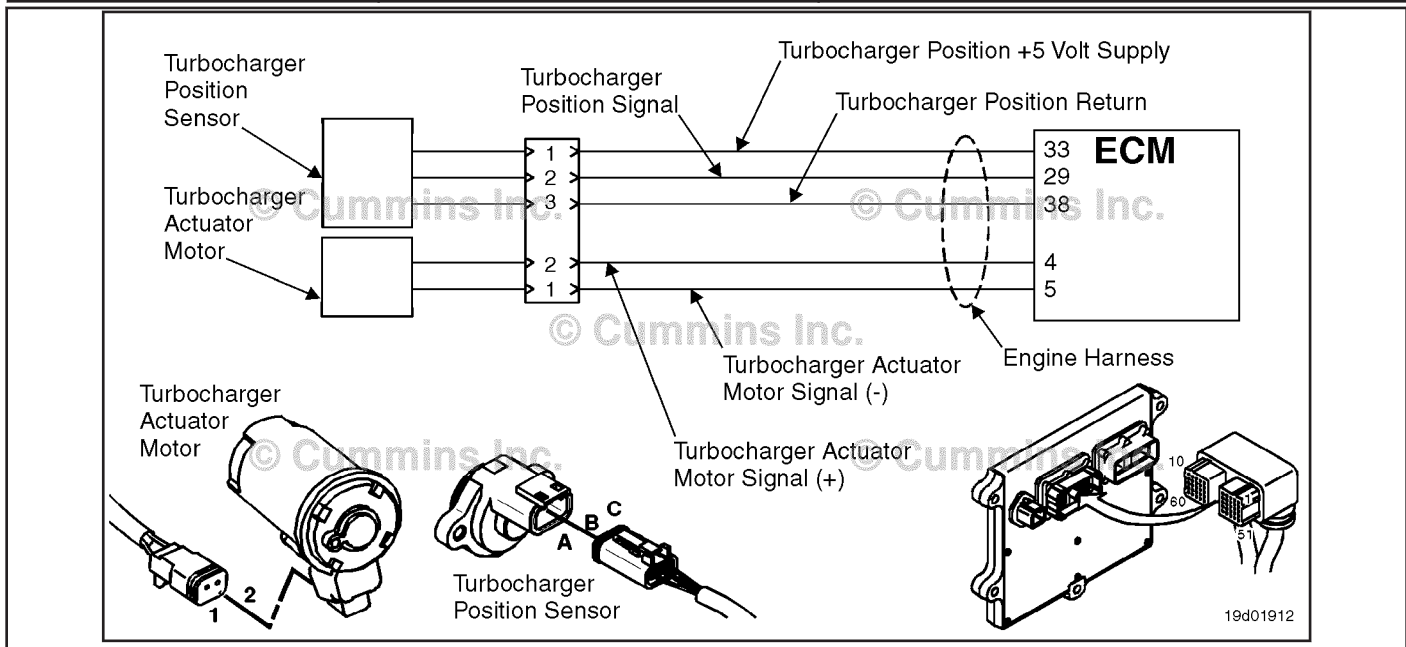
**STEP 4B: Clear the inactive fault codes.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to erase the inactive fault codes.</li> </ul>	All fault codes cleared? <b>YES</b>	Repair complete
	All fault codes cleared? <b>NO</b>	Appropriate troubleshooting steps

## Fault Code 2381

### Turbocharger Position Sensor Circuit - Shorted High

CODES	REASON	EFFECT
Fault Code: 2381 PID(P), SID(S): SPN: 2795 FMI: 4/4 Lamp: Amber SRT:	Turbocharger position sensor circuit - shorted high. High signal voltage detected at the turbocharger position sensor circuit.	Possible low power. Power will be removed from the turbocharger actuator motor. Turbocharger will be open.



Turbocharger Position Sensor Circuit

#### Circuit Description:

The turbocharger position sensor outputs a voltage signal to the electronic control module (ECM). The ECM converts this signal into a percentage value, 0 to 100 percent, indicating the position of the turbocharger actuator. A fully closed turbocharger is equivalent to 100 percent.

#### Component Location:

The turbocharger position sensor is located on the VGT actuator assembly. Refer to Procedure 100-002 for a detailed component location view.

#### Shop Talk:

The turbocharger position sensor shares supply and return wires in the engine harness with other sensors. Opens and shorts in the engine harness can cause multiple fault codes to be active. Possible causes of this fault include:

- Open return circuit in the harness, connectors, or sensor
- Signal shorted to sensor supply or battery voltage
- Failed ECM
- Failed VGT position sensor.

#### Refer to Troubleshooting Fault Code t05-2381

## FAULT CODE 2381 - Turbocharger Position Sensor Circuit - Shorted High TROUBLESHOOTING SUMMARY

### ⚠ CAUTION ⚠

To reduce the possibility of damaging a new engine control module (ECM), all other active fault codes must be investigated prior to replacing the ECM.

### ⚠ CAUTION ⚠

To reduce the possibility of pin and harness damage, use the following test leads when taking a measurement: Part Number 3822758 - male Deutsch™/AMP™/Metri-Pack™ test lead and Part Number 3822917 - female Deutsch™/AMP™/Metri-Pack™ test lead.

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1:</b> Check the fault codes.		
<u>STEP 1A:</u> Check for sensor supply fault codes.	Fault Code 386 active?	
<u>STEP 1B:</u> Check for an active fault code.	Fault Code 2381 active?	
<b>STEP 2:</b> Check the turbocharger position sensor and circuit.		
<u>STEP 2A:</u> Inspect the turbocharger position sensor and harness connector pins.	Dirty or damaged pins?	
<u>STEP 2B:</u> Check the circuit response.	Fault Code 2381 inactive and Fault Code 2382 active?	
<u>STEP 2C:</u> Check the turbocharger position sensor supply and return circuit at the harness.	4.75-VDC to 5.25-VDC?	
<u>STEP 2D:</u> Check the turbocharger position sensor supply and return circuit at the ECM.	4.75-VDC to 5.25-VDC?	
<b>STEP 3:</b> Check the ECM.		
<u>STEP 3A:</u> Inspect the engine harness and ECM connector pins.	Dirty or damaged pins?	
<u>STEP 3B:</u> Check the ECM response.	Fault Code 2381 inactive and Fault Code 2382 active?	
<b>STEP 4:</b> Clear the fault codes.		
<u>STEP 4A:</u> Disable the fault code.	Fault Code 2381 inactive?	
<u>STEP 4B:</u> Clear the inactive fault codes.	All fault codes cleared?	

## TROUBLESHOOTING STEP

### STEP 1: Check the fault codes.

#### STEP 1A: Check for sensor supply fault codes.

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for sensor supply fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 386 active? <b>YES</b>	Fault Code 386
	Fault Code 386 active? <b>NO</b>	1B

#### STEP 1B: Check for an active fault code.

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for an active fault code. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 2381 active? <b>YES</b>	2A
	Fault Code 2381 active? <b>NO</b>	Use the following procedure for an inactive or intermittent fault code. Refer to Procedure 019-362 in Section 19.

**STEP 2: Check the turbocharger position sensor and circuit.**

**STEP 2A: Inspect the turbocharger position sensor and harness connector pins.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the turbocharger position sensor from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the engine harness and turbocharger position sensor connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Clean the connector and pins.</p> <p>Repair the damaged harness, connector, or pins if possible.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	4A
	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	2B

**STEP 2B: Check the circuit response.**

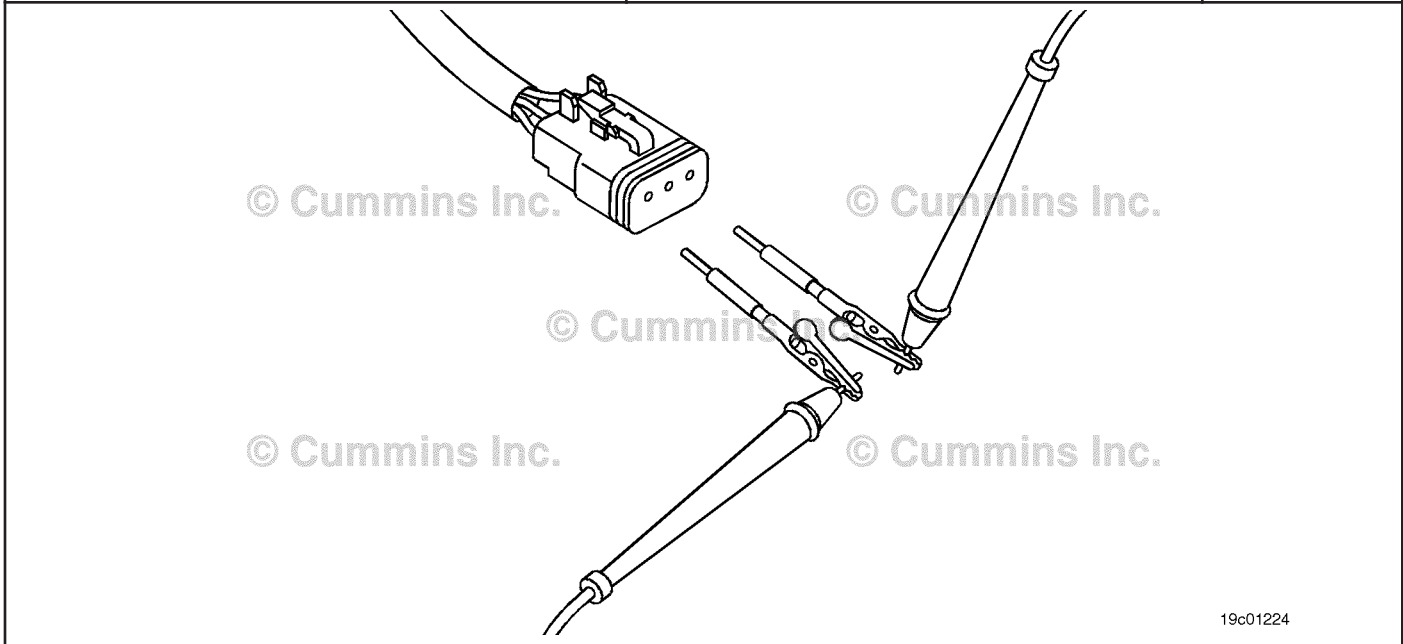
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the turbocharger position sensor from the engine harness.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate ECM response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault Code 2381 inactive and Fault Code 2382 active?</p> <p><b>YES</b></p>	2C
	<p>Fault Code 2381 inactive and Fault Code 2382 active?</p> <p><b>NO</b></p>	3A

**STEP 2C: Check the turbocharger position sensor supply and return circuit at the harness.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the turbocharger position sensor from the engine harness.
- Turn keyswitch ON.

Action	Specification/Repair	Next Step
Check the turbocharger position sensor supply voltage and return circuit at the harness. <ul style="list-style-type: none"> <li>• Measure the voltage between the Turbocharger Position +5 VOLT SUPPLY pin and the Turbocharger Position RETURN pin at the sensor connector of the engine harness.</li> </ul>	4.75-VDC to 5.25-VDC? <b>YES</b> <b>Repair:</b> Replace the turbocharger position sensor. Refer to Procedure 019-405 in Section 19.	4A
	4.75-VDC to 5.25-VDC? <b>NO</b>	2D



19c01224

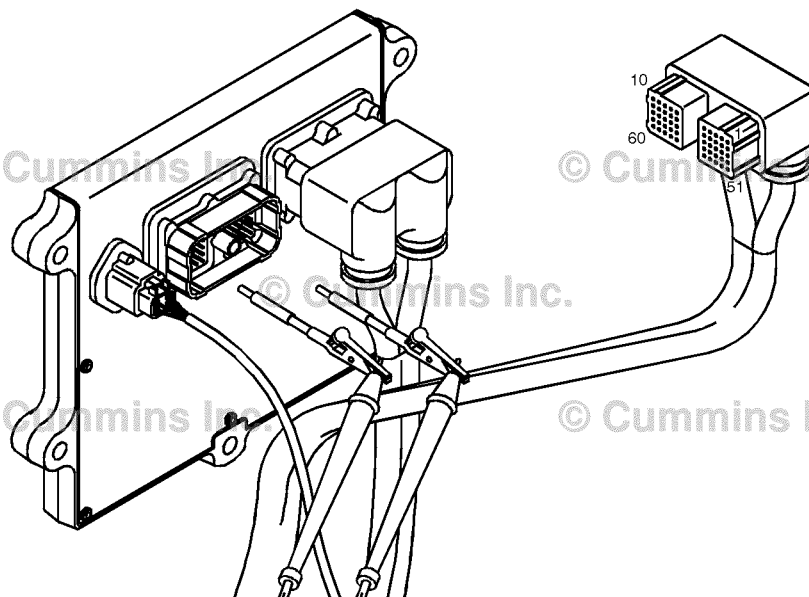


**STEP 2D: Check the turbocharger position sensor supply and return circuit at the ECM.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine harness from the ECM.
- Turn keyswitch ON.

Action	Specification/Repair	Next Step
Check the turbocharger position sensor supply and return circuit at the ECM. • Measure the voltage between the Turbocharger Position +5 VOLT SUPPLY pin and the Turbocharge Position RETURN pin at the ECM port.	4.75-VDC to 5.25-VDC? <b>YES</b> <b>Repair:</b> Repair or replace the engine harness. Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.	4A
	4.75-VDC to 5.25-VDC? <b>NO</b> <b>Repair:</b> Replace the ECM. Refer to Procedure 019-031 in Section 19.	4A



19c01079

**STEP 3: Check the ECM.**

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

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the engine harness and ECM connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Clean the connector and pins.</p> <p>Repair the damaged harness, connector, or pins if possible.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	4A
	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	3B

**STEP 3B: Check the ECM response.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate ECM response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault Code 2381 inactive and Fault Code 2382 active?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.</p>	4A
	<p>Fault Code 2381 inactive and Fault Code 2382 active?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Replace the ECM. Refer to Procedure 019-031 in Section 19.</p>	Repair complete

**STEP 4: Clear the fault codes.**

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

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> <li>• Start the engine and let it idle for 1 minute.</li> <li>• Use INSITE™ electronic service tool to verify the fault code is inactive.</li> </ul>	Fault Code 2381 inactive? <b>YES</b>	4B
	Fault Code 2381 inactive? <b>NO</b>	1A

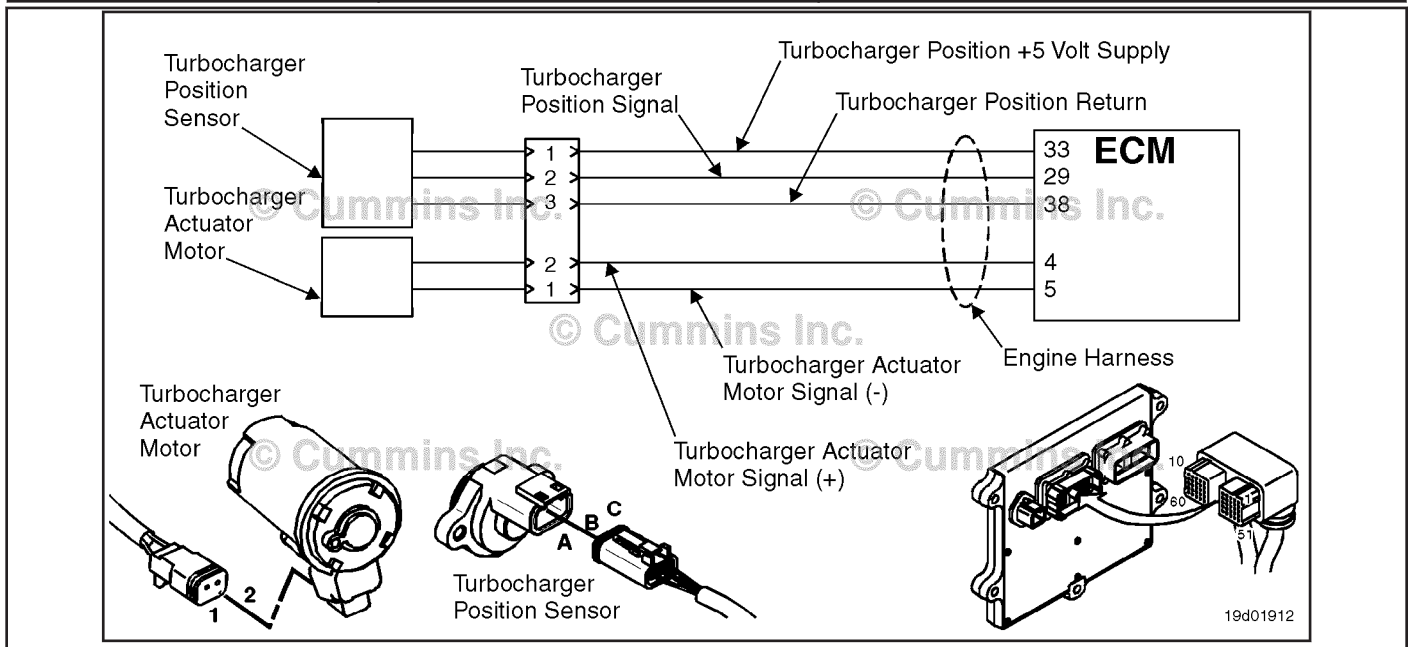
**STEP 4B: Clear the inactive fault codes.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to clear the inactive fault codes.</li> </ul>	All fault codes cleared? <b>YES</b>	Repair complete
	All fault codes cleared? <b>NO</b>	Appropriate troubleshooting steps

## Fault Code 2382

### Turbocharger Position Sensor Circuit - Shorted Low

CODES	REASON	EFFECT
Fault Code: 2382 PID(P), SID(S): SPN: 2795 FMI: 4/4 Lamp: Amber SRT:	Turbocharger position sensor circuit - shorted low. Low signal voltage detected at the turbocharger position sensor circuit.	Possible low power. Power will be removed from the turbocharger actuator motor. Turbocharger will be open.



Turbocharger Position Sensor Circuit

#### **Circuit Description:**

The turbocharger position sensor outputs a voltage signal to the electronic control module (ECM). The ECM converts this signal into a percentage value, 0 to 100 percent, indicating turbocharger position. A fully closed turbocharger is equivalent to 100 percent.

#### **Component Location:**

The turbocharger position sensor is located on the VGT actuator assembly. Refer to Procedure 100-002 for a detailed component location view.

#### **Shop Talk:**

The turbocharger position sensor shares supply and return wires in the engine harness with other sensors. Opens and shorts in the engine harness can cause multiple fault codes to be active. Possible causes of this fault include:

- Signal circuit open or shorted to ground
- Supply circuit open or shorted to ground
- Sensor shorted to ground.

#### **Refer to Troubleshooting Fault Code t05-2382**

## FAULT CODE 2382 - Turbocharger Position Sensor Circuit - Shorted Low TROUBLESHOOTING SUMMARY



To reduce the possibility of damaging a new engine control module (ECM), all other active fault codes must be investigated prior to replacing the ECM.



To reduce the possibility of pin and harness damage, use the following test leads when taking a measurement: Part Number 3822758 - male Deutsch™/AMP™/Metri-Pack™ test lead and Part Number 3822917 - female Deutsch™/AMP™/Metri-Pack™ test lead.

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1: Check the fault codes.</b>		
<b>STEP 1A:</b> Check for sensor supply fault codes.	Fault Code 352 active?	
<b>STEP 1B:</b> Check for an active fault code.	Fault Code 2382 active?	
<b>STEP 2: Check the turbocharger position sensor and circuit.</b>		
<b>STEP 2A:</b> Inspect the turbocharger position sensor and harness connector pins.	Dirty or damaged pins?	
<b>STEP 2B:</b> Check the sensor supply voltage and return circuit.	4.75-VDC to 5.25-VDC?	
<b>STEP 2C:</b> Check the circuit response.	Fault Code 2381 active and Fault Code 2382 inactive?	
<b>STEP 3: Check the engine harness.</b>		
<b>STEP 3A:</b> Inspect the engine harness and ECM connector pins.	Dirty or damaged pins?	
<b>STEP 3B:</b> Check the ECM response.	Fault Code 2381 active and Fault Code 2382 inactive?	
<b>STEP 4: Clear the fault codes.</b>		
<b>STEP 4A:</b> Disable the fault code.	Fault Code 2382 inactive?	
<b>STEP 4B:</b> Clear the inactive fault codes.	All fault codes cleared?	

### TROUBLESHOOTING STEP

**STEP 1: Check the fault codes.**  
**STEP 1A: Check for sensor supply fault codes.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for sensor supply fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 352 active? <b>YES</b>	Fault Code 352
	Fault Code 352 active? <b>NO</b>	1B

**STEP 1B: Check for an active fault code.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for an active fault code.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault Code 2382 active?</p> <p><b>YES</b></p>	2A
	<p>Fault Code 2382 active?</p> <p><b>NO</b></p>	<p>Use the following procedure for an inactive or intermittent fault code. Refer to Procedure 019-362 in Section 19.</p>

**STEP 2: Check the turbocharger position sensor and circuit.**

**STEP 2A: Inspect the turbocharger position sensor and harness connector pins.**

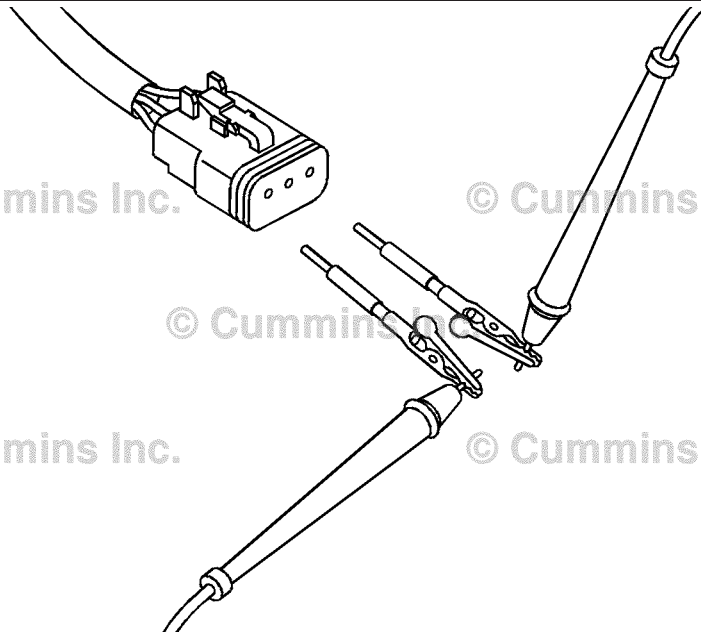
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the turbocharger position sensor from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the engine harness and turbocharger position sensor connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Clean the connector and pins.</p> <p>Repair the damaged harness, connector, or pins if possible.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	4A
		<p>Dirty or damaged pins?</p> <p><b>NO</b></p>

**STEP 2B: Check the sensor supply voltage and return circuit.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the turbocharger position sensor from the engine harness.
- Turn keyswitch ON.

Action	Specification/Repair	Next Step
Check the sensor supply voltage and return circuit.	4.75-VDC to 5.25-VDC? <b>YES</b>	2C
<ul style="list-style-type: none"> <li>• Measure the voltage between the Turbocharger Position +5 VOLT SUPPLY pin and the Turbocharger Position RETURN pin at the sensor connector of the engine harness.</li> </ul>	4.75-VDC to 5.25-VDC? <b>NO</b>	3A



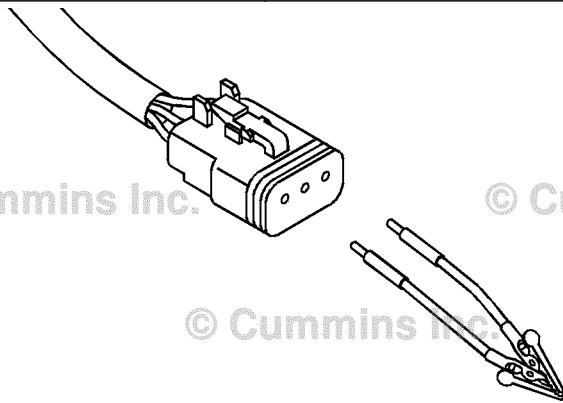
19c01224

**STEP 2C: Check the circuit response.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the turbocharger position sensor from the engine harness.
- Turn keyswitch ON.
- Connect INSITE™ electronic service tool.

Action	Specification/Repair	Next Step
Check the circuit response. <ul style="list-style-type: none"> <li>• Install a jumper wire between the Turbocharger Position +5 VOLT SUPPLY pin and the Turbocharger position SIGNAL pin at the sensor connector of the engine harness:</li> </ul> Check for the appropriate ECM response after 30 seconds.	Fault Code 2381 active and Fault Code 2382 inactive? <b>YES</b> <b>Repair:</b> Replace the turbocharger position sensor. Refer to Procedure 019-405 in Section 19.	4A
<ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool and read the fault codes.</li> </ul>	Fault Code 2381 active and Fault Code 2382 inactive? <b>NO</b>	3A



19c01225



**STEP 3: Check the engine harness.**

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

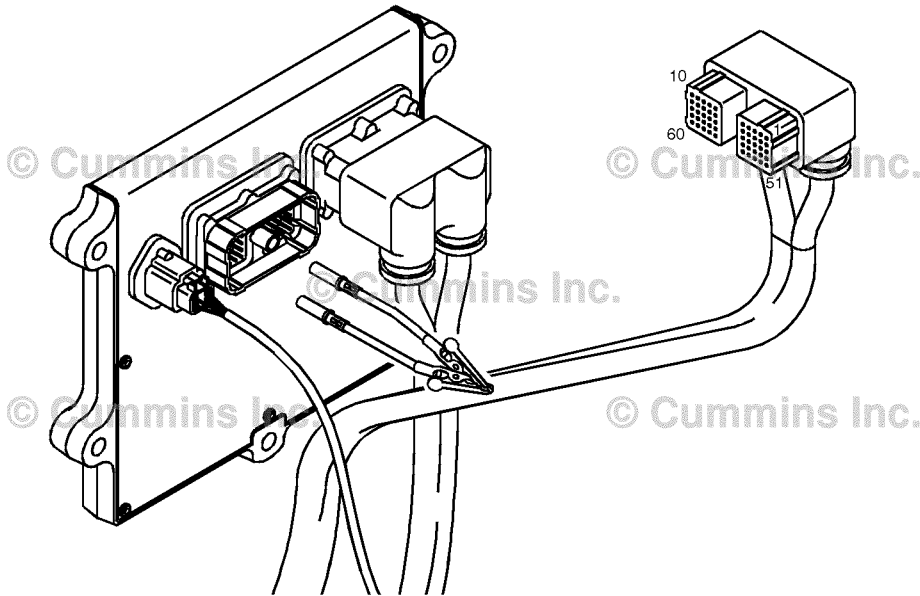
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the engine harness and ECM connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Clean the connector and pins.</p> <p>Repair the damaged harness, connector, or pins if possible.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	4A
	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	3B

**STEP 3B: Check the ECM response.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the turbocharger position sensor from the engine harness.
- Turn keyswitch ON.
- Connect INSITE™ electronic service tool.

