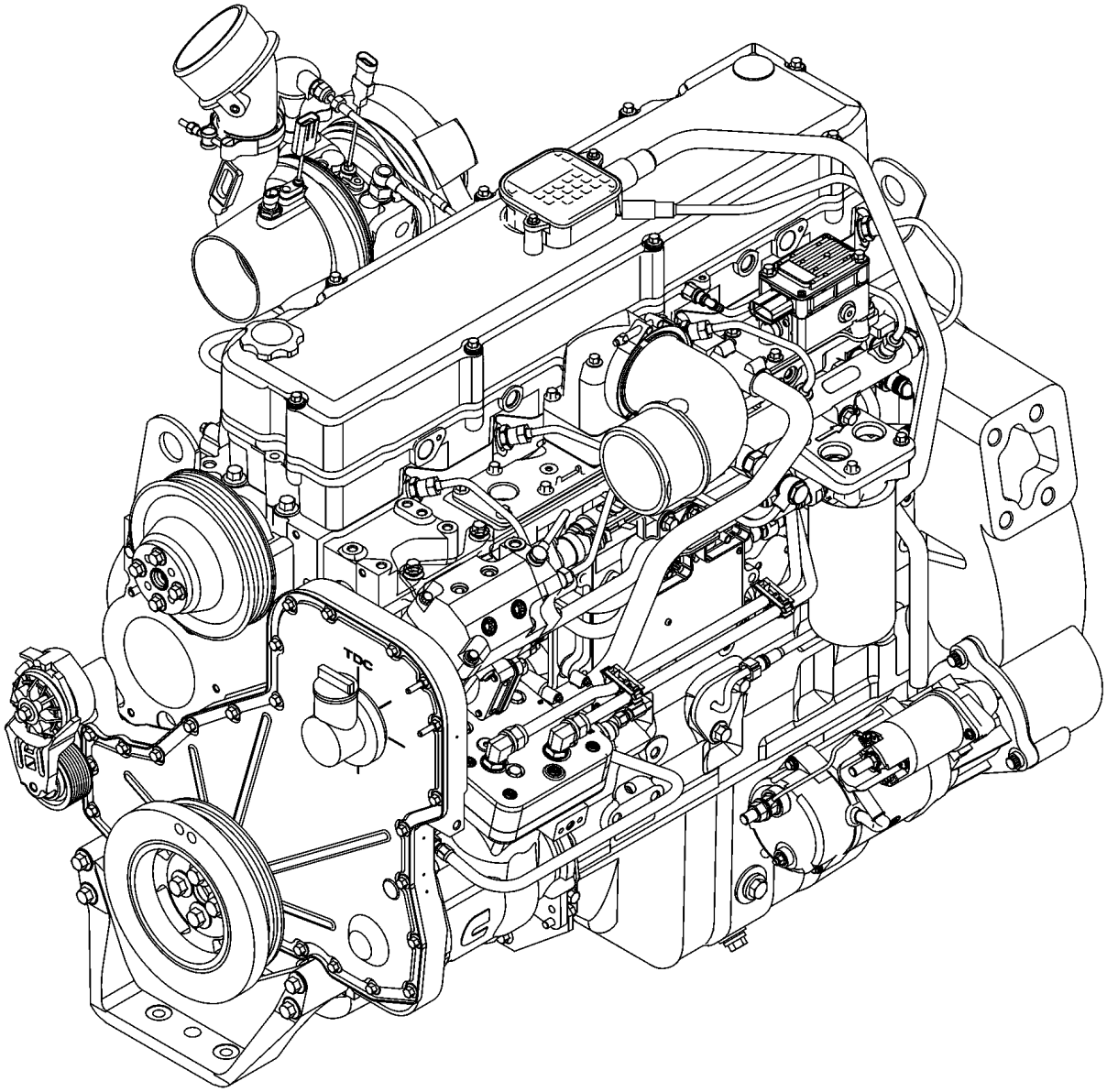
ISB, ISBe Engine Troubleshooting and Repair Manual 3.9, QSB4.5, QSB5.9, QSB6.7, ISC, QSC8.3, ISL, ISLe 9 and QSL9, CM850 Volume 3
Electronic Control System



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Preface

This manual contains instructions for troubleshooting and repairing this engine on the chassis. The procedures for reconditioning components and assemblies are found in the workshop manual. Refer to Section i - Introduction for instructions on using this manual.

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

The manual was organized to guide the service technician through logical steps to identify and correct problems related to the engine. This manual does not cover problems related to the vehicle or the equipment. Consult the vehicle or equipment manufacturer for repair procedures. Various specific service manuals (for example, example: Workshop, Specifications and Alternative Repairs) are available and can be ordered from your local Cummins Authorized Distributor. Refer to Section L, Service Literature, for a list of these Distributors.

The repair procedures used in this manual are recommended by Cummins Brasil Ltda. Some maintenance procedures require the use of special service tools. Use the correct tools as specified.

Cummins Brasil Ltda. encourages the user of this manual to report errors, omissions and suggestions for improvement. Use the Literature Search Form, located at the end of this manual, to send us your comments. The specifications and reconditioning information in this manual are based on the information in force at the time of its publication. Cummins Brasil Ltda. reserves the right to make any changes, at any time, without incurring any obligation. If there are any discrepancies between your engine and the information in this manual, contact an Authorized Cummins Distributor. The most current technology and the highest quality components were used in the production of this engine. Whenever replacement parts are needed, we recommend using only genuine Cummins or ReCon® parts.

Content

Section i - Introduction

Section Content

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About This Manual

General information

This Fault and Repair Diagnostic Manual is intended to assist in determining the cause of engine-related problems and providing the necessary repair procedures.

The manual is organized into sections. Each section is equivalent to a group used in Cummins' filmcard system. Some sections contain **reference** and numbers of **procedure.** The numbers of **reference** provide general information, specifications, diagrams and service tools, where applicable. The numbers of **procedure** are used to identify and reference specific repair procedures to correct the problem. This manual **no** contains electronic diagnostic procedures for fuel system failures. Use the fault diagnosis diagrams in this manual if there are no electronic fault codes. The manual has been designed so that fault diagnosis diagrams are used to find the cause of an engine problem. The fault diagnosis diagrams guide the user to the correct repair procedure. Repair procedures in a section are classified in numerical order. However, the repair steps in a given procedure are organized in the order that the repair **must** carried out, regardless of the numerical order of the steps. The user **must** use the content pages or the general index at the end of the manual to find specific topics when not using diagnostic diagrams.

How to Use the Manual

General information

This manual is organized to provide an easy flow from the identification to the correction of a problem. Section TS, Fault Diagnostic Symptoms, lists fault symptoms with the most common engine problems. The Troubleshooting Symptoms Section should be used as a guide to locate the problem and guide the user to the correct procedure for performing the repair. Follow the steps below to find and fix a problem.

(Step 1) Locate the symptom on page TS-a, Section Content, Section TS.

Identify the page number (to the right of the symptom title) to locate the page containing the diagnostic diagram associated with the problem.

(Step 2) The block column on the left of the Troubleshooting Diagrams pages indicates a probable cause of the problem, starting with the simplest and easiest to repair problem, and continuing in descending order to the most difficult.

The block column on the right provides a brief description of the corrective action and the reference to the number of the correct procedure to be followed for the repair.

(Step 3) Locate the cause of the problem in the left column, then identify the associated procedure in the right column.

(Step 4) The Fault Diagnosis Diagrams are based on the following assumptions:

- The engine was installed according to the manufacturer's specifications.
- The easiest repairs are done first.
- "Generic" solutions are provided covering problems with the most common and Original Equipment Manufacturer (OEM) applications.

Symbols.

General information

The following symbols are used in this manual to visually convey the purpose of each instruction. The meaning of these symbols is defined below:

ADVERTÊNCIA - Possibilidade de ferimentos graves e danos materiais caso as instruções sobre as medidas de segurança **não** sejam obedecidas.

PRECAUÇÃO - Possibilidade de ferimentos de menor gravidade ou danos materiais a componentes, sistemas ou ao próprio motor se as instruções **não** forem seguidas.

Indica **REMOÇÃO** ou **DESMONTAGEM** do componente ou peça.

Indica a **INSTALAÇÃO** ou **MONTAGEM** do componente ou peça.

INSPEÇÃO VISUAL recomendada.

LIMPAR a peça ou conjunto.

EXECUTAR uma **MEDIÇÃO** mecânica ou cronométrica.

LUBRIFICAR a peça ou conjunto.

Indica a **MEDIDA DA CHAVE** ou **TIPO DE FERRAMENTA** necessária para executar o serviço.

APERTAR a um torque específico.

Efetuar uma **MEDIÇÃO ELÉTRICA**.

CONSULTAR outra seção deste Manual, ou outra publicação, para obter informações adicionais.

O peso do componente é 23 Kg [50 lb] ou mais. Para evitar ferimentos, use uma talha ou peça ajuda para erguer o componente.

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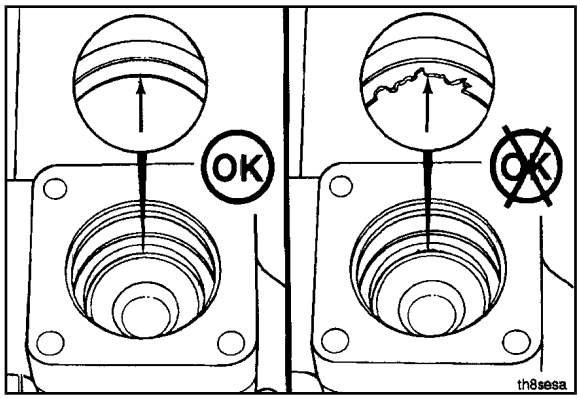
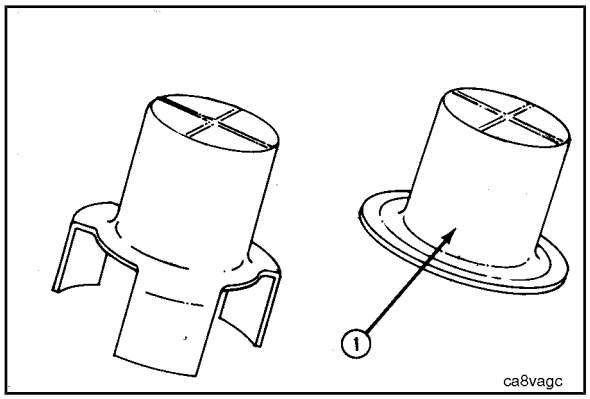


Illustrations

General information

Some of the illustrations in this manual are generic and **no** exactly represent the engine or the components used in its application. Illustrations may contain symbols to indicate a required action and an acceptable condition or **no** acceptable.



The illustrations are intended to show repairs or replacement procedures. The procedure will be the same for all applications, although the illustration may be different.

General Safety Instructions

Important Safety Information

WARNING

Inappropriate practices, carelessness or neglect of warnings can cause burns, cuts, mutilation, suffocation or other injuries, and even death.

Read and make sure you understand all safety precautions and warnings before starting any repairs. The following list contains general safety instructions that **should** be followed to ensure personal safety. The procedures also contain special precautions when applicable.

- Make sure that the areas surrounding the equipment under repair are dry, well lit, ventilated, free from obstructions, loose parts and tools, sources of ignition and hazardous substances. Always be alert to any dangerous conditions that may exist.

- Use **ever** protective glasses and safety boots when carrying out any type of repair.
- Rotating parts can cause cuts, mutilation or strangulation.
- **No** wear excessively loose or torn clothing. Remove rings, rings, watches and other jewelry before starting any repairs.

- Disconnect the battery cables (negative cable [-] first) and discharge all capacitors before starting any repair work. Switch off the pneumatic starter (if equipped) to prevent accidental starting of the engine. Put up a sign that says: "In Repair, **No** Operate "in the vehicle cabin or controls.

- ONLY use appropriate techniques to manually rotate the engine. **No** try to rotate the crankshaft by pulling or forcing the fan blades. This practice can cause serious injuries and material damage, in addition to damaging the fan blades resulting in premature failure of this component.
- If the engine has been running recently and the coolant is still warm, wait until the engine has cooled and then slowly open the radiator cap to relieve pressure on the cooling system.
- Use **ever** blocks, brackets or easels to support or secure the equipment before starting any maintenance or repair work. **No** do no work on equipment that is supported ONLY by a jack or suspended by a hoist.

- Relieve all residual pressure in the air, oil, fuel and cooling systems before removing or disconnecting any lines, connections or other items related to those systems. Always be careful when disconnecting any device from a system that operates under pressure. **No** use your hands to check for fluid leaks under pressure. Oil or fuel under high pressure can cause serious injury.

- To avoid suffocation and frostbite, wear protective clothing and disconnect fuel and coolant lines (freon) ONLY in well-ventilated areas. To protect the environment, liquid refrigerant systems **should** be properly emptied and filled using equipment that prevents the release of gases (fluorocarbons) into the atmosphere. Environmental protection laws require the collection and recycling of liquid refrigerant.

- To avoid injury, use a hoist or winch, or ask for help lifting components weighing more than 23 kg [50 lb]. Make sure that all lifting devices, such as chains, hooks, or straps, are in good condition and have adequate capacity to lift the component. Make sure the hooks are positioned correctly. **Ever** If necessary, use a separator bar. The lifting hooks **should not** subjected to lateral loads.

- Corrosion inhibitors, a component of SCA and lubricating oil, contain alkali. **No** allow these substances to come into contact with your eyes. Avoid prolonged or constant contact with the skin. **Never** ingest these substances. In case of contact, immediately wash the skin with soap and water. In case of contact with eyes, rinse immediately with plenty of water for at least 15 minutes. CONSULT A DOCTOR IMMEDIATELY. KEEP OUT OF THE REACH OF CHILDREN.

- Naphtha and Methyl Ethyl Ketone (MEK) are flammable materials and **should** be used with care. Always follow the manufacturer's instructions to ensure complete safety when using these products. KEEP OUT OF THE REACH OF CHILDREN.

- To avoid burns, never touch hot components of an engine that has recently been switched off, and hot fluids in the lines, tubes and compartments.
- Use **ever** tools that are in good condition. Make sure you know how to use the tools before starting any work. Use ONLY genuine Cummins or Cummins ReCon® replacement parts.

- Use **ever** screws and nuts with the same part number (or equivalent) and the same hardness rating as the original parts. **Never** use inferior quality screws and nuts in case of replacement.
- **Never** make no repairs if you are tired, or after drinking alcohol or drugs that may impair your physical and mental ability.

- Some government agencies consider used engine oil to be a carcinogen and capable of causing reproductive problems. Avoid inhalation of vapors, ingestion and prolonged contact with used engine oil.

- Liquefied petroleum gas is heavier than air and can accumulate close to the ground, in crankcases and in uneven areas.

- Natural gas is lighter than air and can accumulate under hoods and awnings.
- To avoid suffocation and frostbite, wear protective clothing and disconnect natural gas and liquefied petroleum gas lines ONLY in well-ventilated areas.
- The coolant is toxic. If no is reused, dispose of it in accordance with local environmental protection regulations.

- The catalyst reagent contains urea. Do not allow this substance to come into contact with your eyes. In case of contact with eyes, rinse immediately with plenty of water for at least 15 minutes. Avoid prolonged contact with the skin. In case of contact, immediately wash the skin with soap and water. Never ingest these substances. In case of ingestion of the catalyst reagent, consult a doctor immediately.

- The catalyst substrate contains Vanadium Pentoxide. Vanadium pentoxide is considered a carcinogen. Always wear protective gloves and safety glasses when working with the catalyst assembly. Do not allow the catalyst material to come into contact with your eyes. In case of contact with eyes, rinse immediately with plenty of water for at least 15 minutes. Avoid prolonged contact with the skin. In case of contact, immediately wash the skin with soap and water.

- The catalyst substrate contains Vanadium Pentoxide. Vanadium pentoxide is considered a carcinogen. In case of replacement of the catalyst, dispose of it in accordance with local environmental protection regulations.

General Repair Instructions

General information

This engine incorporates the latest technology available at the time of its manufacture; however, it was designed to be repaired using normal repair practices carried out in accordance with quality standards.

- **Cummins Brasil Ltda. does not recommend or authorize modifications or repairs to engines or components except those specified in Cummins Service Information. In particular, unauthorized repair of safety-related components can cause personal injury or even death. Below is a list of components classified as security-related:**

1. **Air compressor**
2. **Air Controls**
3. **Air Cut Sets**
4. **Balancing Counterweights**
5. **Cooling Fan**
6. **Fan Hub Assembly**
7. **Fan Mounting Bracket (s)**
8. **Fan Mounting Screws**
9. **Fan Hub Shaft**
10. **Flywheel**
11. **Adapter Tree of Cranks on the Steering Wheel**
    Engine
12. **Handwheel Mounting Screws**
13. **Fuel Cut Sets**
14. **Fuel Supply Pipes**
15. **Lifting Supports**
16. **Acceleration Controls**
17. **Turbocharger Compressor Housing**
18. **Turbocharger Oil Drain Line (s)**
19. **Line (s) Oil Supply**
    Turbocharger
20. **Turbocharger Turbine Housing**
21. **Shock Absorber Mounting Screws**
    Vibrations

- **Follow all safety instructions contained in the procedures**
  - Follow the manufacturer's recommendations on the use of cleaning solvents and other substances used during engine repair. Some solvents and used motor oil are considered by government agencies to be toxic or carcinogenic. Avoid inhalation, ingestion and contact with such substances. Use **ever** good safety practices when working with tools and equipment.

- **Provide a clean environment and follow the cleaning instructions specified in the procedures**
  - The engine and its components **should** be kept clean during any repair. Contamination of the engine or its components will cause wear premature.

- **Perform the inspections specified in the procedures**
- **Replace any damaged or worn components or assemblies beyond specifications**
- **Use genuine new Cummins or ReCon® parts and assemblies**
  - The assembly instructions have been elaborated to reuse 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 repair services described in this manual are available from all Cummins Distributors and most Dealers.

- **Follow the specified disassembly and assembly procedures to reduce the possibility of component damage**

Complete reconditioning instructions are available in the Workshop Manual and can be ordered or purchased from an Authorized Cummins Service Station. Refer to Section L - Service Literature for ordering instructions.

Welding on a Vehicle with an Electronically Controlled Fuel System

⚠PRECAUTION ⚠

Disconnect the positive (+) and negative (-) cables from the battery before performing any welding work on the vehicle. Connect the welding equipment ground cable to an electrical distance maximum of 0.61 meters [2 feet] of the part being welded. Do not connect the welding equipment ground cable to the ECM cooling plate or to the ECM itself. Welding services on an engine or engine-mounted components are not recommended and can cause damage to the engine or components.

General Cleaning Instructions

Cleaning Definition

The components should be free of residues that can contaminate any engine system. This no it necessarily means that the components must look new.

Sanding the joint surfaces to the factory's machining marks does not solve the problem and is generally harmful in terms of sealing. It is important to maintain the surface finish and flatness tolerances in order to have a good sealing surface. Joints are designed to fill small spaces in the finish of the specified surface.

It is generally not necessary to sand the joint surfaces with molded edges. The joints with molded edges are metal with sealing material glued to the edges of the joint for sealing when the metal part forms a metal-metal joint for stability purposes. Any small amount of sealing material that can stick to the parts is better removed with a blunt edge trowel at the necessary points than the time spent polishing the entire surface with a pneumatic sander or disc. For joints that no have molded edges, almost all have a material that contains release agents to prevent them from sticking to parts. This certainly no it means that some together no are difficult to remove because they have been installed for a long time, have been subjected to overheating or the releasing agent has lost its effectiveness through the application of some sealant. The goal, however, is simply to remove the gasket without damaging the surfaces of the corresponding components without contaminating the engine (do not allow small debris to enter places where they cannot be removed).

Blasting balls on the piston crowns until dark areas are removed is unnecessary. Simply remove the carbon deposits above the top ring and in the ring grooves. You will see more information on ball blasting and piston cleaning later in this document. Cummins Brasil Ltda. no recommends sanding or grinding the carbon ring on the top of the cylinder liners until the clean metal is visible. The jacket will be damaged and any sign of a problem at the reverse point of the upper ring (such as dust removal) will be destroyed. It is necessary to remove the carbon ring to facilitate removal of the piston assembly. A circular brush of medium-grade, high-quality metal bristles with a rated speed greater than the rpm of the tool being used will allow for equally quick work and will cause less damage. Evidently, after removing the piston, the technician must check carefully for broken brush strands, which are more visible and can be attracted with a magnet.

The oil in the components removed from the engine attracts the dirt present in the air. Dirt adheres to the oil. If possible, keep the oil in the component until it is ready for cleaning, inspection and installation, and then remove any dirt. If it is cleaned and then exposed to the environment, it is possible that the component will have to be cleaned again before installation. Make sure that the components are lubricated with clean oil before installing them. No it is necessary to lubricate the entire component, but there must be oil between the moving parts (or a good priming process of the lubrication system must be conducted before the engine starts). In general, blasting balls on components to remove external paint is also unnecessary. The component is likely to be repainted, so just remove the loose paint.

Abrasive Tablets and Abrasive Paper

The keyword here is "abrasive". There is no part of the engine that is designed to resist abrasion. That is, all components must connect or slide over each other. Abrasive materials and dirt particles degrade both functions.

⚠WARNING ⚠

Any abrasive material must be kept out of or removed from oil passages and component wear points. The presence of abrasive materials in the oil passages can cause bushings and bushings to fail which can result in serious damage to the components preventing their reuse. This is especially true for trunnion bearings and connecting rods.

Cummins Brasil Ltda. no recommends the use of tissue paper or sandpaper on any part or component of an engine mounted including but no limited to removing carbon deposits from the cylinder liners or cleaning the bottom or recesses of the block. The coach must be very careful when using abrasive products to clean engine components, especially on partially assembled engines. Abrasive cleaning products are offered in many shapes and sizes. They all contain particles of aluminum oxide, silicon carbide, or sand or some similar rough material. These particles are harder than most engine components. As they are harder, if they are pressed against a "softer" material, the particles will damage the material or become embedded in it. These materials come off the medium that contains them as the product is used.

If the products are used in power equipment, the particles are thrown into the engine. If they fall between two moving components, the particles are likely to damage those components. If the particles are smaller than the clearance between the components at rest (engine stopped), but larger than the operating clearance, damage will occur when the components move relative to each other (engine running). As long as the engine is running and oil pressure is present, particles smaller than the bushing clearance will likely pass between the components without causing damage, but will be trapped in the oil filter. However, particles larger than the bushing gap will remove material from one component and can be incorporated into one of the components. Once incorporated into a component, the particles will cause the other component to abrasion until contact between them is no longer possible. If the damage degrades the oil film sufficiently, there will be contact between the two components, resulting in premature wear or failure due to lack of lubrication.

Abrasive particles can be released into the environment during cleaning and are therefore **much** important to prevent them from entering the engine. This is particularly true for lubrication frames and oil holes, especially those located in addition to oil filters. Close the holes instead of trying to apply compressed air to remove abrasive particles and debris, as debris is usually "blown" further into the oil holes.

All old gasket material **must** removed from the joint surfaces of the components. Meantime, **no** it is necessary to clean and polish the joint surface until the machining marks are erased. Excessive wear or polishing can damage the joint surface. Many of the more modern joints have molded edges (a steel sheet with a sealing element glued to the steel). Small amounts of sealing material that stick to the surface can best be removed with a blunt trowel or a glazing knife. Cleaning surfaces of molded edge joints with abrasive pads or abrasives is usually a waste of time.

⚠ WARNING ⚠

Excessive wear or grinding of the carbon ring at the top of the cylinder liner can damage the liner and prevent reuse. The surface finish will be damaged and abrasive particles can be forced into the liner material, which in turn causes premature cylinder wear or piston ring failure.

Tape any openings inside any component before using abrasive pads or metal bristle brushes. If it is really necessary, for a matter of time, use an electric sander with abrasive pads, tape the oil holes or use plugs and clean as much of the surface as possible with the sander but clean the areas near the holes oil / openings manually to avoid contamination of the holes. Then remove the tape or plugs and clean the rest of the areas carefully without the tool. DO NOT use compressed air to remove debris from the oil holes in an assembled engine! More likely than **no,** residues can be "blown" further into the holes. The use of compressed air is a good option if both ends of the bore are open, but this is rarely the case when working with an assembled engine.

Gasket Surfaces

The purpose of cleaning the joint surfaces is to remove any joint material, and not to re-finish the joint surface. Cummins Brasil Ltda. **no** recommends no specific brand of liquid joint remover. If a liquid joint remover is used, check the directions to make sure the material being cleaned **no** will be damaged. Compressed air powered spatulas can save time, but care must be taken to **no** damage the surface. The angled part of the spatula should be placed against the joint surface to prevent the blade from penetrating the surface. The use of spatulas powered by compressed air to remove joints in components made of "soft" material requires skill and care to avoid damage. If possible, **no** scrape or brush the joint surface.

Solvent and Acid Cleaning

Various solvent and acid-based cleaners can be used to clean disassembled engine components (except pistons. See below). Experience shows that the best results are obtained with the use of a cleaner that can be heated from 90 ° to 95 ° Centigrade (180 ° to 200 ° Fahrenheit). Kerosene emulsion cleaners have different temperature specifications (see below). A cleaning tank that provides constant mixing and filtering of the cleaning solution will give the best results. Cummins Brasil Ltda. does not recommend any specific cleaner. Always follow the instructions of the cleaner manufacturer. Remove all the joint material, the "O" rings and the mud, carbon, etc. deposits with a metal bristle brush or spatula before placing the component in the cleaning tank. Be careful not to damage the joint surfaces. If possible, clean the components with steam before placing them in the cleaning tank.

WARNING

When using solvents, acids or alkaline materials for cleaning, follow the manufacturer's recommendations for use. Wear safety glasses and appropriate protective clothing to reduce the possibility of injury.

Experience shows that kerosene emulsion products are the most suitable for cleaning pistons. These products no must be heated to temperatures above 77 ° C (170 ° F). The solution begins to lose its properties at temperatures above 82 ° C (180 ° F) and will not be as effective.

No use solutions composed mainly of chlorinated hydrocarbons with cresols, phenols and / or cresyl components. Typically, these solutions no they do a good job of removing deposits in the ring grooves and their final disposal is very expensive.

Solutions with a pH above approximately 9.5 darken the aluminum; therefore, no use highly alkaline solutions.

Chemicals with a pH above 7.0 are considered alkaline and substances with a pH below 7.0 are considered acidic. As it moves away from the neutral value 7.0, chemicals become highly alkaline or highly acidic.

Remove all the joint material, the "O" rings and the mud, carbon, etc. deposits with a metal bristle brush or spatula before placing the component in the cleaning tank. Be careful to no damage the joint surfaces. If possible, clean the components with hot water under high pressure or with steam before placing them in the cleaning tank. Removing "heavy" dirt before placing components in the cleaning tank will allow the cleaning solution to be more efficient and the cleaning agent to last longer. Rinse all components with hot water after cleaning. Dry thoroughly with compressed air. Apply compressed air to remove water from the holes in all screws and oil holes. If the components no are used immediately after cleaning, soak them in an anti-rust compound. The antirust compound must removed from components prior to assembly or installation on the engine.

Steam Cleaning

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

WARNING

When using a steam cleaner, wear safety glasses or a mask and protective clothing. Hot steam can cause serious injury. No use steam to clean the following components:

- Electrical Components
- Electrical Harnesses
- Injectors
- Fuel pump
- Belts and Hoses
- Bearings (ball or tapered roller)
- Electronic Control Module (ECM)
- ECM connectors
- Dosing Control Unit

Cleaning with Blasting of Plastic Spheres

Cummins Brasil Ltda. no recommends blasting with glass balls or nutshells in none engine component. Cummins Brasil Ltda. recommends only the use of plastic balls, No. 3822735, or equivalent, for any engine component. Never use sandblasting to clean the engine components. Glass balls and nutshell when no used in accordance with the manufacturer's recommendations can cause excess dust and become trapped in the engine components, resulting in premature failure due to abrasive wear.

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

PRECAUTION

Do not use ball blast cleaning methods on piston aluminum skirts or pin holes, piston skirts and crowns. Small particles of the material will get trapped in aluminum or another "soft" metal and will result in premature wear of the jacket, rings and piston pin holes. Valves, turbocharger shafts, etc., can also be damaged. Follow the cleaning instructions outlined in the procedures.

PRECAUTION

Do not contaminate cleaning tanks and solvent-based cleaning solutions with foreign materials and plastic beads. Remove any foreign material and plastic balls with compressed air, high pressure hot water or steam before placing components in tanks or cleaning solutions. Foreign materials and plastic balls can contaminate the tank and any other engine components immersed in the tank for cleaning. Contaminated components can cause failure due to abrasive wear.

Plastic ball blasting, No. 3822735, can be used to clean all piston ring grooves. **No** apply blasting of plastic balls to the pin holes or the aluminum piston skirts. Follow the equipment manufacturer's cleaning instructions. Make sure to adjust the air pressure in the blaster according to the ball manufacturer's recommendations. Increasing the pressure can remove material from the component and cause the plastic balls to wear out more quickly. The following guidelines can be used to adapt the manufacturer's instructions:

1. Ball gauge: Gauge No. 16-20 US for cleaning pistons with plastic ball blaster, No. 3822735
2. Operating pressure - 270 kPa (40 psi) for cleaning pistons. The pressure should not cause the spheres to rupture.

3. Steam clean or wash parts with solvent to remove all foreign materials and plastic balls after cleaning. Rinse with hot water. Dry with compressed air.

PRECAUTION

The ball blasting operation must not affect the metal surface. If the metal surface is affected, the engine could be damaged due to the greater gap between components or the improper surface finish of components that move against other components.

When cleaning pistons, **no** it is necessary to remove all dark stains from the piston. Simply remove the carbon deposits at the edges and grooves of the rings. The best way to do this is to direct the jet of spheres along the component, not directly over it. If the machining marks are affected by the blasting process, the pressure is too high or the jet is being applied over the same point for too long. The blasting operation **should not** affect the metal surface.

Blasting of nutshell is sometimes used to clean ferrous metals (iron and steel). The blasting of nutshell produces a large amount of dust, especially when the blast air pressure is higher than the material manufacturer's recommendation. Cummins Brasil Ltda. **no** recommends the use of nutshell to clean engine components due to the risk of material particle penetration and subsequent engine contamination. Cummins **NO** recommends using glass balls to clean any engine components. Part of the glass spheres easily penetrates the component material, especially in "soft" materials when the pressure of the compressed air is higher than the pressure recommended by the manufacturer of the spheres. Glass is abrasive and when incorporated into a moving component, all other components that are in contact with it will also be worn. When higher pressures are used, the spheres rupture and form a cloud of particles of very small size, which floats easily in the air. It is very difficult to control this cloud of particles in the workshop, especially if it is used **only** compressed air (not hot water) to blast the spheres after they are removed from the blasting cabinet (the application of blasting inside the cabinet can greatly reduce the amount of particles, but never their total removal).

Ball blasting is best used on dirt / carbon deposits that are difficult to remove than **no** have been removed initially with steam / high pressure wash and then in the wash tank. This applies specifically to pistons. First clean the pistons with steam and immerse them in the wash tank and then use the plastic ball cleaning method to safely remove the carbon deposits remaining in the grooves (instead of running the risk of damaging the surface finish the groove with an electric sander or break a piston ring). Make sure that the components are dry and free of oil before applying the ball blasting to avoid obstructing the return of the balls to the blaster.

Ever direct the nozzle nozzle "along" the component instead of directly over it. This allows the spheres to be directed under the material you want to remove. Move the nozzle nozzle instead of keeping it on a single point. Holding the nozzle nozzle over a point for a long time causes heating and movement of the metal. Remember that the jet **no** only reaches dirt or the deposit of

carbon. If the machining marks on the piston groove or edge are affected, **no** there has been sufficient movement of the nozzle of the blasting machine and / or the air pressure is too high.

Never apply ball blasting to valve stems. Use tape or a glove to protect the rods during the blasting operation. Direct the nozzle of the blaster along the surface and the radius instead of directly over the component. The goal is to remove carbon deposits and continue the blasting operation to remove stains is a waste of time.

Definition of Terms

General information

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

API	American Petroleum Institute
ASTM	American Society of Tests and Materials
° C	Celsius degree
CARB	California Pure Air Resources Preservation Council
CID	Cubic Inches of Displacement
CNG	Compressed Natural Gas
CPL	Control Parts List
cSt	Centistokes
ECM	Electronic Control Module
EGR	Exhaust Gas Recirculation
EPA	Environmental Protection Agency
° F	Degree Fahrenheit
IMF	Failure Mode Identifier
GVW	Gross Vehicle Weight
LPG	Liquefied Petroleum Gas
Hg	Mercury
hp	Wattage
H_2O	Water
ICM	Ignition Control Module
km / l	Kilometer per Liter
kPa	Kilopascals
LNG	Liquid Natural Gas
LTA	Post-Air Cooler Water Chiller
MPa	Megapascal
mph	Miles per Hour

Notes

Section TF - Fault Code Diagnosis

Section Content

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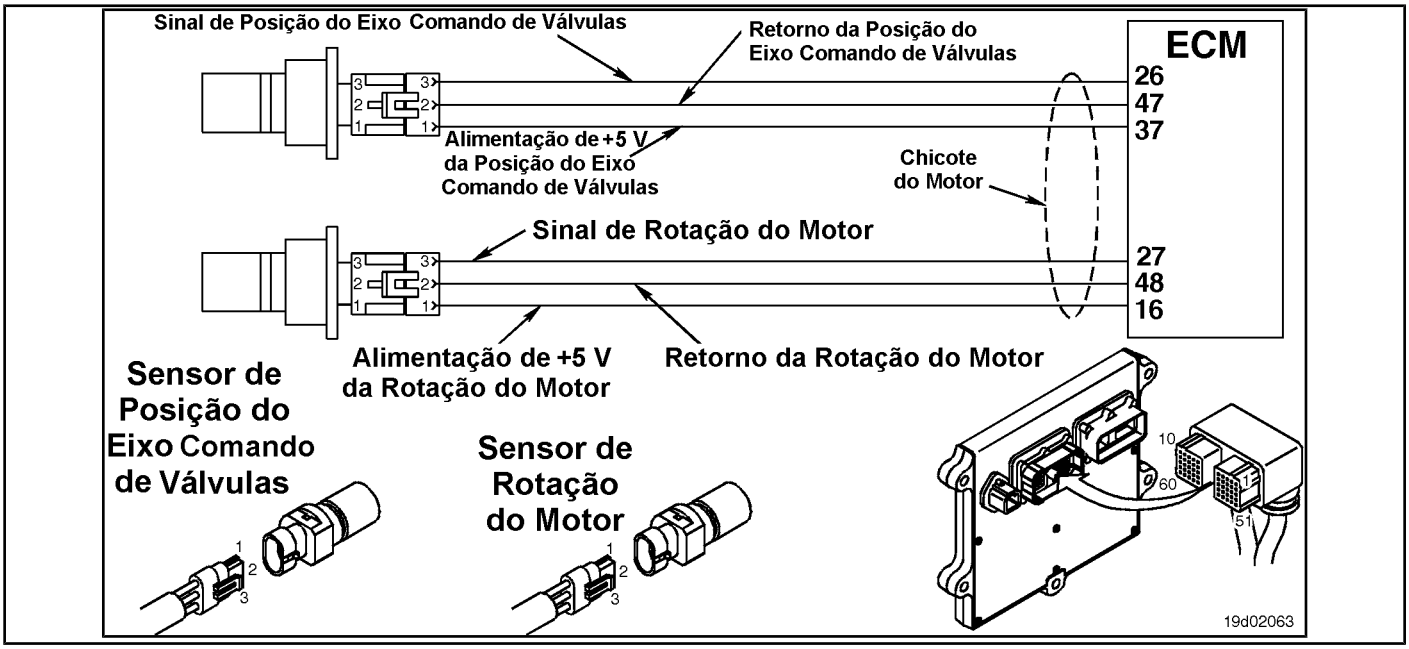
Fault Code 731 (ISB / QSB Automotive and Industrial, ISC / QSC / ISL / QSL Automotive, Industrial or Marine)

Misalignment between the Rotation / Motor Position Sensors on the Camshaft and Crankshaft - Mechanical System DOES NOT Respond Correctly or

Out of Fit

CODES	REASON	IT IS MADE
Fault Code: 731 PID (P), SID (S): S064 IMF: 7/7 Lamp: Amber SRT:	Misalignment between the Rotation / Motor Position Sensors on the Camshaft and Crankshaft - Mechanical System DOES NOT Respond Correctly or Out of Adjustment. Mechanical misalignment between the rotation sensors of the crankshaft and the engine camshaft.	The engine will run unpowered. Possible excess of smoke, difficulty starting and swinging at idle.

Engine Speed Sensor and Shaft Position Sensor Circuit Camshaft



Circuit Descriptions:

The engine speed sensor and the camshaft position sensor provide the engine speed and position signal to the electronic control module (ECM) via the engine harness.

Component Location:

See the Procedure 100-002 for the detailed location of each component.

Workshop Tips:

This fault will become active whenever the ECM receives a signal from the primary EPS (crankshaft sensor) and the backup EPS (camshaft sensor), and the ECM determines that the camshaft and crank tree no are correctly in phase. If this fault code becomes active

immediately after a repair that includes removing the camshaft, the camshaft gear is likely to have been installed incorrectly and **no** synchronized correctly.

SUMMARY OF FAULT DIAGNOSTICS

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Inspect the engine timing pulleys and speed sensors / position.		
STEP 1A: Inspect engine speed and position sensors for defects.	**Any defects?**	
STEP 1B: Inspect the engine timing pulleys for any defects.	**Any defects?**	
STEP 2: Check that the static injection timing is correct.		
STEP 2A: Check the synchronization injection static.	**Are the camshaft and crankshaft gear correctly installed?**	
STEP 3: Inspect the engine and vehicle masses.		
STEP 3A: Inspect the engine block, starter, alternator, chassis and battery ground connections.	**Are all connections present, properly grounded, free of corrosion and tight?**	
STEP 4: Clear the fault code.		
STEP 4A: Disable the fault code.	**Fault code 731 inactive?**	
STEP 4B: Clear the fault codes.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Inspect the engine timing pulleys and speed sensors / position.

STEP 1A: Inspect engine speed and position sensors for defects.

Conditions:
- Turn the ignition key off.

Action	Specifications / Repair	Next step
Inspect for defects. Inspect engine speed and position sensors for defects.	Any defects? **YES** **Repair:** Replace the engine speed or position sensor. See Procedures 019-363 and 019-365 .	4A
	Any defects? **NO**	1B

STEP 1B: Inspect the engine timing pulleys for any defects.

Conditions:
- Turn the ignition key off.

Action	Specifications / Repair	Next step
Inspect for defects. Inspect the crankshaft and camshaft timing pulleys for defects.	Any defects? **YES** **Repair:** Replace the timing pulley. Refer to the procedure for removing the camshaft or crankshaft.	4A
	Any defects? **NO**	2A

STEP 2: Check that the static injection timing is correct.

STEP 2A: Check the static injection timing. Conditions:

- Remove the gear cover.
- Rotate the engine to the PMS for cylinder No. 1 and make sure that the timing marks on the camshaft and crankshaft are correctly aligned. Refer to Procedure 001-008 in the ISC, QSC8.3, ISL and QSL9 Series Engine Troubleshooting and Repair Manual, Bulletin 3653266,

  or ISB Series Engines and and ISB (Common Rail Fuel System), Bulletin 3653336.

Action	Specifications / Repair	Next step
Check the synchronization. Inspect the static injection timing of the engine.	Are the camshaft and crankshaft gear correctly installed? **YES**	3A
	Are the camshaft and crankshaft gear correctly installed? **DO NOT** **REPAIR:** Install the camshaft and crankshaft gear correctly.	4A

STEP 3: Inspect the engine and vehicle masses.

STEP 3A: Inspect the engine block, starter, alternator, chassis and battery ground connections.

Conditions:
- Turn the ignition key off.

Action	Specifications / Repair	Next step
Inspect the engine and vehicle masses. • Inspect the entire engine, starter, alternator, chassis and battery ground connections. • Make sure that all ground connections are present and properly grounded. • Make sure that all connections are free of corrosion and are tight.	Are all connections present, properly grounded, free of corrosion and tight? **YES** **Repair:** None. Did removing and installing the connector correct the failure?	4A
	Are all connections present, properly grounded, free of corrosion and tight? **DO NOT** **REPAIR:** Replace, tighten or clean the earth wires or connections.	4A

STEP 4: Clear the fault code.

STEP 4A: Disable the fault code. Conditions:

- Connect all components.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Use the electronic service tool INSITE ™ to make sure Fault Code 731 is inactive.	Fault code 731 inactive? **YES**	4B
	Fault code 731 inactive? **DO NOT** **REPAIR:** Return to the troubleshooting steps or consult your local Cummins Authorized Service Post after checking and completing all steps again.	1A

STEP 4B: Clear the fault codes. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Clear the fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YES**	Complete Repair
	All codes cleared? **NO**	Proper troubleshooting and repair steps

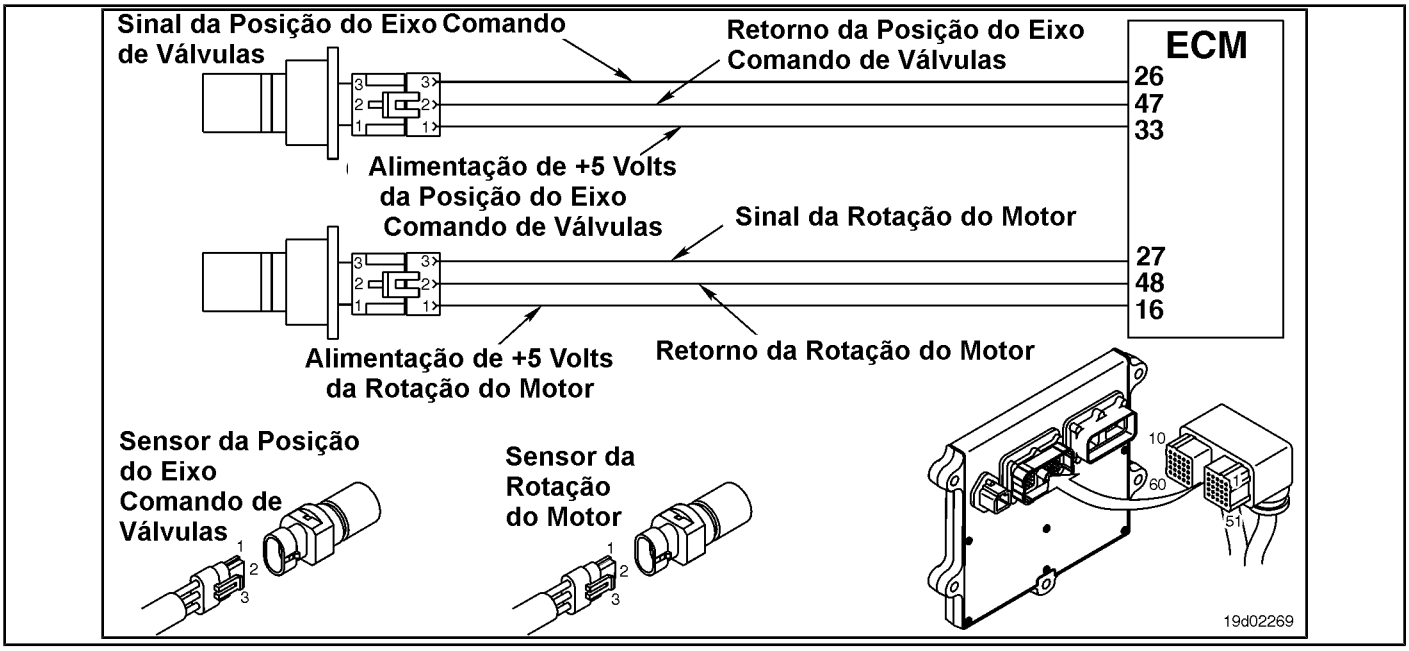
Fault Code 731 (QSB, Marine Applications)

Misalignment between the Rotation / Motor Position Sensors on the Camshaft and Crankshaft - Mechanical System DOES NOT Respond Correctly or

Out of Fit

CODES	REASON	IT IS MADE
Fault Code: 731 PID (P), SID (S): S064 IMF: 7/7 Lamp: Amber SRT:	Misalignment between the Rotation / Motor Position Sensors on the Camshaft and Crankshaft - Mechanical System DOES NOT Respond Correctly or Out of Adjustment. Mechanical misalignment between the rotation sensors of the crankshaft and the engine camshaft.	The engine will run unpowered. Possible excess of smoke, difficulty starting and swinging at idle.

Engine Speed Sensor and Shaft Position Sensor Circuit Camshaft



Circuit Descriptions:

The engine speed sensor and the camshaft position sensor provide the engine speed and position signal to the electronic control module (ECM) via the engine harness.

Component Location:

See the Procedure 100-002 for the detailed location of each component.

Workshop Tips:

This fault will become active whenever the ECM receives a signal from the primary EPS (crankshaft sensor) and the backup EPS (camshaft sensor), and the ECM determines that the camshaft and crank tree **no** are correctly in phase. If this fault code becomes active immediately after a repair that includes removal of the camshaft, it is likely that the camshaft gear has been installed incorrectly and **no** synchronized correctly.

SUMMARY OF FAULT DIAGNOSTICS

STEPS		SPECIFICATIONS	SRT CODE
STEP 1: Inspect the engine timing pulleys and speed sensors / position.			
STEP 1A:	**Inspect engine speed and position sensors for defects.**	**Any defects?**	
STEP 1B:	**Inspect the engine timing pulleys for any defects.**	**Any defects?**	
STEP 2: Check that the static injection timing is correct.			
STEP 2A: Check the synchronization injection static.		**Are the camshaft and crankshaft gear correctly installed?**	
STEP 3: Inspect the engine and vehicle masses.			
STEP 3A:	**Inspect the engine block, starter, alternator, chassis and battery ground connections.**	**Are all connections present, properly grounded, free of corrosion and tight?**	
STEP 4: Clear the fault code.			
STEP 4A: Disable the fault code.		**Fault code 731 inactive?**	
STEP 4B: Clear the fault codes.		**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Inspect the engine timing pulleys and speed sensors / position.

STEP 1A: Inspect engine speed and position sensors for defects.

Conditions:
- Turn the ignition key off.

Action	Specifications / Repair	Next step
Inspect for defects. Inspect engine speed and position sensors for defects.	Any defects? **YES** **Repair:** Replace the engine speed or position sensor. See Procedures 019-363 and 019-365 .	4A
	Any defects? **NO**	1B

STEP 1B: Inspect the engine timing pulleys for any defects.

Conditions:
- Turn the ignition key off.

Action	Specifications / Repair	Next step
Inspect for defects. Inspect the crankshaft and camshaft timing pulleys for defects.	Any defects? **YES** **Repair:** Replace the timing pulley. Refer to the procedure for removing the camshaft or crankshaft.	4A
	Any defects? **NO**	2A

STEP 2: Check that the static injection timing is correct.

STEP 2A: Check the static injection timing. Conditions:

- Remove the gear cover.
- Rotate the engine to the PMS for cylinder No. 1 and make sure that the timing marks on the camshaft and crankshaft are correctly aligned. Refer to Procedure 001-008 in the ISB Series Engine Troubleshooting and Repair Manual and and ISB (Common Rail Fuel System), Bulletin 3653336.

Action	Specifications / Repair	Next step
Check the synchronization. Inspect the static injection timing of the engine.	Are the camshaft and crankshaft gear correctly installed? **YES**	3A
	Are the camshaft and crankshaft gear correctly installed? **DO NOT** **REPAIR:** Install the camshaft and crankshaft gear correctly.	4A

STEP 3: Inspect the engine and vehicle masses.

STEP 3A: Inspect the engine block, starter, alternator, chassis and battery ground connections.

Conditions:
- Turn the ignition key off.

Action	Specifications / Repair	Next step
Inspect the engine and vehicle masses. • Inspect the entire engine, starter, alternator, chassis and battery ground connections. • Make sure that all ground connections are present and properly grounded. • Make sure that all connections are free of corrosion and are tight.	Are all connections present, properly grounded, free of corrosion and tight? **YES** **Repair:** None. Did removing and installing the connector correct the failure?	4A
	Are all connections present, properly grounded, free of corrosion and tight? **DO NOT** **REPAIR:** Replace, tighten or clean the earth wires or connections.	4A

STEP 4: Clear the fault code.

STEP 4A: Disable the fault code. Conditions:

- Connect all components.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Use the electronic service tool INSITE ™ to make sure Fault Code 731 is inactive.	Fault code 731 inactive? **YES**	4B
	Fault code 731 inactive? **DO NOT** **REPAIR:** Return to the troubleshooting steps or consult your local Cummins Authorized Service Post after checking and completing all steps again.	1A

STEP 4B: Clear the fault codes. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

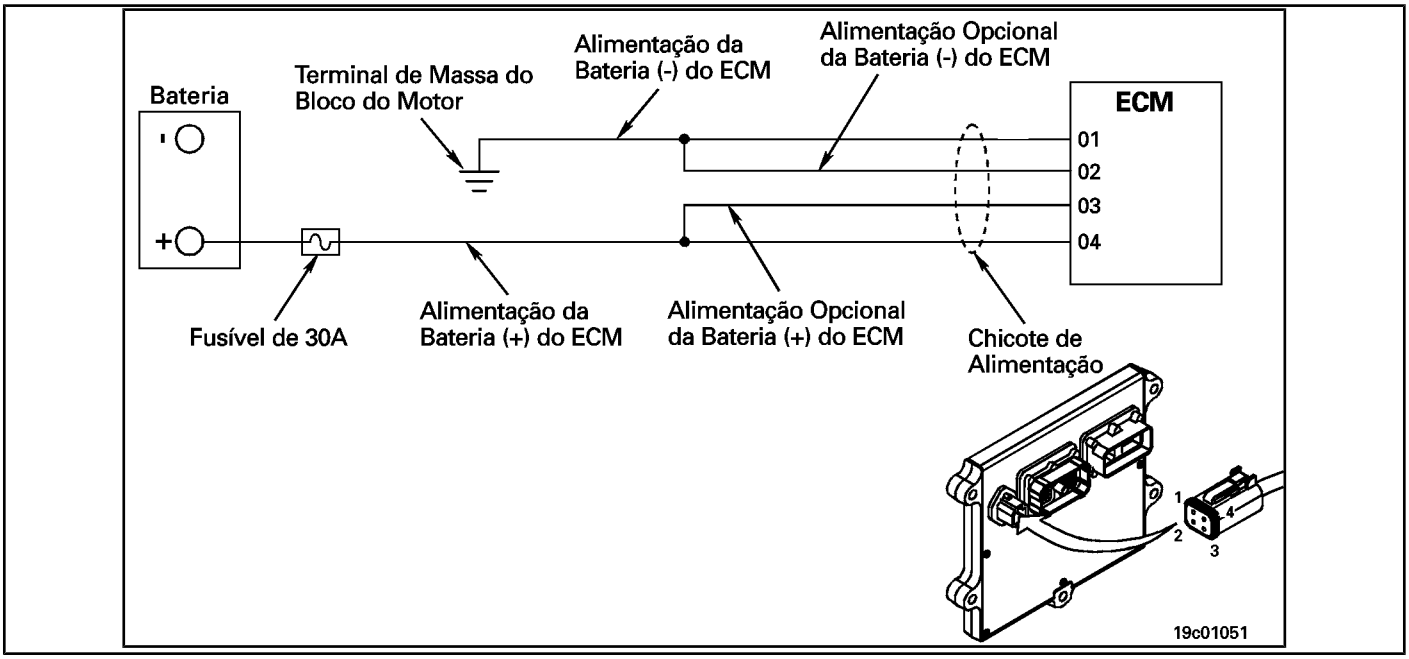
Action	Specifications / Repair	Next step
Clear the fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YES**	Complete Repair
	All codes cleared? **NO**	Proper troubleshooting and repair steps

Fault Code 757

Electronic Control Module Data Loss - Existing Condition

CODES	REASON	IT IS MADE
Fault Code: 757 PID (P), SID (S): None IMF: 11/31 Lamp: Amber SRT:	Engine Control Module Data Loss - Existing Condition Severe loss of ECM data.	Possibly no noticeable performance effect, the engine will "die" or manual start will be required. Fault information, travel information and maintenance monitor data may be inaccurate.

Non-switched Battery Power Circuit



Circuit Descriptions:

The Electronic Control Module (ECM) receives constant voltage from the batteries through non-switched wires that are connected directly to the positive (+) terminal of the batteries. There is a 30 amp fuse in the unswitched battery wires to protect the engine harness from overheating. The ECM receives information from the non-switched battery by wiring the vehicle's ignition key when it is switched on (ON position). The battery return wires are connected directly to the negative (-) terminal of the battery. Pins 2 and 3 are optional circuits possibly no used by the OEM. Refer to the OEM wiring diagram for detailed information on these circuits.

Component Location:

The ECM is located on the left side of the engine, close to its front. The ECM is connected to the battery via the ECM wiring harness. This direct link provides a constant power source for the ECM. The location of the battery varies by OEM. Refer to the OEM's troubleshooting and repair manual.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following test cable when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test cable. STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check for a security code active fault.	**Are there other active fault codes?**	
STEP 2: Check the batteries and the harness connector.		
STEP 2A: Check the resistance of the battery power circuit.	**Less than 10 ohms?**	
STEP 2B: Check the battery voltage.	**Normal conditions: At least (+) 12 VDC? (During start-up rotation: At least (+) 6.2 VDC)?**	
STEP 2C: Check the connections of the drums.	**Tight, corrosion-free connections?**	
STEP 3: Check the OEM's fuses.		
STEP 3A: Make sure that the fuses OEM are installed correctly.	**Fuses installed correctly?**	
STEP 3B: Make sure that the fuses of the OEM are not burnt.	**Are the fuses not blown?**	
STEP 4: Check the harness connector.		
STEP 4A: Check the complementary wiring or accessory in the positive (+) terminal of the battery.	**Are there no damaged wires?**	
STEP 5: Recalibrate the ECM.		
STEP 5A: Recalibrate the ECM.	**Fault code 757 inactive?**	
STEP 6: Clear the fault codes.		
STEP 6A: Disable the fault code.	**Fault code 757 inactive?**	
STEP 6B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Check for an active fault code. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™ to read the fault codes.

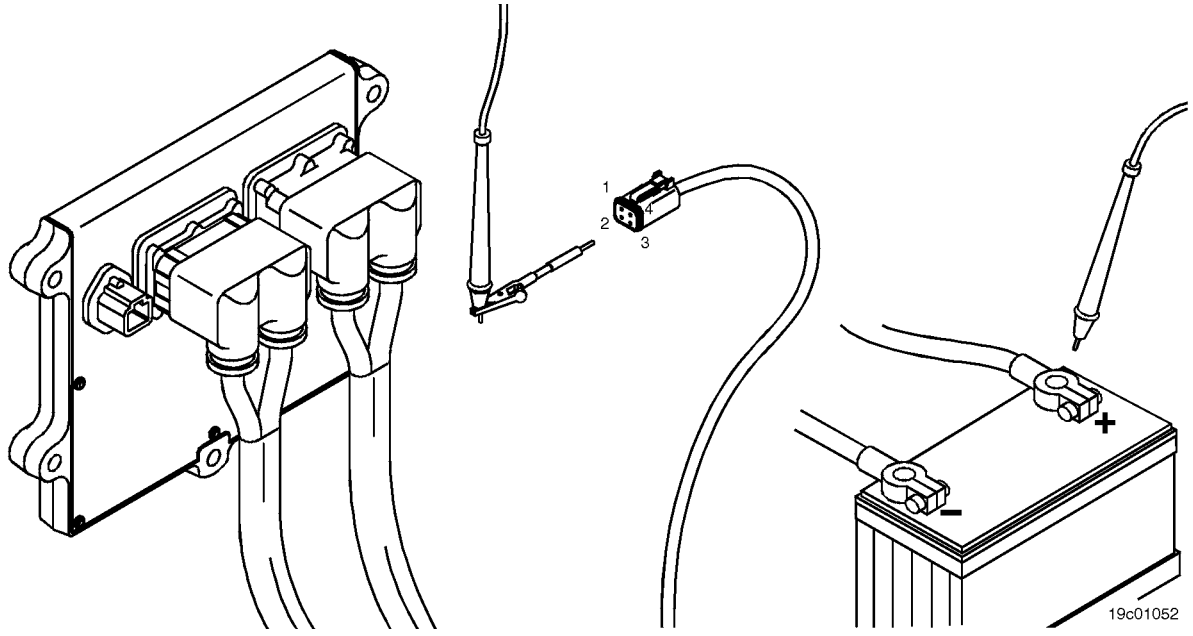
Action	Specifications / Repair	Next step
Check for an active fault code. • Use the electronic service tool INSITE ™ to read fault codes.	Are there other active fault codes? **YES** **Repair:** Troubleshoot the active fault codes.	Go to the fault diagnosis diagram for the appropriate fault code.
	Are there other active fault codes? **NO**	2A

STEP 2: Check the batteries and the power connector.

STEP 2A: Check the resistance of the battery supply circuit. Conditions:

- Turn the ignition key off.
- Disconnect the harness connector from the ECM.

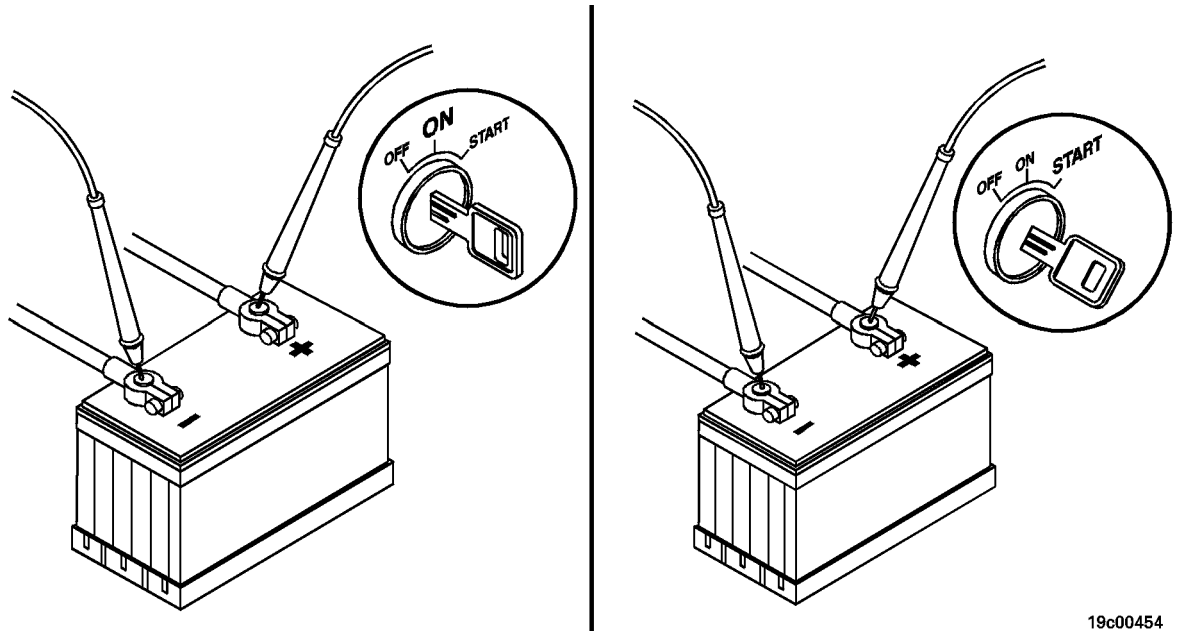
Action	Specifications / Repair	Next step
Check the resistance of the battery supply circuit. • Use a multimeter to measure the resistance between the POWER (+) pin on the ECM battery, on the ECM connector of the harness, and the (+) terminal on the battery. • Use a multimeter to measure the resistance between the POWER (-) pin on the ECM battery, on the wiring harness connector, and the engine block ground. Refer to the circuit diagram or electrical diagram for the identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	Less than 10 ohms? **YES**	2B
	Less than 10 ohms? **NO**	3A



STEP 2B: Check the battery voltage. Conditions:

- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check the battery voltage. • Insert the positive (+) probe of the multimeter into the positive battery terminal. Touch the negative (-) probe of the multimeter to the negative battery terminal while starting the engine.	Normal conditions: At least (+) 12 VDC? (During start-up rotation: At least (+) 6.2 VDC)? **YES**	2C
	Normal conditions: At least (+) 12 VDC? (During start-up rotation: At least (+) 6.2 VDC)? **DO NOT** **REPAIR:** Charge or replace the battery. Refer to the OEM's troubleshooting and repair manual.	5A



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STEP 2C: Check the battery connections. Conditions:

- Turn the ignition key off.

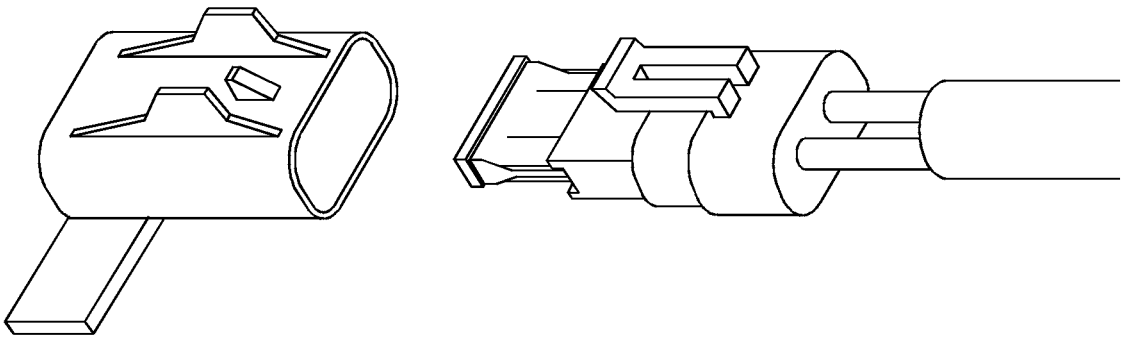
Action	Specifications / Repair	Next step
Check the battery connections. • Inspect the battery terminal connections.	Are the connections firm and free from corrosion? **YES**	4A
	Are the connections firm and free from corrosion? **DO NOT** **REPAIR:** Tighten loose connections and clean the terminals. Refer to the OEM's troubleshooting and repair manual.	5A

STEP 3: Check the OEM's fuses.

STEP 3A: Make sure that the OEM fuses are installed correctly. Conditions:

- Turn the ignition key off.

Action	Specifications / Repair	Next step
Check that the OEM fuses are installed correctly.	Fuses installed correctly? **YES**	3B
	Fuses installed correctly? **DO NOT** **REPAIR:** Install the fuses correctly. See the Procedure 019-198 .	5A



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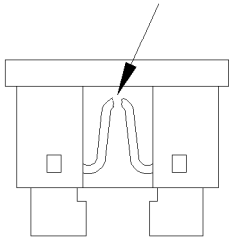
STEP 3B: Make sure that the OEM fuses are not blown. Conditions:

- Turn the ignition key off.

Action	Specifications / Repair	Next step
Make sure that the OEM fuses are not blown.	Is there a blown fuse? **YES** **Repair:** Replace the fuses.	5A
	Is there a blown fuse? **DO NOT** **REPAIR:** Repair or replace the OEM harness. See the Procedure 019-071 .	5A



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STEP 4: Check the harness connector.

STEP 4A: Check the complementary or accessory wiring at the positive (+) terminal of the battery. Conditions:

- Turn the ignition key off.

Action	Specifications / Repair	Next step
Check the complementary or accessory wiring at the positive (+) terminal of the battery. • Starting with the positive terminal (+), follow the wiring of any implement or accessory and check if the wires have damaged insulation or installation error that could cause a short between the supply wire and the motor block.	Are there damaged wires? **YES** **Repair:** Repair or replace damaged wiring.	6A
	Are there damaged wires? **NO**	5A

STEP 5: Recalibrate the ECM.

STEP 5A: Recalibrate the ECM.

Conditions:
- Connect all components.

Action	Specifications / Repair	Next step
Recalibrate the ECM. • Use the electronic service tool INSITE ™ to calibrate the ECM.	Fault code 757 inactive? **YES**	6A
	Fault code 757 inactive? **NO**	6A

STEP 6: Clear the fault codes.

STEP 6A: Disable the fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Turn off the ignition key and wait 30 seconds. • Turn the ignition key ON.	Fault code 757 inactive? **YES**	6B
	Fault code 757 inactive? **DO NOT** **REPAIR:** Return to the troubleshooting steps or consult your local Cummins Authorized Service Station after checking and completing all diagnostic steps again.	1A

STEP 6B: Clear the inactive fault codes. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

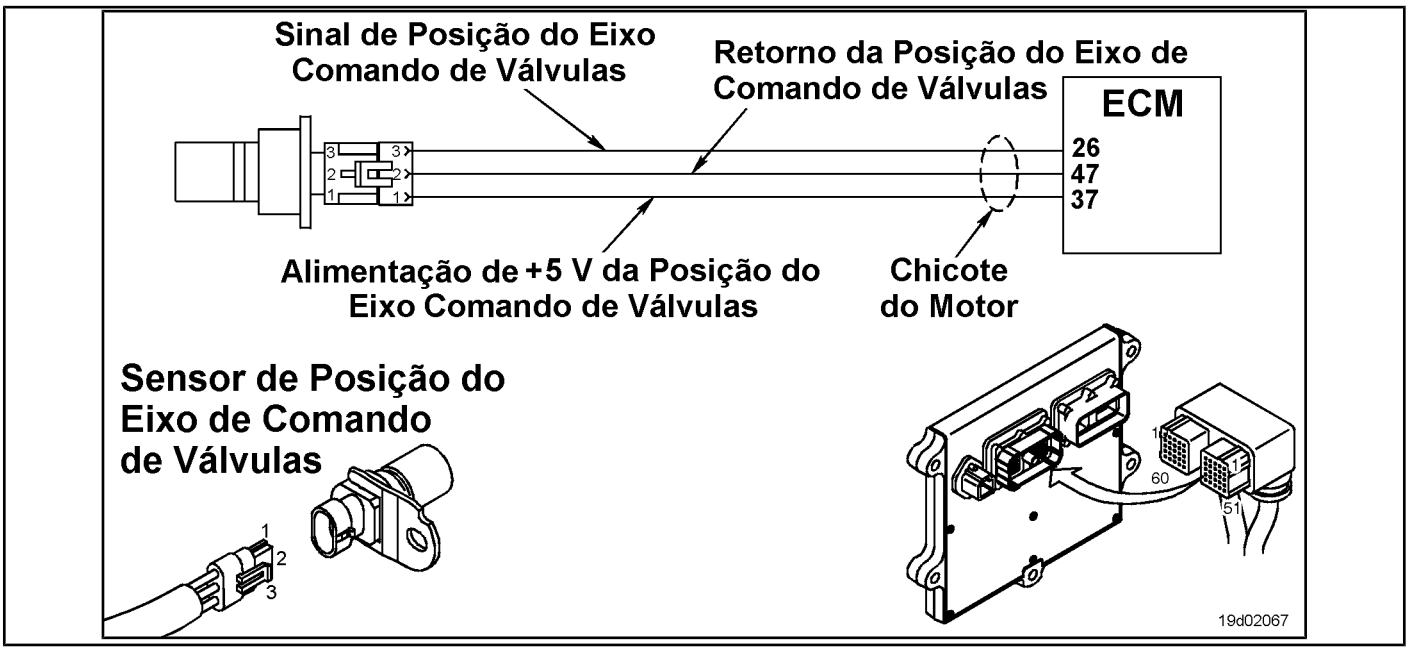
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YES**	Complete repair
	All codes cleared? **DO NOT** **REPAIR:** Troubleshoot any other active fault code.	Proper troubleshooting and repair steps

Fault Code 778

Engine Speed Sensor (Camshaft) Error - Invalid Data, Intermittent or Incorrect

CODES	REASON	IT IS MADE
Fault Code: 778 PID (P), SID (S): S064 IMF: 2 Lamp: Amber SRT:	Engine Speed Sensor (Camshaft) Error - Invalid, Intermittent or Incorrect Data. The ECM detected an error in the camshaft position sensor signal.	Possible starting difficulty. Engine de-powering.

Shaft Position Sensor Circuit Camshaft



Circuit Descriptions:

The camshaft position sensor provides the electronic control module (ECM) with information about the engine position. The sensor is powered by (+) 5 VDC. The sensor generates the signal by detecting the movement of machined reference teeth on a signal wheel mounted on the camshaft.

Component Location:

The camshaft position sensor is located below the fuel pump at the rear of the gear housing. See the Procedure 100-002 for the detailed location of each component.

Workshop Tips:

This failure is recorded when the ECM no receives a signal from the camshaft rotation sensor, or the signal it receives is degraded. Possible causes of this fault code:

- Open circuit in the supply, signal or sensor feedback circuits, in the engine or ECM harness
- Short circuits in the sensor ground or return circuits, in the engine harness or in the ECM
- Short circuits with a voltage source in the sensor, in the engine harness or in the ECM. The INSITE ™ monitoring

parameters associated with this fault code and sensor include:

- Condition of the camshaft position sensor
- Damage to the reference teeth of the sensor or the signal wheel.

If this fault code occurs in intermittent mode, look carefully for probable causes in the harness connections such as loose or worn pins in the engine harness connectors. If this fault code occurs intermittently, Fault Code 2322 too will become active or have high scores.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3164596 -

Framatome male test lead. Part No. 3164597 - Framatome female test lead. STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check for fault codes sensor power supply.	**Fault code 187 or 227 active?**	
STEP 1B: Check for a passcode active fault.	**Fault code 778 active?**	
STEP 2: Check the circuit and the camshaft position sensor.		
STEP 2A: Inspect the camshaft position sensor and connector pins.	**Dirty or damaged pins?**	
STEP 2B: Check the voltage supply and the sensor feedback circuit.	**4.75 to 5.25 VDC?**	
STEP 2C: Check the circuit response.	**Is the status of the camshaft position sensor "low"?**	
STEP 2C-1: Check the response of the circuit.	**Is the status of the camshaft position sensor "high"?**	
STEP 2C-2: Inspect the camshaft position sensor.	**Damaged sensor tip?**	
STEP 2C-3: Check the response of the circuit.	**Does the status of the camshaft position sensor change from "high" to "low" or "low" to "high", or does the state appear to be controlled?**	
STEP 2C-4: Check that the clearance of the motor position sensor on the camshaft is suitable.	**Does the status of the camshaft position sensor change from "high" to "low" or "low" to "high", or does the state appear to be controlled?**	
STEP 2D: Inspect the pins of the engine harness and ECM connectors.	**Dirty or damaged pins?**	
STEP 2E: Check the ECM response.	**Is the monitoring status of the camshaft position sensor "low"?**	
STEP 2E-1: Check the response of the ECM.	**Is the status of the camshaft position sensor "high"?**	

STEP 3: Check the ECM.

STEP 3A:	**Inspect the pins of the engine harness and ECM connectors.**	**Dirty or damaged pins?**
STEP 3B: Check the voltage	**power to the ECM sensor and the return circuit.**	**4.75 to 5.25 VDC?**

STEP 4: Clear the fault codes.

STEP 4A: Disable the fault code.	**Fault code 778 inactive?**
STEP 4B: Clear the fault codes inactive.	**All codes cleared?**

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Check for sensor power failure codes. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for sensor power failure codes. • Start the engine and let it run at idle for 1 minute. • Using INSITE ™, read the fault codes.	Fault code 187 or 227 active? **YES**	Fault Code 187 or 227
	Fault code 187 or 227 active? **NO**	1B

STEP 1B: Check for an active fault code. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an active fault code. • Using INSITE ™, read the fault codes. Fault code 778 active?	**YES**	2A
	Fault code 778 active? **NO**	See the Procedure to 019-362 , Fault Code Inactive or Intermittent.

STEP 2: Check the circuit and the camshaft position sensor.

STEP 2A: Inspect the sensor and connector pins.

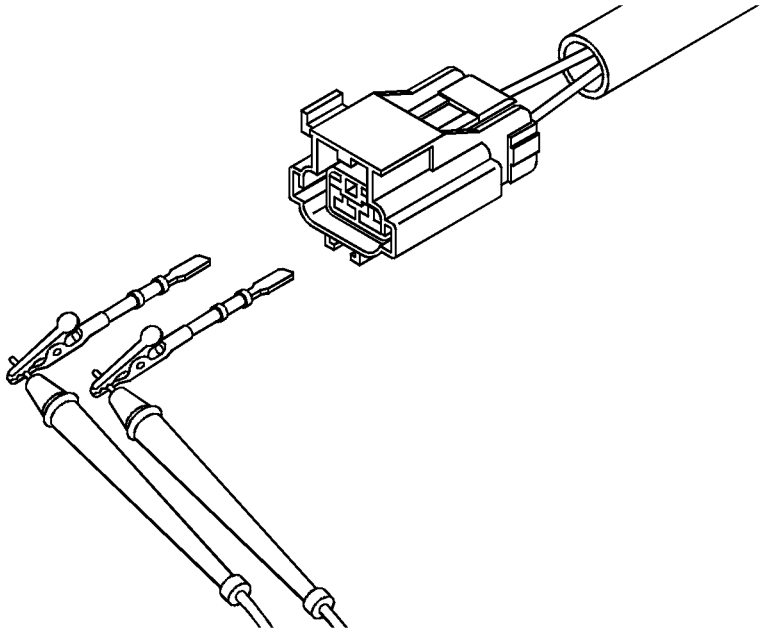
Conditions:
- Turn the ignition key off.
- Disconnect the camshaft position sensor from the engine harness.

Action	Specifications / Repair	Next step
Inspect the engine harness and sensor connector pins for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins • Damage to the wire shield • Connector cover broken. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-043 .	4A
	Dirty or damaged pins? **NO**	2B

STEP 2B: Check the supply voltage and the sensor return circuit. Conditions:

- Turn the ignition key off.
- Disconnect the camshaft position sensor from the engine harness.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check the supply voltage and the sensor feedback circuit. Measure the voltage between the +5 volt POWER pin for the camshaft position sensor and the RETURN pin for the camshaft position sensor on the sensor connector on the engine harness.	4.75 to 5.25 VDC? **YES**	2C
	4.75 to 5.25 VDC? **NO**	3A



19c01086

STEP 2C: Check the circuit response. Conditions:

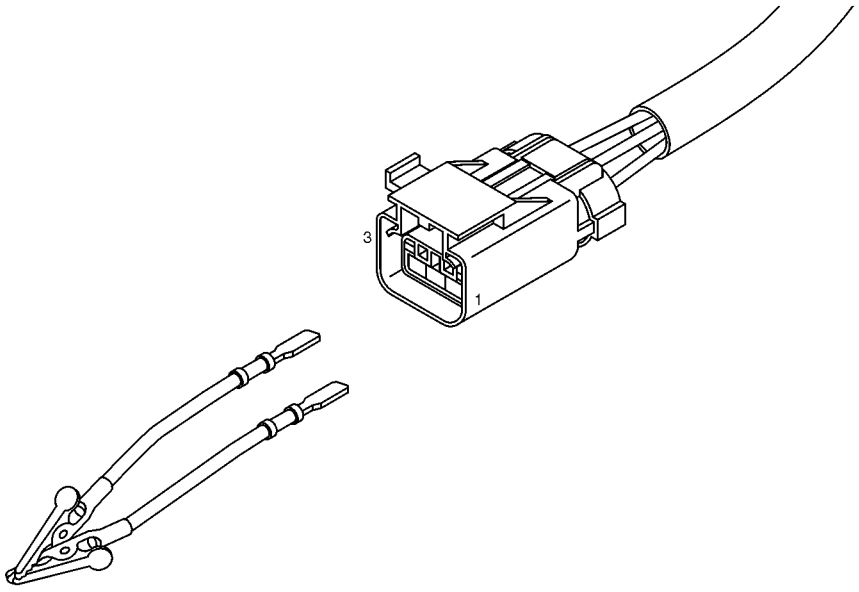
- Turn the ignition key off.
- Disconnect the camshaft position sensor from the engine harness.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check that the ECM response is appropriate. • Read the status of the camshaft position sensor using the INSITE ™ monitor mode.	Is the status of the camshaft position sensor "low"? **YES**	2C-1
	Is the status of the camshaft position sensor "low"? **NO**	2D

STEP 2C-1: Check the circuit response. Conditions:

- Turn the ignition key off.
- Disconnect the camshaft position sensor from the engine harness.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Install a jumper wire between the +5 volt POWER and the camshaft position sensor SIGN pins on the sensor connector on the engine harness. • Check that the ECM response is appropriate. • Read the status of the camshaft position sensor using the INSITE ™ monitor mode. Refer to the electrical diagram for identification of the connector pins.	Is the status of the camshaft position sensor "high"? **YES**	2C-2
	Is the status of the camshaft position sensor "high"? **NO**	2D



19c01110

STEP 2C-2: Inspect the camshaft position sensor.

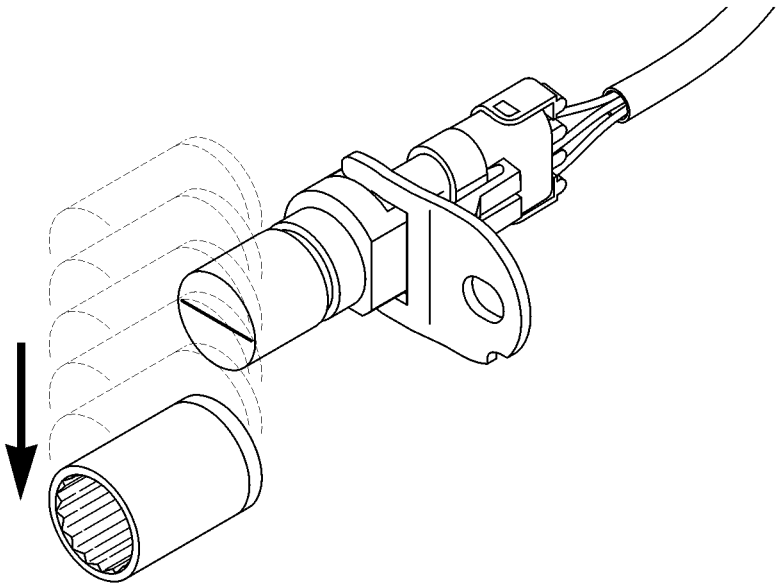
Conditions:
- Turn the ignition key off.
- Remove the camshaft position sensor from the engine. See the Procedure 019-363 .

Action	Specifications / Repair	Next step
Inspect the camshaft position sensor and check for any. • Damaged sensor tip • Evidence that the sensor touches the rotation or position teeth.	Damaged sensor tip? **YES** **Repair:** Replace camshaft position sensor. See the Procedure 019-363 .	4A
	Damaged sensor tip? **NO**	2C-3

STEP 2C-3: Check the circuit response. Conditions:

- Turn the ignition key off.
- Remove the camshaft position sensor from the engine. See the Procedure 019-363 .
- Make sure that the camshaft position sensor is connected to the harness.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Using the ratchet drive side of the socket tool used to remove the sensor from the motor, install it level over the sensor so that the end of the socket is over the end of the sensor. Slowly slide the socket in the direction perpendicular to the line marked on the sensor or in the direction perpendicular to the sensor mounting bracket. Inspect for: • Check that the ECM response is appropriate • Read the status of the camshaft position sensor using the INSITE ™ monitor mode.	Does the status of the camshaft position sensor change from "high" to "low" or "low" to "high", or does the state appear to be controlled? **YES**	2C-4
	Does the status of the camshaft position sensor change from "high" to "low" or "low" to "high", or does the state appear to be controlled? **DO NOT** **REPAIR:** Replace camshaft position sensor. See the Procedure 019-363 .	4A



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STEP 2C-4: Check that the clearance of the motor position sensor on the camshaft is proper.

Conditions:
- Turn the ignition key off.
- Install the camshaft position sensor on the engine. See the Procedure 019-363 .
- Connect the camshaft position sensor to the engine harness.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Momentarily couple the starter but do not start the engine. Repeat this step as many times as necessary. Monitor the status of the camshaft position sensor and check if it shows: • Change of state from "high" to "low" or from "low" to "high", or if the state is activated.	Does the status of the camshaft position sensor change from "high" to "low" or "low" to "high", or does the state appear to be controlled? **YES**	4A
	Does the status of the camshaft position sensor change from "high" to "low" or "low" to "high", or does the state appear to be controlled? **DO NOT** **REPAIR:** Inspect the camshaft gear teeth for damage or "slip". Refer to ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266.	4A

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

Conditions:
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.

Action	Specifications / Repair	Next step
Check the pins of the engine harness connectors and the ECM for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins • Damage to the wire shield • Connector cover broken. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-043 .	4A
	Dirty or damaged pins? **NO**	2E

STEP 2E: Check the ECM response. Conditions:

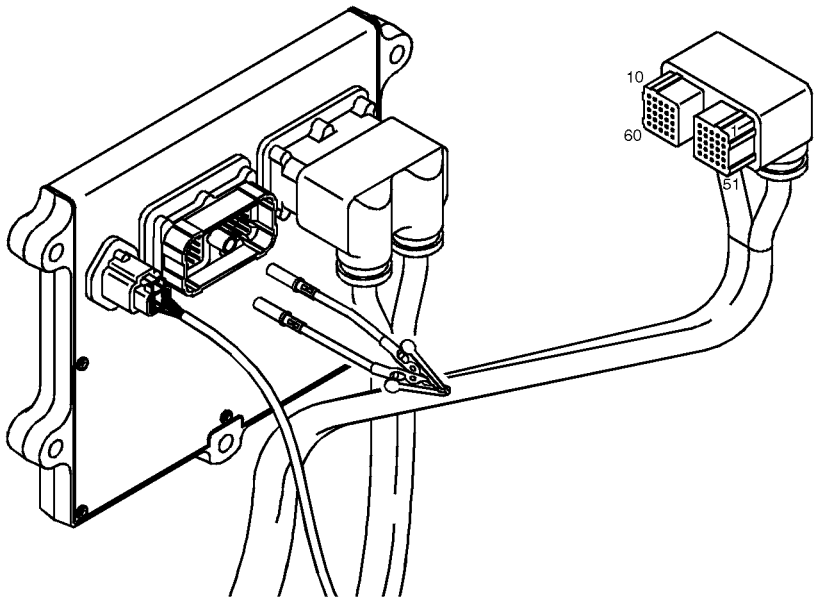
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check that the ECM response is appropriate. • Read the status of the camshaft position sensor using the INSITE ™ monitor mode.	Is the monitoring status of the camshaft position sensor "low"? **YES**	2E-1
	Is the monitoring status of the camshaft position sensor "low"? **DO NOT** **REPAIR:** Call for pre-authorization. Replace the ECM. See the Procedure 019-031 .	4A

STEP 2E-1: Check the ECM response. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Install a jumper wire between the +5 volt POWER and SIGNAL pins for the camshaft position sensor on the ECM port. Check that the ECM response is appropriate. • Read the status of the camshaft position sensor using the INSITE ™ monitor mode. Refer to the electrical diagram for identification of the connector pins.	Is the monitoring status of the camshaft position sensor "high"? **YES** **Repair:** Repair or replace the engine harness. See the Procedure 019-043 .	4A
	Is the monitoring status of the camshaft position sensor "high"? **DO NOT** **REPAIR:** Call for pre-authorization. Replace the ECM. See the Procedure 019-031 .	4A



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STEP 3: Check the ECM.

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

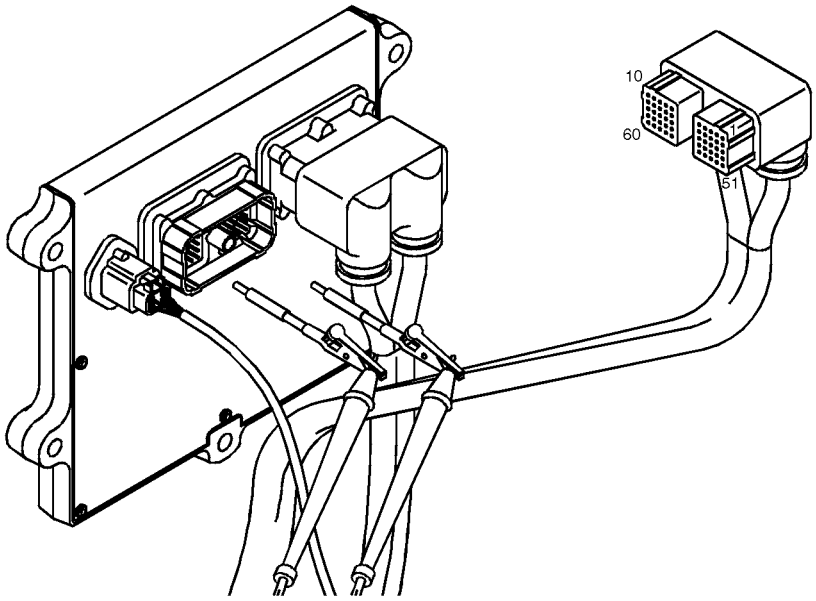
Conditions:
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.

Action	Specifications / Repair	Next step
Check the pins of the engine harness connectors and the ECM for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins • Damage to the wire shield • Connector cover broken. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-043 .	4A
	Dirty or damaged pins? **NO**	3B

STEP 3B: Check the supply voltage of the ECM sensor and the return circuit. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Measure the voltage between the +5 volts and RETURN power supply for the camshaft position sensor on the ECM door. Refer to the electrical diagram for identification of the connector pins.	4.75 to 5.25 VDC? **YES** **Repair:** Repair or replace the engine harness. See the Procedure 019-043 .	4A
	4.75 to 5.25 VDC? **DO NOT** **REPAIR:** Call for pre-authorization. Replace the ECM. See the Procedure 019-031 .	4A



19c01079

STEP 4: Clear the fault codes.