Action	Specification/Repair	Next Step
Check the circuit response. <ul style="list-style-type: none"> <li>• Install a jumper wire between the Turbocharger Position +5 VOLT SUPPLY pin and the Turbocharger Position SIGNAL pin at the ECM port:</li> </ul> Check for the appropriate ECM response after 30 seconds. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool and read the fault codes.</li> </ul>	Fault Code 2381 active and Fault Code 2382 inactive? <p><b>YES</b></p> <p><b>Repair:</b></p> Repair or replace the engine harness. Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.	4A
	Fault Code 2381 active and Fault Code 2382 inactive? <p><b>NO</b></p> <p><b>Repair:</b></p> Replace the ECM. Refer to Procedure 019-031 in Section 19.	4A



19c01111

**STEP 4: Clear the fault codes.**

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

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> <li>• Start the engine and let it idle for 1 minute.</li> <li>• Use INSITE™ electronic service tool to verify the fault code is inactive.</li> </ul>	Fault Code 2382 inactive? <b>YES</b>	4B
	Fault Code 2382 inactive? <b>NO</b>	1A

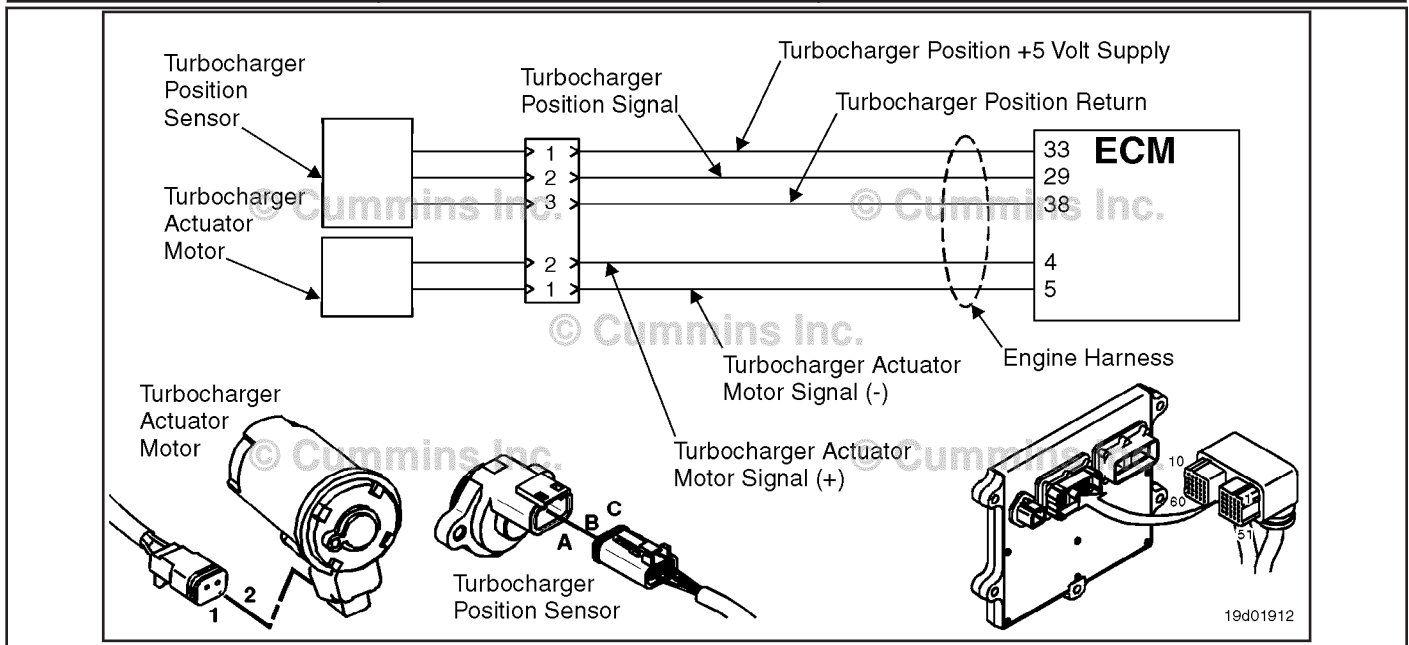
**STEP 4B: Clear the inactive fault codes.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to clear the inactive fault codes.</li> </ul>	All fault codes cleared? <b>YES</b>	Repair complete
	All fault codes cleared? <b>NO</b>	Appropriate troubleshooting steps

## Fault Code 2383

### Variable Geometry Turbocharger Actuator Circuit - Current Below Normal, or Open Circuit

CODES	REASON	EFFECT
Fault Code: 2383 PID(P), SID(S): S027 SPN: 641 FMI: 5/5 Lamp: Amber SRT:	Variable Geometry Turbocharger actuator circuit - current below normal, or open circuit.	Possible low power. Power removed from the turbocharger actuator motor.



Turbocharger Actuator Circuit

#### Circuit Description:

The electronic control module (ECM) controls the turbocharger actuator, which changes the airflow of the turbocharger based on various engine operating conditions. The sliding nozzle in the turbocharger is operated by the turbocharger actuator motor. The actuator is a DC motor that receives voltage from the ECM.

#### Component Location:

The turbocharger actuator motor is part of the turbocharger actuator assembly, which is located on the exhaust side of the engine and is mounted to the bearing housing of the turbocharger. Refer to Procedure 100-002 for a detailed component location view.

#### Shop Talk:

The ECM monitors the voltage level of this circuit and logs a fault code if the voltage level indicates an open circuit or short to voltage source is present. This fault is **always** set inactive when the keyswitch is turned on. If the fault condition reoccurs while the keyswitch is in the ON position, the fault code will be set active. Since active faults are set inactive at key-on, this troubleshooting tree should be used to troubleshoot active and inactive faults. Possible causes of this fault include:

- An open circuit in the engine harness, connectors, motor, or ECM
- Turbocharger actuator motor signal (+ or -) leads shorted to a voltage source in the engine harness or ECM.

Do not supply voltage of any kind to the EGR valve motor. This circuit uses a pulse-width-modulated signal and direct voltage can permanently damage the motor.

**Refer to Troubleshooting Fault Code t05-2383**

FAULT CODE 2383 - Variable Geometry Turbocharger Actuator Circuit -
Current Below Normal, or Open Circuit
TROUBLESHOOTING SUMMARY



To reduce the possibility of pin and harness damage, use the following test lead when taking a measurement:
Part Number 3822758 - male Deutsch™/AMP™/Metri-Pack™ test lead.

Table with 3 columns: STEPS, SPECIFICATIONS, SRT CODE. It lists troubleshooting steps for fault code 2383, such as 'Check the turbocharger actuator motor and circuit' and 'Check the engine harness', with corresponding specifications and SRT codes.

### TROUBLESHOOTING STEP

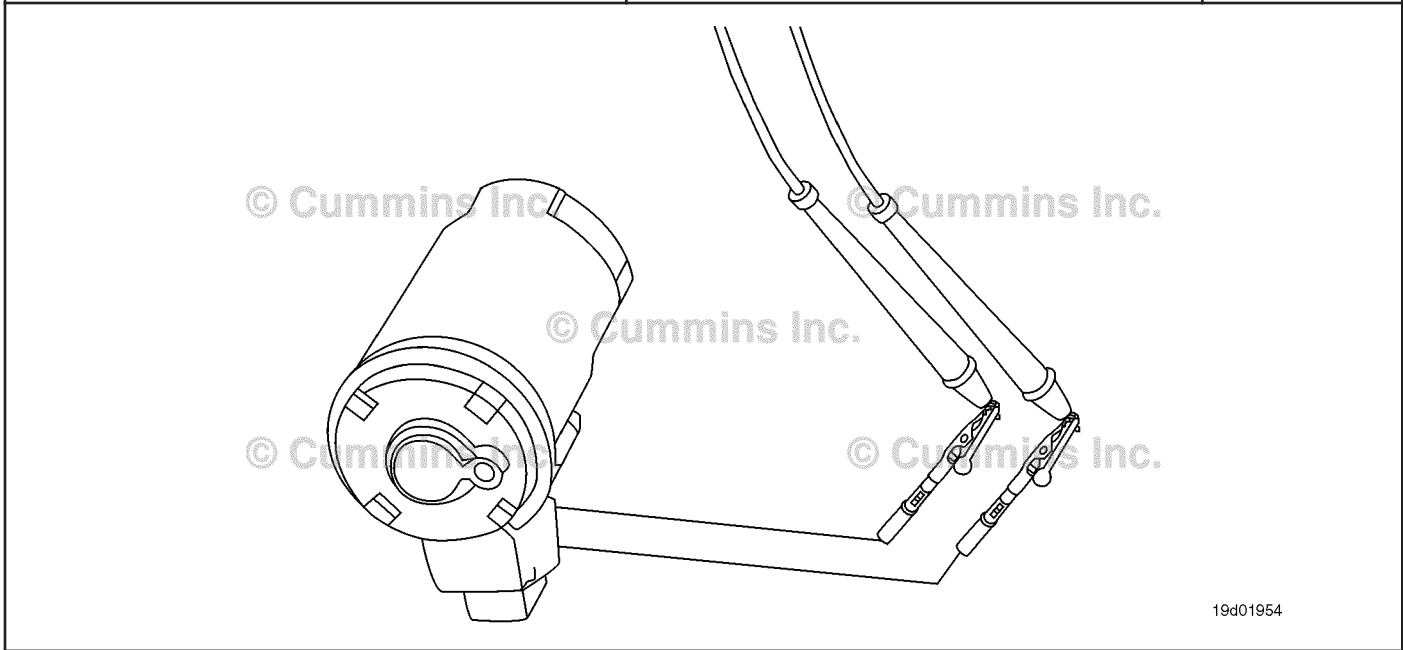
**STEP 1: Check the turbocharger actuator motor and circuit.**

**STEP 1A: Inspect the turbocharger actuator motor and harness connector pins.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the turbocharger actuator motor from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the engine harness and the turbocharger actuator motor connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damaged</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A damaged connection has been detected in the sensor or harness connector pins.</p> <p>Clean the connector and pins.</p> <p>Repair the damaged harness, connector, or pins if possible.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	3A
	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	1B

**STEP 1B: Check for an open circuit in the turbocharger actuator motor.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the turbocharger actuator motor from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for an open circuit in the turbocharger actuator motor.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the turbocharger actuator motor SIGNAL (+) pin and the turbocharger actuator motor SIGNAL (-) pin at the turbocharger actuator connector.</li> </ul> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Less than 15 ohms? <b>YES</b></p>	<p>2A</p>
	<p>Less than 15 ohms? <b>NO</b></p> <p><b>Repair:</b></p> <p>An open circuit has been detected in the turbocharger actuator motor.</p> <p>Replace the turbocharger. Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, 4021271. Refer to Procedure 010-033 in Section 10.</p>	<p>3A</p>



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**STEP 2: Check the engine harness.**

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

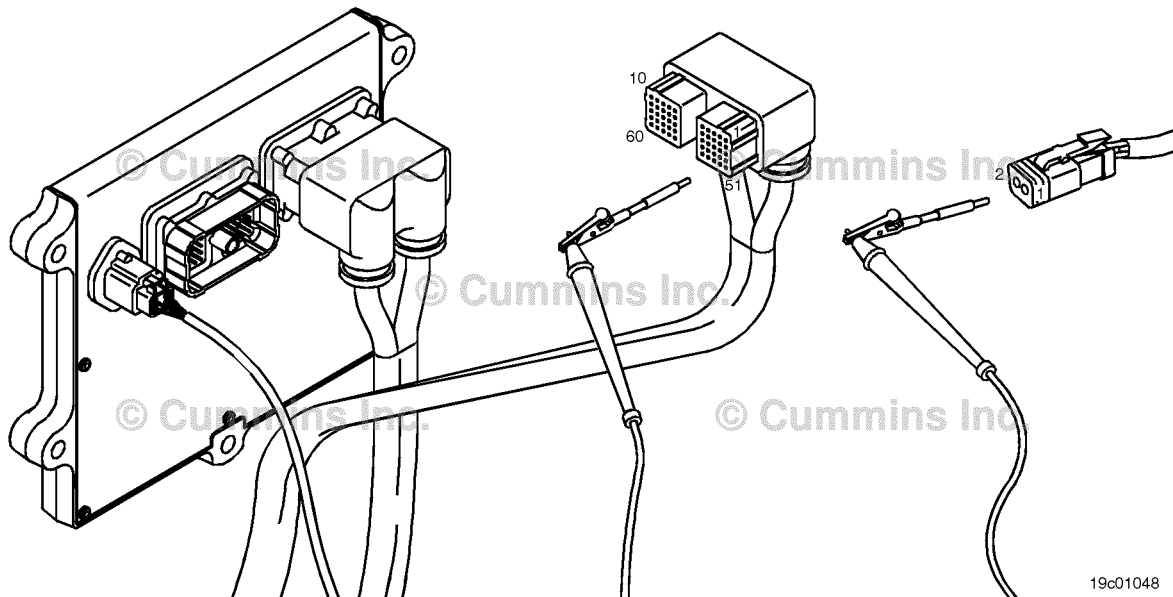
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the engine harness and ECM connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damaged</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A damaged connection has been detected in the sensor or harness connector pins.</p> <p>Clean the connector and pins.</p> <p>Repair the damaged harness, connector, or pins, if possible.</p>	<p>3A</p>
	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	<p>2B</p>

**STEP 2B: Check for an open circuit in the engine harness.**

**Condition:**

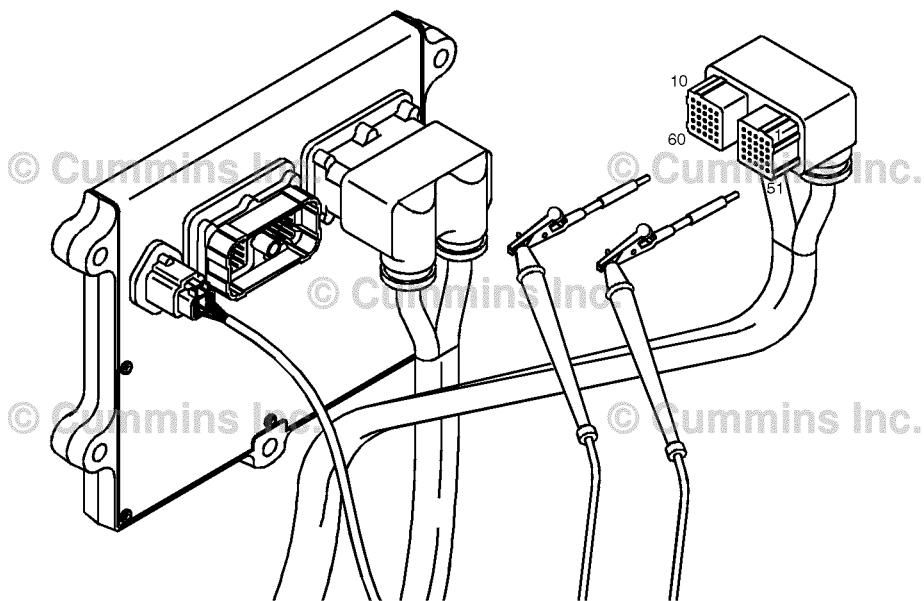
- Turn keyswitch OFF.
- Disconnect the turbocharger actuator motor from the engine harness.
- Disconnect the engine harness from the ECM.

Action	Specification/Repair	Next Step
Check for an open circuit in the engine harness. <ul style="list-style-type: none"> <li>• Measure the resistance between the turbocharger actuator motor SIGNAL (+) pin at the ECM connector of the engine harness and the turbocharger actuator motor SIGNAL (+) pin at the actuator motor connector of the engine harness.</li> <li>• Measure the resistance between the turbocharger actuator motor SIGNAL (-) pin at the ECM connector of the engine harness and the turbocharger actuator motor SIGNAL (-) pin at the actuator motor connector of the engine harness.</li> </ul> Refer to the circuit diagram or wiring diagram for connector pin identification. Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.	Less than 10 ohms? <b>YES</b>	2C
	Less than 10 ohms? <b>NO</b> <b>Repair:</b> Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.	3A



**STEP 2C: Check for a short circuit in the engine harness.**

Action	Specification/Repair	Next Step
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the turbocharger actuator motor from the engine harness.</li> <li>• Disconnect the engine harness from the ECM.</li> </ul> <p>Check for a short circuit in the engine harness.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the turbocharger actuator motor SIGNAL (+) pin and all other pins at the ECM connector of the engine harness.</li> <li>• Measure the resistance between the turbocharger actuator motor SIGNAL (-) pin and all other pins at the ECM connector of the engine harness.</li> </ul> <p>Refer to the circuit diagram or wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Greater than 100k ohms? <b>YES</b></p>	<p>2D</p>
	<p>Greater than 100k ohms? <b>NO</b></p> <p><b>Repair:</b></p> <p>Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.</p>	<p>3A</p>



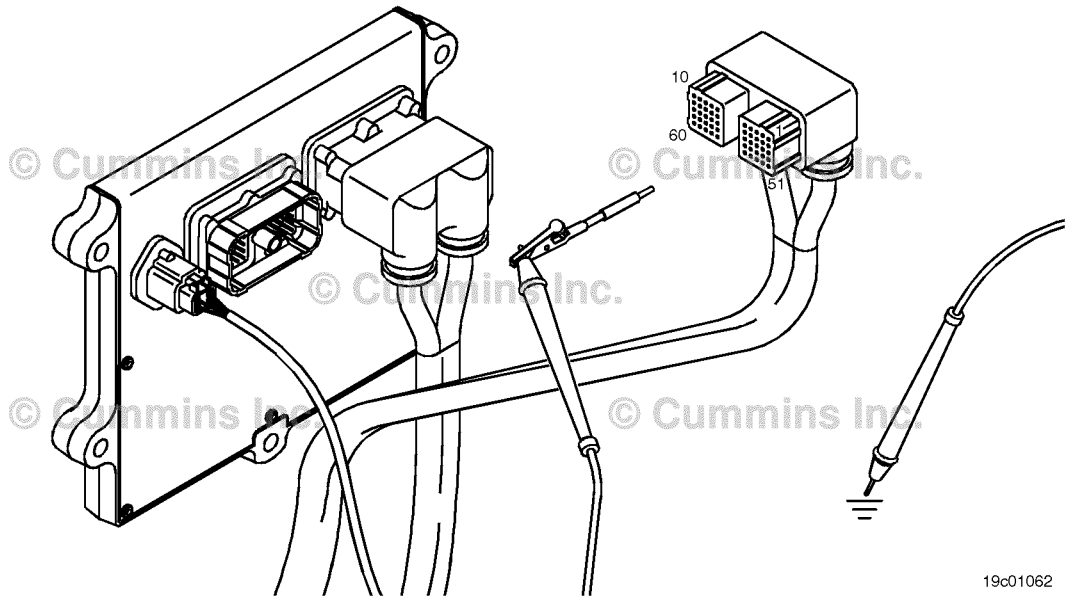
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**STEP 2D: Check for a short circuit to an external voltage source.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the turbocharger actuator motor from the engine harness.
- Disconnect the engine harness from the ECM.
- Turn keyswitch ON.

Action	Specification/Repair	Next Step
Check for a short circuit to an external voltage source. <ul style="list-style-type: none"> <li>• Measure the voltage between the turbocharger actuator motor SIGNAL (+) pin at the ECM connector of the engine harness and engine block ground.</li> <li>• Measure the voltage between the turbocharger actuator motor SIGNAL (-) pin at the ECM connector of the engine harness and engine block ground.</li> </ul> Refer to the circuit diagram or wiring diagram for connector pin identification. Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.	Less than 1.5-VDC? <b>YES</b>	2E
	Less than 1.5-VDC? <b>NO</b> <b>Repair:</b> Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.	3A



**STEP 2E: Check for an inactive fault code.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON</li> <li>• Connect the INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate circuit response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to verify the fault code is inactive</li> </ul>	<p>Fault Code 2383 inactive?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>None. The removal and installation of the connector corrected the fault.</p>	3A
	<p>Fault Code 2383 inactive?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Replace the ECM. Refer to Procedure 019-031 in Section 19.</p>	3A

**STEP 3: Clear the fault codes.**

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

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Disable the fault code.</p> <ul style="list-style-type: none"> <li>• Start the engine and let it idle for 1 minute.</li> <li>• Use INSITE™ electronic service tool to verify the fault code is inactive.</li> </ul>	<p>Fault Code 2383 inactive?</p> <p><b>YES</b></p>	3B
	<p>Fault Code 2383 inactive?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Return to the troubleshooting steps or contact a Cummins® Authorized Repair Location if all steps have been completed and checked again.</p>	1A

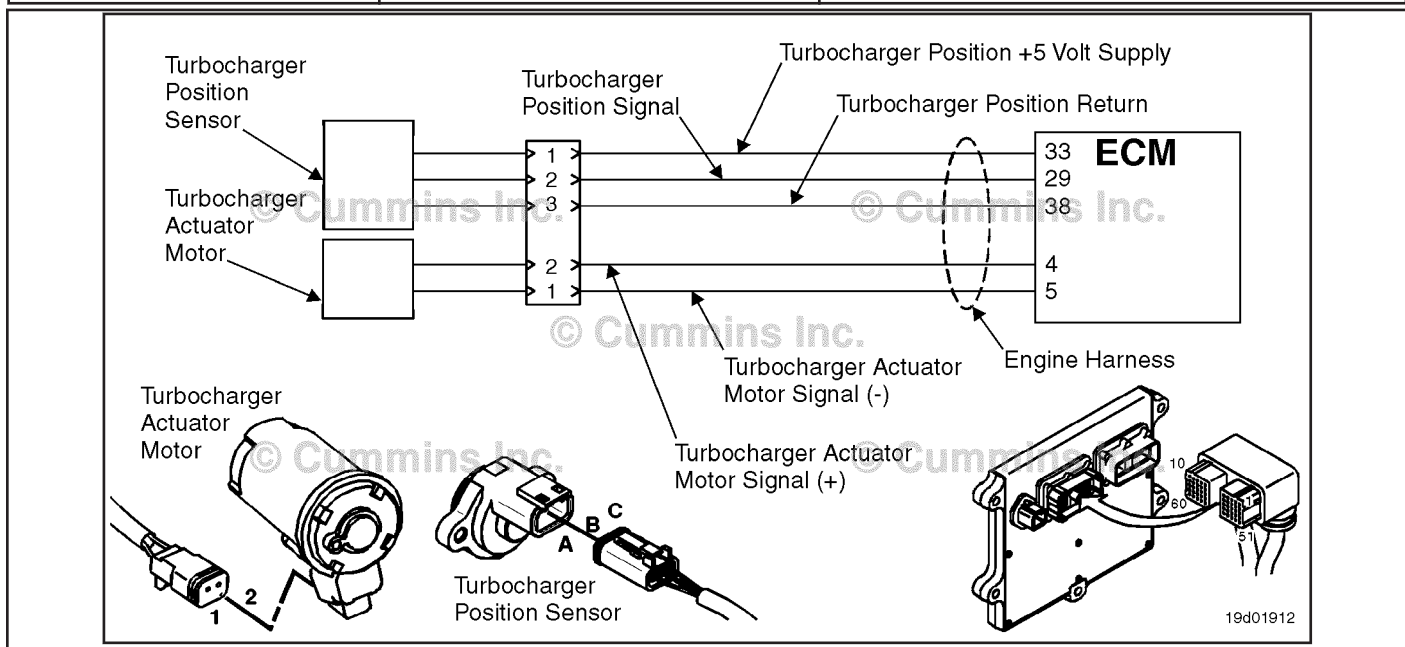
**STEP 3B: Clear the inactive fault codes.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Clear the inactive fault codes.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to erase the inactive fault codes.</li> </ul>	<p>All fault codes cleared?  <b>YES</b></p>	<p>Repair complete</p>
	<p>All fault codes cleared?  <b>NO</b>  <b>Repair:</b>                  Troubleshoot any remaining active fault codes.</p>	<p>Appropriate troubleshooting steps</p>

## Fault Code 2384 (ISB/QSB Automotive and Industrial Application)

### VGT Actuator Driver Circuit - Voltage Below Normal, or Shorted to Low Source

CODES	REASON	EFFECT
Fault Code: 2384 PID(P), SID(S): S027 SPN: 641 FMI: 4/4 Lamp: Amber SRT:	VGT actuator driver circuit - voltage below normal, or shorted to low source.	Possible low power. Power removed from the turbocharger actuator motor.



Turbocharger Actuator Motor Circuit

#### Circuit Description:

The electronic control module (ECM) controls the turbocharger actuator motor, which changes the airflow of the turbocharger based on various engine operating conditions. The sliding nozzle in the turbocharger is operated by the turbocharger actuator motor. The actuator is a DC motor that receives voltage from the ECM.

#### Component Location:

The turbocharger actuator motor is part of the turbocharger actuator assembly, which is located on the exhaust side of the engine and is mounted to the bearing housing of the turbocharger. Refer to Procedure 100-002 for a detailed component location view.

#### Shop Talk:

A possible cause of this fault is the turbocharger actuator signal (+ or -) leads can be shorted to ground in the harness, motor, or the ECM.

Do **not** supply voltage of any kind to the exhaust gas recirculation (EGR) valve motor. This circuit uses a pulse-width-modulated signal and direct voltage can permanently damage the motor.

#### Refer to Troubleshooting Fault Code t05-2384

FAULT CODE 2384 (ISB/QSB Automotive and Industrial Application) - VGT Actuator Driver Circuit - Voltage Below Normal, or Shorted to Low Source TROUBLESHOOTING SUMMARY



To reduce the possibility of pin and harness damage, use the following test leads when taking a measurement: Part Number 3822758 - male Deutsch™/AMP™/Metri-Pack™ test lead and Part Number 3822917 - female Deutsch™/AMP™/Metri-Pack™ test lead.

Table with 3 columns: STEPS, SPECIFICATIONS, and SRT CODE. It lists troubleshooting steps for fault code 2384, such as 'Check the turbocharger actuator motor and circuit' and 'Check the engine harness', with corresponding specifications like 'Dirty or damaged pins?' and 'Greater than 100k ohms?'.

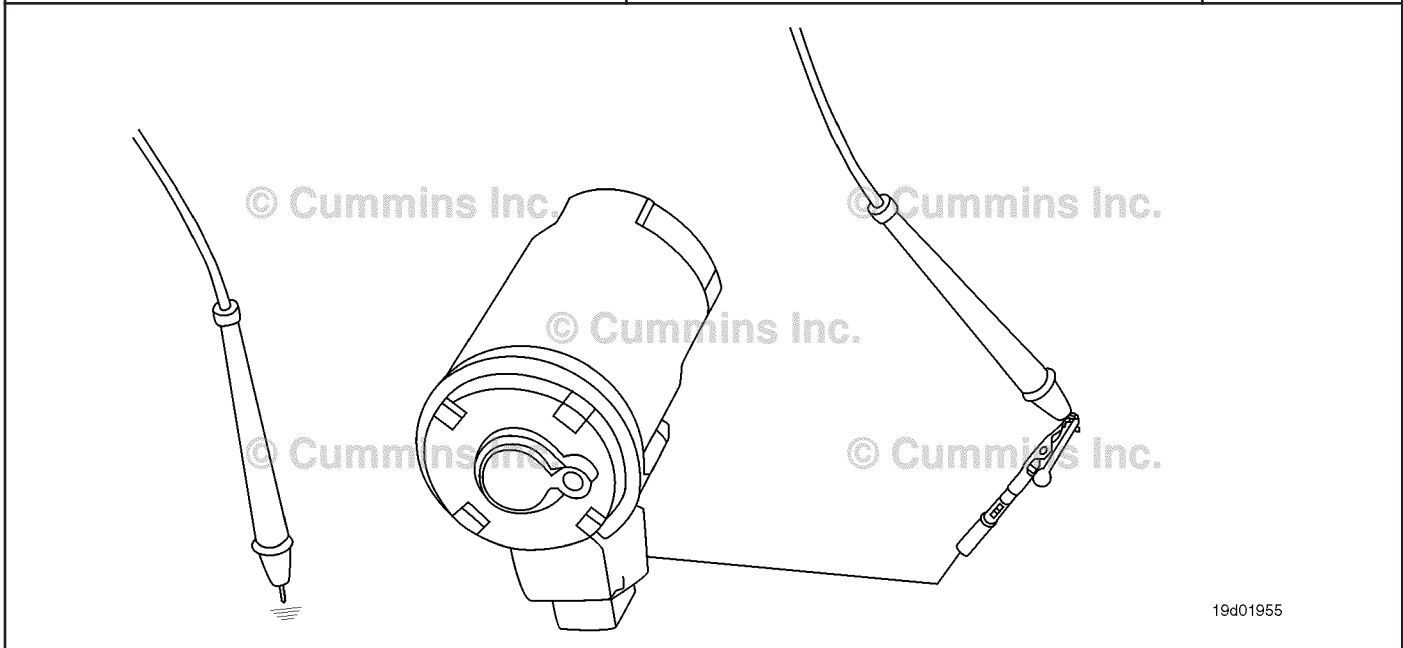


**TROUBLESHOOTING STEP****STEP 1: Check the turbocharger actuator motor and circuit.****STEP 1A: Inspect the turbocharger actuator motor and harness connector pins.**

<b>Condition:</b>		
<ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the turbocharger actuator motor from the engine harness.</li> </ul>		
<b>Action</b>	<b>Specification/Repair</b>	<b>Next Step</b>
Inspect the engine harness and turbocharger actuator motor connector pins for the following: <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.	Dirty or damaged pins? <b>YES</b> <b>Repair:</b> A damaged connection has been detected in the sensor or harness connector pins. Clean the connector and pins. Repair the damaged harness, connector, or pins if possible. Refer to Procedure 019-043 in Section 19.	3A
	Dirty or damaged pins? <b>NO</b>	1B

**STEP 1B: Check for a short circuit to ground in the turbocharger actuator.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the turbocharger actuator motor from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for a short circuit in the turbocharger actuator motor.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the turbocharger actuator motor SIGNAL (+) pin at the turbocharger actuator motor connector and engine block ground.</li> <li>• Measure the resistance between the turbocharger actuator motor SIGNAL (-) pin at the turbocharger actuator motor connector and engine block ground.</li> </ul> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Greater than 100k ohms? <b>YES</b></p>	<p>2A</p>
	<p>Greater than 100k ohms? <b>NO</b></p> <p><b>Repair:</b></p> <p>Replace the turbocharger. Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 010-033 in Section 10.</p>	<p>3A</p>



**STEP 2: Check the engine harness.**

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

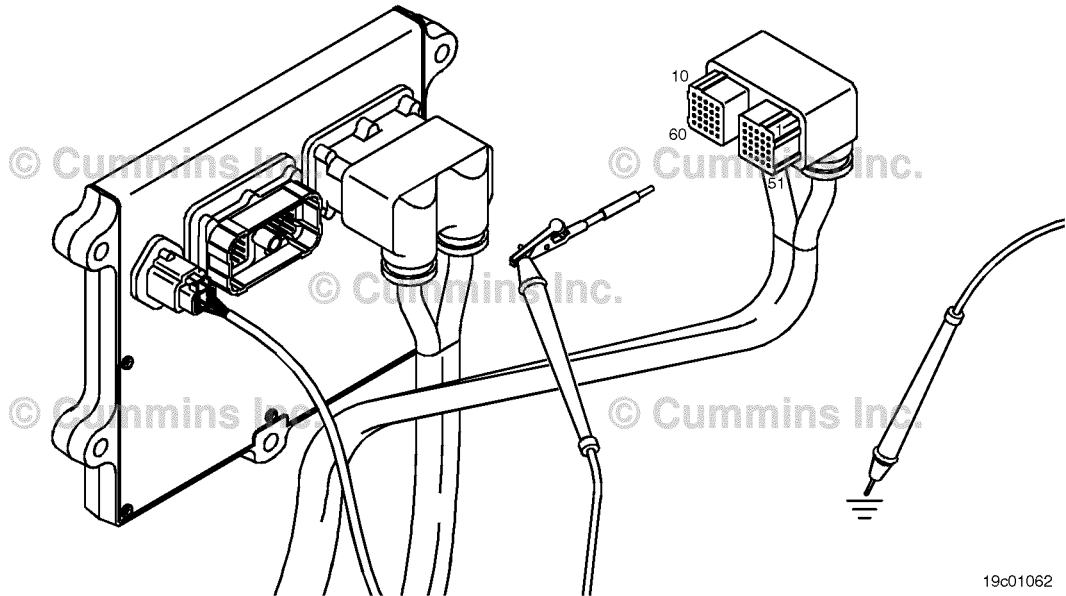
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the engine harness and ECM connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Clean the connector and pins.</p> <p>Repair the damaged harness, connector, or pins if possible.</p> <p>Refer to Procedure 019-043 in Section 19.</p>	<p>3A</p>
	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	<p>2B</p>

**STEP 2B: Check for a short circuit to ground in the engine harness.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the turbocharger actuator motor from the engine harness.
- Disconnect the engine harness from the ECM.

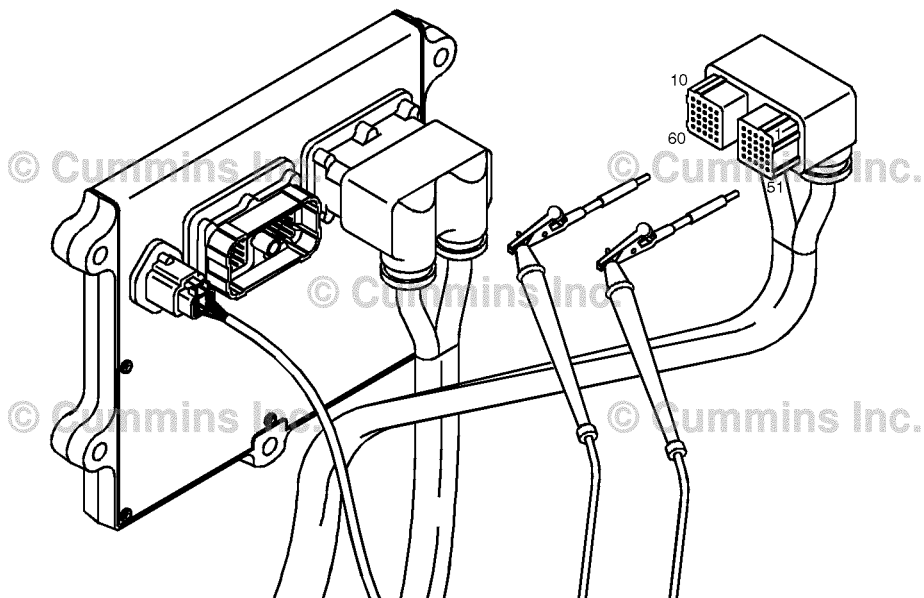
Action	Specification/Repair	Next Step
Check for a short circuit to ground in the engine harness. <ul style="list-style-type: none"> <li>• Measure the resistance between the turbocharger actuator motor SIGNAL (+) pin at the ECM connector of the engine harness and engine block ground.</li> <li>• Measure the resistance between the turbocharger actuator motor SIGNAL (-) pin at the ECM connector of the engine harness and engine block ground.</li> </ul> Refer to the circuit diagram or wiring diagram for connector pin identification. Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.	Greater than 100k ohms? <b>YES</b>	2C
	Greater than 100k ohms? <b>NO</b> <b>Repair:</b> Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.	3A



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**STEP 2C: Check for a short circuit from pin to pin in the engine harness.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the turbocharger actuator motor from the engine harness.</li> <li>• Disconnect the engine harness from the ECM.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for a short circuit from pin to pin in the engine harness.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the turbocharger actuator motor SIGNAL (+) pin and all other pins at the ECM connector of the engine harness.</li> <li>• Measure the resistance between the turbocharger actuator motor SIGNAL (-) pin and all other pins at the ECM connector of the engine harness.</li> </ul> <p>Refer to the circuit diagram or wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Greater than 100k ohms? <b>YES</b></p>	<p>2D</p>
	<p>Greater than 100k ohms? <b>NO</b></p> <p><b>Repair:</b></p> <p>Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.</p>	<p>3A</p>



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**STEP 2D: Check for an inactive fault code.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON</li> <li>• Connect the INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate circuit response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to verify the fault code is inactive</li> </ul>	<p>Fault Code 2384 inactive?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>None. The removal and reinstallation of the connector corrected the fault.</p>	3A
	<p>Fault Code 2384 inactive?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>The troubleshooting procedures need to be repeated from the beginning. A failure mode should have been detected.</p> <p>Replace the ECM. Refer to Procedure 019-031 in Section 19.</p>	3A

**STEP 3: Clear the fault codes.**

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

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Disable the fault code.</p> <ul style="list-style-type: none"> <li>• Start the engine and let it idle for one minute.</li> <li>• Use INSITE™ electronic service tool to verify the fault code is inactive.</li> </ul>	<p>Fault Code 2384 inactive?</p> <p><b>YES</b></p>	3B
	<p>Fault Code 2384 inactive?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Return to the troubleshooting steps or contact a local Cummins® Authorized Repair Location if all steps have been completed and checked again.</p>	1A

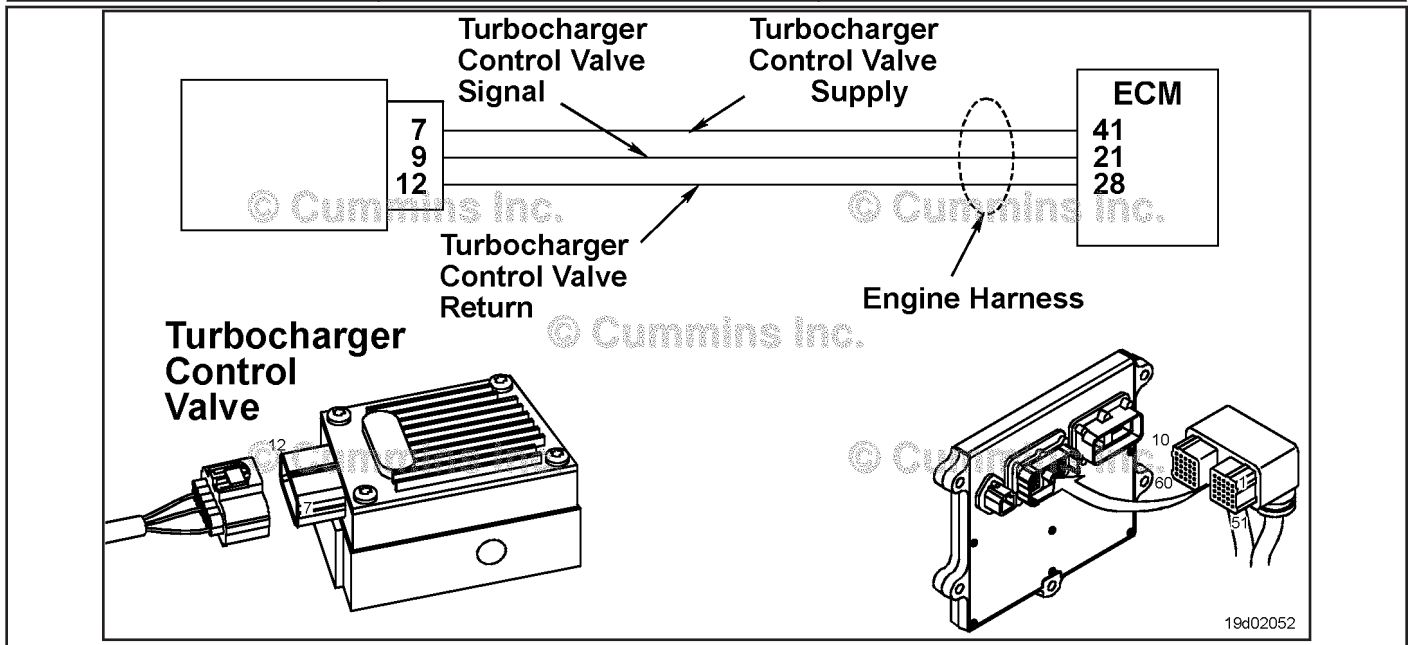
**STEP 3B: Clear the inactive fault codes.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Clear the inactive fault codes.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to erase the inactive fault codes.</li> </ul>	<p>All fault codes cleared?  <b>YES</b></p>	<p>Repair complete</p>
	<p>All fault codes cleared?  <b>NO</b>  <b>Repair:</b>                  Troubleshoot any remaining active fault codes.</p>	<p>Appropriate troubleshooting steps</p>

## Fault Code 2384 (ISC/QSC/ISL/QSL Automotive, Industrial, or Marine Application)

### VGT Actuator - Voltage Below Normal or Shorted to Low Source

CODES	REASON	EFFECT
Fault Code: 2384 PID(P), SID(S): S027 SPN: 641 FMI: 4 Lamp: Amber SRT:	VGT Actuator - Voltage Below Normal or Shorted to Low Source. Low voltage detected at turbocharger control valve circuit.	Variable geometry turbocharger will go to the open position.



**Circuit Description:**

The electronic control module (ECM) controls the variable geometry actuator position with the turbocharger control valve. The turbocharger control valve controls the air pressure to the variable geometry actuator when commanded by the ECM. ECM commands are sent to the control valve through the turbocharger control valve signal of the ECM engine harness.

**Component Location:**

The turbocharger control valve is located on the fuel pump side of the engine. It is mounted between the number 5 and number 6 fuel lines on the air intake manifold. Refer to Procedure 100-002 for a detailed component location view.

**Shop Talk:**

Turbocharger control valve command can be monitored with the INSITE™ electronic service tool. This parameter represents the ECM command to the turbocharger control valve which in turn controls the variable geometry actuator position.

Possible causes of this fault code include:

- Signal short circuit to ground
- Short circuit to ground in the turbocharger control valve.



**Refer to Troubleshooting Fault Code t05-2384**

FAULT CODE 2384 (ISC/QSC/ISL/QLS Automotive, Industrial, or Marine Application) - VGT Actuator - Voltage Below Normal or Shorted to Low Source TROUBLESHOOTING SUMMARY



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



To reduce the possibility of pin and harness damage, use the following test leads when taking a measurement: Part Number 3822758 - male Deutsch™/AMP™/Metri-Pack™ test lead and Part Number 3822917 - female Deutsch™/AMP™/Metri-Pack™ test lead.

Table with 3 columns: STEPS, SPECIFICATIONS, SRT CODE. It lists troubleshooting steps from Step 1 to Step 4, including sub-steps like Step 1A, Step 2A, etc., and their corresponding specifications and SRT codes.

**TROUBLESHOOTING STEP****STEP 1: Check the fault codes.****STEP 1A: Check for an active fault code.**

<b>Condition:</b>		
<ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
<b>Action</b>	<b>Specification/Repair</b>	<b>Next Step</b>
Check for active fault code. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 2384 active? <b>YES</b>	2A
	Fault Code 2384 active? <b>NO</b>	Use the following procedure for an inactive or intermittent fault code. Refer to Procedure 019-362 in Section 19.

**STEP 2: Check the turbocharger control valve circuit.****STEP 2A: Inspect the turbocharger control valve and connector pins.**

<b>Condition:</b>		
<ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the turbocharger control valve from the engine harness.</li> </ul>		
<b>Action</b>	<b>Specification/Repair</b>	<b>Next Step</b>
Inspect the engine harness and turbocharger control valve connector pins for the following: <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.	Dirty or damaged pins? <b>YES</b> <b>Repair:</b> A damaged connection has been detected in the turbocharger control valve connector or the engine harness. Clean the connector and pins. Repair the damaged harness, connector, or pins if possible. Refer to Procedure 019-043 in Section 19.	4A
	Dirty or damaged pins? <b>NO</b>	2B

**STEP 2B: Check the circuit response.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the turbocharger control valve from the engine harness.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate circuit response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault Code 2385 is active and Fault Code 2384 is inactive?</p> <p><b>YES</b></p>	2C
	<p>Fault Code 2385 is active and Fault Code 2384 is inactive?</p> <p><b>NO</b></p>	3A

**STEP 2C: Check the fault codes and verify sensor condition.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Connect the turbocharger control valve to the engine harness.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate circuit response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault Code 2384 is active?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A damaged turbocharger control valve has been detected.</p> <p>Replace the turbocharger control valve. Refer to Procedure 019-388 in Section 19.</p>	4A
	<p>Fault Code 2384 is active?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>None. The removal and installation of the connector corrected the fault.</p>	4A

**STEP 3: Check the ECM and engine harness.**

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

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the engine harness and turbocharger control valve connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A damaged connection has been detected in the turbocharger control valve connector or the engine harness.</p> <p>Clean the connector and pins.</p> <p>Repair the damaged harness, connector, or pins if possible.</p> <p>Refer to Procedure 019-043 in Section 19.</p>	4A
	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	3B

**STEP 3B: Check the ECM response.**

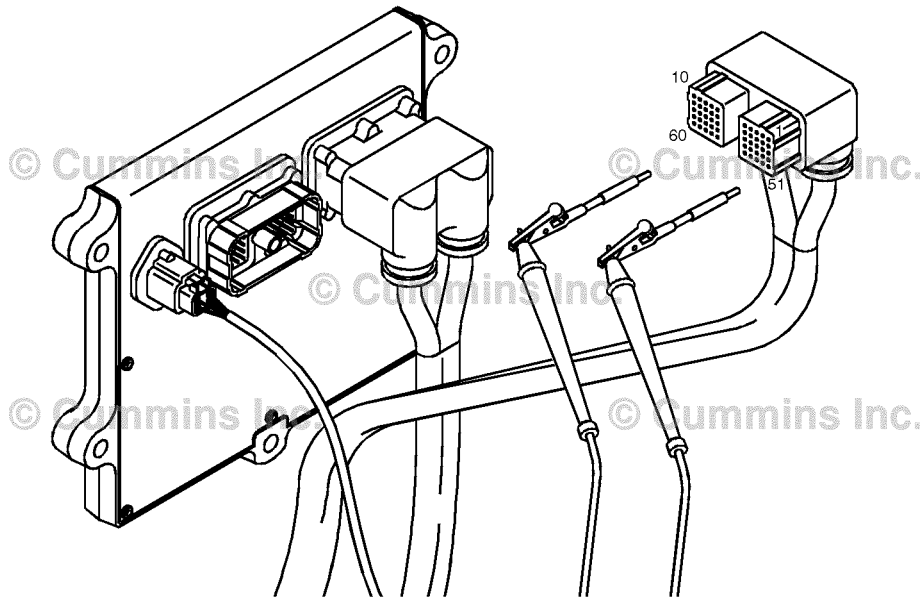
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate circuit response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault Code 2385 active and Fault Code 2384 inactive?</p> <p><b>YES</b></p>	3C
	<p>Fault Code 2385 active and Fault Code 2384 inactive?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Replace the ECM. Refer to Procedure 019-031 in Section 19.</p>	4A

**STEP 3C: Check for a pin-to-pin short circuit in the engine harness.**

**Condition:**

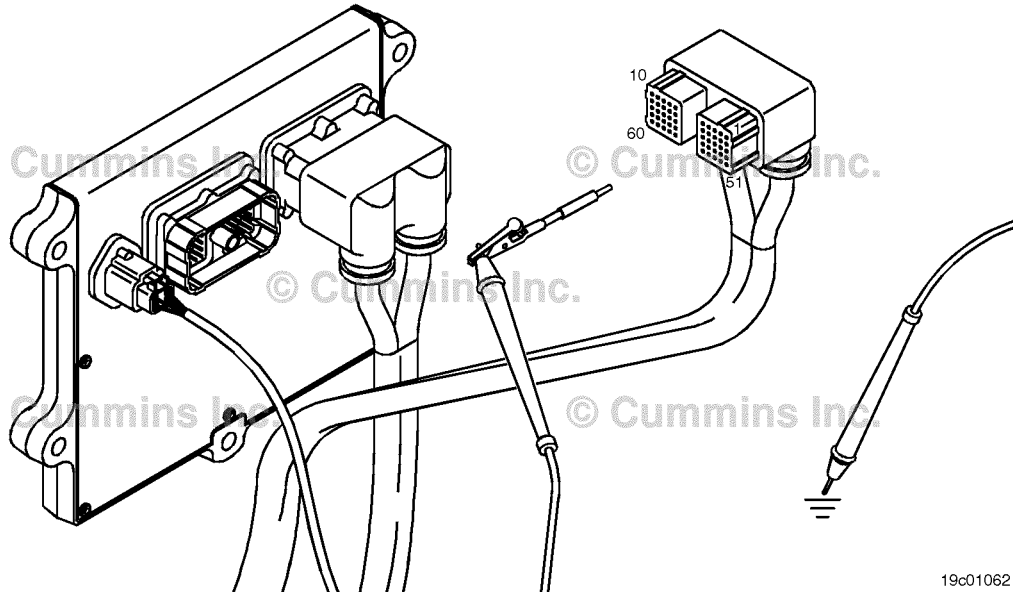
- Turn keyswitch OFF.
- Disconnect the engine harness from the ECM.
- Disconnect the turbocharger control valve from the engine harness.

Action	Specification/Repair	Next Step
Check for a pin-to-pin short. <ul style="list-style-type: none"> <li>• Measure the resistance between the turbocharger control valve SIGNAL pin in the engine harness ECM connector and all other pins in the engine harness ECM connector.</li> </ul> Refer to the circuit diagram or wiring diagram for connector pin identification. Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.	Greater than 100k ohms? <b>YES</b>	3D
	Greater than 100k ohms? <b>NO</b> <b>Repair:</b> A pin-to-pin short circuit on the SIGNAL line has been detected in the engine harness. Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.	4A



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

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> <li>• Disconnect the turbocharger control valve from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for a pin-to-ground short.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the turbocharger control valve SIGNAL pin in the engine harness ECM connector and ground.</li> </ul> <p>Refer to the circuit diagram or wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Greater than 100k ohms? <b>YES</b></p> <hr/> <p>Greater than 100k ohms? <b>NO</b></p> <p><b>Repair:</b> A pin-to-ground short circuit on the SIGNAL line has been detected in the engine harness.</p> <p>Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.</p>	<p>3E</p> <hr/> <p>4A</p>
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**STEP 3E: Check for an inactive fault code.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate circuit response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault Code 2384 is inactive?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>None. The removal and installation of the connector corrected the fault.</p>	4A
	<p>Fault Code 2384 is inactive?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>The troubleshooting procedures need to be repeated from the beginning. A failure mode should have been detected.</p>	1A

**STEP 4: Clear the fault code.**

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

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Disable the fault code.</p> <ul style="list-style-type: none"> <li>• Start the engine and let it idle for one minute.</li> <li>• Use INSITE™ electronic service tool, to verify that the fault code is inactive.</li> </ul>	<p>Fault Code 2384 inactive?</p> <p><b>YES</b></p>	4B
	<p>Fault Code 2384 inactive?</p> <p><b>NO</b></p>	1A

**STEP 4B: Clear the inactive fault code.**

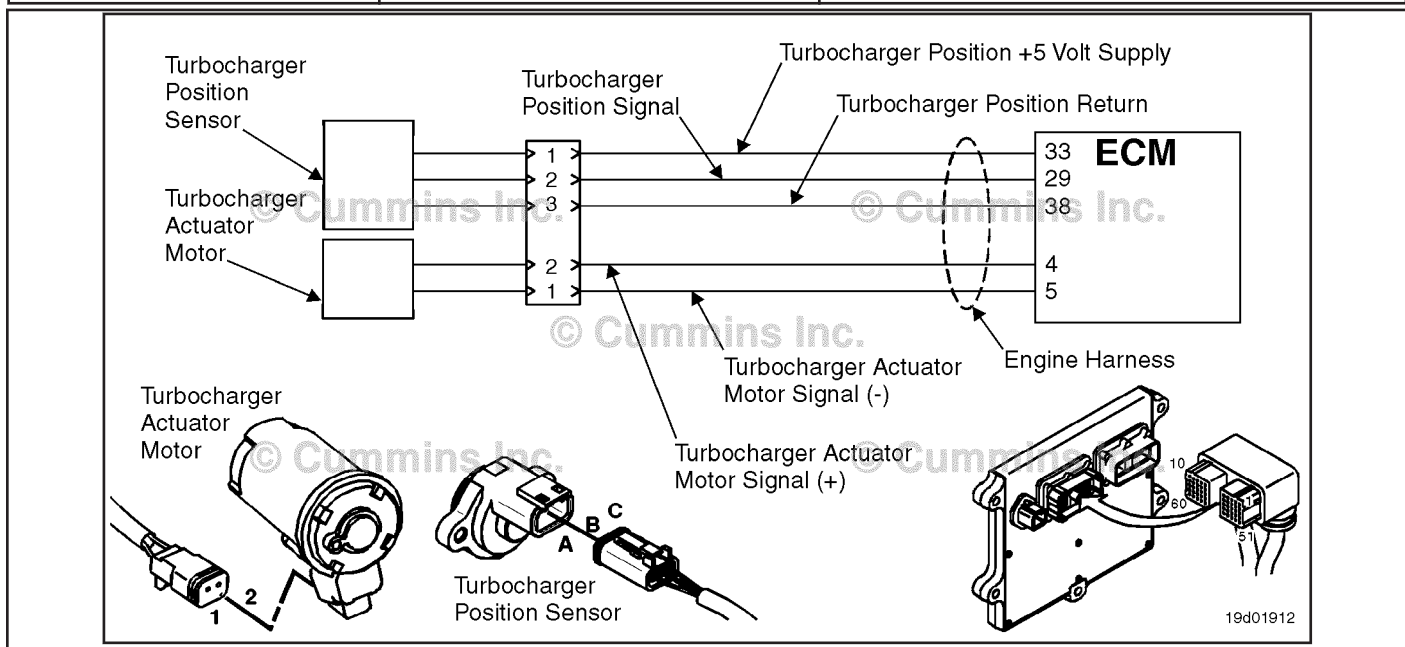
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Clear the inactive fault codes.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to erase the inactive fault codes.</li> </ul>	<p>All fault codes cleared?</p> <p><b>YES</b></p>	Repair complete
	<p>All fault codes cleared?</p> <p><b>NO</b></p>	Appropriate troubleshooting steps



## Fault Code 2385 (ISB/QSB Automotive or Industrial Application)

### VGT Actuator Driver Circuit - Voltage Above Normal or Shorted to High Source

CODES	REASON	EFFECT
Fault Code: 2385 PID(P), SID(S): S027 SPN: 641 FMI: 3/3 Lamp: Amber SRT:	VGT actuator driver circuit - voltage above normal or shorted to high source.	Possible low power. Power removed from the turbocharger actuator motor.