STEP 4A: Disable the fault code. Conditions:

- Connect all components.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Using INSITE ™, make sure that the fault code is inactive.	Fault code 778 inactive? **YES**	4B
	Fault code 778 inactive? **NO**	1A

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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

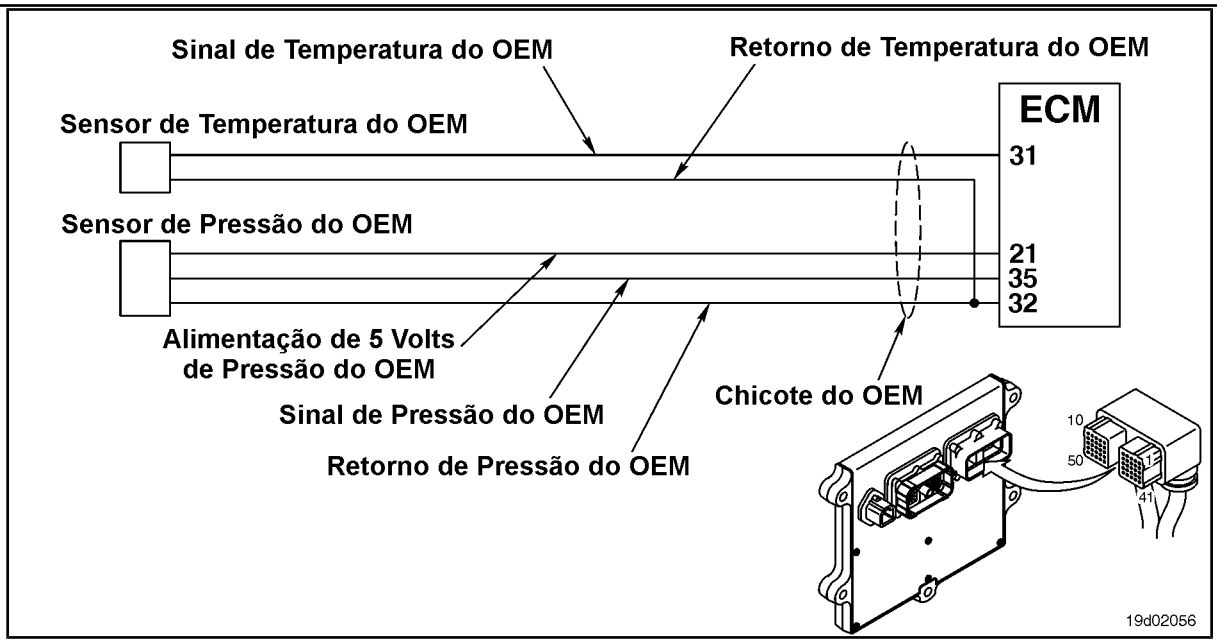
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Using INSITE ™, clear the inactive fault codes.	All codes cleared? **YES**	Complete repair
	All codes cleared? **NO**	Proper troubleshooting and repair steps

Fault Code 779

Auxiliary Equipment Sensor Input # 3 (OEM Switch) - Cause Unknown

CODES	REASON	IT IS MADE
Fault Code: 779 PID (P), SID (S): S051 IMF: 11 Lamp: Amber SRT:	Auxiliary Equipment Sensor Input # 3 (OEM Switch) - Unknown Cause	Possible engine de-powering.

OEM Temperature / Pressure Sensor Circuit



Circuit Descriptions:

The OEM has the option of connecting the input of a pressure or temperature sensor to the Cummins ECM. A calibration is then created to recognize the input from that pressure or temperature sensor. This fault code is activated when the pressure or temperature input of the OEM sensor exceeds the motor protection limit set by the OEM. Depending on requirements from the OEM, an Engine Protection depot can be associated with this fault code.

Component Location:

The OEM pressure or temperature sensor input varies depending on the application. Refer to the OEM fault diagnosis manual for the location of the sensor.

Workshop Tips:

This fault code is activated when the pressure or temperature input of the OEM sensor exceeds the motor protection limit set by the OEM. Engine de-powering is possible depending on the OEM application.

SUMMARY OF FAULT DIAGNOSTICS

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check the Fault Code 779 is registered.	**Fault Code 779 active or inactive counts?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Check if Fault Code 779 is registered. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

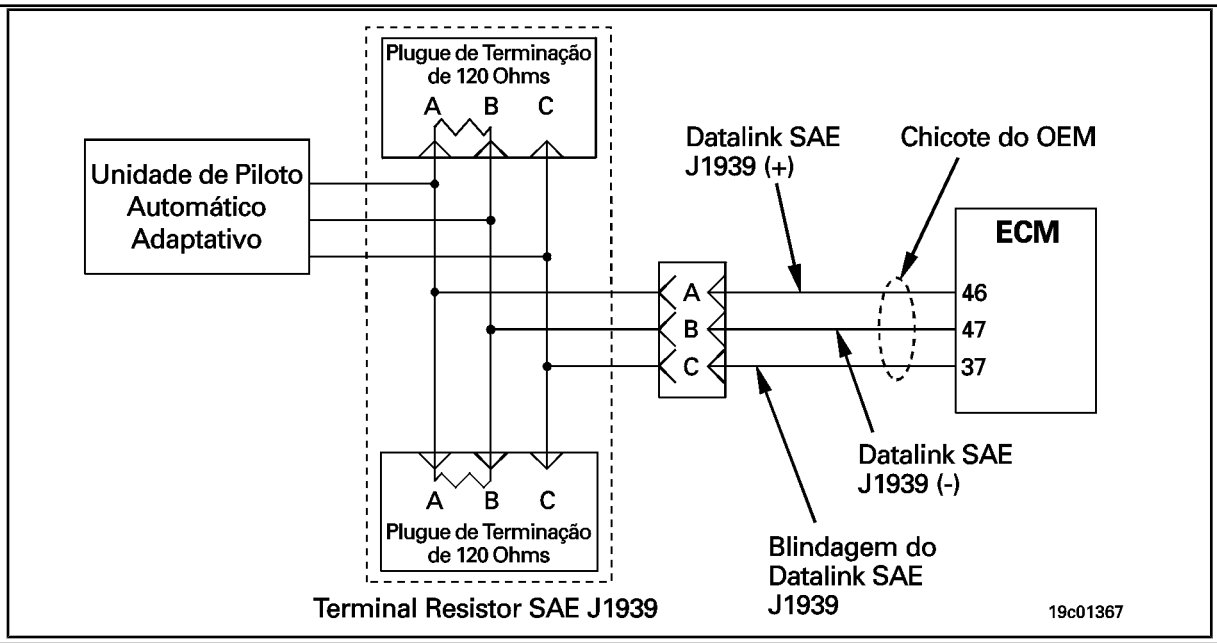
Action	Specifications / Repair	Next step
Check for an inactive fault code. • Using INSITE ™, read the fault codes. Active or inactive Code Code 779 counts	**YES** **Repair:** The motor protection limit has been exceeded for the pressure or temperature input provided by the OEM. Refer to the OEM fault diagnosis manual.	OEM fault diagnosis manual
	Fault Code 779 active or inactive counts? **NO**	Complete repair

Fault Code 784

Adaptive Autopilot - Error

CODES	REASON	IT IS MADE
Fault Code: 784 PID (P), SID (S): IMF: 2 Lamp: Amber SRT:	Loss of communication with the adaptive autopilot. The ECM triggers this fault when the data bus “hit” signal no is received.	The adaptive autopilot no will work. Probably the autopilot no will work correctly.

Autopilot Circuit



Circuit Descriptions:

The adaptive autopilot unit communicates with the electronic control module (ECM), sending and receiving vehicle speed control messages via the SAE J1939 datalink.

Component Location:

Adaptive autopilot is a feature of the INSITE ™ electronic service tool. Refer to the OEM fault diagnosis and repair manual for Adaptive Autopilot Hardware.

Workshop Tips:

Two conditions can cause this problem:

- The adaptive autopilot hardware no is installed in the vehicle and the adaptive autopilot feature has been enabled.
- The signal transmitted by the adaptive autopilot no is being received. Refer to the OEM troubleshooting and repair manual and the Adaptive Autopilot Hardware Manual.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3163151 - Electronic Control Module (ECM) Bench Calibration Harness Part No. 3164185 - ECM Bench Calibration Adapter Cable. STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check for adaptive autopilot hardware.		
STEP 1A: Check that the hardware is the right.	**Is the hardware of the adaptive autopilot installed in the vehicle?**	
STEP 2: Check the SAE J1939 communication.		
STEP 2A: Check if the ECM communicates with the electronic service tool INSITE ™.	**Does the electronic service tool INSITE ™ communicate with the ECM?**	
STEP 2B: Inspect the OEM and ECM harness connector pins.	**Dirty or damaged pins?**	
STEP 2C: Check the communication of the ECM with ECM bench calibration harness.	**Does the electronic service tool INSITE ™ communicate with the ECM?**	
STEP 3: Clear the fault codes.		
STEP 3A: Disable the fault code.	**Fault code 784 inactive?**	
STEP 3B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check for adaptive autopilot hardware.

STEP 1A: Check that the hardware is correct. Conditions:

- Turn the ignition key off.

Action	Specifications / Repair	Next step
Check the hardware. • Check that the adaptive autopilot hardware is installed in the vehicle.	Is the hardware of the adaptive autopilot installed in the vehicle? **YES**	2A
	Is the hardware of the adaptive autopilot installed in the vehicle? **DO NOT** **REPAIR:** Using the electronic service tool INSITE ™, disable the adaptive autopilot feature.	3A

STEP 2: Check the SAE J1939 communication.

STEP 2A: Check that the ECM communicates with the electronic service tool INSITE ™. Conditions:

- Turn the ignition key ON.
- Connect the datalink INLINE II adapter to the vehicle's SAE J1939 datalink diagnostic connector.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Using the electronic service tool INSITE ™, try to communicate with the ECM. • Turn on the electronic service tool INSITE ™. • Select the INLINE ™ II (J1939) connection to the ECM, from the INSITE ™ electronic service tool.	Does the electronic service tool INSITE ™ communicate with the ECM? **YES** **Repair:** The ECM SAE J1939 datalink circuit is functioning correctly.	Refer to the OEM's troubleshooting and repair manual for information on troubleshooting and repairing the vehicle's adaptive control unit and SAE J1939 data link.
	Does the electronic service tool INSITE ™ communicate with the ECM? **NO**	2B

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

Conditions:
- Turn the ignition key off.
- Disconnect the OEM harness from the ECM.

Action	Specifications / Repair	Next step
Inspect the OEM and ECM harness connector pins for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector seals. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** Clean the connector and pins. If damaged, repair the harness, connector and pins, if possible. Refer to Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	3A
	Dirty or damaged pins? **NO**	2C

STEP 2C: Check the ECM communication with the ECM bench calibration harness. Conditions:

- Turn the ignition key off.
- Disconnect the OEM harness from the ECM.
- Connect the ECM bench calibration harness to the ECM.
- Connect the datalink INLINE ™ II adapter to the ECM bench calibration harness.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Using the electronic service tool INSITE ™, try to communicate with the ECM. • Start the electronic service tool INSITE ™ and connect it to the ECM using an ECM-INLINE ™ II connection (J1939).	Does the electronic service tool INSITE ™ communicate with the ECM? **YES** **Repair:** The electronic service tool INSITE ™ can communicate with the ECM. This indicates that the ECM SAE J1939 data link circuit is functioning correctly.	Refer to the OEM's troubleshooting and repair manual for vehicle SAE J1939 circuit and device repair procedures.
	Does the electronic service tool INSITE ™ communicate with the ECM? **NO**	Refer to the fault diagnosis symptom "Communication Error - Electronic Service Tool or Control Device".

STEP 3: Clear the fault codes.

STEP 3A: Disable the fault code. Conditions:

- Connect all components.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Using the electronic service tool INSITE ™, make sure that the fault code is inactive.	Fault code 784 inactive? **YES**	3B
	Fault code 784 inactive? **NO**	1A

STEP 3B: Clear the inactive fault codes. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

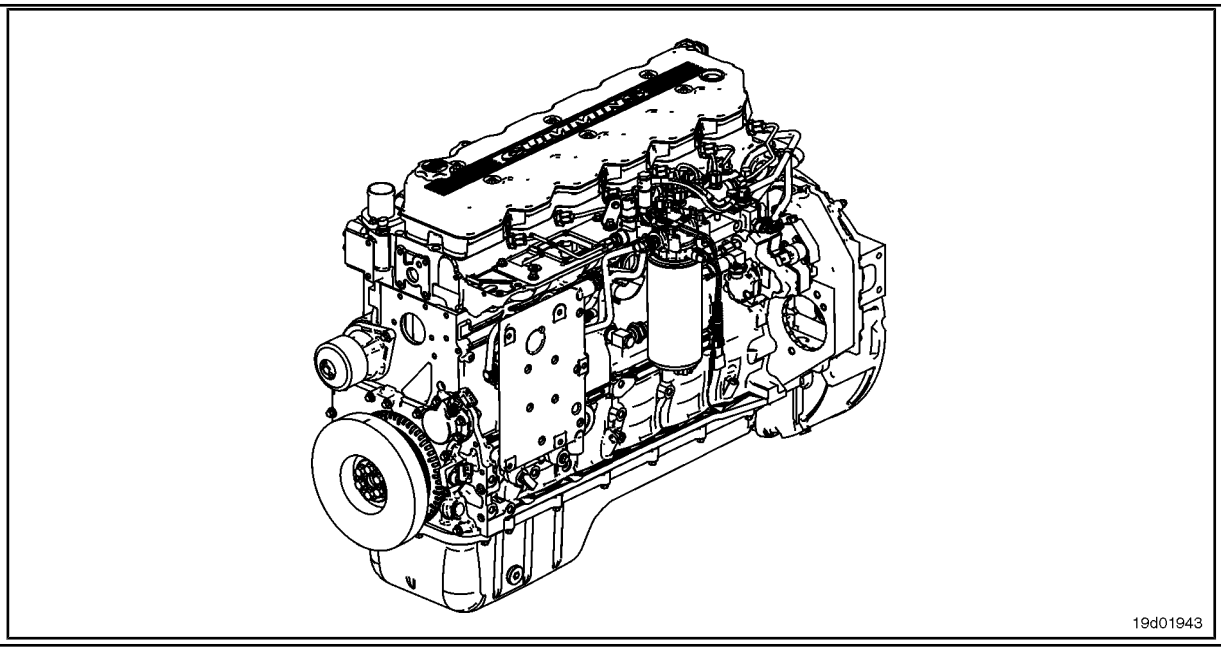
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YES**	Complete repair
	All codes cleared? **NO**	Proper troubleshooting and repair steps

Fault Code 951

Cylinder Power Imbalance Detected

CODES	REASON	IT IS MADE
Fault Code: 951 PID (P), SID (S): P166 IMF: 2 Lamp: No SRT:	Difference in cylinder power between cylinders. The ECM detected a power imbalance between the cylinders.	Possible loss of power, irregular idle or failure to start.

Cylinder Circuit



Circuit Descriptions:

A calibration algorithm in the electronic control module (ECM) monitors the engine speed as each injector is fired while the engine is idling. If a cylinder has a high or low contribution to the engine speed, this fault code becomes active. The purpose of this failure is to assist in the diagnosis of performance failures such as failure to start and loss of engine power. While this code is active, **no** no fault light is on.

Component Location:

The ECM is located on the intake side of the engine, below the air turbine. See the Procedure 100-002 for the detailed location of each component.

Workshop Tips:

If Fault Code 951 is inactive in the ECM's memory and there are no problems with power loss or engine failure, the possible cause of the failure may be an intermittent event, such as the presence of air in the fuel system after an exchange of filters. Fault Code 951 counts should be ignored unless there are other performance symptoms. The causes of the imbalance between the cylinders include:

- Motor brake defect (check that the brakes are out of adjustment or that oil is supplied to the brake actuator when the brakes are deactivated)
- Valve clearance out of adjustment (compare actual valve clearance with readjustment limits)

- Cylinder failure (check for high engine blowing when the engine is under load)
- Valve failure or valve kept open (check if the valve produces a "cicada" noise at the intake)
- Cylinder or gasket head failure (look for signs of oil, coolant or molten material residues in the intake or exhaust passages)

- Extreme wear on the camshaft (check if camshaft bosses are worn)

- Extra, missing or damaged sealing washer under an injector
- HPC / injector interface extremely damaged (check the high pressure fuel connector on the injector end); this problem will also cause excessive fuel return and Fault Code 2292/2216
- Injector failures (switch injectors to see if the problem "follows" the suspected injector).

SUMMARY OF FAULT DIAGNOSTICS

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check for multiple fault codes related to the fuel system.		
STEP 1A: Read the fault codes.	**Active fault codes for fuel system components or accumulated inactive code counts?**	
STEP 2: Run the diagnostic tests.		
STEP 2A: Run the cutting tests cylinder and / or the automatic cylinder balancing diagnostic test.	**All cylinder tests OK?**	
STEP 3: Clear the fault codes.		
STEP 3A: Disable the fault code.	**Fault code 951 inactive?**	
STEP 3B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check for multiple fault codes related to the fuel system.

STEP 1A: Read the fault codes. Conditions:

- Connect the electronic service tool INSITE ™.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Read the fault codes. • Start the engine and let it run at idle for 1 minute. • Use the electronic service tool INSITE ™ to read fault codes.	Active fault codes for fuel system components or accumulated inactive code counts? **YES** **Repair:** Diagnose all fault codes for system components.	Diagnostic and repair diagram of the appropriate fault code
	Active fault codes for fuel system components or accumulated inactive code counts? Diagnose active fault codes first. **NO**	2A

STEP 2: Run the diagnostic tests.

STEP 2A: Run the cylinder cut tests and / or the balance diagnostic test cylinders.

Conditions:
- Turn the ignition key ON.
- Allow the engine to idle.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Use the automatic cylinder balance diagnostic test to determine the power contribution of each cylinder.	All cylinder tests OK? **YES**	3A
	All cylinder tests OK? **DO NOT** **REPAIR:** Failure of the cylinder test can be caused by defective engine brakes, valve clearance out of adjustment, cylinder failure, valve failure, cylinder head or gasket failure, excessive wear on the camshaft or injector failure. Investigate, diagnose and correct the condition of components that are possibly out of adjustment or defective. Switch the injectors between the cylinders to see if the problem "follows" or **no** the specific injector.	ISB Engine Troubleshooting and Repair Manual and and ISB (Common Rail Fuel System), Bulletin 3653241

STEP 3: Clear the fault codes.

STEP 3A: Disable the fault code. Conditions:

- Connect all components.
- Connect the electronic service tool INSITE ™.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Check that the fault code is inactive.	Fault code 951 inactive? **YES**	3B
	Fault code 951 inactive? **NO**	1A

STEP 3B: Clear the inactive fault codes. Conditions:

- Connect all components.
- Connect the electronic service tool INSITE ™.
- Turn the ignition key ON.

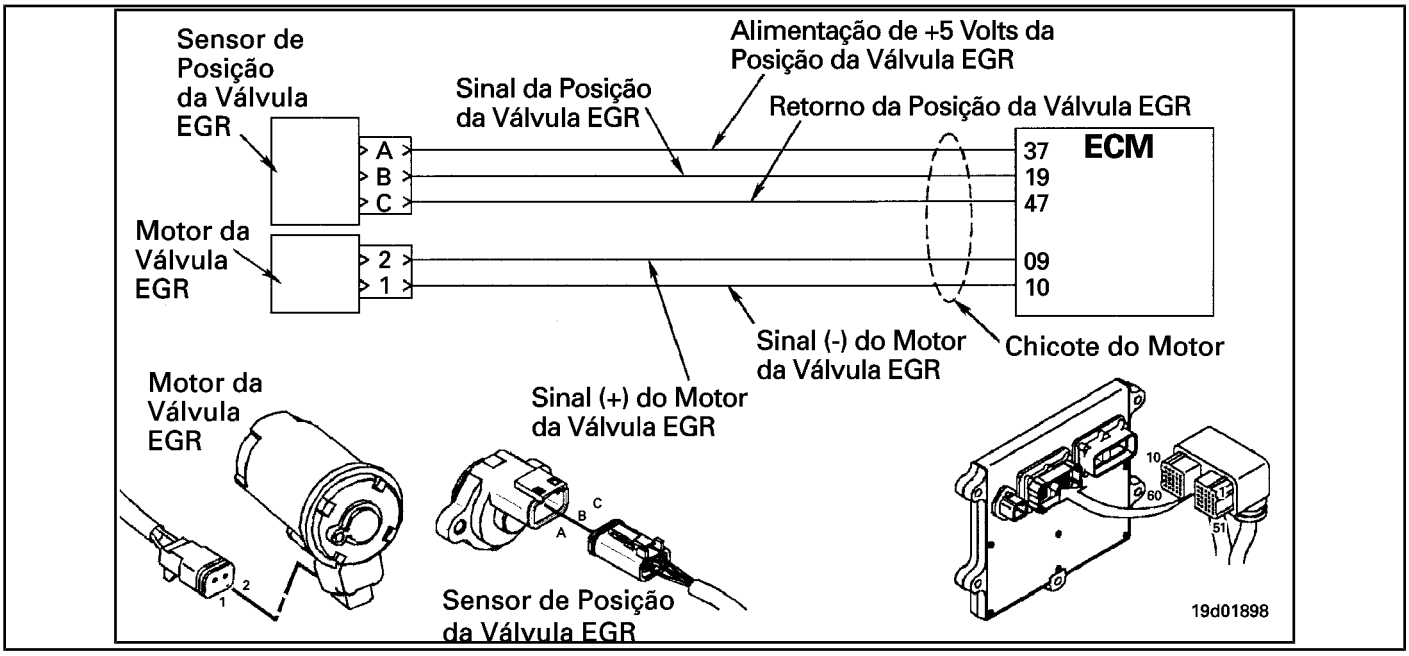
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YES**	Complete repair
	All codes cleared? **NO**	Proper troubleshooting and repair steps

Fault Code 957

EGR Valve Position - Invalid, Intermittent or Incorrect Data

CODES	REASON	IT IS MADE
Fault Code: 957 PID (P), SID (S): P27 IMF: 2 Lamp: Amber SRT:	EGR Valve Position - Invalid, intermittent or incorrect data. The intermittent position information of the EGR valve is being received by the electronic control module (ECM).	Possible loss of power. The EGR valve will be closed.

EGR Valve Position Circuit



Circuit Descriptions:

The EGR valve position sensor provides a voltage signal to the ECM. The ECM converts this signal into a percentage value, from 0 to 100, indicating the position of the EGR valve. A fully open valve is equivalent to 100
Percent.

Component Location:

The EGR valve position sensor is located on the EGR valve assembly. See the Procedure 100-002 for the detailed location of each component.

Workshop Tips:

This fault code is caused by an internal failure of the EGR valve position sensor. This failure will result in incorrect readings of the EGR valve position. The fault diagnostic information for fault code 957 is the same as for fault code 1228. See fault code 1228 for fault code diagnostic information.

SUMMARY OF FAULT DIAGNOSTICS

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check for a security code active fault.	**Is fault code 957 active?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Check for an active fault code. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

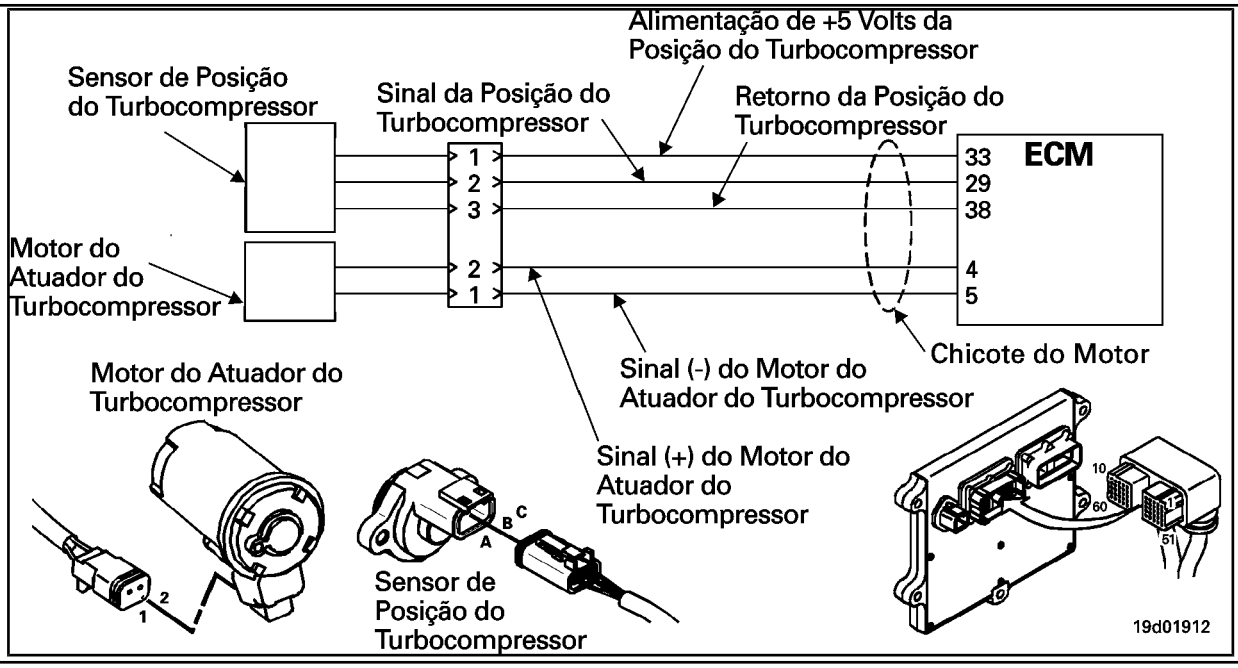
Action	Specifications / Repair	Next step
Check for active fault codes. • Use the electronic service tool INSITE ™ to read fault codes.	Is fault code 957 active? **YES**	Refer to Fault Code 1228.
	Is fault code 957 active? **NO**	Complete Repair

Fault Code 958

TGV Position Sensor - Invalid, Intermittent or Incorrect Data

CODES	REASON	IT IS MADE
Fault Code: 958 PID (P), SID (S): P27 IMF: 2 Lamp: Amber SRT:	TGV Position Sensor - Invalid, intermittent or incorrect data. The intermittent position information of the variable geometry turbocharger (TGV) is being received by the electronic control module (ECM).	Possible loss of power. The power to the turbocharger actuator will be limited.

Variable Geometry Turbocharger Position Sensor Circuit (TGV)



Circuit Descriptions:

The turbocharger's position sensor sends a voltage signal to the ECM. The ECM converts this signal into a percentage value, from 0 to 100 Percent, indicating the position of the turbocharger. A fully closed turbocharger actuator equals 100 Percent.

Component Location:

The turbocharger position sensor is located in the variable geometry (TGV) turbocharger actuator assembly. See the Procedure 100-002 for the detailed location of each component.

Workshop Tips:

This fault code is caused by an internal fault in the variable geometry turbocharger (TGV) position sensor. This failure will result in incorrect readings of the variable geometry turbocharger (TGV) position. The fault diagnostic information for fault code 958 is the same as for fault code 1229. See fault code 1229 for fault code diagnostic information.

SUMMARY OF FAULT DIAGNOSTICS

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check for a security code active fault.	**Is fault code 958 active?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Check for an active fault code. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

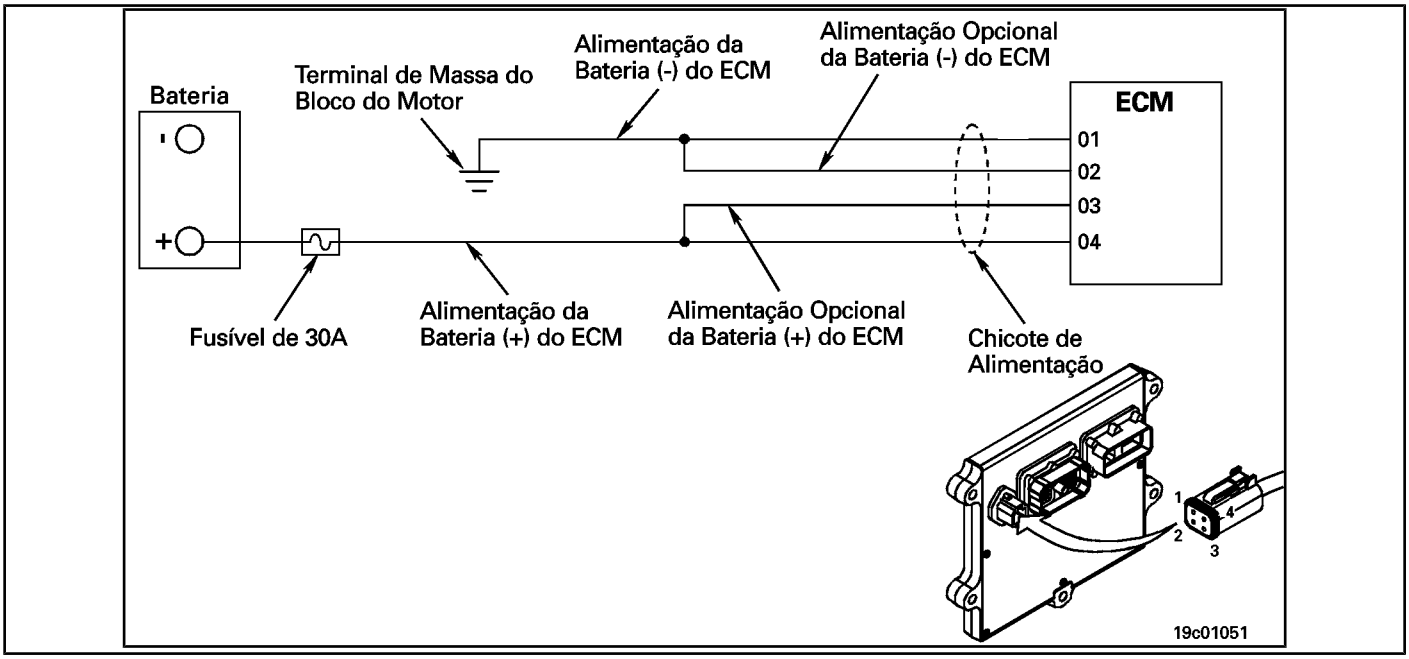
Action	Specifications / Repair	Next step
Check for active fault codes. • Use the electronic service tool INSITE ™ to read fault codes.	Is fault code 958 active? **YES**	Refer to Fault Code 1229.
	Is fault code 958 active? **NO**	Complete Repair

Fault Code 1117 (Automotive Application)

Power Loss without Ignition Shutdown - Invalid, Intermittent or Incorrect

CODES	REASON	IT IS MADE
Fault Code: 1117 PID (P), SID (S): S251 IMF: 2/2 Lamp: No SRT:	Loss of Power without Ignition Shutdown - Invalid, Intermittent or Incorrect Data The supply voltage to the ECM momentarily dropped below 6.2 volts, or the ECM **no** has been shut down correctly (retain the battery voltage for 30 seconds after turning off the ignition key).	Possibly no noticeable performance effect, either the engine will "die" or a manual start will be required. Fault information, travel information and maintenance monitor data may be inaccurate.

Non-switched Battery Power



Circuit Descriptions:

The ECM receives constant voltage from the batteries through non-switched wires that are connected directly to the positive (+) terminal of the batteries. The ECM receives information from the non-switched battery by wiring the vehicle's ignition key when it is switched on (ON position).

Component Location:

The ECM is connected to the battery by the OEM wiring harness via the ECM battery power screw. This provides a constant source of energy for the ECM. The location of the battery varies by OEM. Refer to the OEM's troubleshooting and repair manual.

Workshop Tips:

This fault is made active if the ECM battery supply voltage drops below 6.2 volts while the ignition key is in the ON position.

Make sure that the ECM battery's non-switched power is supplied directly from the battery and **no** by the starter. If the starter is providing unswitched power, it is possible that the battery voltage will drop to a low enough level during the start-up rotation to make this fault active. This failure can also be caused by resistance in the (+) or (-) battery supply circuits of the ECM. The resistance in these circuits can cause the voltage level at the ECM input to drop to a low enough value to make Fault Code 1117 active.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it. To reduce the possibility of damage to the pins and the harness, use the following test cable when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3164133 - Deutsch /

AMP / Metri-Pack female test lead. STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check for fault codes.		
STEP 1A: Check for multiple fault codes.	**Fault code 2362 and / or 2363 active or inactive?**	
STEP 2: Check the batteries and the power connector.		
STEP 2A: Check the batteries and the power connector.	**Tight, corrosion-free connections?**	
STEP 2B: Check the battery voltage.	**Normal conditions: At least (+) 12 VDC [(+) 24 VDC for 24 volt systems]; During Start Spin: At least (+)**	
	6.2 VDC?	
STEP 3: Check the OEM wiring harness.		
STEP 3A: Inspect the harness and ECM connector pins.	**Dirty or damaged pins?**	
STEP 3B: Check for a circuit open in the battery supply circuit.	**At least (+) 10 VDC [(+) 20 VDC for 24 volt systems]?**	
STEP 3B-1: Make sure the OEM fuse is installed correctly.	**Fuse installed correctly?**	
STEP 3B-2: Check that the fuse in the OEM is burnt out.	**Is the fuse blown?**	
STEP 3B-3: Check the wiring complementary or accessory in the positive (+) terminal of the battery.	**Any damaged wire?**	
STEP 3C: Check the resistance of the battery power circuit.	**Less than 1.0 ohms?**	
STEP 3D: Check the key wire ignition input to ECM.	**Ignition key input wire uninterrupted?**	
STEP 3E: Check the input circuit the ignition key.	**Less than 5 ohms?**	
STEP 4: Check the whip motor and the solenoid circuits.		
STEP 4A: Check for a signal short circuit with the ground.	**More than 3.75 VDC?**	
STEP 4A-1: Check the pins engine harness and ECM connectors.	**Dirty or damaged pins?**	
STEP 4A-2: Check for a signal short-circuit with ground in the ECM.	**More than 3.75 VDC?**	

STEP 4B: Check for a short circuit with the dough. — **More than 100k ohms?**

STEP 4C: Check the brake solenoids - motor for a short to ground. — **5 ohms or more?**

STEP 5: Clear the fault codes.

STEP 5A: Disable the fault code. — **Fault code 1117 inactive?**

STEP 5B: Clear the fault codes inactive. — **All codes cleared?**

FAULT DIAGNOSTIC STEP

STEP 1: Check for fault codes.

STEP 1A: Check for multiple fault codes. Conditions:

- Connect all components.
- Connect the electronic service tool INSITE ™.

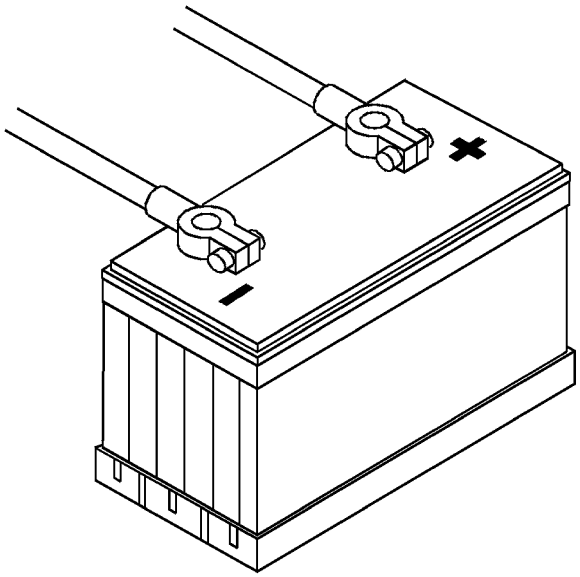
Action	Specifications / Repair	Next step
Are the following fault codes active or inactive? • Fault Code 2362 (Motor Brake Solenoid Signal Circuit No. 1)? • Fault Code 2363 (Motor Brake Solenoid Signal Circuit No. 2)?	Fault code 2362 and / or 2363 active or inactive? **YES** **Repair:** Troubleshoot Fault Code 2362 or 2363.	Fault codes 2362 or 2363
	Fault code 2362 and / or 2363 active or inactive? **NO**	2A

STEP 2: Check the batteries and the power connector.

STEP 2A: Check the batteries and the power connector. Conditions:

- Turn the ignition key off.

Action	Specifications / Repair	Next step
Check the battery connections. • Check the connections at the battery terminals.	Tight, corrosion-free connections? **YES**	2B
	Tight, corrosion-free connections? **DO NOT** **REPAIR:** Tighten the connections. Tighten loose connections and clean the terminals. Refer to the OEM's troubleshooting and repair manual.	5A



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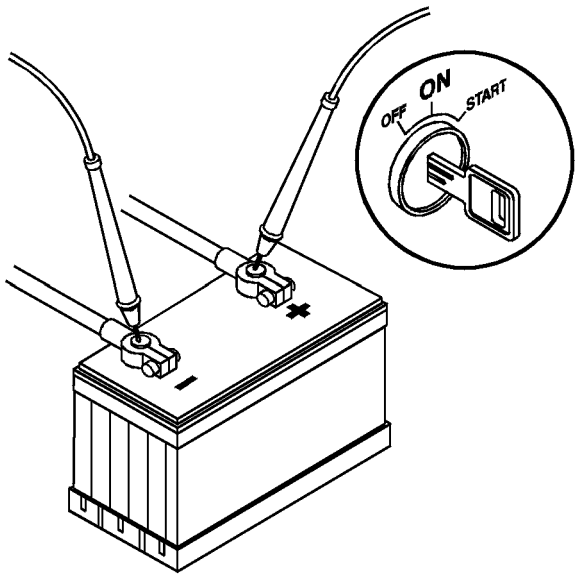
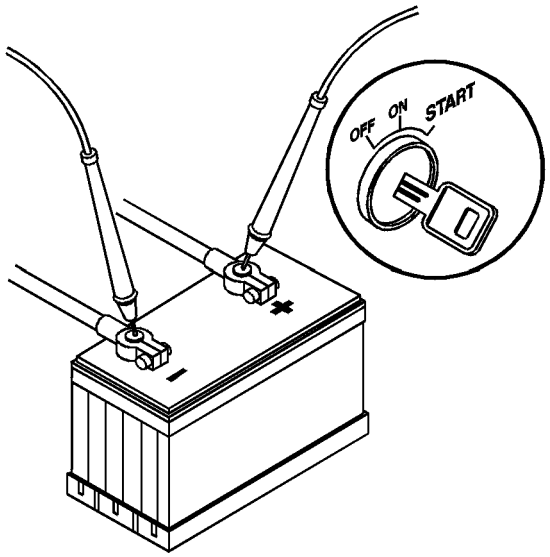
STEP 2B: Check the battery voltage. Conditions:

- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check the battery voltage. • Place the positive (+) probe on the multimeter on the positive battery terminal and touch the negative (-) probe on the negative battery terminal while trying to start the engine.	Normal conditions: At least (+) 12 VDC [(+) 24 VDC for 24 volt systems]; During Start Spin: At least (+) 6.2 VDC? **YES**	3A
	Normal conditions: At least (+) 12 VDC [(+) 24 VDC for 24 volt systems]; During Start Spin: At least (+) 6.2 VDC? **DO NOT** **REPAIR:** Charge or replace the battery. Refer to the OEM's troubleshooting and repair manual.	5A





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STEP 3: Check the OEM wiring harness.

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

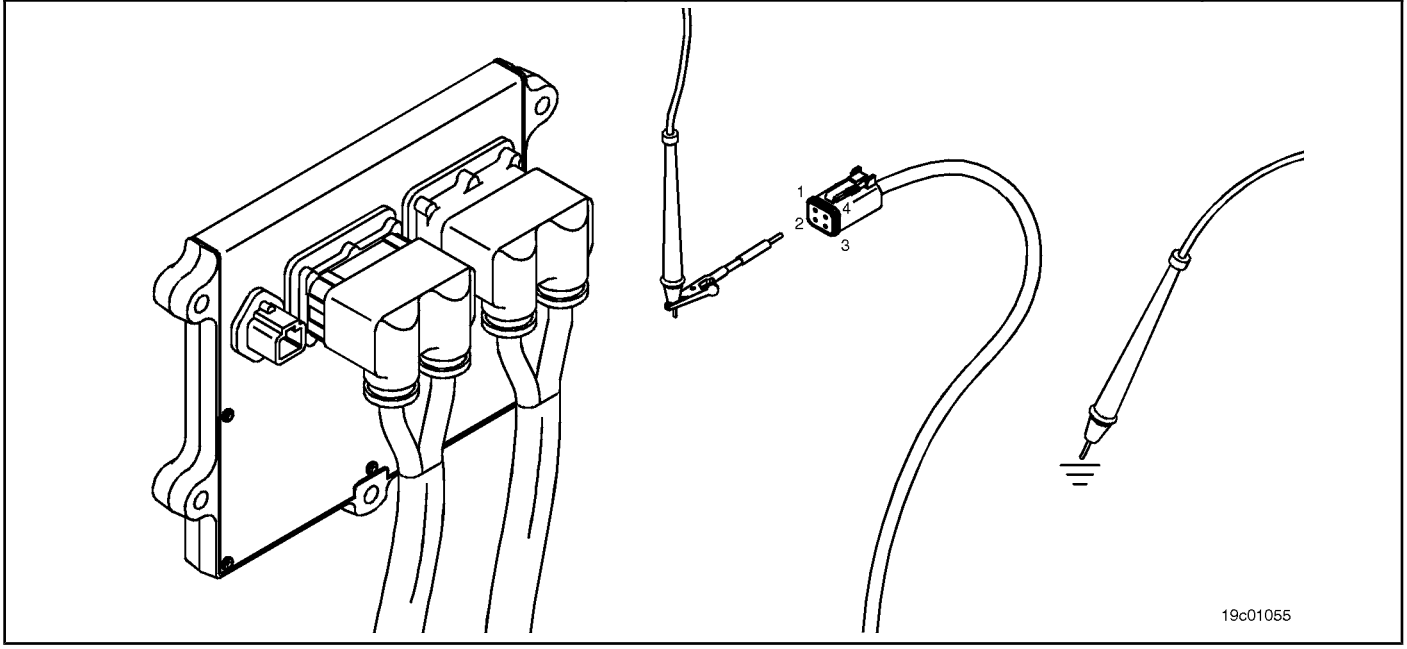
Conditions:
- Turn the ignition key off.
- Disconnect the OEM power harness connector from the ECM.

Action	Specifications / Repair	Next step
Inspect the OEM and ECM harness connector pins and check for: • Loose connector • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Damaged or missing connector seals • Dirt or debris on the connector pins • Damage to the wire shield • Connector cover broken. • Damage to the connector locking tab. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-071 .	5A
	Dirty or damaged pins? **NO**	3B

STEP 3B: Check for an open circuit in the battery supply circuit. Conditions:

- Turn the ignition key off.
- Disconnect the ECM battery power connector on the engine harness from the ECM.

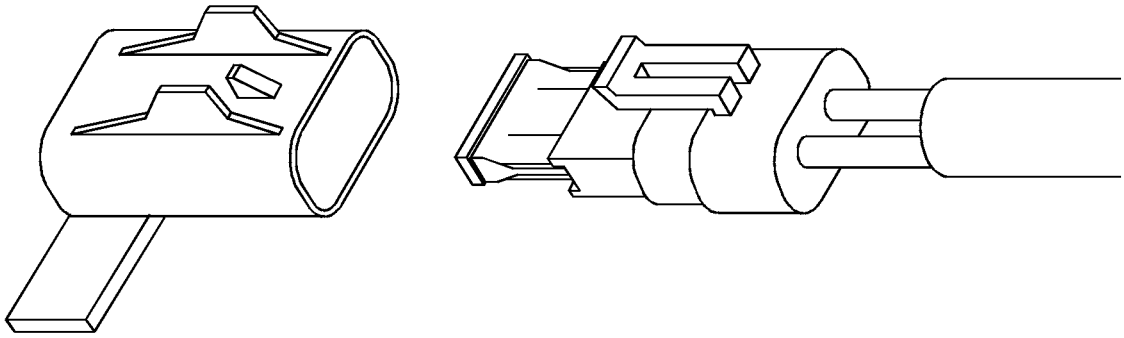
Action	Specifications / Repair	Next step
Check for an open circuit in the battery supply circuits. • Using a multimeter, measure the voltage between the ECM battery power pin (+) on the ECM battery power connector on the engine harness and the engine block ground. Refer to the electrical diagram for identification of the connector pins.	At least (+) 10 VDC [(+) 20 VDC for 24 volt systems]? **YES**	3C
	At least (+) 10 VDC [(+) 20 VDC for 24 volt systems]? **NO**	3B-1



STEP 3B-1: Make sure the OEM fuse is installed correctly. Conditions:

- Turn the ignition key off.

Action	Specifications / Repair	Next step
Check that the OEM fuse installation is correct.	Fuse installed correctly? **YES**	3B-2
	Fuse installed correctly? **DO NOT** **REPAIR:** Install the fuse correctly. See the Procedure 019-198 .	5A



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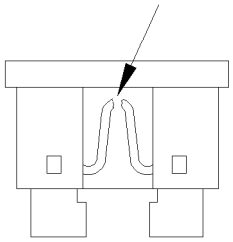
STEP 3B-2: Check if the OEM's fuse is blown. Conditions:

- Turn the ignition key off.

Action	Specifications / Repair	Next step
Make sure that the OEM fuse is not blown.	Is the fuse blown? **YES** **Repair:** Locate the short circuit. Repair or replace the OEM harness. See the Procedure 019-071 . Replace the blown fuse (or fuses). See the Procedure 019-198 .	5A
	Is the fuse blown? **NO**	3B-3



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STEP 3B-3: Check the complementary or accessory wiring at the positive (+) terminal of the battery. Conditions:

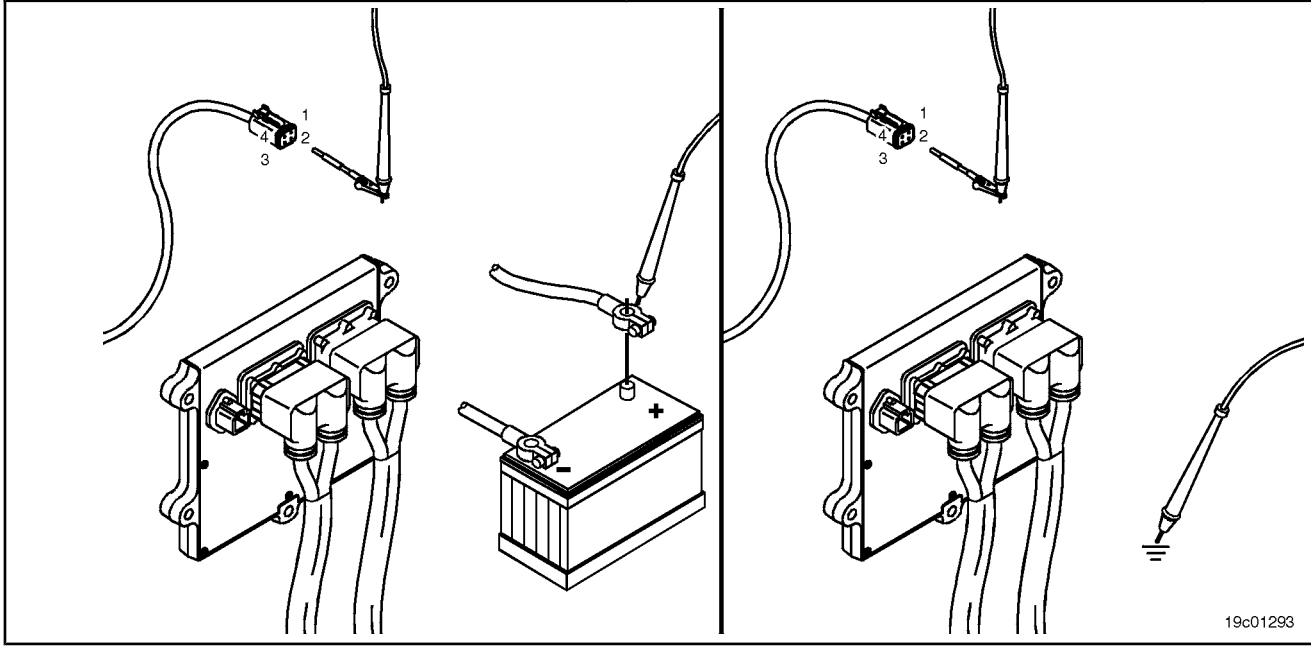
- Turn the ignition key off.

Action	Specifications / Repair	Next step
Check the complementary or accessory wiring at the positive (+) terminal of the battery. • Starting with the positive (+) terminal, follow any complementary or accessory wiring and check for damaged insulation or installation errors that may cause a short between the power cord and the motor block.	Any damaged wire? **YES** **Repair:** Repair or replace damaged wiring.	5A
	Any damaged wire? **DO NOT** **REPAIR:** Repair or replace the OEM wiring harness between the OEM power connector and the batteries.	5A

STEP 3C: Check the resistance of the battery supply circuit. Conditions:

- Turn the ignition key off.
- Disconnect the ECM battery power connector on the engine harness from the ECM.
- Disconnect the positive battery terminal.
- Digital multimeter set to low resistance mode and calibrated to zero.

Action	Specifications / Repair	Next step
Check the resistance of the battery supply circuit. • Measure the resistance between the ECM battery POWER (+) pin on the engine harness ECM battery power connector and the positive battery connector. • Measure the resistance between the ECM battery POWER (-) pin on the engine harness ECM battery power connector and the negative battery connector. Refer to the electrical diagram for identification of the connector pins. **NOTE:** As resistance in the battery supply circuit it is usually very low, it is necessary to use a digital multimeter calibrated to zero in the low resistance setting for the accurate measurement of the circuit resistance. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	Less than 1.0 ohms? **YES**	3D
	Less than 1.0 ohms? **DO NOT** **REPAIR:** Repair or replace the ECM wiring harness. See the Procedure 019-071 .	5A



STEP 3D: Check the input ignition key wire to the ECM. Conditions:

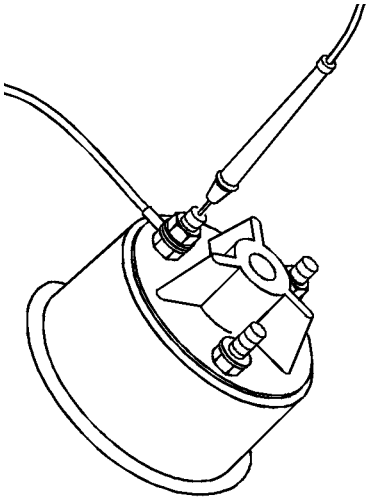
- Turn the ignition key off.

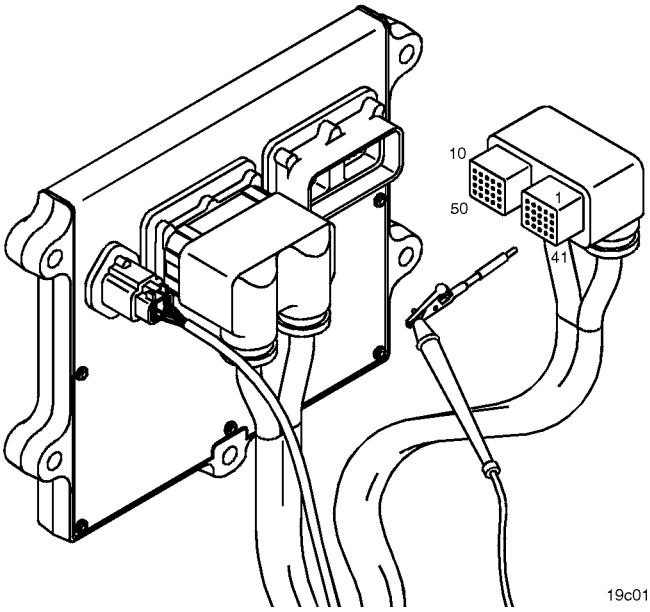
Action	Specifications / Repair	Next step
Inspect the ignition key input wire between the ignition key ignition terminal on the switch assembly and the ECM to make sure there are no breaks in the wire, that is, that there are no solenoids or relays.	Ignition key input wire uninterrupted? **YES** **Repair:** Repair the wiring so that the wire is not interrupted.	5A
	Ignition key input wire uninterrupted? **NO**	3E

STEP 3E: Check the ignition key input circuit. Conditions:

- Turn the ignition key off.
- Disconnect the OEM harness connector from the ECM.

Action	Specifications / Repair	Next step
Check the ignition key input circuit. • Measure the resistance between the ignition terminal on the ignition key assembly and the ignition key input SIGN pin on the OEM harness connector. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	Less than 5 ohms? **YES**	4A
	Less than 5 ohms? **DO NOT** **REPAIR:** Repair or replace the OEM harness. See the Procedure 019-071 .	5A



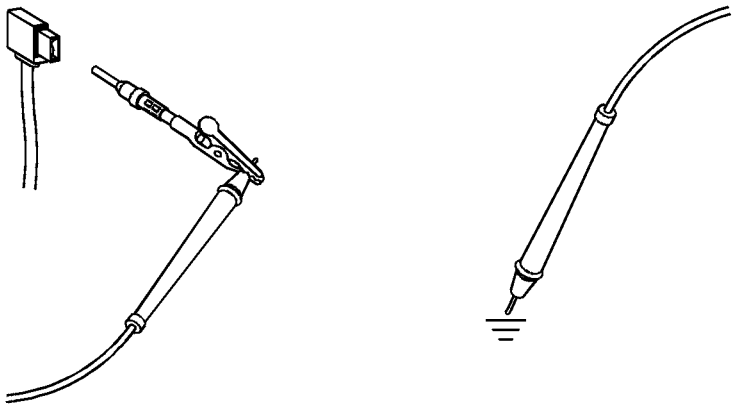


STEP 4: Check the whip motor and the solenoid circuits.

STEP 4A: Check for a short circuit signal with the ground. Conditions:

- Turn the ignition key off.
- Remove the rocker cover. Refer to Procedure 003-011 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266.
- Disconnect the motor harness from the motor-brake connector.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check for a short circuit with the earth. • Using a multimeter, measure the voltage between pin number 1 of the engine brake solenoid on the engine harness and the mass of the engine block. • Using a multimeter, measure the voltage between pin number 2 of the engine brake solenoid on the engine harness and the mass of the engine block. Refer to the electrical diagram for identification of the connector pins.	More than 3.75 VDC? **YES**	4B
	More than 3.75 VDC? **NO**	4A-1



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STEP 4A-1: Check the wiring harness and ECM connector pins. Conditions:

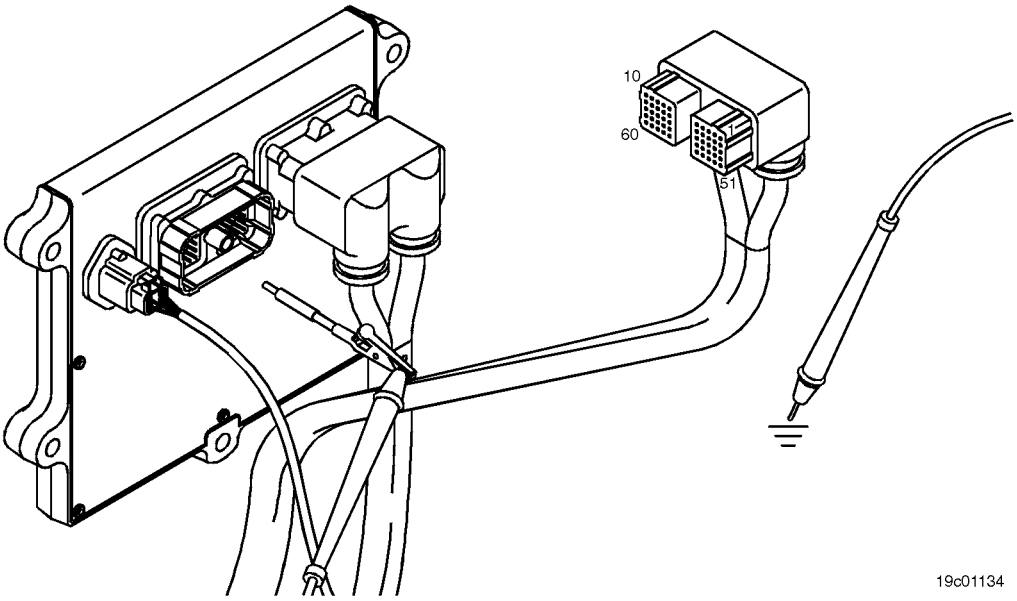
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.

Action	Specifications / Repair	Next step
Inspect the engine harness and ECM connector pins for: • Loose connector • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Damaged or missing connector seals	Dirty or damaged pins? **YES** **Repair:** Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-043 .	5A
• Dirt or debris on the connector pins • Damage to the wire shield • Connector cover broken. • Damage to the connector locking tab. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **NO**	4A-2

STEP 4A-2: Check for an earthed short circuit signal on the ECM. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM connector.
- Turn the ignition key ON.

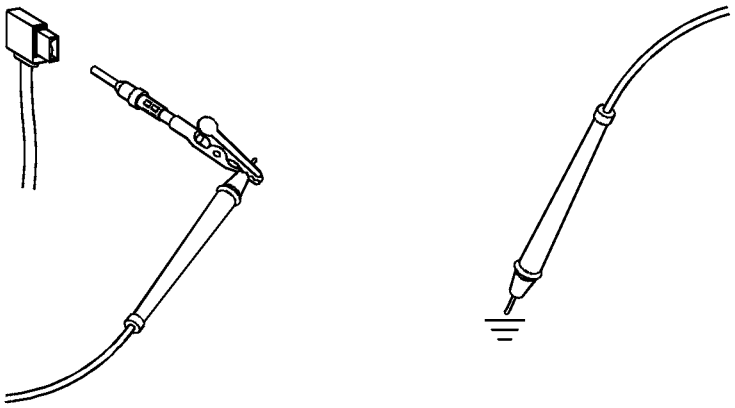
Action	Specifications / Repair	Next step
Check for a short circuit with the ground. • Using a multimeter, measure the voltage between pin number 1 of the motor brake solenoid on the ECM frame and the mass of the motor block. • Using a multimeter, measure the voltage between pin number 2 of the engine brake solenoid on the ECM frame and the mass of the engine block. Refer to the electrical diagram for identification of the connector pins.	More than 3.75 VDC? **YES** **Repair:** Repair or replace the engine harness. See the Procedure 019-043 .	5A
	More than 3.75 VDC? **DO NOT** **REPAIR:** Call for pre-authorization. Replace the ECM. See the Procedure 019-031 .	5A



STEP 4B: Check for an earth short. Conditions:

- Turn the ignition key off.
- Remove the rocker cover. Refer to Procedure 003-011 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266.
- Disconnect the motor harness from the motor-brake connector.

Action	Specifications / Repair	Next step
Check for a short circuit with the ground. • Using a multimeter, measure the resistance between pin number 1 of the motor brake solenoid on the motor brake connector and the mass of the motor block. • Using a multimeter, measure the resistance between pin number 2 of the motor brake solenoid on the motor brake connector and the mass of the motor block. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YES**	5A
	More than 100k ohms? **DO NOT** **REPAIR:** A short circuit was detected with the ground in the motor-brake circuit in the motor harness. Troubleshoot each harness connected in series to determine which one contains the short to ground. See the Procedure 019-043 .	4C



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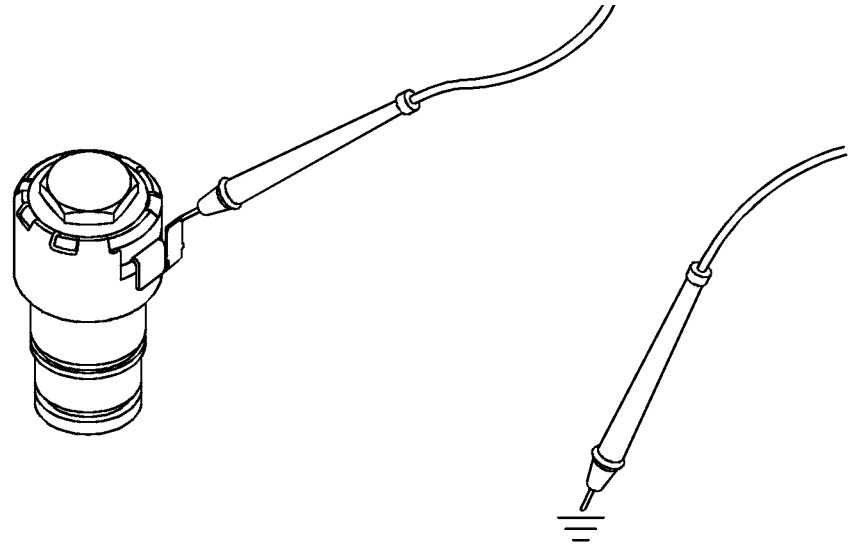
STEP 4C: Check the motor brake solenoids for a short to ground. Conditions:

- Turn the ignition key off.
- Disconnect the motor harness from the motor-brake connector.
- Remove the valve cover from the engine.
- Disconnect the motor brake wiring harness from solenoids 1 and 2.

Action	Specifications / Repair	Next step
Check the resistance of solenoids number 1 and number 2. • Using a multimeter, measure the resistance between the terminal of solenoid number 1 of the engine harness solenoid and the mass of the engine block. • Using a multimeter, measure the resistance between the terminal of solenoid number 2 of the engine harness solenoid and the mass of the engine block. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	5 ohms or more? **YES**	5A
	5 ohms or more? **DO NOT** **REPAIR:** Replace the motor brake solenoid. Refer to Procedure 020-012 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266.	5A



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STEP 5: Clear the fault codes.

STEP 5A: Disable the fault code. Conditions:

- Connect all components.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Keep the ignition key in the OFF position for 30 seconds. • Turn on the ignition key. • Use INSITE ™ to check if the Fault Code is inactive. **NOTE:** For Fault Code 1117 to become inactive, ECM must undergo a complete shutdown.	Fault code 1117 inactive? **YES**	5B
	Fault code 1117 inactive? **DO NOT** **REPAIR:** Perform the troubleshooting steps or consult your local Cummins Authorized Service Station after checking and completing all diagnostic steps again.	1A

STEP 5B: Clear the inactive fault codes. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

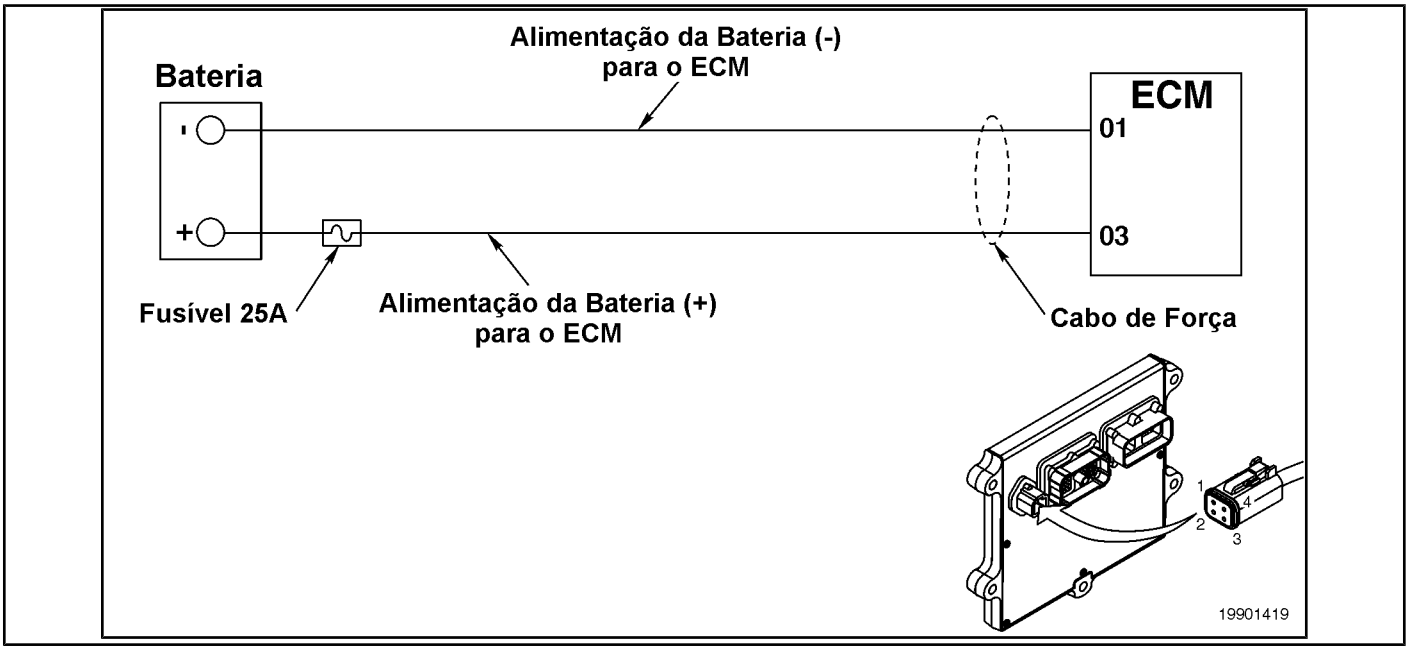
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Using INSITE ™, clear the inactive fault codes.	All codes cleared? **YES**	Complete repair
	All codes cleared? **DO NOT** **REPAIR:** Troubleshoot any other active fault code.	Proper troubleshooting and repair steps

Fault Code 1117 (Marine Applications)

Power Loss without Ignition Shutdown - Invalid, Intermittent or Incorrect

CODES	REASON	IT IS MADE
Fault Code: 1117 PID (P), SID (S): S251 IMF: 2/2 Lamp: No SRT:	Power Loss without Ignition Shutdown - Invalid, Intermittent or Incorrect Data The supply voltage to the ECM dropped below +6.2 volts momentarily, or the ECM **no** has been shut down correctly (retain the battery voltage for 30 seconds after turning off the ignition key).	Possibly no noticeable performance effect, either the engine will "die" or a manual start will be required. Fault information, travel information and maintenance monitor data may be inaccurate.

Unchanged Battery Power



Circuit Descriptions:

The ECM receives constant voltage from the batteries through non-switched wires that are connected directly to the positive (+) terminal of the batteries. The ECM receives information from the non-switched battery by wiring the vehicle's ignition key when it is switched on (ON position).

Component Location:

The ECM is connected to the battery by the OEM wiring harness via the ECM battery power screw. This provides a constant source of energy for the ECM. The location of the battery varies by OEM. Refer to the OEM's troubleshooting and repair manual.

Workshop Tips:

This fault is made active if the ECM battery voltage drops below +6.2 volts while the ignition key is in the ON position.

Make sure that the ECM battery's non-switched power is supplied directly from the battery and **no**
by the starter. If the starter is providing unswitched power, it is possible that the battery voltage will drop to a low enough level during the start-up rotation to make this fault active. This failure can also be caused by resistance in the (+) or (-) battery supply circuits of the ECM. The resistance in these circuits can cause the voltage level at the ECM input to drop to a low enough value to make Fault Code 1117 active.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it. To reduce the possibility of damage to the pins and the harness, use the following test cable when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3164133 - Deutsch /

AMP / Metri-Pack female test lead. STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check the batteries and the power connector.		
STEP 1A: Check the batteries and the power connector.	**Tight, corrosion-free connections?**	
STEP 1B: Check the battery voltage.	**Normal conditions: At least (+) 12 VDC [(+) 24 VDC for 24 volt systems]; During Start Spin: At least (+) 6.2 VDC?**	
STEP 2: Check the OEM wiring harness.		
STEP 2A: Inspect the harness and ECM connector pins.	**Dirty or damaged pins?**	
STEP 2B: Check for a circuit open in the battery supply circuit.	**At least (+) 10 VDC [(+) 20 VDC for 24 volt systems]?**	
STEP 2B-1: Make sure the OEM fuse is installed correctly.	**Fuse installed correctly?**	
STEP 2B-2: Check that the fuse in the OEM is burnt out.	**Is the fuse blown?**	
STEP 2B-3: Check the wiring complementary or accessory in the positive (+) terminal of the battery.	**Any damaged wire?**	
STEP 2C: Check the resistance of the battery power circuit.	**Less than 1.0 ohms?**	
STEP 2D: Check the wire of the ignition input to ECM.	**Ignition key input wire uninterrupted?**	
STEP 2E: Check the input circuit the ignition key.	**Less than 5 ohms?**	
STEP 3: Check the engine harness.		
STEP 3A: Check the connector pins engine harness and ECM.	**Dirty or damaged pins?**	
STEP 4: Clear the fault codes.		
STEP 4A: Disable the fault code.	**Fault code 1117 inactive?**	
STEP 4B: Clear the fault codes inactive.	**All codes cleared?**	

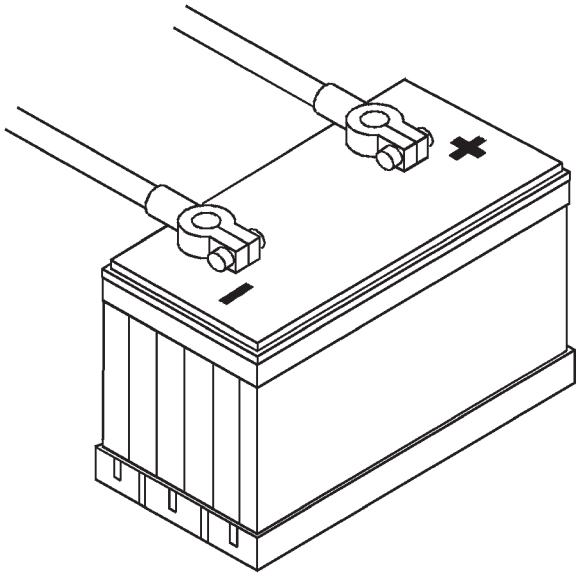
FAULT DIAGNOSTIC STEP

STEP 1: Check the batteries and the power connector.

STEP 1A: Check the batteries and the power connector. Conditions:

- Turn the ignition key off.

Action	Specifications / Repair	Next step
Check the battery connections. • Check the connections at the battery terminals.	Tight, corrosion-free connections? **YES**	1B
	Tight, corrosion-free connections? **DO NOT** **REPAIR:** Tighten the connections. Tighten loose connections and clean the terminals. Refer to the OEM's troubleshooting and repair manual.	4A

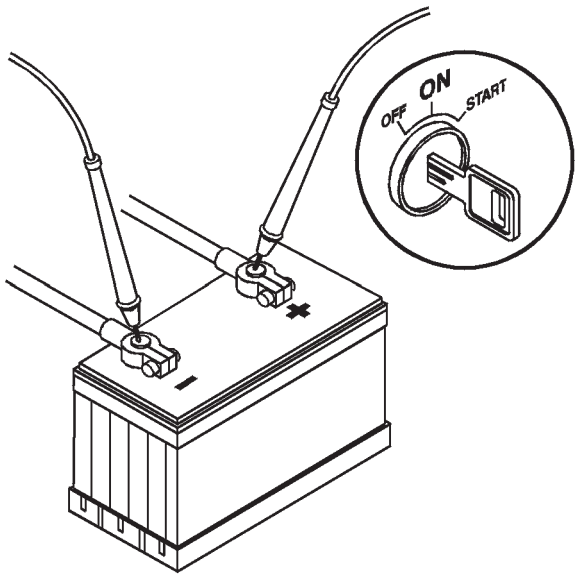


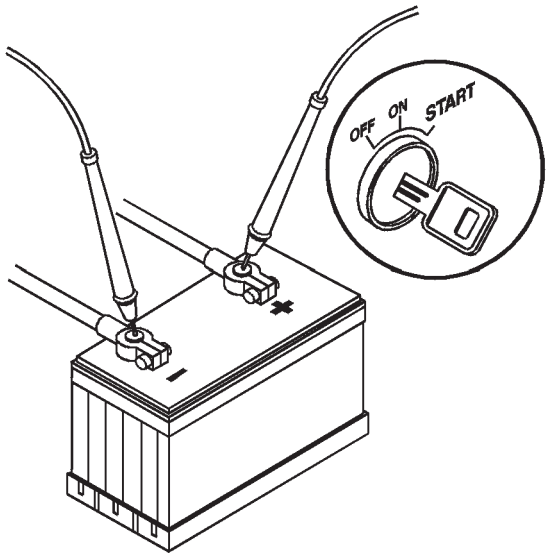
19c00460

STEP 1B: Check the battery voltage. Conditions:

- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check the battery voltage. • Place the positive (+) probe on the multimeter on the positive battery terminal and touch the negative (-) probe on the negative battery terminal while trying to start the engine.	Normal conditions: At least (+) 12 VDC [(+) 24 VDC for 24 volt systems]; During Start Spin: At least (+) 6.2 VDC? **YES**	2A
	Normal conditions: At least (+) 12 VDC [(+) 24 VDC for 24 volt systems]; During Start Spin: At least (+) 6.2 VDC? **DO NOT** **REPAIR:** Charge or replace the battery. Refer to the OEM's troubleshooting and repair manual.	4A





19c00454

STEP 2: Check the OEM wiring harness.

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

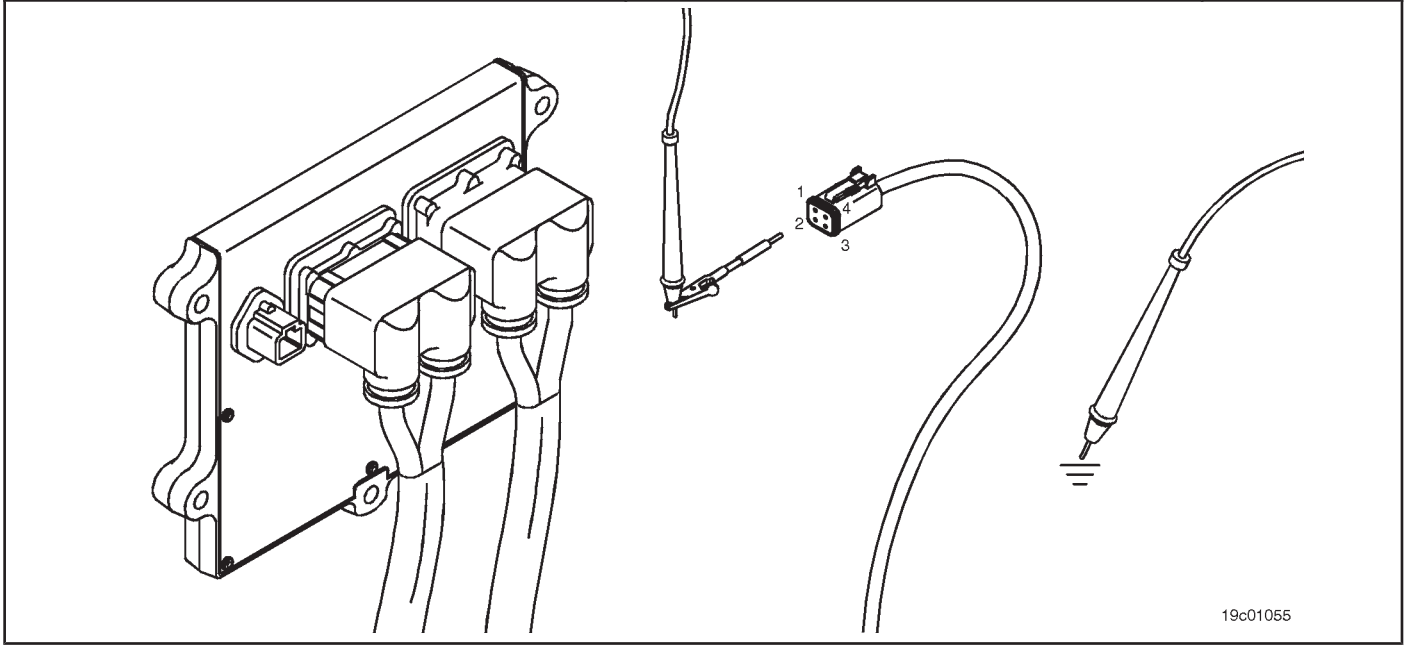
Conditions:
- Turn the ignition key off.
- Disconnect the OEM power harness connector from the ECM.

Action	Specifications / Repair	Next step
Inspect the pins on the ECM harness connectors and check for: • Loose connector • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Damaged or missing connector seals • Dirt or debris on the connector pins • Damage to the wire shield • Connector cover broken. • Damage to the connector locking tab. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-071 .	4A
	Dirty or damaged pins? **NO**	2B

STEP 2B: Check for an open circuit in the battery supply circuit. Conditions:

- Turn the ignition key off.
- Disconnect the ECM battery power connector on the engine harness from the ECM.

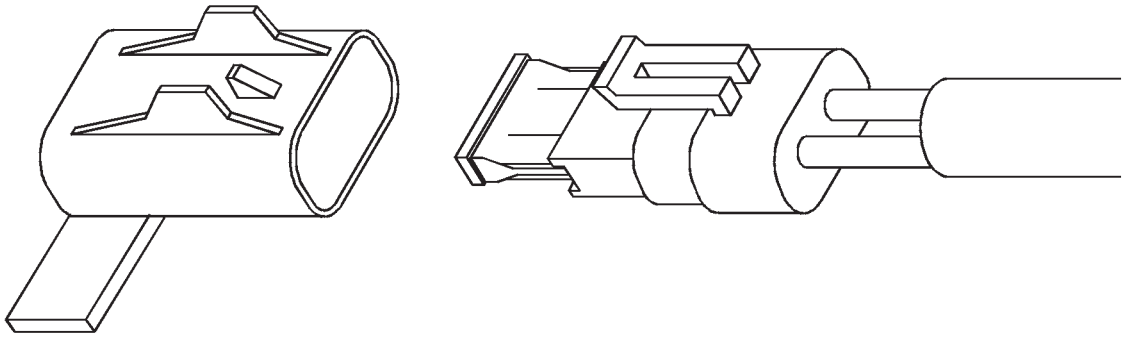
Action	Specifications / Repair	Next step
Check for an open circuit in the battery supply circuits. • Using a multimeter, measure the voltage between the ECM battery power pin (+) on the ECM battery power connector on the engine harness and the engine block ground. Refer to the electrical diagram for identification of the connector pins.	At least (+) 10 VDC [(+) 20 VDC for 24 volt systems]? **YES**	2C
	At least (+) 10 VDC [(+) 20 VDC for 24 volt systems]? **NO**	2B-1



STEP 2B-1: Make sure the OEM fuse is installed correctly. Conditions:

- Turn the ignition key off.

Action	Specifications / Repair	Next step
Check that the OEM fuse installation is correct.	Fuse installed correctly? **YES**	2B-2
	Fuse installed correctly? **DO NOT** **REPAIR:** Install the fuse correctly. See the Procedure 019-198 .	4A

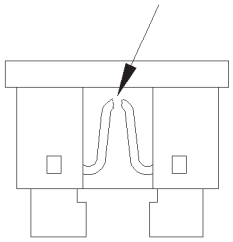


19c00455

STEP 2B-2: Check if the OEM's fuse is blown. Conditions:

- Turn the ignition key off.

Action	Specifications / Repair	Next step
Make sure that the OEM fuse is not blown.	Is the fuse blown? **YES** **Repair:** Locate the short circuit. Repair or replace the OEM harness. See the Procedure 019-071 . Replace the blown fuse (or fuses). See the Procedure 019-198 .	4A
	Is the fuse blown? **NO**	2B-3



19800238

STEP 2B-3: Check the complementary or accessory wiring at the positive (+) terminal of the battery. Conditions:

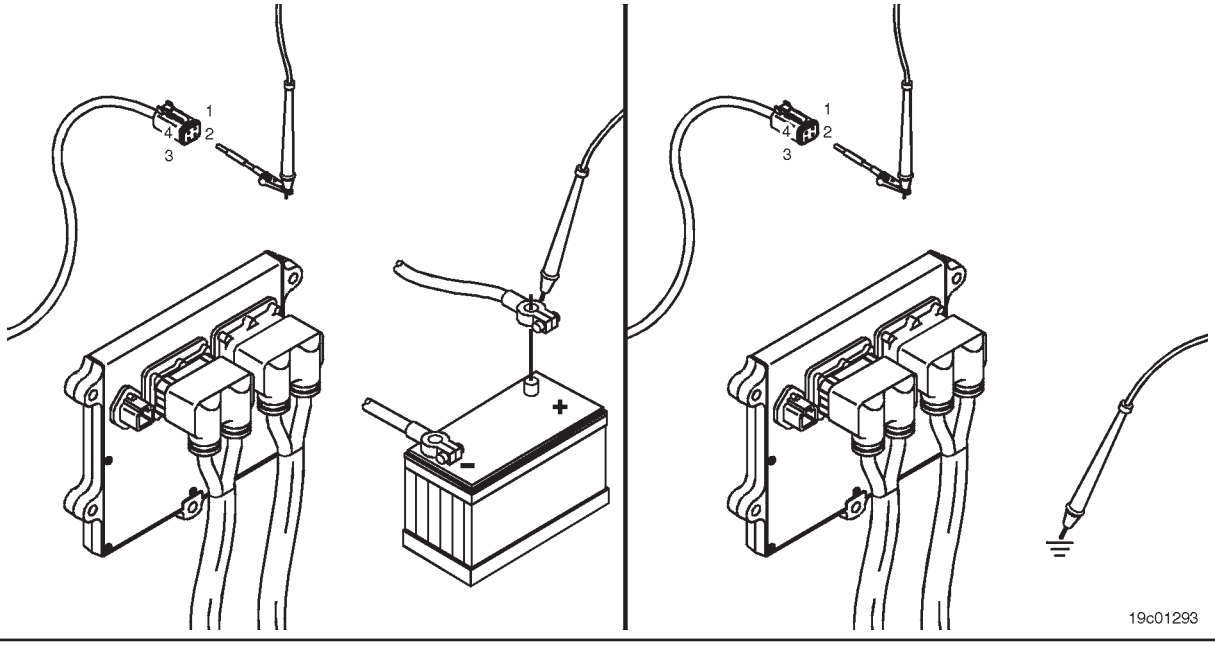
- Turn the ignition key off.

Action	Specifications / Repair	Next step
Check the complementary or accessory wiring at the positive (+) terminal of the battery. • Starting with the positive (+) terminal, follow any complementary or accessory wiring and check for damaged insulation or installation errors that may cause a short between the power cord and the motor block.	Any damaged wire? **YES** **Repair:** Repair or replace damaged wiring.	4A
	Any damaged wire? **DO NOT** **REPAIR:** Repair or replace the OEM wiring harness between the OEM power connector and the batteries.	4A

STEP 2C: Check the resistance of the battery supply circuit. Conditions:

- Turn the ignition key off.
- Disconnect the ECM battery power connector on the engine harness from the ECM.
- Disconnect the positive battery terminal.
- Digital multimeter set to low resistance mode and calibrated to zero.

Action	Specifications / Repair	Next step
Check the resistance of the battery supply circuit. • Measure the resistance between the ECM battery POWER (+) pin on the engine harness ECM battery power connector and the positive battery connector. • Measure the resistance between the ECM battery POWER (-) pin on the engine harness ECM battery power connector and the negative battery connector. Refer to the electrical diagram for identification of the connector pins. **NOTE:** As resistance in the battery supply circuit it is usually very low, it is necessary to use a digital multimeter calibrated to zero in the low resistance setting for the accurate measurement of the circuit resistance. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	Less than 1.0 ohms? **YES**	2D
	Less than 1.0 ohms? **DO NOT** **REPAIR:** Repair or replace the ECM wiring harness. See the Procedure 019-071 .	4A



STEP 2D: Check the input ignition key wire to the ECM. Conditions:

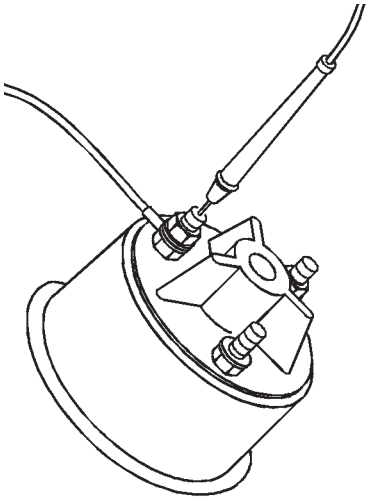
- Turn the ignition key off.

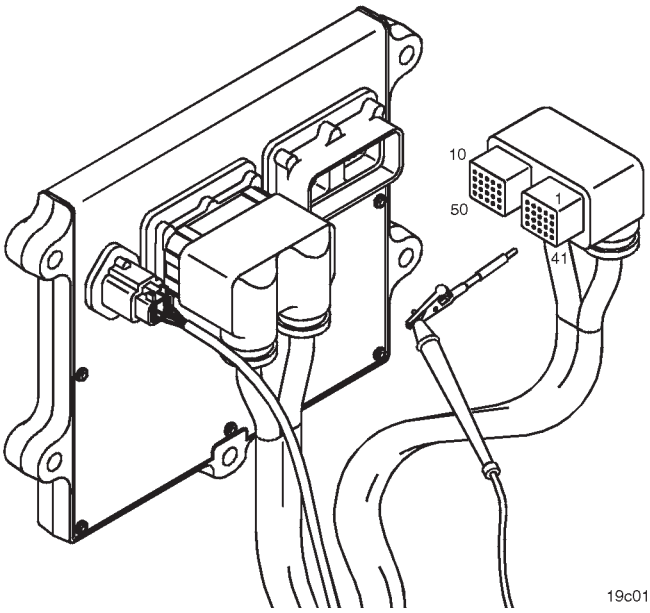
Action	Specifications / Repair	Next step
Inspect the ignition key input wire between the ignition key ignition terminal on the switch assembly and the ECM to make sure there are no breaks in the wire, that is, that there are no solenoids or relays.	Ignition key input wire uninterrupted? **YES** **Repair:** Repair the wiring so that the wire is not interrupted.	4A
	Ignition key input wire uninterrupted? **NO**	2E

STEP 2E: Check the ignition switch input circuit. Conditions:

- Turn the ignition key off.
- Disconnect the OEM harness connector from the ECM.