Turbocharger Actuator Motor Circuit

#### Circuit Description:

The ECM controls the turbocharger actuator motor, which changes the airflow of the turbocharger based on various engine operating conditions. The sliding nozzle in the turbocharger is operated by the turbocharger actuator motor. The actuator is a DC motor that receives voltage from the ECM.

#### Component Location:

The turbocharger actuator motor is part of the turbocharger actuator assembly, which is located on the exhaust side of the engine and is mounted to the bearing housing of the turbocharger. Refer to Procedure 100-002 for a detailed component location view.

#### Shop Talk:

A possible cause of this fault is the turbocharger actuator signal (+ or -) leads can be shorted to a voltage source in the harness or the ECM.

Do **not** supply voltage of any kind to the EGR valve motor. This circuit uses a pulse-width-modulated signal and direct voltage can permanently damage the motor.

#### Refer to Troubleshooting Fault Code t05-2385

## FAULT CODE 2385 (ISB/QSB Automotive or Industrial Application) - VGT Actuator Driver Circuit - Voltage Above Normal or Shorted to High Source

### TROUBLESHOOTING SUMMARY



To reduce the possibility of pin and harness damage, use the following test leads when taking a measurement: Part Number 3822758 - male Deutsch/AMP/Metri-Pack test lead Part Number 3822917 - female Deutsch/AMP/Metri-Pack test lead.

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1: Check the engine harness.</b>		
<b>STEP 1A:</b> Inspect the engine harness and ECM connector pins.	Dirty or damaged pins?	
<b>STEP 1B:</b> Check for a short circuit to a voltage source.	Less than 1.5 VDC?	
<b>STEP 1C:</b> Check for a short circuit from pin-to-pin in the engine harness.	Greater than 100k ohms?	
<b>STEP 1D:</b> Check for an inactive fault code.	Fault Code 2385 inactive?	
<b>STEP 2: Clear the fault codes.</b>		
<b>STEP 2A:</b> Disable the fault code.	Fault Code 2385 inactive?	
<b>STEP 2B:</b> Clear the inactive fault codes.	All fault codes cleared?	

### TROUBLESHOOTING STEP

**STEP 1: Check the engine harness.**  
**STEP 1A: Inspect the engine harness and ECM connector pins.**

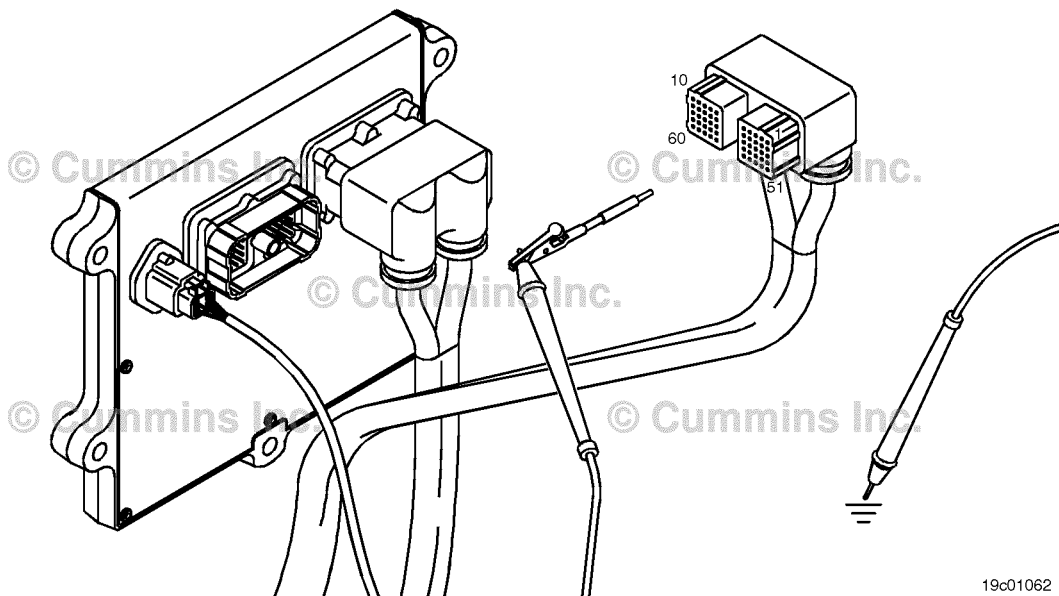
<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> </ul>		
Action	Specification/Repair	Next Step
Inspect the engine harness and ECM connector pins for the following: <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.	Dirty or damaged pins? <b>YES</b> <b>Repair:</b> A damaged connection has been detected in the sensor or harness connector pins. Clean the connector and pins. Repair the damaged harness, connector, or pins if possible.	2A
		Dirty or damaged pins? <b>NO</b>

**STEP 1B: Check for a short circuit to a voltage source.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the turbocharger actuator motor from the engine harness.
- Disconnect the engine harness from the ECM.
- Turn keyswitch ON.

Action	Specification/Repair	Next Step
<p>Check for a short circuit to a voltage source.</p> <ul style="list-style-type: none"> <li>• Measure the voltage between the turbocharger actuator motor SIGNAL (+) pin at the ECM connector of the engine harness and engine block ground.</li> <li>• Measure the voltage between the second turbocharger actuator motor SIGNAL (-) pin at the ECM connector of the engine harness and engine block ground.</li> </ul> <p>Refer to the circuit diagram or the wiring diagram for connector pin identification.</p> <p>Use the following procedure for Multimeter Usage. Refer to Procedure 019-359 in Section 19.</p>	<p>Less than 1.5-VDC? <b>YES</b></p>	<p>1C</p>
	<p>Less than 1.5-VDC? <b>NO</b></p> <p><b>Repair:</b> Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.</p>	<p>2A</p>



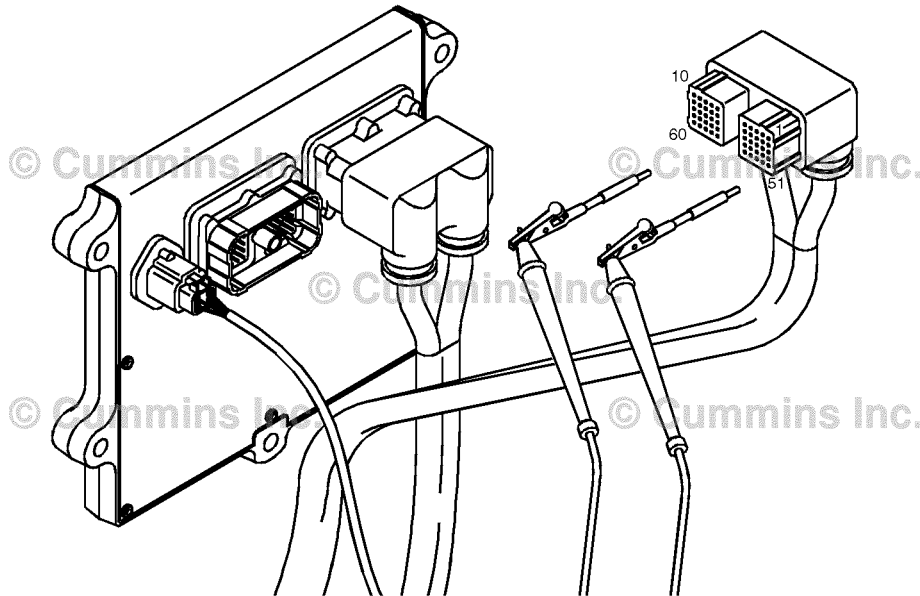
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**STEP 1C: Check for a short circuit from pin-to-pin in the engine harness.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the turbocharger actuator motor from the engine harness.
- Disconnect the engine harness from the ECM.

Action	Specification/Repair	Next Step
Check for a short circuit from pin-to-pin in the engine harness. <ul style="list-style-type: none"> <li>• Measure the resistance between the turbocharger actuator motor SIGNAL (+) pin and all other pins at the ECM connector of the engine harness.</li> <li>• Measure the resistance between the turbocharger actuator motor SIGNAL (-) pin and all other pins at the ECM connector of the engine harness.</li> </ul> Refer to the circuit diagram or the wiring diagram for connector pin identification. Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.	Greater than 100k ohms? <b>YES</b>	1D
	Greater than 100k ohms? <b>NO</b> <b>Repair:</b> Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.	2A



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**STEP 1D: Check for an inactive fault code.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON</li> <li>• Connect the INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to verify the fault code is inactive.</li> </ul>	<p>Fault Code 2385 inactive?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>None. The removal and installation of the connector corrected the fault.</p>	2A
	<p>Fault Code 2385 inactive?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>The troubleshooting procedures need to be repeated from the beginning. A failure mode should have been detected.</p> <p>Replace the ECM. Refer to Procedure 019-031 in Section 19.</p>	2A

**STEP 2: Clear the fault codes.**

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

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect the INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Disable the fault code.</p> <ul style="list-style-type: none"> <li>• Start the engine and let it idle for 1 minute.</li> <li>• Use INSITE™ electronic service tool to verify the fault code is inactive.</li> </ul>	<p>Fault Code 2385 inactive?</p> <p><b>YES</b></p>	2B
	<p>Fault Code 2385 inactive?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Return to the troubleshooting steps or contact a local Cummins® Authorized Repair Location if all steps have been completed and rechecked.</p>	1A

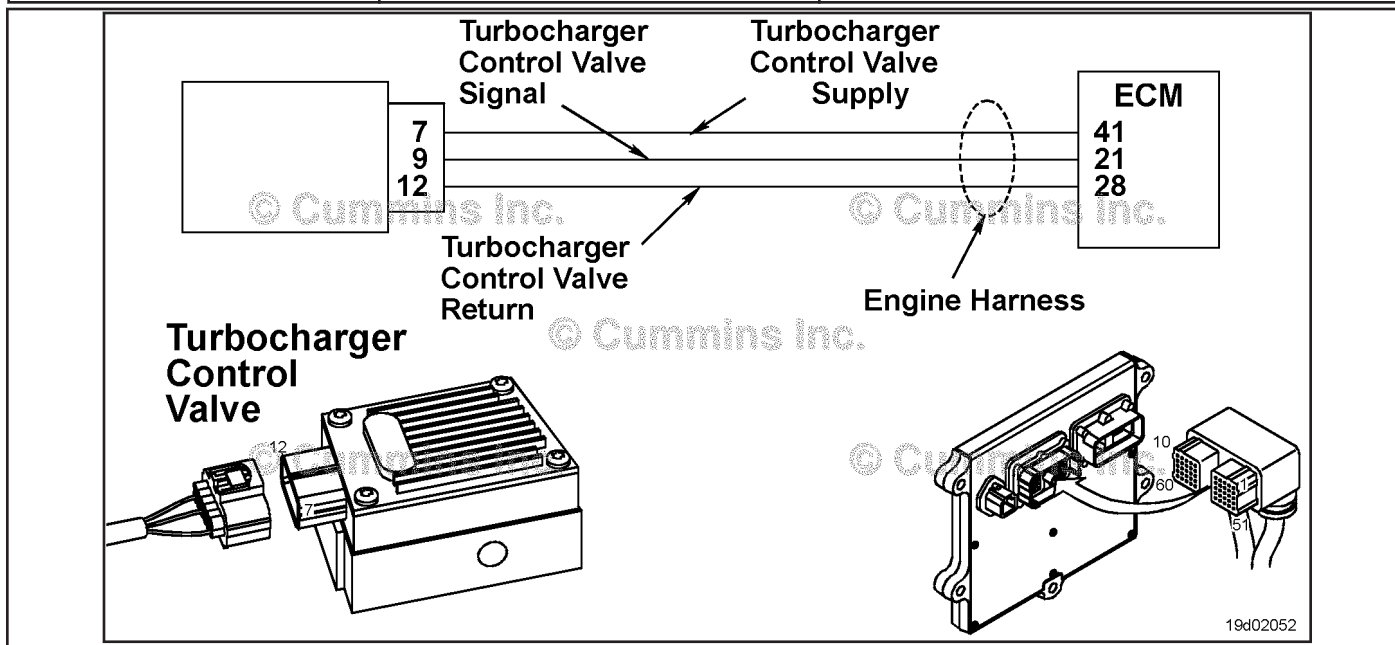
**STEP 2B: Clear the inactive fault codes.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect the INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Clear the inactive fault codes.</p> <ul style="list-style-type: none"> <li>• Use the INSITE™ electronic service tool to erase the inactive fault codes.</li> </ul>	<p>All fault codes cleared? <b>YES</b></p>	<p>Repair complete</p>
	<p>All fault codes cleared? <b>NO</b></p> <p><b>Repair:</b></p> <p>Troubleshoot any remaining active fault codes.</p>	<p>Appropriate troubleshooting steps</p>

## Fault Code 2385 (ISC/QSC/ISL/QSL Automotive, Industrial, or Marine Application)

### VGT Actuator - Voltage Above Normal or Shorted to High Source

CODES	REASON	EFFECT
Fault Code: 2385 PID(P), SID(S): S027 SPN: 641 FMI: 3 Lamp: Amber SRT:	VGT Actuator - Voltage Above Normal or Shorted to High Source. Open circuit or high voltage detected at turbocharger control valve circuit.	Variable geometry turbocharger may be in either the open or closed position.



#### **Circuit Description:**

The electronic control module (ECM) controls the variable geometry actuator position with the turbocharger control valve. The turbocharger control valve controls the air pressure to the variable geometry actuator when commanded by the ECM. ECM commands are sent to the control valve through the turbocharger control valve signal of the ECM engine harness.

#### **Component Location:**

The turbocharger control valve is located on the fuel pump side of the engine. It is mounted between the number 5 and number 6 fuel lines on the air intake manifold. Refer to Procedure 100-002 for a detailed component location view.

#### **Shop Talk:**

Turbocharger control valve command can be monitored with the INSITE™ electronic service tool. This parameter represents the ECM command to the turbocharger control valve, which in turn controls the variable geometry actuator position.

Possible causes of this fault code include:

- Open circuit in the engine harness or connectors
- Open circuit in the turbocharger control valve
- Signal circuit short to voltage source in the engine harness.

**Refer to Troubleshooting Fault Code t05-2385**



## FAULT CODE 2385 (ISC/QSC/ISL/QSL Automotive, Industrial, or Marine Application) - VGT Actuator - Voltage Above Normal or Shorted to High Source

### TROUBLESHOOTING SUMMARY

#### ⚠CAUTION⚠

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

#### ⚠CAUTION⚠

To reduce the possibility of pin and harness damage, use the following test leads when taking a measurement: Part Number 3822758 - male Deutsch™/AMP™/Metri-Pack™ test lead and Part Number 3822917 - female Deutsch™/AMP™/Metri-Pack™ test lead.

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1: Check the fault codes.</b>		
<b>STEP 1A:</b> Check for an active fault code.	Fault Code 2385 active?	
<b>STEP 2: Check the turbocharger control valve and circuit.</b>		
<b>STEP 2A:</b> Check the turbocharger control valve and connector pins.	Dirty or damaged pins?	
<b>STEP 2B:</b> Check the turbocharger control valve diagnostic signal voltage and return circuit.	Greater than 5 VDC?	
<b>STEP 2C:</b> Check the circuit response.	Fault Code 2384 active and Fault Code 2385 inactive?	
<b>STEP 2D:</b> Check the fault codes and verify sensor condition.	Fault Code 2385 is active?	
<b>STEP 3: Check the electronic control module and engine harness.</b>		
<b>STEP 3A:</b> Inspect the electronic control module and engine harness connector pins.	Dirty or damaged pins?	
<b>STEP 3A-1:</b> Check the sensor supply voltage and return circuit.	Greater than 5-VDC?	
<b>STEP 3A-2:</b> Check for an active fault code.	Fault Code 2385 inactive?	
<b>STEP 3B:</b> Check the turbocharger control valve diagnostic supply voltage.	Greater than 5-VDC?	
<b>STEP 3B-1:</b> Check the electronic control module response.	Fault Code 2384 active and Fault Code 2385 inactive?	
<b>STEP 3B-2:</b> Check for an active fault code.	Fault Code 2385 inactive?	
<b>STEP 4: Clear the fault code.</b>		
<b>STEP 4A:</b> Disable the fault code.	Fault Code 2385 inactive?	
<b>STEP 4B:</b> Clear the inactive fault codes.	All fault codes cleared?	

## TROUBLESHOOTING STEP

### STEP 1: Check the fault codes.

#### STEP 1A: Check for an active fault code.

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for active fault code. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 2385 active? <b>YES</b>	2A
	Fault Code 2385 active? <b>NO</b>	Use the following procedure for an inactive or intermittent fault code. Refer to Procedure 019-362 in Section 19.

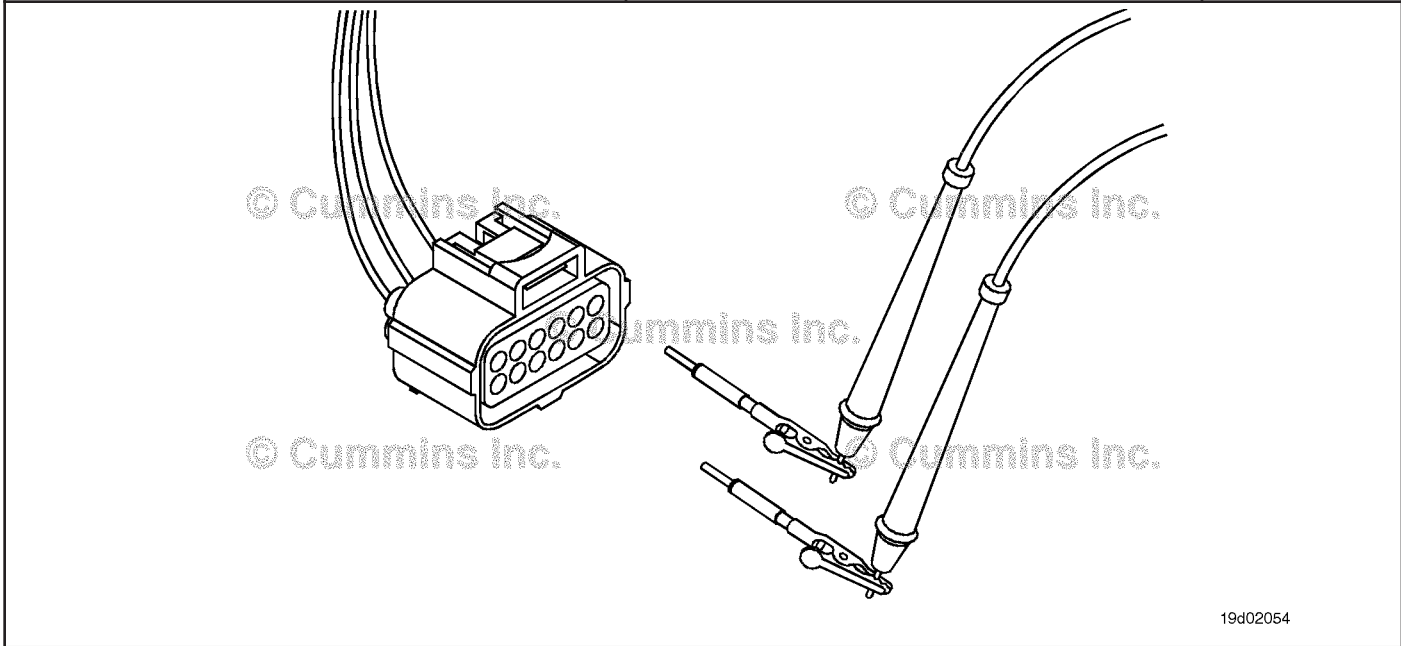
### STEP 2: Check the turbocharger control valve and circuit.

#### STEP 2A: Inspect the turbocharger control valve and connector pins.

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the turbocharger control valve from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
Inspect the engine harness turbocharger control valve connector pins for the following: <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul>	Dirty or damaged pins? <b>YES</b> <b>Repair:</b> A damaged connection has been detected in the sensor or harness connector. Clean the connector and pins. Repair the damaged harness, connector, or pins if possible. Refer to Procedure 019-043 in Section 19.	4A
	Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.	Dirty or damaged pins? <b>NO</b>

**STEP 2B: Check the turbocharger control valve diagnostic signal voltage and return circuit.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the turbocharger control valve from the engine harness.</li> <li>• Turn keyswitch ON.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check the turbocharger control valve diagnostic voltage and return circuit.</p> <ul style="list-style-type: none"> <li>• Measure the diagnostic voltage between the turbocharger control valve SIGNAL pin and the turbocharger control valve RETURN pin at the turbocharger control valve connector of the engine harness.</li> </ul> <p>Refer to the circuit diagram or the wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Greater than 5-VDC? <b>YES</b></p>	2C
	<p>Greater than 5-VDC? <b>NO</b></p>	3A



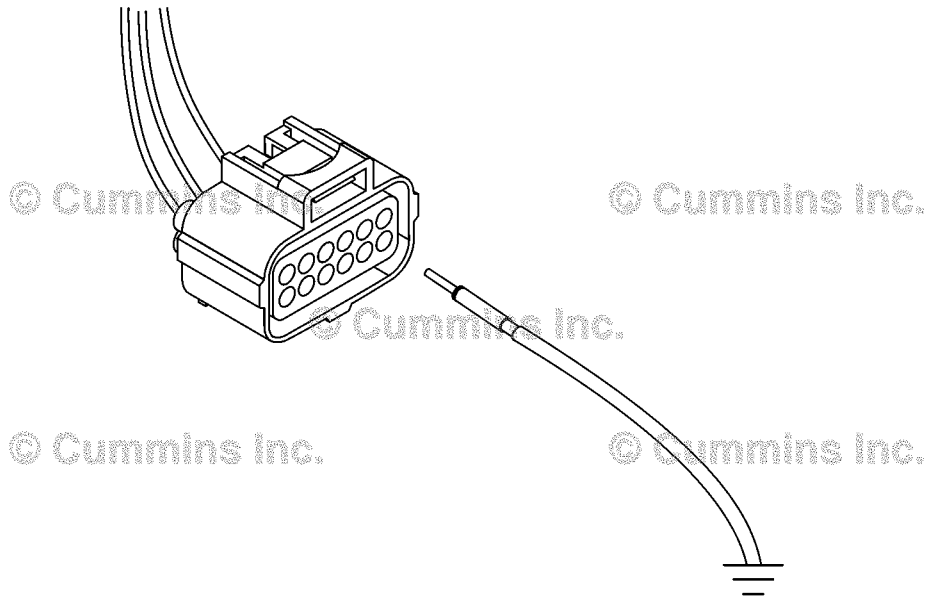
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**STEP 2C: Check the circuit response.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the turbocharger control valve from the engine harness.
- Turn keyswitch ON.
- Connect INSITE™ electronic service tool.

Action	Specification/Repair	Next Step
Check for the appropriate circuit response after 15 seconds. <ul style="list-style-type: none"> <li>• Place a jumper wire between the turbocharger control valve SIGNAL pin at the turbocharger control valve connector of the engine harness and engine block ground.</li> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 2384 active and Fault Code 2385 inactive? <b>YES</b>	2D
	Fault Code 2384 active and Fault Code 2385 inactive? <b>NO</b>	3B



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**STEP 2D: Check the fault codes and verify sensor condition.**

<b>Condition:</b>		
<ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Connect the turbocharger control valve to the engine harness.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
<b>Action</b>	<b>Specification/Repair</b>	<b>Next Step</b>
Check for the appropriate circuit response after 30 seconds. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 2385 is active? <b>YES</b> <b>Repair:</b> A damaged turbocharger control valve has been detected. Clean, repair or replace the engine harness. Replace the turbocharger control valve. Refer to Procedure 019-388 in Section 19.	4A
	Fault Code 2385 is active? <b>NO</b> <b>Repair:</b> None. The removal and installation of the connector corrected the fault.	4A

**STEP 3: Check the electronic control module and engine harness.****STEP 3A: Inspect the electronic control module and engine harness connector pins.**

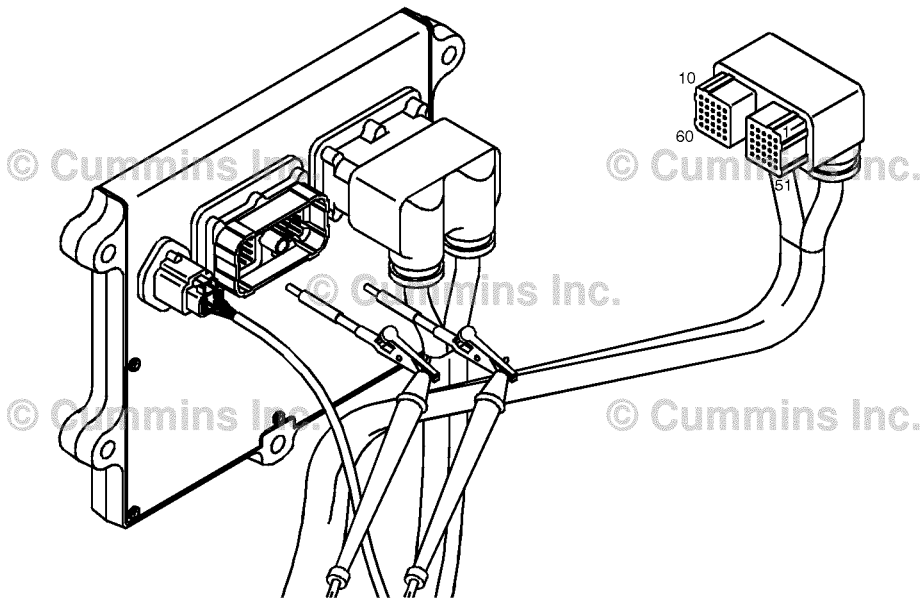
<b>Condition:</b>		
<ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> </ul>		
<b>Action</b>	<b>Specification/Repair</b>	<b>Next Step</b>
Inspect the engine harness ECM connector pins for the following: <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.	Dirty or damaged pins? <b>YES</b> <b>Repair:</b> A damaged connection has been detected in the ECM or engine harness connector. Clean the connector and pins. Repair the damaged harness, connector, or pins if possible. Refer to Procedure 019-043 in Section 19.	4A
	Dirty or damaged pins? <b>NO</b>	3A-2

**STEP 3A-1: Check the sensor supply voltage and return circuit.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine harness from the ECM.
- Turn keyswitch ON.

Action	Specification/Repair	Next Step
Check the turbocharger control valve diagnostic voltage.	Greater than 5-VDC? <b>YES</b>	3A-2
<ul style="list-style-type: none"> <li>• Measure the voltage between the turbocharger control valve SIGNAL pin and the turbocharger control valve RETURN pin at the ECM connector.</li> </ul> Refer to the circuit diagram or the wiring diagram for connector pin identification.	Greater than 5-VDC? <b>NO</b> <b>Repair:</b> Replace the ECM. Refer to Procedure 019-031 in Section 19.	4A



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**STEP 3A-2: Check for an active fault code.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check the appropriate circuit response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault Code 2385 inactive?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>None. The removal and installation of the connector corrected the fault.</p>	4A
	<p>Fault Code 2385 inactive?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>An open SIGNAL or RETURN circuit has been detected in the engine harness.</p> <p>Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.</p>	4A

**STEP 3B: Inspect the electronic control module and engine harness connector pins.**

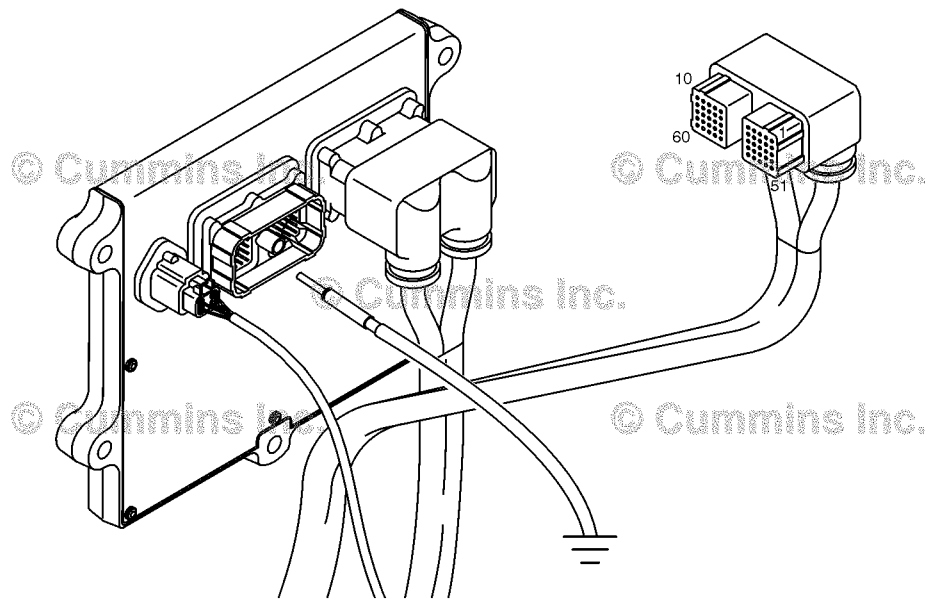
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the engine harness, electronic control module, and engine connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A damaged connection has been detected in the electronic control module, engine connector, or engine harness connector.</p> <p>Clean the connector and pins.</p> <p>Repair the damaged harness, connector, or pins if possible.</p> <p>Refer to Procedure 019-043 in Section 19.</p>	4A
	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	3B-1

**STEP 3B-1: Check the electronic control module response.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine harness from the ECM.
- Turn keyswitch ON.
- Connect INSITE™ electronic service tool.

Action	Specification/Repair	Next Step
Check for the appropriate circuit response after 30 seconds. <ul style="list-style-type: none"> <li>• Place a jumper wire between the turbocharger control valve SIGNAL pin and engine block ground at the electronic control module engine connector.</li> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 2384 active and Fault Code 2385 inactive? <b>YES</b>	3B-2
	Fault Code 2384 active and Fault Code 2385 inactive? <b>NO</b> <b>Repair:</b> Replace the ECM. Refer to Procedure 019-031 in Section 19.	4A



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**STEP 3B-2: Check for an active fault code.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault Code 2385 inactive?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>None. The removal and installation of the connector corrected the fault.</p>	4A
	<p>Fault Code 2385 inactive?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>A pin-to-pin short circuit has been detected on the signal line of the engine harness.</p> <p>Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.</p>	4A

**STEP 4: Clear the fault code.**

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

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Disable the fault code.</p> <ul style="list-style-type: none"> <li>• Start the engine and let it idle for 1 minute.</li> <li>• Use INSITE™ electronic service tool to verify the fault code is inactive.</li> </ul>	<p>Fault Code 2385 inactive?</p> <p><b>YES</b></p>	4B
	<p>Fault Code 2385 inactive?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Return to the troubleshooting steps or contact a local Cummins® Authorized Repair Location if all steps have been completed and checked again.</p>	1A

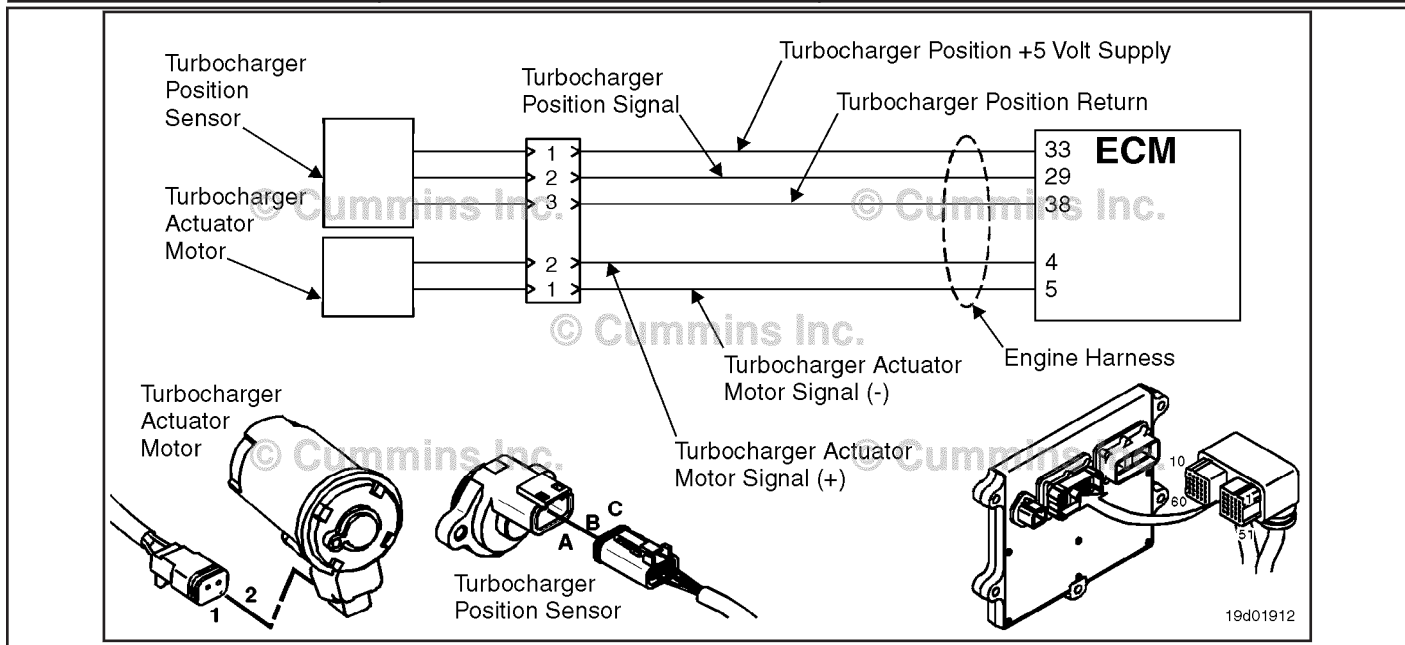
**STEP 4B: Clear the inactive fault codes.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Clear the inactive fault codes.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to erase the inactive fault codes.</li> </ul>	<p>All fault codes cleared?  <b>YES</b></p>	<p>Repair complete</p>
	<p>All fault codes cleared?  <b>NO</b>  <b>Repair:</b>                  Troubleshoot any remaining active fault codes.</p>	<p>Appropriate troubleshooting steps</p>

## Fault Code 2386

### Turbocharger Actuator Motor Circuit - Current Above Normal

CODES	REASON	EFFECT
Fault Code: 2386 PID(P), SID(S): SPN: 2975 FMI: 6/6 Lamp: Amber SRT:	Turbocharger actuator motor circuit - current is above normal. Excessive current detected at the turbocharger actuator motor circuit.	Possible low power. Power will be removed from the turbocharger actuator motor.



Turbocharger Actuator Motor Circuit

#### Circuit Description:

The electronic control module (ECM) controls the turbocharger actuator motor, which changes the airflow of the turbocharger based on various engine operating conditions. The sliding nozzle in the turbocharger is operated by the turbocharger actuator motor. The actuator is a VDC motor that receives voltage from the ECM.

#### Component Location:

The turbocharger actuator motor is part of the turbocharger actuator assembly, which is located on the exhaust side of the engine and is mounted to the bearing housing of the turbocharger. Refer to Procedure 100-002 for a detailed component location view.

#### Shop Talk:

The ECM monitors the current draw of this circuit. If the ECM detects excessive current for a calibrated period of time, it records this fault. Possible causes of this fault include:

- Turbocharger actuator motor signal (+ or -) leads shorted together in the engine harness, turbocharger actuator motor, or ECM
- Low turbocharger actuator motor internal resistance.

#### Refer to Troubleshooting Fault Code t05-2386

## FAULT CODE 2386 - Turbocharger Actuator Motor Circuit - Current Above Normal

### TROUBLESHOOTING SUMMARY



To reduce the possibility of pin and harness damage, use the following test leads when taking a measurement: Part Number 3822758 - male Deutsch™/AMP™/Metri-Pack™ test lead and Part Number 3822917 - female Deutsch™/AMP™/Metri-Pack™ test lead.

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1:</b> Check the fault codes.		
<b>STEP 1A:</b> Check for an active fault code.	Fault Code 2386 active?	
<b>STEP 2:</b> Check the turbocharger actuator motor and circuit.		
<b>STEP 2A:</b> Inspect the turbocharger actuator motor and harness connector pins.	Dirty or damaged pins?	
<b>STEP 2B:</b> Check the resistance of the turbocharger actuator motor.	Greater than 0.5 ohms?	
<b>STEP 3:</b> Check the engine harness.		
<b>STEP 3A:</b> Inspect the engine harness and ECM connector pins.	Dirty or damaged pins?	
<b>STEP 3B:</b> Check for a short circuit in the engine harness.	Greater than 100k ohms?	
<b>STEP 4:</b> Check the turbocharger actuator motor assembly. (Connected to the turbocharger)		
<b>STEP 4A:</b> Perform the INSITE™ electronic service tool Turbocharger Actuator Test.	Actuator position 100 percent when open?	
<b>STEP 4B:</b> Perform the INSITE™ electronic service tool Turbocharger Actuator Test.	Actuator position less than 10 percent when closed?	
<b>STEP 5:</b> Check the turbocharger actuator motor assembly. (Disconnected from the turbocharger)		
<b>STEP 5A:</b> Perform the INSITE™ electronic service tool Turbocharger Actuator Test.	Actuator position 100 percent when open?	
<b>STEP 5B:</b> Perform the INSITE™ electronic service tool Turbocharger Actuator Test.	Actuator position less than 10 percent when closed?	
<b>STEP 6:</b> Clear the fault codes.		
<b>STEP 6A:</b> Disable the fault code.	Fault Code 2386 inactive?	
<b>STEP 6B:</b> Clear the inactive fault codes.	All fault codes cleared?	

**TROUBLESHOOTING STEP****STEP 1: Check the fault codes.****STEP 1A: Check for an active fault code.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for an active fault code. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 2386 active? <b>YES</b>	2A
	Fault Code 2386 active? <b>NO</b>	Use the following procedure for an inactive or intermittent fault code. Refer to Procedure 019-362 in Section 19.

**STEP 2: Check the turbocharger actuator motor and circuit.****STEP 2A: Inspect the turbocharger actuator motor and harness connector pins.**

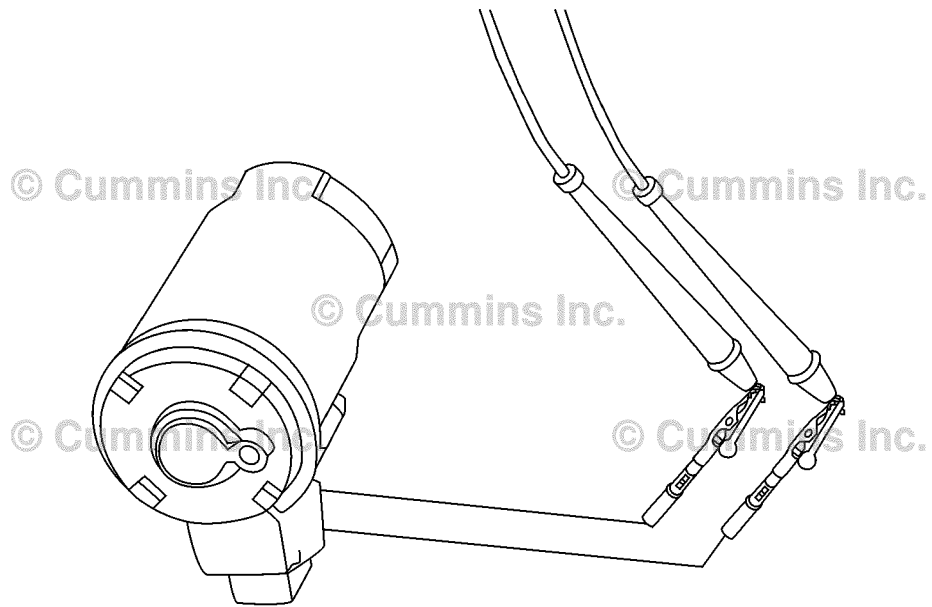
<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the turbocharger actuator motor from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
Inspect the engine harness and turbocharger actuator motor connector pins for the following: <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.	Dirty or damaged pins? <b>YES</b> <b>Repair:</b> Clean the connector and pins. Repair the damaged harness, connector, or pins if possible.	5A
	Dirty or damaged pins? <b>NO</b>	2B

**STEP 2B: Check the resistance of the turbocharger actuator motor.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the turbocharger actuator motor from the engine harness.

Action	Specification/Repair	Next Step
Check the resistance of the turbocharger actuator motor. <ul style="list-style-type: none"> <li>• Measure the resistance between the turbocharger actuator motor SIGNAL (+) pin and the turbocharger actuator motor SIGNAL (-) pin at the turbocharger actuator motor connector.</li> </ul>	Greater than 0.5 ohms? <b>YES</b>	3A
	Greater than 0.5 ohms? <b>NO</b> <b>Repair:</b> Replace the turbocharger actuator assembly. Refer to Procedure 019-388 in Section 19.	5A



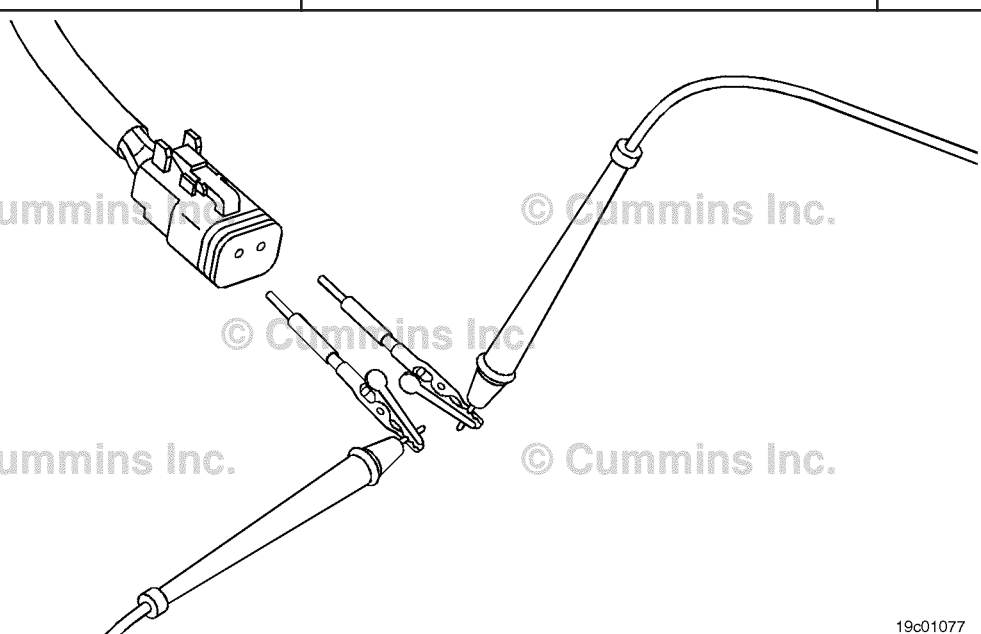
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**STEP 3: Check the engine harness.**

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

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the engine harness and ECM connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Clean the connector and pins.</p> <p>Repair the damaged harness, connector, or pins if possible.</p>	5A
	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	3B

**STEP 3B: Check for a short circuit in the engine harness.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the turbocharger actuator motor from the engine harness.</li> <li>• Disconnect the engine harness from the ECM.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for a short circuit in the engine harness.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the turbocharger actuator motor SIGNAL (+) pin and the turbocharger actuator motor SIGNAL (-) at the turbocharger actuator motor connector of the engine harness.</li> </ul> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Greater than 100k ohms?</p> <p><b>YES</b></p>	4A
	<p>Greater than 100k ohms?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.</p>	5A
		

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**STEP 4: Check the turbocharger actuator motor assembly. (Connected to the turbocharger)**

**STEP 4A: Perform the INSITE™ electronic service tool Turbocharger Actuator Test.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Start the INSITE™ electronic service tool Turbocharger Actuator Test.</p> <ul style="list-style-type: none"> <li>• Select "Open Actuator".</li> </ul>	<p>Actuator position 100 percent when open?</p> <p><b>YES</b></p>	4B
	<p>Actuator position 100 percent when open?</p> <p><b>NO</b></p>	5A



**STEP 4B: Perform the INSITE™ electronic service tool Turbocharger Actuator Test.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Start the INSITE™ electronic service tool Turbocharger Actuator Test. <ul style="list-style-type: none"> <li>• Select “Close Actuator”.</li> </ul>	Actuator position less than 10 percent when closed? <b>YES</b>	6A
	Actuator position less than 10 percent when closed? <b>NO</b>	5B

**STEP 5: Check the turbocharger actuator motor assembly. (Disconnected from the turbocharger)**

**STEP 5A: Perform the INSITE™ electronic service tool Turbocharger Actuator Test.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Remove the turbocharger actuator motor assembly from the turbocharger.</li> <li>• Connect all electrical components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Start the INSITE™ electronic service tool Turbocharger Actuator Test. <ul style="list-style-type: none"> <li>• Select “Open Actuator”.</li> </ul>	Actuator position 100 percent when open? <b>YES</b> <b>Repair:</b> Replace the turbocharger. Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 010-033 in Section 10.	6A
	Actuator position 100 percent when open? <b>NO</b> <b>Repair:</b> Replace the turbocharger actuator motor assembly. Refer to Procedure 019-388 in Section 19.	6A

**STEP 5B: Perform the INSITE™ electronic service tool Turbocharger Actuator Test.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Remove the turbocharger actuator motor assembly from the turbocharger.</li> <li>• Connect all electrical components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Start the INSITE™ electronic service tool Turbocharger Actuator Test.</p> <ul style="list-style-type: none"> <li>• Select "Close Actuator".</li> </ul>	<p>Actuator position less than 10 percent when closed?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Repair or replace the turbocharger. Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 010-033 in Section 10.</p>	6A
	<p>Actuator position less than 10 percent when closed?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Replace the turbocharger actuator motor assembly. Refer to Procedure 019-388 in Section 19.</p>	6A

**STEP 6: Clear the fault codes.**

**STEP 6A: Disable the fault code.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Disable the fault code.</p> <ul style="list-style-type: none"> <li>• Start the engine and let it idle for 1 minute.</li> <li>• Use INSITE™ electronic service tool to verify that the fault code is inactive.</li> </ul>	<p>Fault Code 2386 inactive?</p> <p><b>YES</b></p>	6B
	<p>Fault Code 2386 inactive?</p> <p><b>NO</b></p>	1A

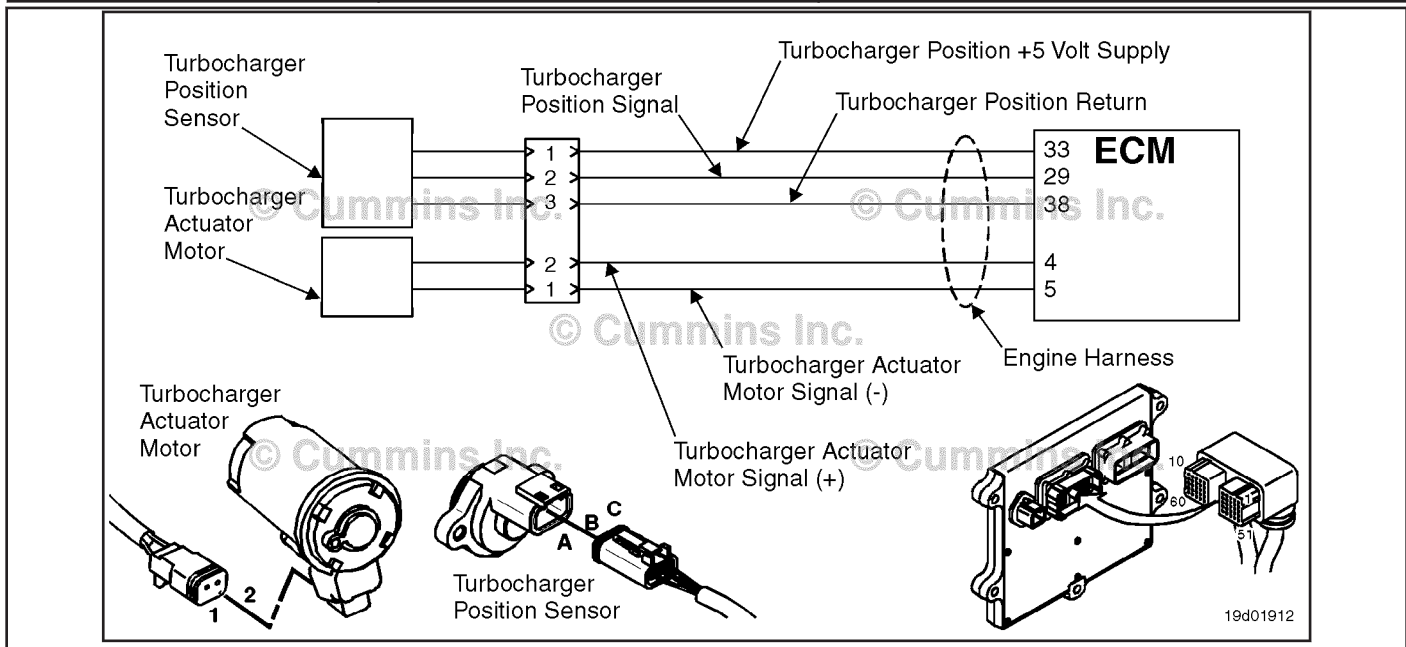
**STEP 6B: Clear the inactive fault codes.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Clear the inactive fault codes.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to erase the inactive fault codes.</li> </ul>	<p>All fault codes cleared?  <b>YES</b></p>	<p>Repair complete</p>
	<p>All fault codes cleared?  <b>NO</b></p>	<p>Appropriate troubleshooting steps</p>

## Fault Code 2387

### Turbocharger Actuator Motor - Mechanical System Not Responding Properly

CODES	REASON	EFFECT
Fault Code: 2387 PID(P), SID(S): S146 SPN: 2975 FMI: 7/7 Lamp: Amber SRT:	Turbocharger actuator motor - the mechanical system is <b>not</b> responding properly or is out of adjustment. Turbocharger actuator is <b>not</b> responding or is slow to respond.	Possible low power. Power will be removed from the turbocharger actuator motor.



Turbocharger Actuator Motor Circuit

**Circuit Description:**

The engine control module (ECM) controls the turbocharger actuator motor, which changes the airflow of the turbocharger based on various engine operating conditions. The sliding nozzle in the turbocharger is operated by the turbocharger actuator motor. The actuator is a DC motor that receives voltage from the ECM.

**Component Location:**

The turbocharger actuator motor is part of the turbocharger actuator assembly, which is located on the exhaust side of the engine and is mounted to the bearing housing of the turbocharger. Refer to Procedure 100-002 in Section E for a detailed component location view.

**Shop Talk:**

Possible causes of this fault include:

- Malfunctioned turbocharger position sensor, and mechanical or electrical malfunction.
- Turbocharger actuator motor assembly malfunction, requiring a high current to operate the turbocharger, such as a stuck or sticking turbocharger.