Action	Specifications / Repair	Next step
Check the ignition key input circuit. • Measure the resistance between the ignition terminal on the ignition key assembly and the ignition key input SIGN pin on the OEM harness connector. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	Less than 5 ohms? **YES**	3A
	Less than 5 ohms? **DO NOT** **REPAIR:** Repair or replace the OEM harness. See the Procedure 019-071 .	4A





STEP 3: Check the engine harness.

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

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.

Action	Specifications / Repair	Next step
Inspect the engine harness and ECM connector pins for: • Loose connector • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Damaged or missing connector seals • Dirt or debris on the connector pins • Damage to the wire shield • Connector cover broken. • Damage to the connector locking tab. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-043 .	4A
	Dirty or damaged pins? **NO**	4A

STEP 4: Clear the fault codes.

STEP 4A: Disable the fault code. Conditions:

- Connect all components.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Keep the ignition key in the OFF position for 30 seconds. • Turn on the ignition key. • Use INSITE ™ to check if the Fault Code is inactive. **NOTE:** For Fault Code 1117 to become inactive, ECM must undergo a complete shutdown.	Fault code 1117 inactive? **YES**	4B
	Fault code 1117 inactive? **DO NOT** **REPAIR:** The fault diagnosis procedures must be repeated from the beginning. A failure mode must have been detected.	1

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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

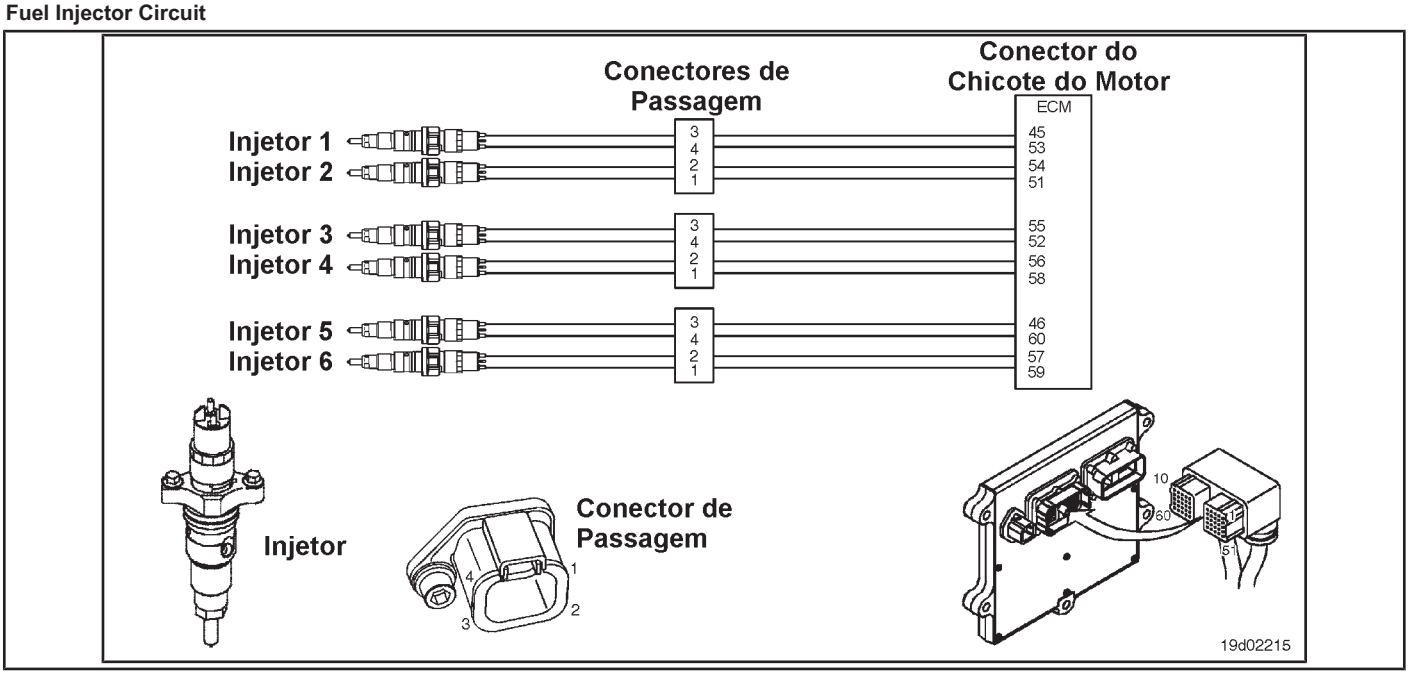
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Using INSITE ™, clear the inactive fault codes.	All codes cleared? **YES**	Complete repair
	All codes cleared? **DO NOT** **REPAIR:** Troubleshoot any other active fault code.	Proper troubleshooting and repair steps

Fault Code 1139

Cylinder Injector Solenoid Actuator - Mechanical System Does Not Respond Correctly or Out of Fit

CODES	REASON	IT IS MADE
Fault Code: 1139 PID (P), SID (S): S001 IMF: 7 Lamp: Amber SRT:	Cylinder Injector Solenoid Actuator 1 - Mechanical System Does Not Respond Correctly or Out of Adjustment. Unattended fuel supply detected in cylinder No. 1.	The engine will stop.

Fuel Injector Circuit



Circuit Descriptions:

The electronic control module (ECM) can detect when unattended fuel injection occurs by monitoring common rail pressure and engine speed. This fault code is recorded when the ECM determines that unattended fuel injection has occurred.

Component Location:

The fuel injector is located on the cylinder head. See the Procedure 100-002 for the detailed location of each component.

Workshop Tips:

This fault code can be caused by a defective or damaged injector providing continuous injection to the cylinder. Progressive damage to the cylinder may occur if the engine runs for an extended period in this condition. If a defective injector is determined to be the cause of this fault code, the cylinder liner and piston **should** inspected for progressive damage.

If an injector nozzle is cracked or stuck, continuous fuel injection into the cylinder will occur. If this condition occurs, the engine will shut down and **no** will start. There will be smoke emission from the exhaust during the

turning and no common rail pressure will be developed. Fault Code 2215 will become active during the start run if this condition exists.

SUMMARY OF FAULT DIAGNOSTICS

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check the Fault Code 1139 is registered.	**Are there active counts or high inactive Fault Code 1139 counts, and high engine crash?**	
STEP 2: Check the fuel system.		
STEP 2A: Check for a stuck injector in the open position.	**The engine crash is eliminated and Fault Code 1139 is inactive?**	
STEP 2A-1: Check for damage progressive on the cylinders.	**Does the measurement of gas blowing in the crankcase exceed the specified limit?**	
STEP 3: Clear the fault code.		
STEP 3A: Disable the fault code.	**Fault code 1139 inactive?**	
STEP 3B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Check that Fault Code 1139 is registered. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an inactive fault code. • Use the electronic service tool INSITE ™ to read fault codes.	Are there active counts or high inactive Fault Code 1139 counts, and high engine crash? **YES**	2A
	Are there active counts or high inactive Fault Code 1139 counts, and high engine crash? **NO**	3A

STEP 2: Check the fuel system.

STEP 2A: Check for an injector stuck in the open position. Conditions:

- Turn the ignition key off.

Action	Specifications / Repair	Next step
Check for an injector stuck in the open position. • Using the fuel system leak tester blocking tool, No. 3164325, block the flow of fuel to injector number 1. See Procedure 006-026 in the ISC Engine Troubleshooting and Repair Manual, QSC8.3 , ISL and QSL9, Bulletin 3653266 or ISB Series Engines and and ISB (Common Rail Fuel System), Bulletin 3653336. • Start the engine and let it run at idle for 1 minute.	The engine crash is eliminated and Fault Code 1139 is inactive? **YES** **Repair:** An injector nozzle stuck in the open position was detected. Replace the fuel injector. Refer to Procedure 006-026 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266 or ISB Series Engines and and ISB (Common Rail Fuel System), Bulletin 3653336.	2A-1
	The engine crash is eliminated and Fault Code 1139 is inactive? **NO**	Refer to the Motor Noise Symptom Diagram

STEP 2A-1: Check the cylinders for progressive damage. Conditions:

- Turn the ignition key off.
- Measure the blowing of gases in the engine crankcase. Refer to Procedure 014-002 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266 or ISB Series Engines and and ISB (Common Rail Fuel System), Bulletin 3653336.

Action	Specifications / Repair	Next step
It is possible that progressive damage to the engine will occur due to the defective injector. • Check for progressive damage. • Measure the blowing of gases in the engine crankcase.	Does the measurement of gas blowing in the crankcase exceed the specified limit? **YES** **Repair:** Check for progressive damage to the engine.	3A
	Does the measurement of gas blowing in the crankcase exceed the specified limit? **NO**	3A

STEP 3: Clear the fault code.

STEP 3A: Disable the fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Using the electronic service tool INSITE ™, make sure that the fault code is inactive.	Fault code 1139 inactive? **YES**	3B
	Fault code 1139 inactive? **NO**	1A

STEP 3B: Clear the inactive fault codes. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

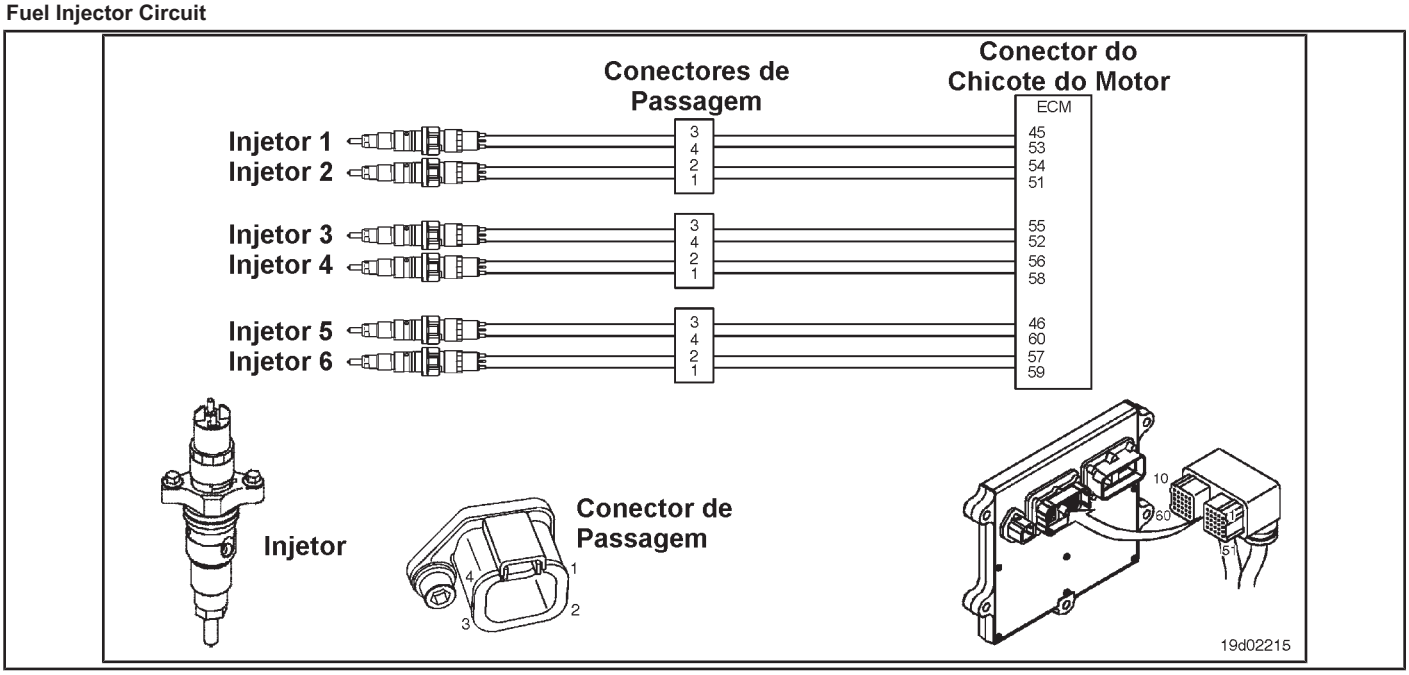
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YES**	Complete repair
	All codes cleared? **NO**	Proper troubleshooting and repair steps

Fault Code 1141

Cylinder 2 Injector Solenoid Driver - Mechanical System Does Not Respond Correctly or Out of Fit

CODES	REASON	IT IS MADE
Fault Code: 1141 PID (P), SID (S): S002 IMF: 7 Lamp: Amber SRT:	Cylinder 2 Injector Solenoid Actuator - Mechanical System Does Not Respond Correctly or Out of Adjustment. Unattended fuel supply detected in cylinder No. 2.	The engine will stop.

Fuel Injector Circuit



Circuit Descriptions:

The electronic control module (ECM) can detect when unattended fuel injection occurs by monitoring common rail pressure and engine speed. This fault code is recorded when the ECM determines that unattended fuel injection has occurred.

Component Location:

The fuel injector is located on the cylinder head. See the Procedure 100-002 for the detailed location of each component.

Workshop Tips:

This fault code can be caused by a defective or damaged injector providing continuous injection to the cylinder. Progressive damage to the cylinder may occur if the engine runs for an extended period in this condition. If a defective injector is determined to be the cause of this fault code, the cylinder liner and piston **should** inspected for progressive damage.

If an injector nozzle is cracked or stuck, continuous fuel injection into the cylinder will occur. If this condition occurs, the engine will shut down and **no** will start. There will be smoke emission from the exhaust during the

turning and no common rail pressure will be developed. Fault Code 2215 will become active during the start run if this condition exists.

SUMMARY OF FAULT DIAGNOSTICS

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check the Fault Code 1141 is registered.	**Are there active counts or high inactive Fault Code 1141 counts, and high engine crash?**	
STEP 2: Check the fuel system.		
STEP 2A: Check for a stuck injector in the open position.	**The engine crash is eliminated and Fault Code 1141 is inactive?**	
STEP 2A-1: Check for damage progressive on the cylinders.	**Does the measurement of gas blowing in the crankcase exceed the specified limit?**	
STEP 3: Clear the fault code.		
STEP 3A: Disable the fault code.	**Fault code 1141 inactive?**	
STEP 3B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Check that Fault Code 1141 is registered. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an inactive fault code. • Use the electronic service tool INSITE ™ to read fault codes.	Are there active counts or high inactive Fault Code 1141 counts, and high engine crash? **YES**	2A
	Are there active counts or high inactive Fault Code 1141 counts, and high engine crash? **NO**	3A

STEP 2: Check the fuel system.

STEP 2A: Check for an injector stuck in the open position. Conditions:

- Turn the ignition key off.

Action	Specifications / Repair	Next step
Check for an injector stuck in the open position. • Using the fuel system leak tester blocking tool, No. 3164325, block the flow of fuel to injector number 1. See Procedure 006-026 in the ISC Engine Troubleshooting and Repair Manual, QSC8.3 , ISL and QSL9, Bulletin 3653266 or ISB Series Engines and and ISB (Common Rail Fuel System), Bulletin 3653336. • Start the engine and let it run at idle for 1 minute.	The engine crash is eliminated and Fault Code 1141 is inactive? **YES** **Repair:** An injector nozzle stuck in the open position was detected. Replace the fuel injector. Refer to Procedure 006-026 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266 or ISB Series Engines and and ISB (Common Rail Fuel System), Bulletin 3653336.	2A-1
	The engine crash is eliminated and Fault Code 1141 is inactive? **NO**	Refer to the Motor Noise Symptom Diagram

STEP 2A-1: Check the cylinders for progressive damage. Conditions:

- Turn the ignition key off.
- Measure the blowing of gases in the engine crankcase. Refer to Procedure 014-002 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266 or ISB Series Engines and and ISB (Common Rail Fuel System), Bulletin 3653336.

Action	Specifications / Repair	Next step
It is possible that progressive damage to the engine will occur due to the defective injector. • Check for progressive damage. • Measure the blowing of gases in the engine crankcase.	Does the measurement of gas blowing in the crankcase exceed the specified limit? **YES** **Repair:** Check for progressive damage to the engine.	3A
	Does the measurement of gas blowing in the crankcase exceed the specified limit? **NO**	3A

STEP 3: Clear the fault code.

STEP 3A: Disable the fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Using the electronic service tool INSITE ™, make sure that the fault code is inactive.	Fault code 1141 inactive? **YES**	3B
	Fault code 1141 inactive? **NO**	1A

STEP 3B: Clear the inactive fault codes. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

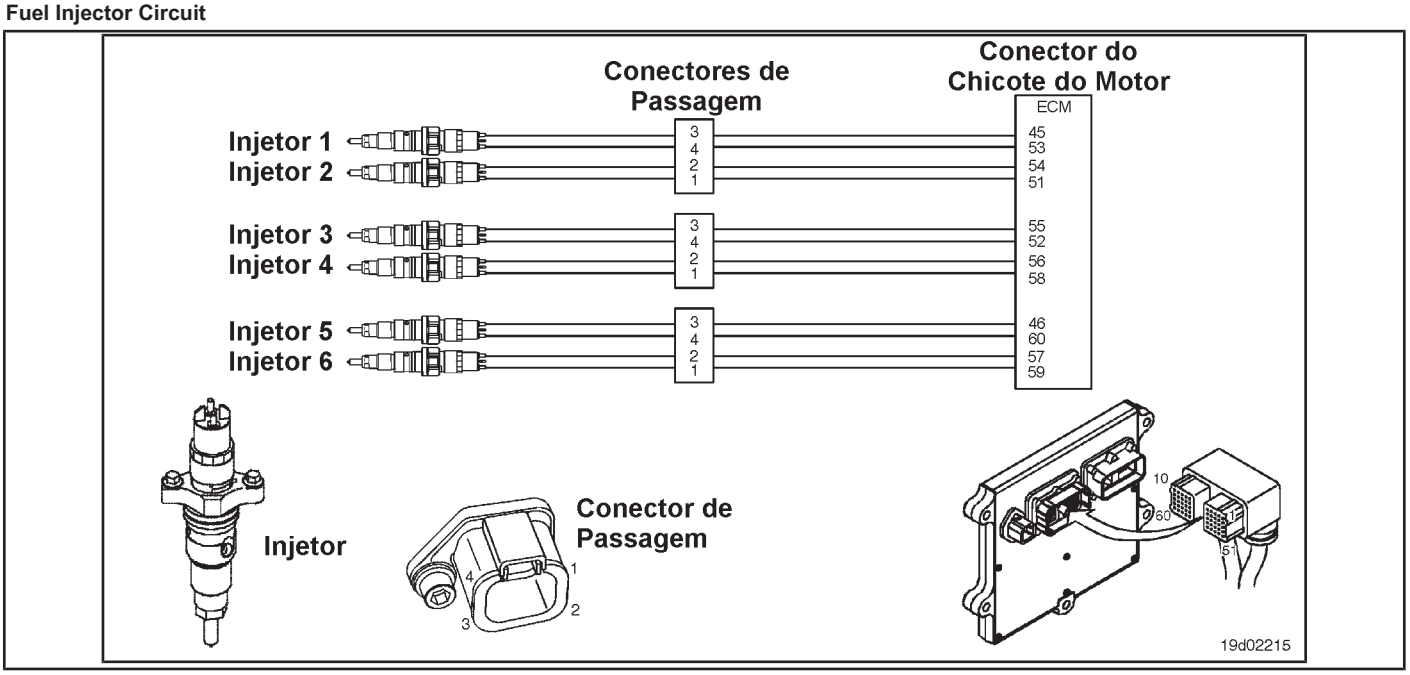
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YES**	Complete repair
	All codes cleared? **NO**	Proper troubleshooting and repair steps

Fault Code 1142

Cylinder 3 Injector Solenoid Actuator - Mechanical System Does Not Respond Correctly or Out of Fit

CODES	REASON	IT IS MADE
Fault Code: 1142 PID (P), SID (S): S003 IMF: 7 Lamp: Amber SRT:	Cylinder Injector Solenoid Actuator 3 - Mechanical System DOES NOT Respond Correctly or Out of Adjustment. Unattended fuel supply in cylinder No. 3 detected.	The engine will stop.

Fuel Injector Circuit



Circuit Descriptions:

The electronic control module (ECM) can detect when unattended fuel injection occurs by monitoring common rail pressure and engine speed. This fault code is recorded when the ECM determines that unattended fuel injection has occurred.

Component Location:

The fuel injector is located on the cylinder head. See the Procedure 100-002 for the detailed location of each component.

Workshop Tips:

This fault code can be caused by a defective or damaged injector providing continuous injection to the cylinder. Progressive damage to the cylinder may occur if the engine runs for an extended period in this condition. If a defective injector is determined to be the cause of this fault code, the cylinder liner and piston **should** inspected for progressive damage.

If an injector nozzle is cracked or stuck, continuous fuel injection into the cylinder will occur. If this condition occurs, the engine will shut down and **no** will start. There will be smoke emission from the exhaust during the

turning and no common rail pressure will be developed. Fault Code 2215 will become active during the start run if this condition exists.

SUMMARY OF FAULT DIAGNOSTICS

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check the Fault Code 1142 is registered.	**Are there active counts or high inactive Fault Code 1142 counts, and high engine crash?**	
STEP 2: Check the fuel system.		
STEP 2A: Check for a stuck injector in the open position.	**The engine crash is eliminated and Fault Code 1142 is inactive?**	
STEP 2A-1: Check for damage progressive on the cylinders.	**Does the measurement of gas blowing in the crankcase exceed the specified limit?**	
STEP 3: Clear the fault code.		
STEP 3A: Disable the fault code.	**Fault code 1142 inactive?**	
STEP 3B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Check that Fault Code 1142 is registered. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an inactive fault code. • Use the electronic service tool INSITE ™ to read fault codes.	Are there active counts or high inactive Fault Code 1142 counts, and high engine crash? **YES**	2A
	Are there active counts or high inactive Fault Code 1142 counts, and high engine crash? **NO**	3A

STEP 2: Check the fuel system.

STEP 2A: Check for an injector stuck in the open position. Conditions:

- Turn the ignition key off.

Action	Specifications / Repair	Next step
Check for an injector stuck in the open position. • Using the fuel system leak tester blocking tool, No. 3164325, block the flow of fuel to injector number 3. See Procedure 006-026 in the ISC Engine Troubleshooting and Repair Manual, QSC8.3 , ISL and QSL9, Bulletin 3653266 or ISB Series Engines and and ISB (Common Rail Fuel System), Bulletin 3653336. • Start the engine and let it run at idle for 1 minute.	The engine crash is eliminated and Fault Code 1142 is inactive? **YES** **Repair:** An injector nozzle stuck in the open position was detected. Replace the fuel injector. Refer to Procedure 006-026 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266 or ISB Series Engines and and ISB (Common Rail Fuel System), Bulletin 3653336.	2A-1
	The engine crash is eliminated and Fault Code 1142 is inactive? **NO**	Refer to the Motor Noise Symptom Diagram

STEP 2A-1: Check the cylinders for progressive damage. Conditions:

- Turn the ignition key off.
- Measure the blowing of gases in the engine crankcase. Refer to Procedure 014-002 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266 or ISB Series Engines and and ISB (Common Rail Fuel System), Bulletin 3653336.

Action	Specifications / Repair	Next step
It is possible that progressive damage to the engine will occur due to the defective injector. • Check for progressive damage. • Measure the blowing of gases in the engine crankcase.	Does the measurement of gas blowing in the crankcase exceed the specified limit? **YES** **Repair:** Check for progressive damage to the engine.	3A
	Does the measurement of gas blowing in the crankcase exceed the specified limit? **NO**	3A

STEP 3: Clear the fault code.

STEP 3A: Disable the fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Using the electronic service tool INSITE ™, make sure that the fault code is inactive.	Fault code 1142 inactive? **YES**	3B
	Fault code 1142 inactive? **NO**	1A

STEP 3B: Clear the inactive fault codes. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

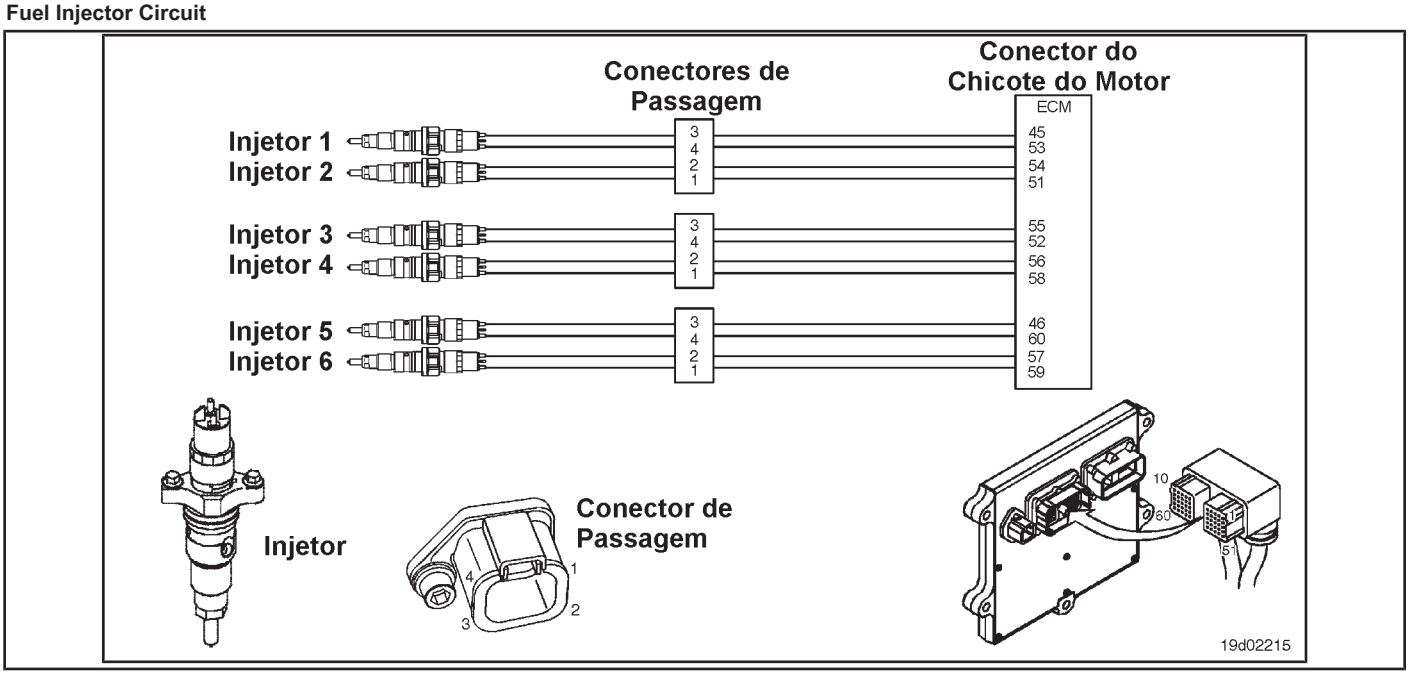
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YES**	Complete repair
	All codes cleared? **NO**	Proper troubleshooting and repair steps

Fault Code 1143

Cylinder 4 Injector Solenoid Driver - Mechanical System Does Not Respond Correctly or Out of Fit

CODES	REASON	IT IS MADE
Fault Code: 1143 PID (P), SID (S): S004 IMF: 7 Lamp: Amber SRT:	Cylinder Injector Solenoid Actuator 4 - Mechanical System Does Not Respond Correctly or Out of Adjustment. Unattended fuel supply in cylinder No. 4 detected.	The engine will stop.

Fuel Injector Circuit



Circuit Descriptions:

The electronic control module (ECM) can detect when unattended fuel injection occurs by monitoring common rail pressure and engine speed. This fault code is recorded when the ECM determines that unattended fuel injection has occurred.

Component Location:

The fuel injector is located on the cylinder head. See the Procedure 100-002 for the detailed location of each component.

Workshop Tips:

This fault code can be caused by a defective or damaged injector providing continuous injection to the cylinder. Progressive damage to the cylinder may occur if the engine runs for an extended period in this condition. If a defective injector is determined to be the cause of this fault code, the cylinder liner and piston **should** inspected for progressive damage.

If an injector nozzle is cracked or stuck, continuous fuel injection into the cylinder will occur. If this condition occurs, the engine will shut down and **no** will start. There will be smoke emission from the exhaust during the

turning and no common rail pressure will be developed. Fault Code 2215 will become active during the start run if this condition exists.

SUMMARY OF FAULT DIAGNOSTICS

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check the Fault Code 1143 is registered.	**Are there active counts or high inactive Fault Code counts 1143, and high engine crash?**	
STEP 2: Check the fuel system.		
STEP 2A: Check for a stuck injector in the open position.	**The engine crash is eliminated and Fault Code 1143 is inactive?**	
STEP 2A-1: Check for damage progressive on the cylinders.	**Does the measurement of gas blowing in the crankcase exceed the specified limit?**	
STEP 3: Clear the fault code.		
STEP 3A: Disable the fault code.	**Fault code 1143 inactive?**	
STEP 3B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Check that Fault Code 1143 is registered. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an inactive fault code. • Use the electronic service tool INSITE ™ to read fault codes.	Are there active counts or high inactive Fault Code counts 1143, and high engine crash? **YES**	2A
	Are there active counts or high inactive Fault Code counts 1143, and high engine crash? **NO**	3A

STEP 2: Check the fuel system.

STEP 2A: Check for an injector stuck in the open position. Conditions:

- Turn the ignition key off.

Action	Specifications / Repair	Next step
Check for an injector stuck in the open position. • Using the fuel system leak tester blocking tool, No. 3164325, block the flow of fuel to injector number 4. See Procedure 006-026 in the ISC Engine Troubleshooting and Repair Manual, QSC8.3 , ISL and QSL9, Bulletin 3653266 or ISB Series Engines and and ISB (Common Rail Fuel System), Bulletin 3653336. • Start the engine and let it run at idle for 1 minute.	The engine crash is eliminated and Fault Code 1143 is inactive? **YES** **Repair:** An injector nozzle stuck in the open position was detected. Replace the fuel injector. Refer to Procedure 006-026 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266 or ISB Series Engines and and ISB (Common Rail Fuel System), Bulletin 3653336.	2A-1
	The engine crash is eliminated and Fault Code 1143 is inactive? **NO**	Refer to the Motor Noise Symptom Diagram

STEP 2A-1: Check the cylinders for progressive damage. Conditions:

- Turn the ignition key off.
- Measure the blowing of gases in the engine crankcase. Refer to Procedure 014-002 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266 or ISB Series Engines and and ISB (Common Rail Fuel System), Bulletin 3653336.

Action	Specifications / Repair	Next step
It is possible that progressive damage to the engine will occur due to the defective injector. • Check for progressive damage. • Measure the blowing of gases in the engine crankcase.	Does the measurement of gas blowing in the crankcase exceed the specified limit? **YES** **Repair:** Check for progressive damage to the engine.	3A
	Does the measurement of gas blowing in the crankcase exceed the specified limit? **NO**	3A

STEP 3: Clear the fault code.

STEP 3A: Disable the fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Using the electronic service tool INSITE ™, make sure that the fault code is inactive.	Fault code 1143 inactive? **YES**	3B
	Fault code 1143 inactive? **NO**	1A

STEP 3B: Clear the inactive fault codes. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

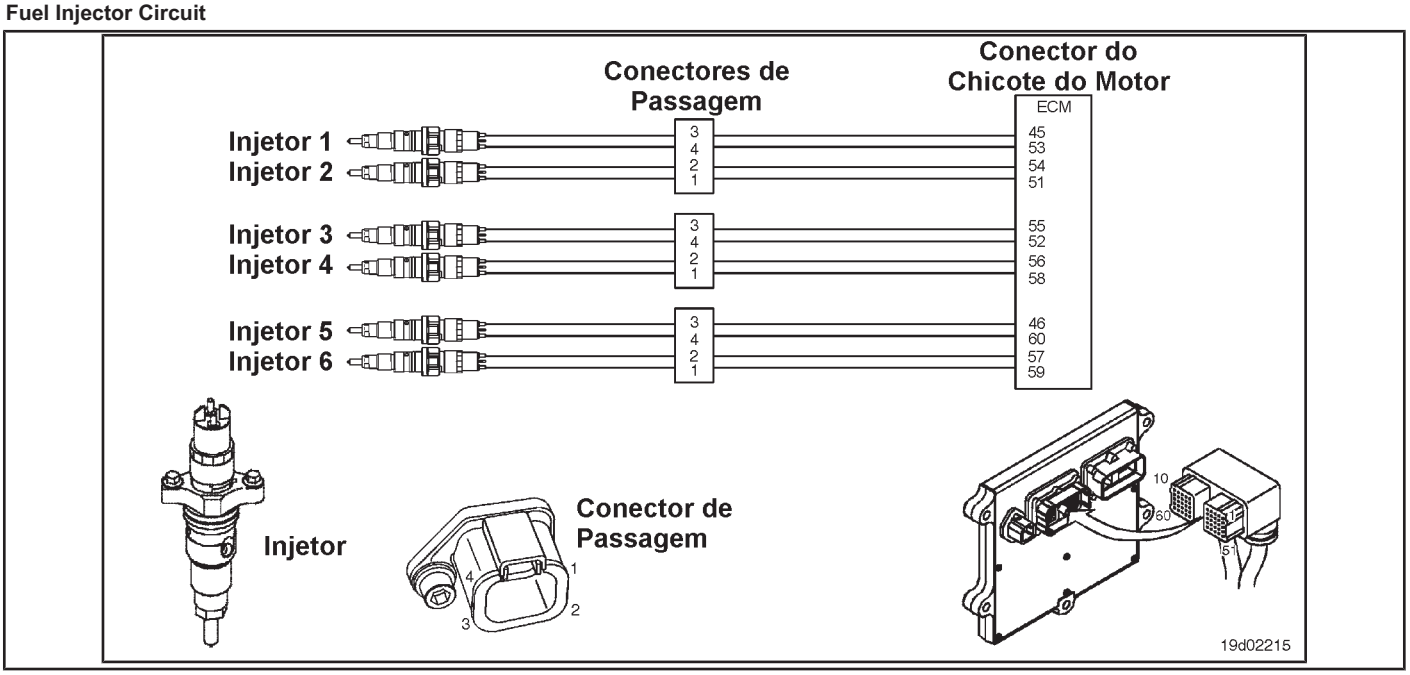
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YES**	Complete repair
	All codes cleared? **NO**	Proper troubleshooting and repair steps

Fault Code 1144

Cylinder 5 Injector Solenoid Driver - Mechanical System Does Not Respond Correctly or Out of Fit

CODES	REASON	IT IS MADE
Fault Code: 1144 PID (P), SID (S): S005 IMF: 7 Lamp: Amber SRT:	Cylinder 5 Injector Solenoid Actuator - Mechanical System No Responds Correctly or Out of Fit. Unattended fuel supply detected in Cylinder No. 5.	The engine will stop.

Fuel Injector Circuit



Circuit Descriptions:

The electronic control module (ECM) can detect when unattended fuel injection occurs by monitoring common rail pressure and engine speed. This fault code is recorded when the ECM determines that unattended fuel injection has occurred.

Component Location:

The fuel injector is located on the cylinder head. See the Procedure 100-002 for the detailed location of each component.

Workshop Tips:

This fault code can be caused by a defective or damaged injector providing continuous injection. If an injector nozzle is cracked or stuck in the open position, continuous fuel injection into the cylinder will occur. If this condition exists, an engine crash will be heard and the engine may stop and no start. In addition, the low pressure on the common rail and the excessive smoke emission will be verified in starting conditions. If a defective injector is found to be the cause of this fault code, progressive damage to the combustion chamber may occur.

SUMMARY OF FAULT DIAGNOSTICS

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check the Fault Code 1144 is registered.	**Are there active counts or high inactive Fault Code 1144 counts, excessive smoke emission and high engine crash?**	
STEP 2: Check the fuel system.		
STEP 2A: Check for a stuck injector in the open position.	**Engine crash occurs, excessive smoke emission is eliminated and Fault Code 1144 is inactive?**	
STEP 2A-1: Check for damage progressive on the cylinders. Measure the blowing of gases in the engine crankcase.	**Is the measurement of the blowing in the engine crankcase within the specified limit?**	
STEP 3: Clear the fault code.		
STEP 3A: Disable the fault code.	**Fault code 1144 inactive?**	
STEP 3B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Check that Fault Code 1144 is registered. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an inactive fault code. • Use the electronic service tool INSITE ™ to read fault codes.	Are there active counts or high inactive Fault Code 1144 counts, excessive smoke emission and high engine crash? **YES**	2A
	Are there active counts or high inactive Fault Code 1144 counts, excessive smoke emission and high engine crash? **NO**	3A

STEP 2: Check the fuel system.

STEP 2A: Check for an injector stuck in the open position. Conditions:

- Turn the ignition key off.

Action	Specifications / Repair	Next step
Check for an injector stuck in the open position. • Using the fuel system leak tester blocking tool, No. 3164325, block the flow of fuel to injector number 5. See Procedure 006-026 in the ISC Engine Troubleshooting and Repair Manual, QSC8.3 , ISL and QSL9, Bulletin 3653266, or ISB Series Engines and and ISB (Common Rail Fuel System), Bulletin 3653336. • Start the engine and let it run at idle for 1 minute.	Engine crash occurs, excessive smoke emission is eliminated and Fault Code 1144 is inactive? **YES** **Repair:** An injector nozzle stuck in the open position was detected. Replace the fuel injector. Refer to Procedure 006-026 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266, or ISB Series Engines and and ISB (Common Rail Fuel System), Bulletin 3653336.	2A-1
	Engine crash occurs, excessive smoke emission is eliminated and Fault Code 1144 is inactive? **NO**	Refer to the Motor Noise Symptom Diagram

STEP 2A-1: Check the cylinders for progressive damage. Conditions:

- Turn the ignition key off.
- Measure the blowing of gases in the engine crankcase. Refer to Procedure 014-002 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266, or ISB Series Engines and and ISB (Common Rail Fuel System), Bulletin 3653336.

Action	Specifications / Repair	Next step
It is possible that progressive damage to the engine will occur due to the defective injector. • Check for progressive damage. • Measure the blowing of gases in the engine crankcase.	Does the measurement of gas blowing in the crankcase exceed the specified limit? **YES** **Repair:** Check for progressive damage.	3A
	Does the measurement of gas blowing in the crankcase exceed the specified limit? **NO**	3A

STEP 3: Clear the fault code.

STEP 3A: Disable the fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Using the electronic service tool INSITE ™, make sure that the fault code is inactive.	Fault code 1144 inactive? **YES**	3B
	Fault code 1144 inactive? **DO NOT** **REPAIR:** Return to the troubleshooting steps or consult your local Cummins Authorized Service Station after checking and completing all diagnostic steps again.	1A

STEP 3B: Clear the inactive fault codes. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

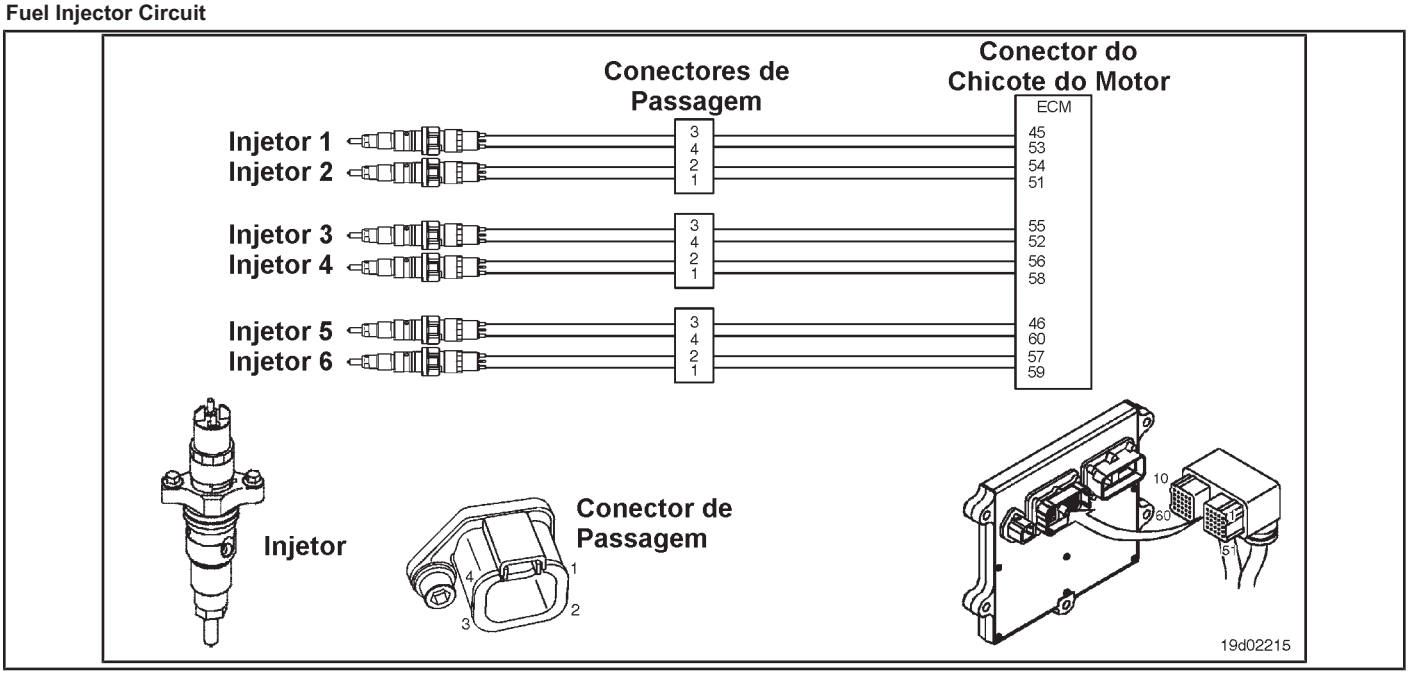
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear fault codes.	All codes cleared? **YES**	Complete repair
	All codes cleared? **DO NOT** **REPAIR:** Troubleshoot any other active fault code.	Proper troubleshooting and repair steps

Fault Code 1145

Cylinder 6 Injector Solenoid Driver - Mechanical System Does Not Respond Correctly or Out of Fit

CODES	REASON	IT IS MADE
Fault Code: 1145 PID (P), SID (S): S006 IMF: 7 Lamp: Amber SRT:	Cylinder Injector Solenoid Actuator 6 - Mechanical System DOES NOT Respond Correctly or Out of Adjustment. Unattended fuel supply detected in Cylinder No. 6.	The engine will stop.

Fuel Injector Circuit



Circuit Descriptions:

The electronic control module (ECM) can detect when unattended fuel injection occurs by monitoring common rail pressure and engine speed. This fault code is recorded when the ECM determines that unattended fuel injection has occurred.

Component Location:

The fuel injector is located on the cylinder head. See the Procedure 100-002 for the detailed location of each component.

Workshop Tips:

This fault code can be caused by a defective or damaged injector providing continuous injection. If an injector nozzle is cracked or stuck in the open position, continuous fuel injection into the cylinder will occur. If this condition exists, an engine crash will be heard and the engine may stop and no start. In addition, the low pressure on the common rail and the excessive smoke emission will be verified in starting conditions. If a defective injector is found to be the cause of this fault code, progressive damage to the combustion chamber may occur.

SUMMARY OF FAULT DIAGNOSTICS

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check the Fault Code 1145 is registered.	**Are there active counts or high inactive Fault Code 1145 counts, excessive smoke emission and high engine crash?**	
STEP 2: Check the fuel system.		
STEP 2A: Check for a stuck injector in the open position.	**The engine crashes, excessive smoke emission is eliminated and Fault Code 1145 is inactive?**	
STEP 2A-1: Check for damage progressive on the cylinders. Measure the blowing of gases in the engine crankcase.	**Is the measurement of the blowing in the engine crankcase within the specified limit?**	
STEP 3: Clear the fault code.		
STEP 3A: Disable the fault code.	**Fault code 1145 inactive?**	
STEP 3B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Check that Fault Code 1145 is registered. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an inactive fault code. • Use the electronic service tool INSITE ™ to read fault codes.	Are there active counts or high inactive Fault Code 1145 counts, excessive smoke emission and high engine crash? **YES**	2A
	Are there active counts or high inactive Fault Code 1145 counts, excessive smoke emission and high engine crash? **NO**	3A

STEP 2: Check the fuel system.

STEP 2A: Check for an injector stuck in the open position. Conditions:

- Turn the ignition key off.

Action	Specifications / Repair	Next step
Check for an injector stuck in the open position. • Using the fuel system leak tester blocking tool, No. 3164325, block the flow of fuel to injector number 6. See Procedure 006-026 in the ISC Engine Troubleshooting and Repair Manual, QSC8.3 , ISL and QSL9, Bulletin 3653266, or ISB Series Engines and and ISB (Common Rail Fuel System), Bulletin 3653336. • Start the engine and let it run at idle for 1 minute.	The engine crashes, excessive smoke emission is eliminated and Fault Code 1145 is inactive? **YES** **Repair:** An injector nozzle stuck in the open position was detected. Replace the fuel injector. Refer to Procedure 006-026 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266, or ISB Series Engines and and ISB (Common Rail Fuel System), Bulletin 3653336.	2A-1
	The engine crashes, excessive smoke emission is eliminated and Fault Code 1145 is inactive? **NO**	Refer to the Motor Noise Symptom Diagram

STEP 2A-1: Check the cylinders for progressive damage. Conditions:

- Turn the ignition key off.
- Measure the blowing of gases in the engine crankcase. Refer to Procedure 014-002 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266, or ISB Series Engines and and ISB (Common Rail Fuel System), Bulletin 3653336.

Action	Specifications / Repair	Next step
It is possible that progressive damage to the engine will occur due to the defective injector. • Check for progressive damage. • Measure the blowing of gases in the engine crankcase.	Does the measurement of gas blowing in the crankcase exceed the specified limit? **YES** **Repair:** Check for progressive damage.	3A
	Does the measurement of gas blowing in the crankcase exceed the specified limit? **NO**	3A

STEP 3: Clear the fault code.

STEP 3A: Disable the fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Using the electronic service tool INSITE ™, make sure that the fault code is inactive.	Fault code 1145 inactive? **YES**	3B
	Fault code 1145 inactive? **DO NOT** **REPAIR:** Return to the troubleshooting steps or consult your local Cummins Authorized Service Station after checking and completing all diagnostic steps again.	1A

STEP 3B: Clear the inactive fault codes. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

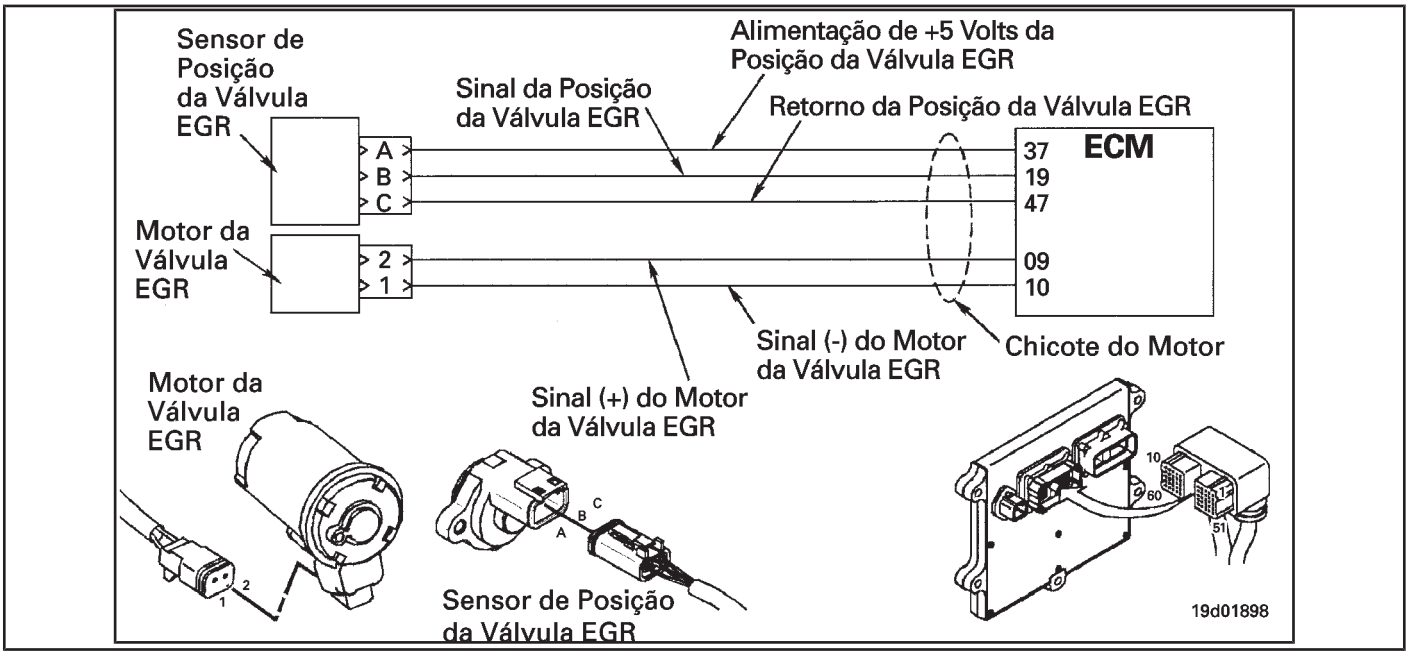
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YES**	Complete repair
	All codes cleared? **DO NOT** **REPAIR:** Troubleshoot any other active fault code.	Proper troubleshooting and repair steps

Fault Code 1228

EGR Valve Position - Invalid, Intermittent or Incorrect Data

CODES	REASON	IT IS MADE
Fault Code: 1228 PID (P), SID (S): P27 IMF: 2/2 Lamp: Amber SRT:	EGR Valve Position - Invalid, intermittent or incorrect data. The intermittent position information of the EGR valve is being received by the electronic control module (ECM).	Possible loss of power. The EGR valve will be closed.

EGR Valve Position Sensor Circuit



Circuit Descriptions:

The EGR valve position sensor provides a voltage signal to the electronic control module (ECM). The ECM converts this signal into a percentage value, from 0 to 100, indicating the position of the EGR valve. A fully open valve is equivalent to 100 Percent.

Component Location:

The EGR valve position sensor is located on the EGR valve assembly. See the Procedure 100-002 for the detailed location of each component.

Workshop Tips:

This fault code is caused by an internal failure of the EGR valve position sensor. This failure will result in incorrect readings of the EGR valve position.

SUMMARY OF FAULT DIAGNOSTICS

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Read the fault codes.		
STEP 1A: Check for fault codes.	**Other active or inactive fault codes?**	
STEP 1B: Check the Fault Code 1228 is registered.	**Fault Code 1228 active or inactive counts?**	
STEP 2: Clear the fault codes.		
STEP 2A: Disable the fault codes.	**Fault code 1228 inactive?**	
STEP 2B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Read the fault codes.

STEP 1A: Check for fault codes. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Use the electronic service tool INSITE ™ to read fault codes.	Other active or inactive fault codes? **YES**	Diagnose other fault codes
	Other active or inactive fault codes? **NO**	1B

STEP 1B: Check that Fault Code 1228 is registered. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Use the electronic service tool INSITE ™ to read fault codes.	Fault Code 1228 active or inactive counts? **YES** **Repair:** Replace the EGR position sensor. See the Procedure 019-372 .	2A
	Fault Code 1228 active or inactive counts? **NO**	2A

STEP 2: Clear the fault codes.

STEP 2A: Disable the fault codes. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Start the engine and let it run at idle for 1 minute. • Use the electronic INSITE ™ service tool to make sure Fault Code 1228 is inactive.	Fault code 1228 inactive? **YES**	2B
	Fault code 1228 inactive? **NO**	1A

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

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

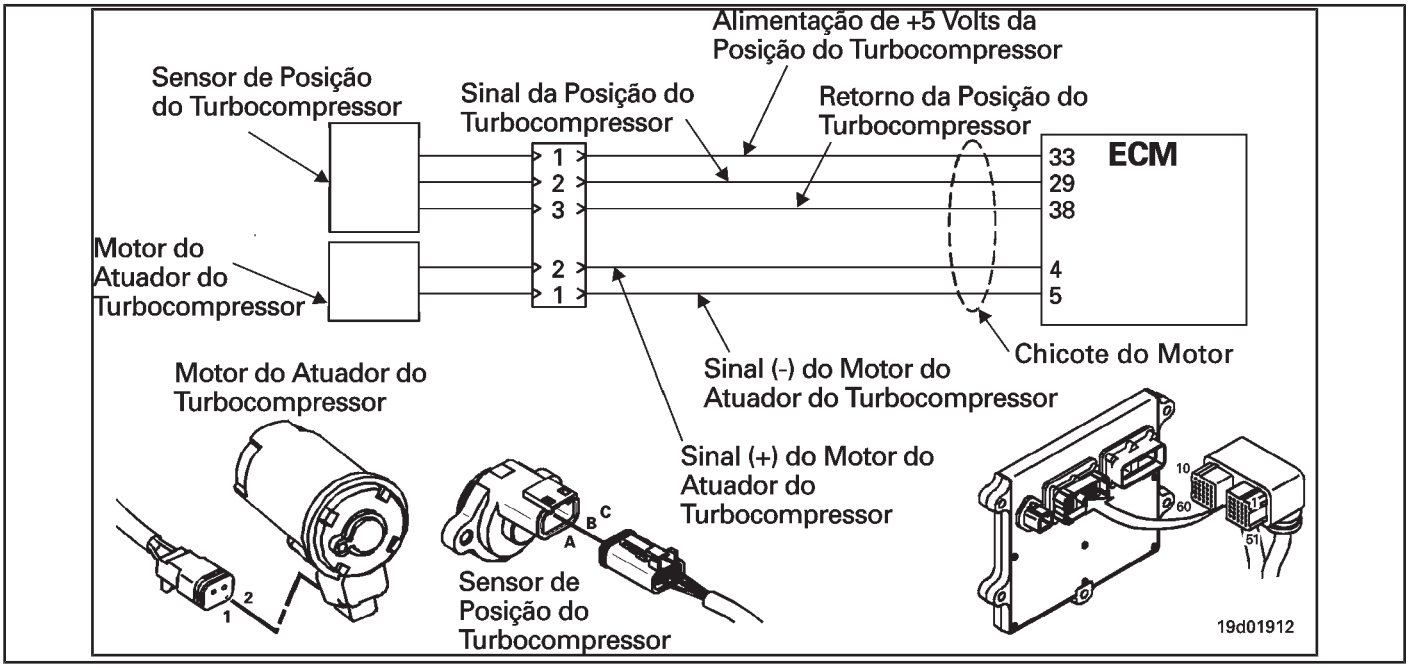
Action	Specifications / Repair	Next step
Clear fault codes using the electronic service tool INSITE ™.	All codes cleared? **YES**	Complete repair
	All codes cleared? **DO NOT** **REPAIR:** Troubleshoot any other active fault code.	Proper troubleshooting and repair steps

Fault Code 1229

TGV Position Sensor - Invalid, Intermittent or Incorrect Data

CODES	REASON	IT IS MADE
Fault Code: 1229 PID (P), SID (S): S27 IMF: 2/2 Lamp: Amber SRT:	TGV Position Sensor - Invalid, intermittent or incorrect data. The intermittent position information of the variable geometry turbocharger (TGV) is being received by the electronic control module (ECM).	Possible loss of power. The power to the turbocharger actuator will be limited.

Turbocharger Position Sensor Circuit



Circuit Descriptions:

The turbocharger's position sensor sends a voltage signal to the ECM. The ECM converts this signal into a percentage value, from 0 to 100 Percent, indicating the position of the turbocharger. A fully closed turbocharger actuator equals 100 Percent.

Component Location:

The turbocharger position sensor is located in the variable geometry (TGV) turbocharger actuator assembly. See the Procedure 100-002 for the detailed location of each component.

Workshop Tips:

This fault code is caused by an internal fault in the variable geometry turbocharger (TGV) position sensor. This failure will result in incorrect readings of the variable geometry turbocharger (TGV) position.

SUMMARY OF FAULT DIAGNOSTICS

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Read the fault codes.		
STEP 1A: Check for fault codes.	**Other active or inactive fault codes?**	
STEP 1B: Check the Fault Code 1229 is registered.	**Fault Code 1229 active or inactive counts?**	
STEP 2: Clear the fault codes.		
STEP 2A: Disable the fault codes.	**Fault code 1229 inactive?**	
STEP 2B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Read the fault codes.

STEP 1A: Check for fault codes. Conditions:

- Turn the ignition key on (ON position).
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Use the electronic service tool INSITE ™ to read fault codes.	Other active or inactive fault codes? **YES**	Diagnose other fault codes
	Other active or inactive fault codes? **NO**	1B

STEP 1B: Check that Fault Code 1229 is registered. Conditions:

- Turn the ignition key on (ON position).
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Use the electronic service tool INSITE ™ to read fault codes.	Fault Code 1229 active or inactive counts? **YES** **Repair:** Replace the variable geometry turbocharger (TGV) position sensor. See the Procedure 019-405 .	2A
	Fault Code 1229 active or inactive counts? **NO**	2A

STEP 2: Clear the fault codes.

STEP 2A: Disable the fault codes. Conditions:

- Turn the ignition key on (ON position).
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Start the engine and let it run at idle for 1 minute. • Using the electronic service tool INSITE ™, make sure that the fault code is inactive.	Fault code 1229 inactive? **YES**	2B
	Fault code 1229 inactive? **DO NOT** **REPAIR:** Return to the troubleshooting steps or consult your local Cummins® Authorized Service Desk after checking and completing all diagnostic steps again.	1A

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

- Turn the ignition key on (ON position).
- Connect the electronic service tool INSITE ™.

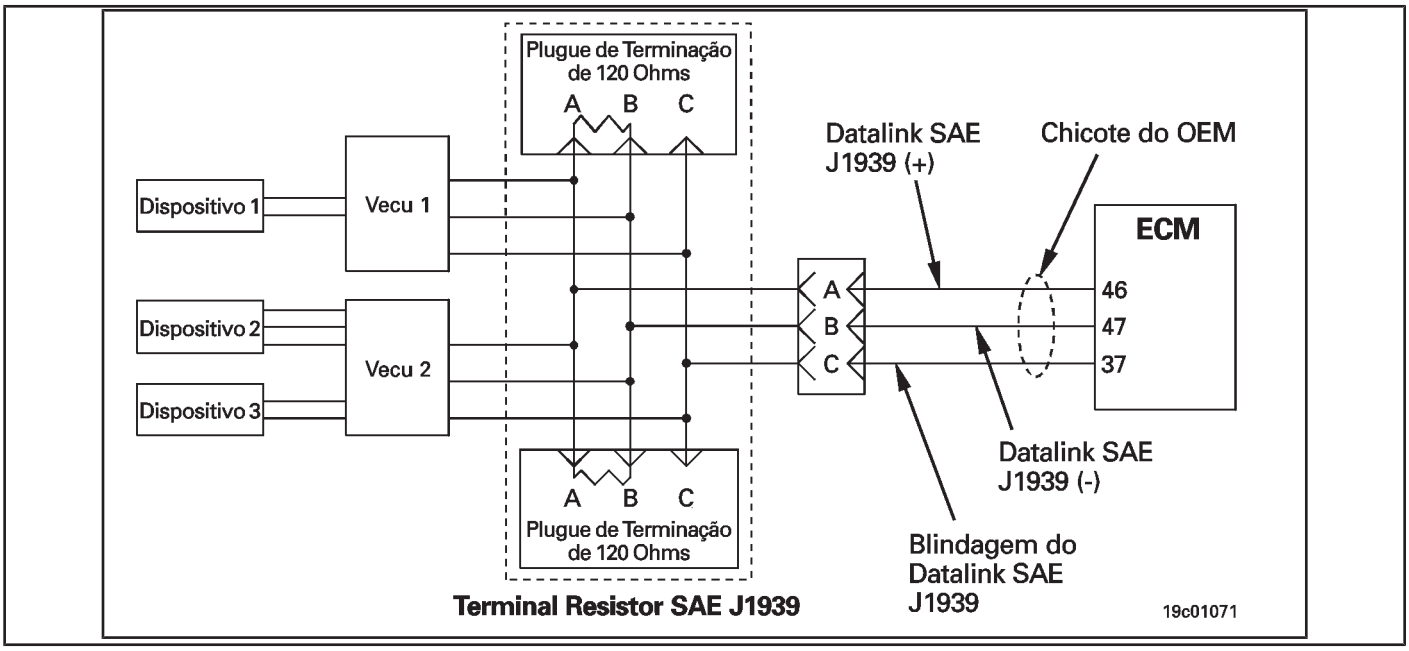
Action	Specifications / Repair	Next step
Clear fault codes using the electronic service tool INSITE ™.	All codes cleared? **YES**	Complete repair
	All codes cleared? **DO NOT** **REPAIR:** Troubleshoot any other active fault code.	Proper troubleshooting and repair steps

Fault Code 1633

Datalink Komnet Cannot Transmit - Invalid, Intermittent or Incorrect Data

CODES	REASON	IT IS MADE
Fault Code: 1633 PID (P), SID (S): None IMF: 2 Lamp: Amber SRT:	Datalink Komnet Cannot Transmit - Invalid, Intermittent or Incorrect Data Communication on the OEM datalink network is intermittent.	None as to performance.

OEM Datalink Network Using J1939



Circuit Descriptions:

The Cummins electronic control module (ECM) communicates with the OEM's datalink network using the J1939 datalink protocol.

Component Location:

Refer to the OEM's fault diagnosis manual for the location of the primary and secondary ECM's installed by the OEM.

Workshop Tips:

This fault code is recorded when the J1939 datalink communication between the ECM's installed by the OEM and the Cummins engine EMC is intermittent. This failure no is powered by the Cummins installed ECM and is stored only as a fault code for information purposes. No recalibrate or replace the Cummins ECM because of this fault code.

SUMMARY OF FAULT DIAGNOSTICS

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check for a security code active fault.	**Fault code 1633 active?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Check for an active fault code. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

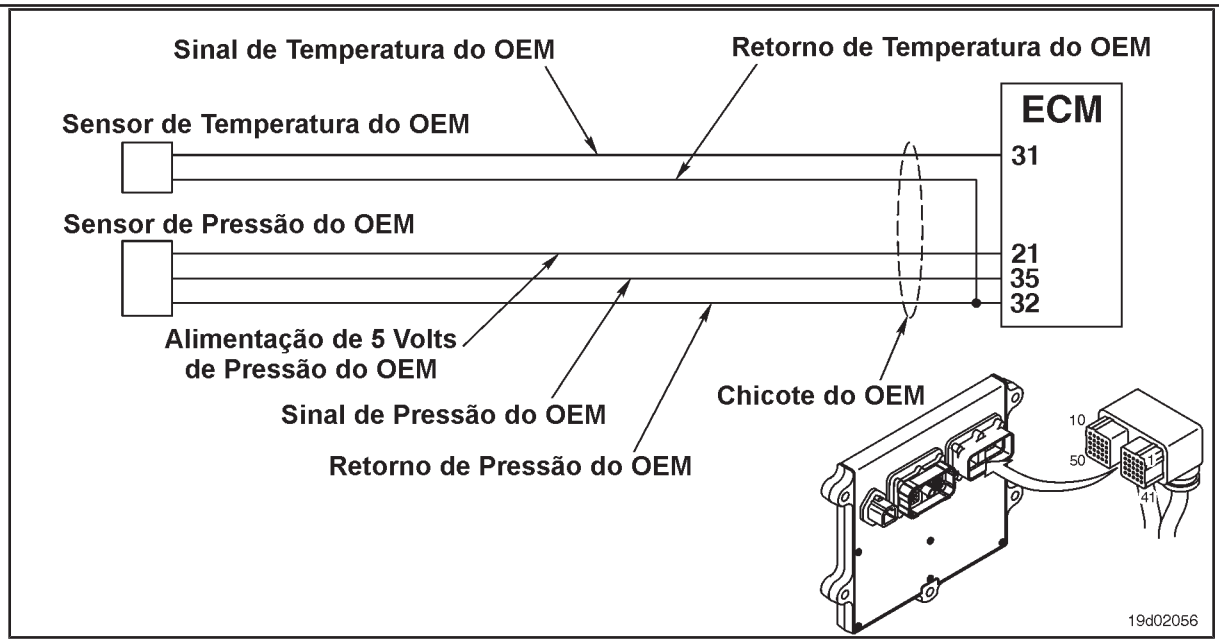
Action	Specifications / Repair	Next step
Check for an active fault code. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 1633 active? **YES** **Repair:** An error was detected in the OEM datalink. Refer to the fault diagnosis OEM for more information.	Complete repair.
	Fault code 1633 active? **NO**	Complete repair.

Fault Code 1639

Auxiliary Equipment Sensor Input # 3 (OEM Switch) - Cause Unknown

CODES	REASON	IT IS MADE
Fault Code: 1639 PID (P), SID (S): S051 IMF: 11 Lamp: None SRT:	Auxiliary Equipment Sensor Input # 3 (OEM Switch) - Unknown Cause	Possible engine de-powering.

OEM Temperature / Pressure Sensor Circuit



Circuit Descriptions:

The OEM has the option of connecting a temperature sensor input to the Cummins ECM. A calibration is then created to recognize the input from that temperature sensor. This fault code is activated when the OEM sensor temperature input exceeds the motor protection limit set by the OEM.
Depending on requirements
from the OEM, an Engine Protection depot can be associated with this fault code.

Component Location:

The OEM pressure or temperature sensor input varies depending on the application. Refer to the OEM fault diagnosis manual for the location of the sensor.

Workshop Tips:

This fault code is activated when the maximum inlet temperature or inlet pressure of a third-party after-treatment system exceeds the maximum allowable limits. A power outage may or may not be associated with this fault code.

SUMMARY OF FAULT DIAGNOSTICS

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check the Fault Code 1639 is registered.	**Fault Code active or inactive 1639 counts?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Check that Fault Code 1639 is registered. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

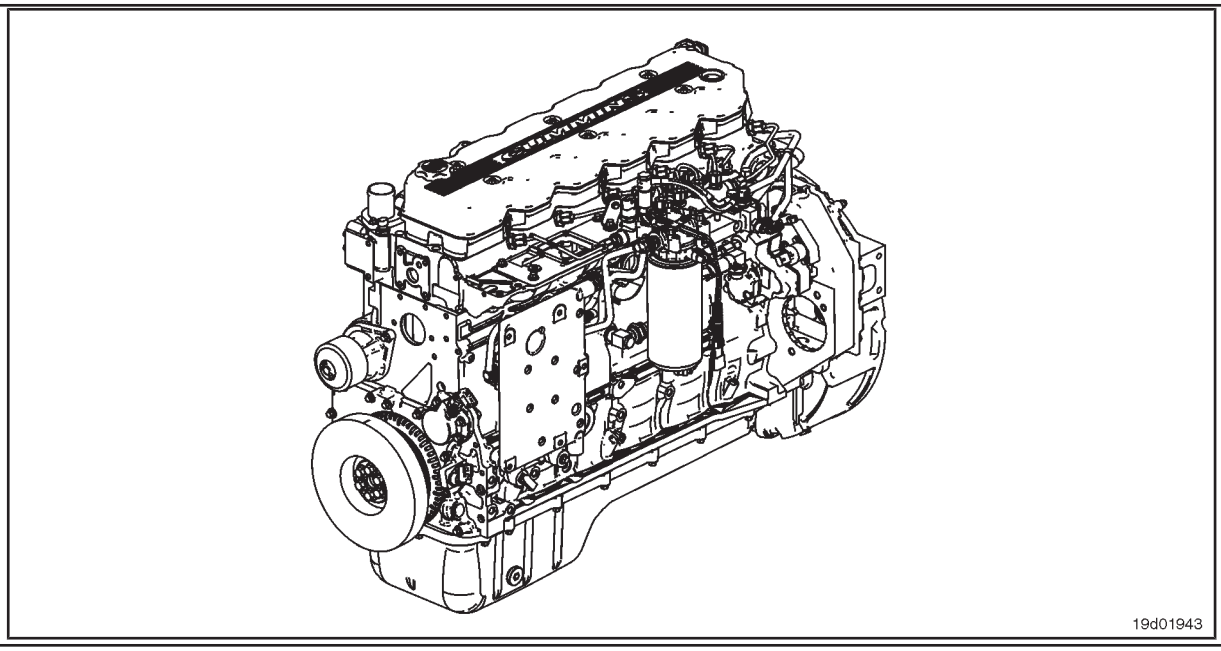
Action	Specifications / Repair	Next step
Check for an inactive fault code. • Use the electronic service tool INSITE ™ to read fault codes.	Fault Code active or inactive 1639 counts? **YES** **Repair:** The maximum inlet temperature or inlet pressure for the Exhaust Gas Filter has been exceeded. Refer to the Exhaust Gas Filter fault diagnosis procedure.	Exhaust Filter Fault Diagnosis
	Fault Code active or inactive 1639 counts? **NO**	Complete repair

Fault Code 1654

Engine Start Failure in Cylinder 1 - Existing Condition.

CODES	REASON	IT IS MADE
Fault Code: 1654 PID (P), SID (S): IMF: 11/31 Lamp: Amber SRT:	Engine Start Failure in Cylinder 1 - Existing Condition. Engine misfire detected on cylinder No. 1.	Possible loss of power, irregular idle or failure to start.

Circuit



Circuit Descriptions:

An ECM calibration algorithm monitors engine speed as each injector is fired while the engine is idling. If a cylinder has a high or low contribution to the engine speed, this fault code becomes active. The purpose of this failure is to assist in the diagnosis of performance failures such as failure to start and loss of engine power.

Component Location:

The ECM is located on the intake side of the engine. See the Procedure 100-002 (Engine Diagrams) in Section E for more details on component locations.

Workshop Tips:

If Fault Code 1654 is inactive in the ECM's memory and there are no problems with power loss or failure to start the engine, the possible cause of the failure may be an intermittent event, such as the presence of air in the fuel system after an exchange of filters. Fault Code 1654 counts should be ignored unless there are other performance symptoms. The engine coolant temperature must be greater than 160 ° F for this diagnosis to be performed. Causes of cylinder misfire include:

- Valve clearance out of specification (compare actual valve clearance with readjustment limits)
- Cylinder failure (check for high engine blowing when the engine is under load)
- Valve failure or valve kept open (check if the valve produces a "cicada" noise at the intake)

- Cylinder or gasket head failure (look for signs of oil, coolant or molten material residues in the intake or exhaust passages)
- Extreme wear on the camshaft (check if camshaft bosses are worn)
- Extra, missing or damaged sealing washer under an injector
- Injector failures (switch injectors to see if the problem "follows" the suspected injector). On-Board Diagnostic Information

(OBD):

- The ECM will illuminate the malfunction indicator lamp (MIL) when the diagnosis is performed and fails.
- The ECM will turn off the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles in which the diagnosis is performed and no failure. The MIL lamp and the fault code can also be cleared with the electronic service tool INSITE ™.
- The fault code will be cleared from memory after 40 consecutive driving cycles in which the diagnosis is performed and approved.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch /

AMP / Metri-Pack female test lead. STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Read the fault codes.	**Fault codes related to the fuel system or accumulated inactive code counts?**	
STEP 1B: Check the cylinder for misfire.	**Was the cylinder misfire detected?**	
STEP 2: Run the diagnostic tests.		
STEP 2A: Perform the cylinder cut test.	**Was the cylinder misfire detected and was the failure isolated to the injector?**	
STEP 3: Clear the fault code.		
STEP 3A: Check the repair.	**Does the cylinder misfire still persist?**	
STEP 3B: Clear the fault codes.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Read the fault codes. Conditions:

- Connect the electronic service tool INSITE ™.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Read the fuel system fault codes. • Start the engine and let it run at idle for 1 minute. • Use INSITE ™ to read the fault codes.	Fault codes related to the fuel system or accumulated inactive code counts? **YES**	Diagnostic and repair diagram of the appropriate fault code.
	Fault codes related to the fuel system or accumulated inactive code counts? **NO**	1B

STEP 1B: Check the cylinder for misfire. Conditions:

- Turn the ignition key ON.
- Start the engine and let it run at idle.

Action	Specifications / Repair	Next step
Check the engine for smoke emission, oscillation, irregular idling or misfire. • Check the engine for black or white smoke emission, oscillation, irregular idling, or ignition failure at idle, maximum idle speed and during quick throttle starts.	Is it possible to detect a cylinder misfire? **YES**	2A
	Is it possible to detect a cylinder misfire? **NO**	3A

STEP 2: Run the diagnostic tests.

STEP 2A: Perform the cylinder cut test. Conditions:

- Turn on the ignition key.
- Allow the engine to idle.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Determine if the No. 1 cylinder injector is misfiring. • Use the INSITE ™ Cylinder Cut Test to determine if the No. 1 cylinder injector is misfiring.	Was the cylinder misfire detected and was the failure isolated to the injector? **YES** **Repair:** A defective injector has been detected. Replace the No. 1 cylinder injector. See Procedure 006-026.	3A
	Was the cylinder misfire detected and was the failure isolated to the injector? **DO NOT** **REPAIR:** Check for other sources of cylinder misfire, such as: valve clearance out of adjustment, cylinder failure, valve failure, cylinder head or gasket failure, or extreme wear on the camshaft.	Proper fault diagnosis procedures.

STEP 3: Clear the fault code.

STEP 3A: Check the repair. Conditions:

- Connect all components
- Turn on the ignition key.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Make sure that the cylinder misfire does not persist. • Start the engine and make sure that the cylinder misfire no longer exists.	Does the cylinder misfire still persist? **YES**	1A
	Does the cylinder misfire still persist? **NO**	3B

STEP 3B: Clear the fault codes. Conditions:

- Connect all components
- Turn on the ignition key.
- Connect the electronic service tool INSITE ™.

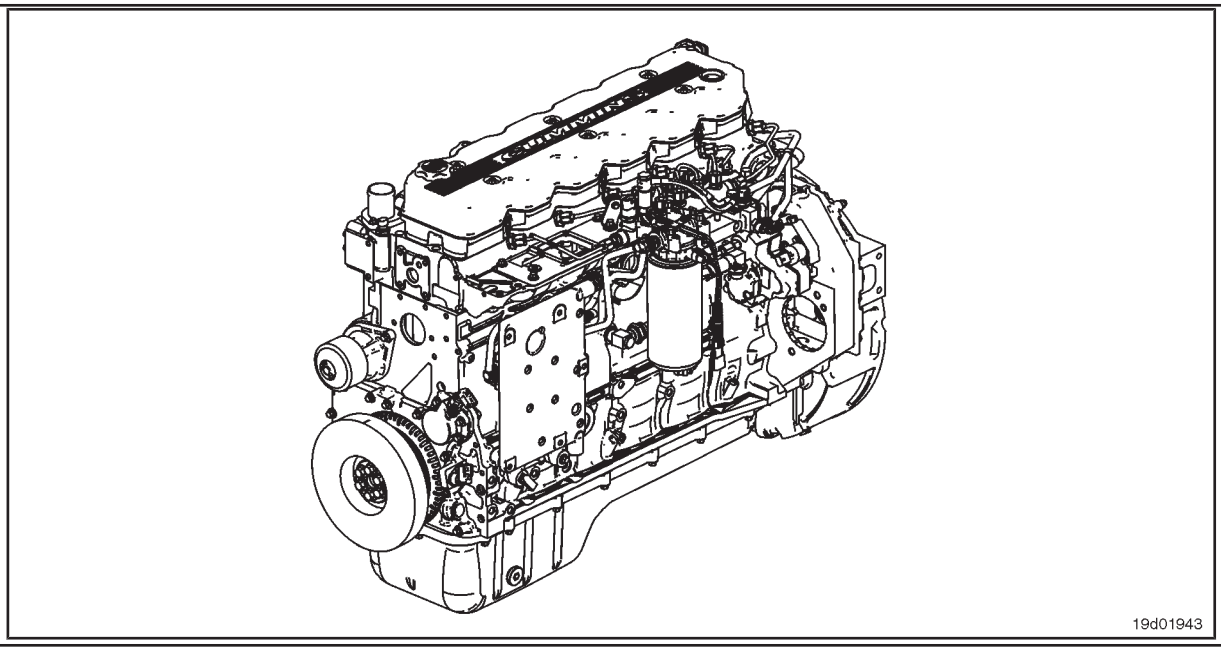
Action	Specifications / Repair	Next step
Clear the fault codes. • Use the electronic service tool INSITE ™ to clear all active and inactive fault codes.	All codes cleared? **YES**	Complete repair?
	All codes cleared? **NO**	Proper troubleshooting and repair steps.

Fault Code 1655

Engine Start Failure in Cylinder 2 - Existing Condition.

CODES	REASON	IT IS MADE
Fault Code: 1655 PID (P), SID (S): IMF: 11/31 Lamp: Amber SRT:	Engine Start Failure in Cylinder 2 - Existing Condition. Engine misfire detected in cylinder No. 2.	Possible loss of power, irregular idle or failure to start.

Circuit



Circuit Descriptions:

An ECM calibration algorithm monitors engine speed as each injector is fired while the engine is idling. If a cylinder has a high or low contribution to the engine speed, this fault code becomes active. The purpose of this failure is to assist in the diagnosis of performance failures such as failure to start and loss of engine power.

Component Location:

The ECM is located on the intake side of the engine. See the Procedure 100-002 (Engine Diagrams) in Section E for more details on component locations.

Workshop Tips:

If Fault Code 1655 is inactive in the ECM's memory and there are no problems with power loss or failure to start the engine, the possible cause of the failure may be an intermittent event, such as the presence of air in the fuel system after an exchange of filters. Fault Code 1655 counts should be ignored unless other performance symptoms exist. The engine coolant temperature must be greater than 160 ° F for this diagnosis to be performed. Causes of cylinder misfire include:

- Valve clearance out of specification (compare actual valve clearance with readjustment limits)
- Cylinder failure (check for high engine blowing when the engine is under load)
- Valve failure or valve kept open (check if the valve produces a "cicada" noise at the intake)

- Cylinder or gasket head failure (look for signs of oil, coolant or molten material residues in the intake or exhaust passages)
- Extreme wear on the camshaft (check if camshaft bosses are worn)
- Extra, missing or damaged sealing washer under an injector
- Injector failures (switch injectors to see if the problem "follows" the suspected injector). On-Board Diagnostic Information

(OBD):

- The ECM will illuminate the malfunction indicator lamp (MIL) when the diagnosis is performed and fails.
- The ECM will turn off the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles in which the diagnosis is performed and no failure. The MIL lamp and the fault code can also be cleared with the electronic service tool INSITE ™.
- The fault code will be cleared from memory after 40 consecutive driving cycles in which the diagnosis is performed and approved.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch /

AMP / Metri-Pack female test lead. STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Read the fault codes.	**Fault codes related to the fuel system or accumulated inactive code counts?**	
STEP 1B: Check the cylinder for misfire.	**Was the cylinder misfire detected?**	
STEP 2: Run the diagnostic tests.		
STEP 2A: Perform the cylinder cut test.	**Was the cylinder misfire detected and was the failure isolated to the injector?**	
STEP 3: Clear the fault code.		
STEP 3A: Check the repair.	**Does the cylinder misfire still persist?**	
STEP 3B: Clear the fault codes.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Read the fault codes. Conditions:

- Connect the electronic service tool INSITE ™.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Read the fuel system fault codes. • Start the engine and let it run at idle for 1 minute. • Use INSITE ™ to read the fault codes.	Fault codes related to the fuel system or accumulated inactive code counts? **YES**	Diagnostic and repair diagram of the appropriate fault code.
	Fault codes related to the fuel system or accumulated inactive code counts? **NO**	1B

STEP 1B: Check the cylinder for misfire. Conditions:

- Turn the ignition key ON.
- Start the engine and let it run at idle.

Action	Specifications / Repair	Next step
Check the engine for smoke emission, oscillation, irregular idling or misfire. • Check the engine for black or white smoke emission, oscillation, irregular idling, or ignition failure at idle, maximum idle speed and during quick throttle starts.	Is it possible to detect a cylinder misfire? **YES**	2A
	Is it possible to detect a cylinder misfire? **NO**	3A

STEP 2: Run the diagnostic tests.

STEP 2A: Perform the cylinder cut test. Conditions:

- Turn on the ignition key.
- Allow the engine to idle.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Determine if the No. 2 cylinder injector is misfiring. • Use the INSITE ™ Cylinder Cut Test to determine if the No. 2 cylinder injector is misfiring.	Was the cylinder misfire detected and was the failure isolated to the injector? **YES** **Repair:** A defective injector has been detected. Replace the No. 2 cylinder injector. See Procedure 006-026.	3A
	Was the cylinder misfire detected and was the failure isolated to the injector? **DO NOT** **REPAIR:** Check for other sources of cylinder misfire, such as: valve clearance out of adjustment, cylinder failure, valve failure, cylinder head or gasket failure, or extreme wear on the camshaft.	Proper fault diagnosis procedures.

STEP 3: Clear the fault code.

STEP 3A: Check the repair. Conditions:

- Connect all components
- Turn on the ignition key.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Make sure that the cylinder misfire does not persist. • Start the engine and make sure that the cylinder misfire no longer exists.	Does the cylinder misfire still persist? **YES**	1A
	Does the cylinder misfire still persist? **NO**	3B

STEP 3B: Clear the fault codes. Conditions:

- Connect all components
- Turn on the ignition key.
- Connect the electronic service tool INSITE ™.

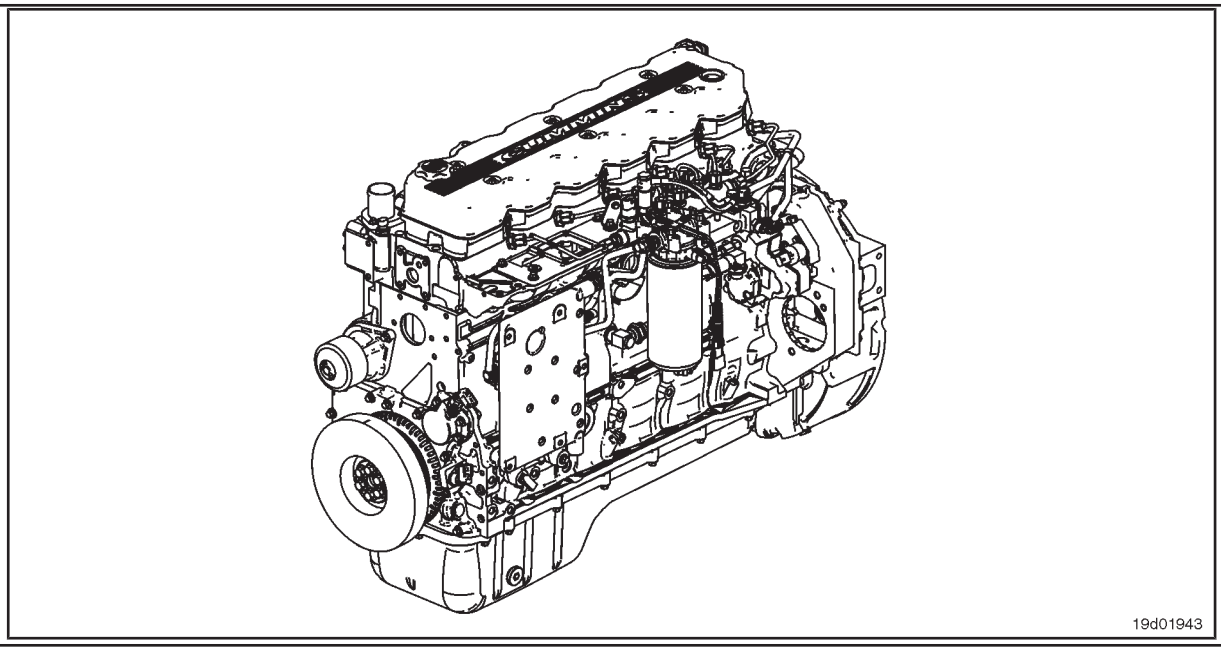
Action	Specifications / Repair	Next step
Clear the fault codes. • Use the electronic service tool INSITE ™ to clear all active and inactive fault codes.	All codes cleared? **YES**	Complete repair?
	All codes cleared? **NO**	Proper troubleshooting and repair steps.

Fault Code 1656

Engine Start Failure in Cylinder 3 - Existing Condition.

CODES	REASON	IT IS MADE
Fault Code: 1656 PID (P), SID (S): IMF: 11/31 Lamp: Amber SRT:	Engine Start Failure in Cylinder 3 - Existing Condition. Engine misfire detected in cylinder No. 3.	Possible loss of power, irregular idle or failure to start.

Circuit



Circuit Descriptions:

An ECM calibration algorithm monitors engine speed as each injector is fired while the engine is idling. If a cylinder has a high or low contribution to the engine speed, this fault code becomes active. The purpose of this failure is to assist in the diagnosis of performance failures such as failure to start and loss of engine power.

Component Location:

The ECM is located on the intake side of the engine. See the Procedure 100-002 (Engine Diagrams) in Section E for more details on component locations.