Inspect the turbocharger vanes for residue, and clean the vanes, if required. Find the source of the residue and repair.

**Refer to Troubleshooting Fault Code t05-2387**

## FAULT CODE 2387 - Turbocharger Actuator Motor - Mechanical System Not Responding Properly

### TROUBLESHOOTING SUMMARY



To reduce the possibility of pin and harness damage, use the following test leads when taking a measurement: Part Number 3822758 - male Deutsch™/AMP™/Metri-Pack™ test lead and Part Number 3822917 - female Deutsch™/AMP™/Metri-Pack™ test lead.

STEPS	SPECIFICATIONS	SRT CODE
<b><u>STEP 1:</u></b> Check the fault codes.		
<b><u>STEP 1A:</u></b> Check for an active fault code.	Fault Code 2387 active?	
<b><u>STEP 2:</u></b> Check the turbocharger position sensor and circuit.		
<b><u>STEP 2A:</u></b> Inspect the engine harness and turbocharger position sensor connector pins.	Dirty or damaged pins?	
<b><u>STEP 2B:</u></b> Check the turbocharger position sensor signal for a short circuit.	Greater than 100k ohms?	
<b><u>STEP 3:</u></b> Check the ECM.		
<b><u>STEP 3A:</u></b> Check the turbocharger position sensor signal voltage.	Less than 0.1-VDC?	
<b><u>STEP 4:</u></b> Check the turbocharger actuator motor assembly.		
<b><u>STEP 4A:</u></b> Perform the INSITE™ electronic service tool Turbocharger Actuator Test.	Actuator position 100 percent when open?	
<b><u>STEP 4B:</u></b> Perform the INSITE™ electronic service tool Turbocharger Actuator Test.	Actuator position less than 10 percent when closed?	
<b><u>STEP 5:</u></b> Clear the fault codes.		
<b><u>STEP 5A:</u></b> Disable the fault code.	Fault Code 2387 inactive?	
<b><u>STEP 5B:</u></b> Clear the inactive fault codes.	All fault codes cleared?	

## TROUBLESHOOTING STEP

### STEP 1: Check the fault codes.

#### STEP 1A: Check for an active fault code.

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for an active fault code. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 2387 active? <b>YES</b>	2A
	Fault Code 2387 active? <b>NO</b>	Use the following procedure for an inactive or intermittent fault code. Refer to Procedure 019-362 in Section 19.

### STEP 2: Check the turbocharger position sensor and circuit.

#### STEP 2A: Inspect the engine harness and turbocharger position sensor connector pins.

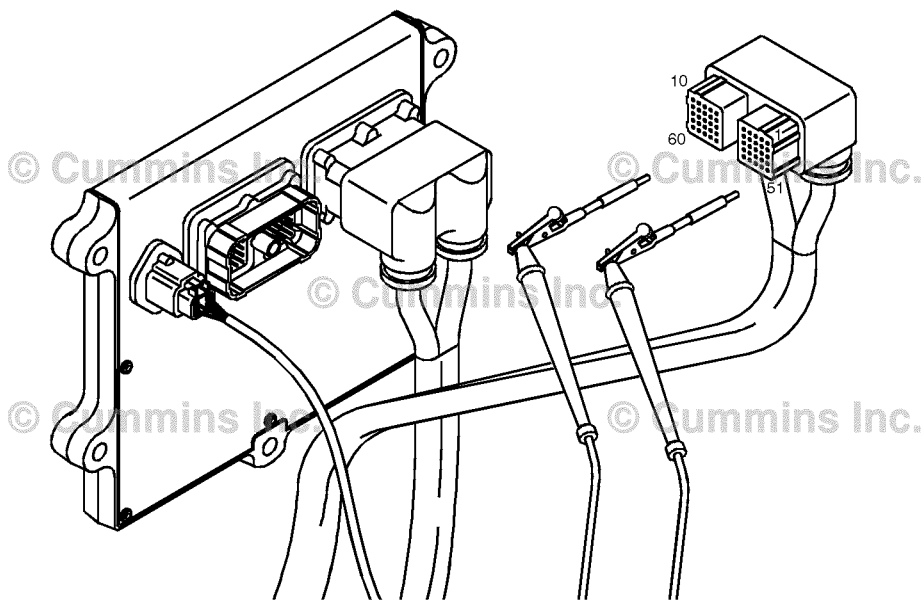
<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> <li>• Disconnect the turbocharger position sensor from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
Inspect the engine harness and turbocharger position sensor connector pins for the following: <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Wire insulation damage</li> <li>• Connector shell broken</li> <li>• Damaged connector locking tab.</li> </ul> Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.	Dirty or damaged pins? <b>YES</b> <b>Repair:</b> Clean the connector and pins. Repair the damaged harness, connector, or pins if possible.	5A
	Dirty or damaged pins? <b>NO</b>	2B

**STEP 2B: Check the turbocharger position sensor signal for a short circuit.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the engine harness from the ECM.
- Disconnect the turbocharger position sensor from the engine harness.
- Disconnect the turbocharger speed sensor from the engine harness.
- Disconnect the barometric pressure sensor from the engine harness.

Action	Specification/Repair	Next Step
Check for a short circuit in the engine harness. • Measure the resistance between the turbocharger position +5 volt SUPPLY pin at the ECM connector of the engine harness and all other pins in the connector.	Greater than 100k ohms? <b>YES</b>	3A
	Greater than 100k ohms? <b>NO</b> <b>Repair:</b> Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.	5A



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**STEP 3: Check the ECM.**

**STEP 3A: Check the turbocharger position sensor signal voltage.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the ECM.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool to the SAE J1939 or SAE J1587 data link connector.</li> </ul>		
Action	Specification/Repair	Next Step
Use the INSITE™ electronic service tool Data Logger/Monitor to check the turbocharger position sensor signal voltage.  -	Less than 0.1-VDC? <b>YES</b>	4A
	Less than 0.1-VDC? <b>NO</b> <b>Repair:</b> Replace the ECM. Refer to Procedure 019-031 in Section 19.	Repair complete

**STEP 4: Check the turbocharger actuator motor assembly.**

**STEP 4A: Perform the INSITE™ electronic service tool Turbocharger Actuator Test.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Start INSITE™ electronic service tool Turbocharger Actuator Test. <ul style="list-style-type: none"> <li>• Open the turbocharger actuator.</li> </ul>	Actuator position 100 percent when open? <b>YES</b>	4B
	Actuator position 100 percent when open? <b>NO</b> <b>Repair:</b> Repair or replace the turbocharger. Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 010-033 in Section 10.	5A



**STEP 4B: Perform the INSITE™ electronic service tool Turbocharger Actuator Test.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Start INSITE™ electronic service tool Turbocharger Actuator Test. <ul style="list-style-type: none"> <li>• Select “Close Actuator”.</li> </ul>	Actuator position less than 10 percent when closed? <b>YES</b>	5A
	Actuator position less than 10 percent when closed? <b>NO</b> <b>Repair:</b> Repair or replace the turbocharger. Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 010-033 in Section 10.	5A

**STEP 5: Clear the fault codes.**

**STEP 5A: Disable the fault code.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> <li>• Start the engine and let it idle for 1 minute.</li> <li>• Use INSITE™ electronic service tool to verify that the fault code is inactive.</li> </ul>	Fault Code 2387 inactive? <b>YES</b>	5B
	Fault Code 2387 inactive? <b>NO</b>	1A

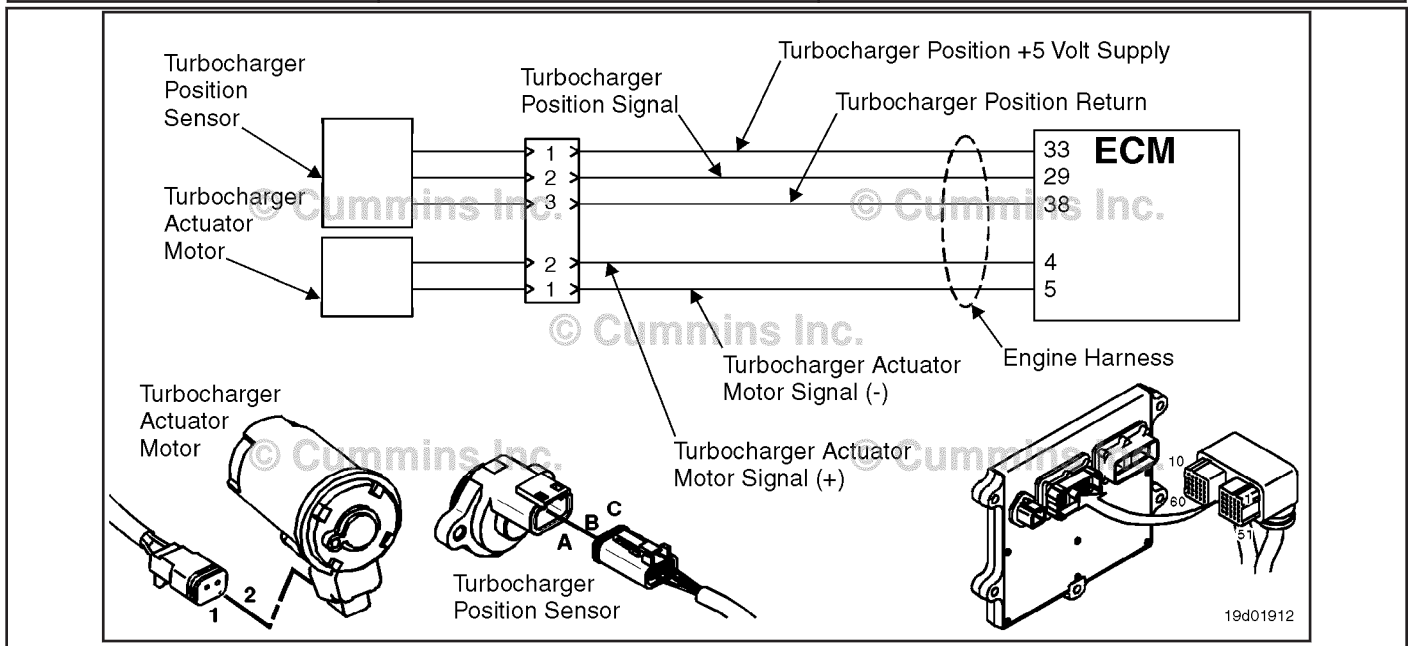
**STEP 5B: Clear the inactive fault codes.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to clear the inactive fault codes.</li> </ul>	All fault codes cleared? <b>YES</b>	Repair complete
	All fault codes cleared? <b>NO</b>	Appropriate troubleshooting steps

## Fault Code 2388

### Variable Geometry Turbocharger Actuator Position Failed Automatic Calibration Procedure - Out of Calibration

CODES	REASON	EFFECT
Fault Code: 2388 PID(P), SID(S): S269 SPN: 2795 FMI: 13/13 Lamp: Amber SRT:	Variable Geometry Turbocharger actuator position failed automatic calibration procedure - out of calibration.	Variable Geometry Turbocharger Possible low power. Variable Geometry Turbocharger actuator will remain either open or closed.



Turbocharger Actuator Motor Circuit

#### Circuit Description:

The electronic control module (ECM) periodically checks and adjusts the zero position of the turbocharger position sensor when the turbocharger is closed. This self-calibrating feature adjusts for wear and unit-to-unit variation of position sensors and actuator assemblies. This fault is logged if the position sensor reading is outside the calibrated limits.

#### Component Location:

The turbocharger position sensor is mounted on the turbocharger actuator assembly on the bearing housing of the turbocharger. Refer to Procedure 100-002 in Section E for a detailed component location view.

#### Shop Talk:

A possible cause of this fault code could be a turbocharger internal failure causing the turbocharger actuator to **not** close fully.

When troubleshooting inactive counts of this fault code, running the Turbocharger Actuator Test in INSITE™ electronic service tool could help to identify a stuck turbocharger actuator.

#### Refer to Troubleshooting Fault Code t05-2388

## FAULT CODE 2388 - Variable Geometry Turbocharger Actuator Position Failed Automatic Calibration Procedure - Out of Calibration TROUBLESHOOTING SUMMARY



To reduce the possibility of pin and harness damage, use the following test leads when taking a measurement: Part Number 3822758 - male Deutsch™/AMP™/Metri-Pack™ test lead and Part Number 3822917 - female Deutsch™/AMP™/Metri-Pack™ test lead.

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1: Check the harness.</b>		
<b>STEP 1A:</b> Inspect the electronic control module and engine harness connector pins.	Dirty or damaged pins?	
<b>STEP 1B:</b> Check for a short circuit in the engine harness.	Greater than 100k ohms?	
<b>STEP 2: Check the turbocharger position sensor.</b>		
<b>STEP 2A:</b> Inspect the turbocharger position sensor and engine harness connector pins.	Dirty or damaged pins?	
<b>STEP 2B:</b> Check the turbocharger position sensor signal voltage.	Less than 0.1-VDC?	
<b>STEP 3: Clear the fault codes.</b>		
<b>STEP 3A:</b> Disable the fault code.	Fault Code 2388 inactive?	
<b>STEP 3B:</b> Clear the inactive fault codes.	All fault codes cleared?	

### TROUBLESHOOTING STEP

**STEP 1: Check the harness.**

**STEP 1A: Inspect the electronic control module and engine harness connector pins.**

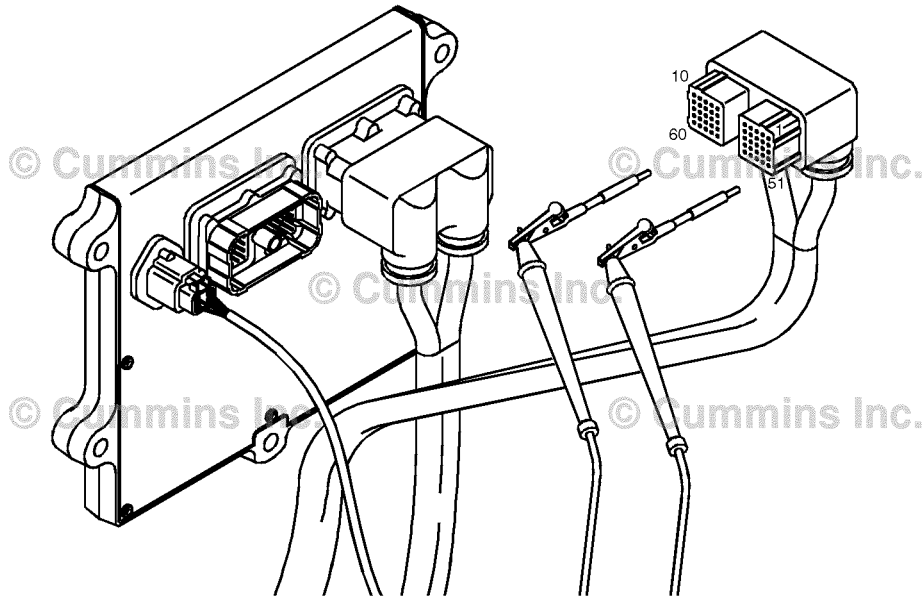
<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the electronic control module from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
Inspect the engine harness and ECM connector pins connector pins for the following: <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.	Dirty or damaged pins? <b>YES</b> <b>Repair:</b> Clean the connector and pins.  Flush the dirt, debris, or moisture from the connector pins with electrical contact cleaner, Part Number 3824510.  Repair the damaged harness, connector, or pins if possible.	3A
		Dirty or damaged pins? <b>NO</b>

**STEP 1B: Check for a short circuit in the engine harness.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the turbocharger position sensor from the engine harness.
- Disconnect the engine harness from the electronic control module.

Action	Specification/Repair	Next Step
Check for a short circuit in the engine harness. <ul style="list-style-type: none"> <li>• Measure the resistance between the turbocharger position SIGNAL pin at the electronic control module connector of the engine harness and all other pins in the connector.</li> </ul> Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.	Greater than 100k ohms? <b>YES</b>	2A
	Greater than 100k ohms? <b>NO</b> <b>Repair:</b> Repair or replace the engine harness. Refer to Procedure 019-043 in Section 19.	3A



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**STEP 2: Check the turbocharger position sensor.**

**STEP 2A: Inspect the turbocharger position sensor and engine harness connector pins.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the turbocharger position sensor from the engine harness.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the engine harness and turbocharger position sensor connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>Clean the connector and pins.</p> <p>Repair the damaged harness, connector, or pins if possible.</p> <p>Refer to Procedure 019-043 in Section 19.</p>	3A
	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	2B

**STEP 2B: Check the turbocharger position sensor signal voltage.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the engine harness from the electronic control module.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool to the SAEJ1939 or SAEJ1587/1708 OEM data link connector.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Use the INSITE™ electronic service tool Data Logger/Monitor to check the turbocharger position sensor signal voltage.</p> <p>-</p>	<p>Less than 0.1-VDC?</p> <p><b>YES</b></p>	3A
	<p>Less than 0.1-VDC?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Replace the ECM. Refer to Procedure 019-031 in Section 19.</p>	4A

**STEP 3: Check the turbocharger actuator motor assembly.**

**STEP 3A: Perform INSITE™ electronic service tool turbocharger actuator test.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components</li> <li>• Turn keyswitch ON</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Start INSITE™ electronic service tool turbocharger actuator test.</p> <ul style="list-style-type: none"> <li>• Open the turbocharger actuator.</li> </ul>	<p>Actuator position 100 percent when open?</p> <p><b>YES</b></p>	3B
	<p>Actuator position 100 percent when open?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Flush the dirt, debris, or moisture from the connector pins with electrical contact cleaner, Part Number 3824510.</p> <p>Repair or replace the turbocharger. Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 010-033 in Section 19.</p>	4A

**STEP 3B: Perform the INSITE™ electronic service tool turbocharger actuator test.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Start INSITE™ electronic service tool turbocharger actuator test.</p> <ul style="list-style-type: none"> <li>• Select "Close Actuator".</li> </ul>	<p>Actuator position less than 10 percent when closed?</p> <p><b>YES</b></p>	4A
	<p>Actuator position less than 10 percent when closed?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Repair or replace the turbocharger. Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 010-033 in Section 19.</p>	4A

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

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> <li>• Start the engine and let it idle for 1 minute.</li> <li>• Use INSITE™ electronic service tool to verify the fault code is inactive.</li> </ul>	Fault Code 2388 inactive? <b>YES</b>	4B
	Fault Code 2388 inactive? <b>NO</b> <b>Repair:</b> Return to the troubleshooting steps or contact a Cummins® Authorized Repair Location if all steps have been completed and checked again.	1A

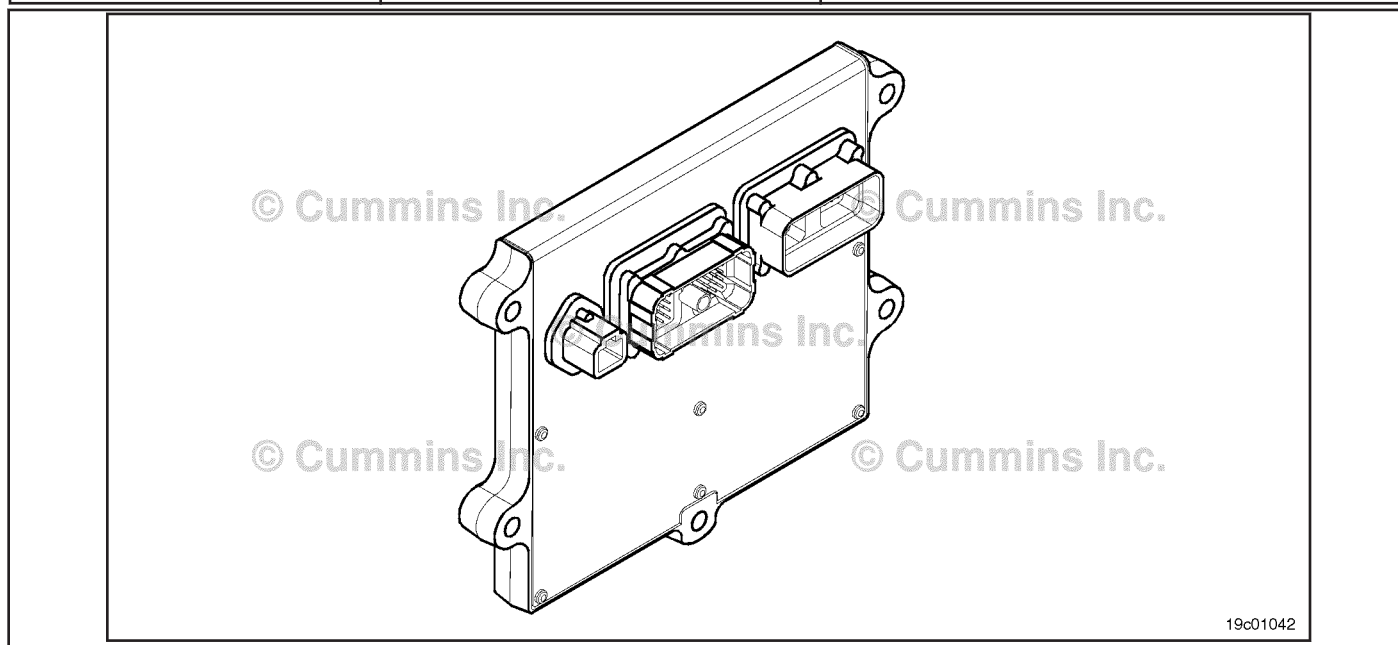
**STEP 4B: Clear the inactive fault codes**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components</li> <li>• Turn keyswitch ON</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to clear the inactive fault codes.</li> </ul>	All fault codes cleared? <b>YES</b>	Repair complete
	All fault codes cleared? <b>NO</b> <b>Repair:</b> Troubleshoot any remaining active fault codes.	Reference the appropriate troubleshooting steps.

## Fault Code 2448

### Coolant Level - Data Valid But Below Normal Operational Range - Least Severe Level

CODES	REASON	EFFECT
Fault Code: 2448 PID(P), SID(S): SPN: 111 FMI: 1/17 Lamp: Maintenance SRT:	Coolant Level - Data Valid But Below Normal Operational Range - Least Severe Level. Low engine coolant level detected.	None on performance.



ISB, ISC, and ISL - Electronic Control Module

#### **Circuit Description:**

The coolant level sensor is a switch and is used to measure the level of the engine coolant in the radiator top tank. The coolant level sensor is immersed in the coolant and returns a different signal voltage when immersed in coolant versus being out of coolant. The electronic control module (ECM) monitors the change in the signal voltage to determine the level of the engine coolant.

#### **Component Location:**

The engine coolant level sensor is typically located in the radiator top tank or surge tank. Refer to the OEM service manual for the location.

#### **Conditions for Running the Diagnostics:**

This diagnostic runs continuously when the keyswitch is in the ON position or when the engine is operating.

#### **Conditions for Setting the Fault Codes:**

The ECM detects that the coolant level is below the normal operating limits.

#### **Action Taken When the Fault Code is Active:**

- The ECM flashes the amber CHECK ENGINE light at initial key-on for 30 seconds when low engine coolant level has been detected.



**Conditions for Clearing the Fault Code:**

The ECM will stop flashing the amber CHECK ENGINE light at key-on when coolant has been added to the engine.

**Shop Talk:**

Verify the electronic control module (ECM) calibration is correct. Check the calibration revision history found on QuickServe® Online for applicable fixes to the calibration stored in the ECM. If necessary, recalibrate the ECM. Refer to Procedure 019-032 in Section 19.

This fault code goes active when the coolant level inside the radiator top tank or surge tank drops below the sensor level. Fill the top tank with coolant.

**Refer to Troubleshooting Fault Code t05-2448**

## Coolant Level - Data Valid But Below Normal Operating Range - Least Severe Level

### TROUBLESHOOTING SUMMARY

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1:</b> Check the fault codes.		
<b>STEP 1A:</b> Check for Fault Code 2448.	Active or inactive counts of Fault Code 2448?	

### TROUBLESHOOTING STEP

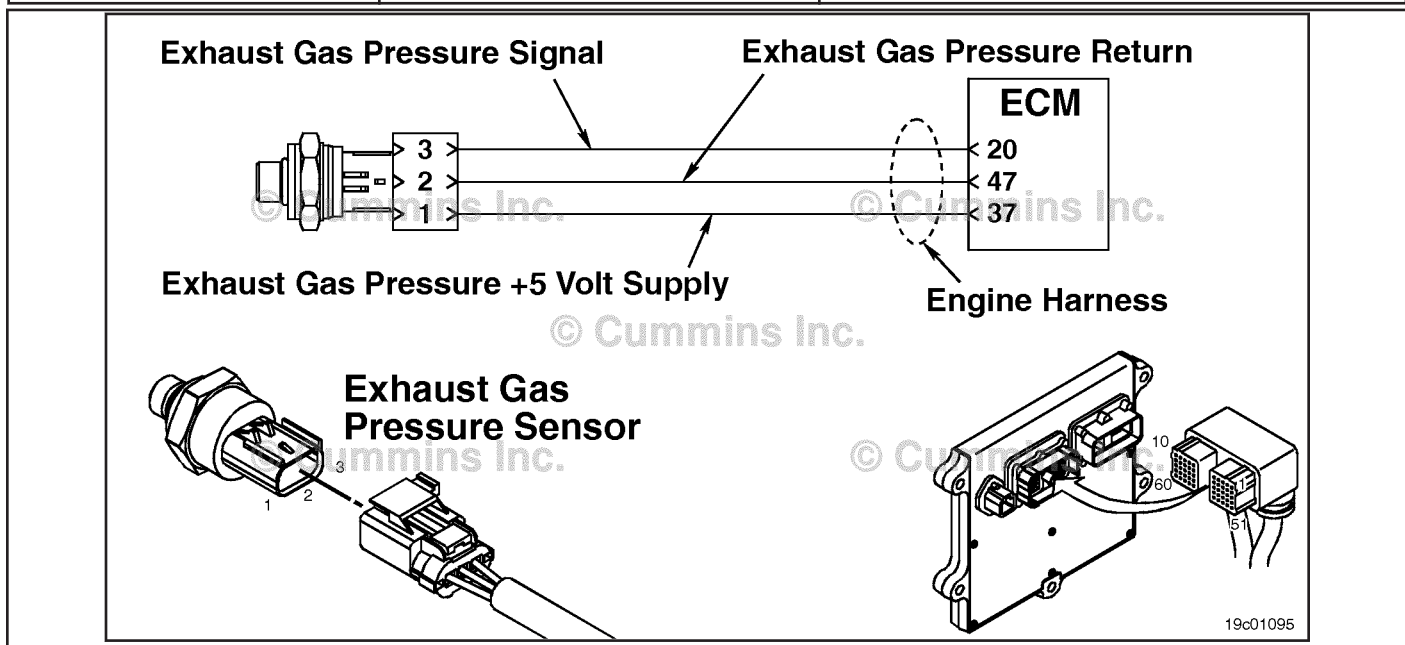
**STEP 1:** Check the fault codes.  
**STEP 1A:** Check for Fault Code 2448.

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Active or inactive counts of Fault Code 2448? <b>YES</b> <b>Repair:</b> Add coolant to the engine. <ul style="list-style-type: none"> <li>• Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual. Refer to Procedure 008-018 in Section 8.</li> <li>• Use the following procedure in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Engines, Troubleshooting and Repair Manual, Bulletin 4021418. Refer to Procedure 008-018 in Section 8.</li> </ul> If Fault Code 2448 is active and the coolant level is <b>not</b> low, a malfunctioning coolant level sensor is a likely cause. Refer to the OEM service manual before replacing the coolant level sensor.	Repair complete.
	Active or inactive counts of Fault Code 2448? <b>NO</b>	

## Fault Code 2554

### Exhaust Pressure Sensor Circuit - Data Erratic, Intermittent, or Incorrect

CODES	REASON	EFFECT
Fault Code: 2554 PID(P), SID(S): P095 SPN: 1209 FMI: 2/2 Lamp: Amber SRT:	Exhaust pressure sensor circuit - data erratic, intermittent, or incorrect. An error in the exhaust pressure sensor signal was detected by the ECM.	Engine power derate. Exhaust Gas Recirculator (EGR) valve will be closed.



Exhaust Pressure Sensor Circuit

#### Circuit Description:

The exhaust pressure is used by the electronic control module (ECM) to monitor the engine exhaust pressure. This information is used by the ECM to control emissions and EGR valve operation.

#### Component Location:

The exhaust pressure sensor is located above the EGR cooler, on the exhaust side of the engine. Refer to Procedure 100-002 for a detailed component location view.

#### Shop Talk:

At key-on, before the engine is started, the readings for intake manifold pressure, barometric pressure, and exhaust pressure are compared. This fault code occurs if the exhaust pressure sensor reading is different from the other two. This check is **only** done once after the keyswitch is turned on. This fault will **not** occur while the engine is running.

#### Refer to Troubleshooting Fault Code t05-2554

## FAULT CODE 2554 - Exhaust Pressure Sensor Circuit - Data Erratic, Intermittent, or Incorrect

### TROUBLESHOOTING SUMMARY

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1: Check for a valid fault code.</b>		
<b>STEP 1A:</b> Check for an active Fault Code 2554.	Fault Code 2554 inactive?	
<b>STEP 1B:</b> Check for condensation or foreign material.	Fault Code 2554 active?	
<b>STEP 2: Clear the fault codes.</b>		
<b>STEP 2A:</b> Disable the fault code.	Fault Code 2554 inactive?	
<b>STEP 2B:</b> Clear the inactive fault codes.	All fault codes cleared?	

### TROUBLESHOOTING STEP

**STEP 1: Check for a valid fault code.**  
**STEP 1A: Check for an active Fault Code 2554.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>Turn keyswitch OFF for at least 30 seconds.</li> <li>Turn keyswitch ON.</li> <li>Connect the electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for an active fault code. <ul style="list-style-type: none"> <li>Wait 30 seconds after keyswitch is turned on.</li> </ul>	Fault Code 2554 active? <b>YES</b>	1B
	Fault Code 2554 active? <b>NO</b>	2A

**STEP 1B: Check for condensation or foreign material.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>Turn keyswitch OFF.</li> </ul>		
Action	Specification/Repair	Next Step
Check for condensation or foreign material. <ul style="list-style-type: none"> <li>Remove the exhaust pressure sensor, pedestal, and exhaust pressure sensor tube. Use the following procedure in the ISB, ISBe, ISBe4, QSB4.5, QSB5.9, and QSB6.7 (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 011-027 in Section 11.</li> <li>Check for condensation or foreign material.</li> <li>Clean all removed components.</li> <li>Install removed components.</li> <li>Turn keyswitch ON.</li> <li>Wait 30 seconds after the keyswitch is turned on.</li> </ul>	Fault Code 2554 active? <b>YES</b> <b>Repair:</b> Replace the exhaust pressure sensor. Refer to Procedure 019-376 in Section 19.	2A
		Fault Code 2554 active? <b>NO</b>

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

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON or Run/Stop switch to the Run position.</li> <li>• Connect the electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> <li>• Start the engine and let it idle for one minute.</li> <li>• Use INSITE™ electronic service tool to verify the fault code is inactive.</li> </ul>	Fault Code 2554 inactive? <b>YES</b>	2B
	Fault Code 2554 inactive? <b>NO</b> <b>Repair:</b> Return to the troubleshooting steps or contact a local Cummins® Authorized Repair location if all steps have been completed and checked again.	1A

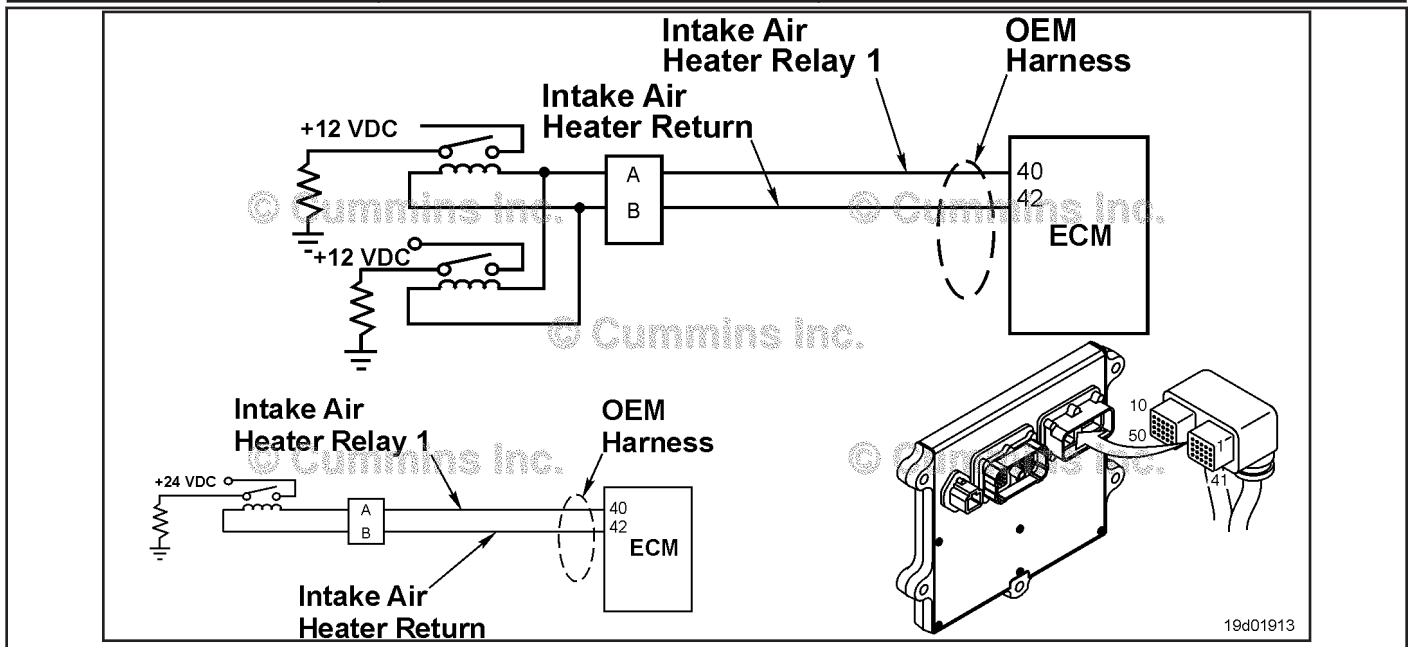
**STEP 2B: Clear the inactive fault codes.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON or Run/Stop switch to the Run position.</li> <li>• Connect the electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> <li>• Use INISTE™ electronic service tool to erase the inactive fault codes.</li> </ul>	All fault codes cleared? <b>YES</b>	Repair complete
	All fault codes cleared? <b>NO</b> <b>Repair:</b> Troubleshoot any remaining active fault codes.	Appropriate troubleshooting steps

## Fault Code 2555

### Intake Air Heater #1 Circuit - Voltage Above Normal or Shorted to High Source

CODES	REASON	EFFECT
Fault Code: 2555 PID(P), SID(S): S070 SPN: 729 FMI: 3 Lamp: Amber SRT:	Intake Air Heater #1 Circuit - Voltage Above Normal or Shorted to High Source. High voltage detected at the intake air heater signal circuit.	The intake air heaters may be ON or OFF all the time.



Intake Air Heater #1 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 intake air heater. 12-volt systems will have two relays while 24-volt systems **only** require one relay.

#### Component Location:

The intake air heater is located at the air inlet connection into the intake manifold. The location of the intake air heater relays will vary by OEM. Refer to Procedure 100-002 in Section E.

#### Shop Talk:

Possible causes of this fault code include:

- Intake air heater relay signal wire **not** connected to the relay
- Intake air heater relay return wire **not** connected to the relay
- Open circuit in the intake air heater relay signal wire
- Open circuit in the intake air heater relay return wire
- Intake air heater signal wire shorted to a voltage source.

#### Refer to Troubleshooting Fault Code t05-2555

## FAULT CODE 2555 - Intake Air Heater #1 Circuit - Voltage Above Normal or Shorted to High Source

### TROUBLESHOOTING SUMMARY

#### ⚠CAUTION⚠

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

#### ⚠CAUTION⚠

To reduce the possibility of pin and harness damage, use the following test leads when taking a measurement: Part Number 3822758 - male Deutsch™/AMP™/Metri-Pack™ test lead and Part Number 3822917 - female Deutsch™/AMP™/Metri-Pack™ test lead.

STEPS	SPECIFICATIONS	SRT CODE
<b>STEP 1:</b> Check the fault codes.		
<b>STEP 1A:</b> Check for an inactive fault code.	Fault Code 2555 inactive?	
<b>STEP 2:</b> Check the intake air heater relay and circuit.		
<b>STEP 2A:</b> Inspect the intake air heater relay and electrical connections.	Dirty or damaged pins?	
<b>STEP 2B:</b> Check for an open circuit in the intake air heater relay.	Less than 100 ohms?	
<b>STEP 2C:</b> Check the intake air heater diagnostic voltage, supply line and return circuit.	Greater than 3.75-VDC?	
<b>STEP 2D:</b> Check for an open circuit in the intake air heater relay return circuit.	Less than 10 ohms?	
<b>STEP 3:</b> Check the ECM and OEM harness.		
<b>STEP 3A:</b> Inspect the ECM and OEM harness connector pins.	Dirty or damaged pins?	
<b>STEP 3B:</b> Check for an open circuit in the OEM harness.	Less than 10 ohms?	
<b>STEP 3C:</b> Check for a pin to pin short circuit in the OEM harness.	Greater than 100k ohms?	
<b>STEP 3D:</b> Check for an inactive fault code.	Fault Code 2555 inactive?	
<b>STEP 4:</b> Clear the fault code.		
<b>STEP 4A:</b> Disable the fault code.	Fault Code 2555 inactive?	
<b>STEP 4B:</b> Clear the inactive fault codes.	All fault codes cleared?	

## TROUBLESHOOTING STEP

**STEP 1: Check the fault codes.**  
**STEP 1A: Check for an inactive fault code.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch ON</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for an inactive fault code. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 2555 inactive? <b>YES</b>	Use the following procedure for an inactive or intermittent fault code. Refer to Procedure 019-362 in Section 19.
	Fault Code 2555 inactive? <b>NO</b>	2A

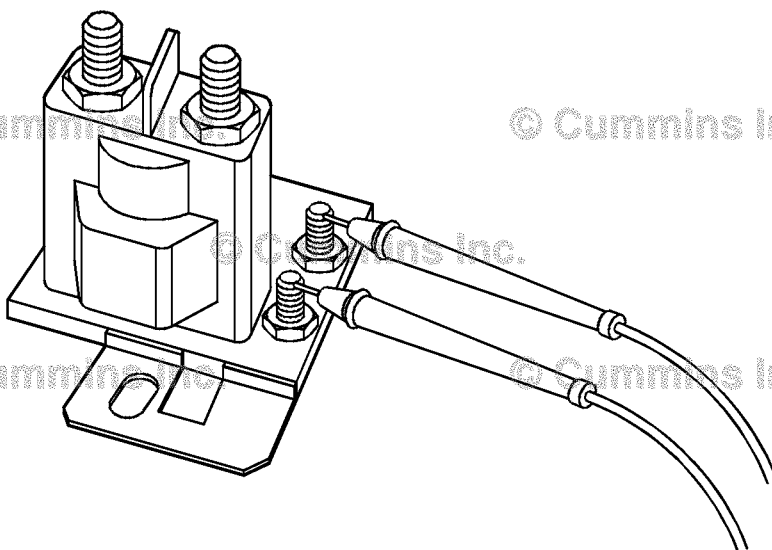
**STEP 2: Check the intake air heater relay and circuit.**  
**STEP 2A: Inspect the intake air heater relay and electrical connections.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF</li> <li>• Disconnect the intake air heater relays from the OEM harness.</li> </ul>		
Action	Specification/Repair	Next Step
Inspect the OEM harness and intake air heater relay connections for the following: <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> Perform these checks on all interconnecting harness connectors in the circuit. Use the circuit art or wiring diagram to identify the connectors and pins.	Dirty or damaged pins? <b>YES</b> <b>Repair:</b> A damaged connection has been detected in the sensor or harness connector. Repair the damaged harness, connector, or pins, if possible. <ul style="list-style-type: none"> <li>• Flush the dirt, debris, or moisture from the connector pins. Use electrical contact cleaner, Part Number 3824510.</li> <li>• Install the appropriate connector seal if it is damaged or missing.</li> <li>• Refer to Procedure 019-071 in Section 19.</li> </ul>	4A
	Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.	Dirty or damaged pins? <b>NO</b>



**STEP 2B: Check for an open circuit in the intake air heater relay.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF</li> <li>• Disconnect the intake air heater relays from the OEM harness.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check the intake air heater relay resistance.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the intake air heater SIGNAL pin and the intake air heater RETURN pin at the intake air heater relay.</li> </ul> <p>NOTE: For 12-volt systems, both relays should be checked.</p> <p>Perform these checks on all interconnecting harness connectors in the circuit. Use the circuit art or wiring diagram to identify the connectors and pins.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Less than 100 ohms? <b>YES</b></p>	<p>2C</p>
	<p>Less than 100 ohms? <b>NO</b></p> <p><b>Repair:</b></p> <p>An open circuit has been detected in the intake air heater relay.</p> <p>Replace the intake air heater relay.</p> <p>Refer to the OEM service manual.</p>	<p>4A</p>



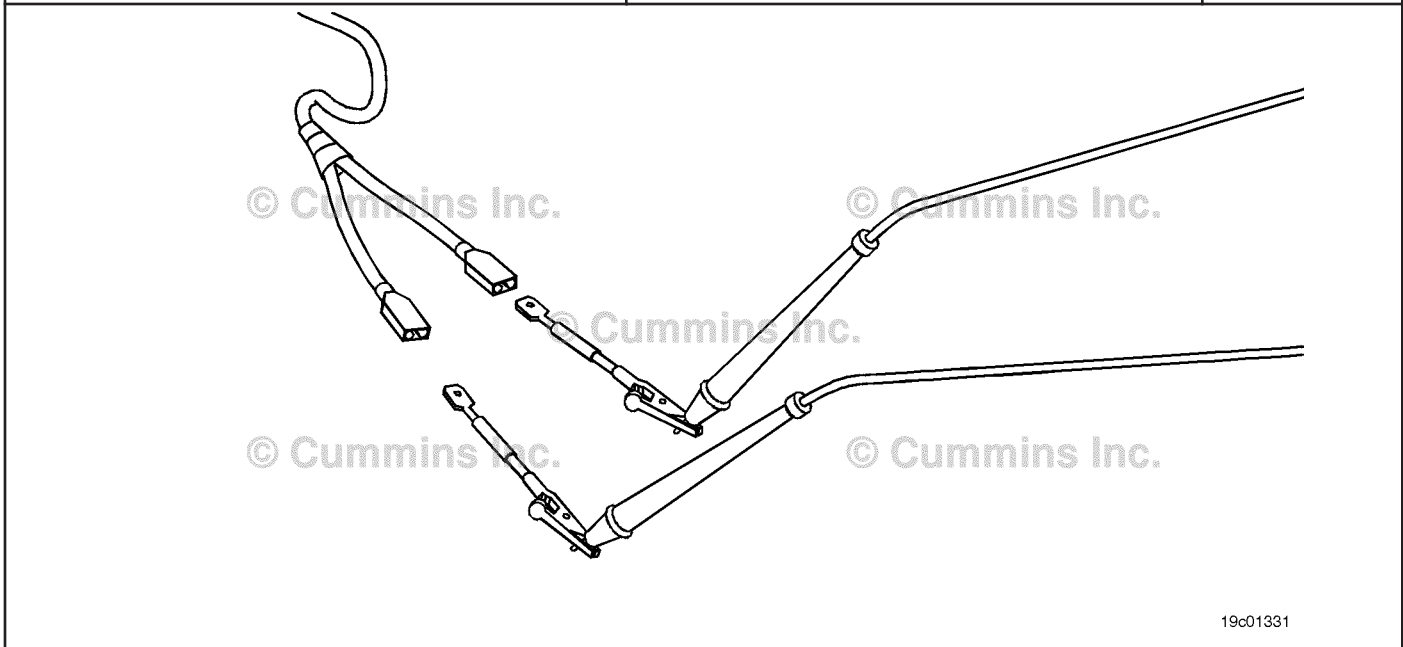
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**STEP 2C: Check the intake air heater diagnostic voltage, supply line and return circuit.**

**Condition:**

- Turn keyswitch OFF
- Disconnect the intake air heater relay from the OEM harness
- Turn keyswitch ON.

Action	Specification/Repair	Next Step
Check the intake air heater supply voltage and return circuit. <ul style="list-style-type: none"> <li>• Measure the voltage between the intake air heater relay SIGNAL line and the intake air heater relay RETURN line at the intake air heater relay connector of the OEM harness.</li> </ul> NOTE: For 12-volt systems, both leads should be tested.	Greater than 3.75-VDC? <b>YES</b>	3C
	Greater than 3.75-VDC? <b>NO</b>	2D

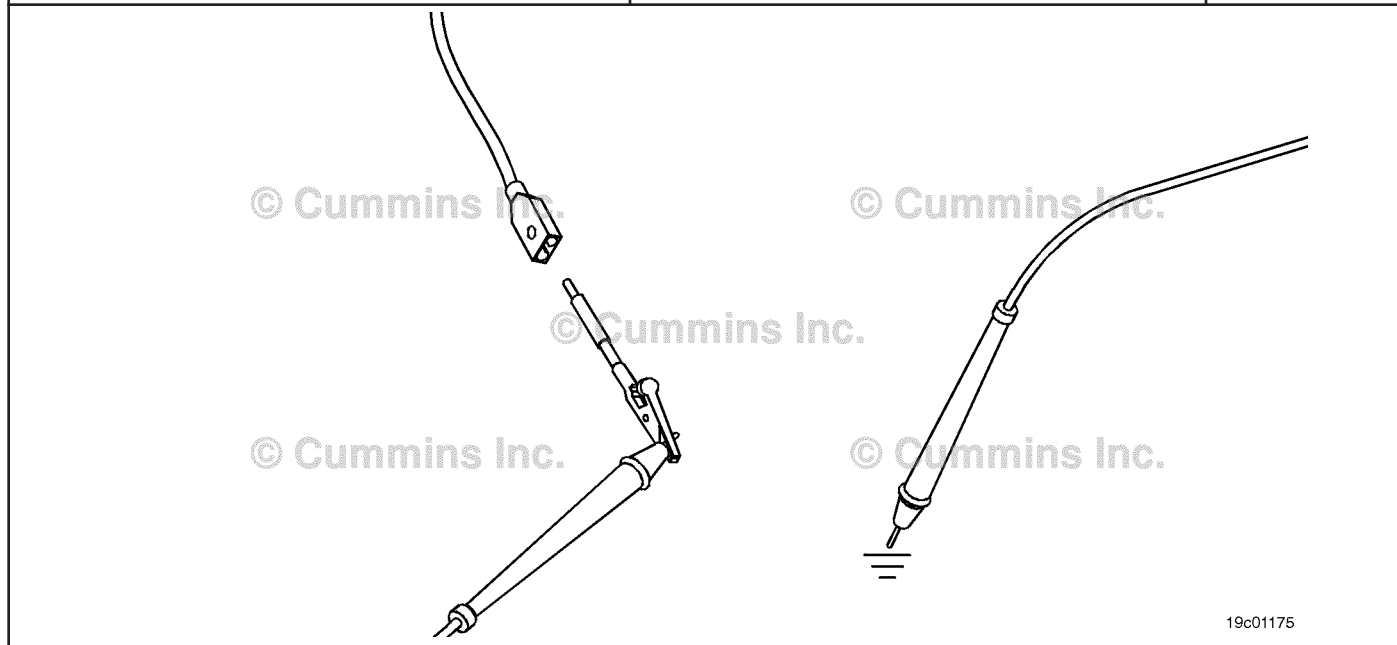


**STEP 2D: Check for an open circuit in the intake air heater relay return circuit.**

**Condition:**

- Turn keyswitch OFF
- Disconnect the intake air heater relay from the OEM harness.

Action	Specification/Repair	Next Step
<p>Check for an open circuit.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the intake air heater relay RETURN pin at the intake air heater relay connector to ground.</li> </ul> <p>Perform these checks on all interconnecting harness connectors in the circuit. Use the circuit art or wiring diagram to identify the connectors and pins.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Less than 10 ohms? <b>YES</b></p>	<p>3A</p>
	<p>Less than 10 ohms? <b>NO</b></p> <p><b>Repair:</b></p> <p>An open circuit on the RETURN wire has been detected. Use the OEM wiring diagram for RETURN wire configuration.</p> <p>If the RETURN is wired to the ECM, repair or replace the OEM harness.</p> <ul style="list-style-type: none"> <li>• Refer to Procedure 019-071 in Section 19.</li> </ul> <p>If the RETURN wire is grounded to chassis or engine block ground, repair the source of the damaged connection.</p> <p>Clean, repair, or replace the OEM harness if possible.</p> <ul style="list-style-type: none"> <li>• Refer to Procedure 019-071 in Section 19.</li> </ul>	<p>4A</p>



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**STEP 3: Check the ECM and OEM harness.**

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

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF</li> <li>• Disconnect the OEM harness from the ECM.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Inspect the OEM harness ECM connector pins for the following:</p> <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> <p>Perform these checks on all interconnecting harness connectors in the circuit. Use the circuit art or wiring diagram to identify the connectors and pins.</p> <p>Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.</p>	<p>Dirty or damaged pins?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A damaged connection has been detected in the ECM or OEM harness connector.</p> <p>Repair the damaged harness, connector, or pins, if possible.</p> <ul style="list-style-type: none"> <li>• Flush the dirt, debris, or moisture from the connector pins. Use electrical contact cleaner, Part Number 3824510.</li> <li>• Install the appropriate connector seal if it is damaged or missing.</li> <li>• Refer to Procedure 019-071 in Section 19.</li> </ul>	4A
	<p>Dirty or damaged pins?</p> <p><b>NO</b></p>	3B

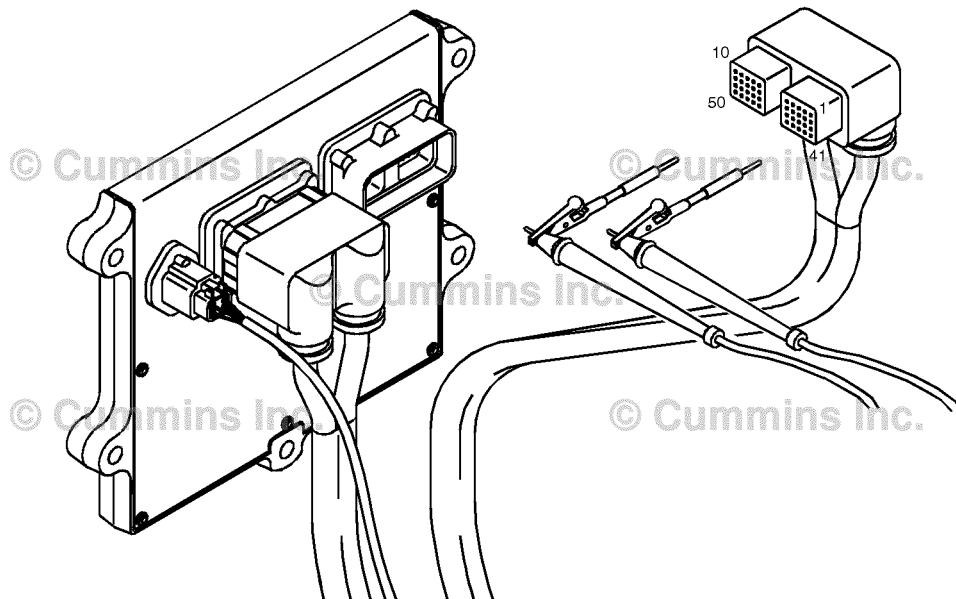
**STEP 3B: Check for an open circuit in the OEM harness.**

Action	Specification/Repair	Next Step
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF</li> <li>• Disconnect the OEM harness from the ECM</li> <li>• Disconnect the intake air heater relay from the OEM harness.</li> </ul> <p>Check for an open circuit.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the OEM harness ECM connector intake air heater relay SIGNAL pin and the OEM harness intake air heater relay connector SIGNAL pin.</li> </ul> <p>NOTE: For 12-volt systems, both leads should be tested.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Less than 10 ohms? <b>YES</b></p> <hr/> <p>Less than 10 ohms? <b>NO</b></p> <p><b>Repair:</b></p> <p>An open intake air heater relay SIGNAL circuit has been detected in the OEM harness.</p> <p>Repair or replace the OEM harness. Refer to Procedure 019-071 in Section 19.</p>	<p>3C</p> <hr/> <p>4A</p>

The diagram illustrates the testing procedure for an open circuit in the OEM harness. It shows a multimeter being used to measure the resistance between the SIGNAL pin of the OEM harness ECM connector and the SIGNAL pin of the OEM harness intake air heater relay connector. The ECM connector has pins labeled 10 and 50, and the heater relay connector has pin 41. The multimeter leads are connected to these specific pins. The diagram is watermarked with '© Cummins Inc.' and includes the part number 19d02049 in the bottom right corner.