Workshop Tips:

If Fault Code 1656 is inactive in the ECM's memory and there are no problems with power loss or failure to start the engine, the possible cause of the failure may be an intermittent event, such as the presence of air in the fuel system after an exchange of filters. Fault Code 1656 counts should be ignored unless there are other performance symptoms. The engine coolant temperature must be greater than 160 ° F for this diagnosis to be performed. Causes of cylinder misfire include:

- Valve clearance out of specification (compare actual valve clearance with readjustment limits)
- Cylinder failure (check for high engine blowing when the engine is under load)
- Valve failure or valve kept open (check if the valve produces a "cicada" noise at the intake)

- Cylinder or gasket head failure (look for signs of oil, coolant or molten material residues in the intake or exhaust passages)
- Extreme wear on the camshaft (check if camshaft bosses are worn)
- Extra, missing or damaged sealing washer under an injector
- Injector failures (switch injectors to see if the problem "follows" the suspected injector). On-Board Diagnostic Information

(OBD):

- The ECM will illuminate the malfunction indicator lamp (MIL) when the diagnosis is performed and fails.
- The ECM will turn off the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles in which the diagnosis is performed and no failure. The MIL lamp and the fault code can also be cleared with the electronic service tool INSITE ™.
- The fault code will be cleared from memory after 40 consecutive driving cycles in which the diagnosis is performed and approved.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch /

AMP / Metri-Pack female test lead. STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Read the fault codes.	**Fault codes related to the fuel system or accumulated inactive code counts?**	
STEP 1B: Check the cylinder for misfire.	**Was the cylinder misfire detected?**	
STEP 2: Run the diagnostic tests.		
STEP 2A: Perform the cylinder cut test.	**Was the cylinder misfire detected and was the failure isolated to the injector?**	
STEP 3: Clear the fault code.		
STEP 3A: Check the repair.	**Does the cylinder misfire still persist?**	
STEP 3B: Clear the fault codes.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Read the fault codes. Conditions:

- Connect the electronic service tool INSITE ™.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Read the fuel system fault codes. • Start the engine and let it run at idle for 1 minute. • Use INSITE ™ to read the fault codes.	Fault codes related to the fuel system or accumulated inactive code counts? **YES**	Diagnostic and repair diagram of the appropriate fault code.
	Fault codes related to the fuel system or accumulated inactive code counts? **NO**	1B

STEP 1B: Check the cylinder for misfire. Conditions:

- Turn the ignition key ON.
- Start the engine and let it run at idle.

Action	Specifications / Repair	Next step
Check the engine for smoke emission, oscillation, irregular idling or misfire. • Check the engine for black or white smoke emission, oscillation, irregular idling, or ignition failure at idle, maximum idle speed and during quick throttle starts.	Is it possible to detect a cylinder misfire? **YES**	2A
	Is it possible to detect a cylinder misfire? **NO**	3A

STEP 2: Run the diagnostic tests.

STEP 2A: Perform the cylinder cut test. Conditions:

- Turn on the ignition key.
- Allow the engine to idle.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Determine if the No. 3 cylinder injector is misfiring. • Use the INSITE ™ Cylinder Cut Test to determine if the No. 3 cylinder injector is misfiring.	Was the cylinder misfire detected and was the failure isolated to the injector? **YES** **Repair:** A defective injector has been detected. Replace the cylinder injector No. 3. See Procedure 006-026.	3A
	Was the cylinder misfire detected and was the failure isolated to the injector? **DO NOT** **REPAIR:** Check for other sources of cylinder misfire, such as: valve clearance out of adjustment, cylinder failure, valve failure, cylinder head or gasket failure, or extreme wear on the camshaft.	Proper fault diagnosis procedures.

STEP 3: Clear the fault code.

STEP 3A: Check the repair. Conditions:

- Connect all components
- Turn on the ignition key.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Make sure that the cylinder misfire does not persist. • Start the engine and make sure that the cylinder misfire no longer exists.	Does the cylinder misfire still persist? **YES**	1A
	Does the cylinder misfire still persist? **NO**	3B

STEP 3B: Clear the fault codes. Conditions:

- Connect all components
- Turn on the ignition key.
- Connect the electronic service tool INSITE ™.

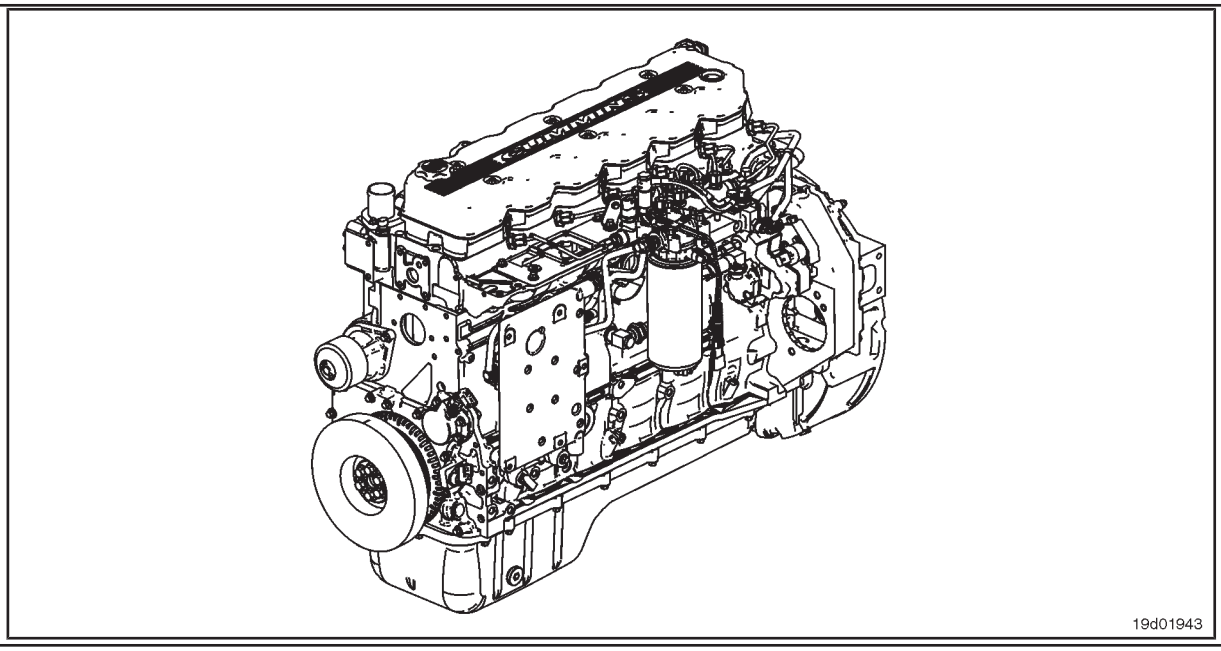
Action	Specifications / Repair	Next step
Clear the fault codes. • Use the electronic service tool INSITE ™ to clear all active and inactive fault codes.	All codes cleared? **YES**	Complete repair?
	All codes cleared? **NO**	Proper troubleshooting and repair steps.

Fault Code 1657

Engine Start Failure in Cylinder 4 - Existing Condition.

CODES	REASON	IT IS MADE
Fault Code: 1657 PID (P), SID (S): IMF: 11/31 Lamp: Amber SRT:	Engine Start Failure in Cylinder 4 - Existing Condition. Engine misfire detected in cylinder No. 4.	Possible loss of power, irregular idle or failure to start.

Circuit



Circuit Descriptions:

An ECM calibration algorithm monitors engine speed as each injector is fired while the engine is idling. If a cylinder has a high or low contribution to the engine speed, this fault code becomes active. The purpose of this failure is to assist in the diagnosis of performance failures such as failure to start and loss of engine power.

Component Location:

The ECM is located on the intake side of the engine. See the Procedure 100-002 (Engine Diagrams) in Section E for more details on component locations.

Workshop Tips:

If Fault Code 1657 is inactive in the ECM's memory and there are no problems with power loss or failure to start the engine, the possible cause of the failure may be an intermittent event, such as the presence of air in the fuel system after an exchange of filters. Fault Code 1657 counts should be ignored unless there are other performance symptoms. The engine coolant temperature must be greater than 160 ° F for this diagnosis to be performed. Causes of cylinder misfire include:

- Valve clearance out of specification (compare actual valve clearance with readjustment limits)
- Cylinder failure (check for high engine blowing when the engine is under load)
- Valve failure or valve kept open (check if the valve produces a "cicada" noise at the intake)

- Cylinder or gasket head failure (look for signs of oil, coolant or molten material residues in the intake or exhaust passages)
- Extreme wear on the camshaft (check if camshaft bosses are worn)
- Extra, missing or damaged sealing washer under an injector
- Injector failures (switch injectors to see if the problem "follows" the suspected injector). On-Board Diagnostic Information

(OBD):

- The ECM will illuminate the malfunction indicator lamp (MIL) when the diagnosis is performed and fails.
- The ECM will turn off the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles in which the diagnosis is performed and no failure. The MIL lamp and the fault code can also be cleared with the electronic service tool INSITE ™.
- The fault code will be cleared from memory after 40 consecutive driving cycles in which the diagnosis is performed and approved.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch /

AMP / Metri-Pack female test lead. STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Read the fault codes.	**Fault codes related to the fuel system or accumulated inactive code counts?**	
STEP 1B: Check the cylinder for misfire.	**Was the cylinder misfire detected?**	
STEP 2: Run the diagnostic tests.		
STEP 2A: Perform the cylinder cut test.	**Was the cylinder misfire detected and was the failure isolated to the injector?**	
STEP 3: Clear the fault code.		
STEP 3A: Check the repair.	**Does the cylinder misfire still persist?**	
STEP 3B: Clear the fault codes.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Read the fault codes. Conditions:

- Connect the electronic service tool INSITE ™.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Read the fuel system fault codes. • Start the engine and let it run at idle for 1 minute. • Use INSITE ™ to read the fault codes.	Fault codes related to the fuel system or accumulated inactive code counts? **YES**	Diagnostic and repair diagram of the appropriate fault code.
	Fault codes related to the fuel system or accumulated inactive code counts? **NO**	1B

STEP 1B: Check the cylinder for misfire. Conditions:

- Turn the ignition key ON.
- Start the engine and let it run at idle.

Action	Specifications / Repair	Next step
Check the engine for smoke emission, oscillation, irregular idling or misfire. • Check the engine for black or white smoke emission, oscillation, irregular idling, or ignition failure at idle, maximum idle speed and during quick throttle starts.	Is it possible to detect a cylinder misfire? **YES**	2A
	Is it possible to detect a cylinder misfire? **NO**	3A

STEP 2: Run the diagnostic tests.

STEP 2A: Perform the cylinder cut test. Conditions:

- Turn on the ignition key.
- Allow the engine to idle.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Determine if the cylinder injector No. 4 is misfiring. • Use the INSITE ™ Cylinder Cut Test to determine if the No. 4 cylinder injector is misfiring.	Was the cylinder misfire detected and was the failure isolated to the injector? **YES** **Repair:** A defective injector has been detected. Replace the No. 4 cylinder injector. See Procedure 006-026.	3A
	Was the cylinder misfire detected and was the failure isolated to the injector? **DO NOT** **REPAIR:** Check for other sources of cylinder misfire, such as: valve clearance out of adjustment, cylinder failure, valve failure, cylinder head or gasket failure, or extreme wear on the camshaft.	Proper fault diagnosis procedures.

STEP 3: Clear the fault code.

STEP 3A: Check the repair. Conditions:

- Connect all components
- Turn on the ignition key.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Make sure that the cylinder misfire does not persist. • Start the engine and make sure that the cylinder misfire no longer exists.	Does the cylinder misfire still persist? **YES**	1A
	Does the cylinder misfire still persist? **NO**	3B

STEP 3B: Clear the fault codes. Conditions:

- Connect all components
- Turn on the ignition key.
- Connect the electronic service tool INSITE ™.

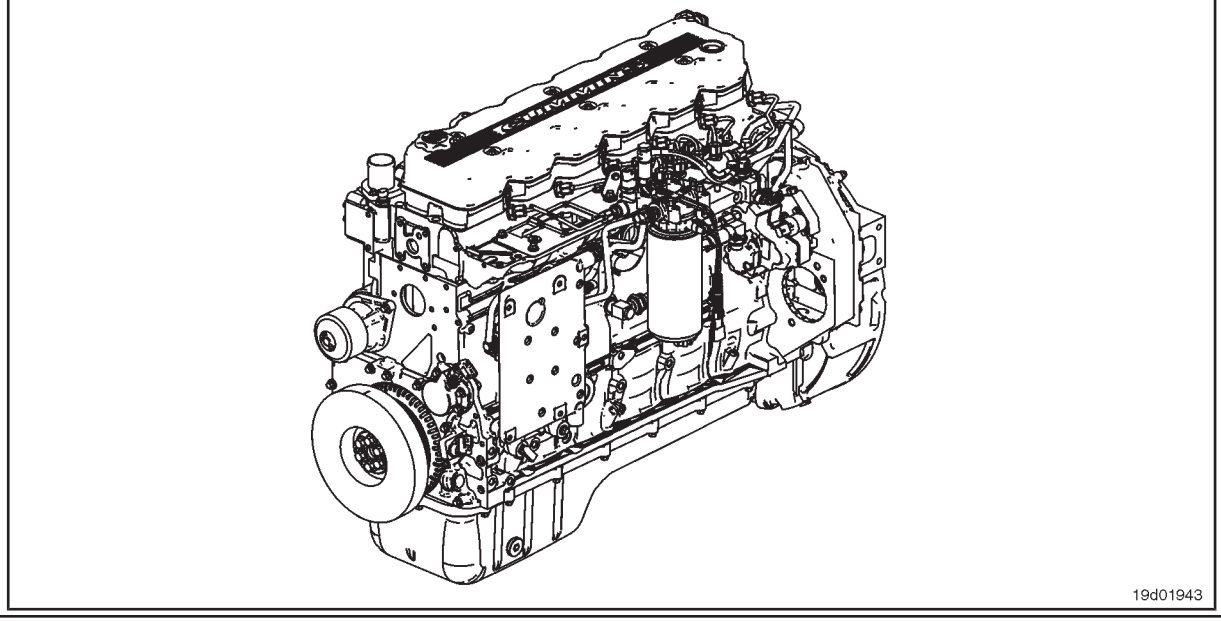
Action	Specifications / Repair	Next step
Clear the fault codes. • Use the electronic service tool INSITE ™ to clear all active and inactive fault codes.	All codes cleared? **YES**	Complete repair?
	All codes cleared? **NO**	Proper troubleshooting and repair steps.

Fault Code 1658

Engine Start Failure in Cylinder 5 - Existing Condition.

CODES	REASON	IT IS MADE
Fault Code: 1658 PID (P), SID (S): IMF: 11/31 Lamp: Amber SRT:	Engine Start Failure in Cylinder 5 - Existing Condition. Engine misfire detected in cylinder No. 5.	Possible loss of power, irregular idle or failure to start.

Circuit



Circuit Descriptions:

An ECM calibration algorithm monitors engine speed as each injector is fired while the engine is idling. If a cylinder has a high or low contribution to the engine speed, this fault code becomes active. The purpose of this failure is to assist in the diagnosis of performance failures such as failure to start and loss of engine power.

Component Location:

The ECM is located on the intake side of the engine. See the Procedure 100-002 (Engine Diagrams) in Section E for more details on component locations.

Workshop Tips:

If Fault Code 1658 is inactive in ECM memory and there are no problems with power loss or engine failure, the possible cause of the failure may be an intermittent event, such as the presence of air in the fuel system after an exchange of filters. Fault Code 1658 counts should be ignored unless there are other performance symptoms. The engine coolant temperature must be greater than 160 ° F for this diagnosis to be performed. Causes of cylinder misfire include:

- Valve clearance out of specification (compare actual valve clearance with readjustment limits)
- Cylinder failure (check for high engine blowing when the engine is under load)
- Valve failure or valve kept open (check if the valve produces a "cicada" noise at the intake)

- Cylinder or gasket head failure (look for signs of oil, coolant or molten material residues in the intake or exhaust passages)
- Extreme wear on the camshaft (check if camshaft bosses are worn)
- Extra, missing or damaged sealing washer under an injector
- Injector failures (switch injectors to see if the problem "follows" the suspected injector). On-Board Diagnostic Information

(OBD):

- The ECM will illuminate the malfunction indicator lamp (MIL) when the diagnosis is performed and fails.
- The ECM will turn off the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles in which the diagnosis is performed and no failure. The MIL lamp and the fault code can also be cleared with the electronic service tool INSITE ™.
- The fault code will be cleared from memory after 40 consecutive driving cycles in which the diagnosis is performed and approved.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch /

AMP / Metri-Pack female test lead. STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Read the fault codes.	**Fault codes related to the fuel system or accumulated inactive code counts?**	
STEP 1B: Check the cylinder for misfire.	**Was the cylinder misfire detected?**	
STEP 2: Run the diagnostic tests.		
STEP 2A: Perform the cylinder cut test.	**Was the cylinder misfire detected and was the failure isolated to the injector?**	
STEP 3: Clear the fault code.		
STEP 3A: Check the repair.	**Does the cylinder misfire still persist?**	
STEP 3B: Clear the fault codes.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Read the fault codes. Conditions:

- Connect the electronic service tool INSITE ™.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Read the fuel system fault codes. • Start the engine and let it run at idle for 1 minute. • Use INSITE ™ to read the fault codes.	Fault codes related to the fuel system or accumulated inactive code counts? **YES**	Diagnostic and repair diagram of the appropriate fault code.
	Fault codes related to the fuel system or accumulated inactive code counts? **NO**	1B

STEP 1B: Check the cylinder for misfire. Conditions:

- Turn the ignition key ON.
- Start the engine and let it run at idle.

Action	Specifications / Repair	Next step
Check the engine for smoke emission, oscillation, irregular idling or misfire. • Check the engine for black or white smoke emission, oscillation, irregular idling, or ignition failure at idle, maximum idle speed and during quick throttle starts.	Is it possible to detect a cylinder misfire? **YES**	2A
	Is it possible to detect a cylinder misfire? **NO**	3A

STEP 2: Run the diagnostic tests.

STEP 2A: Perform the cylinder cut test. Conditions:

- Turn on the ignition key.
- Allow the engine to idle.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Determine if the No. 5 cylinder injector is misfiring. • Use the INSITE ™ Cylinder Cut Test to determine if the No. 5 cylinder injector is misfiring.	Was the cylinder misfire detected and was the failure isolated to the injector? **YES** **Repair:** A defective injector was detected. Replace the No. 5 cylinder injector. See Procedure 006-026.	3A
	Was the cylinder misfire detected and was the failure isolated to the injector? **DO NOT** **REPAIR:** Check for other sources of cylinder misfire, such as: valve clearance out of adjustment, cylinder failure, valve failure, cylinder head or gasket failure, or extreme wear on the camshaft.	Proper fault diagnosis procedures.

STEP 3: Clear the fault code.

STEP 3A: Check the repair. Conditions:

- Connect all components
- Turn on the ignition key.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Make sure that the cylinder misfire does not persist. • Start the engine and make sure that the cylinder misfire no longer exists.	Does the cylinder misfire still persist? **YES**	1A
	Does the cylinder misfire still persist? **NO**	3B

STEP 3B: Clear the fault codes. Conditions:

- Connect all components
- Turn on the ignition key.
- Connect the electronic service tool INSITE ™.

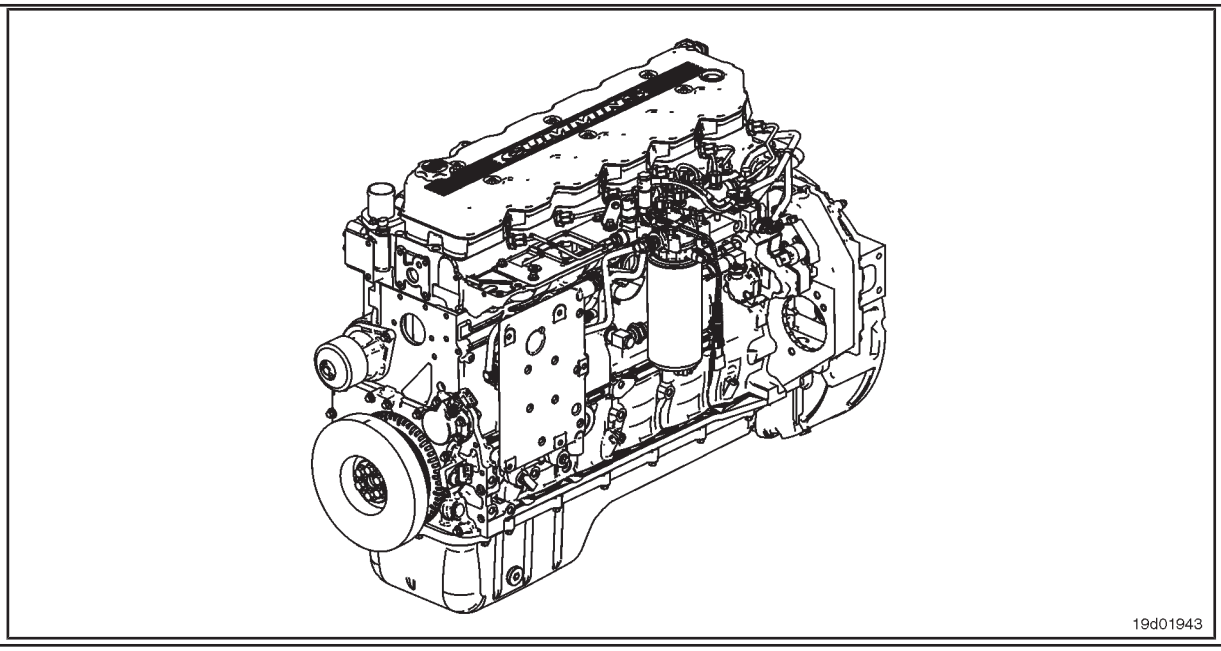
Action	Specifications / Repair	Next step
Clear the fault codes. • Use the electronic service tool INSITE ™ to clear all active and inactive fault codes.	All codes cleared? **YES**	Complete repair?
	All codes cleared? **NO**	Proper troubleshooting and repair steps.

Fault Code 1659

Engine Start Failure in Cylinder 6 - Existing Condition.

CODES	REASON	IT IS MADE
Fault Code: 1659 PID (P), SID (S): IMF: 11/31 Lamp: Amber SRT:	Engine Start Failure in Cylinder 6 - Existing Condition. Engine misfire detected in cylinder No. 6.	Possible loss of power, irregular idle or failure to start.

Circuit



Circuit Descriptions:

An ECM calibration algorithm monitors engine speed as each injector is fired while the engine is idling. If a cylinder has a high or low contribution to the engine speed, this fault code becomes active. The purpose of this failure is to assist in the diagnosis of performance failures such as failure to start and loss of engine power.

Component Location:

The ECM is located on the intake side of the engine. See the Procedure 100-002 (Engine Diagrams) in Section E for more details on component locations.

Workshop Tips:

If Fault Code 1659 is inactive in ECM memory and there are no problems with power loss or engine failure, the possible cause of the failure may be an intermittent event, such as the presence of air in the fuel system after an exchange of filters. Fault Code 1659 counts should be ignored unless there are other performance symptoms. The engine coolant temperature must be greater than 160 ° F for this diagnosis to be performed. Causes of cylinder misfire include:

- Valve clearance out of specification (compare actual valve clearance with readjustment limits)
- Cylinder failure (check for high engine blowing when the engine is under load)
- Valve failure or valve kept open (check if the valve produces a "cicada" noise at the intake)

- Cylinder or gasket head failure (look for signs of oil, coolant or molten material residues in the intake or exhaust passages)
- Extreme wear on the camshaft (check if camshaft bosses are worn)
- Extra, missing or damaged sealing washer under an injector
- Injector failures (switch injectors to see if the problem "follows" the suspected injector). On-Board Diagnostic Information

(OBD):

- The ECM will illuminate the malfunction indicator lamp (MIL) when the diagnosis is performed and fails.
- The ECM will turn off the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles in which the diagnosis is performed and no failure. The MIL lamp and the fault code can also be cleared with the electronic service tool INSITE ™.
- The fault code will be cleared from memory after 40 consecutive driving cycles in which the diagnosis is performed and approved.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch /

AMP / Metri-Pack female test lead. STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Read the fault codes.	**Fault codes related to the fuel system or accumulated inactive code counts?**	
STEP 1B: Check the cylinder for misfire.	**Was the cylinder misfire detected?**	
STEP 2: Run the diagnostic tests.		
STEP 2A: Perform the cylinder cut test.	**Was the cylinder misfire detected and was the failure isolated to the injector?**	
STEP 3: Clear the fault code.		
STEP 3A: Check the repair.	**Does the cylinder misfire still persist?**	
STEP 3B: Clear the fault codes.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Read the fault codes. Conditions:

- Connect the electronic service tool INSITE ™.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Read the fuel system fault codes. • Start the engine and let it run at idle for 1 minute. • Use INSITE ™ to read the fault codes.	Fault codes related to the fuel system or accumulated inactive code counts? **YES**	Diagnostic and repair diagram of the appropriate fault code.
	Fault codes related to the fuel system or accumulated inactive code counts? **NO**	1B

STEP 1B: Check the cylinder for misfire. Conditions:

- Turn the ignition key ON.
- Start the engine and let it run at idle.

Action	Specifications / Repair	Next step
Check the engine for smoke emission, oscillation, irregular idling or misfire. • Check the engine for black or white smoke emission, oscillation, irregular idling, or ignition failure at idle, maximum idle speed and during quick throttle starts.	Is it possible to detect a cylinder misfire? **YES**	2A
	Is it possible to detect a cylinder misfire? **NO**	3A

STEP 2: Run the diagnostic tests.

STEP 2A: Perform the cylinder cut test. Conditions:

- Turn on the ignition key.
- Allow the engine to idle.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Determine if the No. 6 cylinder injector is misfiring. • Use the INSITE ™ Cylinder Cut Test to determine if the No. 6 cylinder injector is misfiring.	Was the cylinder misfire detected and was the failure isolated to the injector? **YES** **Repair:** A defective injector was detected. Replace the No. 6 cylinder injector. See Procedure 006-026.	3A
	Was the cylinder misfire detected and was the failure isolated to the injector? **DO NOT** **REPAIR:** Check for other sources of cylinder misfire, such as: valve clearance out of adjustment, cylinder failure, valve failure, cylinder head or gasket failure, or extreme wear on the camshaft.	Proper fault diagnosis procedures.

STEP 3: Clear the fault code.

STEP 3A: Check the repair. Conditions:

- Connect all components
- Turn on the ignition key.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Make sure that the cylinder misfire does not persist. • Start the engine and make sure that the cylinder misfire no longer exists.	Does the cylinder misfire still persist? **YES**	1A
	Does the cylinder misfire still persist? **NO**	3B

STEP 3B: Clear the fault codes. Conditions:

- Connect all components
- Turn on the ignition key.
- Connect the electronic service tool INSITE ™.

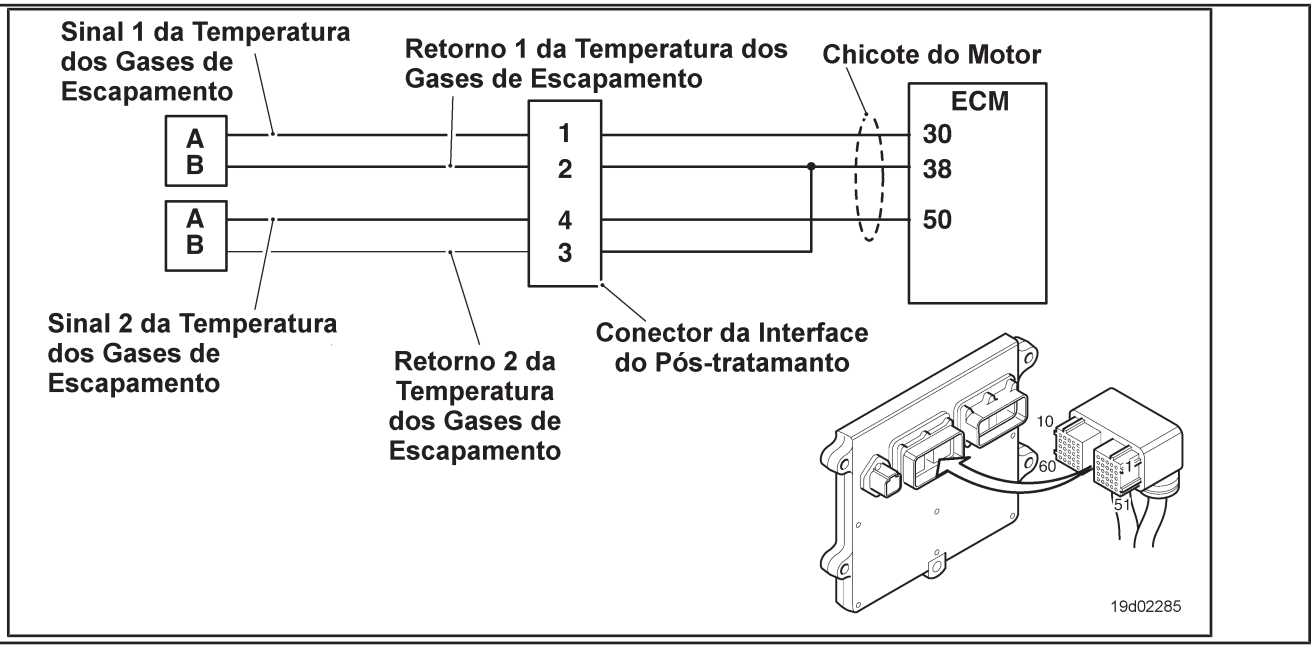
Action	Specifications / Repair	Next step
Clear the fault codes. • Use the electronic service tool INSITE ™ to clear all active and inactive fault codes.	All codes cleared? **YES**	Complete repair?
	All codes cleared? **NO**	Proper troubleshooting and repair steps.

Fault Code 1663

Temperature Sensor at Catalyst Inlet Replaced with Output - Condition Existing.

CODES	REASON	IT IS MADE
Fault Code: 1663 PID (P), SID (S): IMF: 11/31 Lamp: Amber SRT:	Temperature Sensor at Catalyst Inlet Replaced with Output - Existing Condition. The inlet and outlet connections of the catalyst temperature sensor are switched.	The injection of catalyst solution into the after-treatment system is disabled.

Circuit



Circuit Descriptions:

The catalyst temperature sensors are used to monitor the temperatures of the exhaust gas entering and leaving the catalyst.

Component Location:

Inlet and exhaust temperature sensors are located in the after-treatment system. The inlet temperature sensor is located before the catalytic converter and the exhaust temperature sensor is located at the exhaust outlet.

Workshop Tips:

The two exhaust gas inlet and outlet temperature sensors have the same part numbers, so it is possible to connect them inversely to the engine harness. This fault code is activated when the ECM determines that the temperature reading on the input and output temperature sensors is reversed. The most likely cause of this fault code is the inverted connection of the input and output temperature sensor connectors to the motor harness. Disconnect the inlet and outlet temperature sensors from the harness and invert the connectors. The catalyst temperature sensors must read the ambient temperature and the engine must be switched off for a period of eight hours before this diagnosis is made.

On-Board Diagnostic Information (OBD):

- The ECM will illuminate the malfunction indicator lamp (MIL) when the diagnosis is performed and fails.
- The ECM will turn off the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles in which the diagnosis is performed and no failure. The MIL lamp and the fault code can also be cleared with the electronic service tool INSITE ™.
- The fault code will be cleared from memory after 40 consecutive driving cycles in which the diagnosis is performed and approved.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch /

AMP / Metri-Pack female test lead. STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check for sensor circuit fault codes.		
STEP 1A: Check for fault codes.	**Fault Codes 1674, 1675, Are 1676, 1655, 1666 or 1667 active?**	
STEP 2: Check the configuration of the temperature sensors.		
STEP 2A: Check the circuit response.	**Fault code 1675 active?**	
STEP 2B: Check the circuit response.	**Fault code 1676 active?**	
STEP 3: Clear the fault code.		
STEP 3A: Clear the fault codes.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check for sensor circuit fault codes.

STEP 1A: Check for fault codes. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for active fault codes. • Use the electronic service tool INSITE ™ to read fault codes.	Fault Codes 1674, 1675, 1676, Are 1665, 1666 or 1667 active? **YES**	Diagnostic and repair diagram of the appropriate fault code.
	Fault Codes 1674, 1675, 1676, Are 1665, 1666 or 1667 active? **NO**	2A

STEP 2: Check the configuration of the temperature sensors.

STEP 2A: Check the circuit response. Conditions:

- Turn the ignition key off.
- Disconnect engine exhaust gas temperature sensor 1 (catalytic inlet) from the engine harness.
- Turn on the ignition key.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an appropriate ECM response after 30 seconds. • Use INSITE ™ to read the fault codes.	Fault code 1666 active? **YES** **Repair:** The readings from the catalyst inlet and exhaust temperature sensors are reversed. In the wiring harness, replace the connections of the exhaust gas temperature sensor 1 and the catalytic converter exhaust temperature sensor.	3A
	Fault code 1666 active? **NO**	2B

STEP 2B: Check the circuit response. Conditions:

- Turn the ignition key off.
- Disconnect the engine exhaust gas temperature sensor 2 (catalytic inlet) from the engine harness.
- Turn on the ignition key.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an appropriate ECM response after 30 seconds. • Use INSITE ™ to read the fault codes.	Fault code 1675 active? **YES** **Repair:** The readings from the catalyst inlet and exhaust temperature sensors are reversed. In the wiring harness, replace the connections of the exhaust gas temperature sensor 1 (catalyst inlet) and exhaust gas temperature sensor 2 (catalyst outlet).	3A
	Fault code 1675 active? **NO**	3A

STEP 3: Clear the fault code.

STEP 3A: Clear the fault codes. Conditions:

- Connect all components
- Turn on the ignition key.
- Connect the electronic service tool INSITE ™.

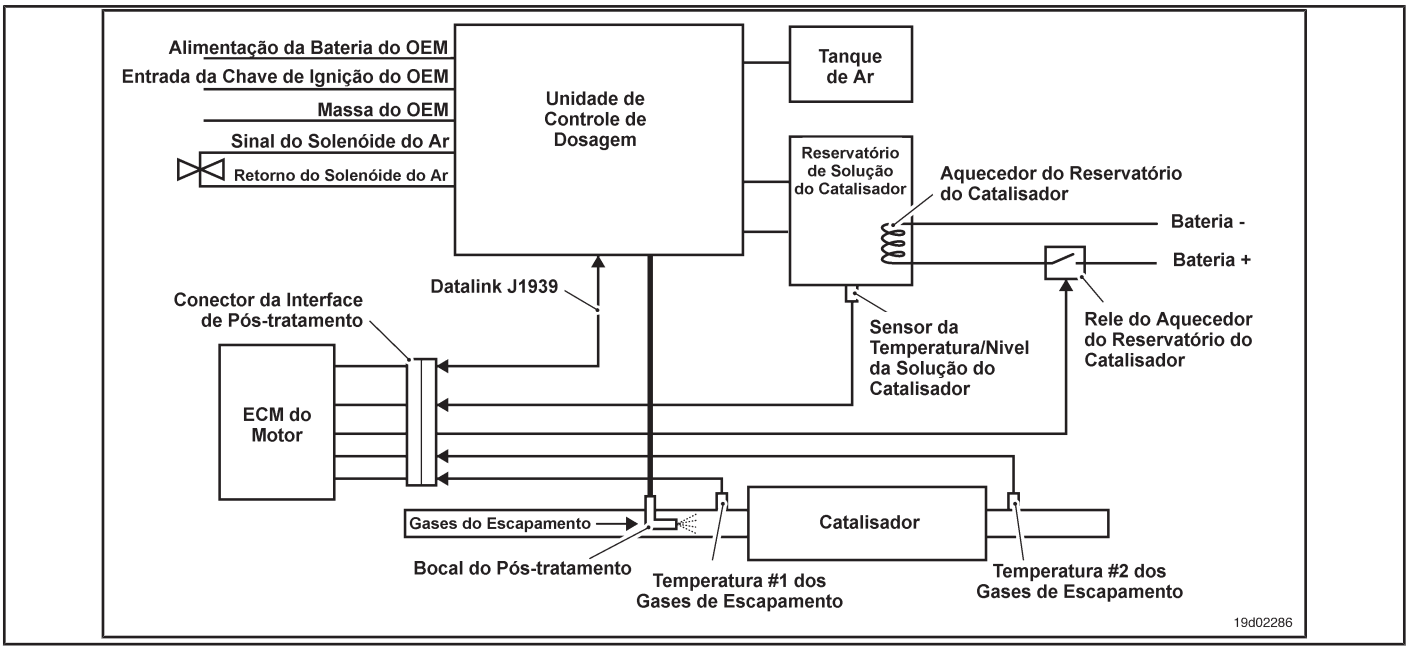
Action	Specifications / Repair	Next step
Clear the fault codes. • Use the electronic service tool INSITE ™ to clear all active and inactive fault codes.	All codes cleared? **YES**	Complete repair.
	All codes cleared? **NO**	Proper troubleshooting and repair steps.

Fault Code 1664

Catalyst Not Installed - Condition Existing.

CODES	REASON	IT IS MADE
Fault Code: 1664 PID (P), SID (S): IMF: 11/31 Lamp: Amber SRT:	Catalyst Not Installed - Condition Existing. The after-treatment catalyst in the exhaust system **no** it's installed.	The injection of catalyst solution into the after-treatment system is disabled.

Circuit: Aftertreatment Control System



Circuit Descriptions:

The catalyst is monitored by the inlet and outlet temperature sensors located in the after-treatment system. The inlet temperature sensor is located before the catalyst and the outlet temperature sensor is located at the outlet of the catalyst system.

Component Location:

The catalyst is located in the exhaust system. The catalyst location may vary, depending on the OEM.

Workshop Tips:

This fault code becomes active when the inlet and outlet temperature sensors no detect the presence of a catalyst in the post-treatment system. The cause may be a breach of the catalytic converter system, removal of the catalyst from the vehicle or a defective catalyst. Catalyst temperature sensors
should read the ambient temperature and the engine **must** be switched off for a period of eight hours before this diagnosis is made.

On-Board Diagnostic Information (OBD):

- The ECM will light the malfunction indicator lamp (MIL) for the second consecutive ignition cycle when the diagnosis is performed and fails.
- **The ECM will turn off the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles in which the diagnosis is performed and no failure.** The MIL lamp and the fault code can also be cleared with the electronic service tool INSITE ™.

- The fault code will be cleared from memory after 40 consecutive driving cycles in which the diagnosis is performed and approved.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch /

AMP / Metri-Pack female test lead. STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check for sensor circuit fault codes.		
STEP 1A: Check for fault codes.	**Fault Codes 1663, 1674, Are 1675, 1676, 1665, 1666 or 1667 active?**	
STEP 1B: Check if there is a catalyst installed.	**Is there a catalyst installed in the after-treatment system?**	
STEP 1C: Inspect the after-treatment system.	**Were found damage or breach in the after-treatment system?**	
STEP 2: Clear the fault code.		
STEP 2A: Check the repair.	**Are the catalyst inlet and outlet temperature readings within the 25 ° F range between them?**	
STEP 2B: Clear the fault code.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check for sensor circuit fault codes.

STEP 1A: Check for fault codes. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for active fault codes. • Use the electronic service tool INSITE ™ to read fault codes.	Fault Codes 1663, 1674, 1675, Are 1676, 1665, 1666 or 1667 active? **YES**	Diagnostic and repair diagram of the appropriate fault code.
	Fault Codes 1663, 1674, 1675, Are 1676, 1665, 1666 or 1667 active? **NO**	1B

STEP 1B: Check if a catalyst is installed. Conditions:

- Turn the ignition key off.

Action	Specifications / Repair	Next step
Check that a catalyst is installed. • Check that a catalyst is installed in the exhaust system.	Is there a catalyst installed in the after-treatment system? **YES**	1C
	Is there a catalyst installed in the after-treatment system? **DO NOT** **REPAIR:** Install the correct catalyst for the application. Refer to the OEM fault diagnosis procedures.	2A

STEP 1C: Inspect the after-treatment system.

Conditions:
- Turn the ignition key off.
- Remove the catalyst from the exhaust system.

Action	Specifications / Repair	Next step
Inspect the catalyst. • Inspect the catalyst for cracks or contamination.	Were found damage or breach to the catalytic converter system? **YES** **Repair:** Install the correct catalyst for the application. Refer to the OEM fault diagnosis procedures.	2A
	Were found damage or breach to the catalytic converter system? **NO**	2A

STEP 2: Clear the fault code.

STEP 2A: Check the repair. Conditions:

- Connect all components
- Turn on the ignition key.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Compare the INSITE readings for the inlet and outlet temperatures of the catalyst. • start the INSITE ™ Monitor / Data Logger and compare the INSITE ™ readings for the inlet and outlet temperatures of the catalyst.	Are the catalyst inlet and outlet temperature readings within the 25 ° F range between them? **YES**	2B
	Are the catalyst inlet and outlet temperature readings within the 25 ° F range between them? **NO**	1A

STEP 2B: Clear the fault codes. Conditions:

- Connect all components
- Turn on the ignition key.
- Connect the electronic service tool INSITE ™.

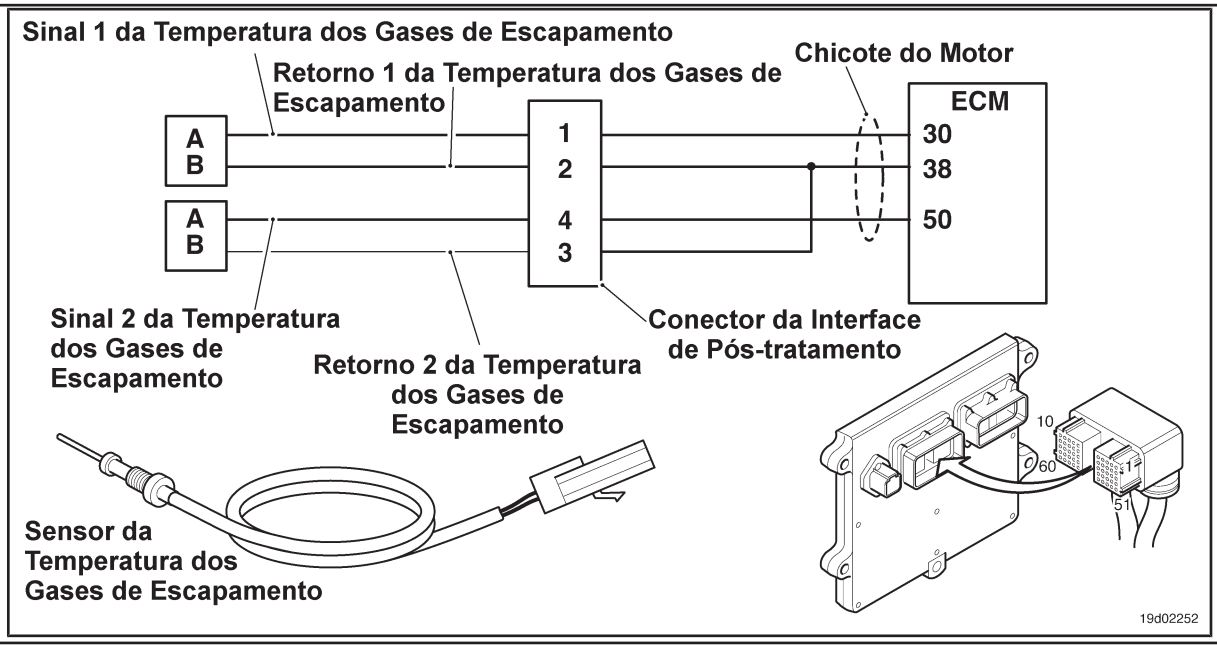
Action	Specifications / Repair	Next step
Clear the fault codes. • Use the electronic service tool INSITE ™ to clear all active and inactive fault codes.	All codes cleared? **YES**	Complete repair.
	All codes cleared? **NO**	Proper troubleshooting and repair steps.

Fault Code 1665

Exhaust Gas Temperature Circuit 1 - Voltage Below Normal or with Low voltage.

CODES	REASON	IT IS MADE
Fault Code: 1665 PID (P), SID (S): IMF: 4 Lamp: Amber SRT:	Exhaust Gas Temperature Circuit 1 - Voltage Below Normal or Low Voltage. Low voltage signal detected in the temperature sensor circuit at the catalyst input.	Possible non-compliance with emission standards. Standard temperature value used at the catalyst inlet.

Circuit: Temperature 1 of the Exhaust Gases



Circuit Descriptions:

The temperature sensor at the catalyst inlet is used by the electronic control module (ECM) to monitor the temperature of the engine exhaust gases entering the catalyst unit. The ECM monitors the voltage at the signal pin and converts it to a temperature value.

Component Location:

The temperature sensor at the catalyst inlet is located in the after-treatment system. It is located between the outlet of the turbocharger and the entry of the catalytic converter unit into the exhaust system.

Workshop Tips:

The temperature sensor at the catalyst inlet shares the engine harness return wires with other sensors. A shorted return can cause the activation of several fault codes. Possible causes of this fault code:

- Short signal with the mass in the whip
- Signal shorted with feedback or ground in the sensor. On-Board

Diagnostic Information (OBD):

- The ECM will illuminate the malfunction indicator lamp (MIL) when the diagnosis is performed and fails.
- The ECM will turn off the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles in which the diagnosis is performed and no failure. The MIL lamp and the fault code can also be cleared with the electronic service tool INSITE ™.
- The fault code will be cleared from memory after 40 consecutive driving cycles in which the diagnosis is performed and approved.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch /

AMP / Metri-Pack female test lead. STEPS

		SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.			
STEP 1A: Check for a security code failure inactive.		**Fault code 1665 inactive?**	
STEP 2: Check the circuit and the No. 1 exhaust gas temperature sensor.			
STEP 2A:	**Inspect the exhaust gas temperature sensor No. 1 and the connector pins.**	**Dirty or damaged pins?**	
STEP 2B: Check the circuit response.		**Fault Code 1666 active and Fault Code 1665 inactive?**	
STEP 2C: Check the fault codes and the sensor condition.		**Fault code 1665 active?**	
STEP 3: Check the ECM and the engine harness.			
STEP 3A:	**Inspect the pins of the engine harness and ECM connectors.**	**Dirty or damaged pins?**	
STEP 3B: Check the circuit response.		**Fault Code 1666 active and Fault Code 1665 inactive?**	
STEP 3C: Check for a short circuit between pins in the engine harness.		**More than 100k ohms?**	
STEP 3D: Check if there is a short circuit between pins and ground.		**More than 100k ohms?**	
STEP 3E: Check for a passcode failure inactive.		**Fault code 1665 inactive?**	
STEP 4: Clear the fault codes.			
STEP 4A: Disable the fault code.		**Fault code 1665 inactive?**	
STEP 4B: Clear the fault codes inactive.		**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

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

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an inactive fault code. • Use INSITE ™ to read the fault codes. Fault code 1665 inactive?	**YES**	Fault Code Inactive or Intermittent, Procedure 019-362 .
	Fault code 1665 inactive? **NO**	2A

STEP 2: Check the circuit and the No. 1 exhaust gas temperature sensor.

STEP 2A: Inspect the exhaust gas temperature sensor No. 1 and the connector pins.

Conditions:
- Turn the ignition key off.
- Disconnect the No. 1 exhaust gas temperature sensor from the engine harness.

Action	Specifications / Repair	Next step
Check the engine harness and No. 1 exhaust gas temperature sensor for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Damage to the wire shield • Moisture inside or over the connector • Connector seals damaged or missing • Broken connector cover • Connector pin dirt or debris For general inspection techniques, see Connector and Component Pin Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected in the sensor or in the harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-071 .	4A
	Dirty or damaged pins? **NO**	2B

STEP 2B: Check the circuit response. Conditions:

- Turn the ignition key off.
- Disconnect the No. 1 exhaust gas temperature sensor from the engine harness.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an appropriate ECM response after 30 seconds. • Use INSITE ™ to read the fault codes.	Fault Code 1666 active and Fault Code 1665 inactive? **YES**	2C
	Fault Code 1666 active and Fault Code 1665 inactive? **NO**	3A

STEP 2C: Check the fault codes and the condition of the sensor. Conditions:

- Turn the ignition key off.
- Connect the No. 1 exhaust gas temperature sensor to the engine harness.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Use INSITE ™ to read the fault codes.	Fault code 1665 active? **YES** **Repair:** Replace the exhaust gas temperature sensor No. 1. See the Procedure 019-013 .	4A
	Fault code 1665 active? **DO NOT** **REPAIR:** None. Did removing and installing the connector correct the failure?	4A

STEP 3: Check the ECM and the engine harness.

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

Conditions:
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.

Action	Specifications / Repair	Next step
Check that the pins on the engine harness and ECM connectors have: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Damage to the wire shield • Moisture inside or over the connector • Connector seals damaged or missing • Broken connector cover • Connector pin dirt or debris For general inspection techniques, see Connector and Component Pin Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected at the ECM connector or the motor harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-043 .	4A
	Dirty or damaged pins? **NO**	3B

STEP 3B: Check the circuit response. Conditions:

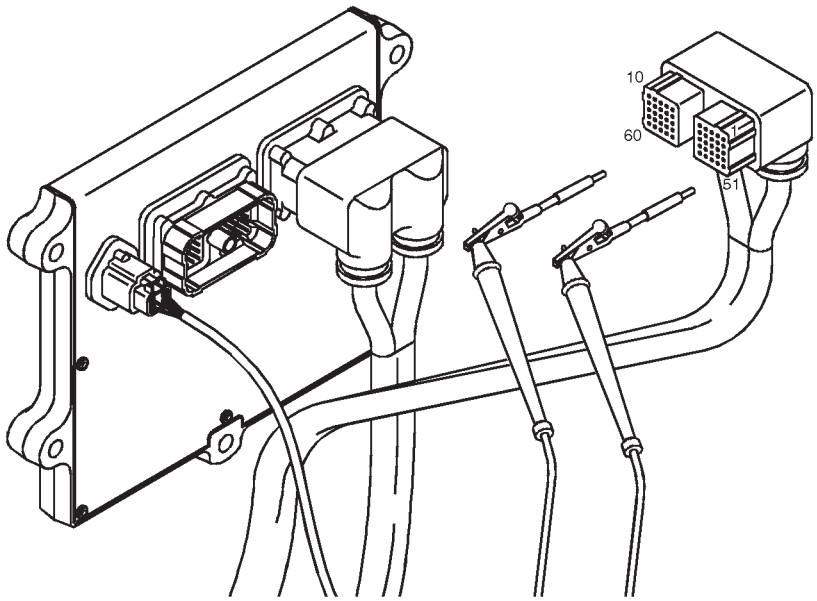
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Use INSITE ™ to read the fault codes.	Fault Code 1666 active and Fault Code 1665 inactive? **YES**	3C
	Fault Code 1666 active and Fault Code 1665 inactive? **DO NOT** **REPAIR:** Call for pre-authorization. Replace the ECM. See the Procedure 019-031 .	4A

STEP 3C: Check the motor harness for a short circuit between pins. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Disconnect the No. 1 exhaust gas temperature sensor from the engine harness.

Action	Specifications / Repair	Next step
Check for a short circuit between pins. • Measure the resistance between the exhaust gas temperature sensor No. 1 SIGN pin on the ECM connector on the engine harness and all other pins on the ECM connector on the engine harness. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YES**	3D
	More than 100k ohms? **DO NOT** **REPAIR:** A short circuit was detected between pins in the SIGNAL line in the motor harness. Repair or replace the engine harness. See the Procedure 019-043 .	4A



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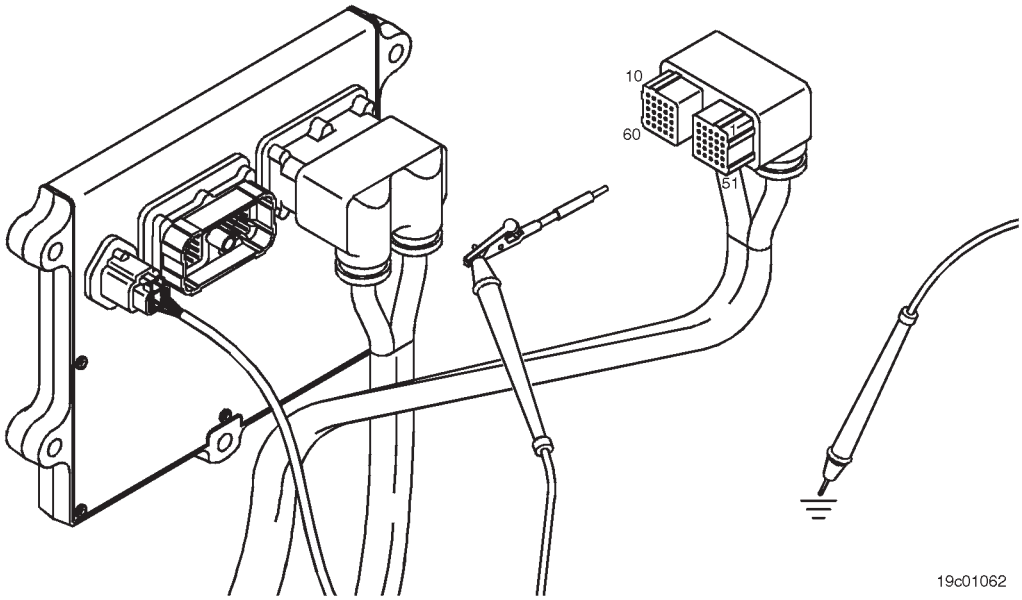
STEP 3D: Check if there is a short circuit between the pins and the ground. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Disconnect the No. 1 exhaust gas temperature sensor from the engine harness.

Action	Specifications / Repair	Next step
Check for a short between pins and ground. • Measure the resistance between the SIGN pin of the No. 1 exhaust gas temperature sensor, the ECM connector on the engine harness, and the ground. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YES**	3E
	More than 100k ohms? **DO NOT** **REPAIR:** A short circuit was detected between the pins and the ground in the SIGNAL line in the motor harness. Repair or replace the engine harness. See the Procedure 019-043 .	4A



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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Use INSITE ™ to read the fault codes.	Fault code 1665 inactive? **YES** **Repair:** None. Did removing and installing the connector correct the failure?	4A
	Fault code 1665 inactive? **DO NOT** **REPAIR:** The fault diagnosis procedures must be repeated from the beginning. A failure mode must have been detected.	1A

STEP 4: Clear the fault codes.

STEP 4A: Disable the fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Use INSITE ™ to check if the fault code is inactive.	Fault code 1665 inactive? **YES**	4B
	Fault code 1665 inactive? **NO**	1A

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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

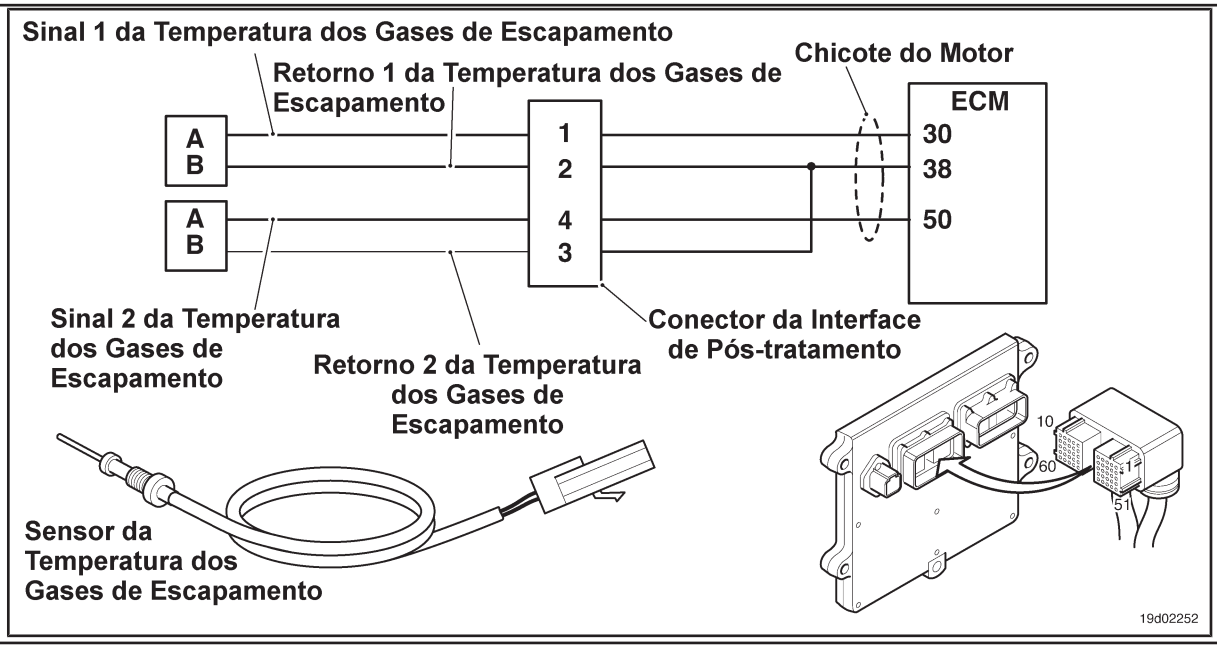
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use INSITE ™ to clear inactive fault codes.	All codes cleared? **YES**	Complete repair
	All codes cleared? **NO**	Proper troubleshooting and repair steps

Fault Code 1666

Exhaust Gas Temperature Circuit 1 - Voltage Above Normal or with High Voltage

CODES	REASON	IT IS MADE
Fault Code: 1666 PID (P), SID (S): IMF: 3 Lamp: Amber SRT:	Exhaust Gas Temperature Circuit 1 - Voltage Above Normal or High Voltage. High voltage signal detected in the temperature sensor circuit at the catalyst input.	Possible non-compliance with emission standards. Standard temperature value used at the catalyst inlet.

Circuit: Temperature 1 of the Exhaust Gases



Circuit Descriptions:

The temperature sensor at the catalyst inlet is used by the electronic control module (ECM) to monitor the temperature of the engine exhaust gases entering the catalyst unit. The ECM monitors the voltage at the signal pin and converts it to a temperature value.

Component Location:

The temperature sensor at the catalyst inlet is located in the after-treatment system. It is located between the outlet of the turbocharger and the entry of the catalytic converter unit into the exhaust system.

Workshop Tips:

The temperature sensor at the catalyst inlet shares the engine harness return wires with other sensors. A shorted return can cause the activation of several fault codes. Possible causes of this fault code:

- Return circuit open at harness, connectors or sensor.
- Open or short-circuit signal with a voltage source. On-Board Diagnostic Information (OBD):

- The ECM will illuminate the malfunction indicator lamp (MIL) when the diagnosis is performed and fails.
- The ECM will turn off the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles in which the diagnosis is performed and no failure. The MIL lamp and the fault code can also be cleared with the electronic service tool INSITE ™.
- The fault code will be cleared from memory after 40 consecutive driving cycles in which the diagnosis is performed and approved.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch /

AMP / Metri-Pack female test lead. STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check for a security code failure inactive.	**Fault code 1666 inactive?**	
STEP 2: Check the circuit and the No. 1 exhaust gas temperature sensor.		
STEP 2A: Inspect the exhaust gas temperature sensor No. 1 and the connector pins.	**Dirty or damaged pins?**	
STEP 2B: Check the circuit response.	**Fault Code 1665 active and Fault Code 1666 inactive?**	
STEP 2C: Check the fault codes and the sensor condition.	**Fault code 1666 active?**	
STEP 3: Check the ECM and the engine harness.		
STEP 3A: Inspect the pins of the engine harness and ECM connectors.	**Dirty or damaged pins?**	
STEP 3B: Check the circuit response.	**Fault Code 1665 active and Fault Code 1666 inactive?**	
STEP 3C: Check for a circuit open in the engine harness.	**Less than 10 ohms?**	
STEP 3C-1: Check for a circuit open in the engine harness.	**Less than 10 ohms?**	
STEP 3D: Check for a short circuit between pins in the engine harness.	**More than 100k ohms?**	
STEP 3E: Check for a passcode failure inactive.	**Fault code 1666 inactive?**	
STEP 4: Clear the fault codes.		
STEP 4A: Disable the fault code.	**Fault code 1666 inactive?**	
STEP 4B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

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

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an inactive fault code. • Use INSITE ™ to read the fault codes. Fault code 1666 inactive?	**YES**	Fault Code Inactive or Intermittent, Procedure 019-362 .
	Fault code 1666 inactive? **NO**	2A

STEP 2: Check the circuit and the No. 1 exhaust gas temperature sensor.

STEP 2A: Inspect the exhaust gas temperature sensor No. 1 and the connector pins.

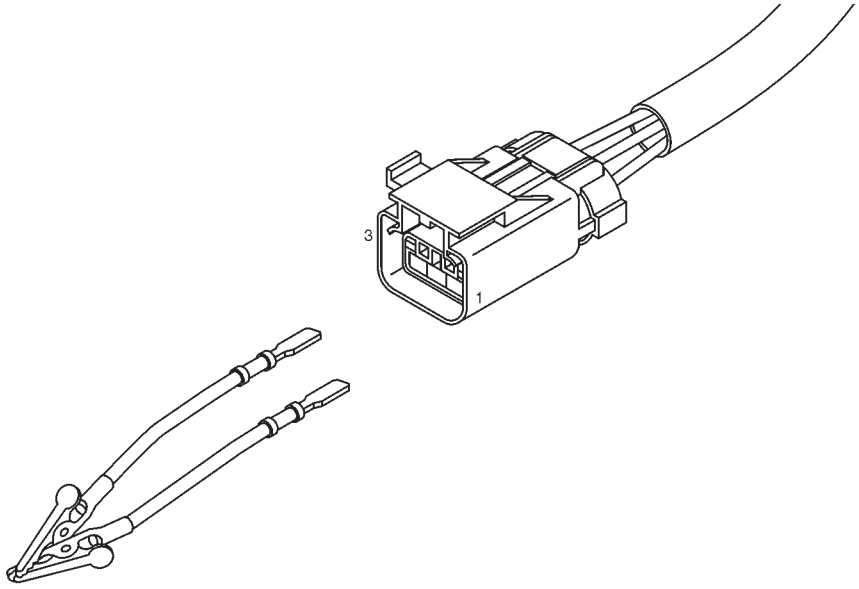
Conditions:
- Turn the ignition key off.
- Disconnect the No. 1 exhaust gas temperature sensor from the engine harness.

Action	Specifications / Repair	Next step
Check the engine harness and No. 1 exhaust gas temperature sensor for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Damage to the wire shield • Moisture inside or over the connector • Connector seals damaged or missing • Broken connector cover • Connector pin dirt or debris For general inspection techniques, see Connector and Component Pin Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected in the sensor or in the harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-071 .	4A
	Dirty or damaged pins? **NO**	2B

STEP 2B: Check the circuit response. Conditions:

- Turn the ignition key off.
- Disconnect the No. 1 exhaust gas temperature sensor from the engine harness.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Install a jumper wire between the SIGNAL and RETURN pins of the No. 1 exhaust gas temperature sensor, to the sensor connector on the engine harness. • Refer to the electrical diagram for identification of the connector pins.	Fault Code 1665 active and Fault Code 1666 inactive? **YES**	2C
	Fault Code 1665 active and Fault Code 1666 inactive? **NO**	3A



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STEP 2C: Check the fault codes and the condition of the sensor. Conditions:

- Turn the ignition key off.
- Connect the No. 1 exhaust gas temperature sensor to the engine harness.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Use INSITE ™ to read the fault codes.	Fault code 1666 active? **YES** **Repair:** A defective exhaust gas temperature sensor 1 has been detected. Replace the exhaust gas temperature sensor No. 1. See the Procedure 019-013 .	4A
	Fault code 1666 active? **DO NOT** **REPAIR:** None. Did removing and installing the connector correct the failure?	4A

STEP 3: Check the ECM and the engine harness.

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

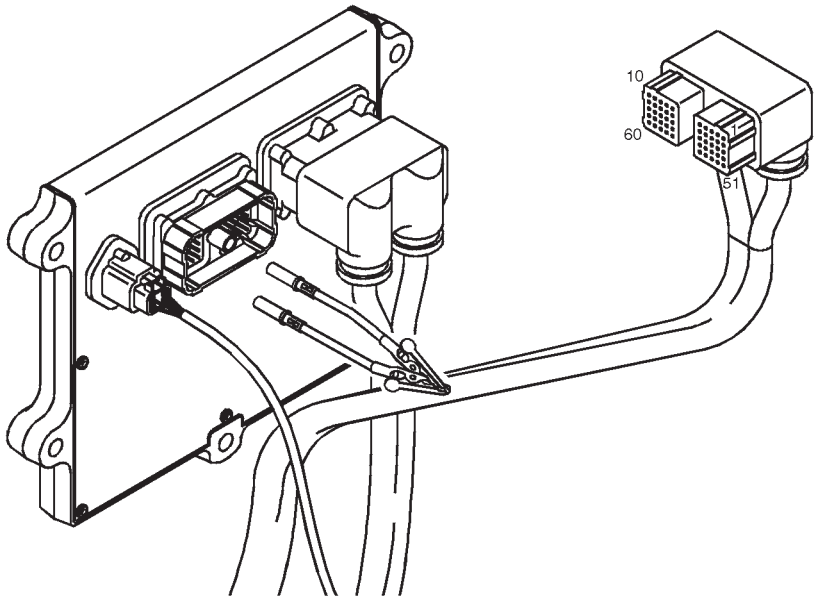
Conditions:
- Turn the ignition key off.
- Disconnect the engine harness from the ECM connector.

Action	Specifications / Repair	Next step
Check that the pins on the engine harness and ECM connectors have: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Damage to the wire shield • Moisture inside or over the connector • Connector seals damaged or missing • Broken connector cover • Connector pin dirt or debris For general inspection techniques, see Connector and Component Pin Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected at the ECM connector or the motor harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-043 .	4A
	Dirty or damaged pins? **NO**	3B

STEP 3B: Check the circuit response. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Install a bridge wire between the SIGNAL and RETURN pins of the exhaust gas temperature sensor 1, on the ECM connector. • Check for proper circuit response after 30 seconds. • Use INSITE ™ to read the fault codes. Refer to the electrical diagram for identification of the connector pins.	Fault Code 1665 active and Fault Code 1666 inactive? **YES**	3C
	Fault Code 1665 active and Fault Code 1666 inactive? **DO NOT** **REPAIR:** Call for pre-authorization. Replace the ECM. See the Procedure 019-031 .	4A



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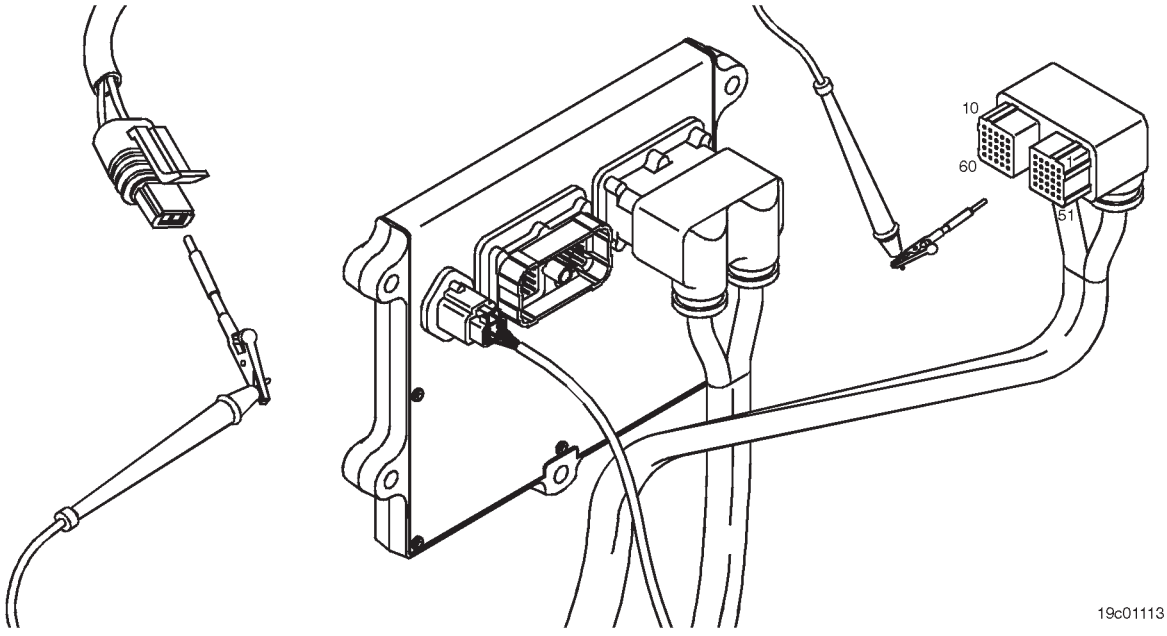
STEP 3C: Check the motor harness for an open circuit. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Disconnect the No. 1 exhaust gas temperature sensor from the engine harness.

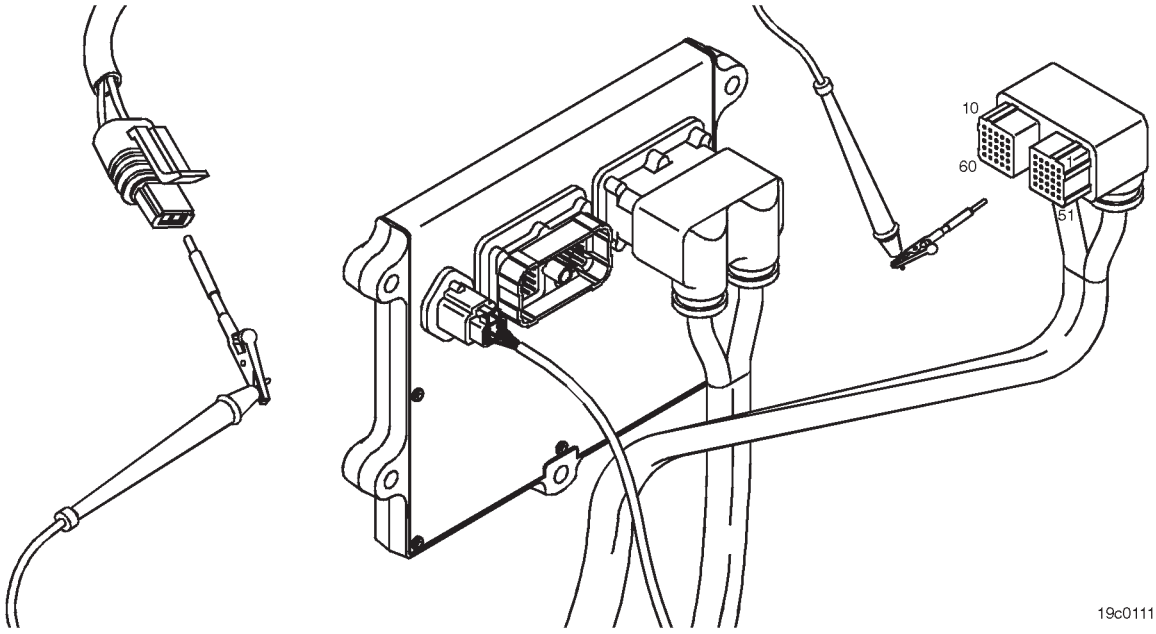
Action	Specifications / Repair	Next step
Check for an open circuit. • Measure the resistance between the RETURN pin of the exhaust gas temperature sensor 1, on the ECM connector on the engine harness, and the RETURN pin on the exhaust gas temperature sensor 1 connector, on the engine harness. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	Less than 10 ohms? **YES**	3C-1
	Less than 10 ohms? **DO NOT** **REPAIR:** An open RETURN circuit was detected in the engine harness. Repair or replace the engine harness. See the Procedure 019-043 .	4A



STEP 3C-1: Check the motor harness for an open circuit. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Disconnect the No. 1 exhaust gas temperature sensor from the engine harness.

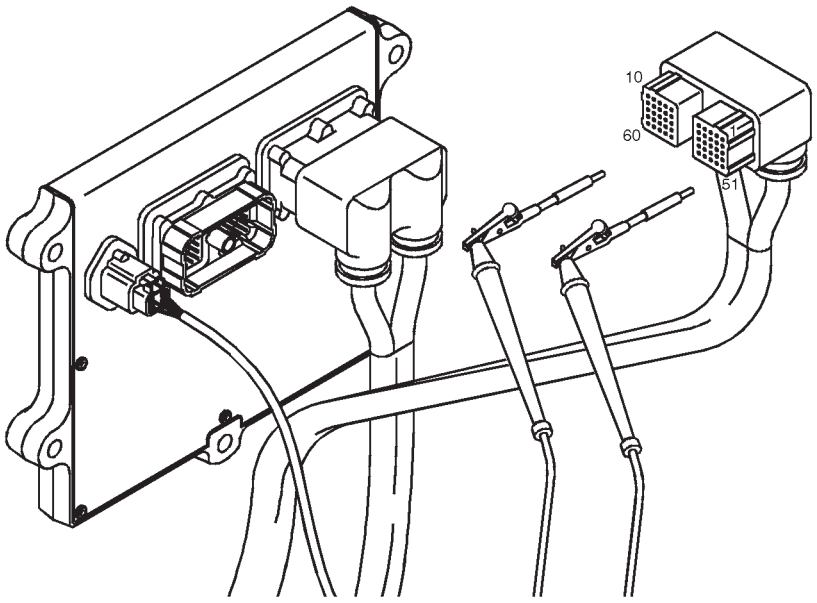
Action	Specifications / Repair	Next step
Check for an open circuit. • Measure the resistance between the exhaust temperature sensor 1 SIGN pin on the ECM connector on the engine harness and the SIGN pin on the exhaust temperature sensor 1 connector on the engine harness. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	Less than 10 ohms? **YES**	3D
	Less than 10 ohms? **DO NOT** **REPAIR:** An open SIGNAL circuit was detected in the engine harness. Repair or replace the engine harness. See the Procedure 019-043 .	4A



STEP 3D: Check the motor harness for a short circuit between pins. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Disconnect the No. 1 exhaust gas temperature sensor from the engine harness.

Action	Specifications / Repair	Next step
Check for a short circuit between pins. • Measure the resistance between the exhaust gas temperature sensor No. 1 SIGN pin on the ECM connector on the engine harness and all other pins on the ECM connector on the engine harness. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YES**	3E
	More than 100k ohms? **DO NOT** **REPAIR:** A short circuit was detected between pins in the SIGNAL line in the motor harness. Repair or replace the engine harness. See the Procedure 019-043 .	4A



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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Use INSITE ™ to read the fault codes.	Fault code 1666 inactive? **YES** **Repair:** None. Did removing and installing the connector correct the failure?	4A
	Fault code 1666 inactive? **DO NOT** **REPAIR:** The fault diagnosis procedures must be repeated from the beginning. A failure mode must have been detected.	1A

STEP 4: Clear the fault code.

STEP 4A: Disable the fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Use INSITE ™ to check if the fault code is inactive.	Fault code 1666 inactive? **YES**	4B
	Fault code 1666 inactive? **NO**	1A

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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

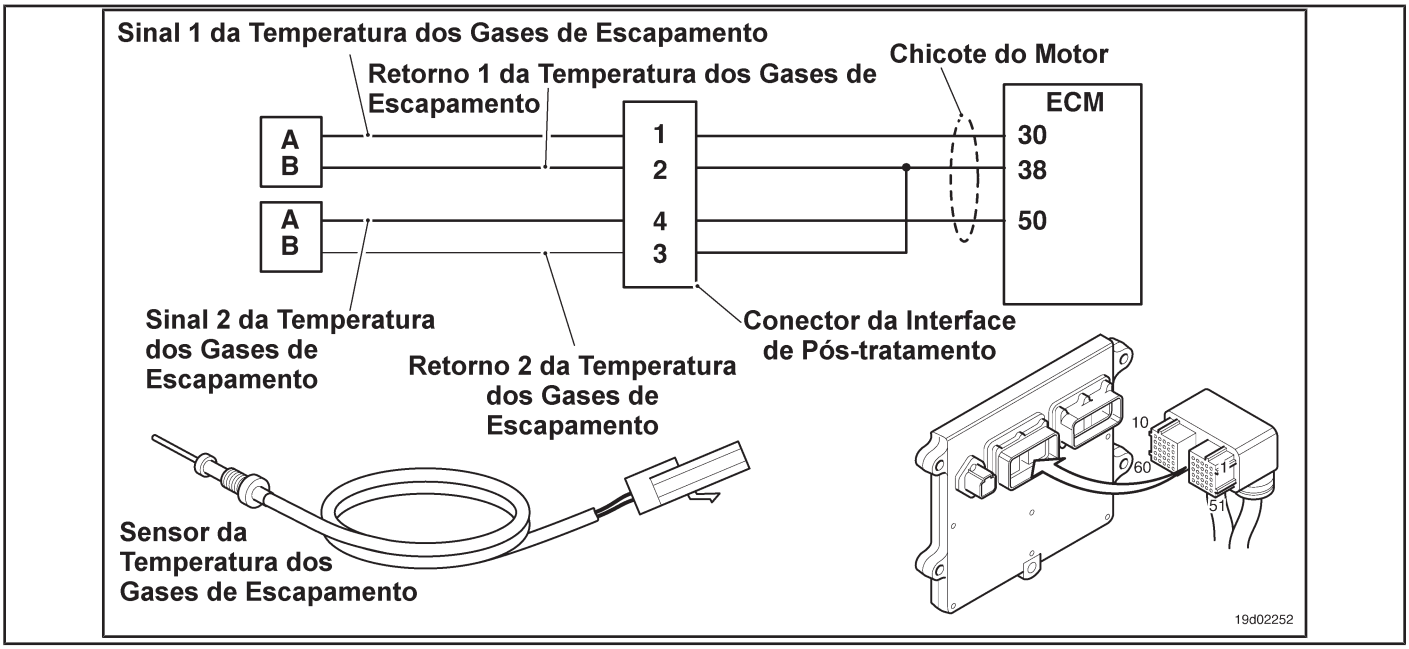
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use INSITE ™ to clear inactive fault codes.	All codes cleared? **YES**	Complete repair
	All codes cleared? **NO**	Proper troubleshooting and repair steps

Fault Code 1667

Exhaust Gas Temperature 1 - Invalid, Intermittent or Incorrect Data

CODES	REASON	IT IS MADE
Fault Code: 1667 PID (P), SID (S): IMF: 2 Lamp: Amber SRT:	Exhaust Gas Temperature 1 - Invalid, Intermittent or Incorrect Data. The exhaust gas temperature sensor 1 does not change according to the engine's operating conditions.	Possible non-compliance with emission standards. The standard value for exhaust gas temperature 1 is used.

Circuit: Temperature 1 of the Exhaust Gases



Circuit Descriptions:

The exhaust gas temperature sensor No. 1 is used by the electronic control module (ECM) to monitor the temperature of the engine exhaust gases entering the catalyst unit. The ECM monitors the voltage at the signal pin and converts it to a temperature value.

Component Location:

The No. 1 catalyst exhaust gas temperature sensor is located in the after-treatment system. It is located between the outlet of the turbocharger and the entry of the catalytic converter unit into the exhaust system.

Workshop Tips:

This diagnosis is performed when the engine has not been running for the past eight hours. The exhaust gas temperature sensor 1 is compared to the coolant temperatures and in the intake manifold when the ignition key is turned on after an eight-hour shutdown. This fault code will be logged if the exhaust gas temperature sensor 1 reading is not the same as the engine coolant temperature readings and the intake manifold. Possible causes of this fault code:

- Exhaust gas temperature sensor "stuck" in the operating range
- High resistance in the signal and return lines of the exhaust gas temperature 1 sensor.

On-Board Diagnostic Information (OBD):

- The ECM will light the malfunction indicator lamp (MIL) for the second consecutive ignition cycle when the diagnosis is performed and fails.
- The ECM will turn off the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles in which the diagnosis is performed and no failure. The MIL lamp and the fault code can also be cleared with the electronic service tool INSITE ™.
- The fault code will be cleared from memory after 40 consecutive driving cycles in which the diagnosis is performed and approved.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch /

AMP / Metri-Pack female test lead. STEPS

		SPECIFICATIONS	SRT CODE
STEP 1: Check for sensor circuit fault codes.			
STEP 1A: Check the Fault Codes	**1665 and 1666 are registered.**	**Are Fault Codes 1665 or 1666 active?**	
STEP 2: Check the circuit and the No. 1 exhaust gas temperature sensor.			
STEP 2A:	**Inspect the exhaust gas temperature sensor No. 1 and the connector pins.**	**Dirty or damaged pins?**	
STEP 2B: Check the circuit response.		**Fault code 1666 active?**	
STEP 2C: Check the circuit response.		**Fault code 1665 active?**	
STEP 3: Check the ECM and the engine harness.			
STEP 3A:	**Inspect the pins of the engine harness and ECM connectors.**	**Dirty or damaged pins?**	
STEP 3B: Check the circuit response.		**Fault code 1666 active?**	
STEP 3C: Check the circuit response.		**Fault code 1665 active?**	
STEP 4: Clear the fault codes.			
STEP 4A: Check the repair.		**Are the temperature readings at the inlet and outlet of the catalyst within the 25 ° F range between them?**	
STEP 4B: Clear the fault codes.		**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check for sensor circuit fault codes.

STEP 1A: Check that Fault Codes 1665 and 1666 are registered. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for active fault codes. • Use INSITE ™ to read the fault codes. Fault Codes 1665 or 1666 are active?	**YES**	Fault diagnosis diagram for Fault Code 1665 or 1666.
	Are Fault Codes 1665 or 1666 active? **NO**	2A

STEP 2: Check the circuit and the No. 1 exhaust gas temperature sensor.

STEP 2A: Inspect the exhaust gas temperature sensor No. 1 and the connector pins.

Conditions:

- Turn the ignition key off.
- Disconnect the No. 1 exhaust gas temperature sensor from the engine harness.

Action	Specifications / Repair	Next step
Check the engine harness and No. 1 exhaust gas temperature sensor for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Damage to the wire shield • Moisture inside or over the connector • Connector seals damaged or missing • Broken connector cover • Connector pin dirt or debris For general inspection techniques, see Connector and Component Pin Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected in the sensor or in the harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-071 .	4A
	Dirty or damaged pins? **NO**	2B

STEP 2B: Check the circuit response. Conditions:

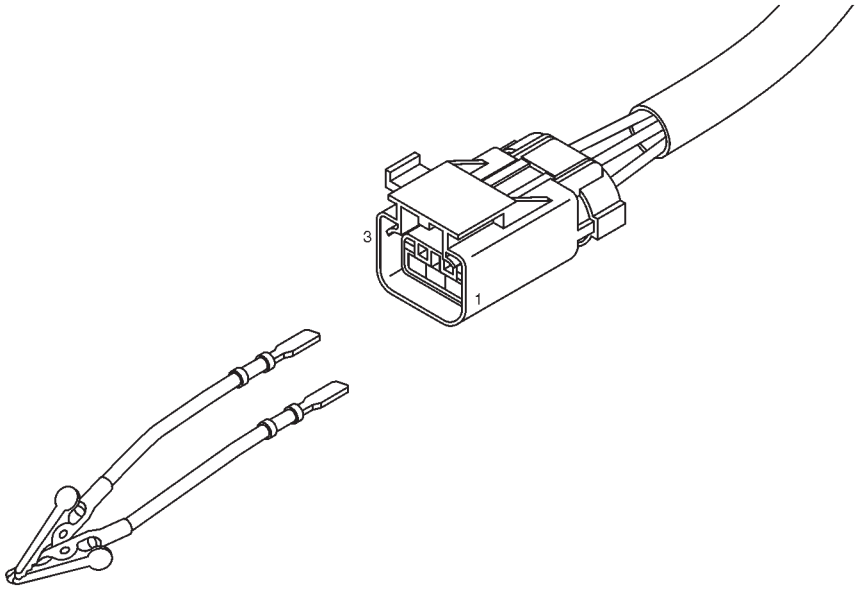
- Turn the ignition key off.
- Disconnect the No. 1 exhaust gas temperature sensor from the engine harness.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an appropriate ECM response after 30 seconds. • Use INSITE ™ to read the fault codes.	Fault code 1666 active? **YES**	2C
	Fault code 1666 active? **NO**	3A

STEP 2C: Check the circuit response. Conditions:

- Turn the ignition key off.
- Disconnect the exhaust gas temperature sensor 1 from the engine harness.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Install a bridge wire between the SIGNAL and RETURN pins of the exhaust gas temperature sensor 1, on the engine harness connector. Refer to the electrical diagram for identification of the connector pins. Check for proper circuit response after 30 seconds.	Fault code 1665 active? **YES** **Repair:** Replace the exhaust gas temperature sensor No. 1. See the Procedure 019-013 .	4A
• Use INSITE ™ to read the fault codes.	Fault code 1665 active? **NO**	3A



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STEP 3: Check the ECM and the engine harness.

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

Conditions:
- Turn the ignition key off.
- Disconnect the engine harness from the ECM connector.

Action	Specifications / Repair	Next step
Check that the pins on the engine harness and ECM connectors have: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Damage to the wire shield • Moisture inside or over the connector • Connector seals damaged or missing • Broken connector cover • Connector pin dirt or debris For general inspection techniques, see Connector and Component Pin Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected at the ECM connector or the motor harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-043 .	4A
	Dirty or damaged pins? **NO**	3B

STEP 3B: Check the circuit response. Conditions:

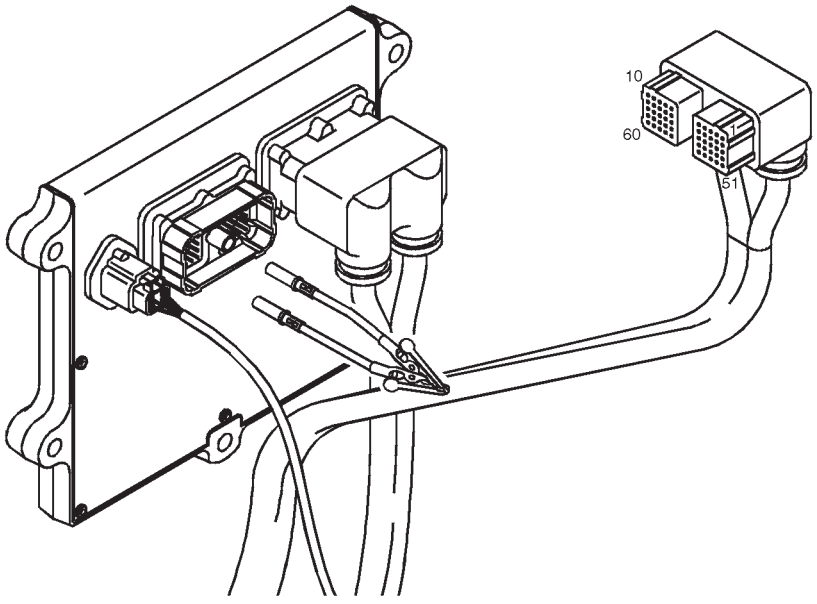
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Use INSITE ™ to read the fault codes.	Fault code 1666 active? **YES**	3C
	Fault code 1666 active? **DO NOT** **REPAIR:** Call for pre-authorization. Replace the ECM. See the Procedure 019-031 .	4A

STEP 3C: Check the circuit response. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Install a bridge wire between the SIGNAL and RETURN pins of the exhaust gas temperature sensor 1, on the ECM connector. Check for proper circuit response after 30 seconds. • Use INSITE ™ to read the fault codes.	Fault code 1665 active? **YES** **Repair:** High resistance or a short circuit was detected in the engine harness. Repair or replace the engine harness. See the Procedure 019-043 .	4A
	Fault code 1665 active? **DO NOT** **REPAIR:** Call for pre-authorization. Replace the ECM. See the Procedure 019-031 .	4A



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STEP 4: Clear the fault code.

STEP 4A: Check the repair. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Start the INSITE ™ Monitor / Data Logger. • Compare INSITE ™ readings for catalyst inlet and outlet temperatures.	Are the temperature readings at the inlet and outlet of the catalyst within the 25 ° F range between them? **YES**	4B
	Are the temperature readings at the inlet and outlet of the catalyst within the 25 ° F range between them? **NO**	1A

STEP 4B: Clear the fault codes. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

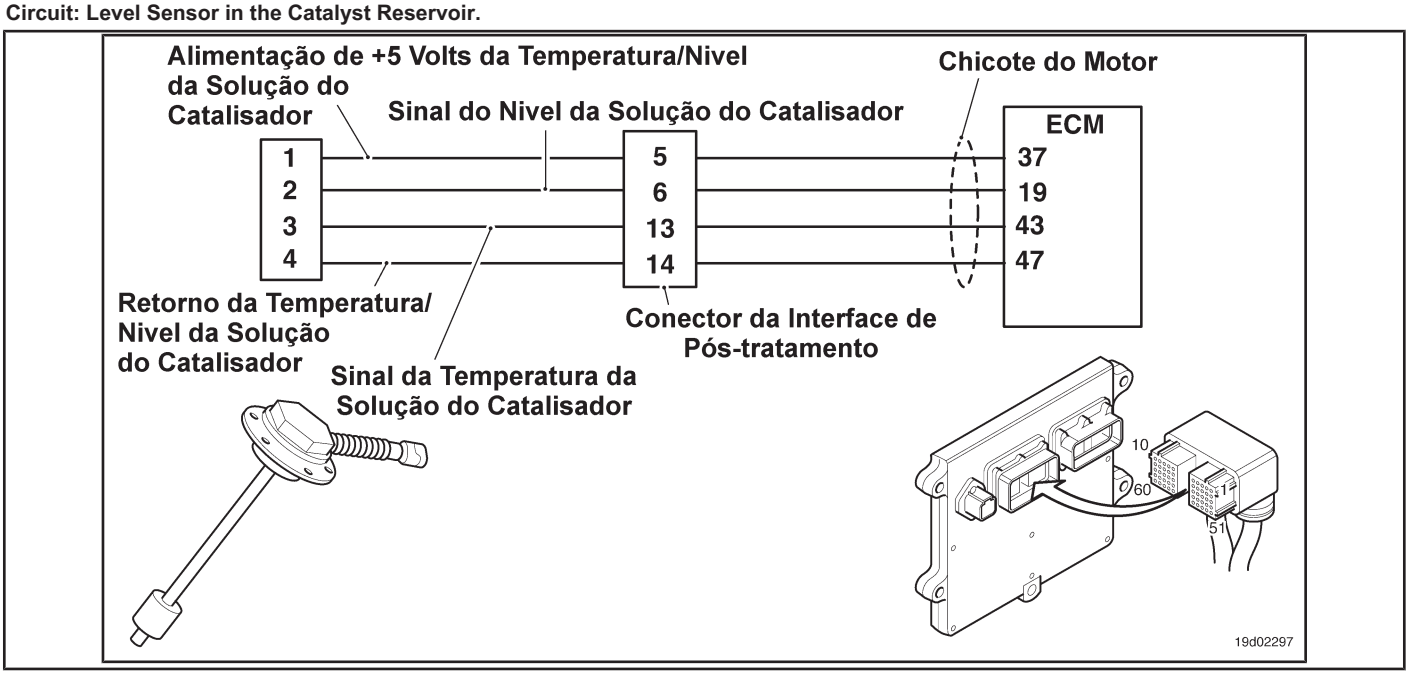
Action	Specifications / Repair	Next step
Clear the fault codes. • Use the electronic service tool INSITE ™ to clear all active and inactive fault codes.	All codes cleared? **YES**	Complete repair
	All codes cleared? **NO**	Proper troubleshooting and repair steps

Fault Code 1668

Level Sensor Circuit in Catalyst Reservoir - Voltage Below Normal or with low voltage

CODES	REASON	IT IS MADE
Fault Code: 1668 PID (P), SID (S): IMF: 4/4 Lamp: Amber SRT:	Level Sensor Circuit in Catalyst Reservoir - Voltage Below Normal or Low Voltage. Low voltage signal detected in the level sensor circuit in the catalyst reservoir.	The injection of catalyst solution into the after-treatment system is disabled.

Circuit: Level Sensor in the Catalyst Reservoir.



Circuit Descriptions:

The level sensor in the catalyst reservoir is used to monitor the level of the catalyst solution inside the catalyst reservoir. The level sensor in the catalyst reservoir is a sensor combined with the temperature sensor of the catalyst solution. The level and temperature sensors share a common feedback loop.

Component Location:

The level sensor in the catalyst reservoir is located in the catalyst solution reservoir. The locations of the solution level reservoir and sensor depend on the OEM.

Workshop Tips:

The level sensor in the catalytic converter reservoir shares the supply and return wires of the engine harness with other sensors. Open and short circuits in the engine harness can cause several fault codes to be activated.

Before diagnosing fault code 1668, check for other faults. Possible causes of this fault code:

- Open or shorted signal circuit with ground in the motor or sensor harness.

- Supply line open or shorted to ground. On-Board Diagnostic Information

(OBD):

- The ECM will illuminate the malfunction indicator lamp (MIL) when the diagnosis is performed and fails.
- The ECM will turn off the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles in which the diagnosis is performed and no failure. The MIL lamp and the fault code can also be cleared with the electronic service tool INSITE ™.
- The fault code will be cleared from memory after 40 consecutive driving cycles in which the diagnosis is performed and approved.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch /

AMP / Metri-Pack female test lead. STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check for fault codes sensor power supply.	**Fault code 187 active?**	
STEP 1B: Check for a passcode failure inactive.	**Fault Code 1668 inactive?**	
STEP 2: Check the level sensor in the catalyst reservoir and the circuit.		
STEP 2A: Inspect the level sensor in the catalyst reservoir and the connector pins.	**Dirty or damaged pins?**	
STEP 2B: Check the voltage supply and the sensor feedback circuit.	**4.75 to 5.25 VDC?**	
STEP 2C: Check the circuit response.	**Fault Code 1669 active and Fault Code 1668 inactive?**	
STEP 2D: Check the fault codes and the sensor condition.	**Fault code 1668 active?**	
STEP 3: Check the ECM and the engine harness.		
STEP 3A: Inspect the pins of the engine harness and ECM connectors.	**Dirty or damaged pins?**	
STEP 3A-1: Check the voltage supply and the sensor feedback circuit.	**4.75 to 5.25 VDC?**	
STEP 3A-2: Check for a code fault active.	**Fault Code 1668 inactive?**	
STEP 3B: Inspect the engine control module and the connector pins on the engine harness.	**Dirty or damaged pins?**	
STEP 3B-1: Check the response of the electronic engine control module.	**Fault Code 1669 active and Fault Code 1668 inactive?**	
STEP 3B-2: Check for a code fault active.	**Fault Code 1668 inactive?**	
STEP 4: Clear the fault codes.		
STEP 4A: Disable the fault code.	**Fault Code 1668 inactive?**	
STEP 4B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Check for sensor power failure codes. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for sensor power failure codes. • Use INSITE ™ to read the fault codes.	Fault code 187 active? **YES**	Refer to Fault Code 187.
	Fault code 187 active? **NO**	1B

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

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an inactive fault code. • Use INSITE ™ to read the fault codes. Fault Code 1668 inactive?	**YES**	Fault Code Inactive or Intermittent, Procedure 019-362 .
	Fault Code 1668 inactive? **NO**	2A

STEP 2: Check the level sensor in the catalyst reservoir and the circuit.

STEP 2A: Inspect the level sensor in the catalyst reservoir and the connector pins.

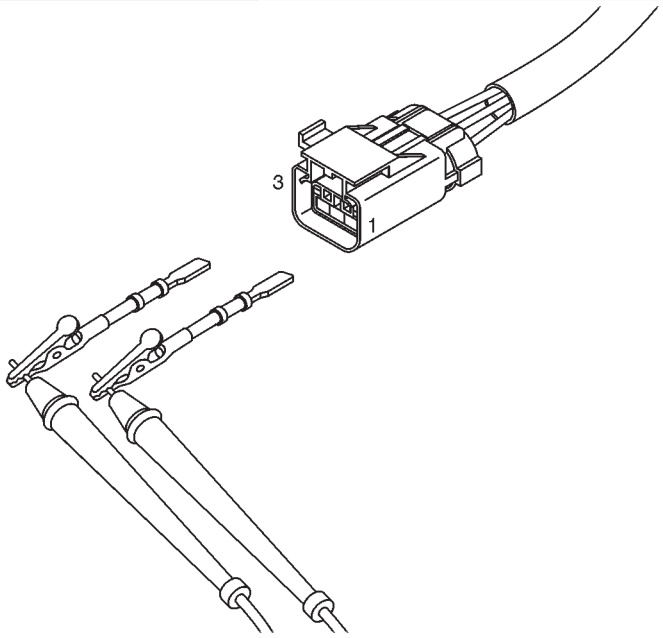
Conditions:
- Turn the ignition key off.
- Disconnect the level sensor in the catalytic reservoir from the engine harness.

Action	Specifications / Repair	Next step
Inspect the engine harness and level sensor connector pins in the catalytic converter reservoir for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Damage to the wire shield • Moisture inside or over the connector • Connector seals damaged or missing • Broken connector cover • Connector pin dirt or debris For general inspection techniques, see Connector and Component Pin Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected in the sensor or in the harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-043 .	4A
	Dirty or damaged pins? **NO**	2B

STEP 2B: Check the supply voltage and the sensor return circuit. Conditions:

- Turn the ignition key off.
- Disconnect the level sensor in the catalytic reservoir from the engine harness.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check the supply voltage and the return circuit. • Measure the voltage between the +5 volt POWER and RETURN pins of the level sensor in the catalyst reservoir, at the sensor connector on the engine harness. Refer to the electrical diagram for identification of the connector pins.	4.75 to 5.25 VDC? **YES**	2C
	4.75 to 5.25 VDC? **NO**	3A



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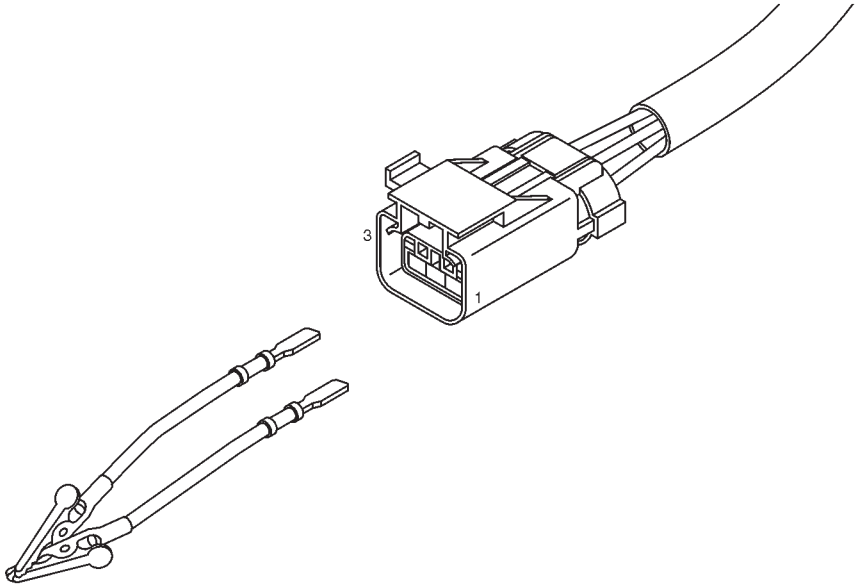
STEP 2C: Check the circuit response. Conditions:

- Turn the ignition key off.
- Disconnect the level sensor in the catalytic reservoir from the engine harness.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Install a jumper wire between the +5 volt POWER and SIGNAL level sensor pins in the catalytic converter reservoir in the sensor connector on the engine harness. • Use the electronic service tool INSITE ™ to read fault codes.	Fault Code 1669 active and Fault Code 1668 inactive? **YES**	2D
	Fault Code 1669 active and Fault Code 1668 inactive? **NO**	3B



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STEP 2D: Check the fault codes and the condition of the sensor. Conditions:

- Turn the ignition key off.
- Connect the level sensor to the catalyst reservoir in the engine harness.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Using INSITE ™, read the fault codes.	Is fault code 1668 active? **YES** **Repair:** A defective sensor has been detected. Replace the level sensor in the catalyst reservoir. Refer to the OEM fault diagnosis manual.	4A
	Is fault code 1668 active? **DO NOT** **REPAIR:** None. Did removing and reinstalling the connector correct the failure?	4A

STEP 3: Check the ECM and the engine harness.

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

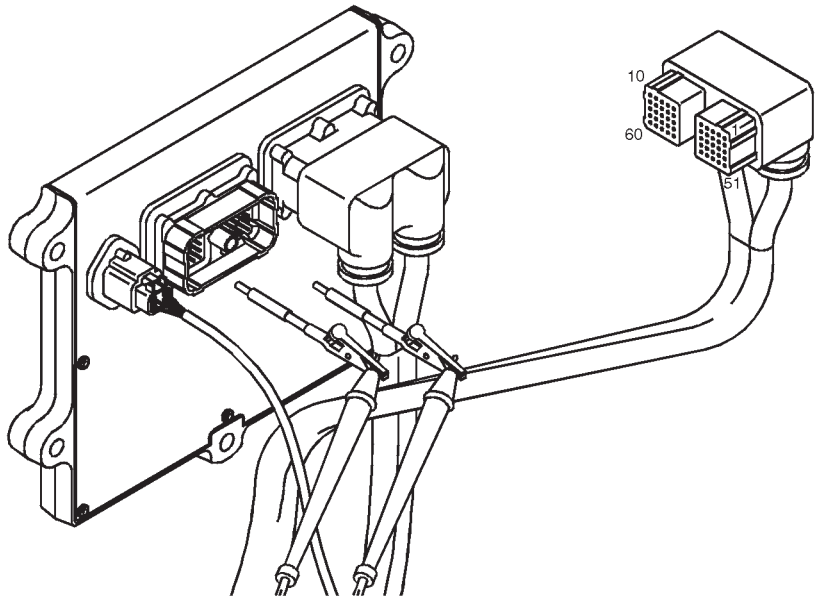
Conditions:
- Turn the ignition key off.
- Disconnect the engine harness from the ECM connector.

Action	Specifications / Repair	Next step
Check that the pins on the engine harness and ECM connectors have: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Damage to the wire shield • Moisture inside or over the connector • Connector seals damaged or missing • Broken connector cover • Connector pin dirt or debris For general inspection techniques, see Connector and Component Pin Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected at the ECM connector or the motor harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-043 .	4A
	Dirty or damaged pins? **NO**	3A-1

STEP 3A-1: Check the supply voltage and the sensor return circuit. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check the supply voltage and the return circuit. • Measure the voltage between the +5 volt POWER and RETURN pins of the level sensor in the catalyst reservoir, on the motor connector of the electronic control module. Refer to the electrical diagram for identification of the connector pins.	4.75 to 5.25 VDC? **YES**	3A-2
	4.75 to 5.25 VDC? **DO NOT** **REPAIR:** Call for pre-authorization. Replace the ECM. See the Procedure 019-031 .	4A



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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Using INSITE ™, read the fault codes.	Fault Code 1668 inactive? **YES** **Repair:** None. Did removing and reinstalling the connector correct the failure?	4A
	Fault code 1668 active? **DO NOT** **REPAIR:** An open or shorted POWER circuit was detected in the engine harness. Repair or replace the engine harness. See the Procedure 019-043 .	4A

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

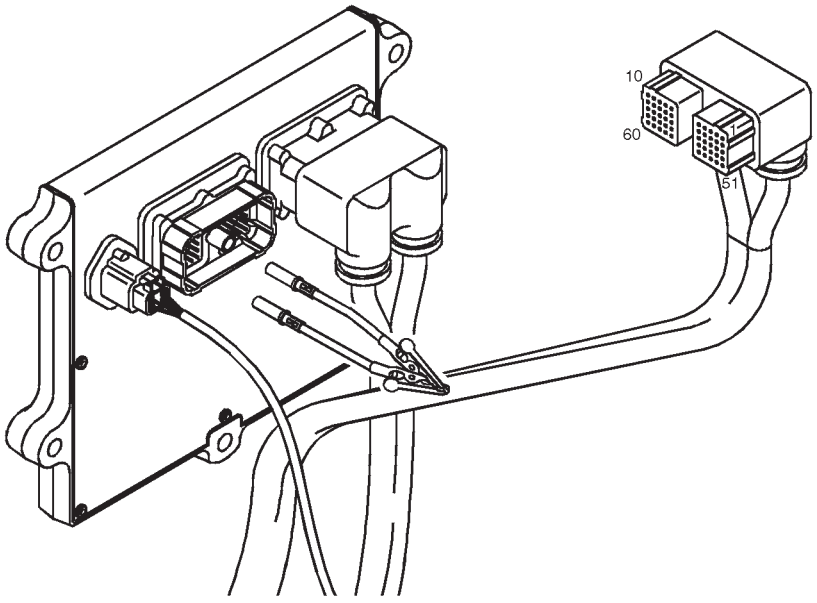
Conditions:
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.

Action	Specifications / Repair	Next step
Inspect the pins of the engine harness connectors and the electronic control module for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Damage to the wire shield • Moisture inside or over the connector • Connector seals damaged or missing • Broken connector cover • Connector pin dirt or debris For general inspection techniques, see Connector and Component Pin Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A defective connection has been detected in the connector of the electronic engine control module or in the engine harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-043 .	4A
	Dirty or damaged pins? **NO**	3B-1

STEP 3B-1: Check the response of the electronic engine control module. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Install a jumper wire between the +5 volts POWER and SIGNAL pins of the level sensor in the catalyst reservoir, in the motor connector of the electronic control module. • Use the electronic service tool INSITE ™ to read fault codes.	Fault Code 1669 active and Fault Code 1668 inactive? **YES**	3B-2
	Fault Code 1669 active and Fault Code 1668 inactive? **DO NOT** **REPAIR:** Call for pre-authorization. Replace the ECM. See the Procedure 019-031 .	4A



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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Using INSITE ™, read the fault codes.	Fault Code 1668 inactive? **YES** **Repair:** None. Did removing and reinstalling the connector correct the failure?	4A
	Fault Code 1668 inactive? **DO NOT** **REPAIR:** An open circuit or a short circuit between pins was detected in the motor harness. Repair or replace the engine harness. See the Procedure 019-043 .	4A

STEP 4: Clear the fault code.

STEP 4A: Disable the fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Use INSITE ™ to check if the fault code is inactive.	Fault Code 1668 inactive? **YES**	4B
	Fault Code 1668 inactive? **NO**	1A

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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

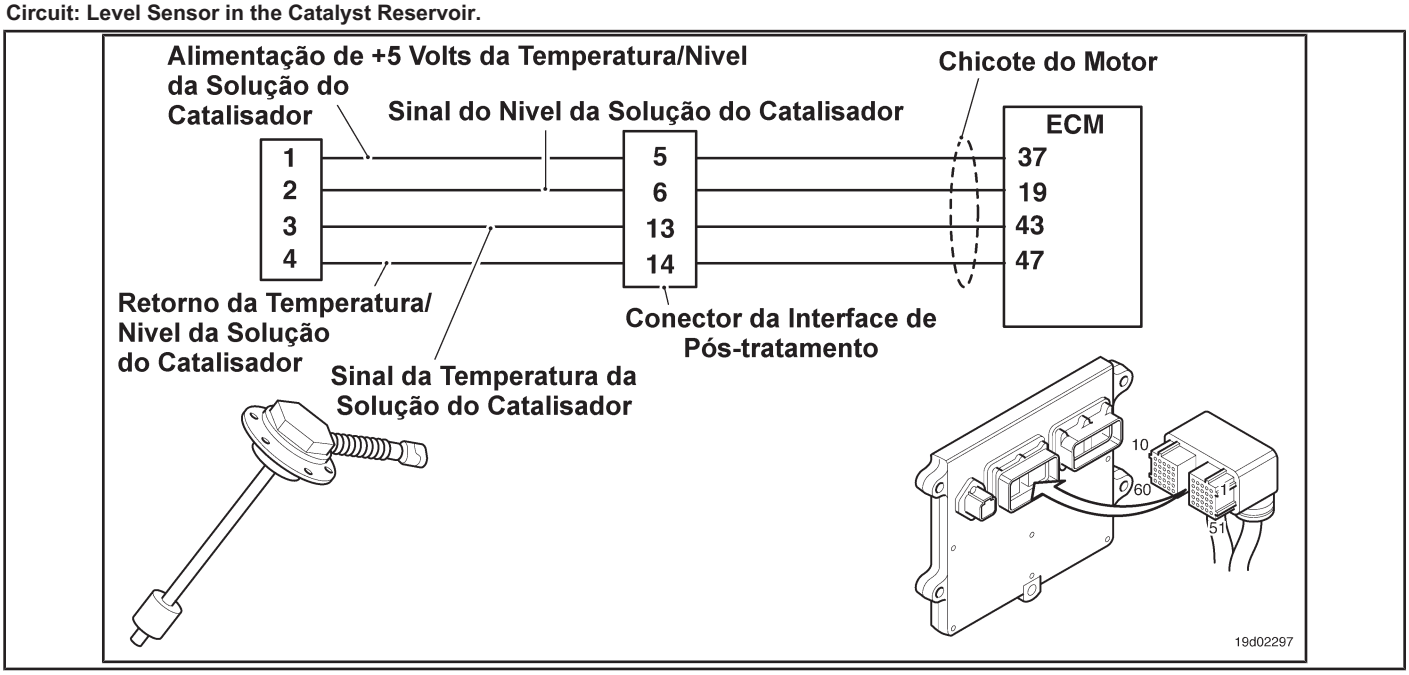
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use INSITE ™ to clear inactive fault codes.	All codes cleared? **YES**	Complete repair
	All codes cleared? **NO**	Proper troubleshooting and repair steps

Fault Code 1669

Level Sensor Circuit in Catalyst Reservoir - Voltage Above Normal or with High Voltage

CODES	REASON	IT IS MADE
Fault Code: 1669 PID (P), SID (S): IMF: 3 Lamp: Amber SRT:	Level Sensor Circuit in Catalyst Reservoir - Voltage Above Normal or with High Voltage. High voltage signal detected in the level sensor circuit in the catalyst reservoir.	The injection of catalyst solution into the after-treatment system is disabled.

Circuit: Level Sensor in the Catalyst Reservoir.



Circuit Descriptions:

The level sensor in the catalyst reservoir is used to monitor the level of the catalyst solution inside the catalyst reservoir. The level sensor in the catalyst reservoir is a sensor combined with the temperature sensor of the catalyst solution. The level and temperature sensors share a common feedback loop.

Component Location:

The level sensor in the catalyst reservoir is located in the catalyst reservoir. The locations of the solution level reservoir and sensor depend on the OEM.

Workshop Tips:

The level sensor in the catalytic converter reservoir shares the supply and return wires of the engine harness with other sensors. Open and short circuits in the engine harness can cause several fault codes to be activated.

Before diagnosing fault code 1669, check for other faults. Possible causes of this fault code:

- Return circuit open at harness, connectors or sensor

- Circuito de sinal em curto com a alimentação do sensor ou com a voltagem da bateria. Informações de

Diagnóstico On-Board (OBD):

- O ECM acenderá a lâmpada indicadora de falha de funcionamento (MIL) quando o diagnóstico for executado e falhar.
- O ECM desligará a lâmpada indicadora de mal funcionamento (MIL) após 3 ciclos consecutivos de ignição nos quais o diagnóstico é executado e não falha. A lâmpada MIL e o código de falha também podem ser apagados com a ferramenta eletrônica de serviço INSITE™.
- O código de falha será apagado da memória após 40 ciclos consecutivos de condução nos quais o diagnóstico é executado e aprovado.

RESUMO DOS DIAGNÓSTICOS DE FALHAS

PRECAUÇÃO

Para evitar danos a um novo ECM, investigue todos os outros códigos de falha ativos antes de substituí-lo.

PRECAUÇÃO

Para reduzir a possibilidade de danos aos pinos e ao chicote, utilize as seguintes pontas de prova ao efetuar uma medição:

No. de Peça 3822758 - ponta de teste macho Deutsch/AMP/Metri-Pack No. de Peça

3822917 - ponta de teste fêmea Deutsch/AMP/Metri-Pack. PASSOS

	ESPECIFICAÇÕES	CÓDIGO SRT
PASSO 1: Verifique os códigos de falha.		
PASSO 1A: Verifique se há códigos de falha de alimentação do sensor.	**Código de Falha 227 ativo?**	
PASSO 1B: Verifique se há um código de falha inativo.	**Código de Falha 1669 inativo?**	
PASSO 2: Verifique o sensor do nível no reservatório do catalisador e o circuito.		
PASSO 2A: Inspecione o sensor do nível no reservatório do catalisador e os pinos do conector.	**Pinos sujos ou danificados?**	
PASSO 2B: Verifique a resposta do circuito.	**Código de Falha 1668 ativo e Código de Falha 1669 inativo?**	
PASSO 2C: Verifique a voltagem de alimentação e o circuito de retorno do sensor.	**4,75 a 5,25 VCC?**	
PASSO 2D: Verifique os códigos de falha e a condição do sensor.	**Código de Falha 1669 ativo?**	
PASSO 3: Verifique o ECM e o chicote do motor.		
PASSO 3A: Inspecione os pinos dos conectores do chicote do motor e do ECM.	**Pinos sujos ou danificados?**	
PASSO 3A-1: Verifique a resposta do módulo eletrônico de controle do motor.	**Código de Falha 1668 ativo e Código de Falha 1669 inativo?**	
PASSO 3A-2: Verifique se há um código de falha ativo.	**Código de Falha 1669 inativo?**	
PASSO 3B: Inspecione o módulo de controle do motor e os pinos do conector no chicote do motor.	**Pinos sujos ou danificados?**	
PASSO 3B-1: Verifique a voltagem de alimentação e o circuito de retorno do sensor.	**4,75 a 5,25 VCC?**	
PASSO 3B-2: Verifique se há um código de falha ativo.	**Código de Falha 1669 inativo?**	
PASSO 4: Apague os códigos de falha.		
PASSO 4A: Desative o código de falha.	**Código de Falha 1669 inativo?**	
PASSO 4B: Apague os códigos de falha inativos.	**Todos os códigos apagados?**	

PASSO DE DIAGNÓSTICO DE FALHA

PASSO 1: Verifique os códigos de falha.

PASSO 1A: Verifique se há códigos de falha de alimentação do sensor. Condições:

- Ligue a chave de ignição (ON).
- Conecte a ferramenta eletrônica de serviço INSITE™.

Ação	Especificações/Reparo	Próximo Passo
Verifique se há códigos de falha de alimentação do sensor. • Utilize o INSITE™ para ler os códigos de falha.	Código de Falha 227 ativo? **SIM**	Consulte o Código de Falha 227.
	Código de Falha 227 ativo? **NÃO**	1B

PASSO 1B: Verifique se há um código de falha inativo. Condições:

- Ligue a chave de ignição (ON).
- Conecte a ferramenta eletrônica de serviço INSITE™.

Ação	Especificações/Reparo	Próximo Passo
Verifique se há um código de falha inativo. • Utilize o INSITE™ para ler os códigos de falha. Código de Falha 1669 inativo?	**SIM**	Código de Falha Inativo ou Intermitente, Procediment o 019-362 .
	Código de Falha 1669 inativo? **NÃO**	2A

PASSO 2: Verifique o sensor do nível no reservatório do catalisador e o circuito.

PASSO 2A: Inspecione o sensor do nível no reservatório do catalisador e os pinos do conector.

Condições:
- Desligue a chave de ignição.
- Desconecte do chicote do motor o sensor do nível no reservatório do catalisador.

Ação	Especificações/Reparo	Próximo Passo
Inspecione os pinos dos conectores do chicote do motor e do sensor do nível no reservatório do catalisador quanto a: • Pinos corroídos • Pinos tortos ou quebrados • Pinos torcidos para trás ou expandidos • Dano na blindagem do fio • Umidade dentro ou sobre o conector • Vedações do conector danificadas ou faltando • Capa do conector quebrada • Sujeira ou resíduos nos pinos do conector Para obter técnicas gerais de inspeção, consulte Inspeção de Conectores e de Pinos de Componentes, Procedimento 019-361 .	Pinos sujos ou danificados? **SIM** **Reparo:** Foi detectada uma conexão defeituosa no sensor ou no conector do chicote. Limpe o conector e os pinos. Se danificados, repare o chicote, o conector ou os pinos, se possível. Consulte o Procedimento 019-043 .	4A
	Pinos sujos ou danificados? **NÃO**	2B

PASSO 2B: Verifique a resposta do circuito. Condições:

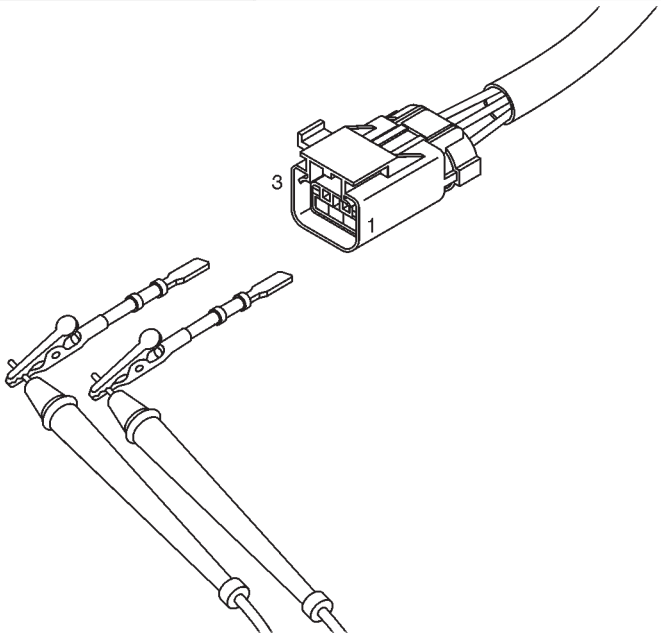
- Desligue a chave de ignição.
- Desconecte do chicote do motor o sensor do nível no reservatório do catalisador.
- Ligue a chave de ignição (ON).
- Conecte a ferramenta eletrônica de serviço INSITE™.

Ação	Especificações/Reparo	Próximo Passo
Verifique se há resposta apropriada do circuito após 30 segundos. • Utilize a ferramenta eletrônica de serviço INSITE™ para ler os códigos de falha.	Código de Falha 1668 ativo e Código de Falha 1669 inativo? **SIM**	2C
	Código de Falha 1668 ativo e Código de Falha 1669 inativo? **NÃO**	3A

PASSO 2C: Verifique a voltagem de alimentação e o circuito de retorno do sensor. Condições:

- Desligue a chave de ignição.
- Desconecte do chicote do motor o sensor do nível no reservatório do catalisador.
- Ligue a chave de ignição (ON).

Ação	Especificações/Reparo	Próximo Passo
Verifique a voltagem de alimentação e o circuito de retorno. • Meça a voltagem entre os pinos de ALIMENTAÇÃO de +5 volts e de RETORNO do sensor do nível no reservatório do catalisador, no conector do sensor no chicote do motor. Consulte o diagrama elétrico para obter a identificação dos pinos do conector.	4,75 a 5,25 VCC? **SIM**	2D
	4,75 a 5,25 VCC? **NÃO**	3B



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PASSO 2D: Verifique os códigos de falha e a condição do sensor. Condições:

- Desligue a chave de ignição.
- Conecte o sensor do nível no reservatório do catalisador no chicote do motor.
- Ligue a chave de ignição (ON).
- Conecte a ferramenta eletrônica de serviço INSITE™.

Ação	Especificações/Reparo	Próximo Passo
Verifique se há resposta apropriada do circuito após 30 segundos. • Utilizando o INSITE™, leia os códigos de falha.	O código de falha 1669 está ativo? **SIM** **Reparo:** Foi detectado um sensor defeituoso. Substitua o sensor do nível no reservatório do catalisador. Consulte o manual de diagnóstico de falhas do OEM.	4A
	O código de falha 1669 está ativo? **NÃO** **Reparo:** Nenhum. A remoção e a reinstalação do conector corrigiu a falha?	4A

PASSO 3: Verifique o ECM e o chicote do motor.

PASSO 3A: Inspecione os pinos dos conectores do chicote do motor e do ECM.

Condições:
- Desligue a chave de ignição.
- Desconecte do conector do ECM o chicote do motor.

Ação	Especificações/Reparo	Próximo Passo
Verifique se os pinos dos conectores do chicote do motor e do ECM apresentam: • Pinos corroídos • Pinos tortos ou quebrados • Pinos torcidos para trás ou expandidos • Dano na blindagem do fio • Umidade dentro ou sobre o conector • Vedações do conector danificadas ou faltando • Capa do conector quebrada • Sujeira ou resíduos nos pinos do conector Para obter técnicas gerais de inspeção, consulte Inspeção de Conectores e de Pinos de Componentes, Procedimento 019-361 .	Pinos sujos ou danificados? **SIM** **Reparo:** Foi detectada uma conexão defeituosa no conector do ECM ou no conector do chicote do motor. Limpe o conector e os pinos. Se danificados, repare o chicote, o conector ou os pinos, se possível. Consulte o Procedimento 019-043 .	4A
	Pinos sujos ou danificados? **NÃO**	3A-1

PASSO 3A-1: Verifique a resposta do módulo eletrônico de controle do motor. Condições:

- Desligue a chave de ignição.
- Desconecte do ECM o chicote do motor.
- Ligue a chave de ignição (ON).
- Conecte a ferramenta eletrônica de serviço INSITE™.

Ação	Especificações/Reparo	Próximo Passo
Verifique se há resposta apropriada do circuito após 30 segundos. • Utilizando o INSITE™, leia os códigos de falha.	Código de Falha 1668 ativo e Código de Falha 1669 inativo? **SIM**	3A-2
	Código de Falha 1668 ativo e Código de Falha 1669 inativo? **NÃO** **Reparo:** Ligue para obter pré-autorização. Substitua o ECM. Consulte o Procedimento 019-031 .	4A

PASSO 3A-2: Verifique se há um código de falha ativo. Condições:

- Conecte todos os componentes.
- Ligue a chave de ignição (ON).
- Conecte a ferramenta eletrônica de serviço INSITE™.

Ação	Especificações/Reparo	Próximo Passo
Verifique se há resposta apropriada do circuito após 30 segundos. • Utilizando o INSITE™, leia os códigos de falha.	Código de Falha 1669 inativo? **SIM** **Reparo:** Nenhum. A remoção e a reinstalação do conector corrigiu a falha?	4A
	Código de Falha 1669 ativo? **NÃO** **Reparo:** Foi detectado um curto-circuito entre pinos na linha de sinal no chicote do motor. Repare ou substitua o chicote do motor. Consulte o Procedimento 019-043 .	4A

PASSO 3B: Inspecione o módulo de controle do motor e os pinos do conector no chicote do motor.

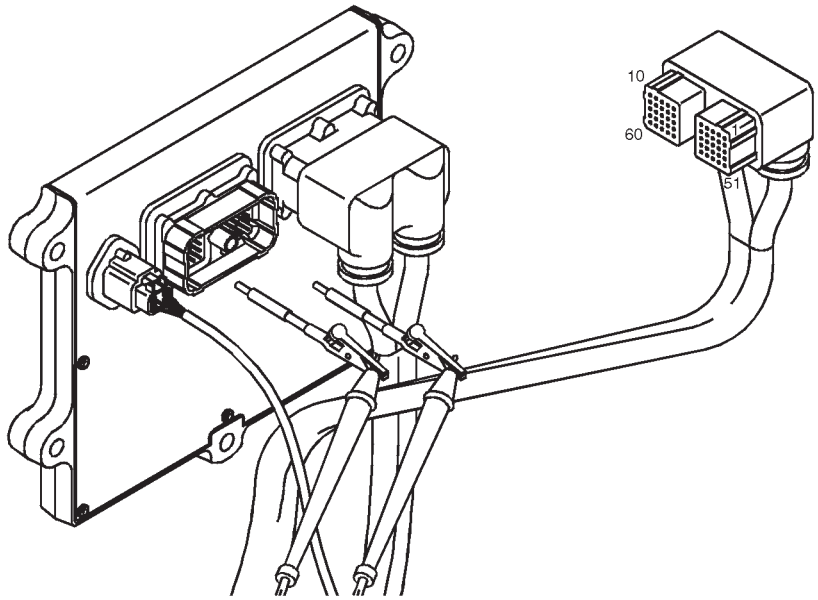
Condições:
- Desligue a chave de ignição.
- Desconecte do ECM o chicote do motor.

Ação	Especificações/Reparo	Próximo Passo
Inspecione os pinos dos conectores do chicote do motor e do módulo eletrônico de controle quanto a: • Pinos corroídos • Pinos tortos ou quebrados • Pinos torcidos para trás ou expandidos • Dano na blindagem do fio • Umidade dentro ou sobre o conector • Vedações do conector danificadas ou faltando • Capa do conector quebrada • Sujeira ou resíduos nos pinos do conector Para obter técnicas gerais de inspeção, consulte Inspeção de Conectores e de Pinos de Componentes, Procedimento 019-361 .	Pinos sujos ou danificados? **SIM** **Reparo:** Foi detectada uma conexão defeituosa no conector do módulo eletrônico de controle do motor ou no conector do chicote do motor. Limpe o conector e os pinos. Se danificados, repare o chicote, o conector ou os pinos, se possível. Consulte o Procedimento 019-043 .	4A
	Pinos sujos ou danificados? **NÃO**	3B-1

PASSO 3B-1: Verifique a voltagem de alimentação e o circuito de retorno do sensor. Condições:

- Desligue a chave de ignição.
- Desconecte do chicote do motor o conector do ECM.
- Ligue a chave de ignição (ON).

Ação	Especificações/Reparo	Próximo Passo
Verifique a voltagem de alimentação e o circuito de retorno. • Meça a voltagem entre os pinos de ALIMENTAÇÃO de +5 volts e de RETORNO do sensor do nível no reservatório do catalisador, no conector do motor do módulo eletrônico de controle. Consulte o diagrama elétrico para obter a identificação dos pinos do conector.	4,75 a 5,25 VCC? **SIM**	3B-2
	4,75 a 5,25 VCC? **NÃO** **Reparo:** Ligue para obter pré-autorização. Substitua o ECM. Consulte o Procedimento 019-031 .	4A



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PASSO 3B-2: Verifique se há um código de falha ativo. Condições:

- Conecte todos os componentes.
- Ligue a chave de ignição (ON).
- Conecte a ferramenta eletrônica de serviço INSITE™.

Ação	Especificações/Reparo	Próximo Passo
Verifique se há resposta apropriada do circuito após 30 segundos. • Utilizando o INSITE™, leia os códigos de falha.	Código de Falha 1669 inativo? **SIM** **Reparo:** Nenhum. A remoção e a reinstalação do conector corrigiu a falha?	4A
	Código de Falha 1669 inativo? **NÃO** **Reparo:** Foi detectado um circuito de RETORNO aberto no chicote do motor. Repare ou substitua o chicote do motor. Consulte o Procedimento 019-043 .	4A

PASSO 4: Apague o código de falha.

PASSO 4A: Desative o código de falha. Condições:

- Conecte todos os componentes.
- Ligue a chave de ignição (ON).
- Conecte a ferramenta eletrônica de serviço INSITE™.

Ação	Especificações/Reparo	Próximo Passo
Desative o código de falha. • Ligue o motor e deixe-o funcionar em marcha lenta durante 1 minuto. • Utilize o INSITE™ para verificar se o código de falha está inativo.	Código de Falha 1669 inativo? **SIM**	4B
	Código de Falha 1669 inativo? **NÃO**	1A

PASSO 4B: Apague os códigos de falha inativos. Condições:

- Conecte todos os componentes.
- Ligue a chave de ignição (ON).
- Conecte a ferramenta eletrônica de serviço INSITE™.

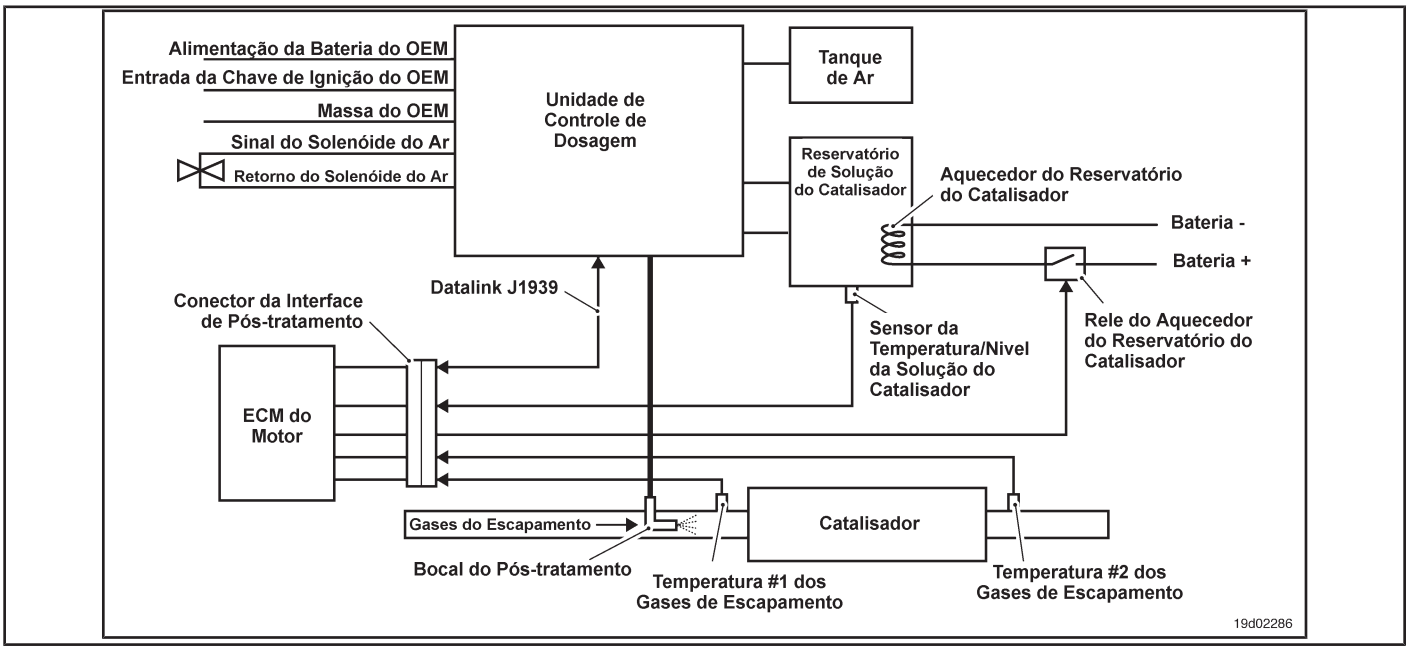
Ação	Especificações/Reparo	Próximo Passo
Apague os códigos de falha inativos. • Utilize o INSITE™ para apagar os códigos de falha inativos.	Todos os códigos apagados? **SIM**	Reparo completo
	Todos os códigos apagados? **NÃO**	Passos apropriados de diagnóstico de falhas e reparos

Código de Falha 1671

Nível no Reservatório do Catalisador - Dados Válidos mas Abaixo da Faixa Normal de Operação - Nível Moderadamente Severo.

CÓDIGOS	RAZÃO	EFEITO
Código de Falha: 1671 PID(P), SID(S): FMI: 1/18 Lâmpada: Manutenção SRT:	Nível no Reservatório do Catalisador - Dados Válidos mas Abaixo da Faixa Normal de Operação - Nível Moderadamente Severo. Foi detectado um nível baixo da solução do catalisador no reservatório da solução do catalisador.	Nenhum quanto ao desempenho.

Circuito: Sistema de Controle de Pós-tratamento



Descrições do Circuito:

O sensor do nível da solução do catalisador é utilizado para monitorar o nível da solução do catalisador no interior do reservatório do catalisador.

Localização do Componente:

O sensor do nível da solução do catalisador está localizado no reservatório de solução do catalisador. As localizações do reservatório e do sensor do nível da solução dependem do OEM.

Dicas para a Oficina:

O Código de Falha 1671 é acionado quando é detectado um nível baixo da solução do catalisador no reservatório de solução do catalisador. Adicione solução do catalisador no reservatório. Este código de falha é somente uma advertência de nível baixo da solução do catalisador no reservatório. Informações de Diagnóstico On-Board (OBD):

- O ECM acende a lâmpada de falha âmbar ou vermelha apropriada quando o diagnóstico é executado e falha.
- O ECM desliga a lâmpada de falha apropriada quando o diagnóstico é executado com sucesso.

RESUMO DOS DIAGNÓSTICOS DE FALHAS

PRECAUÇÃO

Para evitar danos a um novo ECM, investigue todos os outros códigos de falha ativos antes de substituí-lo.

PRECAUÇÃO

Para reduzir a possibilidade de danos aos pinos e ao chicote, utilize as seguintes pontas de prova ao efetuar uma medição:

No. de Peça 3822758 - ponta de teste macho Deutsch/AMP/Metri-Pack No. de Peça

3822917 - ponta de teste fêmea Deutsch/AMP/Metri-Pack. PASSOS

	ESPECIFICAÇÕES	CÓDIGO SRT
PASSO 1: Verifique os códigos de falha.		
PASSO 1A: Leia os códigos de falha.	**Código de Falha 1671 ativo?**	
PASSO 2: Apague o código de falha.		
PASSO 2A: Desative o código de falha.	**Código de Falha 1671 inativo?**	
PASSO 2B: Apague os códigos de falha inativos.	**Todos os códigos apagados?**	

PASSO DE DIAGNÓSTICO DE FALHA

PASSO 1: Verifique os códigos de falha.

PASSO 1A: Leia os códigos de falha. Condições:

- Ligue a chave de ignição (ON).
- Conecte a ferramenta eletrônica de serviço INSITE™.

Ação	Especificações/Reparo	Próximo Passo
Leia os códigos de falha. • Utilize a ferramenta eletrônica de serviço INSITE™ para ler os códigos de falha.	Código de Falha 1671 ativo? **SIM** **Reparo:** Foi detectado um nível baixo de solução do catalisador. Adicione solução do catalisador no reservatório do catalisador.	2A
	Código de Falha 1671 ativo? **NÃO**	2A

PASSO 2: Apague o código de falha.

PASSO 2A: Desative o código de falha. Condições:

- Conecte todos os componentes
- Ligue a chave de ignição.
- Conecte a ferramenta eletrônica de serviço INSITE™.

Ação	Especificações/Reparo	Próximo Passo
Desative o código de falha. • Utilizando o INSITE™, certifique-se de que o código de falha esteja inativo.	Código de Falha 1671 inativo? **SIM**	2B
	Código de Falha 1671 inativo? **NÃO**	1A

PASSO 2B: Apague os códigos de falha inativos. Condições:

- Conecte todos os componentes
- Ligue a chave de ignição.
- Conecte a ferramenta eletrônica de serviço INSITE™.

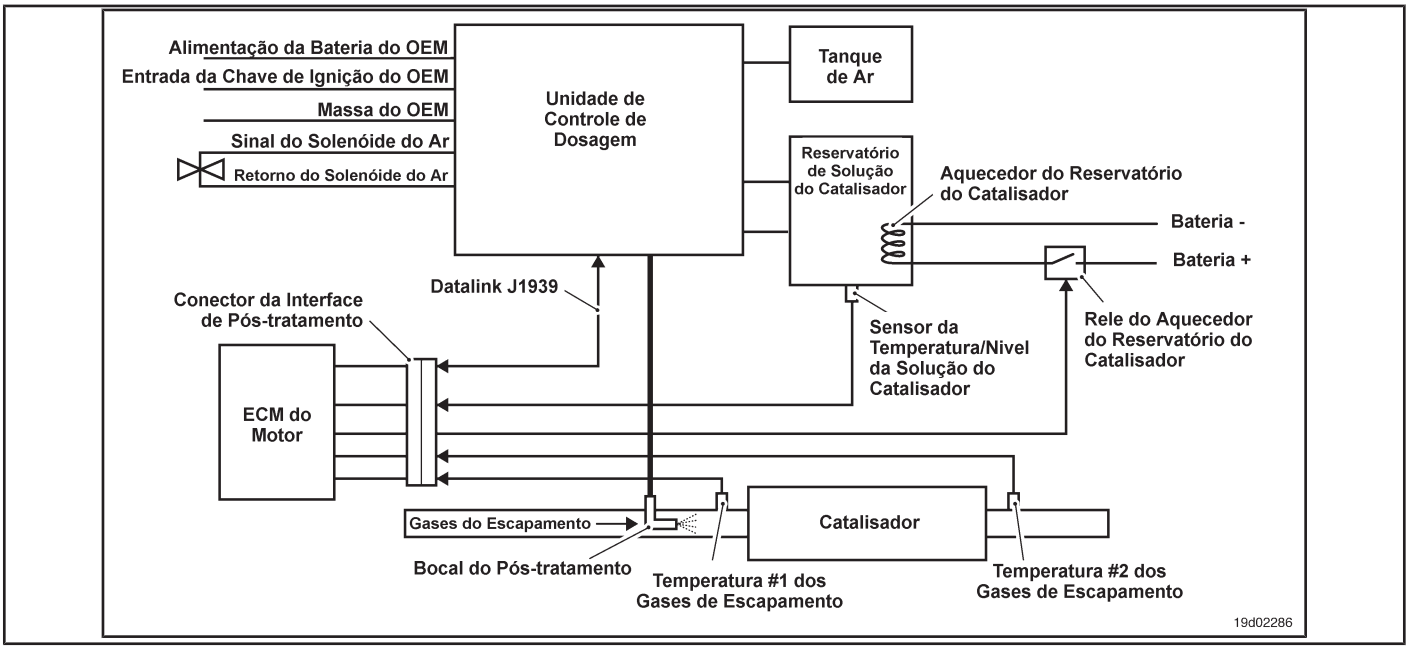
Ação	Especificações/Reparo	Próximo Passo
Apague os códigos de falha inativos. • Utilize a ferramenta eletrônica de serviço INSITE™ para apagar todos os códigos de falha inativos.	Todos os códigos apagados? **SIM**	Reparo completo.
	Todos os códigos apagados? **NÃO**	Passos apropriados de diagnóstico de falhas e reparos.

Código de Falha 1673

Nível do Reservatório do Catalisador - Dados Inválidos, Intermitentes ou Incorretos.

CÓDIGOS	RAZÃO	EFEITO
Código de Falha: 1673 PID(P), SID(S): FMI: 1 Lâmpada: Âmbar SRT:	Nível do Reservatório do Catalisador - Dados Válidos mas Abaixo da Faixa Normal de Operação - Nível Mais Severo. Não foi detectada a presença de solução do catalisador no reservatório do catalisador.	A injeção de solução do catalisador no sistema de pós-tratamento está desabilitada.

Circuito: Sistema de Controle de Pós-tratamento



Descrições do Circuito:

O sensor do nível da solução do catalisador é utilizado para monitorar o nível da solução do catalisador no interior do reservatório do catalisador.

Localização do Componente:

O sensor do nível da solução do catalisador está localizado no reservatório de solução do catalisador. As localizações do reservatório e do sensor do nível da solução dependem do OEM.

Dicas para a Oficina:

O Código de Falha 1673 será acionado quando o sensor do nível da solução do catalisador detectar que o reservatório do catalisador está vazio. A solução do catalisador ainda poderá ser visível no interior do reservatório quando esse código de falha estiver ativo. Adicione solução do catalisador no reservatório. Informações de Diagnóstico On-Board (OBD):

- O ECM acenderá a lâmpada indicadora de falha de funcionamento (MIL) quando o diagnóstico for executado e falhar.
- O ECM desligará a lâmpada indicadora de mal funcionamento (MIL) após 3 ciclos consecutivos de ignição nos quais o diagnóstico é executado e **não** falha. A lâmpada MIL e o código de falha também podem ser apagados com a ferramenta eletrônica de serviço INSITE™.

- The fault code will be cleared from memory after 40 consecutive driving cycles in which the diagnosis is performed and approved.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch /

AMP / Metri-Pack female test lead. STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Read the fault codes.	**Fault code 1673 active?**	
STEP 2: Clear the fault code.		
STEP 2A: Disable the fault code.	**Fault code 1673 inactive?**	
STEP 2B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Read the fault codes. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Read the fault codes. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 1673 active? **YES** **Repair:** The catalyst solution was not detected in the catalyst reservoir. Add catalyst solution to the catalyst reservoir.	2A
	Fault code 1673 active? **NO**	2A

STEP 2: Clear the fault code.

STEP 2A: Disable the fault code. Conditions:

- Connect all components
- Turn on the ignition key.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Using INSITE ™, make sure that the fault code is inactive.	Fault code 1673 inactive? **YES**	2B
	Fault code 1673 inactive? **NO**	1A

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

- Connect all components
- Turn on the ignition key.
- Connect the electronic service tool INSITE ™.

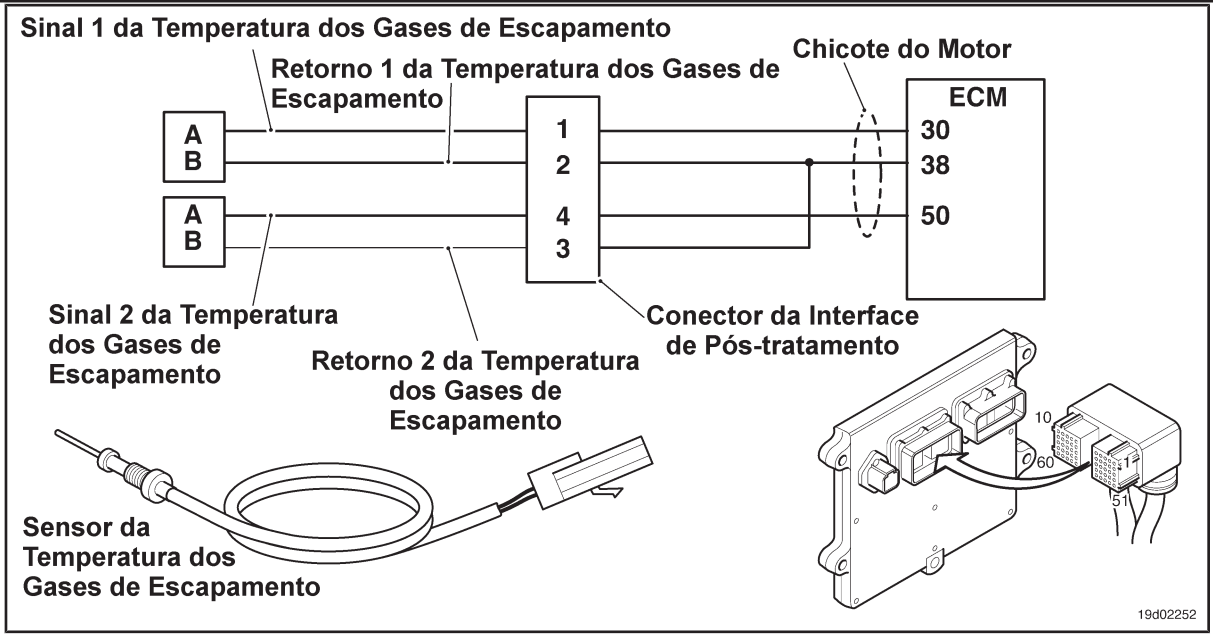
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear all inactive fault codes.	All codes cleared? **YES**	Complete repair.
	All codes cleared? **NO**	Proper troubleshooting and repair steps.

Fault Code 1674

Exhaust Gas Temperature Circuit 2 - Voltage Below Normal or with Low Voltage

CODES	REASON	IT IS MADE
Fault Code: 1674 PID (P), SID (S): IMF: 4 Lamp: Amber SRT:	Exhaust Gas Temperature Circuit 2 - Voltage Below Normal or Low Voltage. Low voltage signal detected in the catalyst exhaust temperature sensor circuit.	Possible non-compliance with emission standards. Standard catalyst exhaust temperature value was used.

Circuit: Exhaust Gas Temperature 2



Circuit Descriptions:

The temperature sensor at the catalyst outlet is used by the electronic control module (ECM) to monitor the temperature of the engine exhaust gases leaving the catalyst unit. The ECM monitors the voltage at the signal pin and converts it to a temperature value.

Component Location:

The catalyst outlet temperature sensor is located in the after-treatment system. It is located at the outlet of the post-treatment catalyst unit.

Workshop Tips:

The temperature sensor at the catalyst outlet shares the engine harness return wires with other sensors. A shorted return can cause the activation of several fault codes. Possible causes of this fault code:

- Short signal with the mass in the whip
- Signal shorted with feedback or ground in the sensor. On-Board

Diagnostic Information (OBD):

- The ECM will illuminate the malfunction indicator lamp (MIL) when the diagnosis is performed and fails.
- The ECM will turn off the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles in which the diagnosis is performed and no failure. The MIL lamp and the fault code can also be cleared with the electronic service tool INSITE ™.
- The fault code will be cleared from memory after 40 consecutive driving cycles in which the diagnosis is performed and approved.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch /

AMP / Metri-Pack female test lead. STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check for a security code failure inactive.	**Fault code 1674 inactive?**	
STEP 2: Check the exhaust gas temperature circuit and sensor No. 2.		
STEP 2A: Inspect the exhaust gas temperature sensor No. 2 and the connector pins.	**Dirty or damaged pins?**	
STEP 2B: Check the circuit response.	**Fault Code 1675 active and Fault Code 1674 inactive?**	
STEP 2C: Check the fault codes and the sensor condition.	**Fault code 1674 active?**	
STEP 3: Check the ECM and the engine harness.		
STEP 3A: Inspect the pins of the engine harness and ECM connectors.	**Dirty or damaged pins?**	
STEP 3B: Check the circuit response.	**Fault Code 1675 active and Fault Code 1674 inactive?**	
STEP 3C: Check for a short circuit between pins in the engine harness.	**More than 100k ohms?**	
STEP 3D: Check if there is a short circuit between pins and ground.	**More than 100k ohms?**	
STEP 3E: Check for a passcode failure inactive.	**Fault code 1674 inactive?**	
STEP 4: Clear the fault codes.		
STEP 4A: Disable the fault code.	**Fault code 1674 inactive?**	
STEP 4B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

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

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an inactive fault code. • Use INSITE ™ to read the fault codes. Fault code 1674 inactive?	**YES**	Fault Code Inactive or Intermittent, Procedure 019-362 .
	Fault code 1674 inactive? **NO**	2A

STEP 2: Check the exhaust gas temperature circuit and sensor No. 2.

STEP 2A: Inspect the exhaust gas temperature sensor No. 2 and the connector pins.

Conditions:

- Turn the ignition key off.
- Disconnect the exhaust gas temperature sensor No. 2 from the engine harness.

Action	Specifications / Repair	Next step
Check the engine harness and exhaust gas temperature sensor No. 2 for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Damage to the wire shield • Moisture inside or over the connector • Connector seals damaged or missing • Broken connector cover • Connector pin dirt or debris For general inspection techniques, see Connector and Component Pin Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected in the sensor or in the harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-071 .	4A
	Dirty or damaged pins? **NO**	2B

STEP 2B: Check the circuit response. Conditions:

- Turn the ignition key off.
- Disconnect the exhaust gas temperature sensor No. 2 from the engine harness.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an appropriate ECM response after 30 seconds. • Use INSITE ™ to read the fault codes.	Fault Code 1675 active and Fault Code 1674 inactive? **YES**	2C
	Fault Code 1675 active and Fault Code 1674 inactive? **NO**	3A

STEP 2C: Check the fault codes and the condition of the sensor. Conditions:

- Turn the ignition key off.
- Connect the No. 2 exhaust gas temperature sensor to the engine harness.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Use INSITE ™ to read the fault codes.	Fault code 1674 active? **YES** **Repair:** Replace the exhaust gas temperature sensor No. 2. See the Procedure 019-013 .	4A
	Fault code 1674 active? **DO NOT** **REPAIR:** None. Did removing and installing the connector correct the failure?	4A

STEP 3: Check the ECM and the engine harness.

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

Conditions:
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.

Action	Specifications / Repair	Next step
Check that the pins on the engine harness and ECM connectors have: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Damage to the wire shield • Moisture inside or over the connector • Connector seals damaged or missing • Broken connector cover • Connector pin dirt or debris For general inspection techniques, see Connector and Component Pin Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected at the ECM connector or the motor harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-043 .	4A
	Dirty or damaged pins? **NO**	3B

STEP 3B: Check the circuit response. Conditions:

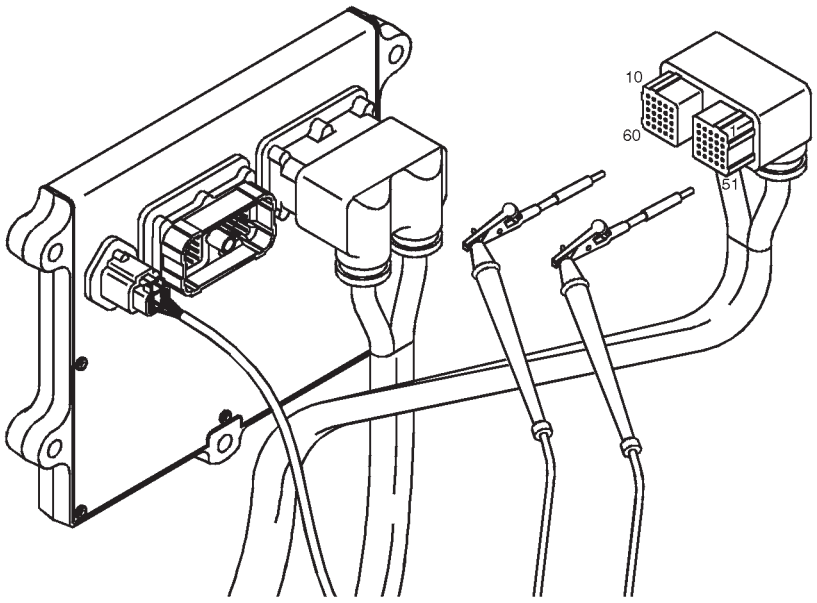
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Use INSITE ™ to read the fault codes.	Fault Code 1675 active and Fault Code 1674 inactive? **YES**	3C
	Fault Code 1675 active and Fault Code 1674 inactive? **DO NOT** **REPAIR:** Call for pre-authorization. Replace the ECM. See the Procedure 019-031 .	4A

STEP 3C: Check the motor harness for a short circuit between pins. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Disconnect the exhaust gas temperature sensor No. 2 from the engine harness.

Action	Specifications / Repair	Next step
Check for a short circuit between pins. • Measure the resistance between the exhaust gas temperature sensor No. 2 SIGN pin on the ECM connector on the engine harness and all other pins on the ECM connector on the engine harness. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YES**	3D
	More than 100k ohms? **DO NOT** **REPAIR:** A short circuit was detected between pins in the SIGNAL line in the motor harness. Repair or replace the engine harness. See the Procedure 019-043 .	4A



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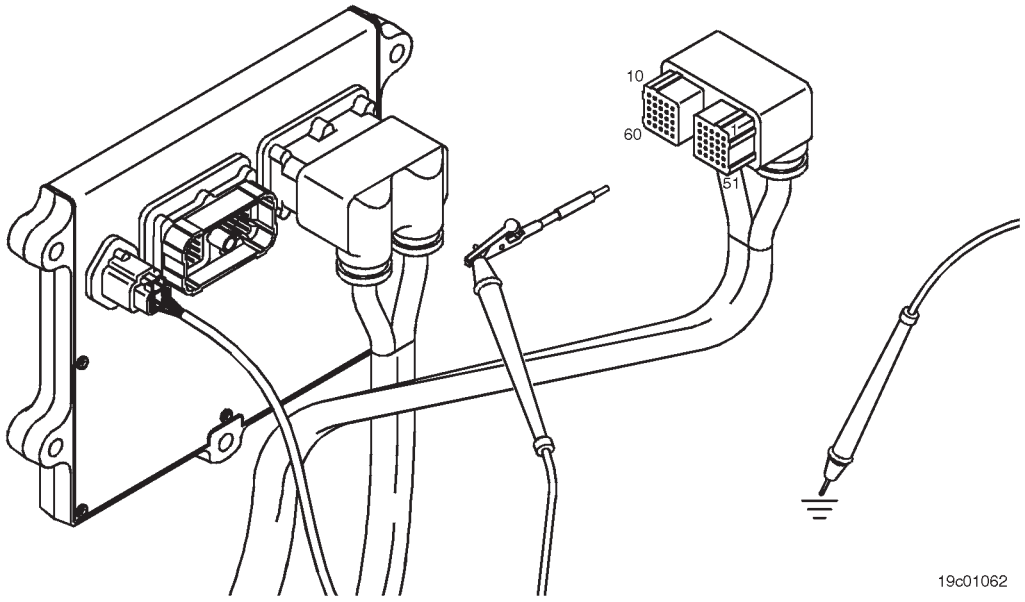
STEP 3D: Check if there is a short circuit between the pins and the ground. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Disconnect the exhaust gas temperature sensor No. 2 from the engine harness.

Action	Specifications / Repair	Next step
Check for a short between pins and ground. • Measure the resistance between the SIGNAL pin of sensor No. 2 for the exhaust gas temperature, the ECM connector on the engine harness, and the ground. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YES**	3E
	More than 100k ohms? **DO NOT** **REPAIR:** A short circuit was detected between the pins and the ground in the SIGNAL line in the motor harness. Repair or replace the engine harness. See the Procedure 019-043 .	4A



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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Use INSITE ™ to read the fault codes.	Fault code 16674 inactive? **YES** **Repair:** None. Did removing and installing the connector correct the failure?	4A
	Fault code 1674 inactive? **DO NOT** **REPAIR:** The fault diagnosis procedures must be repeated from the beginning. A failure mode must have been detected.	1A

STEP 4: Clear the fault code.

STEP 4A: Disable the fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Use INSITE ™ to check if the fault code is inactive.	Fault code 1674 inactive? **YES**	4B
	Fault code 1674 inactive? **NO**	1A

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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

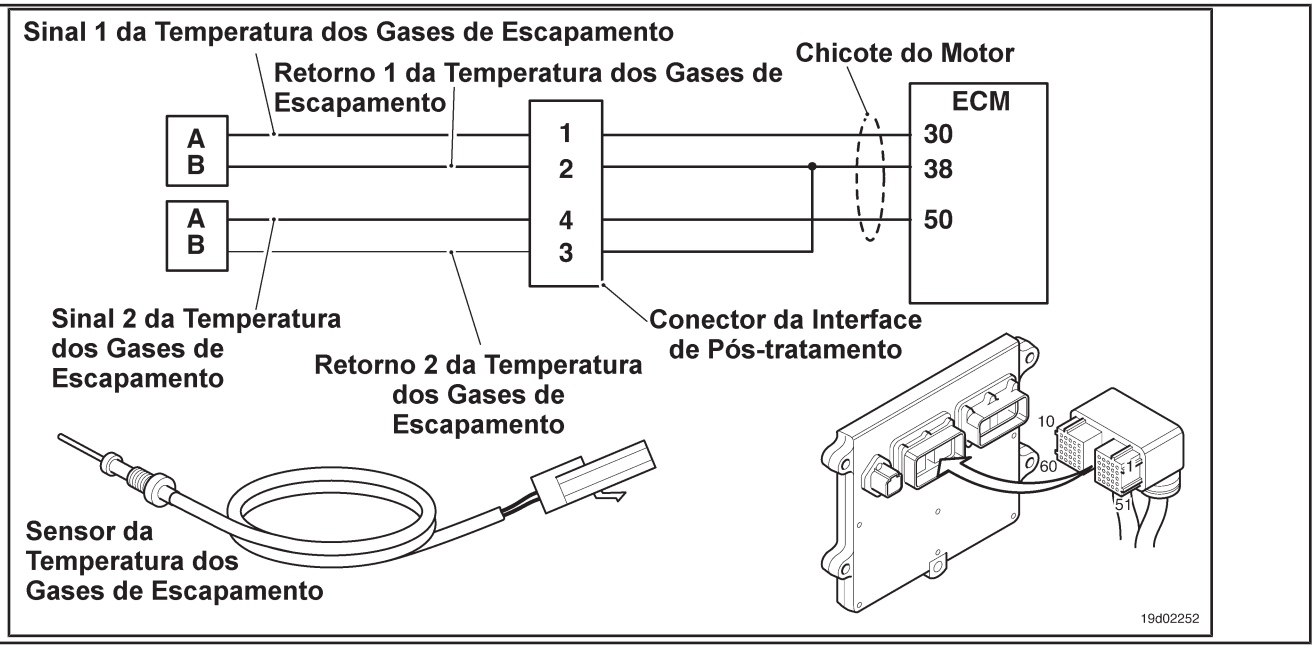
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use INSITE ™ to clear inactive fault codes.	All codes cleared? **YES**	Complete repair
	All codes cleared? **NO**	Proper troubleshooting and repair steps

Fault Code 1675

Exhaust Gas Temperature Circuit 2 - Voltage Above Normal or with High Voltage

CODES	REASON	IT IS MADE
Fault Code: 1675 PID (P), SID (S): IMF: 3 Lamp: Amber SRT:	Exhaust Gas Temperature Circuit 2 - Voltage Above Normal or High Voltage. High voltage signal detected in the catalyst output temperature sensor circuit.	Possible non-compliance with emission standards. Standard catalyst outlet temperature value was used.

Circuit: Exhaust Gas Temperature 2



Circuit Descriptions:

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

Component Location:

The catalyst outlet temperature sensor is located in the after-treatment system. It is located at the outlet of the post-treatment catalyst unit.

Workshop Tips:

The catalyst outlet temperature sensor shares the engine harness return wires with other sensors. A shorted return can cause the activation of several fault codes. Possible causes of this fault code:

- Return circuit open at harness, connectors or sensor.
- Open or short-circuit signal with a voltage source. On-Board Diagnostic Information (OBD):

- The ECM will illuminate the malfunction indicator lamp (MIL) when the diagnosis is performed and fails.
- The ECM will turn off the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles in which the diagnosis is performed and no failure. The MIL lamp and the fault code can also be cleared with the electronic service tool INSITE ™.
- The fault code will be cleared from memory after 40 consecutive driving cycles in which the diagnosis is performed and approved.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch /

AMP / Metri-Pack female test lead. STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check for a security code failure inactive.	**Fault code 1675 inactive?**	
STEP 2: Check the exhaust gas temperature circuit and sensor No. 2.		
STEP 2A: Inspect the exhaust gas temperature sensor No. 2 and the connector pins.	**Dirty or damaged pins?**	
STEP 2B: Check the circuit response.	**Fault Code 1674 active and Fault Code 1675 inactive?**	
STEP 2C: Check the fault codes and the sensor condition.	**Fault code 1675 active?**	
STEP 3: Check the ECM and the engine harness.		
STEP 3A: Inspect the pins of the engine harness and ECM connectors.	**Dirty or damaged pins?**	
STEP 3B: Check the circuit response.	**Fault Code 1674 active and Fault Code 1675 inactive?**	
STEP 3C: Check for a circuit open in the engine harness.	**Less than 10 ohms?**	
STEP 3C-1: Check for a circuit open in the engine harness.	**Less than 10 ohms?**	
STEP 3D: Check for a short circuit between pins in the engine harness.	**More than 100k ohms?**	
STEP 3E: Check for a passcode failure inactive.	**Fault code 1675 inactive?**	
STEP 4: Clear the fault code.		
STEP 4A: Disable the fault code.	**Fault code 1675 inactive?**	
STEP 4B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

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

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an inactive fault code. • Use INSITE ™ to read the fault codes. Fault code 1675 inactive?	**YES**	Fault Code Inactive or Intermittent, Procedure 019-362 .
	Fault code 1675 inactive? **NO**	2A

STEP 2: Check the exhaust gas temperature circuit and sensor No. 2.

STEP 2A: Inspect the exhaust gas temperature sensor No. 2 and the connector pins.

Conditions:

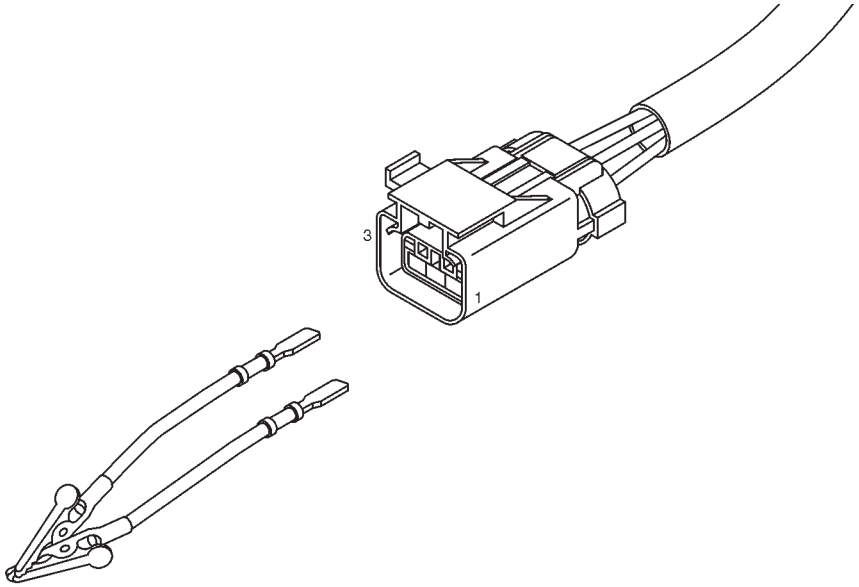
- Turn the ignition key off.
- Disconnect the exhaust gas temperature sensor No. 2 from the engine harness.

Action	Specifications / Repair	Next step
Check the engine harness and exhaust gas temperature sensor No. 2 for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Damage to the wire shield • Moisture inside or over the connector • Connector seals damaged or missing • Broken connector cover • Connector pin dirt or debris For general inspection techniques, see Connector and Component Pin Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected in the sensor or in the harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-071 .	4A
	Dirty or damaged pins? **NO**	2B

STEP 2B: Check the circuit response. Conditions:

- Turn the ignition key off.
- Disconnect the exhaust gas temperature sensor No. 2 from the engine harness.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Install a jumper wire between the SIGNAL and RETURN pins of the exhaust gas temperature sensor No. 2, on the engine harness sensor connector. • Refer to the electrical diagram for identification of the connector pins.	Fault Code 1674 active and Fault Code 1675 inactive? **YES**	2C
	Fault Code 1674 active and Fault Code 1675 inactive? **NO**	3A



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STEP 2C: Check the fault codes and the condition of the sensor. Conditions:

- Turn the ignition key off.
- Connect the No. 2 exhaust gas temperature sensor to the engine harness.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Use INSITE ™ to read the fault codes.	Fault code 1675 active? **YES** **Repair:** A defective exhaust gas temperature sensor 2 has been detected. Replace the exhaust gas temperature sensor No. 2. See the Procedure 019-013 .	4A
	Fault code 1675 active? **DO NOT** **REPAIR:** None. Did removing and installing the connector correct the failure?	4A

STEP 3: Check the ECM and the engine harness.

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

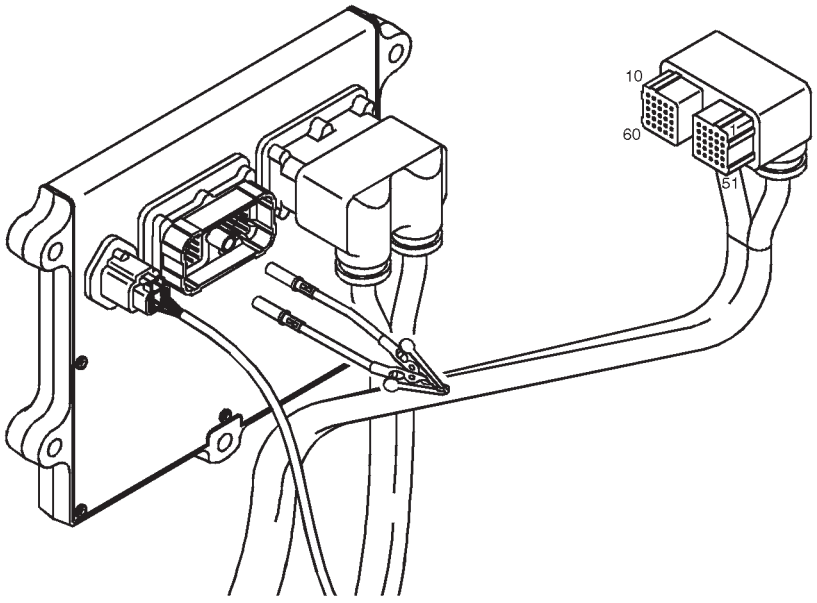
Conditions:
- Turn the ignition key off.
- Disconnect the engine harness from the ECM connector.

Action	Specifications / Repair	Next step
Check that the pins on the engine harness and ECM connectors have: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Damage to the wire shield • Moisture inside or over the connector • Connector seals damaged or missing • Broken connector cover • Connector pin dirt or debris For general inspection techniques, see Connector and Component Pin Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected at the ECM connector or the motor harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-043 .	4A
	Dirty or damaged pins? **NO**	3B

STEP 3B: Check the circuit response. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Install a jumper wire between the SIGNAL and RETURN pins of the exhaust gas temperature 2 sensor, on the ECM connector. • Check for proper circuit response after 30 seconds. • Use INSITE ™ to read the fault codes. Refer to the electrical diagram for identification of the connector pins.	Fault Code 1674 active and Fault Code 1675 inactive? **YES**	3C
	Fault Code 1674 active and Fault Code 1675 inactive? **DO NOT** **REPAIR:** Call for pre-authorization. Replace the ECM. See the Procedure 019-031 .	4A



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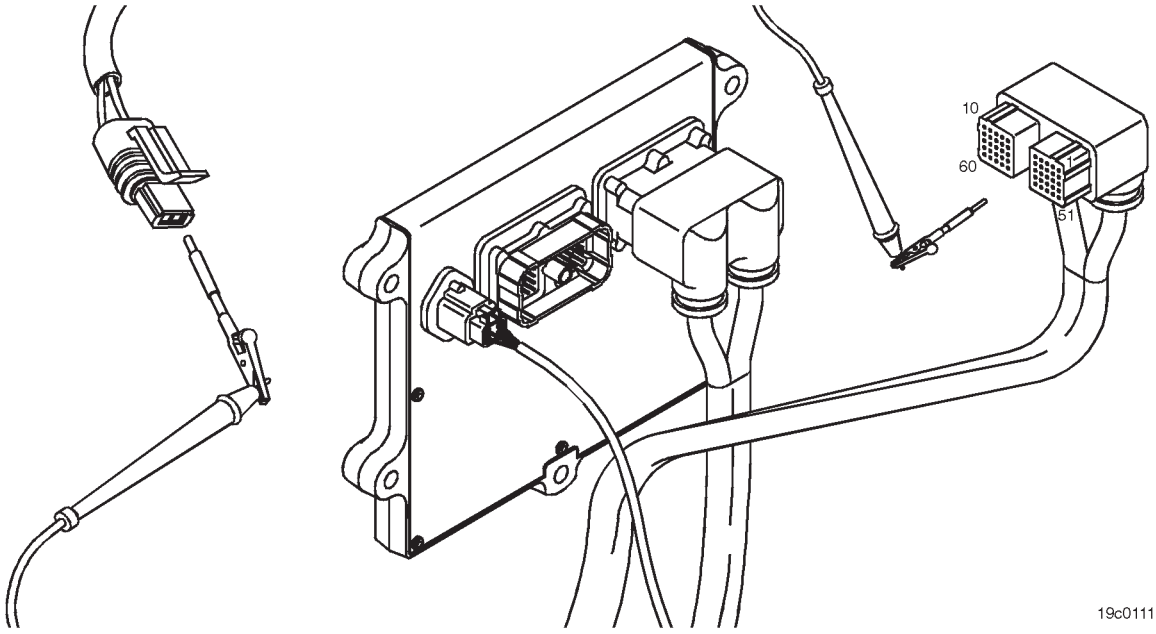
STEP 3C: Check the motor harness for an open circuit. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Disconnect the exhaust gas temperature sensor No. 2 from the engine harness.

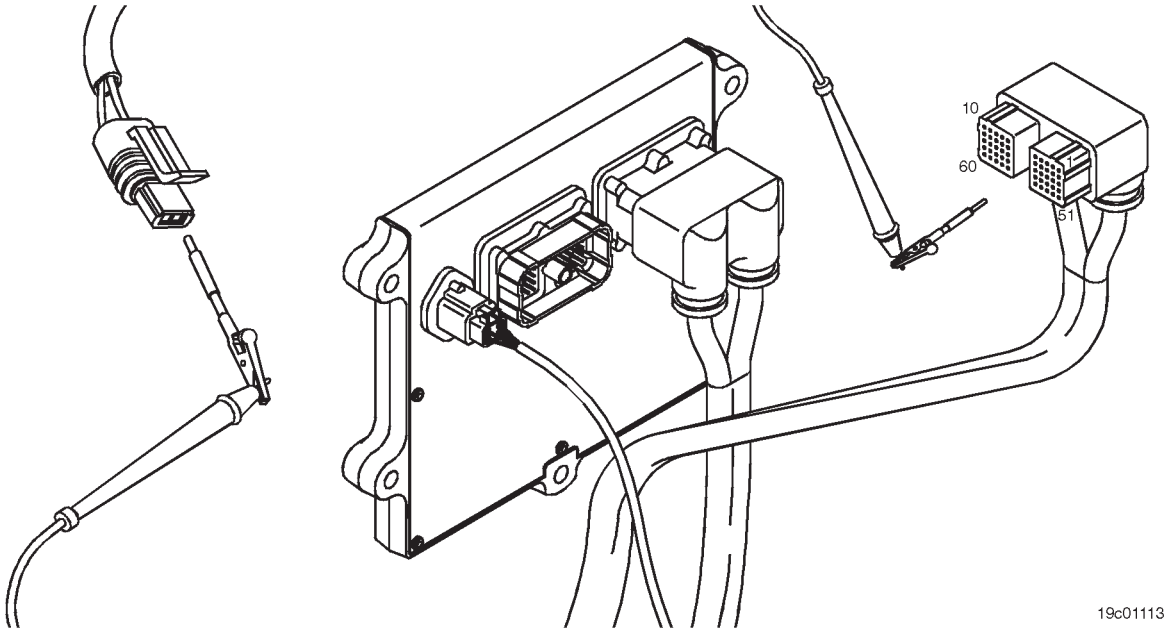
Action	Specifications / Repair	Next step
Check for an open circuit. • Measure the resistance between the RETURN pin on the exhaust gas temperature sensor 2 on the ECM connector on the engine harness and the RETURN pin on the exhaust gas temperature sensor 2 connector on the engine harness. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	Less than 10 ohms? **YES**	3C-1
	Less than 10 ohms? **DO NOT** **REPAIR:** An open RETURN circuit was detected in the engine harness. Repair or replace the engine harness. See the Procedure 019-043 .	4A



STEP 3C-1: Check the motor harness for an open circuit. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Disconnect the exhaust gas temperature sensor No. 2 from the engine harness.