**STEP 3C: Check for a pin-to-pin short circuit in the OEM harness.**

Action	Specification/Repair	Next Step
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF</li> <li>• Disconnect the OEM harness from the ECM</li> <li>• Disconnect the intake air heater from the OEM harness.</li> </ul> <p>Check for a pin-to-pin short.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the intake air heater relay SIGNAL pin in the OEM harness ECM connector and all other pins in the ECM connector.</li> </ul> <p>Use the wiring diagram and the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Greater than 100k ohms? <b>YES</b></p>	<p>3D</p>
	<p>Greater than 100k ohms? <b>NO</b></p> <p><b>Repair:</b></p> <p>A pin-to-pin short circuit on the intake air heater relay SIGNAL line has been detected in the OEM harness.</p> <p>Repair or replace the OEM harness. Refer to Procedure 019-071 in Section 19.</p>	<p>4A</p>



**STEP 3D: Check for an inactive fault code.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components</li> <li>• Turn keyswitch ON</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate circuit response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault Code 2555 inactive?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>None. The removal and installation of the connector corrected the fault.</p>	4A
	<p>Fault Code 2555 inactive?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Replace the ECM. Refer to Procedure 019-031 in Section 19.</p>	4A

**STEP 4: Clear the fault code.**

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

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components</li> <li>• Turn keyswitch ON</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Disable the fault code.</p> <ul style="list-style-type: none"> <li>• Start the engine and let it idle for 1 minute.</li> <li>• Use INSITE™ electronic service tool to verify that the fault code is inactive.</li> </ul>	<p>Fault Code 2555 inactive?</p> <p><b>YES</b></p>	4B
	<p>Fault Code 2555 inactive?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>Return to the troubleshooting steps or contact a Cummins® Authorized Repair Location if all steps have been completed and checked again.</p>	1A

**STEP 4B: Clear the inactive fault codes.**

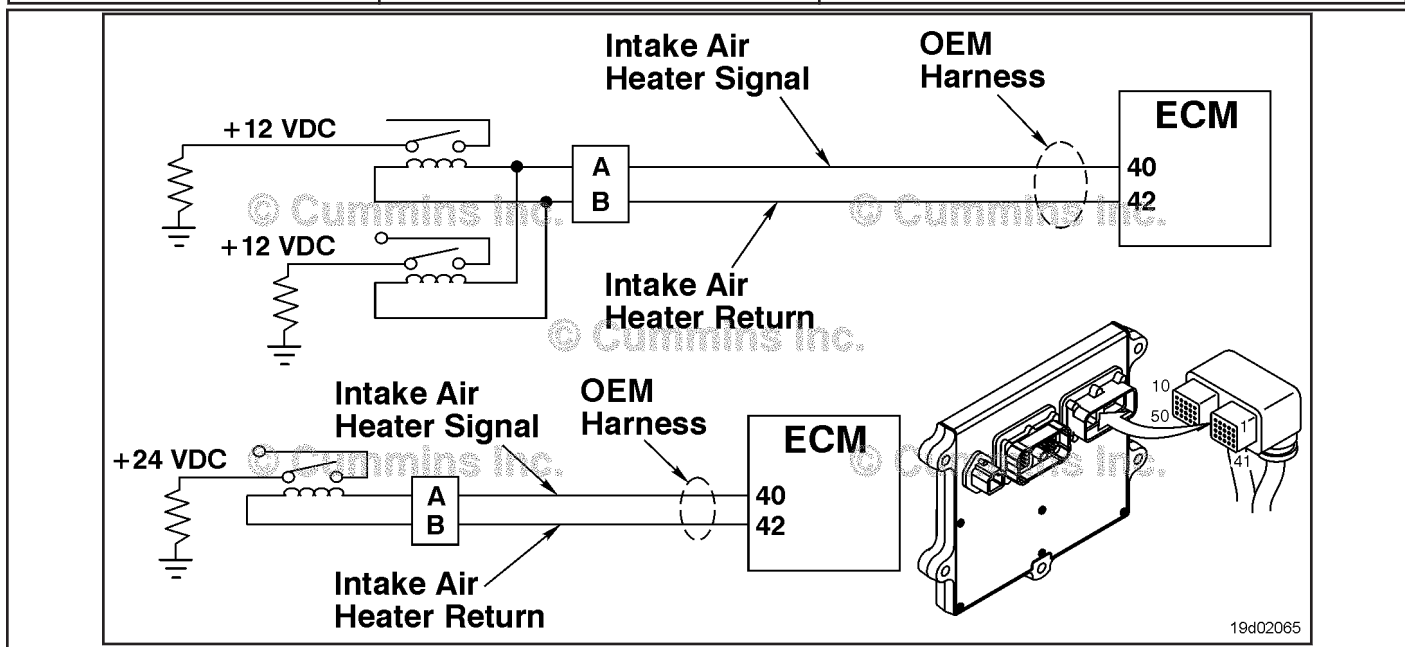
<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Connect all components</li> <li>• Turn keyswitch ON</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Clear the inactive fault codes.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to clear the inactive fault codes.</li> </ul>	<p>All fault codes cleared? <b>YES</b></p>	<p>Repair complete</p>
	<p>All fault codes cleared? <b>NO</b></p> <p><b>Repair:</b></p> <p>Troubleshoot any remaining active fault codes.</p>	<p>Appropriate troubleshooting steps</p>



## Fault Code 2556

### Intake Air Heater #1 Circuit - Voltage Below Normal or Shorted to Low Source

CODES	REASON	EFFECT
Fault Code: 2556 PID(P), SID(S): S070 SPN: 729 FMI: 4 Lamp: Amber SRT:	Intake Air Heater #1 Circuit - Voltage Below Normal or Shorted to Low Source. Low voltage detected at the intake air heater signal circuit.	The intake air heaters may be ON or OFF all the time.



#### 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 intake air heater. 12-volt systems will have two relays while 24-volt systems **only** require one relay.

#### Component Location:

The intake air heater is located at the air inlet connection into the intake manifold. The location of the intake air heater relays will vary by OEM. Refer to Section E for a detailed component location view.

#### Shop Talk:

Possible causes of this fault code include:

- A shorted intake air heater relay
- Intake air heater relay supply wire shorted to ground.

#### **Refer to Troubleshooting Fault Code t05-2556**

FAULT CODE 2556 - Intake Air Heater #1 Circuit - Voltage Below Normal or Shorted to Low Source
TROUBLESHOOTING SUMMARY



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



To reduce the possibility of pin and harness damage, use the following test leads when taking a measurement: Part Number 3822758 - male Deutsch™/AMP™/Metri-Pack™ test lead and Part Number 3822917 - female Deutsch™/AMP™/Metri-Pack™ test lead.

Table with 3 columns: STEPS, SPECIFICATIONS, SRT CODE. It lists troubleshooting steps from Step 1 to Step 4, including sub-steps like Step 1A, Step 2A, Step 2B, Step 2C, Step 3A, Step 3B, Step 3C, Step 3D, Step 4A, and Step 4B, with corresponding specifications and SRT codes.

**TROUBLESHOOTING STEP****STEP 1: Check the fault codes.****STEP 1A: Check for an inactive fault code.**

<b>Condition:</b>		
<ul style="list-style-type: none"> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
<b>Action</b>	<b>Specification/Repair</b>	<b>Next Step</b>
Check for an inactive fault code. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 2556 is inactive? <b>YES</b>	Use the following procedure for an inactive or intermittent fault code. Refer to Procedure 019-362 in Section 19.
	Fault Code 2556 is inactive? <b>NO</b>	2A

**STEP 2: Check the intake air heater relay and circuit.****STEP 2A: Inspect the intake air heater relay and electrical connections.**

<b>Condition:</b>		
<ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the intake air heater relays from the OEM harness.</li> </ul>		
<b>Action</b>	<b>Specification/Repair</b>	<b>Next Step</b>
Inspect the OEM harness and intake air heater relay connections for the following: <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.	Dirty or damaged pins? <b>YES</b> <b>Repair:</b> A damaged connection has been detected in the sensor or harness connector. Clean the connector and pins. Repair the damaged harness, connector, or pins if possible. Refer to Procedure 019-071 in Section 19.	4A
	Dirty or damaged pins? <b>NO</b>	2B

**STEP 2B: Check the circuit response.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the intake air heater relays from the engine harness.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate circuit response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault Code 2555 is active and Fault Code 2556 is inactive?</p> <p><b>YES</b></p>	2C
	<p>Fault Code 2555 is active and Fault Code 2556 is inactive?</p> <p><b>NO</b></p>	3A

**STEP 2C: Check the fault codes and verify sensor condition.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Connect the intake air heater relay to the engine harness.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for the appropriate circuit response after 30 seconds.</p> <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	<p>Fault Code 2556 is active?</p> <p><b>YES</b></p> <p><b>Repair:</b></p> <p>A damaged intake air heater relay has been detected.</p> <p>Replace the damaged intake air heater relay. Refer to the OEM service manual.</p>	4A
	<p>Fault Code 2556 is active?</p> <p><b>NO</b></p> <p><b>Repair:</b></p> <p>None. The removal and installation of the connector corrected the fault.</p>	4A

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

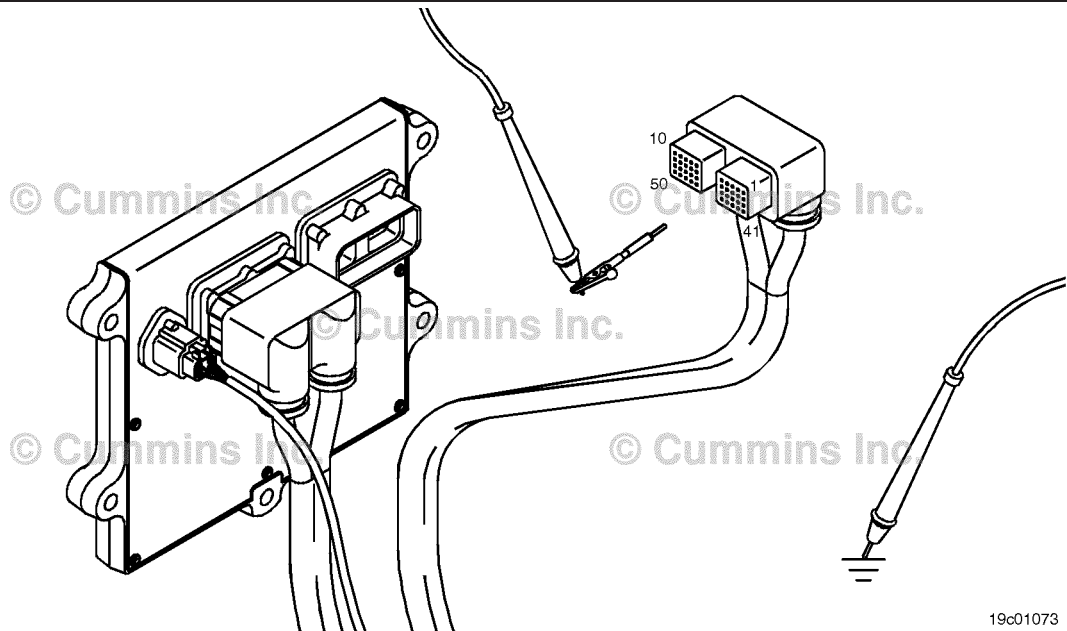
<b>Condition:</b>		
<ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the OEM harness from the ECM.</li> </ul>		
<b>Action</b>	<b>Specification/Repair</b>	<b>Next Step</b>
Inspect the OEM harness ECM connector pins for the following: <ul style="list-style-type: none"> <li>• Loose connector</li> <li>• Corroded pins</li> <li>• Bent or broken pins</li> <li>• Pushed back or expanded pins</li> <li>• Moisture in or on the connector</li> <li>• Missing or damaged connector seals</li> <li>• Dirt or debris in or on the connector pins</li> <li>• Connector shell broken</li> <li>• Wire insulation damage</li> <li>• Damaged connector locking tab.</li> </ul> Use the following procedure for general inspection techniques. Refer to Procedure 019-361 in Section 19.	Dirty or damaged pins? <b>YES</b> <b>Repair:</b> A damaged connection has been detected in the sensor or harness connector. Clean the connector and pins. Repair the damaged harness, connector, or pins if possible. Refer to Procedure 019-071 in Section 19.	4A
	Dirty or damaged pins? <b>NO</b>	3B

**STEP 3B: Check for a pin short circuit to ground.**

**Condition:**

- Turn keyswitch OFF.
- Disconnect the OEM harness from the ECM.
- Disconnect the intake air heater relay from the OEM harness.

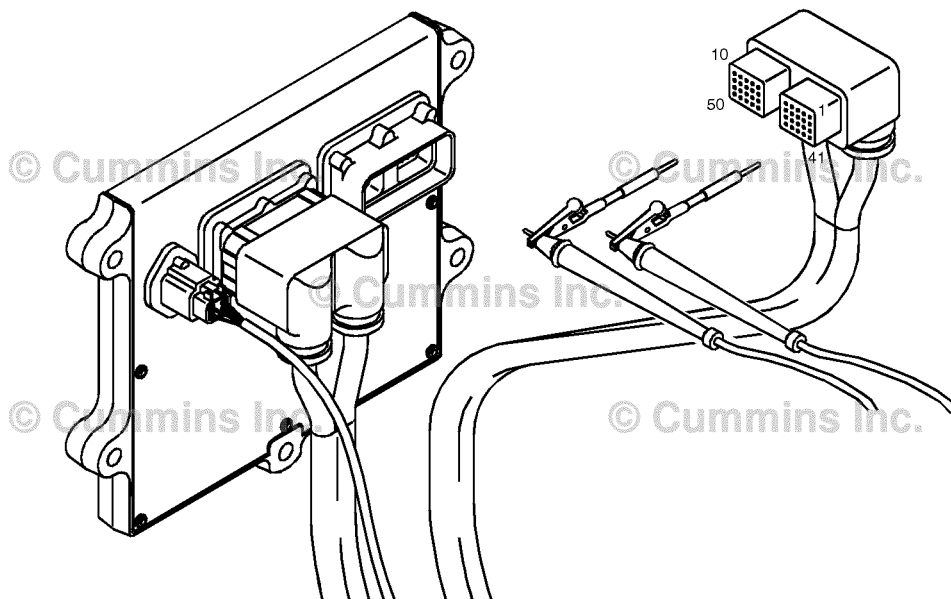
Action	Specification/Repair	Next Step
Check for a pin-to-ground short. <ul style="list-style-type: none"> <li>• Measure the resistance between the intake air heater relay SIGNAL pin in the OEM harness ECM connector and ground.</li> </ul> NOTE: For 12-volt systems, both leads should be tested. Refer to the wiring diagram for connector pin identification. Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.	Greater than 100k ohms? <b>YES</b>	3C
	Greater than 100k ohms? <b>NO</b> <b>Repair:</b> A pin-to-ground short circuit on the intake air heater relay line has been detected in the OEM harness. Repair or replace the OEM harness. Refer to Procedure 019-071 in Section 19.	4A



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**STEP 3C: Check for a pin-to-pin short circuit in the OEM harness.**

<p><b>Condition:</b></p> <ul style="list-style-type: none"> <li>• Turn keyswitch OFF.</li> <li>• Disconnect the OEM harness from the ECM.</li> <li>• Disconnect the intake air heater relay from the OEM harness.</li> </ul>		
Action	Specification/Repair	Next Step
<p>Check for a pin-to-pin short.</p> <ul style="list-style-type: none"> <li>• Measure the resistance between the intake air heater relay SIGNAL pin in the OEM harness ECM connector and all other pins in the OEM connector.</li> </ul> <p>Refer to the wiring diagram for connector pin identification.</p> <p>Use the following procedure for general resistance measurement techniques. Refer to Procedure 019-360 in Section 19.</p>	<p>Greater than 100k ohms? <b>YES</b></p>	<p>3D</p>
	<p>Greater than 100k ohms? <b>NO</b></p> <p><b>Repair:</b></p> <p>A pin-to-pin short circuit on the intake air heater SIGNAL line has been detected in the OEM harness.</p> <p>Repair or replace the OEM harness. Refer to Procedure 019-071 in Section 19.</p>	<p>4A</p>



19c01056

**STEP 3D: Check for an inactive fault code.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Check for the appropriate circuit response after 30 seconds. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to read the fault codes.</li> </ul>	Fault Code 2556 inactive? <b>YES</b> <b>Repair:</b> None. The removal and installation of the connector corrected the fault.	4A
	Fault Code 2556 inactive? <b>NO</b> <b>Repair:</b> Replace the ECM. Refer to Procedure 019-031 in Section 19.	4A

**STEP 4: Clear the fault code.**

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

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Disable the fault code. <ul style="list-style-type: none"> <li>• Start the engine and let it idle for 1 minute.</li> <li>• Use INSITE™ electronic service tool to verify that the fault code is inactive.</li> </ul>	Fault Code 2556 inactive? <b>YES</b>	4B
	Fault Code 2556 inactive? <b>NO</b>	1A

**STEP 4B: Clear the inactive fault codes.**

<b>Condition:</b> <ul style="list-style-type: none"> <li>• Connect all components.</li> <li>• Turn keyswitch ON.</li> <li>• Connect INSITE™ electronic service tool.</li> </ul>		
Action	Specification/Repair	Next Step
Clear the inactive fault codes. <ul style="list-style-type: none"> <li>• Use INSITE™ electronic service tool to erase the inactive fault codes.</li> </ul>	All fault codes cleared? <b>YES</b>	Repair complete
	All fault codes cleared? <b>NO</b>	Appropriate troubleshooting steps





**Fault Codes**

<b>Fault Code 1669</b> .....	TF-1	Aftertreatment #1 Air Enable Actuator — Voltage Below Normal, or Shorted to Low Source.	<b>Fault Code</b> .....	TF-155
Catalyst Tank Level Sensor Circuit — Voltage Above Normal, or Shorted to High Source				
<b>Fault Code</b> .....	TF-3			
<b>Fault Code 1671</b> .....	TF-12		<b>Fault Code 1699</b> .....	TF-165
Catalyst Tank Level — Data Valid but Below Normal Operational Range — Moderately Severe Level.			Catalyst Tank Level Sensor — Data Erratic, Intermittent, or Incorrect.	
<b>Fault Code</b> .....	TF-13		<b>Fault Code</b> .....	TF-167
<b>Fault Code 1673</b> .....	TF-15		<b>Fault Code 1711</b> .....	TF-173
Catalyst Tank Level - Data Erratic, Intermittent, or Incorrect.			Dosing Control Unit Data Link — Abnormal Update Rate	
<b>Fault Code</b> .....	TF-17		<b>Fault Code</b> .....	TF-175
<b>Fault Code 1674</b> .....	TF-19		<b>Fault Code 1712</b> .....	TF-185
Exhaust Gas Temperature 2 Circuit — Voltage Below Normal, or Shorted to Low Source			Catalyst Tank Heater Circuit — Data Valid But Below Normal Operating Range — Moderately Severe Level	
<b>Fault Code</b> .....	TF-21		<b>Fault Code</b> .....	TF-187
<b>Fault Code 1675</b> .....	TF-28		<b>Fault Code 1713</b> .....	TF-193
Exhaust Gas Temperature 2 Circuit — Voltage Above Normal, or Shorted to Low Source			Catalyst Tank Heater Circuit - Data Valid But Above Normal Operating Range - Moderately Severe Level	
<b>Fault Code</b> .....	TF-30		<b>Fault Code</b> .....	TF-195
<b>Fault Code 1676</b> .....	TF-39		<b>Fault Code 1716</b> .....	TF-200
Exhaust Gas Temperature 2— Data Erratic, Intermittent, or Incorrect			Auxiliary Temperature Sensor Input 1 Circuit - Root Cause Not Known	
<b>Fault Code</b> .....	TF-41		<b>Fault Code</b> .....	TF-202
<b>Fault Code 1677</b> .....	TF-45		<b>Fault Code 1717</b> .....	TF-203
Catalyst Tank Temperature — Voltage Below Normal, or Shorted to Low Source			Exhaust Gas Temperature 1 — Data Valid but Above Normal Operational Range — Least Severe Level	
<b>Fault Code</b> .....	TF-47		<b>Fault Code</b> .....	TF-204
<b>Fault Code 1678</b> .....	TF-54		<b>Fault Code 1718</b> .....	TF-207
Catalyst Tank Temperature — Voltage Above Normal, or Shorted to High Source			Engine Misfire for Multiple Cylinders — Condition Exists.	
<b>Fault Code</b> .....	TF-56		<b>Fault Code</b> .....	TF-209
<b>Fault Code 1679</b> .....	TF-65		<b>Fault Code 1845</b> .....	TF-212
Catalyst Tank Temperature — Data Erratic, Intermittent, or Incorrect			Water-in-Fuel Indicator Sensor Circuit - Voltage Above Normal or Shorted to High Source (For Generator Engines Only)	
<b>Fault Code</b> .....	TF-67		<b>Fault Code</b> .....	TF-214
<b>Fault Code 1681</b> .....	TF-73		<b>Fault Code 1846</b> .....	TF-224
Dosing Control Unit — Bad Intelligent Device or Component.			Water-in-Fuel Indicator Sensor Circuit - Voltage Below Normal or Shorted to Low Source (For Generator Engines Only)	
<b>Fault Code</b> .....	TF-75		<b>Fault Code</b> .....	TF-226
<b>Fault Code 1682</b> .....	TF-77		<b>Fault Code 1848</b> .....	TF-234
Aftertreatment Diesel Exhaust Fluid Dosing Control Unit Input Lines - Condition Exists			Intake Manifold 1 Temperature — Abnormal Rate of Change	
<b>Fault Code</b> .....	TF-80		<b>Fault Code</b> .....	TF-236
<b>Fault Code 1683</b> .....	TF-90		<b>Fault Code 1849</b> .....	TF-243
Catalyst Tank Heater Circuit — Voltage Above Normal, or Shorted to High Source			Exhaust Gas Temperature 1 — Abnormal Rate of Change	
<b>Fault Code</b> .....	TF-92		<b>Fault Code</b> .....	TF-245
<b>Fault Code 1684</b> .....	TF-102		<b>Fault Code 1851</b> .....	TF-251
Catalyst Tank Heater Circuit — Voltage Below Normal, or Shorted to Low Source			Exhaust Gas Temperature 2 — Abnormal Rate of Change	
<b>Fault Code</b> .....	TF-104		<b>Fault Code</b> .....	TF-253
<b>Fault Code 1687</b> .....	TF-111		<b>Fault Code 1892</b> .....	TF-259
Catalyst Over Temperature - Data Valid but Above Normal Operational Range - Most Severe Level			Wheel-Based Vehicle Speed — Data Valid but Below Normal Operational Range — Moderately Severe Level	
<b>Fault Code</b> .....	TF-112		<b>Fault Code</b> .....	TF-261
<b>Fault Code 1689</b> .....	TF-116		<b>Fault Code 1911</b> .....	TF-269
Real-Time Clock Power Interrupt - Data Erratic, Intermittent or Incorrect			Injector Metering Rail Number 1 Pressure - Data Valid But Above Normal Operating Range - Most Severe Level	
<b>Fault Code</b> .....	TF-118		<b>Fault Code</b> .....	TF-271
<b>Fault Code 1692</b> .....	TF-127		<b>Fault Code 1992</b> .....	TF-283
Aftertreatment Outlet NOx Sensor - Voltage Below Normal, or Shorted to Low Source			Engine Crankshaft Speed/Position - Data Valid but Above Normal Operational Range - Moderately Severe Level	
<b>Fault Code</b> .....	TF-129		<b>Fault Code</b> .....	TF-285
<b>Fault Code 1694</b> .....	TF-137		<b>Fault Code 2183</b> .....	TF-289
Aftertreatment Outlet NOx Sensor - Data Erratic, Intermittent, or Incorrect			Engine Brake Actuator Driver 1 Circuit - Voltage Below Normal or Shorted to Low Source	
<b>Fault Code</b> .....	TF-139		<b>Fault Code</b> .....	TF-291
<b>Fault Code 1697</b> .....	TF-145		<b>Fault Code 2185</b> .....	TF-302
Aftertreatment #1 Air Enable Actuator — Voltage Above Normal, or Shorted to High Source.			Sensor Supply Voltage 4 Circuit - Voltage Above Normal or Shorted to High Source	
<b>Fault Code</b> .....	TF-147		<b>Fault Code</b> .....	TF-303
<b>Fault Code 1698</b> .....	TF-153		<b>Fault Code 2186</b> .....	TF-308
			Sensor Supply Voltage 4 Circuit - Voltage Below Normal or Shorted to Low Source	
			<b>Fault Code</b> .....	TF-309

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<b>Fault Code 2215b</b> .....TF-319 Fuel Pump Delivery Pressure - Data Valid But Below Normal Operational Range - Moderately Severe Level	<b>Fault Code 2345cl</b> .....TF-492 Turbocharger Speed Invalid Rate of Change Detected - Abnormal Rate of Change <b>Fault Code</b> .....TF-493
<b>Fault Code 2215cl</b> .....TF-340 Fuel Pump Delivery Pressure Low - Data Valid but Below Normal Operational Range - Moderately Severe Level	<b>Fault Code 2346b</b> .....TF-496 Exhaust Gas Temperature - Data Above Normal <b>Fault Code</b> .....TF-497
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VGT Actuator - Voltage Below Normal or Shorted to Low Source		Catalyst Tank Level - Data Erratic, Intermittent, or Incorrect. (FC 1673) .....	TF-15
Fault Code .....	TF-715	(FC) .....	TF-17
Fault Code 2385b .....	TF-722	Catalyst Tank Level — Data Valid but Below Normal Operational Range — Moderately Severe Level. (FC 1671) .....	TF-12
VGT Actuator Driver Circuit - Voltage Above Normal or Shorted to High Source		(FC) .....	TF-13
Fault Code .....	TF-723	Catalyst Tank Level Sensor — Data Erratic, Intermittent, or Incorrect. (FC 1699) .....	TF-165
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VGT Actuator - Voltage Above Normal or Shorted to High Source		Catalyst Tank Level Sensor Circuit — Voltage Above Normal, or Shorted to High Source (FC 1669) .....	TF-1
Fault Code .....	TF-730	(FC) .....	TF-3
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Turbocharger Actuator Motor - Mechanical System Not Responding Properly		Catalyst Tank Temperature — Voltage Below Normal, or Shorted to Low Source (FC 1677) .....	TF-45
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