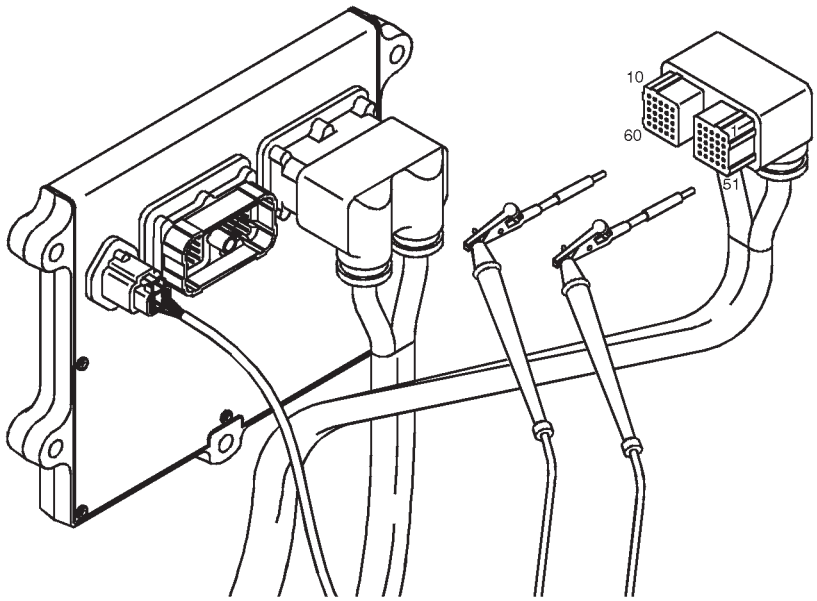
Action	Specifications / Repair	Next step
Check for an open circuit. • Measure the resistance between the exhaust gas temperature sensor 2 SIGN pin on the ECM connector on the engine harness and the SIGN pin on the exhaust temperature sensor 2 connector on the engine harness. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	Less than 10 ohms? **YES**	3D
	Less than 10 ohms? **DO NOT** **REPAIR:** An open SIGNAL circuit was detected in the engine harness. Repair or replace the engine harness. See the Procedure 019-043 .	4A



STEP 3D: Check the motor harness for a short circuit between pins. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Disconnect the exhaust gas temperature sensor No. 2 from the engine harness.

Action	Specifications / Repair	Next step
Check for a short circuit between pins. • Measure the resistance between the exhaust gas temperature sensor No. 2 SIGN pin on the ECM connector on the engine harness and all other pins on the ECM connector on the engine harness. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YES**	3E
	More than 100k ohms? **DO NOT** **REPAIR:** A short circuit was detected between pins in the SIGNAL line in the motor harness. Repair or replace the engine harness. See the Procedure 019-043 .	4A



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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Use INSITE ™ to read the fault codes.	Fault code 1675 inactive? **YES** **Repair:** None. Did removing and installing the connector correct the failure?	4A
	Fault code 1675 inactive? **DO NOT** **REPAIR:** The fault diagnosis procedures must be repeated from the beginning. A failure mode must have been detected.	1A

STEP 4: Clear the fault code.

STEP 4A: Disable the fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Use INSITE ™ to check if the fault code is inactive.	Fault code 1675 inactive? **YES**	4B
	Fault code 1675 inactive? **NO**	1A

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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

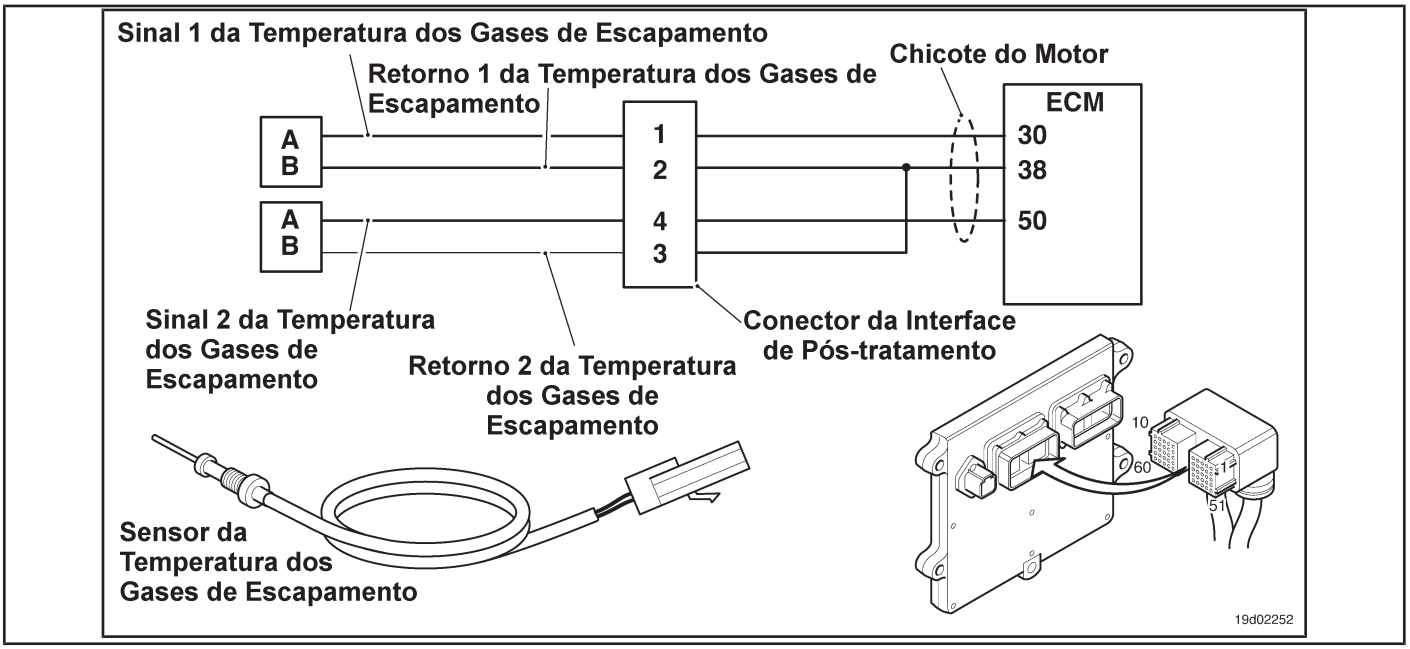
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use INSITE ™ to clear inactive fault codes.	All codes cleared? **YES**	Complete repair
	All codes cleared? **NO**	Proper troubleshooting and repair steps

Fault Code 1676

Exhaust Gas Temperature 2 - Invalid, Intermittent or Incorrect Data

CODES	REASON	IT IS MADE
Fault Code: 1676 PID (P), SID (S): IMF: 2 Lamp: Amber SRT:	Exhaust Gas Temperature 2 - Invalid, Intermittent or Incorrect Data. The exhaust gas temperature sensor 2 does not change according to the engine's operating conditions.	Possible non-compliance with emission standards. The standard value for exhaust gas temperature 2 was used.

Circuit: Exhaust Gas Temperature 2



Circuit Descriptions:

Exhaust gas temperature sensor No. 2 is used by the electronic control module (ECM) to monitor the temperature of the engine exhaust gases entering the catalyst unit. The ECM monitors the voltage at the signal pin and converts it to a temperature value. This sensor is also called the catalyst outlet temperature sensor.

Component Location:

The catalyst exhaust gas temperature sensor No. 2 is located in the after-treatment system. It is located between the outlet of the turbocharger and the outlet of the catalyst unit in the exhaust system.

Workshop Tips:

This diagnosis is performed when the engine has not been running for the past eight hours. The exhaust gas temperature sensor 2 is compared to the temperatures of the coolant and in the intake manifold when the ignition key is turned on after an eight-hour shutdown. This fault code will be logged if the exhaust gas temperature sensor 2 reading is not the same as the engine coolant temperature readings and the intake manifold. Possible causes of this fault code:

- Exhaust gas temperature sensor 2 "stuck" in the operating range

- High resistance in the exhaust gas temperature 2 sensor signal and return lines. On-Board Diagnostic Information (OBD):

- The ECM will light the malfunction indicator lamp (MIL) for the second consecutive ignition cycle when the diagnosis is performed and fails.
- The ECM will turn off the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles in which the diagnosis is performed and no failure. The MIL lamp and the fault code can also be cleared with the electronic service tool INSITE ™.
- The fault code will be cleared from memory after 40 consecutive driving cycles in which the diagnosis is performed and approved.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch /

AMP / Metri-Pack female test lead. STEPS

		SPECIFICATIONS	SRT CODE
STEP 1: Check for sensor circuit fault codes.			
STEP 1A: Check the Fault Codes	**1674 and 1675 are registered.**	**Are Fault Codes 1674 or 1675 active?**	
STEP 2: Check the exhaust gas temperature circuit and sensor No. 2.			
STEP 2A:	**Inspect the exhaust gas temperature sensor No. 2 and the connector pins.**	**Dirty or damaged pins?**	
STEP 2B: Check the circuit response.		**Fault code 1675 active?**	
STEP 2C: Check the circuit response.		**Fault code 1674 active?**	
STEP 3: Check the ECM and the engine harness.			
STEP 3A:	**Inspect the pins of the engine harness and ECM connectors.**	**Dirty or damaged pins?**	
STEP 3B: Check the circuit response.		**Fault code 1675 active?**	
STEP 3C: Check the circuit response.		**Fault code 1674 active?**	
STEP 4: Clear the fault codes.			
STEP 4A: Check the repair.		**Are the temperature readings at the inlet and outlet of the catalyst within the 25 ° F range between them?**	
STEP 4B: Clear the fault codes.		**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check for sensor circuit fault codes.

STEP 1A: Check that Fault Codes 1674 and 1675 are registered. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for active fault codes. • Use INSITE ™ to read the fault codes. Fault Codes 1674 or 1675 active?	**YES**	Fault diagnosis diagram for Fault Code 1674 or 1675.
	Are Fault Codes 1674 or 1675 active? **NO**	2A

STEP 2: Check the exhaust gas temperature circuit and sensor No. 2.

STEP 2A: Inspect the exhaust gas temperature sensor No. 2 and the connector pins.

Conditions:

- Turn the ignition key off.
- Disconnect the exhaust gas temperature sensor No. 2 from the engine harness.

Action	Specifications / Repair	Next step
Check the engine harness and exhaust gas temperature sensor No. 2 for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Damage to the wire shield • Moisture inside or over the connector • Connector seals damaged or missing • Broken connector cover • Connector pin dirt or debris For general inspection techniques, see Connector and Component Pin Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected in the sensor or in the harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-071 .	4A
	Dirty or damaged pins? **NO**	2B

STEP 2B: Check the circuit response. Conditions:

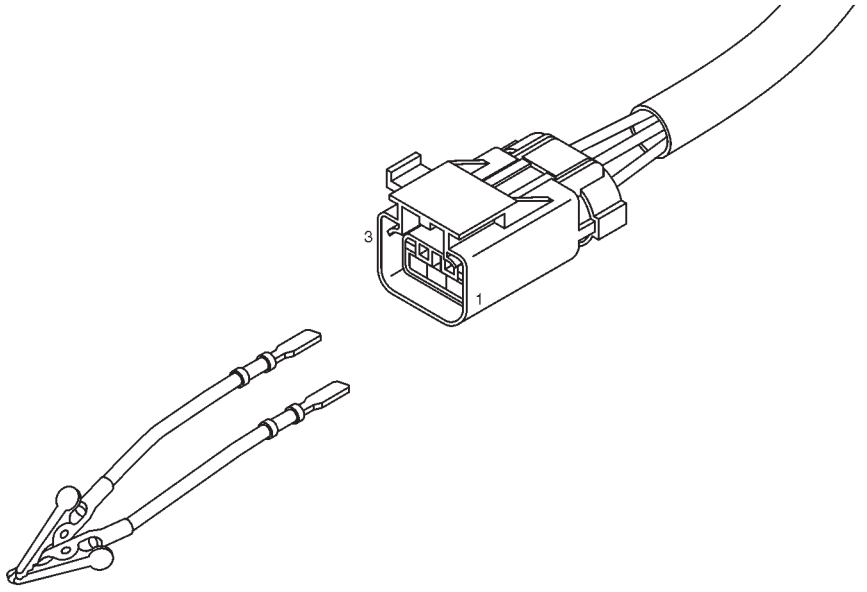
- Turn the ignition key off.
- Disconnect the exhaust gas temperature sensor No. 2 from the engine harness.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an appropriate ECM response after 30 seconds. • Use INSITE ™ to read the fault codes.	Fault code 1675 active? **YES**	2C
	Fault code 1675 active? **NO**	3A

STEP 2C: Check the circuit response. Conditions:

- Turn the ignition key off.
- Connect the No. 2 exhaust gas temperature sensor to the engine harness.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Install a jumper wire between the SIGNAL and RETURN pins of the exhaust gas temperature 2 sensor, on the engine harness connector. Refer to the electrical diagram for identification of the connector pins. Check for proper circuit response after 30 seconds.	Fault code 1674 active? **YES** **Repair:** Replace the exhaust gas temperature sensor No. 2. See the Procedure 019-013 .	4A
• Use INSITE ™ to read the fault codes.	Fault code 1674 active? **NO**	3A



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STEP 3: Check the ECM and the engine harness.

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

Conditions:
- Turn the ignition key off.
- Disconnect the engine harness from the ECM connector.

Action	Specifications / Repair	Next step
Check that the pins on the engine harness and ECM connectors have: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Damage to the wire shield • Moisture inside or over the connector • Connector seals damaged or missing • Broken connector cover • Connector pin dirt or debris For general inspection techniques, see Connector and Component Pin Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected at the ECM connector or the motor harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-043 .	4A
	Dirty or damaged pins? **NO**	3B

STEP 3B: Check the circuit response. Conditions:

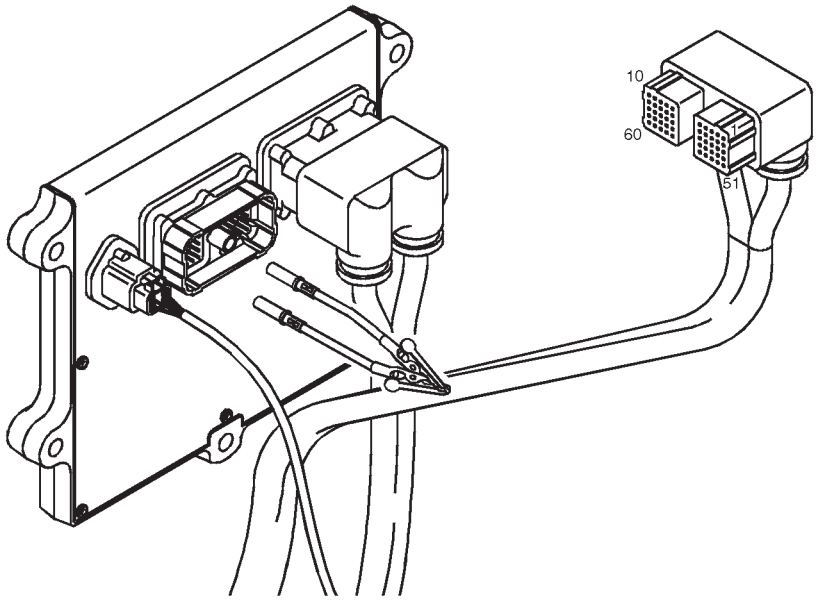
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Use INSITE ™ to read the fault codes.	Fault code 1675 active? **YES**	3C
	Fault code 1675 active? **DO NOT** **REPAIR:** Call for pre-authorization. Replace the ECM. See the Procedure 019-031 .	4A

STEP 3C: Check the circuit response. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Install a jumper wire between the SIGNAL and RETURN pins of the exhaust gas temperature 2 sensor, on the ECM connector. Check for proper circuit response after 30 seconds. • Use INSITE ™ to read the fault codes.	Fault code 1674 active? **YES** **Repair:** High resistance or a short circuit was detected in the engine harness. Repair or replace the engine harness. See the Procedure 019-043 .	4A
	Fault code 1674 active? **DO NOT** **REPAIR:** Call for pre-authorization. Replace the ECM. See the Procedure 019-031 .	4A



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STEP 4: Clear the fault code.

STEP 4A: Check the repair. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Start the INSITE ™ Monitor / Data Logger. • Compare the INSITE ™ readings for the catalyst inlet and outlet temperatures.	Are the temperature readings at the inlet and outlet of the catalyst within the 25 ° F range between them? **YES**	4B
	Are the temperature readings at the inlet and outlet of the catalyst within the 25 ° F range between them? **NO**	1A

STEP 4B: Clear the fault codes. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

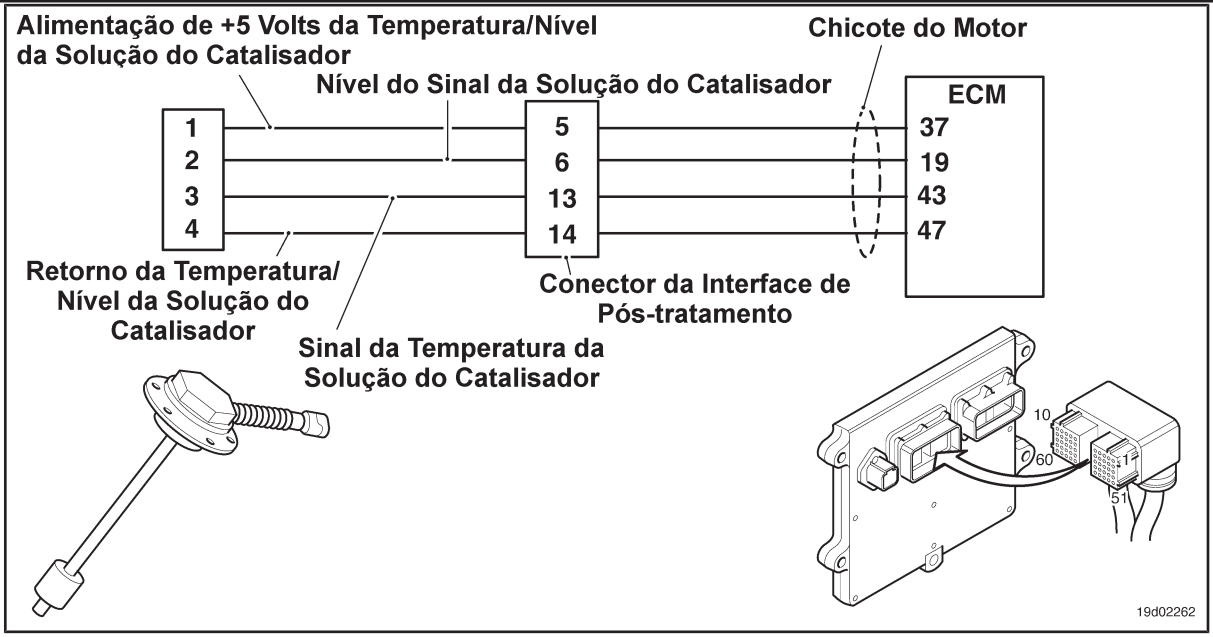
Action	Specifications / Repair	Next step
Clear the fault codes. • Use the electronic service tool INSITE ™ to clear all active and inactive fault codes.	All codes cleared? **YES**	Complete repair
	All codes cleared? **NO**	Proper troubleshooting and repair steps

Fault Code 1677

Catalyst Reservoir Temperature - Voltage Below Normal or With Voltage Low

CODES	REASON	IT IS MADE
Fault Code: 1677 PID (P), SID (S): IMF: 4 Lamp: Amber SRT:	Catalyst Reservoir Temperature - Voltage Below Normal or Low Voltage. Low voltage signal detected in the catalyst solution temperature sensor circuit.	Standard temperature value of the catalyst solution was used.

Circuit: Catalyst Solution Temperature Sensor



Circuit Descriptions:

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

Component Location:

The catalyst solution temperature sensor is located in the catalyst reservoir. The reservoir is assembled by the OEM. For more information, see the OEM service manual.

Workshop Tips:

The catalyst solution temperature sensor shares the engine harness return wires with other sensors. A shorted return can cause the activation of several fault codes. Before diagnosing Fault Code 1677, check for multiple fault codes. Possible causes of this fault code:

- Short signal with the mass in the whip
- Signal shorted with feedback or ground in the sensor. On-Board

Diagnostic Information (OBD):

- The ECM will illuminate the malfunction indicator lamp (MIL) when the diagnosis is performed and fails.
- The ECM will turn off the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles in which the diagnosis is performed and no failure. The MIL lamp and the fault code can also be cleared with the electronic service tool INSITE ™.
- The fault code will be cleared from memory after 40 consecutive driving cycles in which the diagnosis is performed and approved.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch /

AMP / Metri-Pack female test lead. STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check for a security code failure inactive.	**Fault code 1677 inactive?**	
STEP 2: Check the catalyst solution temperature sensor and the circuit.		
STEP 2A: Inspect the catalyst solution temperature sensor and connector pins.	**Dirty or damaged pins?**	
STEP 2B: Check the circuit response.	**Fault Code 1678 active and Fault Code 1677 inactive?**	
STEP 2C: Check the fault codes and the sensor condition.	**Fault code 1677 active?**	
STEP 3: Check the ECM and the engine harness.		
STEP 3A: Inspect the pins of the engine harness and ECM connectors.	**Dirty or damaged pins?**	
STEP 3B: Check the circuit response.	**Fault Code 1678 active and Fault Code 1677 inactive?**	
STEP 3C: Check for a short circuit between pins in the engine harness.	**More than 100k ohms?**	
STEP 3D: Check if there is a short circuit between pins and ground.	**More than 100k ohms?**	
STEP 3E: Check for a passcode failure inactive.	**Fault code 1677 inactive?**	
STEP 4: Clear the fault code.		
STEP 4A: Disable the fault code.	**Fault code 1677 inactive?**	
STEP 4B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

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

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an inactive fault code. • Use INSITE ™ to read the fault codes. Fault code 1677 inactive?	**YES**	Fault Code Inactive or Intermittent, Procedure 019-362 .
	Fault code 1677 inactive? **NO**	2A

STEP 2: Check the catalyst solution temperature sensor and the circuit.

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

Conditions:

- Turn the ignition key off.
- Disconnect the temperature sensor from the catalyst solution from the engine harness.

Action	Specifications / Repair	Next step
Check that the engine harness and catalyst solution temperature sensor have: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Damage to the wire shield • Moisture inside or over the connector • Connector seals damaged or missing • Broken connector cover • Connector pin dirt or debris For general inspection techniques, see Connector and Component Pin Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected in the sensor or in the harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-071 .	4A
	Dirty or damaged pins? **NO**	2B

STEP 2B: Check the circuit response. Conditions:

- Turn the ignition key off.
- Disconnect the temperature sensor from the catalyst solution from the engine harness.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an appropriate ECM response after 30 seconds. • Use INSITE ™ to read the fault codes.	Fault Code 1678 active and Fault Code 1677 inactive? **YES**	2C
	Fault Code 1678 active and Fault Code 1677 inactive? **NO**	3A

STEP 2C: Check the fault codes and the condition of the sensor. Conditions:

- Turn the ignition key off.
- Connect the catalyst solution temperature sensor to the engine harness.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Use INSITE ™ to read the fault codes.	Fault code 1677 active? **YES** **Repair:** Replace the catalyst solution temperature sensor. Refer to the OEM fault diagnosis manual.	4A
	Fault code 1677 active? **DO NOT** **REPAIR:** None. Did removing and installing the connector correct the failure?	4A

STEP 3: Check the ECM and the engine harness.

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

Conditions:
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.

Action	Specifications / Repair	Next step
Check that the pins on the engine harness and ECM connectors have: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Damage to the wire shield • Moisture inside or over the connector • Connector seals damaged or missing • Broken connector cover • Connector pin dirt or debris For general inspection techniques, see Connector and Component Pin Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected at the ECM connector or the motor harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-043 .	4A
	Dirty or damaged pins? **NO**	3B

STEP 3B: Check the circuit response. Conditions:

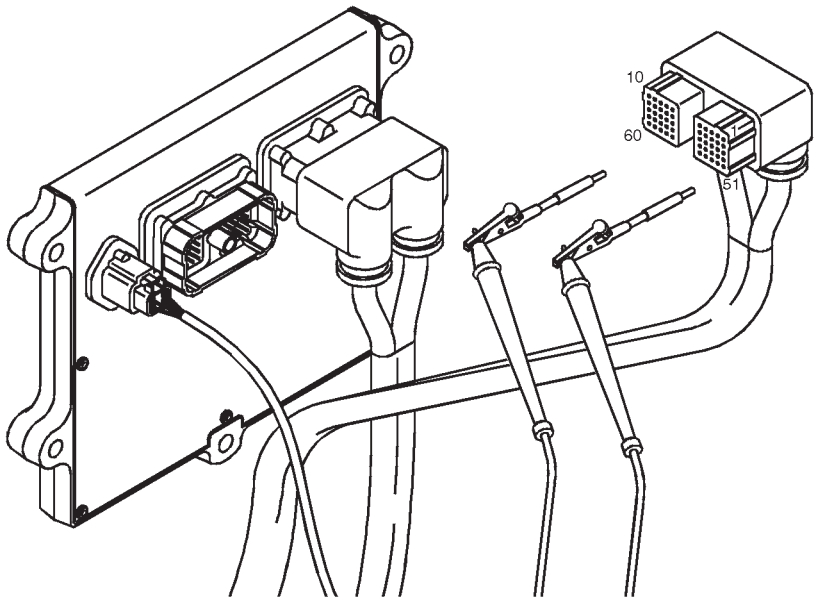
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Use INSITE ™ to read the fault codes.	Fault Code 1678 active and Fault Code 1677 inactive? **YES**	3C
	Fault Code 1678 active and Fault Code 1677 inactive? **DO NOT** **REPAIR:** Call for pre-authorization. Replace the ECM. See the Procedure 019-031 .	4A

STEP 3C: Check the motor harness for a short circuit between pins. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Disconnect the temperature sensor from the catalyst solution from the engine harness.

Action	Specifications / Repair	Next step
Check for a short circuit between pins. • Measure the resistance between the catalyst solution temperature sensor SIGN pin, the ECM connector on the engine harness, and all other pins on the engine harness ECM connector. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YES**	3D
	More than 100k ohms? **DO NOT** **REPAIR:** A short circuit was detected between pins in the SIGNAL line in the motor harness. Repair or replace the engine harness. See the Procedure 019-043 .	4A



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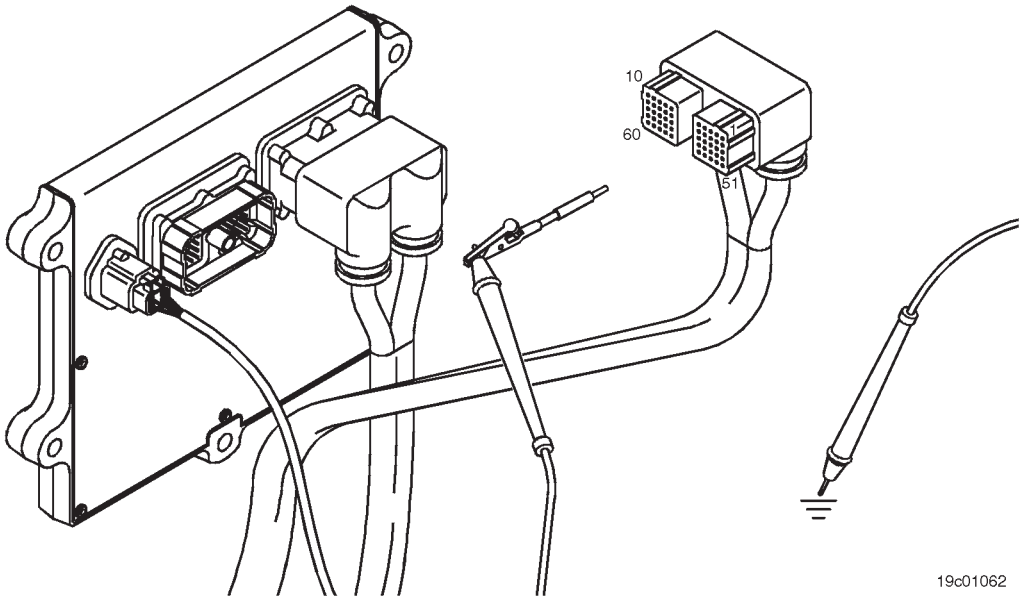
STEP 3D: Check if there is a short circuit between the pins and the ground. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Disconnect the temperature sensor from the catalyst solution from the engine harness.

Action	Specifications / Repair	Next step
Check for a short between pins and ground. • Measure the resistance between the catalyst solution temperature sensor SIGN pin, the ECM connector on the engine harness, and the ground. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YES**	3E
	More than 100k ohms? **DO NOT** **REPAIR:** A short circuit was detected between the pins and the ground in the SIGNAL line in the motor harness. Repair or replace the engine harness. See the Procedure 019-043 .	4A



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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Use INSITE ™ to read the fault codes.	Fault code 1677 inactive? **YES** **Repair:** None. Did removing and installing the connector correct the failure?	4A
	Fault code 1677 inactive? **DO NOT** **REPAIR:** The fault diagnosis procedures must be repeated from the beginning. A failure mode must have been detected.	1A

STEP 4: Clear the fault code.

STEP 4A: Disable the fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Use INSITE ™ to check if the fault code is inactive.	Fault code 1677 inactive? **YES**	4B
	Fault code 1677 inactive? **NO**	1A

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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

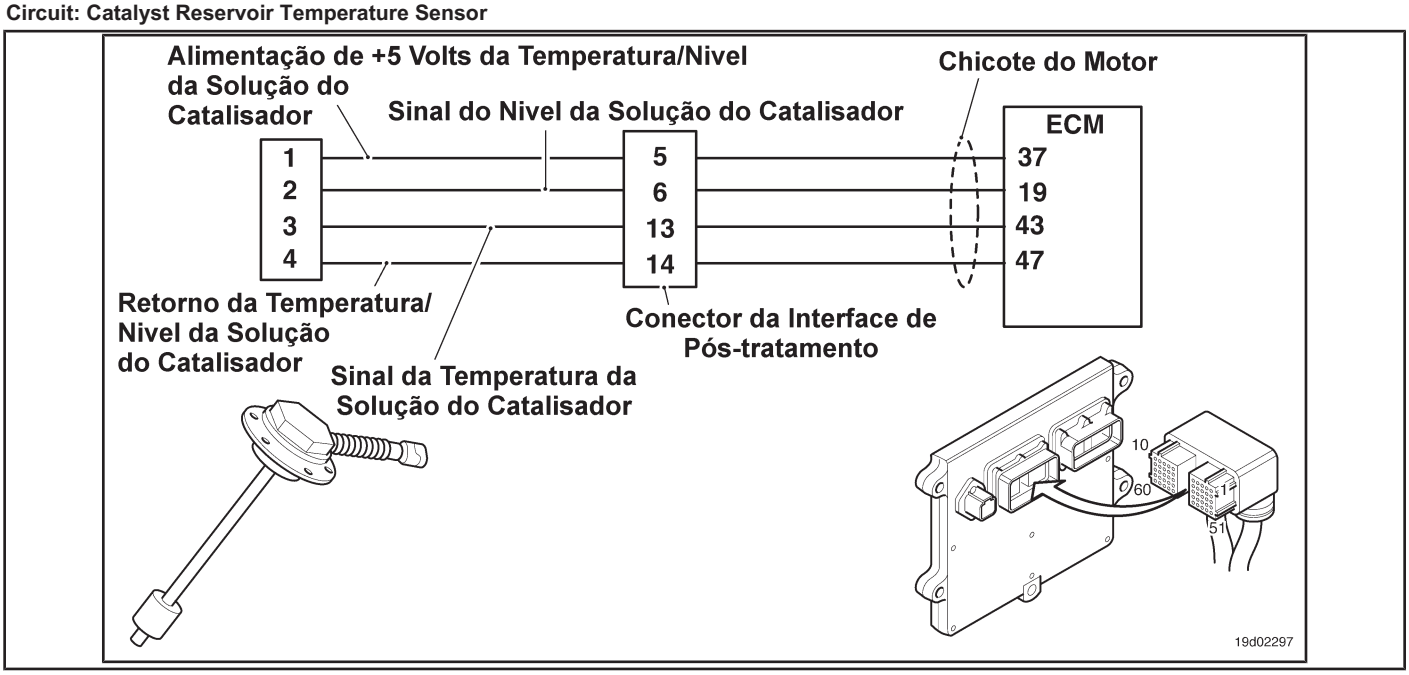
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use INSITE ™ to clear inactive fault codes.	All codes cleared? **YES**	Complete repair
	All codes cleared? **NO**	Proper troubleshooting and repair steps

Fault Code 1678

Catalyst Reservoir Temperature - Voltage Above Normal or with Voltage High

CODES	REASON	IT IS MADE
Fault Code: 1678 PID (P), SID (S): IMF: 3 Lamp: Amber SRT:	Catalyst Reservoir Temperature - Voltage Above Normal or High Voltage. High voltage signal or an open circuit is detected in the catalyst reservoir temperature sensor circuit.	The standard temperature value of the catalyst reservoir is used.

Circuit: Catalyst Reservoir Temperature Sensor



Circuit Descriptions:

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

Component Location:

The catalyst solution temperature sensor is located in the catalyst reservoir. The reservoir is assembled by the OEM. For more information, see the OEM service manual.

Workshop Tips:

The catalyst solution temperature sensor shares the engine harness return wires with other sensors. An open return can cause the activation of several fault codes. Possible causes of this fault code:

- Return circuit open at harness, connectors or sensor.
- Open or short-circuit signal with a voltage source. On-Board Diagnostic Information (OBD):

- The ECM will illuminate the malfunction indicator lamp (MIL) when the diagnosis is performed and fails.
- The ECM will turn off the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles in which the diagnosis is performed and no failure. The MIL lamp and the fault code can also be cleared with the electronic service tool INSITE ™.
- The fault code will be cleared from memory after 40 consecutive driving cycles in which the diagnosis is performed and approved.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch /

AMP / Metri-Pack female test lead. STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check for a security code failure inactive.	**Fault code 1678 inactive?**	
STEP 2: Check the catalyst solution temperature sensor and the circuit.		
STEP 2A: Inspect the catalyst solution temperature sensor and connector pins.	**Dirty or damaged pins?**	
STEP 2B: Check the resistance of the sensor.	**180 ohms to 160k ohms?**	
STEP 2C: Check the fault codes and the sensor condition.	**Fault code 1678 active?**	
STEP 3: Check the ECM and the engine harness.		
STEP 3A: Inspect the pins of the engine harness and ECM connectors.	**Dirty or damaged pins?**	
STEP 3B: Check the circuit response.	**Fault Code 1677 active and Fault Code 1678 inactive?**	
STEP 3C: Check for a circuit open in the engine harness.	**Less than 10 ohms?**	
STEP 3C-1: Check for a circuit open in the engine harness.	**Less than 10 ohms?**	
STEP 3D: Check for a short circuit between pins in the engine harness.	**More than 100k ohms?**	
STEP 3E: Check for a passcode failure inactive.	**Fault code 1678 inactive?**	
STEP 4: Clear the fault code.		
STEP 4A: Disable the fault code.	**Fault code 1678 inactive?**	
STEP 4B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

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

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an inactive fault code. • Use INSITE ™ to read the fault codes. Fault code 1678 inactive?	**YES**	Fault Code Inactive or Intermittent, Procedure 019-362 .
	Fault code 1678 inactive? **NO**	2A

STEP 2: Check the catalyst solution temperature sensor and the circuit.

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

Conditions:

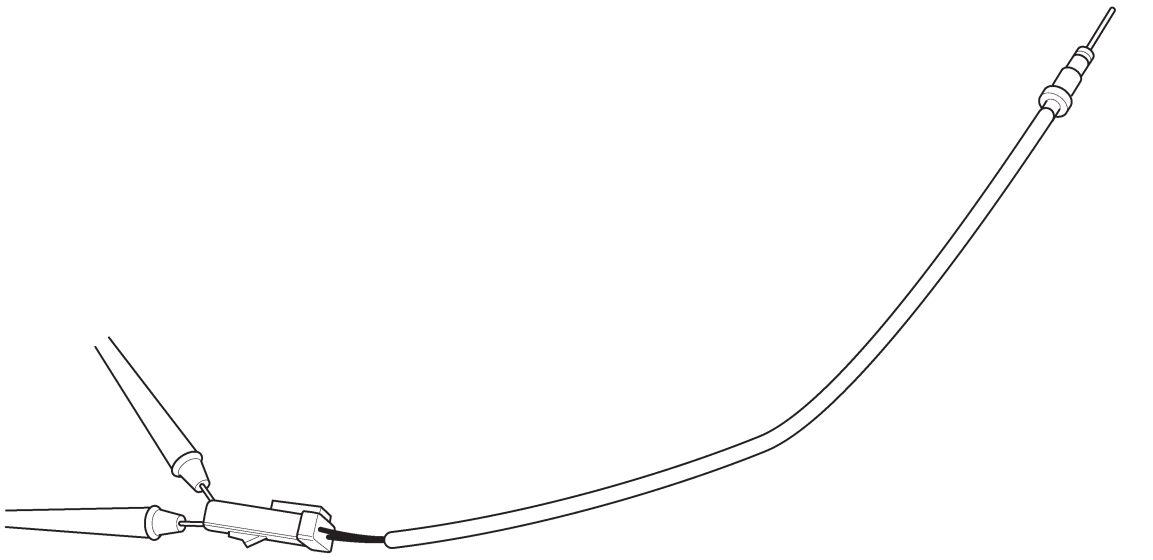
- Turn the ignition key off.
- Disconnect the temperature sensor from the catalyst solution from the engine harness.

Action	Specifications / Repair	Next step
Inspect the engine harness connector and catalytic converter temperature sensor pins for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Damage to the wire shield • Moisture inside or over the connector • Connector seals damaged or missing • Broken connector cover • Connector pin dirt or debris For general inspection techniques, see Connector and Component Pin Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected in the sensor or in the harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-071 .	4A
	Dirty or damaged pins? **NO**	2B

STEP 2B: Check the resistance of the sensor. Conditions:

- Turn the ignition key off.
- Disconnect the temperature sensor from the catalyst solution from the engine harness.

Action	Specifications / Repair	Next step
Measure the resistance of the sensor. • Measure the resistance between the SIGNAL and RETURN pins of the catalyst solution temperature sensor on the catalyst solution temperature sensor. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	180 ohms to 160k ohms? **YES**	2C
	180 ohms to 160k ohms? **DO NOT** **REPAIR:** Replace the catalyst solution temperature sensor. Refer to the OEM fault diagnosis procedures.	4A



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STEP 2C: Check the fault codes and the condition of the sensor. Conditions:

- Turn the ignition key off.
- Connect the catalyst solution temperature sensor to the engine harness.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Use INSITE ™ to read the fault codes.	Fault code 1678 active? **YES**	3A
	Fault code 1678 active? **DO NOT** **REPAIR:** None. Did removing and installing the connector correct the failure?	4A

STEP 3: Check the ECM and the engine harness.

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

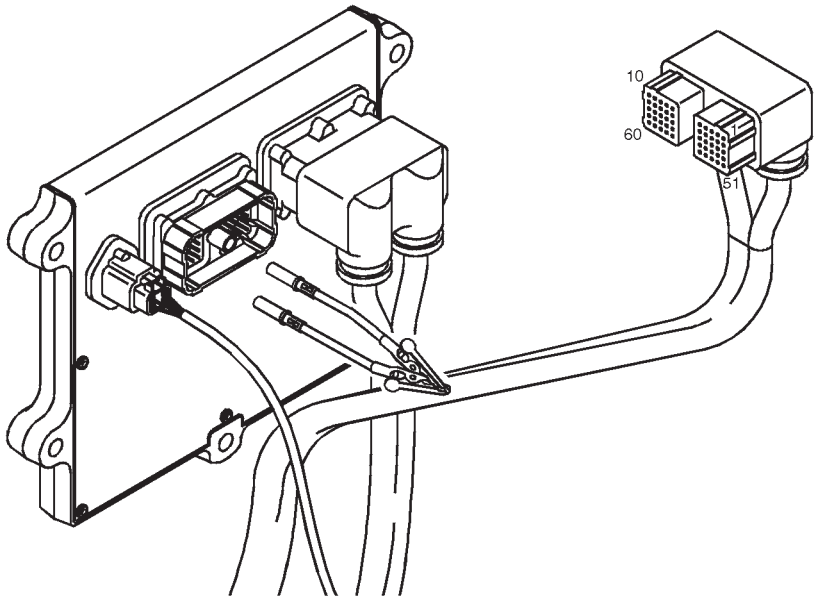
Conditions:
- Turn the ignition key off.
- Disconnect the engine harness from the ECM connector.

Action	Specifications / Repair	Next step
Check that the pins on the engine harness and ECM connectors have: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Damage to the wire shield • Moisture inside or over the connector • Connector seals damaged or missing • Broken connector cover • Connector pin dirt or debris For general inspection techniques, see Connector and Component Pin Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected at the ECM connector or the motor harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-043 .	4A
	Dirty or damaged pins? **NO**	3B

STEP 3B: Check the circuit response. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Install a jumper wire between the SIGNAL and RETURN pins of the catalyst solution temperature sensor on the ECM connector. • Check for proper circuit response after 30 seconds. • Use INSITE ™ to read the fault codes. Refer to the electrical diagram for identification of the connector pins.	Fault Code 1677 active and Fault Code 1678 inactive? **YES**	3C
	Fault Code 1677 active and Fault Code 1678 inactive? **DO NOT** **REPAIR:** Call for pre-authorization. Replace the ECM. See the Procedure 019-031 .	4A



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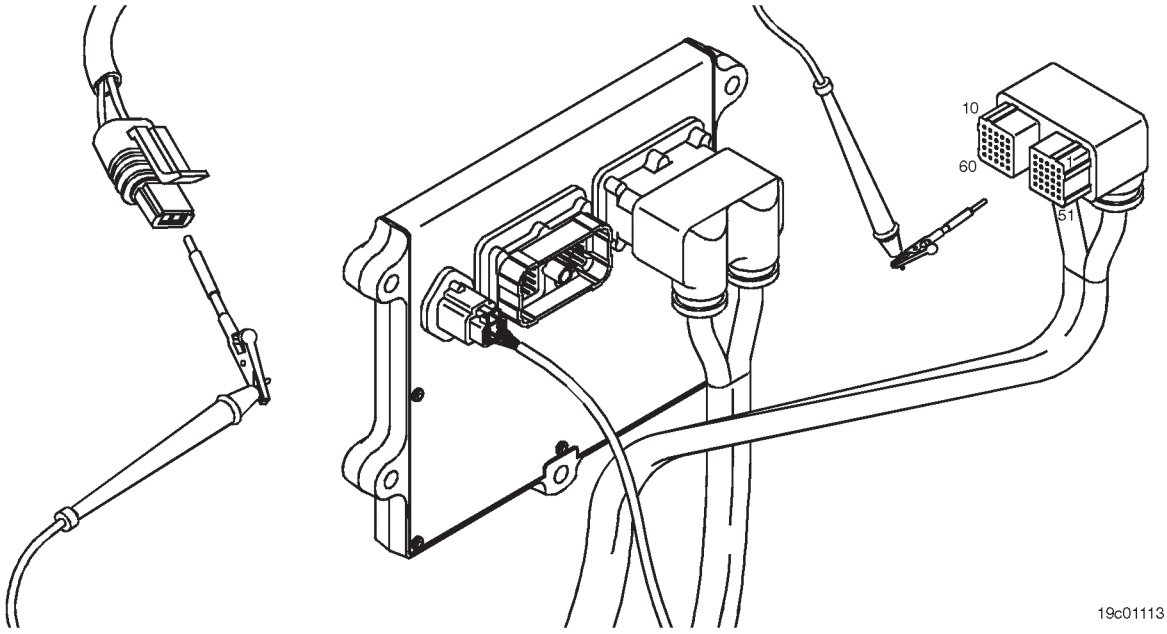
STEP 3C: Check the motor harness for an open circuit. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Disconnect the temperature sensor from the catalyst solution from the engine harness.

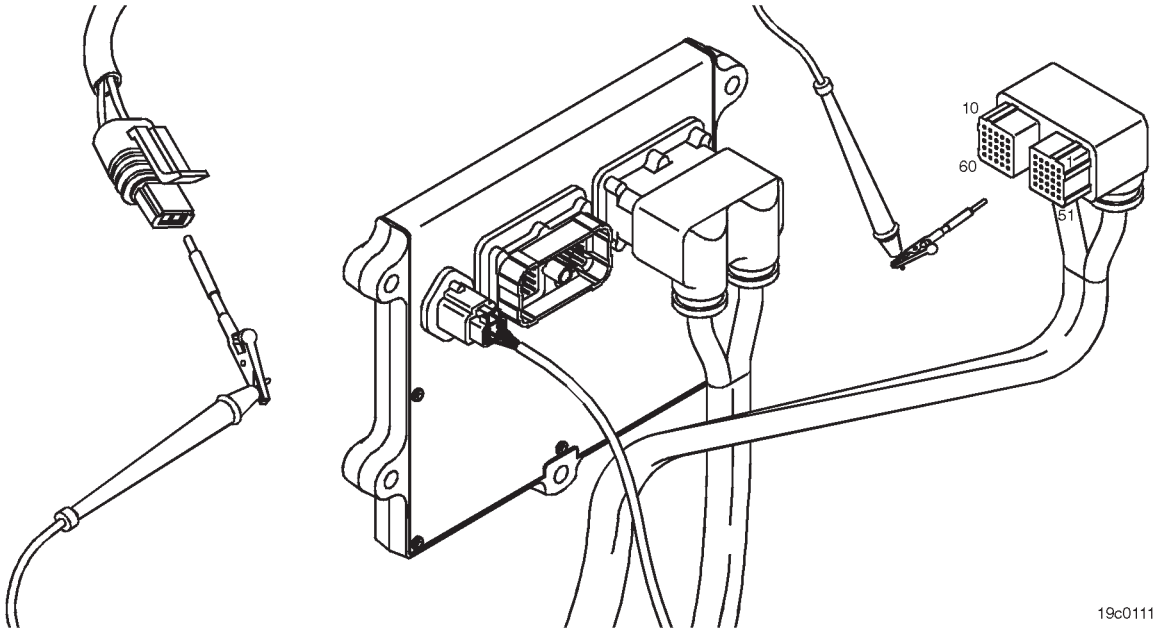
Action	Specifications / Repair	Next step
Check for an open circuit. • Measure the resistance between the RETURN pin of the catalyst solution temperature sensor, on the ECM connector on the engine harness, and the RETURN pin on the catalyst solution temperature sensor connector of the OEM harness. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	Less than 10 ohms? **YES**	3C-1
	Less than 10 ohms? **DO NOT** **REPAIR:** An open RETURN circuit was detected in the engine harness. Repair or replace the engine harness. See the Procedure 019-043 .	4A



STEP 3C-1: Check the motor harness for an open circuit. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Disconnect the temperature sensor from the catalyst solution from the engine harness.

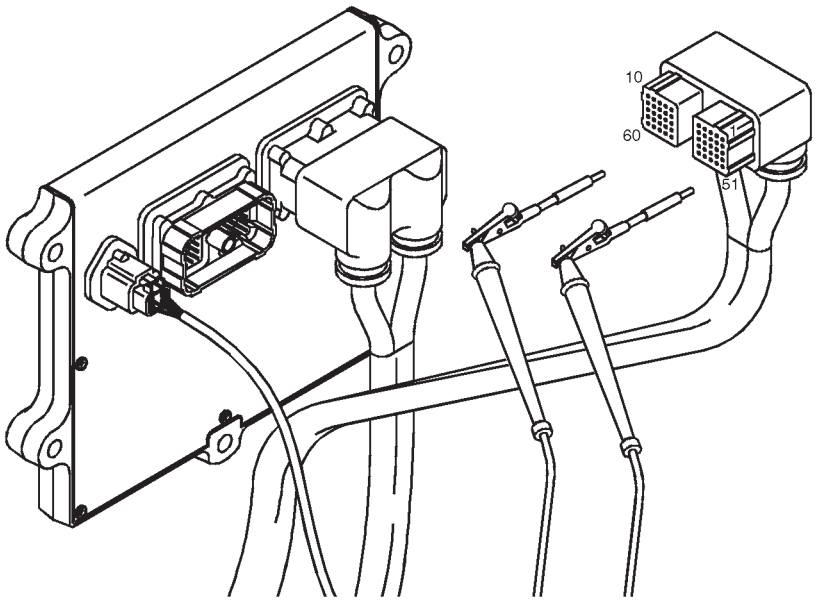
Action	Specifications / Repair	Next step
Check for an open circuit. • Measure the resistance between the catalyst solution temperature sensor SIGN pin, on the ECM connector on the engine harness, and the SIGN pin on the OEM harness catalyst solution temperature sensor connector. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	Less than 10 ohms? **YES**	3D
	Less than 10 ohms? **DO NOT** **REPAIR:** An open SIGNAL circuit was detected in the engine harness. Repair or replace the engine harness. See the Procedure 019-043 .	4A



STEP 3D: Check the motor harness for a short circuit between pins. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Disconnect the temperature sensor from the catalyst solution from the engine harness.

Action	Specifications / Repair	Next step
Check for a short circuit between pins. • Measure the resistance between the catalyst solution temperature sensor SIGN pin, the ECM connector on the engine harness, and all other pins on the engine harness ECM connector. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YES**	3E
	More than 100k ohms? **DO NOT** **REPAIR:** A short circuit was detected between pins in the SIGNAL line in the motor harness. Repair or replace the engine harness. See the Procedure 019-043 .	4A



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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Use INSITE ™ to read the fault codes.	Fault code 1678 inactive? **YES** **Repair:** None. Did removing and installing the connector correct the failure?	4A
	Fault code 1678 inactive? **DO NOT** **REPAIR:** The fault diagnosis procedures must be repeated from the beginning.	1A

STEP 4: Clear the fault code.

STEP 4A: Disable the fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Use INSITE ™ to check if the fault code is inactive.	Fault code 1678 inactive? **YES**	4B
	Fault code 1678 inactive? **NO**	1A

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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

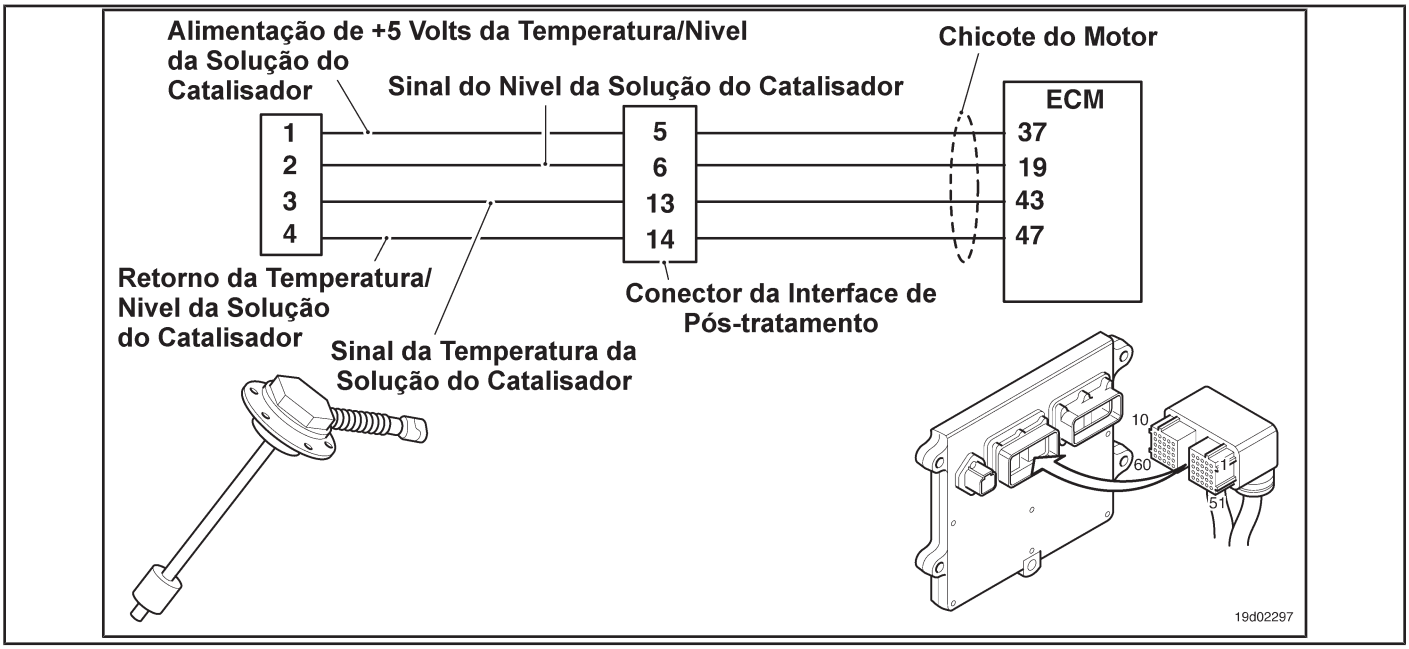
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use INSITE ™ to clear inactive fault codes.	All codes cleared? **YES**	Complete repair
	All codes cleared? **NO**	Proper troubleshooting and repair steps

Fault Code 1679

Catalyst Reservoir Temperature - Invalid, Intermittent or Incorrect Data

CODES	REASON	IT IS MADE
Fault Code: 1679 PID (P), SID (S): IMF: 2 Lamp: Amber SRT:	Catalyst Reservoir Temperature - Invalid, Intermittent or Incorrect Data. The temperature sensor of the catalyst solution does not change with engine operating conditions.	The standard temperature value of the catalyst solution was used.

Circuit: Catalyst Solution Temperature Sensor



Circuit Descriptions:

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

Component Location:

The catalyst solution temperature sensor is located in the catalyst reservoir. The reservoir is assembled by the OEM. For more information, see the OEM service manual.

Workshop Tips:

This diagnosis is performed when the engine has not been running for the past eight hours. The temperature sensor of the catalyst solution is compared to the temperatures of the coolant and the intake manifold when the ignition key is turned on after the eight-hour shutdown. This fault code will be logged if the temperature sensor reading from the catalyst solution does not match the temperature readings for the engine coolant and intake manifold. Possible causes of this fault code:

- Catalyst solution temperature sensor "stuck" in the operating range
- High resistance in the signal and return lines of the catalyst solution temperature sensor.

On-Board Diagnostic Information (OBD):

- The ECM will light the malfunction indicator lamp (MIL) for the second consecutive ignition cycle when the diagnosis is performed and fails.
- The ECM will turn off the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles in which the diagnosis is performed and no failure. The MIL lamp and the fault code can also be cleared with the electronic service tool INSITE ™.
- The fault code will be cleared from memory after 40 consecutive driving cycles in which the diagnosis is performed and approved.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch /

AMP / Metri-Pack female test lead. STEPS

		SPECIFICATIONS	SRT CODE
STEP 1: Check for sensor circuit fault codes.			
STEP 1A: Check for fault codes.		**Are Fault Codes 1677 or 1678 active?**	
STEP 2: Check the catalyst solution temperature sensor and the circuit.			
STEP 2A:	**Inspect the catalyst solution temperature sensor and connector pins.**	**Dirty or damaged pins?**	
STEP 2B: Check the circuit response.		**Fault code 1678 active?**	
STEP 2C: Check the circuit response.		**Fault code 1677 active?**	
STEP 3: Check the ECM and the engine harness.			
STEP 3A:	**Inspect the pins of the engine harness and ECM connectors.**	**Dirty or damaged pins?**	
STEP 3B: Check the circuit response.		**Fault code 1678 active?**	
STEP 3C: Check the circuit response.		**Fault code 1677 active?**	
STEP 4: Clear the fault codes.			
STEP 4A: Check the repair.		**Are the temperature readings of the catalyst solution and thermometer within 5 ° F of each other?**	
STEP 4B: Clear the fault codes.		**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check for sensor circuit fault codes.

STEP 1A: Check for fault codes. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for active fault codes. • Use INSITE ™ to read the fault codes. Fault Codes 1677 or 1678 active?	**YES**	Diagnostic and repair diagram of the appropriate fault code.
	Are Fault Codes 1677 or 1678 active? **NO**	2A

STEP 2: Check the catalyst solution temperature sensor and the circuit.

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

Conditions:

- Turn the ignition key off.
- Disconnect the temperature sensor from the catalyst solution from the engine harness.

Action	Specifications / Repair	Next step
Check that the engine harness and catalyst solution temperature sensor have: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Damage to the wire shield • Moisture inside or over the connector • Connector seals damaged or missing • Broken connector cover • Connector pin dirt or debris For general inspection techniques, see Connector and Component Pin Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected in the sensor or in the harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-071 .	4A
	Dirty or damaged pins? **NO**	2B

STEP 2B: Check the circuit response. Conditions:

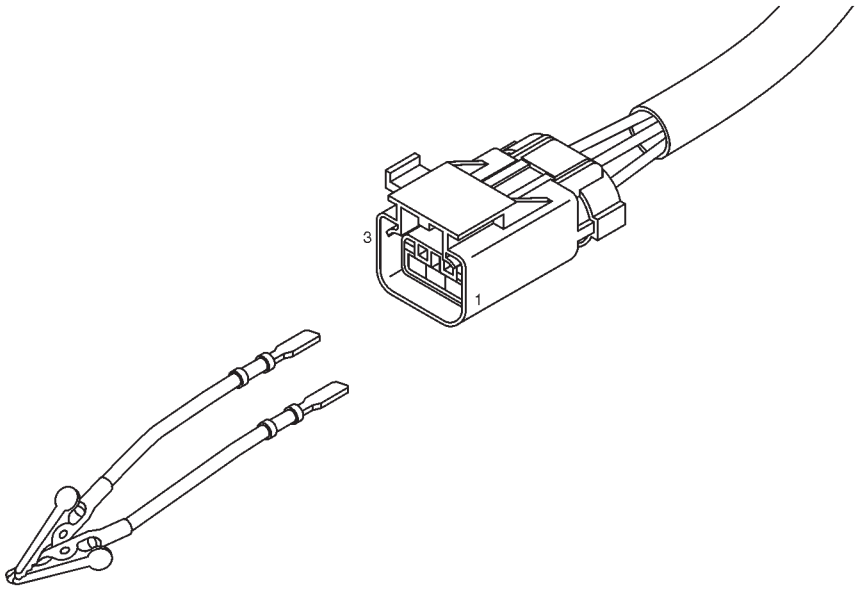
- Turn the ignition key off.
- Disconnect the temperature sensor from the catalyst solution from the engine harness.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an appropriate ECM response after 30 seconds. • Use INSITE ™ to read the fault codes.	Fault code 1678 active? **YES**	2C
	Fault code 1678 active? **NO**	3A

STEP 2C: Check the circuit response. Conditions:

- Turn the ignition key off.
- Disconnect the temperature sensor from the catalyst solution from the engine harness.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Install a wire bridge between the SIGNAL and RETURN pins of the catalyst solution temperature sensor on the catalyst solution temperature sensor connector on the engine harness. Refer to the electrical diagram for identification of the connector pins. Check for proper circuit response after 30 seconds.	Fault code 1677 active? **YES** **Repair:** Replace the catalyst solution temperature sensor. Refer to the OEM fault diagnosis procedures.	4A
• Use INSITE ™ to read the fault codes.	Fault code 1677 active? **NO**	3A



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STEP 3: Check the ECM and the engine harness.

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

Conditions:
- Turn the ignition key off.
- Disconnect the engine harness from the ECM connector.

Action	Specifications / Repair	Next step
Check that the pins on the engine harness and ECM connectors have: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Damage to the wire shield • Moisture inside or over the connector • Connector seals damaged or missing • Broken connector cover • Connector pin dirt or debris For general inspection techniques, see Connector and Component Pin Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected at the ECM connector or the motor harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-043 .	4A
	Dirty or damaged pins? **NO**	3B

STEP 3B: Check the circuit response. Conditions:

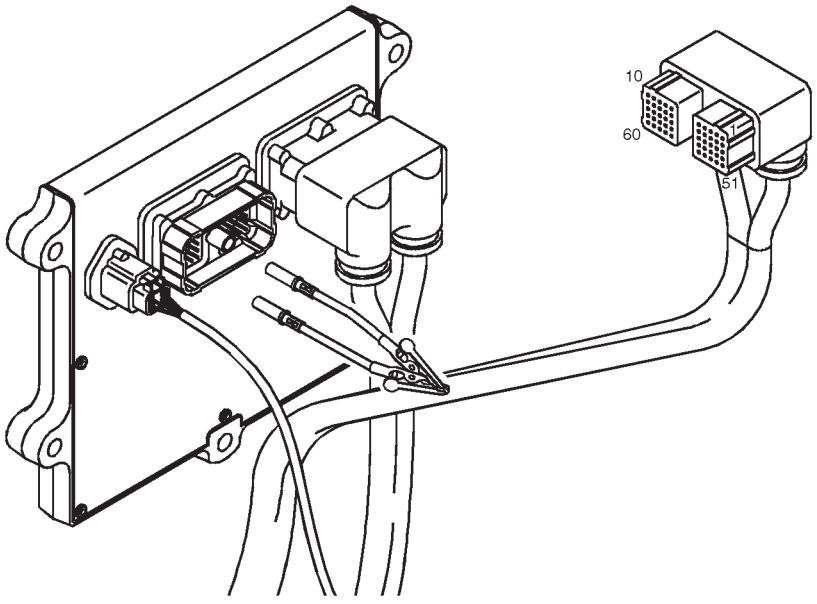
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Use INSITE ™ to read the fault codes.	Fault code 1678 active? **YES**	3C
	Fault code 1678 active? **DO NOT** **REPAIR:** Call for pre-authorization. Replace the ECM. See the Procedure 019-031 .	4A

STEP 3C: Check the circuit response. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Install a jumper wire between the SIGNAL and RETURN pins of the catalyst solution temperature sensor on the ECM connector. Check for proper circuit response after 30 seconds. • Use INSITE ™ to read the fault codes.	Fault code 1677 active? **YES** **Repair:** High resistance or a short circuit was detected in the engine harness. Repair or replace the engine harness. See the Procedure 019-043 .	4A
	Fault code 1677 active? **DO NOT** **REPAIR:** Call for pre-authorization. Replace the ECM. See the Procedure 019-031 .	4A



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STEP 4: Clear the fault code.

STEP 4A: Check the repair. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.
- Insert a thermometer into the catalyst solution reservoir.

Action	Specifications / Repair	Next step
Start the INSITE ™ Monitor / Data Logger. • Compare the temperature value of the catalyst solution read by INSITE ™ with that of the thermometer.	Are the temperature readings of the catalyst solution and thermometer within 5 ° F of each other? **YES**	4B
	Are the temperature readings of the catalyst solution and thermometer within 5 ° F of each other? **NO**	1A

STEP 4B: Clear the fault codes. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

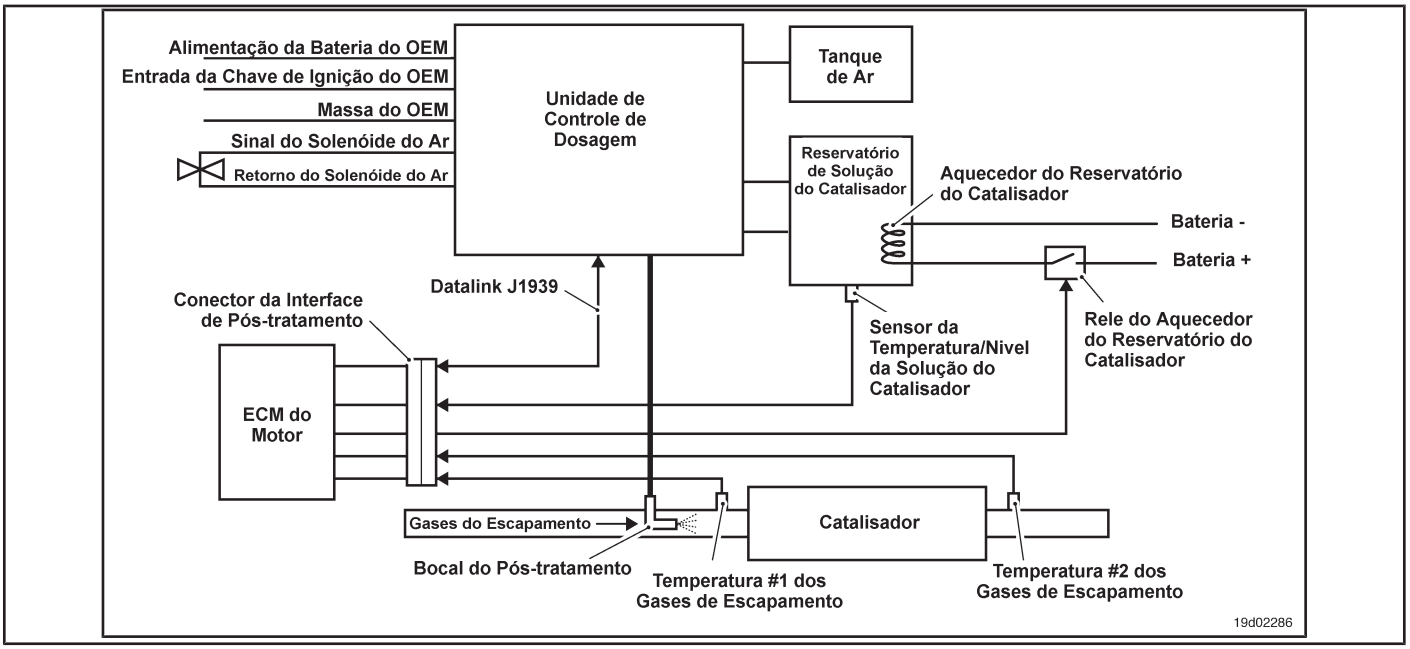
Action	Specifications / Repair	Next step
Clear the fault codes. • Use the electronic service tool INSITE ™ to clear all active and inactive fault codes.	All codes cleared? **YES**	Complete repair
	All codes cleared? **NO**	Proper troubleshooting and repair steps

Fault Code 1681

Dosing Control Unit - Invalid Smart Device or Component.

CODES	REASON	IT IS MADE
Fault Code: 1681 PID (P), SID (S): IMF: 12 Lamp: Amber SRT:	Catalyst Dosage Control Unit - Invalid Smart Device or Component. An internal error was detected in the catalyst dosing control unit.	The injection of catalyst solution into the after-treatment system is disabled.

Circuit: Aftertreatment Control System



Circuit Descriptions:

The Dosing Control Unit communicates with the electronic control module (ECM) of the primary engine through the J1939 datalink network. The dosage control unit accurately measures the amount of catalyst solution to be injected into the after-treatment system. The dosage control unit has three primary cycles. A primary cycle when the ignition key is turned on for the first time ensures that the catalyst solution is available in the dosing control unit. During the dosing cycle, the catalyst solution is supplied to the post-treatment spray nozzle. A purge cycle occurs when the engine is stopped. The purge cycle ensures that the entire catalyst solution is removed from the post-treatment line and the spray nozzle.

Component Location:

The location of the dosing control unit depends on the OEM.

Workshop Tips:

Fault Code 1681 is triggered when the dosing control unit detects an internal error. The recalibration of the engine ECM is the only fault diagnosis measure that can be made. If Fault Code 1681 is still active after recalibrating the engine ECM, the dosing control unit must be replaced. On-Board Diagnostic Information (OBD):

- The ECM will illuminate the malfunction indicator lamp (MIL) when the diagnosis is performed and fails.
- The ECM will turn off the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles in which the diagnosis is performed and no failure. The MIL lamp and the fault code can also be cleared with the electronic service tool INSITE ™.
- The fault code will be cleared from memory after 40 consecutive driving cycles in which the diagnosis is performed and approved.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch /

AMP / Metri-Pack female test lead. STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Read the fault codes.	**Fault code 1681 active?**	
STEP 1B: Read the fault codes.	**Is Fault Code 1681 active after recalibrating the ECM?**	
STEP 2: Clear the fault code.		
STEP 2A: Disable the fault code.	**Fault code 1681 inactive?**	
STEP 2B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Read the fault codes. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Read the fault codes. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 1681 active? **YES** **Repair:** Recalibrate the engine ECM. See the Procedure 019-032 .	1B
	Fault code 1681 active? **NO**	2A

STEP 1B: Read the fault codes. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Read the fault codes. • Use the electronic service tool INSITE ™ to read fault codes.	Is Fault Code 1681 active after recalibrating the ECM? **YES** **Repair:** Replace the dosing control unit. Refer to Procedure 019-440.	2A
	Is Fault Code 1681 active after recalibrating the ECM? **NO**	2A

STEP 2: Clear the fault code.

STEP 2A: Disable the fault code. Conditions:

- Connect all components
- Turn on the ignition key.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Using INSITE ™, make sure that the fault code is inactive.	Fault code 1681 inactive? **YES**	2B
	Fault code 1681 inactive? **NO**	1A

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

- Connect all components
- Turn on the ignition key.
- Connect the electronic service tool INSITE ™.

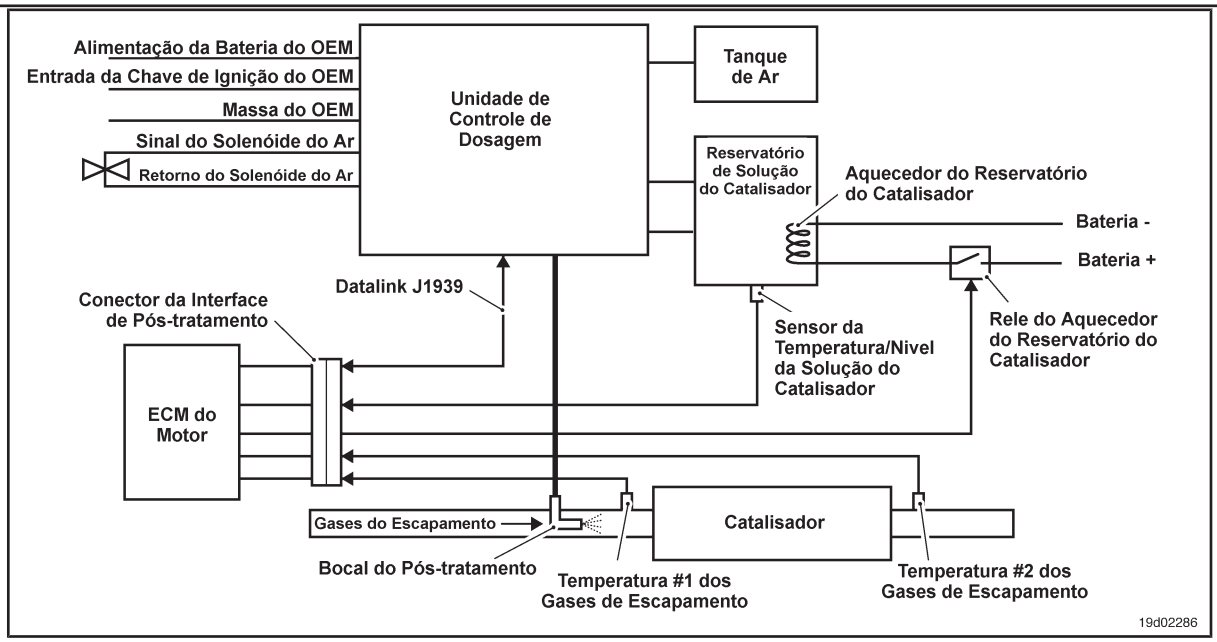
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YES**	Complete repair.
	All codes cleared? **NO**	Proper troubleshooting and repair steps.

Fault Code 1682

Catalyst Reagent Dosing Unit Inlet Lines - Condition Existing

CODES	REASON	IT IS MADE
Fault Code: 1682 PID (P), SID (S): IMF: 11/31 Lamp: Amber SRT:	Catalyst Reagent Dosing Unit Inlet Lines - Existing Condition. An error was detected in the catalyst dosing control unit.	The injection of catalyst solution into the after-treatment system is disabled.

Circuit: Aftertreatment Control System



Circuit Descriptions:

The catalyst metering control unit requires air pressure from the OEM air tanks. The dosage control unit accurately measures the amount of catalyst solution to be injected into the after-treatment system. The dosage control unit has three primary cycles. A primary cycle when the ignition key is turned on for the first time ensures that the catalyst solution is available in the dosing control unit. During the dosing cycle, the catalyst solution is supplied to the post-treatment spray nozzle. A purge cycle occurs when the engine is stopped. The purge cycle ensures that the entire catalyst solution is removed from the post-treatment line and the spray nozzle.

Component Location:

The location of the dosing control unit varies with the OEM.

Workshop Tips:

The low level of catalyst solution in the catalyst reservoir can make this fault code active. Low air pressure or loss of air pressure during priming and dosing cycles can also make this fault code active.

Fault Code 1682 is recorded by the following failure modes:

- Failure of the dosing control unit to prime correctly

- Low air pressure detected in the dosing control unit
- Air pressure cycling below the minimum limit required by the dosing control unit
- Post-treatment spray nozzle obstructed or restricted
- Post-treatment spray nozzle supply line obstructed or restricted
- Dosing control unit return line obstructed or restricted
- Dosing control unit supply line obstructed or restricted
- In-line air filter blocked or restricted. On-Board Diagnostic

Information (OBD):

- The ECM will illuminate the malfunction indicator lamp (MIL) when the diagnosis is performed and fails.

- The ECM will turn off the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles in which the diagnosis is performed and no failure. The MIL lamp and the fault code can also be cleared with the electronic service tool INSITE ™.

- The fault code will be cleared from memory after 40 consecutive driving cycles in which the diagnosis is performed and approved.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch /

AMP / Metri-Pack female test lead. STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check the dosing control unit.		
STEP 1A: Read the fault codes.	**Fault codes 1697, 1698, 1671 or 1673 active?**	
STEP 1B: Perform the rollback test urea metering pump with INSITE ™.	**Is the dosing control unit cycling correctly in the required states and is the catalyst solution flowing correctly through the system?**	
STEP 2: Check the dosing control system.		
STEP 2A: Check for leaks in the catalyst solution system.	**Are there any visible external leaks from the catalyst solution?**	
STEP 2B: Check the air supply for the dosing control unit.	**Is there an air pressure greater than 75 psi in the dosing control unit?**	
STEP 2C: Check the air solenoid of the dosing control unit.	**Does the air solenoid emit a "click" when it is activated with INSITE ™?**	
STEP 2D: Inspect the catalyst solution lines for obstructions.	**Are there any restrictions or contamination in the lines or in the spray nozzle?**	
STEP 3: Clear the fault code.		
STEP 3A: Disable the fault code.	**Fault code 1682 inactive?**	
STEP 3B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the dosing control unit.

STEP 1A: Read the fault codes. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Read the fault codes. • Use the electronic service tool INSITE ™ to read fault codes.	Fault codes 1697, 1698, 1671 or 1673 active? **YES**	Diagnostic and repair diagram of the appropriate fault code
	Fault codes 1697, 1698, 1671 or 1673 active? **NO**	1B

STEP 1B: Perform the urea metering pump override test with INSITE ™. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Perform the urea metering pump override test. • Perform the urea metering pump override test with INSITE ™. • Make sure that the dosing control unit cycles correctly in priming, dosing and purging cycles. • Make sure that the catalyst solution flows correctly from the catalyst solution reservoir during priming. The catalyst solution must also return to the catalyst solution reservoir during the priming state. • Make sure that the catalyst solution is being injected through the post-treatment spray tip during the dosing state. • Make sure that the post-treatment nozzle line is being cleaned during the purge cycle.	Is the dosing control unit cycling correctly in the required states and is the catalyst solution flowing correctly through the system? **YES**	2A
	Is the dosing control unit cycling correctly in the required states and is the catalyst solution flowing correctly through the system? **DO NOT** **REPAIR:** Remove the catalyst solution lines from the dosing control unit. Check for obstructions or restrictions. Check the air supply to the dosing control unit. Make sure that the dosing control unit is priming correctly.	3A

STEP 2: Check the dosing control system.

STEP 2A: Check the catalyst solution system for leaks. Conditions:

- Turn the ignition key off.

Action	Specifications / Repair	Next step
Visually inspect the following components for leaks: • Between the dosing control unit supply line and the catalyst reservoir • Between the dosing control unit return line and the catalyst reservoir • Post-treatment injector supply line.	Are there any visible external leaks from the catalyst solution? **YES** **Repair:** Replace the defective catalyst solution line. Refer to the OEM fault diagnosis procedures.	3A
	Are there any visible external leaks from the catalyst solution? **NO**	2B

STEP 2B: Check the air supply to the dosing control unit. Conditions:

- Turn on the ignition key.
- Start the engine and let it run at idle.

Action	Specifications / Repair	Next step
Check the air supply to the dosing control unit. • Remove the air supply line from the dosing control unit. • Confirm the presence of air pressure in the dosing control unit. NOTE: Most vehicles are equipped with an in-line air filter on the air line before the dosing control unit. A blocked or restricted inline air filter can cause low air pressure to the dosing control unit.	Is there an air pressure greater than 75 psi in the dosing control unit? **YES**	2C
	Is there an air pressure greater than 75 psi in the dosing control unit? **DO NOT** **REPAIR:** Determine the cause of the low air pressure for the dosing control unit. Inspect the inline air filter for restrictions. Refer to the OEM fault diagnosis procedures.	3A

STEP 2C: Check the dosing control unit air solenoid. Conditions:

- Turn on the ignition key.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check the dosing control unit air solenoid for correct function. • Perform the Urea Meter Pump Air Solenoid Activation Test with INSITE ™.	Does the air solenoid emit a "click" when it is activated with INSITE ™? **YES**	2D
	Does the air solenoid emit a "click" when it is activated with INSITE ™? **DO NOT** **REPAIR:** Replace the dosing control unit air solenoid. Refer to the OEM fault diagnosis procedures.	3A

STEP 2D: Inspect the catalyst solution lines for obstructions.

Conditions:
- Remove the supply line from the dosing control unit.
- Remove the return line from the dosing control unit.
- Remove the post-treatment spray nozzle supply line.
- Remove the aftertreat spray nozzle from the exhaust system.

Action	Specifications / Repair	Next step
Check the following components for obstructions, restrictions or contamination. • After-treatment spray nozzle • Dosing control unit supply line • Dosing control unit return line • Post-treatment spray nozzle supply line.	Are there any restrictions or contamination in the lines or in the spray nozzle? **YES** **Repair:** Replace the defective catalyst solution line or spray tip. Refer to the OEM fault diagnosis procedures.	3A
	Are there any restrictions or contamination in the lines or in the spray nozzle? **NO**	3A

STEP 3: Clear the fault code.

STEP 3A: Disable the fault codes. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault codes. • Using INSITE ™, make sure that the fault code is inactive.	Fault code 1682 inactive? **YES**	3B
	Fault code 1682 inactive? **NO**	1A

STEP 3B: Clear the inactive fault codes. Conditions:

- Connect all components
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

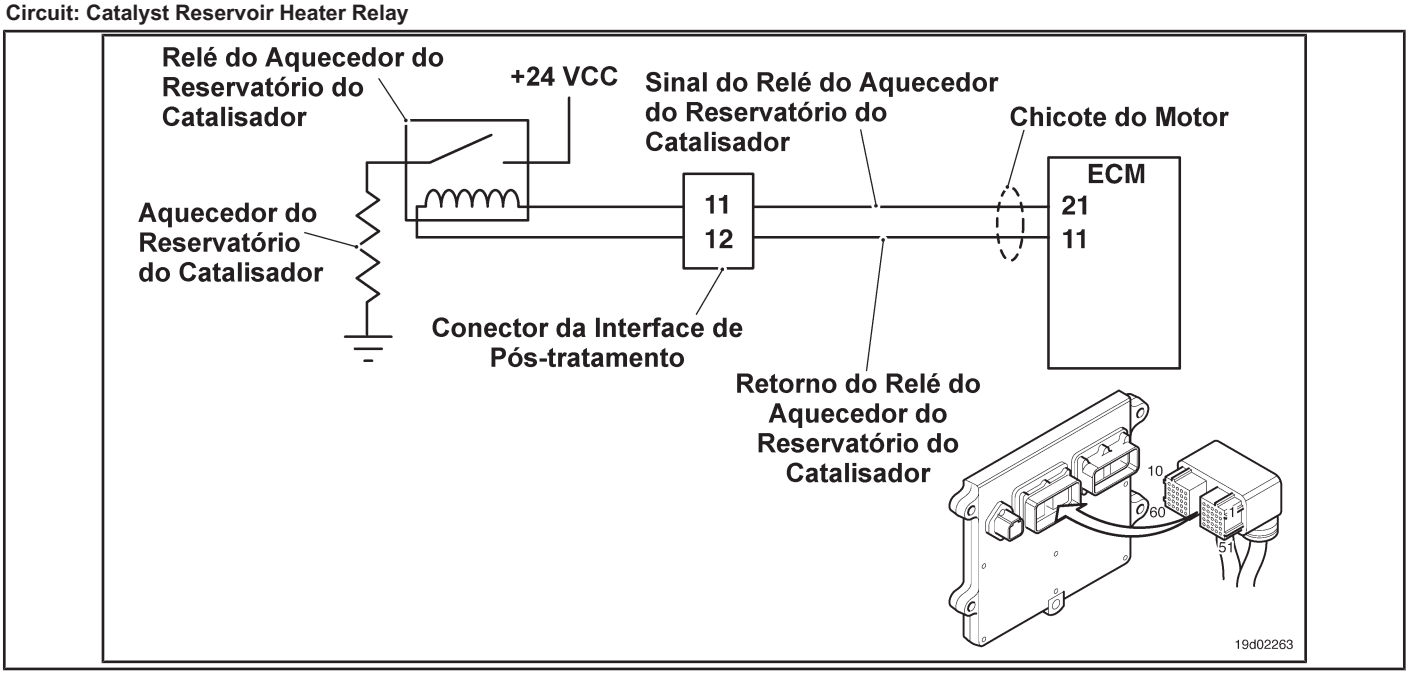
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use INSITE ™ to clear all fault codes.	All codes cleared? **YES**	Complete repair.
	All codes cleared? **NO**	Proper troubleshooting and repair steps.

Fault Code 1683

Catalyst Reservoir Heater Circuit - Voltage Above Normal or with High Voltage

CODES	REASON	IT IS MADE
Fault Code: 1683 PID (P), SID (S): IMF: 3 Lamp: Amber SRT:	Catalyst Reservoir Heater Circuit - Voltage Above Normal or High Voltage. High voltage signal detected in the catalyst reservoir heater relay sensor circuit.	The catalyst reservoir heater will be disabled.

Circuit: Catalyst Reservoir Heater Relay



Circuit Descriptions:

The catalyst reservoir heater prevents freezing of the catalyst solution in the reservoir. The catalyst reservoir heater element is powered by the catalyst reservoir heater relay.

Component Location:

The catalyst reservoir heater is located in the catalyst reservoir. The location of the catalytic converter heater relays varies by OEM.

Workshop Tips:

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

Possible causes of this fault code:

- The signal wire from the catalytic converter heater relay is not connected to the relay.
- The return wire from the catalytic converter heater relay is not connected to the relay.
- Defective catalyst reservoir heater relay
- Open circuit on the catalyst reservoir heater relay signal wire

- Open circuit in the catalyst reservoir heater relay return wire
- Catalyst reservoir heater signal wire shorted with a voltage source. On-Board Diagnostic Information (OBD):

- The ECM will illuminate the malfunction indicator lamp (MIL) when the diagnosis is performed and fails.

- The ECM will turn off the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles in which the diagnosis is performed and no failure. The MIL lamp and the fault code can also be cleared with the electronic service tool INSITE ™.

- The fault code will be cleared from memory after 40 consecutive driving cycles in which the diagnosis is performed and approved.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch /

AMP / Metri-Pack female test lead. STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check for a security code failure inactive.	**Fault code 1683 inactive?**	
STEP 2: Check the catalyst reservoir heater relay and circuit.		
STEP 2A: Inspect the relay and electrical connections to the catalyst reservoir heater.	**Dirty or damaged pins?**	
STEP 2B: Check the heater relay of the catalyst reservoir for an open circuit.	**Less than 100 ohms?**	
STEP 2C: Check the voltage diagnostics, the supply line and the catalyst reservoir heater return circuit.	**More than 6 VDC?**	
STEP 2D: Check the return circuit of the catalyst reservoir heater for an open circuit.	**Less than 10 ohms?**	
STEP 3: Check the ECM and the engine harness.		
STEP 3A: Inspect the pins of the engine harness and ECM connectors.	**Dirty or damaged pins?**	
STEP 3B: Check the voltage diagnosis of the catalyst reservoir heater relay.	**More than 6 VDC?**	
STEP 3C: Check for a circuit open in the engine harness.	**Less than 10 ohms?**	
STEP 3D: Check for a short circuit between pins in the engine harness.	**More than 100k ohms?**	
STEP 3E: Check for a passcode failure inactive.	**Fault code 1683 inactive?**	
STEP 4: Clear the fault code.		
STEP 4A: Disable the fault code.	**Fault code 1683 inactive?**	
STEP 4B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

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

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an inactive fault code. • Use INSITE ™ to read the fault codes. Fault code 1683 inactive?	**YES**	Fault Code Inactive or Intermittent, Procedure 019-362 .
	Fault code 1683 inactive? **NO**	2A

STEP 2: Check the catalyst reservoir heater relay and circuit.

STEP 2A: Inspect the relay and electrical connections to the catalyst reservoir heater.

Conditions:

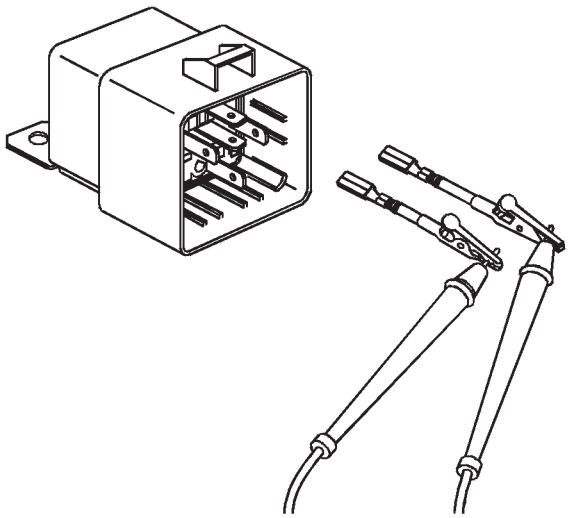
- Turn the ignition key off.
- Disconnect the heater relays from the catalyst reservoir from the engine harness.

Action	Specifications / Repair	Next step
Inspect the engine harness and the catalytic converter heater relay connections for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Damage to the wire shield • Moisture inside or over the connector • Connector seals damaged or missing • Broken connector cover • Connector pin dirt or debris For general inspection techniques, see Connector and Component Pin Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected in the sensor or in the harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-071 .	4A
	Dirty or damaged pins? **NO**	2B

STEP 2B: Check the catalyst reservoir heater relay for an open circuit. Conditions:

- Turn the ignition key off.
- Disconnect the heater relays from the catalyst reservoir from the engine harness.

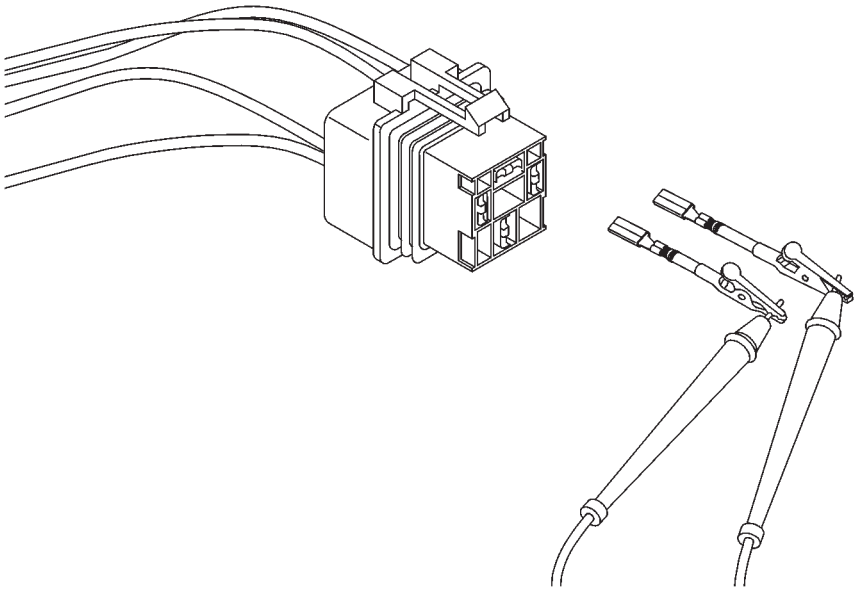
Action	Specifications / Repair	Next step
Check the resistance of the catalytic converter heater relay. • Measure the resistance between the SIGNAL and RETURN pins of the catalytic converter heater in the catalytic converter heater relay. Refer to the electrical diagram for identification of the connector pins.	Less than 100 ohms? **YES**	2C
	Less than 100 ohms? **DO NOT** **REPAIR:** An open circuit was detected in the catalyst reservoir heater relay. Replace the catalyst reservoir heater relay. Refer to the OEM fault diagnosis manual.	4A



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

Conditions:
- Turn the ignition key off.
- Connect the catalyst reservoir heater relay to the engine harness.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check the supply voltage and the heater return circuit of the catalyst reservoir. • Measure the voltage between the SIGNAL and RETURN lines of the catalyst reservoir heater relay, on the heater relay connector on the engine harness.	More than 6 VDC? **YES**	3D
	More than 6 VDC? **NO**	2D



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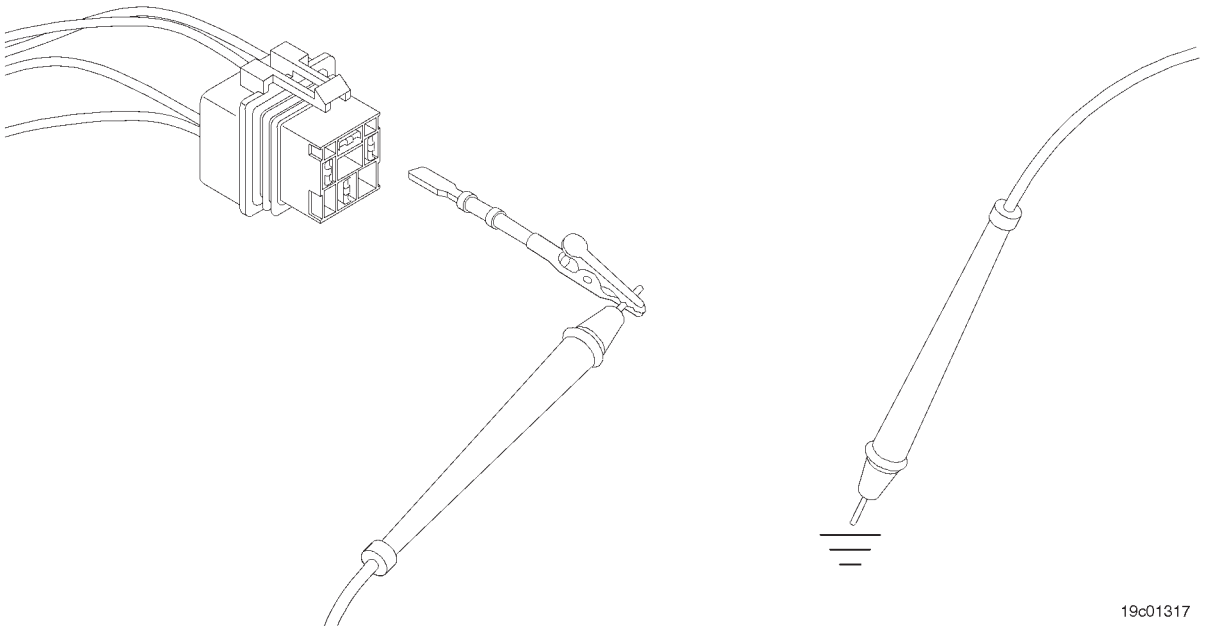
STEP 2D: Check the catalyst reservoir heater return circuit for a open circuit.

Conditions:
- Turn the ignition key off.
- Disconnect the catalyst reservoir heater relay from the engine harness.

Action	Specifications / Repair	Next step
Check for an open circuit. • Measure the resistance between the RETURN pin of the catalyst reservoir heater relay, on the engine harness, and the ground. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	Less than 10 ohms? **YES**	3A
	Less than 10 ohms? **DO NOT** **REPAIR:** An open circuit was detected between the pins and the ground in the RETURN line of the engine harness. Troubleshoot each harness connected in series to determine which one contains the open return circuit with ground. Repair or replace the engine harness. See the Procedure 019-031 .	4A



STEP 3: Check the ECM and the engine harness.

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

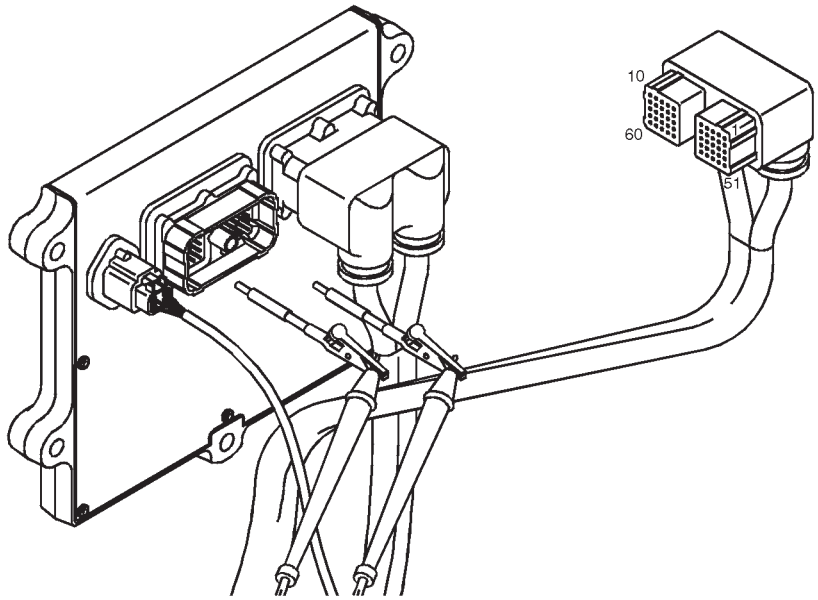
Conditions:
- Turn the ignition key off.
- Disconnect the engine harness from the ECM connector.

Action	Specifications / Repair	Next step
Check that the pins on the engine harness and ECM connectors have: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Damage to the wire shield • Moisture inside or over the connector • Connector seals damaged or missing • Broken connector cover • Connector pin dirt or debris For general inspection techniques, see Connector and Component Pin Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected at the ECM connector or the motor harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-043 .	4A
	Dirty or damaged pins? **NO**	3B

STEP 3B: Check the diagnostic voltage of the catalyst reservoir heater relay. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check the diagnostic voltage of the catalyst reservoir heater relay. • Measure the voltage between the signal pin on the catalyst reservoir heater relay and ground, on the ECM connector. Refer to the electrical diagram for identification of the connector pins.	More than 6 VDC? **YES**	3C
	More than 6 VDC? **DO NOT** **REPAIR:** Call for pre-authorization. Replace the ECM. See the Procedure 019-031 .	4A



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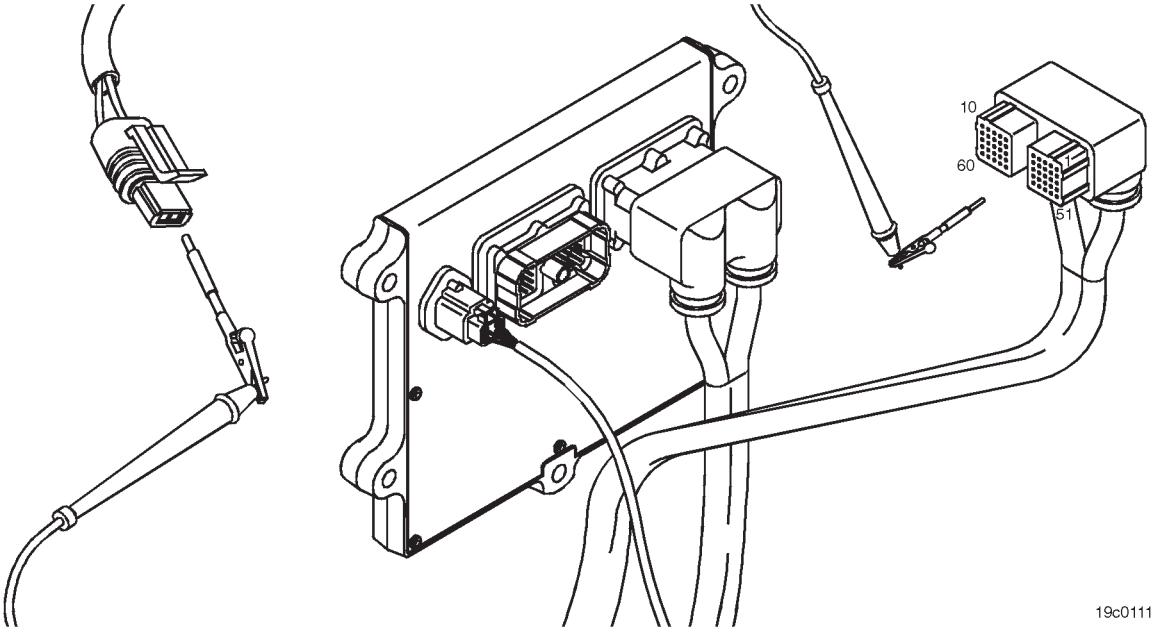
STEP 3C: Check the motor harness for an open circuit. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Disconnect the catalyst reservoir heater relay from the engine harness.

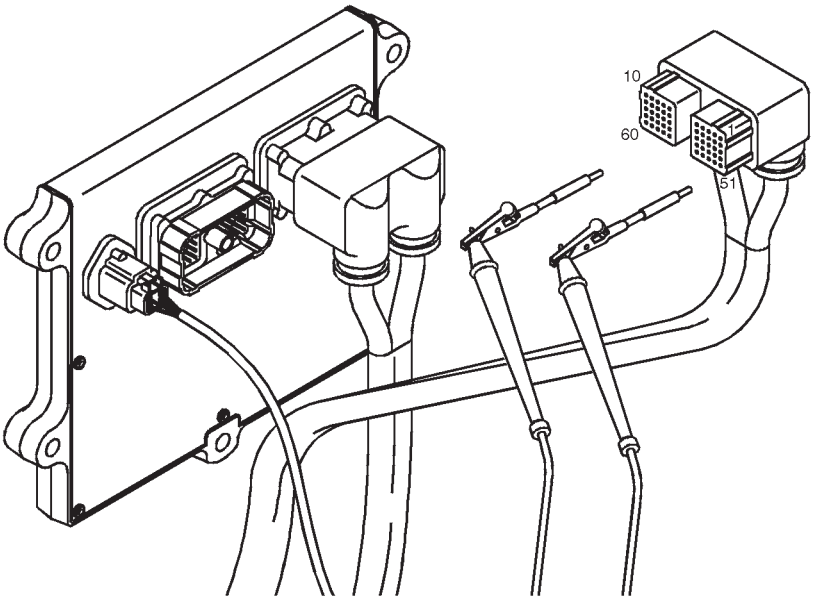
Action	Specifications / Repair	Next step
Check for an open circuit. • Measure the resistance between the POWER pin of the catalyst reservoir heater relay, on the ECM connector on the engine harness, and the POWER pin of the catalyst reservoir heater relay connector, on the heater relay connector on the engine harness. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	Less than 10 ohms? **YES**	3D
	Less than 10 ohms? **DO NOT** **REPAIR:** An open circuit was detected in the POWER wire of the catalyst reservoir heater, in the engine harness. Troubleshoot all harnesses connected in series to determine which harness contains the open circuit. Repair or replace the engine harness. See the Procedure 019-043 .	4A



STEP 3D: Check the motor harness for a short circuit between pins. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Disconnect the catalyst reservoir heater relay from the engine harness.

Action	Specifications / Repair	Next step
Check for a short circuit between pins. • Measure the resistance between the FOOD of the catalyst reservoir heater relay, on the ECM connector on the engine harness, and all other pins on the ECM connector on the engine harness. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YES**	3E
	More than 100k ohms? **DO NOT** **REPAIR:** A short circuit between pins in the FOOD of the catalyst reservoir heater relay. Troubleshoot the harnesses connected in series to determine which one contains the shorted power circuit. Repair or replace the engine harness. See the Procedure 019-043 .	4A



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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Use INSITE ™ to read the fault codes.	Fault code 1683 inactive? **YES** **Repair:** None. Did removing and installing the connector correct the failure?	4A
	Fault code 1683 inactive? **DO NOT** **REPAIR:** Call for pre-authorization. Replace the ECM. See the Procedure 019-031 .	4A

STEP 4: Clear the fault code.

STEP 4A: Disable the fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Use INSITE ™ to check if the fault code is inactive.	Fault code 1683 inactive? **YES**	4B
	Fault code 1683 inactive? **NO**	1A

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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

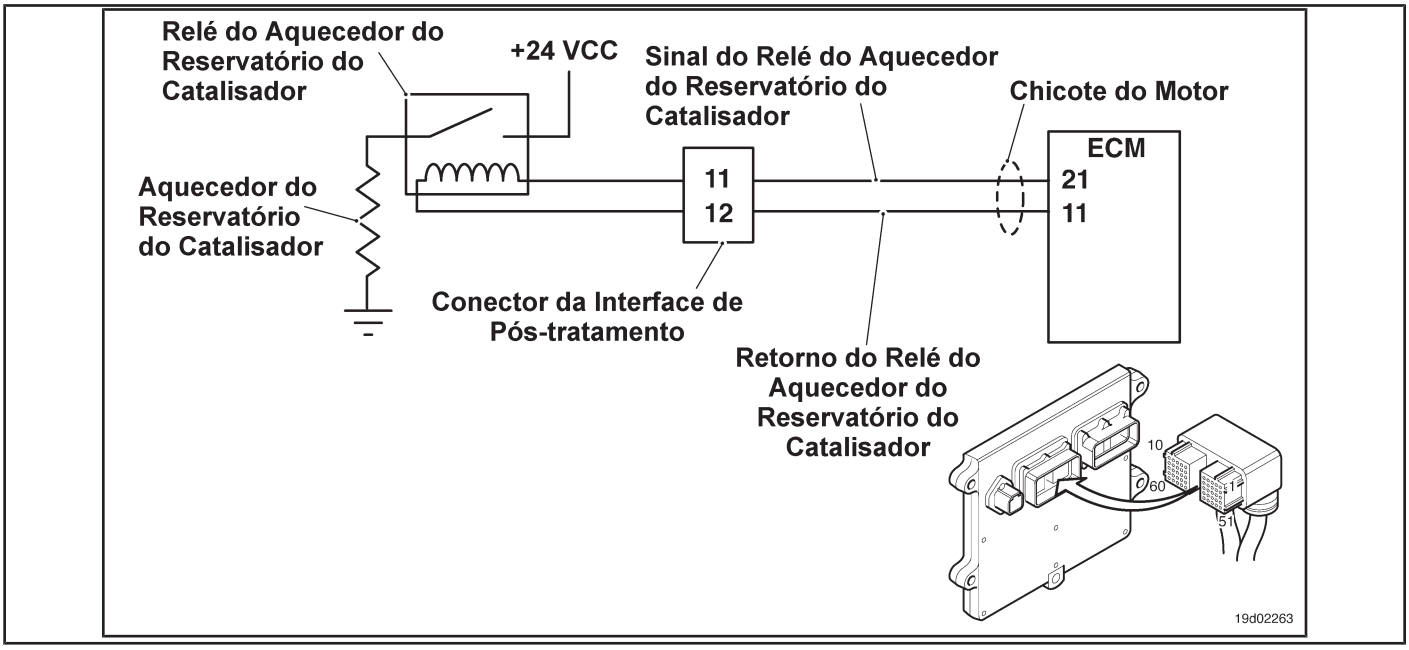
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use INSITE ™ to clear inactive fault codes.	All codes cleared? **YES**	Complete repair
	All codes cleared? **NO**	Proper troubleshooting and repair steps

Fault Code 1684

Catalyst Reservoir Heater Circuit - Voltage Below Normal or with Low Voltage

CODES	REASON	IT IS MADE
Fault Code: 1684 PID (P), SID (S): IMF: 4 Lamp: Amber SRT:	Catalyst Reservoir Heater Circuit - Voltage Below Normal or Low Voltage. Low voltage signal detected in the catalyst reservoir heater relay sensor circuit.	The catalyst reservoir heater will be disabled.

Circuit: Catalyst Reservoir Heater Relay



Circuit Descriptions:

The catalyst reservoir heater prevents freezing of the catalyst solution in the reservoir. The catalyst reservoir heater is also used to defrost a reservoir with frozen catalyst solution. The catalyst reservoir heater element is powered by the catalyst reservoir heater relay.

Component Location:

The catalyst reservoir heater is located in the catalyst reservoir. The location of the catalytic converter heater relays varies by OEM.

Workshop Tips:

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

Possible causes of this fault code:

- A short in the catalyst reservoir heater relay
- The catalyst reservoir heater signal wire is shorted to ground.

On-Board Diagnostic Information (OBD):

- The ECM will illuminate the malfunction indicator lamp (MIL) when the diagnosis is performed and fails.
- The ECM will turn off the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles in which the diagnosis is performed and no failure. The MIL lamp and the fault code can also be cleared with the electronic service tool INSITE ™.
- The fault code will be cleared from memory after 40 consecutive driving cycles in which the diagnosis is performed and approved.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch /

AMP / Metri-Pack female test lead. STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check for a security code failure inactive.	**Fault code 1684 inactive?**	
STEP 2: Check the catalyst reservoir heater relay and circuit.		
STEP 2A: Inspect the relay and electrical connections to the catalyst reservoir heater.	**Dirty or damaged pins?**	
STEP 2B: Check the circuit response.	**Fault Code 1683 active and Fault Code 1684 inactive?**	
STEP 2C: Check the fault codes and the relay condition.	**Fault code 1684 active?**	
STEP 3: Check the ECM and the engine harness.		
STEP 3A: Inspect the pins of the engine harness and ECM connectors.	**Dirty or damaged pins?**	
STEP 3B: Check the circuit response.	**Fault Code 1683 active and Fault Code 1684 inactive?**	
STEP 3C: Check for a short circuit between pins in the engine harness.	**More than 100k ohms?**	
STEP 3D: Check if there is a short circuit between pins and ground.	**More than 100k ohms?**	
STEP 3E: Check for a passcode failure inactive.	**Fault code 1684 inactive?**	
STEP 4: Clear the fault code.		
STEP 4A: Disable the fault code.	**Fault code 1684 inactive?**	
STEP 4B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

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

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an inactive fault code. • Use INSITE ™ to read the fault codes. Fault code 1684 inactive?	**YES**	Fault Code Inactive or Intermittent, Procedure 019-362 .
	Fault code 1684 inactive? **NO**	2A

STEP 2: Check the catalyst reservoir heater relay and circuit.

STEP 2A: Inspect the relay and electrical connections to the catalyst reservoir heater.

Conditions:
- Turn the ignition key off.
- Disconnect the heater relays from the catalyst reservoir from the engine harness.

Action	Specifications / Repair	Next step
Inspect the engine harness and the catalytic converter heater relay connections for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Damage to the wire shield • Moisture inside or over the connector • Connector seals damaged or missing • Broken connector cover • Connector pin dirt or debris For general inspection techniques, see Connector and Component Pin Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected in the sensor or in the harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-071 .	4A
	Dirty or damaged pins? **NO**	2B

STEP 2B: Check the circuit response. Conditions:

- Turn the ignition key off.
- Disconnect the heater relays from the catalyst reservoir from the engine harness.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Using INSITE ™, read the fault codes.	Fault Code 1683 active and Fault Code 1684 inactive? **YES**	2C
	Fault Code 1683 active and Fault Code 1684 inactive? **NO**	3A

STEP 2C: Check the fault codes and the condition of the relay. Conditions:

- Turn the ignition key off.
- Connect the catalyst reservoir heater relay to the engine harness.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Using INSITE ™, read the fault codes.	Is fault code 1684 active? **YES** **Repair:** A fault was detected in the heater relay of the catalyst reservoir. Replace the catalyst reservoir heater relay. Refer to the OEM's troubleshooting and repair manual.	4A
	Is fault code 1684 active? **DO NOT** **REPAIR:** None. Did removing and installing the connector correct the failure?	4A

STEP 3: Check the ECM and the engine harness.

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

Conditions:
- Turn the ignition key off.
- Disconnect the engine harness from the ECM connector.

Action	Specifications / Repair	Next step
Check that the pins on the engine harness and ECM connectors have: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Damage to the wire shield • Moisture inside or over the connector • Connector seals damaged or missing • Broken connector cover • Connector pin dirt or debris For general inspection techniques, see Connector and Component Pin Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected at the ECM connector or the motor harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-043 .	4A
	Dirty or damaged pins? **NO**	3B

STEP 3B: Check the circuit response. Conditions:

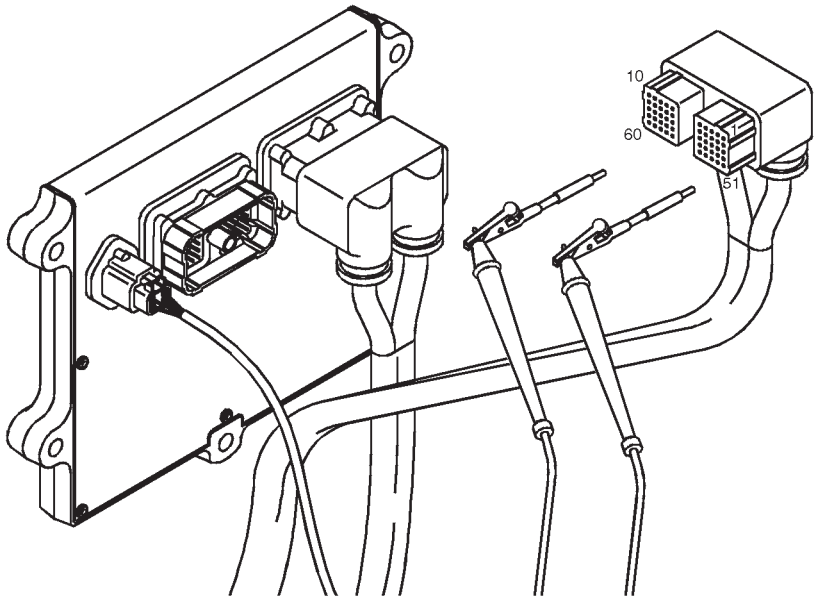
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Using INSITE ™, read the fault codes.	Fault Code 1683 active and Fault Code 1684 inactive? **YES**	3C
	Fault Code 1683 active and Fault Code 1684 inactive? **NO**	3E

STEP 3C: Check the motor harness for a short circuit between pins. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Disconnect the catalyst reservoir heater relay from the engine harness.

Action	Specifications / Repair	Next step
Check for a short circuit between pins. • Measure the resistance between the FOOD of the catalyst reservoir heater relay, on the ECM connector on the engine harness, and all other pins on the ECM connector on the engine harness. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YES**	3D
	More than 100k ohms? **DO NOT** **REPAIR:** A short circuit was detected between pins in the SIGNAL line in the motor harness. Repair or replace the engine harness. See the Procedure 019-043 .	4A



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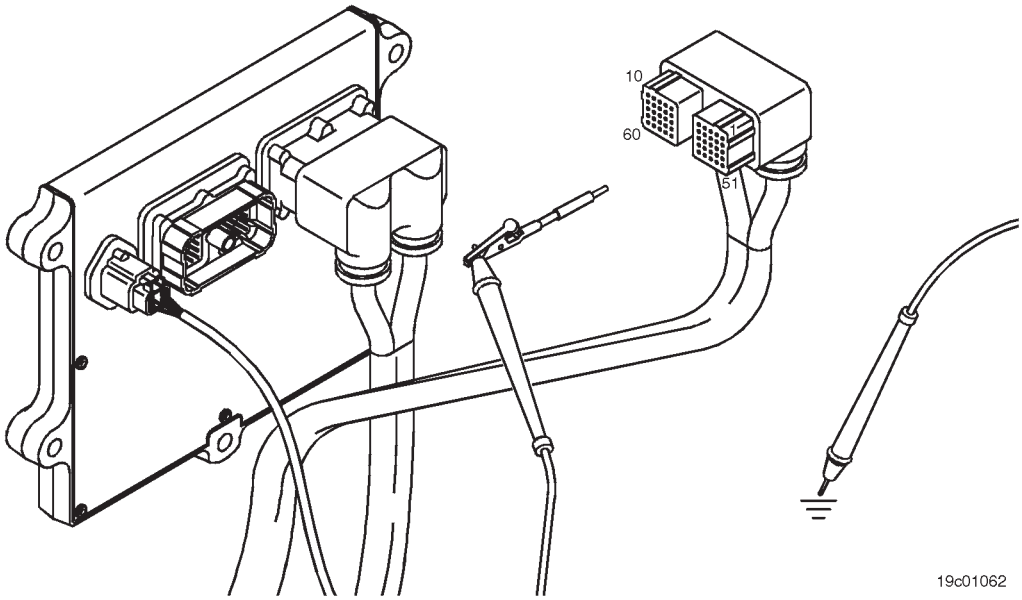
STEP 3D: Check if there is a short circuit between the pins and the ground. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Disconnect the catalyst reservoir heater relay from the engine harness.

Action	Specifications / Repair	Next step
Check for a short between pins and ground. • Measure the resistance between the catalyst reservoir heater relay SIGN pin on the engine harness and the ground. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YES**	3E
	More than 100k ohms? **DO NOT** **REPAIR:** A short circuit was detected between the pins and the ground in the POWER line in the engine harness. Repair or replace the engine harness. See the Procedure 019-043 .	4A



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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Use INSITE ™ to read the fault codes.	Fault code 1684 inactive? **YES** **Repair:** None. Did removing and installing the connector correct the failure?	4A
	Fault code 1684 inactive? **DO NOT** **REPAIR:** Replace the ECM. Call for authorization. See the Procedure 019-031 .	4A

STEP 4: Clear the fault code.

STEP 4A: Disable the fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Use INSITE ™ to check if the fault code is inactive.	Fault code 1684 inactive? **YES**	4B
	Fault code 1684 inactive? **NO**	1A

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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

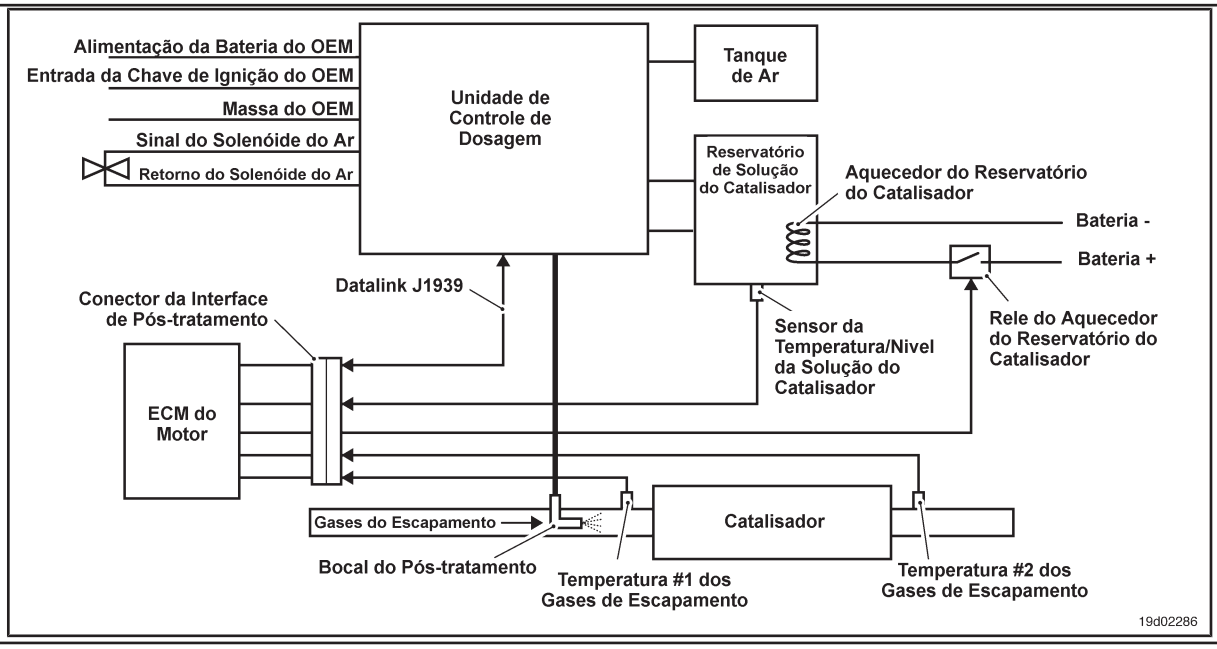
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use INSITE ™ to clear inactive fault codes.	All codes cleared? **YES**	Complete repair
	All codes cleared? **NO**	Proper troubleshooting and repair steps

Fault Code 1687

Catalyst Excessive Temperature - Valid Data but Above Normal Range Operation - Most Severe Level

CODES	REASON	IT IS MADE
Fault Code: 1687 PID (P), SID (S): IMF: 0 Lamp: Amber SRT:	Catalyst Excessive Temperature - Valid Data but Above the Normal Operating Range - More Severe Level. Very high temperatures were detected in the post-treatment system.	The injection of catalyst solution into the after-treatment system is disabled.

Circuit: Aftertreatment Control System



Circuit Descriptions:

The No. 2 Exhaust Gas Temperature sensor is used by the electronic control module (ECM) to monitor the temperature of the engine exhaust gases leaving the catalyst unit. The ECM monitors the voltage at the signal pin and converts it to a temperature value.

Component Location:

The catalyst exhaust temperature sensor is located in the after-treatment system. It is located at the outlet of the exhaust system of the catalyst.

Workshop Tips:

This fault is triggered when the temperature at the exhaust outlet of the catalyst exceeds the maximum temperature allowed for a given engine rating. On-Board Diagnostic Information (OBD):

- The ECM will illuminate the malfunction indicator lamp (MIL) when the diagnosis is performed and fails.

- The ECM will turn off the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles in which the diagnosis is performed and no failure. The MIL lamp and the fault code can also be cleared with the electronic service tool INSITE ™.

- The fault code will be cleared from memory after 40 consecutive driving cycles in which the diagnosis is performed and approved.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch /

AMP / Metri-Pack female test lead. STEPS

		SPECIFICATIONS	SRT CODE
STEP 1: Check for fault codes related to the fuel system.			
STEP 1A: Check for fault codes	**related to fuel injectors.**	**Fault Codes 1654, 1655, Are 1656, 1657, 1658, 1659 and 1718 active or are there high counts of inactive failures?**	
STEP 2: Check the catalyst system for proper operation.			
STEP 2A:	**Inspect the catalyst solution.**	**Is the catalyst solution contaminated?**	
STEP 2B:	**Inspect the turbocharger.**	**Does the turbocharger turbine housing show signs of oil leakage to the exhaust system?**	
STEP 3: Clear the fault code.			
STEP 3A: Clear the fault codes.		**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check for fuel system fault codes.

STEP 1A: Check for fault codes related to the fuel injectors. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for active fault codes. • Use the electronic service tool INSITE ™ to read fault codes.	Fault Codes 1654, 1655, 1656, Are 1657, 1658, 1659 and 1718 active or are there high counts of inactive failures? **YES** **Repair:** Replace the post-treatment catalyst. Refer to the OEM fault diagnosis procedures.	OEM Fault Diagnostics procedures.
	Fault Codes 1654, 1655, 1656, Are 1657, 1658, 1659 and 1718 active or are there high counts of inactive failures? **NO**	2A

STEP 2: Check the catalyst system for proper operation.

STEP 2A: Inspect the catalyst solution.

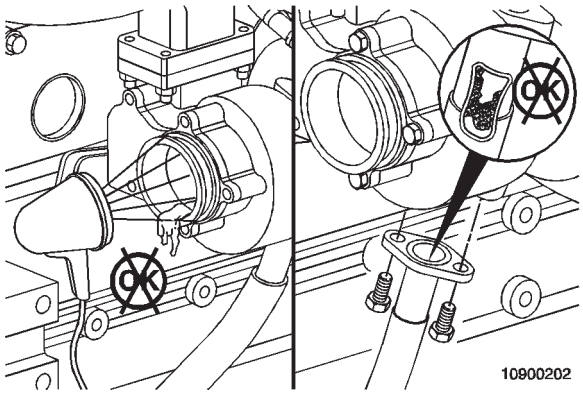
Conditions:
- Turn the ignition key off.

Action	Specifications / Repair	Next step
Check that the catalyst solution is not contaminated. Take a sample of the catalyst solution from the catalyst reservoir. Inspect the catalyst solution for contamination by diesel fuel, gasoline or engine oil.	Is the catalyst solution contaminated? **YES**	2B
	Is the catalyst solution contaminated? **DO NOT** **REPAIR:** Drain the catalyst reservoir and wash it with distilled water. Wash the catalyst solution lines with distilled water. Replace the post-treatment catalyst. Refer to the OEM fault diagnosis procedures.	3A

STEP 2B: Inspect the turbocharger.

Conditions:
- Turn the ignition key off.
- Remove the exhaust pipe in the turbocharger.

Action	Specifications / Repair	Next step
Check the turbocharger turbine housing. Check the turbine housing of the turbocharger for signs of oil leakage to the exhaust system.	Does the turbocharger turbine housing show signs of oil leakage to the exhaust system? **YES** **Repair:** Replace the post-treatment catalyst. Refer to the OEM fault diagnosis procedures.	3A
	Does the turbocharger turbine housing show signs of oil leakage to the exhaust system? **DO NOT** **REPAIR:** Remove the oil drain line and check for restrictions. Refer to Procedure 010-045. Replace the post-treatment catalyst. Refer to the OEM fault diagnosis procedures.	3A



STEP 3: Clear the fault code.

STEP 3A: Clear the fault codes. Conditions:

- Connect all components
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

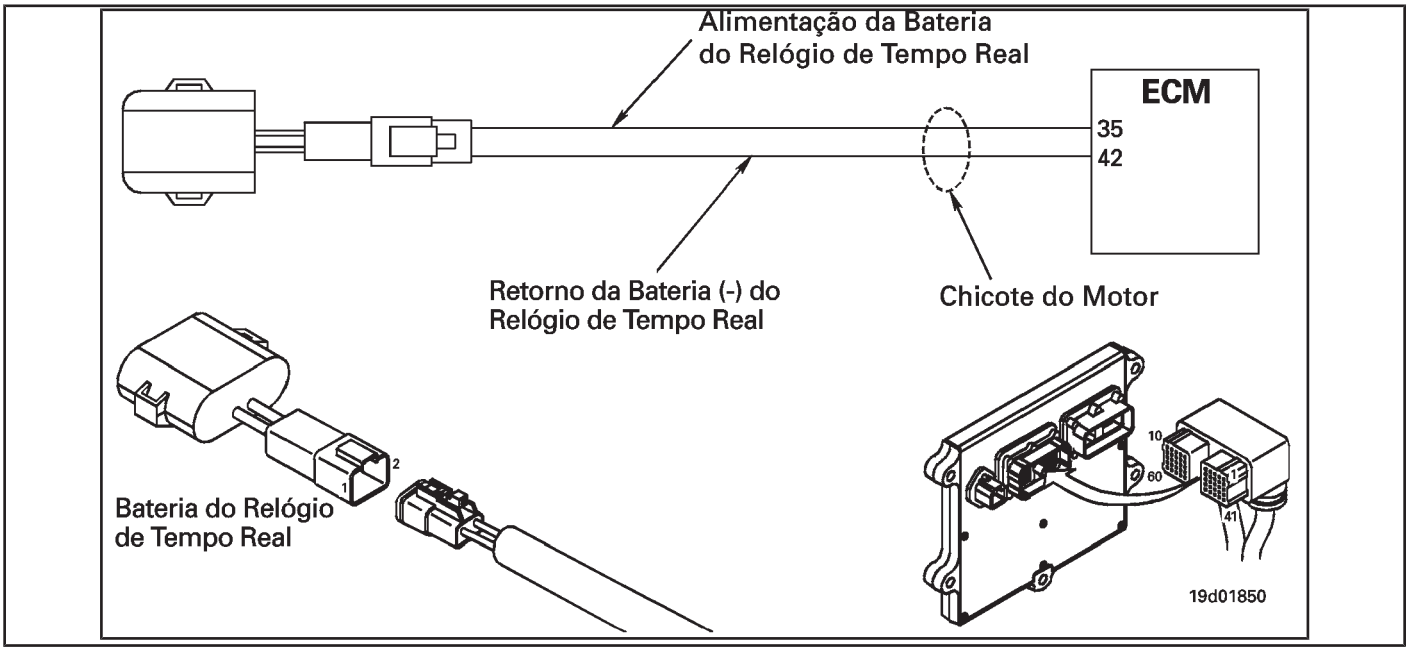
Action	Specifications / Repair	Next step
Clear the fault codes. • Using INSITE ™, clear all fault codes.	All codes cleared? **YES**	Complete repair.
	All codes cleared? **NO**	Proper troubleshooting and repair steps.

Fault Code 1689

Real Time Clock Power Switch - Invalid, Intermittent or Incorrect

CODES	REASON	IT IS MADE
Fault Code: 1689 PID (P), SID (S): P251 IMF: 12/2 Lamp: Amber SRT:	Real Time Clock Power Switch - Invalid, Intermittent or Incorrect Data. Real Time Clock power has been interrupted.	None as to performance. The data in the ECM no will have accurate date and time information.

Real Time Clock Power Circuit



Circuit Descriptions:

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

Component Location:

The battery of the real-time clock is attached to the engine harness next to the ECM. See the Procedure 100-002 for the detailed location of each component.

Workshop Tips:

This fault code indicates that the ECM real time clock has lost power. Possible causes for this failure are a dead or defective battery, defective wiring or connectors between the battery and the ECM, or the motor no it is equipped with a real-time clock battery and the vehicle's battery power to the ECM has been lost.

On-Board Diagnostic Information (OBD):

- The ECM will light the malfunction indicator lamp (MIL) for the second consecutive ignition cycle when the diagnosis is performed and fails.

- The ECM will turn off the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles in which the diagnosis is performed and no failure. The MIL lamp and the fault code can also be cleared with the electronic service tool INSITE ™.

- The fault code will be cleared from memory after 40 consecutive driving cycles in which the diagnosis is performed and approved.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To avoid damage to the pins and harness, use the following test leads when making a measurement: Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch / AMP female test lead / Metri-Pack STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check the battery and connections of the real time clock.		
STEP 1A: Inspect the pins of the engine harness and ECM connectors.	Dirty or damaged pins?	
STEP 1B: Check the battery voltage of the real-time clock on the ECM harness connector.	Between 3.3 and 3.6 VDC?	
STEP 1B-1: Inspect the battery of the real-time clock and the pins of the engine harness connector.	Dirty or damaged pins?	
STEP 1B-2: Check the voltage of the real-time clock battery in the battery module connector.	Between 3.3 and 3.6 VDC?	
STEP 2: Check the battery module harness.		
STEP 2A: Check for a circuit open in the engine harness.	Less than 10 ohms?	
STEP 2B: Check for a short circuit in the engine harness.	More than 100k ohms?	
STEP 2C: Check for a short circuit with the dough.	More than 100k ohms?	
STEP 3: Clear the fault codes.		
STEP 3A: Disable the fault code.	Fault code 1689 inactive?	
STEP 3B: Clear the fault codes inactive.	All codes cleared?	

FAULT DIAGNOSTIC STEP

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

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

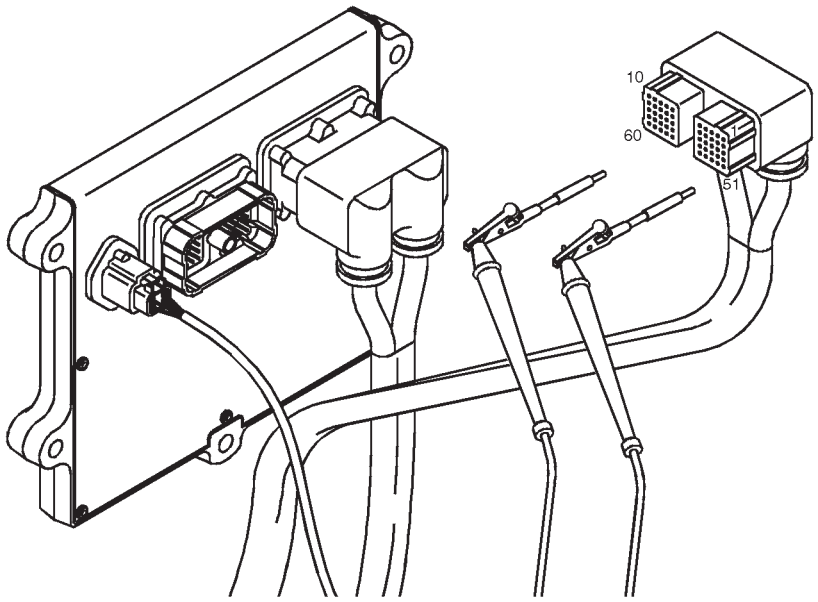
Conditions:
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.

Action	Specifications / Repair	Next step
Check that the pins on the engine harness and ECM connectors have: • Loose connector • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins • Damage to the wire shield • Connector cover broken. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected at the sensor harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-043 .	3A
	Dirty or damaged pins? **NO**	1B

STEP 1B: Check the battery voltage of the real time clock on the ECM harness connector. Conditions:

- Engine equipped with an optional real-time clock battery.
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.

Action	Specifications / Repair	Next step
Measure the voltage between the POWER pin of the real-time clock battery and the negative (-) RETURN pin of the real-time clock battery on the ECM connector on the engine harness. Refer to the electrical diagram for identification of the connector pins.	Between 3.3 and 3.6 VDC? **YES**	3A
	Between 3.3 and 3.6 VDC? **NO**	1B-1



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

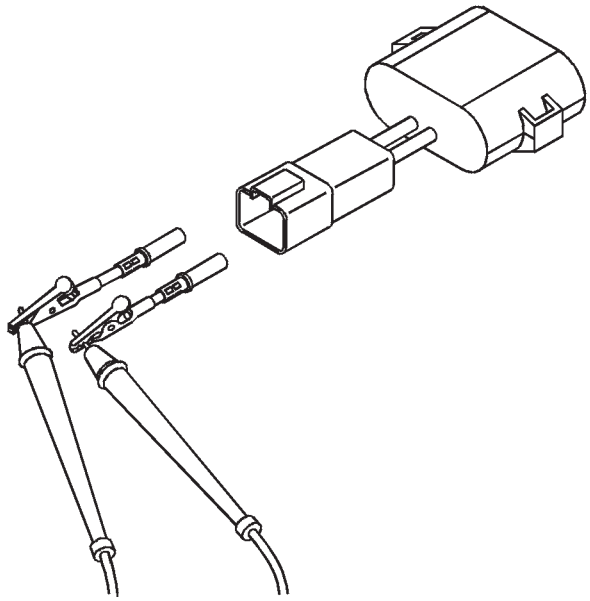
Conditions:
- Turn the ignition key off.
- Disconnect the battery from the real-time clock from the engine harness.

Action	Specifications / Repair	Next step
Inspect the real-time clock battery and engine harness connector pins for: • Loose connector • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins • Damage to the wire shield • Connector cover broken. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected in the sensor or in the harness connector. Repair or replace the battery of the real time clock or the engine harness. See the Procedure 019-311 or 019-043 .	3A
	Dirty or damaged pins? **NO**	1B-2

STEP 1B-2: Check the battery voltage of the real-time clock on the connector of the batteries.

Conditions:
- Engine equipped with an optional real-time clock battery.
- Turn the ignition key off.
- Disconnect the battery from the real-time clock from the engine harness.

Action	Specifications / Repair	Next step
Measure the voltage between the POWER pin of the real-time clock battery and the negative (-) RETURN pin of the real-time clock battery on the battery connector of the real-time clock. Refer to the electrical diagram for identification of the connector pins.	Between 3.3 and 3.6 VDC? **YES**	2A
	Between 3.3 and 3.6 VDC? **DO NOT** **REPAIR:** Replace the battery of the real time clock. See the Procedure 019-311 .	3A



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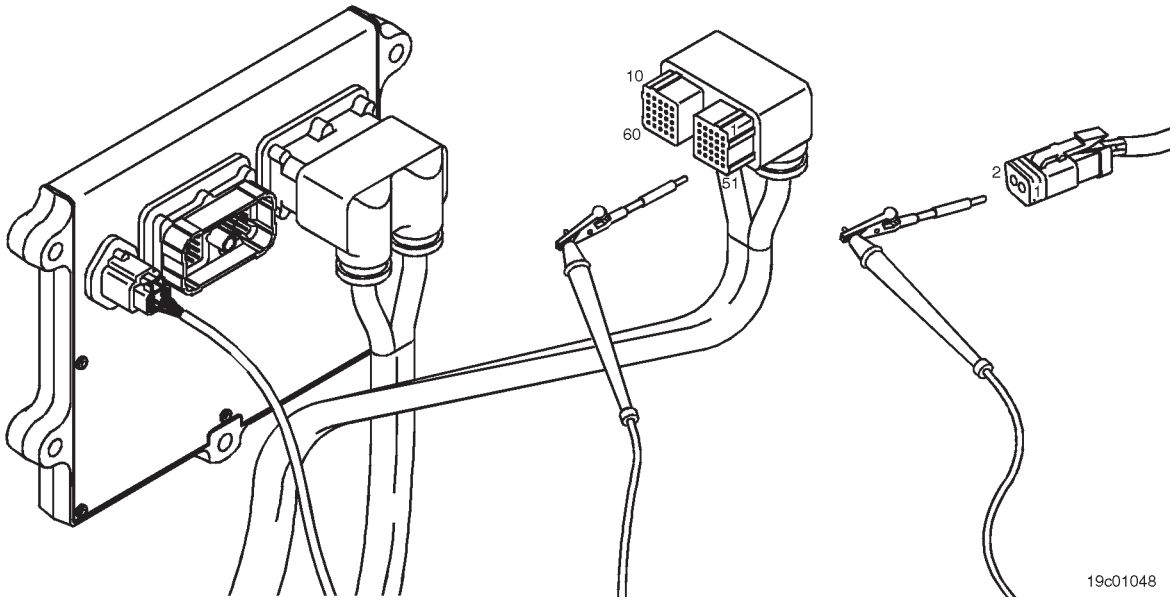
STEP 2: Check the battery module harness.

STEP 2A: Check the motor harness for an open circuit. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.

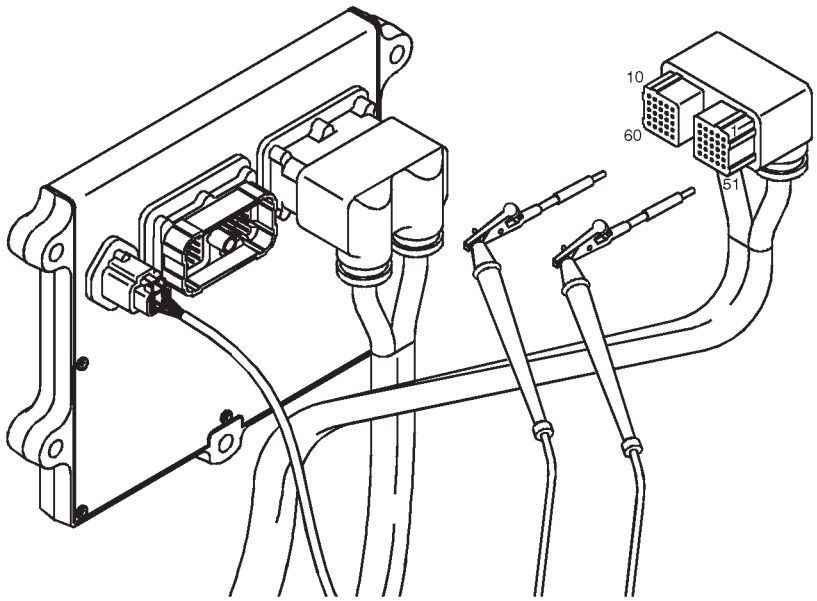
Action	Specifications / Repair	Next step
Measure the following resistance: • The resistance between the POWER pin of the real-time clock battery in the battery harness connector of the motor and the POWER POWER pin of the real-time clock battery in the ECM harness connector. • The resistance between the negative (-) RETURN pin of the real-time clock battery on the engine harness battery connector and the negative (-) RETURN pin of the real-time battery on the ECM harness connector. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	Less than 10 ohms? **YES**	2B
	Less than 10 ohms? **DO NOT** **REPAIR:** An open circuit was detected in the engine harness. Repair or replace the engine harness. See the Procedure 019-043 .	3A



STEP 2B: Check the motor harness for a short circuit. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Disconnect the battery from the real-time clock from the engine harness.

Action	Specifications / Repair	Next step
Using a multimeter, measure the resistance between the POWER pin of the real-time clock battery, the ECM connector on the engine harness, and all other connector pins. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YES**	2C
	More than 100k ohms? **DO NOT** **REPAIR:** A short circuit was detected in the engine harness. Repair or replace the engine harness. See the Procedure 019-043 .	3A



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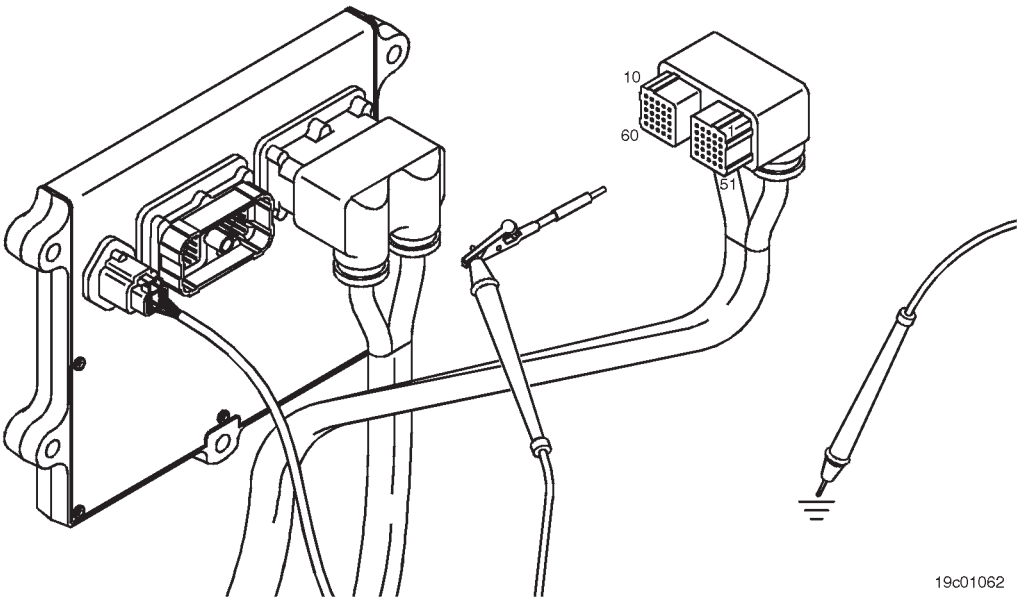
STEP 2C: Check for an earth short. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Disconnect the battery from the real-time clock from the engine harness.

Action	Specifications / Repair	Next step
Using a multimeter, measure the resistance between the POWER pin of the real-time clock battery, the ECM connector on the engine harness, and the mass of the engine block. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YES**	3A
	More than 100k ohms? **DO NOT** **REPAIR:** A short circuit was detected in the engine harness. Repair or replace the engine harness. See the Procedure 019-043 .	3A



STEP 3: Clear the fault codes.

STEP 3A: Disable the fault code. Conditions:

- Connect all components.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Using INSITE ™, set the correct date and time on the real time clock. • Make sure Fault Code 1689 is inactive.	Fault code 1689 inactive? **YES**	3B
	Fault code 1689 inactive? **NO**	1A

STEP 3B: Clear the fault codes. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

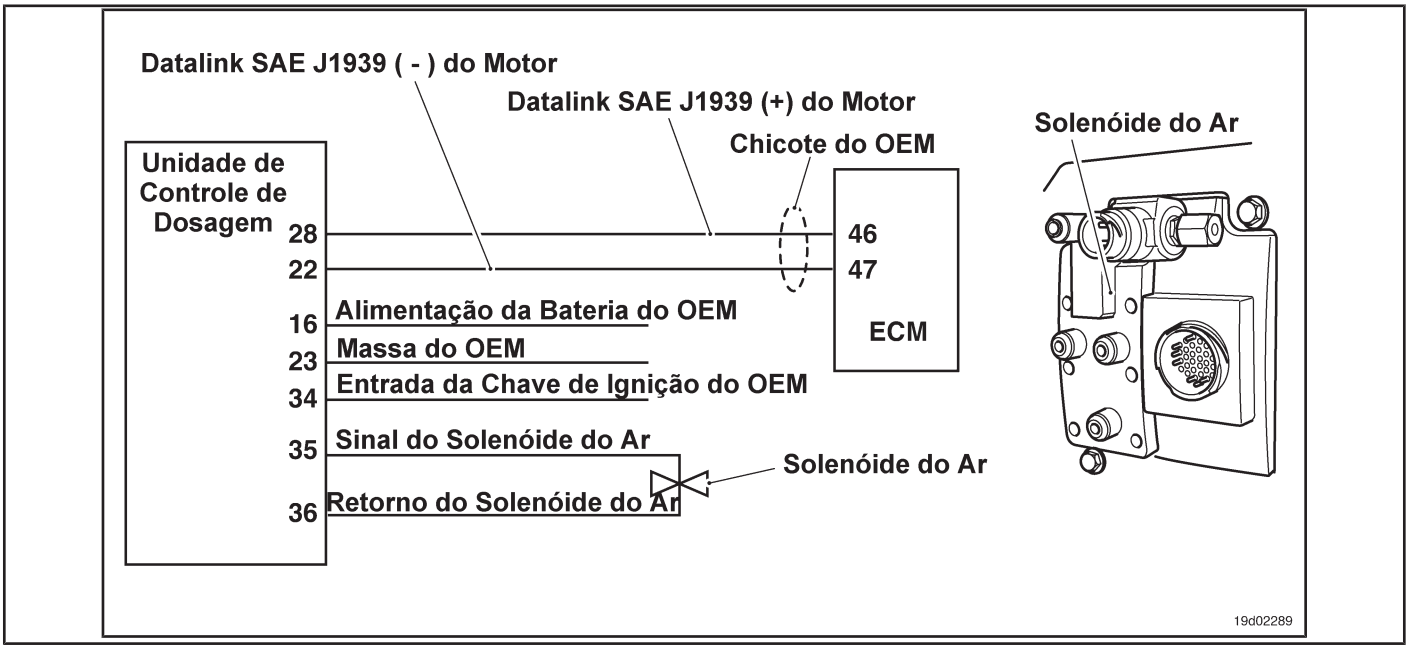
Action	Specifications / Repair	Next step
Clear the fault codes. • Using INSITE ™, clear all fault codes.	All codes cleared? **YES**	Complete repair.
	All codes cleared? **NO**	Proper troubleshooting and repair steps

Fault Code 1697

Post-treatment System Air Enabling Actuator 1 - Voltage Above Normal or with High Voltage.

CODES	REASON	IT IS MADE
Fault Code: 1697 PID (P), SID (S): IMF: 3 Lamp: Amber SRT:	Post-treatment System Air Enabling Actuator 1 - Voltage Above Normal or High Voltage. High signal voltage was detected in the catalyst air solenoid circuit.	The injection of catalyst solution into the after-treatment system is disabled.

Circuit: Post-treatment System Air Enabling Actuator 1



Circuit Descriptions:

The post treatment's No. 1 air solenoid is used to enable and disable the truck's air supply to the dosing control unit. Air is used to transport the catalyst solution to the catalyst spray nozzle.

Component Location:

The post-treatment system's No. 1 air solenoid is mounted on the rear of the dosing control unit. The dosing control unit is assembled by the OEM.

Workshop Tips:

This fault code is recorded when the supply voltage of the air solenoid is greater than +12 volts. Possible causes of this fault code:

- Shorted air solenoid signal wire with a voltage source
- Defective dosing control unit. On-Board Diagnostic

Information (OBD):

- The ECM will illuminate the malfunction indicator lamp (MIL) when the diagnosis is performed and fails.

- The ECM will turn off the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles in which the diagnosis is performed and no failure. The MIL lamp and the fault code can also be cleared with the electronic service tool INSITE ™.

- The fault code will be cleared from memory after 40 consecutive driving cycles in which the diagnosis is performed and approved.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch /

AMP / Metri-Pack female test lead. STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check for a security code failure inactive.	**Fault code 1697 inactive?**	
STEP 2: Check the air solenoid and the circuit.		
STEP 2A: Inspect the air solenoid and electrical connections.	**Dirty or damaged pins?**	
STEP 3: Check the dosing control unit and the harness.		
STEP 3A: Inspect the dosing control unit and connector pins.	**Dirty or damaged pins?**	
STEP 3B: Check for a short circuit between pins in the OEM harness.	**More than 100k ohms?**	
STEP 3C: Check for a security code failure inactive.	**Fault code 1697 inactive?**	
STEP 4: Clear the fault codes.		
STEP 4A: Check the repair.	**Does the air solenoid "click" when it is enabled with INSITE ™?**	
STEP 4B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

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

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an inactive fault code. • Use INSITE ™ to read the fault codes. Fault code 1697 inactive?	**YES**	Fault Code Inactive or Intermittent, Procedure 019-362 .
	Fault code 1697 inactive? **NO**	2A

STEP 2: Check the air solenoid and the circuit.

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

Conditions:

- Turn the ignition key off.
- Disconnect the air solenoid from the OEM harness.

Action	Specifications / Repair	Next step
Inspect the OEM harness and air solenoid connections for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Damage to the wire shield • Moisture inside or over the connector • Connector seals damaged or missing • Broken connector cover • Connector pin dirt or debris For general inspection techniques, see Connector and Component Pin Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected in the sensor or in the harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-071 .	4A
	Dirty or damaged pins? **NO**	3A

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

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

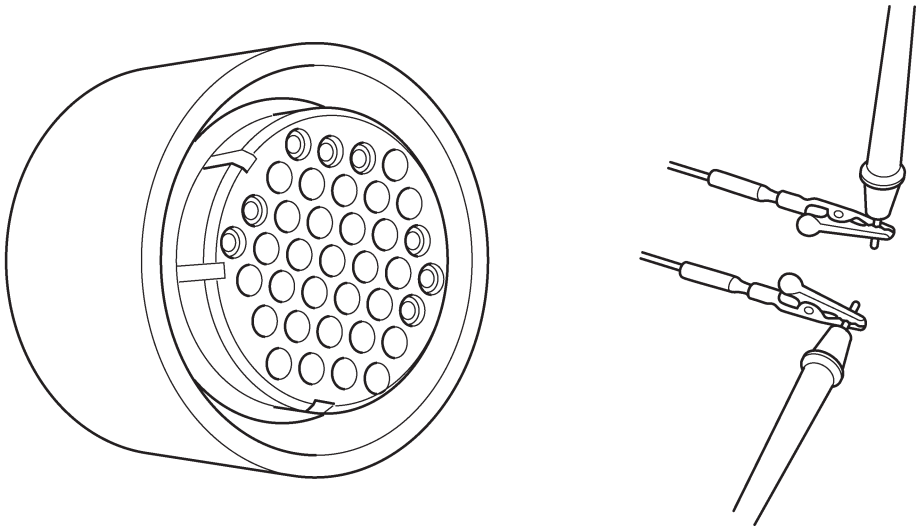
Conditions:
- Turn the ignition key off.
- Disconnect the dosing control unit from the OEM harness.

Action	Specifications / Repair	Next step
Inspect the OEM and ECM harness connector pins for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Damage to the wire shield • Moisture inside or over the connector • Connector seals damaged or missing • Broken connector cover • Connector pin dirt or debris For general inspection techniques, see Connector and Component Pin Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection has been detected in the dosing control unit. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-071 .	4A
	Dirty or damaged pins? **NO**	3B

STEP 3B: Check the OEM harness for a short circuit between pins. Conditions:

- Turn the ignition key off.
- Disconnect the dosing control unit from the OEM harness.
- Disconnect the air solenoid from the OEM harness.

Action	Specifications / Repair	Next step
Check for a short circuit between pins. • Measure the resistance between the air solenoid SIGN pin, on the OEM harness ECM connector, and all other pins on the OEM connector. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YES**	3C
	More than 100k ohms? **DO NOT** **REPAIR:** A short circuit between pins in the SIGNAL line of the air solenoid was detected in the OEM harness. Repair or replace the OEM harness. See the Procedure 019-071 .	4A



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STEP 3C: Check for an inactive fault code. Conditions:

- Connect all components
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 1697 inactive? **YES** **Repair:** None. Did removing and reinstalling the connector correct the failure?	4A
	Fault code 1697 inactive? **DO NOT** **REPAIR:** Replace the dosing control unit. Refer to the information in the OEM troubleshooting and repair manual.	4A

STEP 4: Clear the fault code.

STEP 4A: Check the repair. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Using INSITE, perform the Air Solenoid Activation Test of the Urea Metering Pump. • Check if an air solenoid activation "click" is emitted when it is enabled with INSITE ™.	Does the air solenoid "click" when it is enabled with INSITE ™? **YES**	4B
	Does the air solenoid "click" when it is enabled with INSITE ™? **NO**	1A

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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

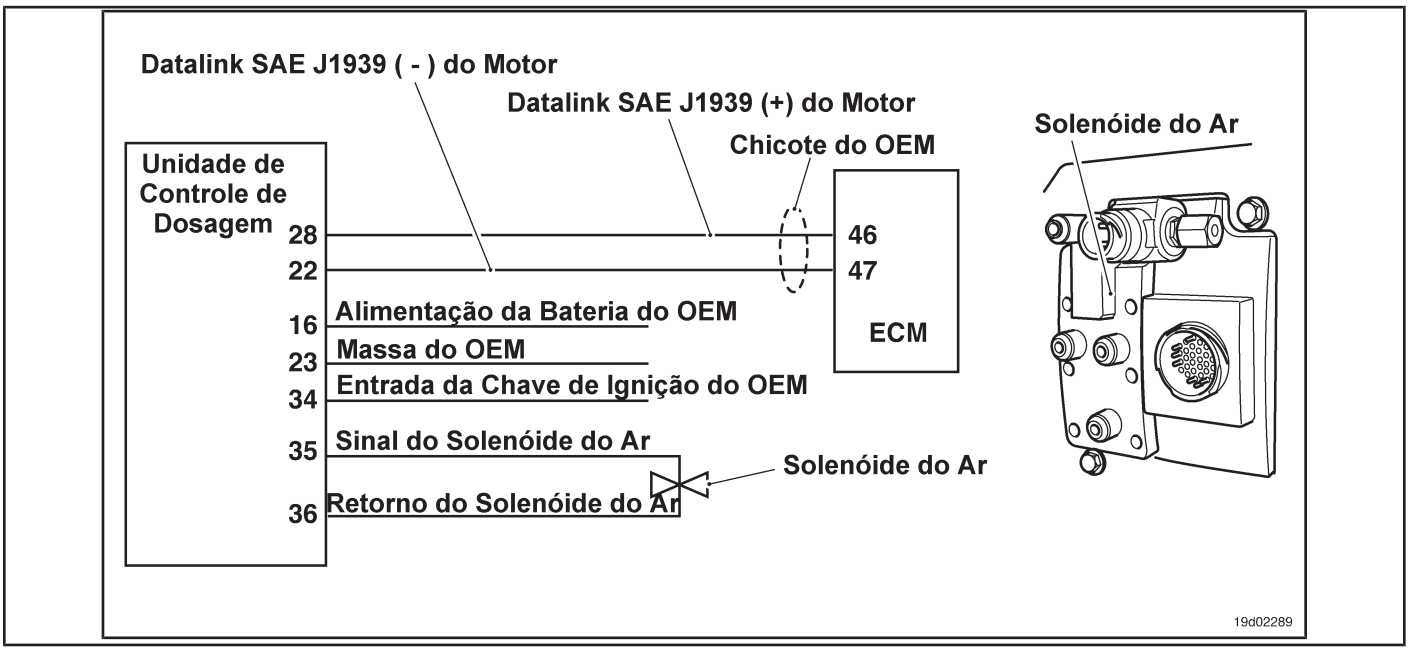
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use INSITE ™ to clear inactive fault codes.	All codes cleared? **YES**	Complete repair
	All codes cleared? **NO**	Proper troubleshooting and repair steps

Fault Code 1698

Post-treatment System Air Enabling Actuator 1 - Voltage Below Normal or with Low Voltage.

CODES	REASON	IT IS MADE
Fault Code: 1698 PID (P), SID (S): IMF: 4 Lamp: Amber SRT:	Post-treatment System Air Enabling Actuator 1 - Voltage Below Normal or Low Voltage. A low voltage signal was detected in the catalyst air solenoid circuit.	The injection of catalyst solution into the after-treatment system is disabled.

Circuit:



Circuit Descriptions:

The post treatment's No. 1 air solenoid is used to enable and disable the truck's air supply to the dosing control unit. Air is used to transport the catalyst solution to the catalyst spray nozzle.

Component Location:

The post-treatment system's No. 1 air solenoid is mounted on the rear of the dosing control unit. The dosing control unit is assembled by the OEM.

Workshop Tips:

This fault code is recorded when the supply voltage of the air solenoid is less than +12 volts. Possible causes of this fault code:

- Open circuit on the air solenoid signal wire.
- Open circuit in the air solenoid return wire.
- Short circuit between pins in the air solenoid signal wire
- Defective air solenoid
- Defective dosing control unit.

On-Board Diagnostic Information (OBD):

- The ECM will illuminate the malfunction indicator lamp (MIL) when the diagnosis is performed and fails.
- The ECM will turn off the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles in which the diagnosis is performed and no failure. The MIL lamp and the fault code can also be cleared with the electronic service tool INSITE ™.
- The fault code will be cleared from memory after 40 consecutive driving cycles in which the diagnosis is performed and approved.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch /

AMP / Metri-Pack female test lead. STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check for a security code failure inactive.	**Fault code 1698 inactive?**	
STEP 2: Check the air solenoid and the circuit.		
STEP 2A: Inspect the air solenoid and electrical connections.	**Dirty or damaged pins?**	
STEP 2B: Check for a short circuit on the air solenoid.	**Is the solenoid resistance between 8 and 20 ohms?**	
STEP 2B-1: Check for a short circuit with the ground in the air solenoid.	**More than 100k ohms?**	
STEP 3: Check the OEM dosing control unit and harness.		
STEP 3A: Inspect the connector pins on the OEM dosing control unit and harness.	**Dirty or damaged pins?**	
STEP 3B: Check for a short circuit between pins and ground.	**More than 100k ohms?**	
STEP 3C: Check for a short circuit between pins in the engine harness.	**More than 100k ohms?**	
STEP 3D: Check for a circuit open in the signal circuit.	**Less than 10k ohms?**	
STEP 3E: Check for a circuit open in the return circuit.	**Less than 10k ohms?**	
STEP 3F: Check for a security code failure inactive.	**Fault code 1698 inactive?**	
STEP 4: Clear the fault codes.		
STEP 4A: Check the repair.	**Does the air solenoid "click" when it is enabled with INSITE ™?**	
STEP 4B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

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

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an inactive fault code. • Use INSITE ™ to read the fault codes. Fault code 1698 inactive?	**YES**	Fault Code Inactive or Intermittent, Procedure 019-362 .
	Fault code 1698 inactive? **NO**	2A

STEP 2: Check the air solenoid and the circuit.

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

Conditions:

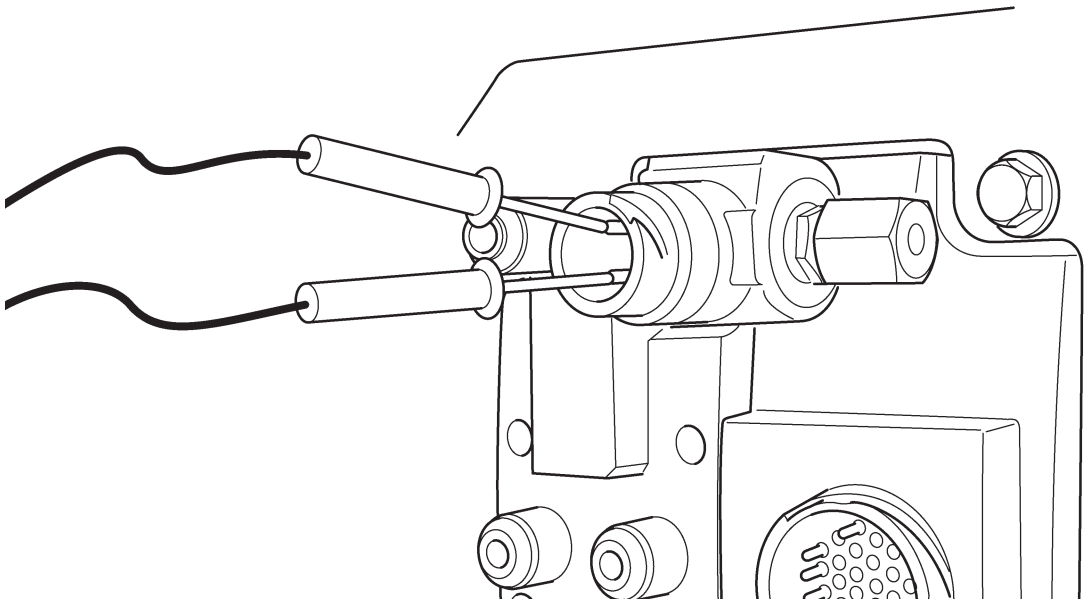
- Turn the ignition key off.
- Disconnect the air solenoid from the OEM harness.

Action	Specifications / Repair	Next step
Inspect the dosing control unit and air solenoid connections for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Damage to the wire shield • Moisture inside or over the connector • Connector seals damaged or missing • Broken connector cover • Connector pin dirt or debris For general inspection techniques, see Connector and Component Pin Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected in the sensor or in the harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-071 .	4A
	Dirty or damaged pins? **NO**	2B

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

- Turn the ignition key off.
- Disconnect the air solenoid from the OEM harness.

Action	Specifications / Repair	Next step
Check the resistance of the solenoid to air. • Measure the resistance between the SIGNAL and RETURN pins of the air solenoid on the solenoid harness. Refer to the electrical diagram for identification of the connector pins.	Is the solenoid resistance between 8 and 20 ohms? **YES**	2B-1
	Is the solenoid resistance between 8 and 20 ohms? **DO NOT** **REPAIR:** An open circuit or a short circuit was detected in the air solenoid. Replace the dosing control unit. Refer to the OEM's troubleshooting and repair manual.	4A



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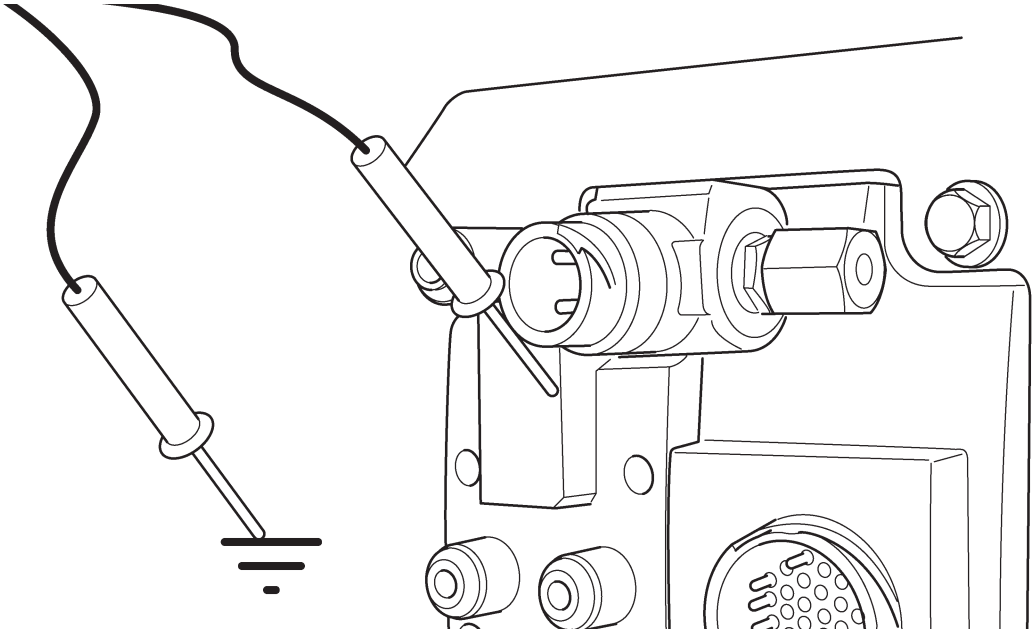
STEP 2B-1: Check for a short circuit with the ground in the air solenoid. Conditions:

- Turn the ignition key off.
- Disconnect the air solenoid from the OEM harness.

Action	Specifications / Repair	Next step
Check the air solenoid for a short with ground. • Measure the resistance between the SIGN pin on the air solenoid and the ground on the air solenoid. Refer to the electrical diagram for identification of the connector pins.	More than 100k ohms? **YES**	3A
	More than 100k ohms? **DO NOT** **REPAIR:** Replace the dosing control unit. Refer to the OEM's troubleshooting and repair manual.	4A



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

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

Conditions:
- Turn the ignition key off.
- Disconnect the dosing control unit from the OEM harness.

Action	Specifications / Repair	Next step
Inspect the OEM and ECM harness connector pins for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Damage to the wire shield • Moisture inside or over the connector • Connector seals damaged or missing • Broken connector cover • Connector pin dirt or debris For general inspection techniques, see Connector and Component Pin Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection has been detected in the dosing control unit. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-071 .	4A
	Dirty or damaged pins? **NO**	3B

STEP 3B: Check for a short circuit between the pins and the ground. Conditions:

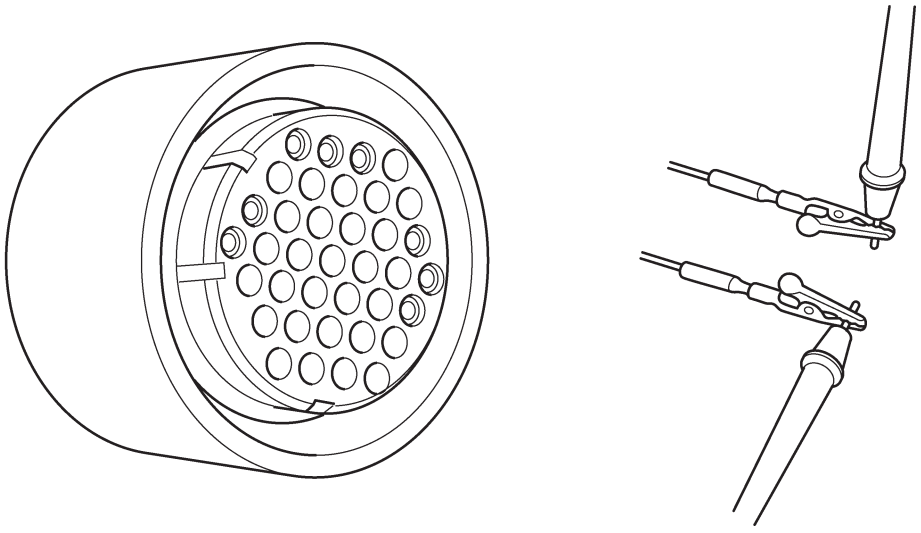
- Turn the ignition key off.
- Disconnect the dosing control unit from the OEM harness.
- Disconnect the air solenoid from the OEM harness.

Action	Specifications / Repair	Next step
Check for a short circuit between pins. • Measure the resistance between the air solenoid SIGN pin on the dosing control unit harness and the ground. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YES**	3C
	More than 100k ohms? **DO NOT** **REPAIR:** A short circuit between pins in the SIGNAL line of the air solenoid was detected in the OEM harness. Troubleshoot the harnesses connected in series to determine which one contains the shorted signal circuit. Repair or replace the OEM harness. See the Procedure 019-071 .	4A

STEP 3C: Check the motor harness for a short circuit between pins. Conditions:

- Turn the ignition key off.
- Disconnect the dosing control unit from the OEM harness.
- Disconnect the air solenoid from the OEM harness.

Action	Specifications / Repair	Next step
Check for a short circuit between pins. • Measure the resistance between the air solenoid SIGN pin on the OEM harness and all other OEM harness connector pins. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YES**	3D
	More than 100k ohms? **DO NOT** **REPAIR:** A short circuit between pins in the SIGNAL line of the air solenoid was detected in the OEM harness. Repair or replace the OEM harness. See the Procedure 019-071 .	4A



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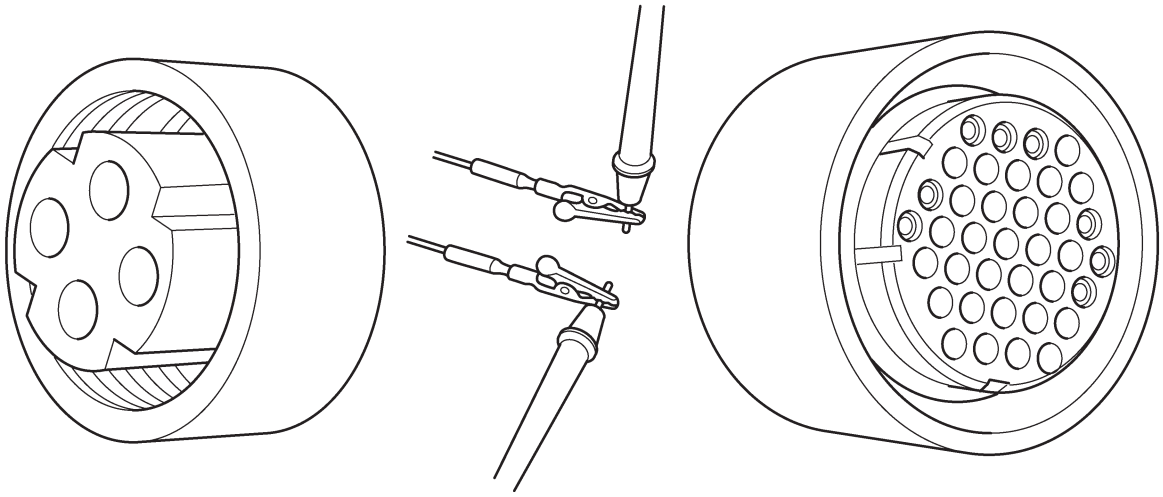
STEP 3D: Check for an open circuit in the signal circuit. Conditions:

- Turn the ignition key off.
- Disconnect the dosing control unit from the OEM harness.
- Disconnect the air solenoid from the OEM harness.

Action	Specifications / Repair	Next step
Check for an open circuit. • Measure the resistance between the air solenoid SIGN pin, on the OEM harness, dosing control unit side, and the air solenoid SIGN pin, on the OEM harness, air solenoid side. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	Less than 10 ohms? **YES**	3F
	Less than 10 ohms? **DO NOT** **REPAIR:** A short circuit between pins in the SIGNAL line of the air solenoid was detected in the OEM harness. Troubleshoot the harnesses connected in series to determine which one contains the shorted signal circuit. Repair or replace the OEM harness. See the Procedure 019-071 .	4A



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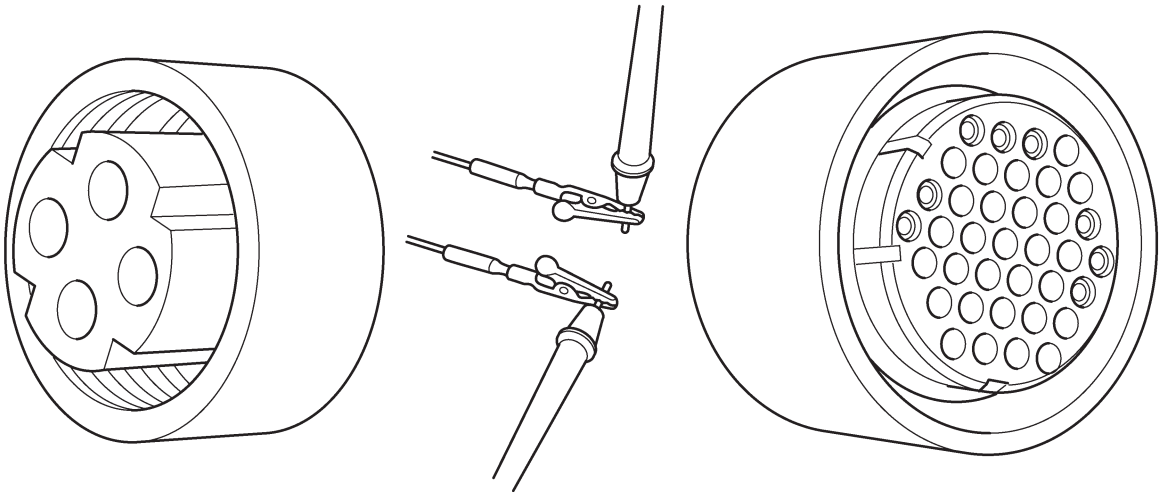
STEP 3E: Check for an open circuit in the return circuit. Conditions:

- Turn the ignition key off.
- Disconnect the dosing control unit from the OEM harness.
- Disconnect the air solenoid from the dosing control unit.

Action	Specifications / Repair	Next step
Check for an open circuit. • Measure the resistance between the RETURN pin of the air solenoid, on the OEM harness, side of the dosing control unit, and the RETURN pin of the air solenoid, on the OEM harness, side of the air solenoid. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	Less than 10 ohms? **YES**	3G
	Less than 10 ohms? **DO NOT** **REPAIR:** A short circuit between pins in the RETURN line of the air solenoid was detected in the OEM harness. Troubleshoot the harnesses connected in series to determine which one contains the shorted signal circuit. Repair or replace the OEM harness. See the Procedure 019-071 .	4A



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

- Connect all components
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 1698 inactive? **YES** **Repair:** None. Did removing and reinstalling the connector correct the failure?	4A
	Fault code 1698 inactive? **DO NOT** **REPAIR:** Replace the dosing control unit. Refer to the information in the OEM troubleshooting and repair manual.	4A

STEP 4: Clear the fault code.

STEP 4A: Check the repair. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Using INSITE, perform the Air Solenoid Activation Test of the Urea Metering Pump. • Check if an air solenoid activation "click" is emitted when it is enabled with INSITE ™.	Does the air solenoid "click" when it is enabled with INSITE ™? **YES**	4B
	Does the air solenoid "click" when it is enabled with INSITE ™? **NO**	1A

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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

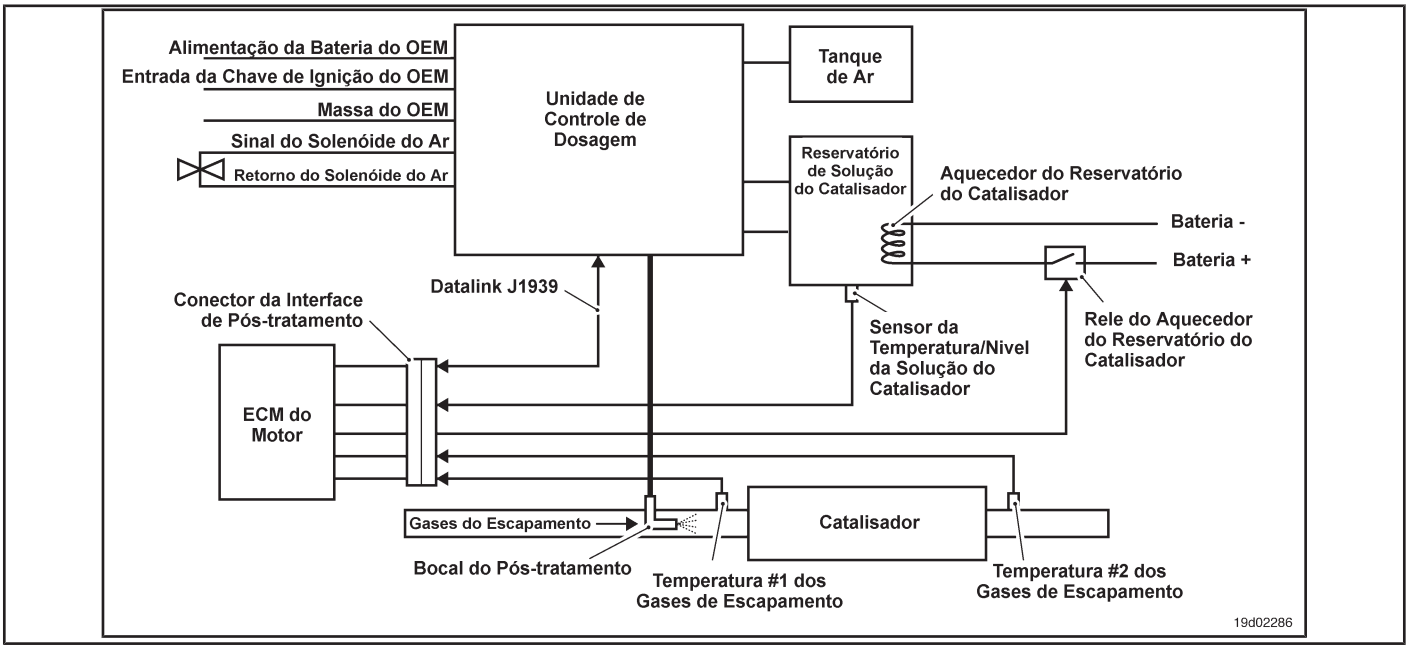
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use INSITE ™ to clear inactive fault codes.	All codes cleared? **YES**	Complete repair
	All codes cleared? **NO**	Proper troubleshooting and repair steps

Fault Code 1699

Catalyst Reservoir Level Sensor - Invalid, Intermittent or Incorrect.

CODES	REASON	IT IS MADE
Fault Code: 1699 PID (P), SID (S): IMF: 2 Lamp: Amber SRT:	Catalyst Reservoir Level Sensor - Invalid, Intermittent or Incorrect Data. The level of the catalyst solution does not change with engine operating conditions.	The injection of catalyst solution into the after-treatment system is disabled.

Circuit:



Circuit Descriptions:

The level sensor in the catalyst reservoir is located in the catalyst reservoir. The locations of the solution level reservoir and sensor depend on the OEM.

Component Location:

The location of the catalyst solution reservoir depends on the OEM.

Workshop Tips:

This fault code is triggered when the reading of the catalyst solution level in the catalyst reservoir does not change with the operating conditions of the engine. If the catalyst metering control unit indicates the occurrence of catalyst injection but the solution level in the catalyst reservoir remains unchanged, this fault code will be recorded. This fault code will also be logged even if catalyst injection occurs but a drop in the solution level is detected. Possible causes of this fault code:

- Sensor defective catalyst reservoir level
- Obstruction or restriction in the catalyst solution lines
- Obstruction or restriction in the post-treatment spray nozzle
- External leaks in the catalyst reservoir or catalyst solution lines

- Violation of the catalyst reservoir level sensor. On-Board Diagnostic

Information (OBD):

- The ECM will illuminate the malfunction indicator lamp (MIL) when the diagnosis is performed and fails.
- The ECM will turn off the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles in which the diagnosis is performed and no failure. The MIL lamp and the fault code can also be cleared with the electronic service tool INSITE ™.
- The fault code will be cleared from memory after 40 consecutive driving cycles in which the diagnosis is performed and approved.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch /

AMP / Metri-Pack female test lead. STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check for sensor circuit fault codes.		
STEP 1A: Check for fault codes related to the catalyst reservoir level sensor.	**Are Fault Codes 1669 or 1671 active?**	
STEP 2: Check the catalyst system.		
STEP 2A: Check that the catalyst solution has external leaks.	**Are there any external leaks in the system?**	
STEP 2B: Inspect the catalyst solution lines.	**Is there an obstruction or restriction in the catalyst solution lines?**	
STEP 2C: Inspect the post-treatment spray nozzle.	**Is there an obstruction or restriction in the post-treatment spray nozzle?**	
STEP 2D: Inspect the catalyst reservoir and the catalyst reservoir level sensor for breach.	**Was a breach detected in the catalyst system?**	
STEP 3: Inspect the catalyst reservoir level sensor.		
STEP 3A: Check that the level sensor is catalyst reservoir works correctly.	**Is the solution level sensor reading in the catalyst reservoir correct?**	
STEP 4: Clear the fault codes.		
STEP 4A: Disable the fault code.	**Fault code 1699 inactive?**	
STEP 4B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check for sensor circuit fault codes.

STEP 1A: Check for fault codes related to the tank reservoir level sensor catalyst.

Conditions:
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for active fault codes. • Use INSITE ™ to read the fault codes. Fault Codes 1669 or 1671 are active?	**YES**	Fault diagnosis diagram for Fault Code 1669 or 1671.
	Are Fault Codes 1669 or 1671 active? **NO**	2A

STEP 2: Check the catalyst system.

STEP 2A: Check the catalyst solution system for external leaks. Conditions:

- Turn the ignition key off.

Action	Specifications / Repair	Next step
Inspect the lines and the catalyst solution reservoir for: • External leaks.	Are there any external leaks in the system? **YES** **Repair:** Repair the source of the external leak.	4A
	Are there any external leaks in the system? **NO**	2B

STEP 2B: Inspect the catalyst solution lines.

Conditions:
- Turn the ignition key off.

Action	Specifications / Repair	Next step
Inspect the catalyst solution lines for: • Obstruction or restrictions.	Is there an obstruction or restriction in the catalyst solution lines? **YES** **Repair:** Repair or replace the catalyst solution lines. Refer to the OEM fault diagnosis procedures.	4A
	Is there an obstruction or restriction in the catalyst solution lines? **NO**	2C

STEP 2C: Inspect the post-treatment spray nozzle.

Conditions:
- Turn the ignition key off.
- Remove the post-treatment spray nozzle. See the Procedure 011-040 in manual 3653266.

Action	Specifications / Repair	Next step
Inspect the post-treatment spray nozzle for: • Obstruction or restrictions. Refer to Procedure 011-040 in manual 3653266 for inspection techniques.	Is there an obstruction or restriction in the post-treatment spray nozzle? **YES** **Repair:** Clean or replace the post-treatment spray nozzle. Refer to Procedure 011-040 in the manual 3653266.	4A
	Is there an obstruction or restriction in the post-treatment spray nozzle? **NO**	2D

STEP 2D: Inspect the catalyst reservoir and the catalyst reservoir level sensor for breach.

Conditions:
- Turn the ignition key off.

Action	Specifications / Repair	Next step
Inspect the catalyst reservoir and the catalyst reservoir level sensor for: • External catalyst solution reservoirs • Oversized catalyst solution reservoir • Violation of the catalyst reservoir level sensor.	Was a breach detected in the catalyst system? **YES** **Repair:** Remove any external breach devices. Install the correct catalyst solution reservoir.	4A
	Was a breach detected in the catalyst system? **NO**	3A

STEP 3: Inspect the catalyst reservoir level sensor.

STEP 3A: Check that the catalyst reservoir level sensor works correctly. Conditions:

- Turn the ignition key off.
- Connect the electronic service tool INSITE ™.
- Visually check the level of the catalyst solution in the catalyst reservoir.

Action	Specifications / Repair	Next step
Check the function of the catalyst reservoir level sensor. • Use INSITE ™ to monitor the position of the solution level in the catalyst reservoir. • Compare the INSITE ™ reading to the actual level of the catalyst solution.	Is the reading of the solution level sensor in the catalyst reservoir correct? **YES**	4A
	Is the reading of the solution level sensor in the catalyst reservoir correct? **DO NOT** **REPAIR:** Replace the solution level sensor in the catalyst reservoir. Refer to the OEM fault diagnosis procedures.	4A

STEP 4: Clear the fault code.

STEP 4A: Disable the fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Using INSITE ™, make sure that the fault code is inactive.	Fault code 1699 inactive? **YES**	4B
	Fault code 1699 inactive? **NO**	1A

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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

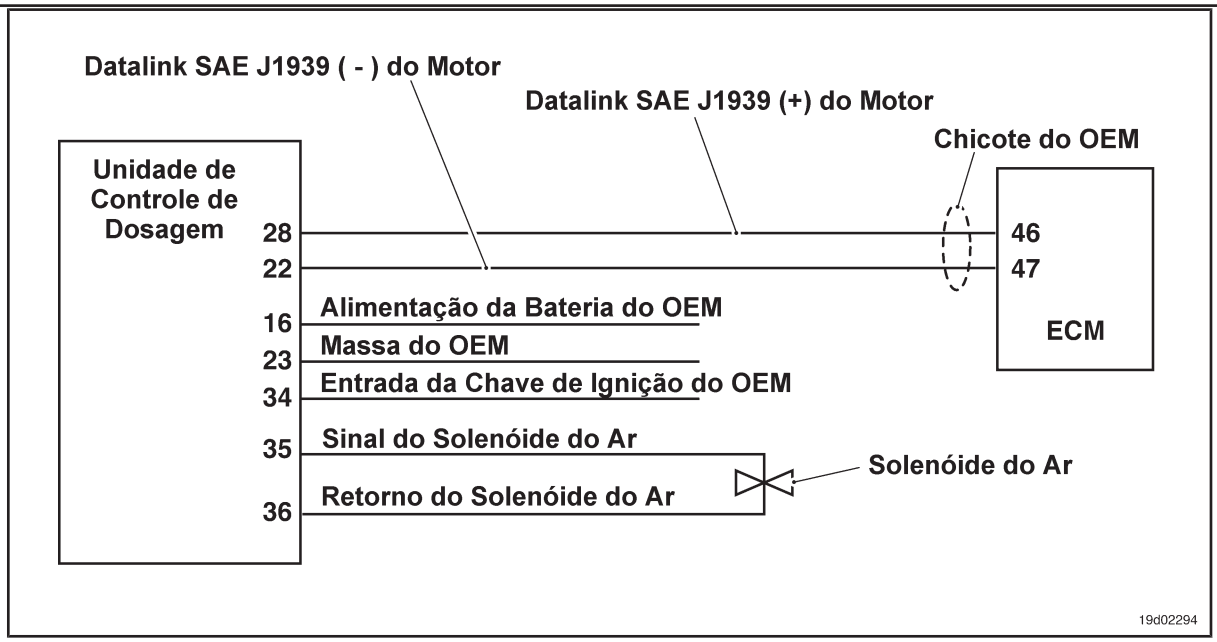
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use INSITE ™ to clear inactive fault codes.	All codes cleared? **YES**	Complete repair
	All codes cleared? **NO**	Proper troubleshooting and repair steps

Fault Code 1711

Dosing Control Unit Datalink - Abnormal Update Rate

CODES	REASON	IT IS MADE
Fault Code: 1711 PID (P), SID (S): IMF: 9 Lamp: Amber SRT:	Dosing Control Unit Datalink - Abnormal Update Rate. Datalink communication between the ECM and the dosing control unit has been interrupted.	The injection of catalyst solution into the after-treatment system is disabled.

Circuit: Dosing Control Unit



Circuit Descriptions:

The dosing control unit communicates with the electronic control module (ECM) of the primary engine through the public network of the datalink J1939. The dosing control unit also receives power from the battery, the ignition key input and the vehicle's ground from the OEM.

Component Location:

The location of the dosing control unit depends on the OEM. Refer to the fault diagnosis OEM for more information.

Workshop Tips:

Possible causes of this fault code:

- Loss of battery voltage to the dosing control unit
- Loss of battery weight for the dosing control unit
- Loss of ignition key input to the dosing control unit
- Wiring with open or shorted circuit of the J1939 datalink between the dosing control unit and the ECM of the primary motor

- Defective dosing control unit. On-Board Diagnostic

Information (OBD):

- The ECM will illuminate the malfunction indicator lamp (MIL) when the diagnosis is performed and fails.
- The ECM will turn off the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles in which the diagnosis is performed and no failure. The MIL lamp and the fault code can also be cleared with the electronic service tool INSITE ™.
- The fault code will be cleared from memory after 40 consecutive driving cycles in which the diagnosis is performed and approved.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To avoid damage to the pins and harness, use the following test leads when making a measurement: Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch / AMP female test lead / Metri-Pack STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check for a security code active fault	Fault code 1711 active?	
STEP 2: Check the battery and ground circuits.		
STEP 2A: Check the power of the battery for the dosing control unit.	Voltage greater than 24 volts?	
STEP 2A-1: Check the circuit of the pasta.	Less than 10 ohms?	
STEP 2B: Check the voltage of the switch ignition for the dosing control unit.	Voltage greater than 24 volts?	
STEP 3: Check the datalink harness.		
STEP 3A: Check for a circuit or a short circuit in the J1939 datalink harness.	Is the resistance between 50 and 70 ohms?	
STEP 4: Check the OEM harness.		
STEP 4A: Check the pins of the ECM and OEM harness connectors.	Dirty or damaged pins?	
STEP 4B: Check for a circuit open or a short circuit in the ECM J1939 datalink harness.	Is the resistance between 50 and 70 ohms?	
STEP 4C: Check for a short circuit on the ECM J1939 datalink harness.	More than 100k ohms?	
STEP 5: Clear the fault codes.		
STEP 5A: Disable the fault code.	Fault code 1711 inactive?	
STEP 5B: Clear the fault codes inactive.	All codes cleared?	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Check for an active fault code Conditions:

- Turn the ignition key off.
- Connect the electronic service tool INSITE ™.

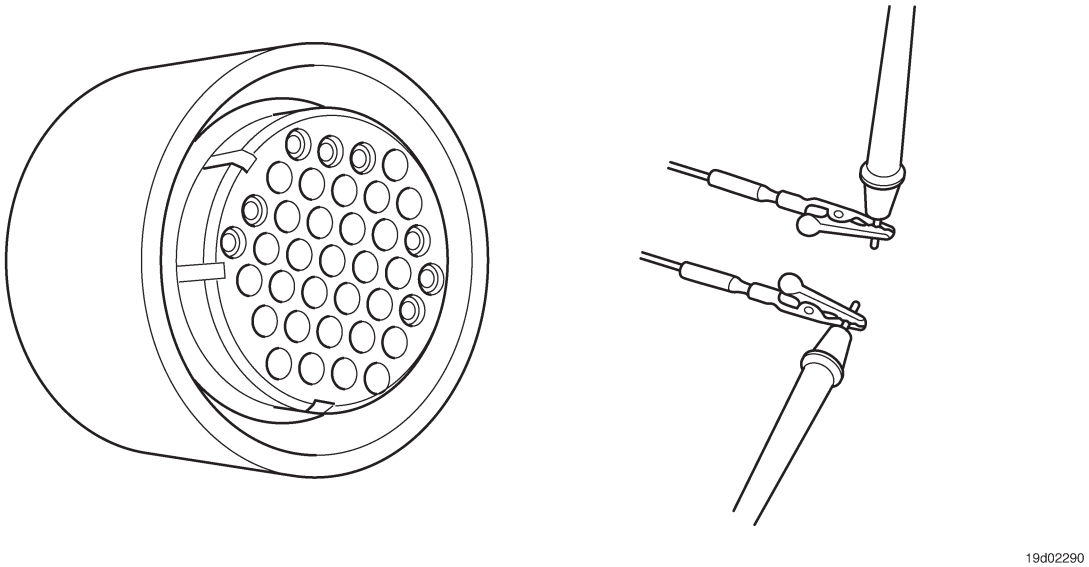
Action	Specifications / Repair	Next step
Check for an active fault code. • Using INSITE ™, read the fault codes. Is fault code 1711 active?	**YES**	2A
	Is fault code 1711 active? **NO**	See the Procedure 019-362, Fault Code Inactive or Intermittent.

STEP 2: Check the battery and ground circuits.

STEP 2A: Check the battery supply to the dosing control unit. Conditions:

- Turn the ignition key off.
- Disconnect the dosing control unit from the electrical harness.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check the voltage for the dosing control unit. • Measure the voltage between the OEM battery power of the dosing control unit and the OEM mass of the dosing control unit. Refer to the electrical diagram for identification of the connector pins.	Voltage greater than 24 volts? **YES**	2B
	Voltage greater than 24 volts? **NO**	2A-1



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STEP 2A-1: Check the ground circuit. Conditions:

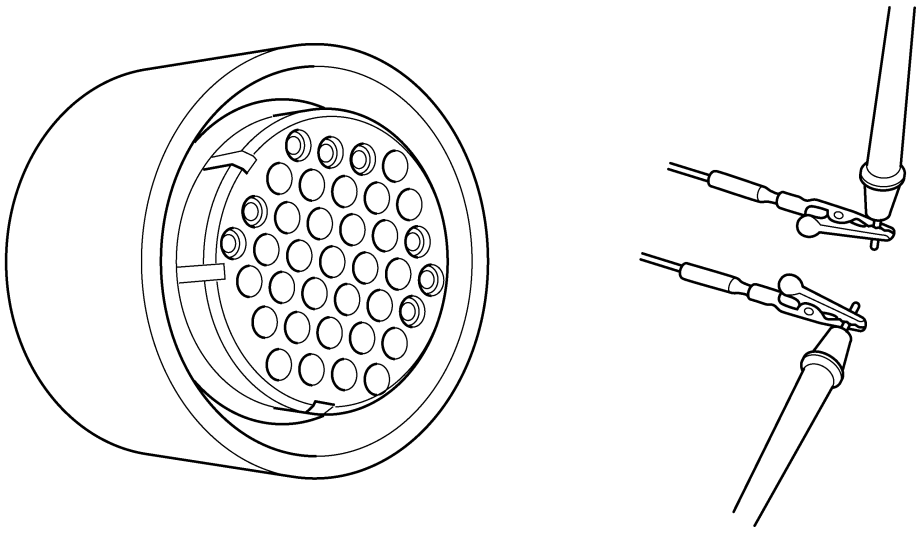
- Turn the ignition key off.
- Disconnect the dosing control unit from the electrical harness.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Measure the resistance. • Measure the resistance between the OEM mass of the dosing control unit and the mass of the engine block.	Less than 10 ohms? **YES** **Repair:** An open circuit in the OEM battery supply circuit. Repair or replace the OEM harness. Refer to the OEM fault diagnosis procedures.	5A
	Less than 10 ohms? **DO NOT** **REPAIR:** An open circuit in the OEM ground circuit. Repair or replace the OEM harness. Refer to the OEM fault diagnosis procedures.	5A

STEP 2B: Check the ignition key voltage for the dosing control unit. Conditions:

- Turn the ignition key off.
- Disconnect the dosing control unit from the electrical harness.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check the input voltage at the ignition switch for the dosing control unit. • Measure the voltage between the input and the ground of the OEM ignition key of the dosing control unit.	Voltage greater than 24 volts? **YEA**	3A
	Voltage greater than 24 volts? **DO NOT** **REPAIR:** An open circuit or low ignition key input voltage was detected in the ground circuit of the dosing control unit. Repair or replace the OEM harness. Refer to the OEM fault diagnosis procedures.	3A



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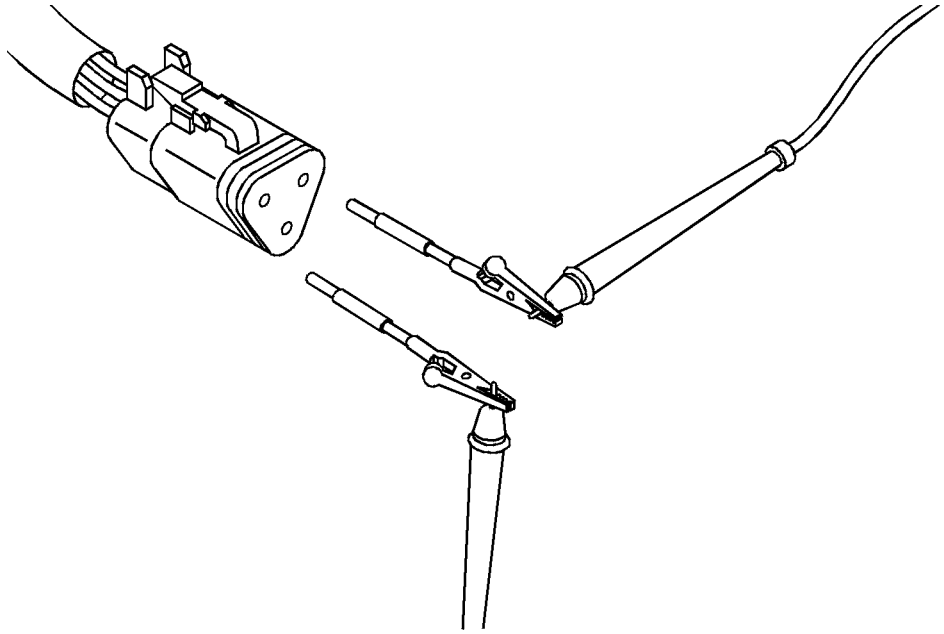
STEP 3: Check the datalink harness.

STEP 3A: Check the J1939 harness for an open circuit or a short circuit. Conditions:

- Turn the ignition key off.
- Disconnect the datalink adapter from the service datalink connector.

Action	Specifications / Repair	Next step
Check for an open circuit or a short circuit. • Measure the resistance between the Datalink SAE J1939 (+) wire and the Datalink SAE J1939 (-) wire on the service datalink connector. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	Is the resistance between 50 and 70 ohms? **YEA**	4A
	Is the resistance between 50 and 70 ohms? **DO NOT** **REPAIR:** An open circuit or short circuit was detected in the service datalink connector or in the harness connection with the J1939 datalink resistive terminal. Repair or replace the OEM harness. See the Procedure 019-071 .	5A



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STEP 4: Check the OEM harness.

STEP 1A: Check the pins on the ECM connectors and the OEM harness. Conditions:

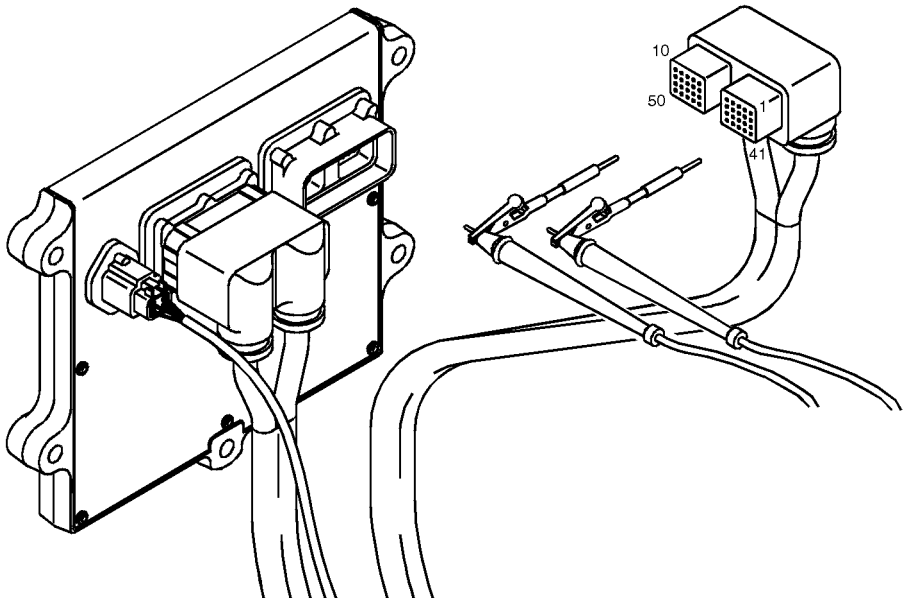
- Turn the ignition key off.
- Disconnect the OEM harness from the ECM.

Action	Specifications / Repair	Next step
Inspect the ECM datalink harness connector pins for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins	Dirty or damaged pins? **YES** **Repair:** A defective connection to the Cummins ECM was detected on the connector or harness on the J1939 datalink. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible.	5A
	Dirty or damaged pins? **NOT**	4B

STEP 4B: Check the ECM datalink J1939 harness for an open circuit or a short circuit. Conditions:

- Turn the ignition key off.
- Disconnect the OEM harness from the ECM.

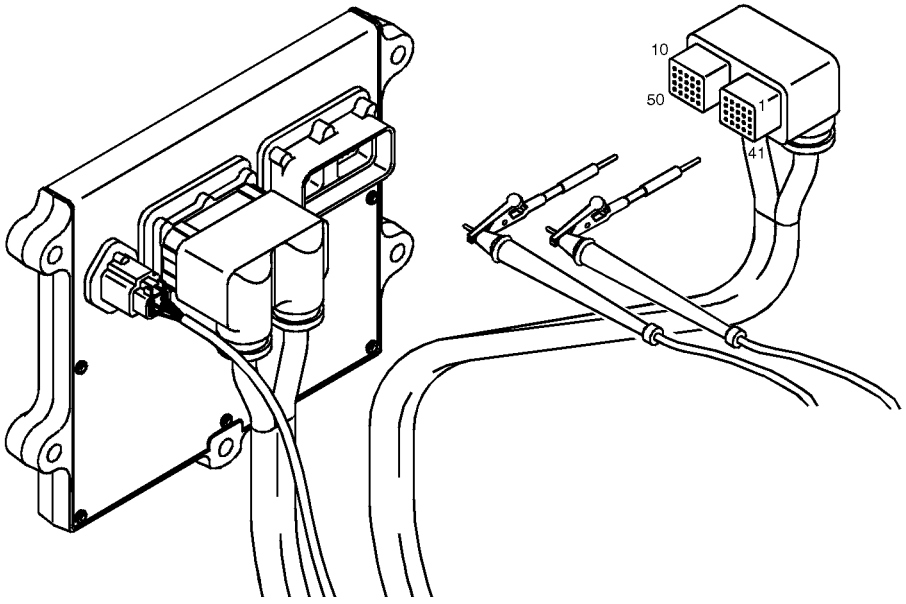
Action	Specifications / Repair	Next step
Check for an open circuit or a short circuit. • Measure the resistance between the Datalink SAE J1939 wire (+) and the Datalink SAE J1939 (-) pin at the appropriate connection from the Cummins and OEM ECM to the J1939 datalink harness connector. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	Is the resistance between 50 and 70 ohms? **YEA**	4C
	Is the resistance between 50 and 70 ohms? **DO NOT** **REPAIR:** An open circuit or short circuit was detected in the OEM harness. Repair or replace the OEM harness. See the Procedure 019-071 .	5A



STEP 4C: Check the ECM datalink J1939 harness for a short circuit. Conditions:

- Turn the ignition key off.
- Disconnect the OEM harness from the ECM.

Action	Specifications / Repair	Next step
Check for an open circuit or a short circuit. • Measure the resistance and check for a short circuit between the Datalink SAE J1939 (+) wire and the Datalink SAE J1939 (-) pin at the appropriate connection from the Cummins and OEM ECM to the J1939 datalink harness connector. **note:** Disregard any resistance between 50 and 70 ohms between the pins (+) and (-) of the Datalink SAE J1939 connector. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YES** **Repair:** A defective dosing control unit has been detected. Replace the dosing control unit. Refer to the OEM fault diagnosis procedures.	5A
	More than 100k ohms? **DO NOT** **REPAIR:** A short circuit was detected in the OEM harness. Repair or replace the OEM harness. See the Procedure 019-071 .	5A



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STEP 5: Clear the fault code.

STEP 5A: Disable the fault code. Conditions:

- Connect all components
- Turn on the ignition key.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Using INSITE ™, make sure that the fault code is inactive.	Fault code 1711 inactive? **YEA**	5B
	Fault code 1711 inactive? **NOT**	1A

STEP 5B: Clear the inactive fault codes. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

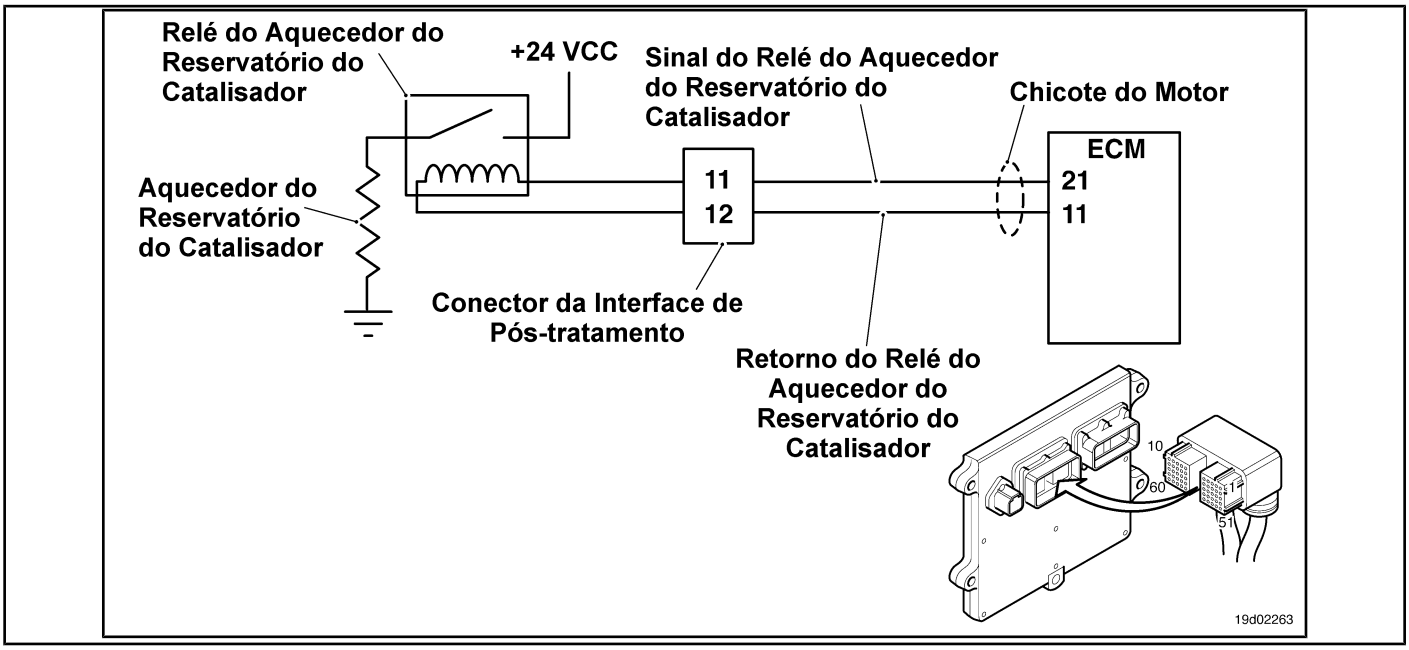
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Using INSITE ™, clear all fault codes.	All codes cleared? **YEA**	Complete repair.
	All codes cleared? **NOT**	Proper troubleshooting and repair steps

Fault Code 1712

Catalyst Reservoir Heater Circuit - Valid Data but Below Range
Normal Operating - Moderately Severe Level

CODES	REASON	IT IS MADE
Fault Code: 1712 PID (P), SID (S): IMF: 1/18 Lamp: Amber SRT:	Catalyst Reservoir Heater Circuit - Valid Data but Below the Normal Operating Range - Moderately Severe Level. The temperature of the catalyst solution did not increase when the catalyst reservoir heater was activated.	None as to performance. The injection of the catalyst solution into the after-treatment system may be disabled if the catalyst solution is frozen.

Circuit: Catalyst Reservoir Heater Relay



Circuit Descriptions:

The catalyst reservoir heater prevents freezing of the catalyst solution in the reservoir. The catalyst reservoir heater element is powered by the catalyst reservoir heater relay.

Component Location:

The catalyst reservoir heater is located in the catalyst reservoir. The location of the catalytic converter heater relays varies by OEM. See the Procedure 100-002 (Engine Diagrams) in Section E for details on component locations.

Workshop Tips:

This fault code is recorded when the ECM The engine controls the activation of the catalyst reservoir heater, but no corresponding increase in the reservoir temperature is registered by the catalyst temperature sensor.

Possible causes of this fault code:

- Defective catalyst reservoir heater relay
- Catalyst reservoir heater power supply failure
- Mass circuit failure in the catalyst reservoir heater
- Wiring fault between catalyst reservoir heater relay and catalyst reservoir heater

- Catalyst reservoir heater failure. On-Board Diagnostic Information

(OBD):

- The ECM will light the malfunction indicator lamp (MIL) for the second consecutive ignition cycle when the diagnosis is performed and fails.

- The ECM will turn off the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles in which the diagnosis is performed and **not** failure. The MIL lamp and the fault code can also be cleared with the electronic service tool INSITE ™.

- The fault code will be cleared from memory after 40 consecutive driving cycles in which the diagnosis is performed and approved.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch /

AMP / Metri-Pack female test lead. STEPS

		SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.			
STEP 1A: Read the fault codes.		**Fault Codes 1677, 1678, 1679, 1683, 1684 active?**	
STEP 2: Check the catalyst reservoir heater relay and circuit.			
STEP 2A:	**Inspect the relay and electrical connections to the catalyst reservoir heater.**	**Dirty or damaged pins?**	
STEP 2B: Check for voltage	**supply to the catalytic converter heater relay.**	**More than +22 volts?**	
STEP 2C: Check the heater wiring	**of the catalyst reservoir.**	**Less than 10 ohms?**	
STEP 2D: Perform the relay override test	**urea warmer with INSITE ™.**	**Is the catalyst solution reservoir heater relay working correctly?**	
STEP 3: Check the catalyst reservoir heater.			
STEP 3A: Check the system heater	**catalyst reservoir for an open circuit.**	**Less than 10 ohms?**	
STEP 4: Clear the fault code.			
STEP 4A: Check the repair.		**Are the temperature readings of the catalyst solution and thermometer within 5 ° F of each other?**	
STEP 4B: Clear the fault codes	**inactive.**	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Read the fault codes. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for fault codes related to the catalyst reservoir heater or catalyst temperature sensor. • Use INSITE ™ to read fault codes.	Fault Codes 1677, 1678, 1679, 1683, 1684 active? **YEA**	Diagnostic and repair diagram of the appropriate fault code.
	Fault Codes 1677, 1678, 1679, 1683, 1684 active? **NOT**	2A

STEP 2: Check the catalyst reservoir heater relay and circuit.

STEP 2A: Inspect the relay and electrical connections to the catalyst reservoir heater.

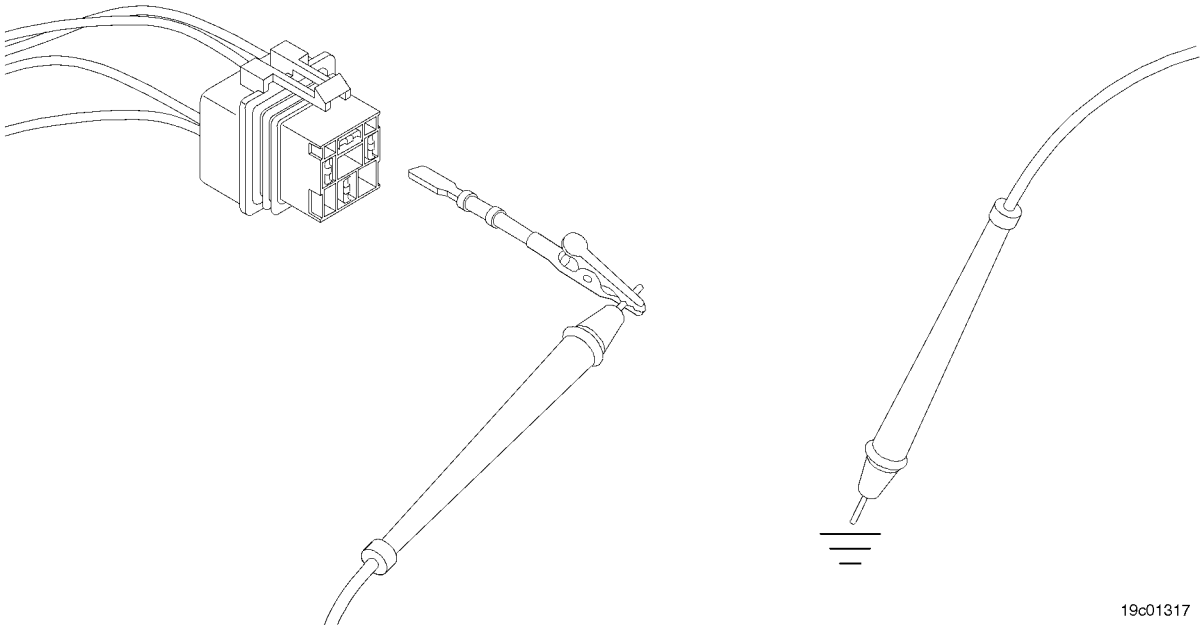
Conditions:
- Turn the ignition key off.
- Disconnect the catalyst reservoir heater relay from the engine harness.

Action	Specifications / Repair	Next step
Inspect the engine harness and the catalytic converter heater relay connections for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Damage to the wire shield • Moisture inside or over the connector • Connector seals damaged or missing • Broken connector cover • Dirt or debris on the connector pins For general inspection techniques, see Connector and Component Pin Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected in the sensor or in the harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-071 .	4A
	Dirty or damaged pins? **NOT**	2B

STEP 2B: Check for supply voltage to the catalyst reservoir heater relay. Conditions:

- Turn the ignition key off.
- Disconnect the heater relays from the catalyst reservoir from the engine harness.

Action	Specifications / Repair	Next step
Check the power supply to the catalytic converter heater relay. • Measure the voltage between the catalyst reservoir heater power pin and the block mass. Refer to the electrical diagram for identification of the connector pins.	More than +22 volts? **YEA**	2C
	More than +22 volts? **DO NOT** **REPAIR:** The catalytic converter heater power supply is not the correct one. Repair or replace the OEM wiring to the catalytic converter heater relay. Refer to the OEM fault diagnosis procedures.	4A



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STEP 2C: Check the catalyst reservoir heater wiring. Conditions:

- Turn the ignition key off.

Action	Specifications / Repair	Next step
Check the catalytic converter heater wiring between the catalytic converter heater relay and the heater. • Measure the resistance of the supply wire between the catalyst reservoir heater relay and the heater. Refer to the electrical diagram for identification of the connector pins.	Less than 10 ohms? **YEA**	2D
	Less than 10 ohms? **DO NOT** **REPAIR:** There is an open circuit between the catalyst reservoir heater relay and the heater. Repair or replace the OEM wiring between the catalyst reservoir heater relay and the heater. Refer to the OEM fault diagnosis procedures.	4A

STEP 2D: Perform the override test of the urea heater relay with INSITE ™. Conditions:

- Turn the ignition key off.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Perform the urea heater relay override test with INSITE ™. • Enable the Urea Heater Relay Override Test and check the heater relay function of the catalyst solution reservoir. A "click" should be heard.	Is the catalyst solution reservoir heater relay working correctly? **YEA**	3A
	Is the catalyst solution reservoir heater relay working correctly? **DO NOT** **REPAIR:** Remove the catalyst reservoir heater relay from the electrical harness. Check the relay pins and that the relay works correctly. Replace the catalyst reservoir heater relay.	4A

STEP 3: Check the catalyst reservoir heater.

STEP 3A: Check the catalyst reservoir heater for an open circuit. Conditions:

- Turn the ignition key off.
- Remove the heater from the catalyst reservoir. Refer to the OEM fault diagnosis manual.

Action	Specifications / Repair	Next step
Check the catalyst reservoir heater for an open circuit. • Measure the resistance of the catalyst reservoir heater coil.	Less than 10 ohms? **YEA**	1A
	Less than 10 ohms? **DO NOT** **REPAIR:** An open circuit was detected in the catalyst reservoir heater. Replace the catalyst reservoir heater. Refer to the OEM fault diagnosis manual.	4A

STEP 4: Clear the fault codes.

STEP 4A: Check the repair. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.
- Insert a thermometer into the catalyst solution reservoir.

Action	Specifications / Repair	Next step
Start the INSITE ™ Monitor / Data Logger. • Compare the temperature value of the catalyst solution read by INSITE ™ with that of the thermometer.	Are the temperature readings of the catalyst solution and thermometer within 5 ° F of each other? **YEA**	4B
	Are the temperature readings of the catalyst solution and thermometer within 5 ° F of each other? **NOT**	1A

STEP 4B: Clear the fault codes. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

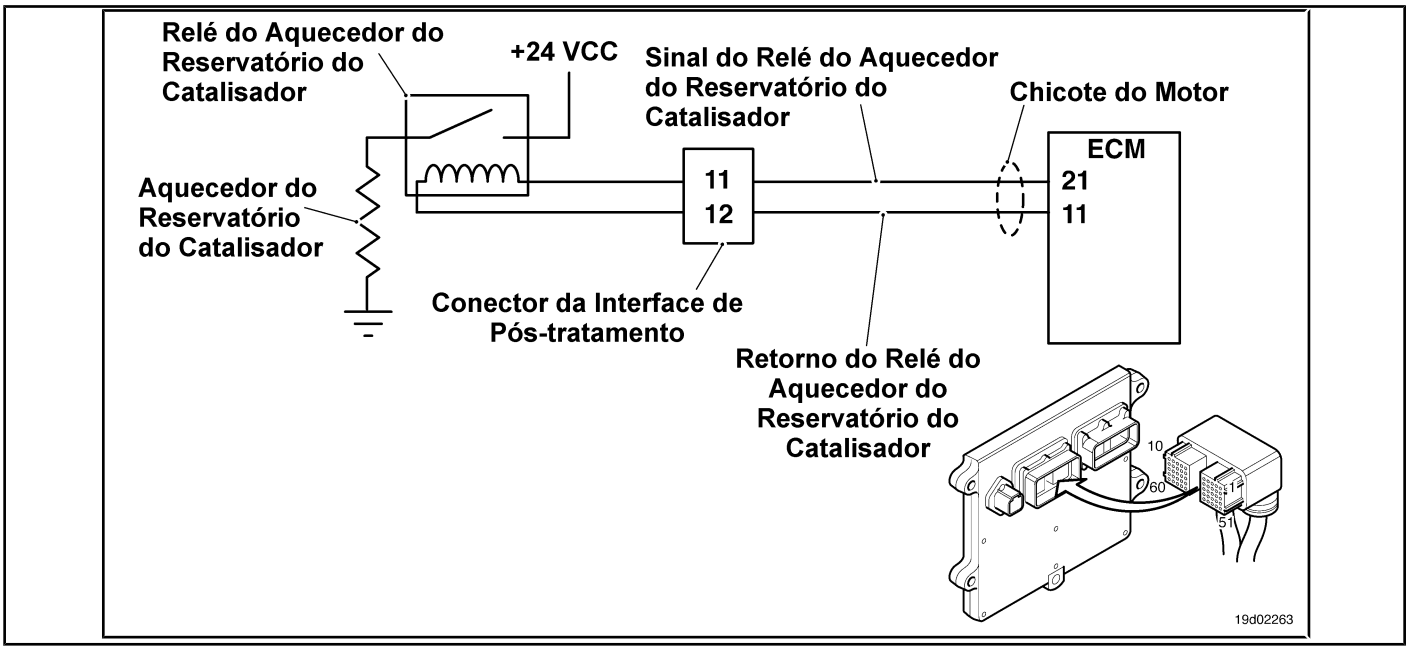
Action	Specifications / Repair	Next step
Clear the fault codes. • Use INSITE ™ to clear all active and inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **NOT**	Proper troubleshooting and repair steps

Fault Code 1713

Catalyst Reservoir Heater Circuit - Valid Data but Above Range
Normal Operating - Moderately Severe Level

CODES	REASON	IT IS MADE
Fault Code: 1713 PID (P), SID (S): IMF: 0/16 Lamp: Amber SRT:	Catalyst Reservoir Heater Circuit - Valid Data but Above Normal Operating Range - Moderately Severe Level. The catalyst reservoir heater remains on constantly.	None as to performance.

Circuit: Catalyst Reservoir Heater Relay



Circuit Descriptions:

The catalyst reservoir heater prevents freezing of the catalyst solution in the reservoir. The catalyst reservoir heater element is powered through the catalyst reservoir heater relay.

Component Location:

The catalyst reservoir heater is located in the catalyst reservoir. The location of the catalytic converter heater relays varies by OEM.

Workshop Tips:

This fault code is registered when the engine ECM detects that the catalyst reservoir heater is on (ON position) when it is commanded to be off (OFF position). Possible causes of this fault code:

- Defective catalyst solution reservoir heater relay
- Defective ECM commanding the heater to be on continuously. On-Board Diagnostic Information

(OBD):

- The ECM lights up the appropriate amber or red fault lamp when the diagnosis is run and fails.
- The ECM turns off the appropriate fault lamp when the diagnosis is successfully performed.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch /

AMP / Metri-Pack female test lead. STEPS

		SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.			
STEP 1A: Read the fault codes.		**Fault Codes 1677, 1678, 1679, 1683 or 1684 active?**	
STEP 2: Check the solution solution heater relay and circuit of the catalyst.			
STEP 2A:	**Inspect the relay and electrical connections to the catalyst solution reservoir heater.**	**Dirty or damaged pins?**	
STEP 2B: Check the heater relay of the	**catalyst solution reservoir.**	**Less than 10 ohms?**	
STEP 2C: Check the voltage	**diagnostic, supply line and heater return circuit from catalyst solution reservoir.**	**More than 6 VDC?**	
STEP 2D: Perform the relay override test	**urea warmer with INSITE ™.**	**Is the catalyst solution reservoir heater relay working correctly?**	
STEP 3: Clear the fault code.			
STEP 3A: Disable the fault code.		**Fault code 1713 inactive?**	
STEP 3B: Clear the fault codes	**inactive.**	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Read the fault codes. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for fault codes related to the catalyst reservoir heater or catalyst temperature sensor. • Use INSITE ™ to read fault codes.	Fault codes 1677, 1678, 1679, 1683 or 1684 active? **YEA**	Diagnostic and repair diagram of the appropriate fault code.
	Fault codes 1677, 1678, 1679, 1683 or 1684 active? **NOT**	2A

STEP 2: Check the solution solution heater relay and circuit of the catalyst.

STEP 2A: Inspect the relay and electrical connections to the catalyst solution reservoir heater.

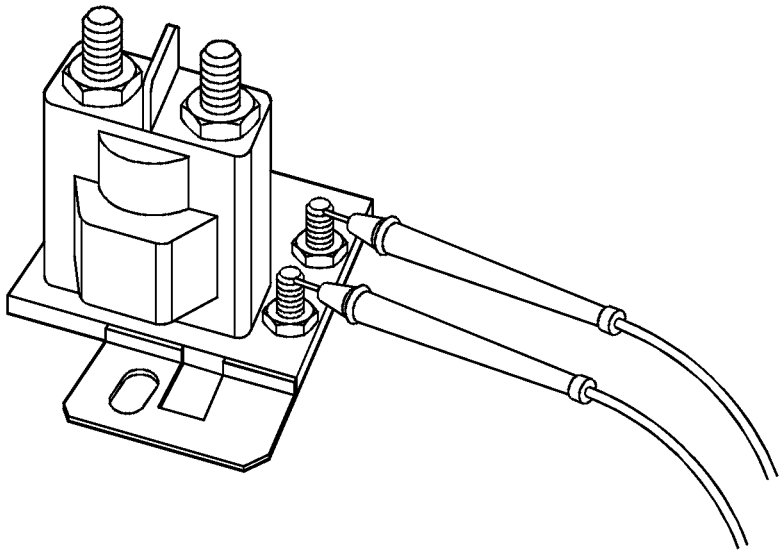
Conditions:
- Turn the ignition key off.
- Disconnect the catalyst reservoir heater relay from the engine harness.

Action	Specifications / Repair	Next step
Inspect the engine harness and the catalytic converter heater relay connections for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Damage to the wire shield • Moisture inside or over the connector • Connector seals damaged or missing • Broken connector cover • Dirt or debris on the connector pins For general inspection techniques, see Connector and Component Pin Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected in the sensor or in the harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-071 .	4A
	Dirty or damaged pins? **NOT**	2B

STEP 2B: Check the catalyst solution reservoir heater relay. Conditions:

- Turn the ignition key off.
- Disconnect the catalyst reservoir heater relay from the engine harness.

Action	Specifications / Repair	Next step
Check the resistance of the catalyst solution reservoir heater relay. • Measure the resistance between the SIGNAL and RETURN pins of the catalyst solution heater relay heater in the catalyst reservoir heater relay. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	Less than 10 ohms? **YES** **Repair:** The catalyst solution reservoir heater relay was found to be "stuck" in the closed position. Replace the catalyst solution reservoir heater relay. Refer to the OEM fault diagnosis manual.	4A
	Less than 10 ohms? **NOT**	2C



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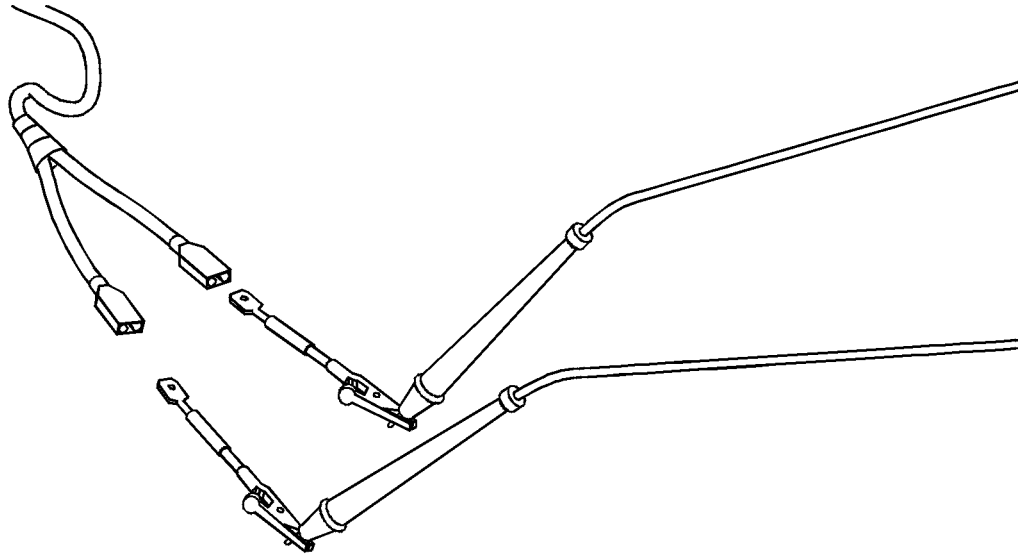
STEP 2C: Check the diagnostic voltage, the supply line and the return circuit of the catalyst solution reservoir heater.

Conditions:
- Turn the ignition key off.
- Disconnect the heater relay from the catalyst solution reservoir from the engine harness.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check the supply voltage and the heater return circuit of the catalyst solution reservoir. • Measure the resistance between the SIGNAL and RETURN pins of the catalyst solution reservoir heater relay in the engine harness. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 11 VDC? **YES** **Repair:** A defective ECM has been detected. Call for authorization. See the Procedure 019-031 .	4A
	More than 11 VDC? **NOT**	2D



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STEP 2D: Perform the override test of the urea heater relay with INSITE ™. Conditions:

- Turn the ignition key off.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Perform the urea heater relay override test with INSITE ™. • Enable the Urea Heater Relay Override Test and check the heater relay function of the catalyst solution reservoir. A "click" should be heard.	Is the catalyst solution reservoir heater relay working correctly? **YEA**	3A
	Is the catalyst solution reservoir heater relay working correctly? **DO NOT** **REPAIR:** Remove the catalyst reservoir heater relay from the electrical harness. Check the relay pins and that the relay works correctly. Replace the catalyst reservoir heater relay.	4A

STEP 3: Clear the fault code.

STEP 3A: Disable the fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Using the electronic service tool INSITE ™, make sure that the fault code is inactive.	Fault code 1713 inactive? **YEA**	3B
	Fault code 1713 inactive? **NOT**	1A

STEP 3B: Clear the inactive fault codes. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

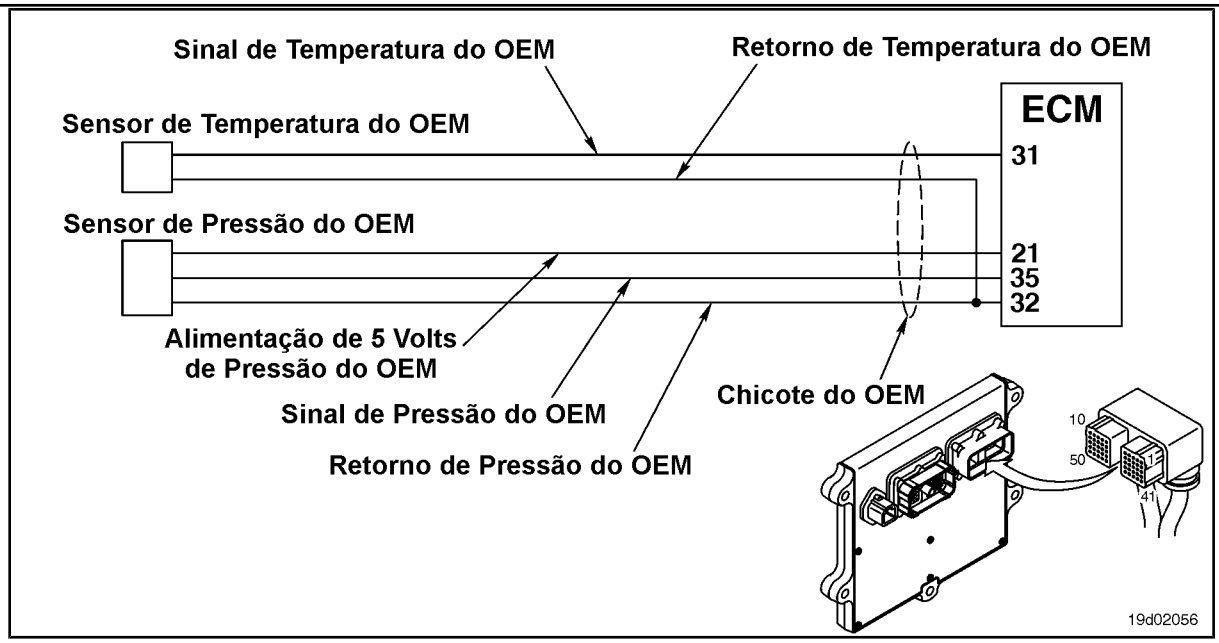
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **NOT**	Proper troubleshooting and repair steps

Fault Code 1716

Auxiliary Temperature Sensor Input Circuit 1 - Unknown Cause

CODES	REASON	IT IS MADE
Fault Code: 1716 PID (P), SID (S): IMF: 11 Lamp: No SRT:	Auxiliary Temperature Sensor Input Circuit 1 - Cause Unknown. High temperature detected by the OEM temperature sensor.	Possible engine de-powering.

OEM Temperature / Pressure Sensor Circuit



Circuit Descriptions:

The OEM has the option of connecting the input of a temperature sensor to the Cummins ECM. A calibration is then created to recognize the input from that temperature sensor. This fault code is activated when the OEM sensor temperature input exceeds the motor protection limit set by the OEM. Depending on the OEM's requirements, an Engine Protection de-powering may be associated with this fault code.

Component Location:

The OEM pressure or temperature sensor input varies depending on the application. Refer to the OEM fault diagnosis manual for the location of the sensor.

Workshop Tips:

This fault code is activated when the OEM sensor temperature input exceeds the motor protection limit set by the OEM. Engine de-powering is possible depending on the OEM application. On-Board Diagnostic Information (OBD):

- The ECM lights up the appropriate amber or red fault lamp when the diagnosis is performed and fails
- The ECM turns off the appropriate fault lamp when the diagnosis is successfully performed.

SUMMARY OF FAULT DIAGNOSTICS

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check the Fault Code 1716 is registered.	**Fault Code active or inactive 1716 counts?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Check that Fault Code 1716 is registered. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

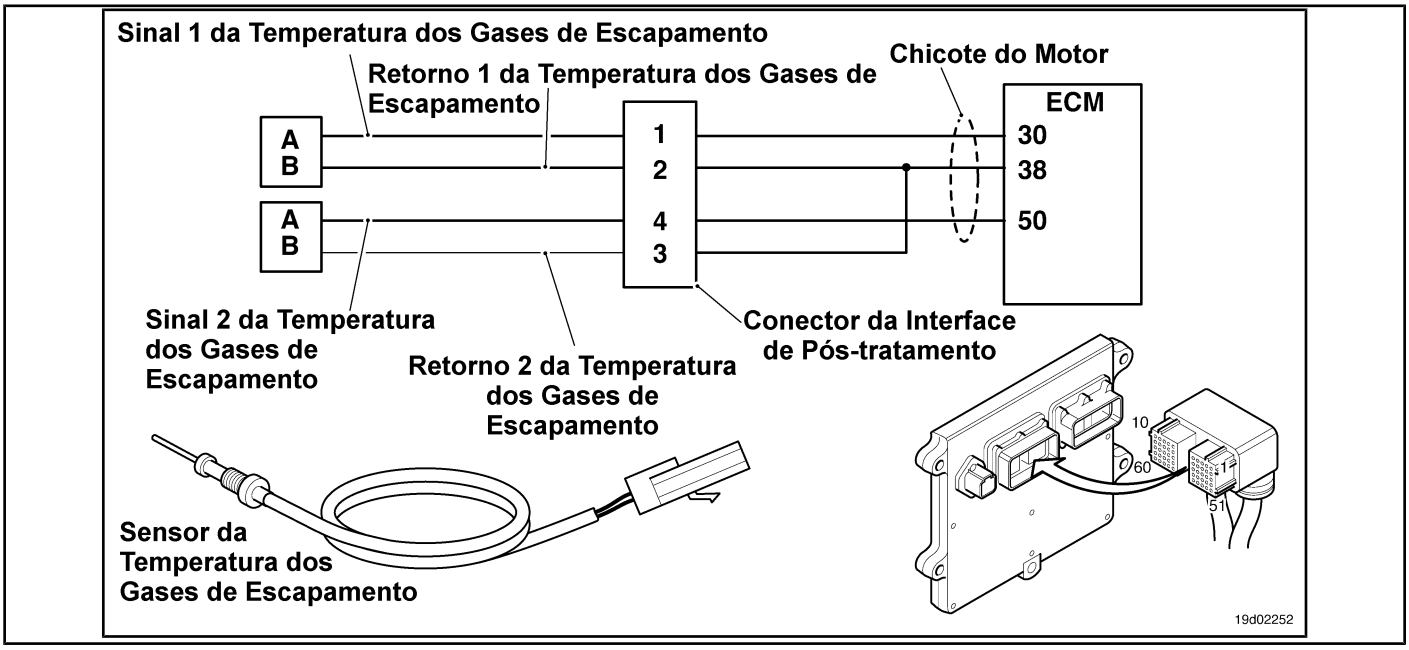
Action	Specifications / Repair	Next step
Check for an inactive fault code. • Using INSITE ™, read the fault codes. Active or inactive Code Failed 1716	Fault Code active or inactive 1716 counts? **YES** **Repair:** The motor protection limit has been exceeded for the pressure or temperature input provided by the OEM. Refer to the OEM fault diagnosis manual.	OEM fault diagnosis manual
	Fault Code active or inactive 1716 counts? **NOT**	Complete repair

Fault Code 1717

Exhaust Gas Temperature 1 - Valid Data but Above Normal Range
Operation - Less Severe Level

CODES	REASON	IT IS MADE
Fault Code: 1717 PID (P), SID (S): IMF: 0/15 Lamp: No SRT:	Exhaust Gas Temperature 1 - Valid Data but Above Normal Operating Range - Less Severe Level. High catalyst inlet temperature detected.	Possible engine de-powering.

Circuit: Exhaust Gas Temperature 1



Circuit Descriptions:

Exhaust gas temperature sensor No. 1 is used by the electronic control module (ECM) to monitor the temperature of the engine exhaust gases entering the catalyst unit. The ECM monitors the voltage at the signal pin and converts it to a temperature value.

Component Location:

The catalyst exhaust gas temperature sensor No. 1 is located in the after-treatment system. It is located between the outlet of the turbocharger and the entry of the catalytic converter unit into the exhaust system.

Workshop Tips:

This fault is triggered when the temperature at the outlet of the catalyst inlet exceeds the maximum temperature allowed for a given motor rating. Leaks in the air-to-air cooler system or a defective turbocharger can cause high exhaust gas temperatures. On-Board Diagnostic Information (OBD):

- The ECM lights up the appropriate amber or red fault lamp when the diagnosis is run and fails.
- The ECM turns off the appropriate fault lamp when the diagnosis is successfully performed.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch /

AMP / Metri-Pack female test lead. STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check for sensor circuit fault codes.		
STEP 1A: Check the Fault Codes 1665 and 1666 are registered.	**Are Fault Codes 1665 or 1666 active?**	
STEP 2: Check that the operation of the air component system is correct.		
STEP 2A: Check the air-to-air cooler, the clamps, hoses and tubing.	**Is there an air leak or are the clamps loose?**	
STEP 2B: Inspect the compressor and turbocharger turbine blades.	**Any damage found to the turbocharger blades?**	
STEP 3: Inspect the exhaust gas temperature sensor No. 1.		
STEP 3A: Inspect the exhaust gas temperature sensor No. 1.	**Is the No. 1 exhaust gas temperature sensor damaged?**	
STEP 4: Clear the fault codes.		
STEP 4A: Disable the fault code.	**Fault code 1717 inactive?**	
STEP 4B: Clear the fault codes.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check for sensor circuit fault codes.

STEP 1A: Check that Fault Codes 1665 and 1666 are registered. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for active fault codes. • Use INSITE ™ to read fault codes. Fault Codes 1665 or 1666 are active?	**YEA**	Fault diagnosis diagram for Fault Code 1665 or 1666.
	Are Fault Codes 1665 or 1666 active? **NOT**	2A

STEP 2: Check that the operation of the air component system is correct.

STEP 2A: Check the air-to-air cooler, clamps, hoses and piping. Conditions:

- Turn the ignition key off.

Action	Specifications / Repair	Next step
Check for leaks in the air-to-air cooler, hoses and piping. • Check that the clamp torque is correct.	Are there air leaks or loose clamps? **YEA**	2B
	Are there air leaks or loose clamps? **DO NOT** **REPAIR:** Repair air leaks.	4A

STEP 2B: Inspect the compressor and turbocharger turbine blades.

Conditions:
- Turn the ignition key off.
- Remove the intake and exhaust connections from the turbocharger.

Action	Specifications / Repair	Next step
Inspect the turbocharger compressor and turbine blades for damage. • Refer to Procedure 010-033.	Any damage found to the turbocharger blades? **YEA**	3A
	Any damage found to the turbocharger blades? **DO NOT** **REPAIR:** Replace the turbocharger. Refer to Procedure 010-033.	4A

STEP 3: Inspect the exhaust gas temperature sensor No. 1.

STEP 3A: Inspect the exhaust gas temperature sensor No. 1.

Conditions:
- Turn the ignition key off.
- Remove exhaust gas temperature sensor No. 1 from the exhaust system.

Action	Specifications / Repair	Next step
Inspect the exhaust gas temperature sensor No. 1. • Inspect the exhaust gas temperature sensor No. 1 for damage or signs of excessively high temperature.	Is the No. 1 exhaust gas temperature sensor damaged? **YEA**	4A
	Is the No. 1 exhaust gas temperature sensor damaged? **DO NOT** **REPAIR:** Replace the exhaust gas temperature sensor No. 1. See the Procedure 019-013 .	4A

STEP 4: Clear the fault code.

STEP 4A: Disable the fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Using INSITE ™, make sure that the fault code is inactive.	Fault code 1717 inactive? **YEA**	4B
	Fault code 1717 inactive? **NOT**	1A

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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

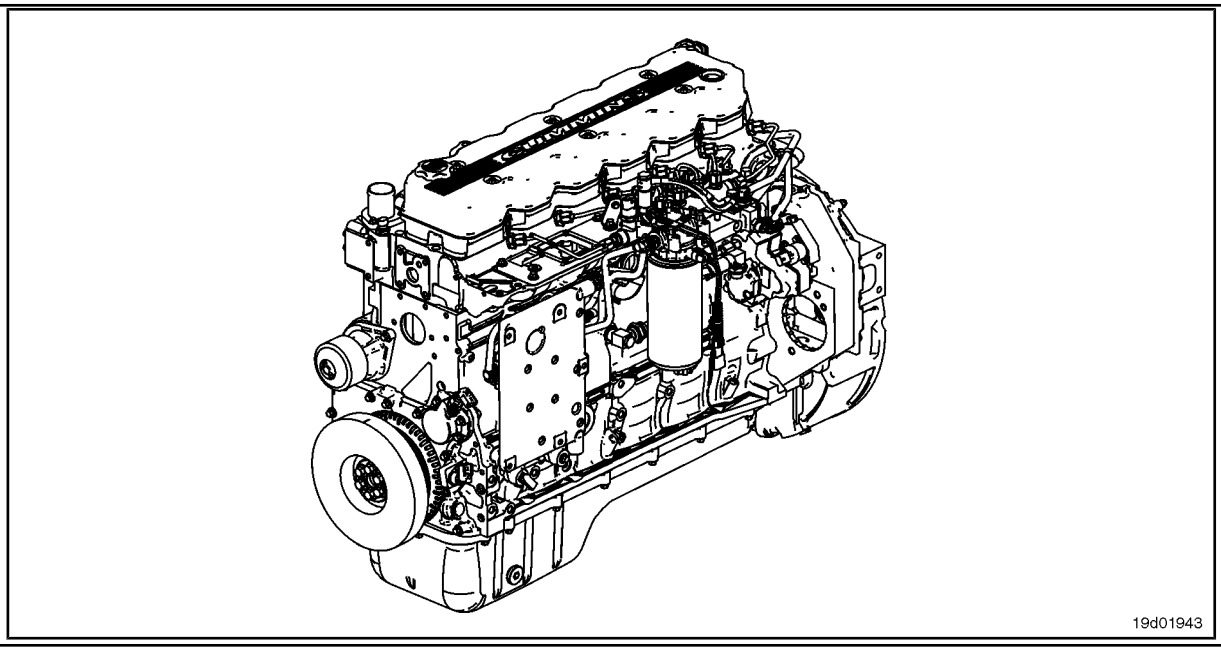
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **NOT**	Proper troubleshooting and repair steps

Fault Code 1718

Engine Starting Failure for Multiple Cylinders - Existing Condition.

CODES	REASON	IT IS MADE
Fault Code: 1718 PID (P), SID (S): IMF: 11/31 Lamp: Amber SRT:	Engine Starting Failure for Multiple Cylinders - Existing Condition. Engine misfire detected on several cylinders.	Possible loss of power, irregular idle or failure to start.

Circuit



Circuit Descriptions:

An ECM calibration algorithm monitors engine speed as each injector is fired while the engine is idling. If a cylinder has a high or low contribution to the engine speed, this fault code becomes active. The purpose of this failure is to assist in the diagnosis of performance failures such as failure to start and loss of engine power.

Component Location:

The ECM is located on the intake side of the engine. See the Procedure 100-002 (Engine Diagrams) in Section E for details on component locations.

Workshop Tips:

If Fault Code 1718 is inactive in the ECM's memory and there are no problems with power loss or failure to start the engine, the possible cause of the failure may be an intermittent event, such as the presence of air in the fuel system after an exchange of filters. Fault Code 1718 counts should be ignored unless there are other performance symptoms. The engine coolant temperature must be greater than 160 ° F for this diagnosis to be performed. Causes of cylinder misfire include:

- Valve clearance out of specification (compare actual valve clearance with readjustment limits)
- Cylinder failure (check for high engine blowing when the engine is under load)
- Valve failure or valve kept open (check if the valve produces a "cicada" noise at the intake)

- Cylinder or gasket head failure (look for signs of oil, coolant or molten material residues in the intake or exhaust passages)
- Extreme wear on the camshaft (check if camshaft bosses are worn)
- Extra, missing or damaged sealing washer under an injector
- Injector failures (switch injectors to see if the problem "follows" the suspected injector). On-Board Diagnostic Information

(OBD):

- The ECM will illuminate the malfunction indicator lamp (MIL) when the diagnosis is performed and fails.
- The ECM will turn off the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles in which the diagnosis is performed and not failure. The MIL lamp and the fault code can also be cleared with the electronic service tool INSITE ™.
- The fault code will be cleared from memory after 40 consecutive driving cycles in which the diagnosis is performed and approved.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch /

AMP / Metri-Pack female test lead. STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Read the fault codes.	**Fault codes related to the fuel system or accumulated inactive code counts?**	
STEP 1B: Check the cylinder for misfire.	**Was the cylinder misfire detected?**	
STEP 2: Run the diagnostic tests.		
STEP 2A: Perform the cylinder cut test.	**Was the cylinder misfire detected and was the failure isolated to the injector?**	
STEP 3: Clear the fault code.		
STEP 3A: Check the repair.	**Does the cylinder misfire still persist?**	
STEP 3B: Clear the fault codes.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Read the fault codes. Conditions:

- Connect the electronic service tool INSITE ™.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Read the fuel system fault codes. • Start the engine and let it run at idle for 1 minute. • Use INSITE ™ to read fault codes.	Fault codes related to the fuel system or accumulated inactive code counts? **YEA**	Diagnostic and repair diagram of the appropriate fault code.
	Fault codes related to the fuel system or accumulated inactive code counts? **NOT**	1B

STEP 1B: Check the cylinder for misfire. Conditions:

- Turn the ignition key ON.
- Start the engine and let it run at idle.

Action	Specifications / Repair	Next step
Check the engine for smoke emission, oscillation, irregular idling or misfire. • Check the engine for black or white smoke emission, oscillation, irregular idling, or ignition failure at idle, maximum idle speed and during quick throttle starts.	Is it possible to detect a cylinder misfire? **YEA**	2A
	Is it possible to detect a cylinder misfire? **NOT**	3A

STEP 2: Run the diagnostic tests.

STEP 2A: Perform the cylinder cut test. Conditions:

- Turn on the ignition key.
- Allow the engine to idle.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Use the INSITE ™ Cylinder Cut Test to determine if multiple cylinders are misfiring. • Cut individual cylinders to locate the misfired cylinder.	Was the cylinder misfire detected and was the failure isolated to the injector? **YES** **Repair:** A defective injector has been detected. Replace the defective injector. See Procedure 006-026.	3A
	Was the cylinder misfire detected and was the failure isolated to the injector? **DO NOT** **REPAIR:** Check for other sources of cylinder misfire, such as: valve clearance out of adjustment, cylinder failure, valve failure, cylinder head or gasket failure, or extreme wear on the camshaft.	Appropriate fault diagnosis procedures.

STEP 3: Clear the fault code.

STEP 3A: Check the repair. Conditions:

- Connect all components
- Turn on the ignition key.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Make sure that the cylinder misfire does not persist. • Start the engine and make sure that the cylinder misfire no longer exists.	Does the cylinder misfire still persist? **YEA**	1A
	Does the cylinder misfire still persist? **NOT**	3B

STEP 3B: Clear the fault codes. Conditions:

- Connect all components
- Turn on the ignition key.
- Connect the electronic service tool INSITE ™.

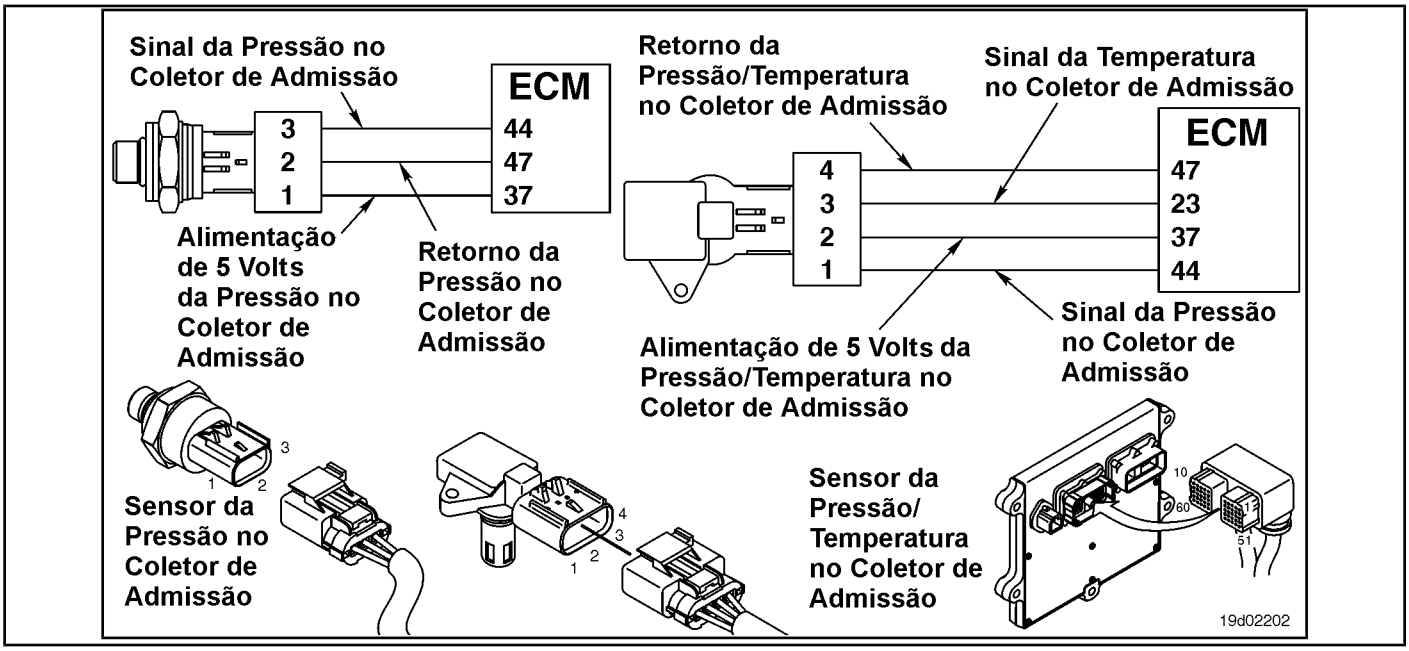
Action	Specifications / Repair	Next step
Clear the fault codes. • Use the electronic INSITE ™ service tool to clear all active and inactive fault codes.	All codes cleared? **YEA**	Complete repair?
	All codes cleared? **NOT**	Proper troubleshooting and repair steps.

Fault Code 1848

Intake Manifold Temperature 1 - Abnormal Rate of Change

CODES	REASON	IT IS MADE
Fault Code: 1848 PID (P), SID (S): P105 IMF: 10 Lamp: Amber SRT:	Temperature 1 in the Intake Manifold - Abnormal Rate of Change. The temperature sensor in the intake manifold is not responding to a change in engine operating conditions.	The ECM will estimate the temperature at the engine intake manifold.

Circuit: Temperature 1 at the Intake Manifold



Circuit Descriptions:

The temperature sensor in the engine intake manifold is used by the ECM to monitor the temperature in the engine intake manifold. The ECM monitors the voltage at the signal pin and converts it to a temperature value. The temperature value in the engine intake manifold is used by the ECM for the engine's emission protection and control system.

Component Location:

The temperature sensor on the engine intake manifold is located on the air intake manifold. See the Procedure 100-002 (Engine Diagrams) in Section E for details on component locations.

Workshop Tips:

The temperature in the engine intake manifold is monitored while the engine is warming up. If the temperature reading on the engine intake manifold is not changed according to the operating conditions of the engine, the temperature sensor on the engine intake manifold will be "stuck" in the operating range and this fault code will be logged. The ECM **should not** detect engine rotation for a period of eight hours before performing this diagnosis.

Possible causes of this fault code:

- Temperature sensor in the engine intake manifold "stuck" in the operating range.

- High resistance in the signal and return lines of the temperature sensor in the engine intake manifold. On-Board Diagnostic Information

(OBD):

- The ECM will light the malfunction indicator lamp (MIL) for the second consecutive ignition cycle when the diagnosis is performed and fails.
- The ECM will turn off the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles in which the diagnosis is performed and **not** failure. The MIL lamp and the fault code can also be cleared with the electronic service tool INSITE ™.
- The fault code will be cleared from memory after 40 consecutive driving cycles in which the diagnosis is performed and approved.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch /

AMP / Metri-Pack female test lead. STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check for sensor circuit fault codes.		
STEP 1A: Check for fault codes active.	**Is fault code 1848 active?**	
STEP 1B: Check for fault codes.	**Are Fault Codes 153 or 154 active?**	
STEP 2: Check the circuit and temperature sensor on the intake manifold of the motor.		
STEP 2A: Check the sensor of the temperature in the engine intake manifold and the connector pins.	**Dirty or damaged pins?**	
STEP 2B: Check the circuit response.	**Fault Code 153 active?**	
STEP 2C: Check the circuit response.	**Fault Code 154 active?**	
STEP 3: Check the ECM and the engine harness.		
STEP 3A: Inspect the pins of the engine harness and ECM connectors.	**Dirty or damaged pins?**	
STEP 3B: Check the circuit response.	**Fault Code 153 active?**	
STEP 3C: Check the circuit response.	**Fault Code 154 active?**	
STEP 4: Clear the fault codes.		
STEP 4A: Check the repair.	**Are the inlet and outlet temperature readings on the intake manifold within 10 ° F of each other?**	
STEP 4B: Clear the fault codes.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check for sensor circuit fault codes.

STEP 1A: Check for active fault codes. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for active fault codes. • Use INSITE ™ to read fault codes. Fault code 1848 active?	**YEA**	1B
	Fault code 1848 active? **NOT**	4A

STEP 1B: Check that Fault Codes 153 and 154 are registered. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for active fault codes. • Use INSITE ™ to read fault codes. Fault Codes 153 or 154 areactive?	**YEA**	Diagnostic and repair diagram of the appropriate fault code.
	Are Fault Codes 153 or 154 active? **NOT**	2A

STEP 2: Check the circuit and temperature sensor on the engine intake manifold.

STEP 2A: Check the temperature sensor on the engine intake manifold and the connector pins. Conditions:

- Turn the ignition key off.
- Disconnect the air temperature sensor on the engine intake manifold from the engine harness.

Action	Specifications / Repair	Next step
Inspect the temperature sensor connector pins on the engine intake manifold and engine harness for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Damage to the wire shield • Moisture inside or over the connector • Connector seals damaged or missing • Broken connector cover • Dirt or debris on the connector pins For general inspection techniques, see Connector and Component Pin Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected in the sensor or in the harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-071 .	4A
	Dirty or damaged pins? **NOT**	2B

STEP 2B: Check the circuit response. Conditions:

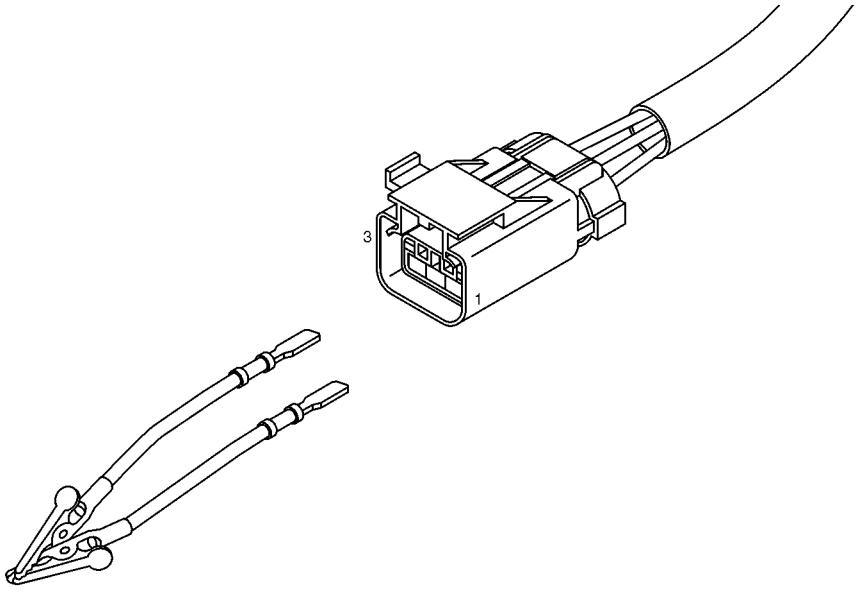
- Turn the ignition key off.
- Disconnect the air temperature sensor on the engine intake manifold from the engine harness.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an appropriate ECM response after 30 seconds. • Use INSITE ™ to read fault codes. Note: Fault Code 123 will also be activated when the temperature sensor on the intake manifold is disconnected.	Fault Code 153 active? **YEA**	2C
	Fault Code 153 active? **NOT**	3A

STEP 2C: Check the circuit response. Conditions:

- Turn the ignition key off.
- Disconnect the air temperature sensor on the engine intake manifold from the engine harness.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Install a bridge wire between the SIGNAL and RETURN pins of the temperature sensor on the engine intake manifold, on the temperature connector on the engine intake manifold on the engine harness. Refer to the electrical diagram for identification of the connector pins. Check for proper circuit response after 30 seconds. • Use INSITE ™ to read fault codes.	Fault Code 154 active? **YES** **Repair:** An out of range fault was detected in the temperature sensor in the intake manifold. Replace the temperature sensor on the engine intake manifold. See the Procedure 019-059 .	4A
	Fault Code 154 active? **NOT**	3A



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STEP 3: Check the ECM and the engine harness.

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

Conditions:
- Turn the ignition key off.
- Disconnect the engine harness from the ECM connector.

Action	Specifications / Repair	Next step
Check that the pins on the engine harness and ECM connectors have: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Damage to the wire shield • Moisture inside or over the connector • Connector seals damaged or missing • Broken connector cover • Dirt or debris on the connector pins For general inspection techniques, see Connector and Component Pin Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection has been detected in the ECM connector or the motor harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-043.	4A
	Dirty or damaged pins? **NOT**	3B

STEP 3B: Check the circuit response. Conditions:

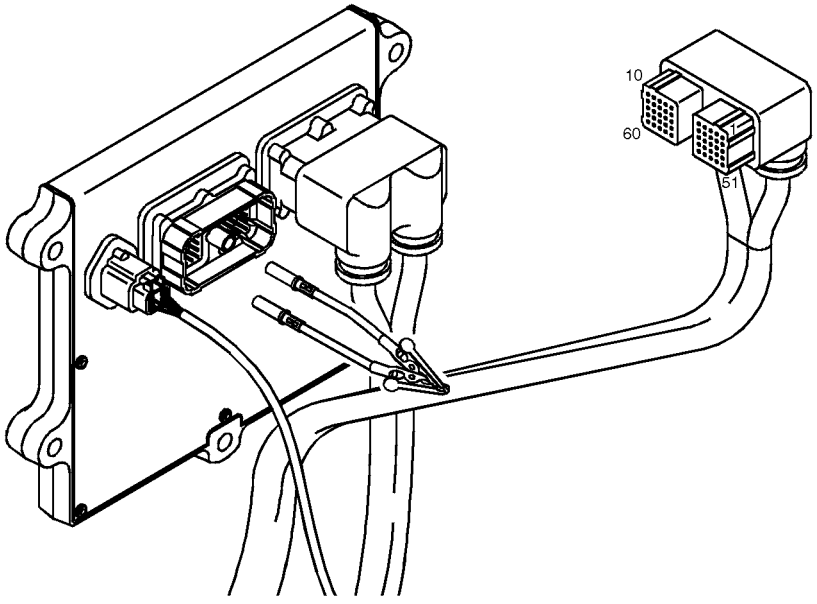
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Use INSITE ™ to read fault codes.	Fault Code 153 active? **YEA**	3C
	Fault Code 153 active? **DO NOT** **REPAIR:** Call for pre-authorization. Replace the ECM. See the Procedure 019-031 .	4A

STEP 3C: Check the circuit response. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Install a jumper wire between the SIGNAL and RETURN pins of the temperature sensor on the engine intake manifold on the ECM connector. Check for proper circuit response after 30 seconds. • Use INSITE ™ to read fault codes.	Fault Code 154 active? **YES** **Repair:** High resistance or a short circuit was detected in the engine harness. Repair or replace the engine harness. See the Procedure 019-043 .	4A
	Fault Code 154 active? **DO NOT** **REPAIR:** Call for pre-authorization. Replace the ECM. See the Procedure 019-031 .	4A



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STEP 4: Clear the fault code.

STEP 4A: Check the repair. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Start the INSITE ™ Monitor / Data Logger. • Compare the INSITE ™ reading of the temperature in the intake manifold and the inlet temperature of the catalyst.	Are the inlet and outlet temperature readings on the intake manifold within 10 ° F of each other? **YEA**	4B
	Are the inlet and outlet temperature readings on the intake manifold within 10 ° F of each other? **NOT**	1A

STEP 4B: Clear the fault codes. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

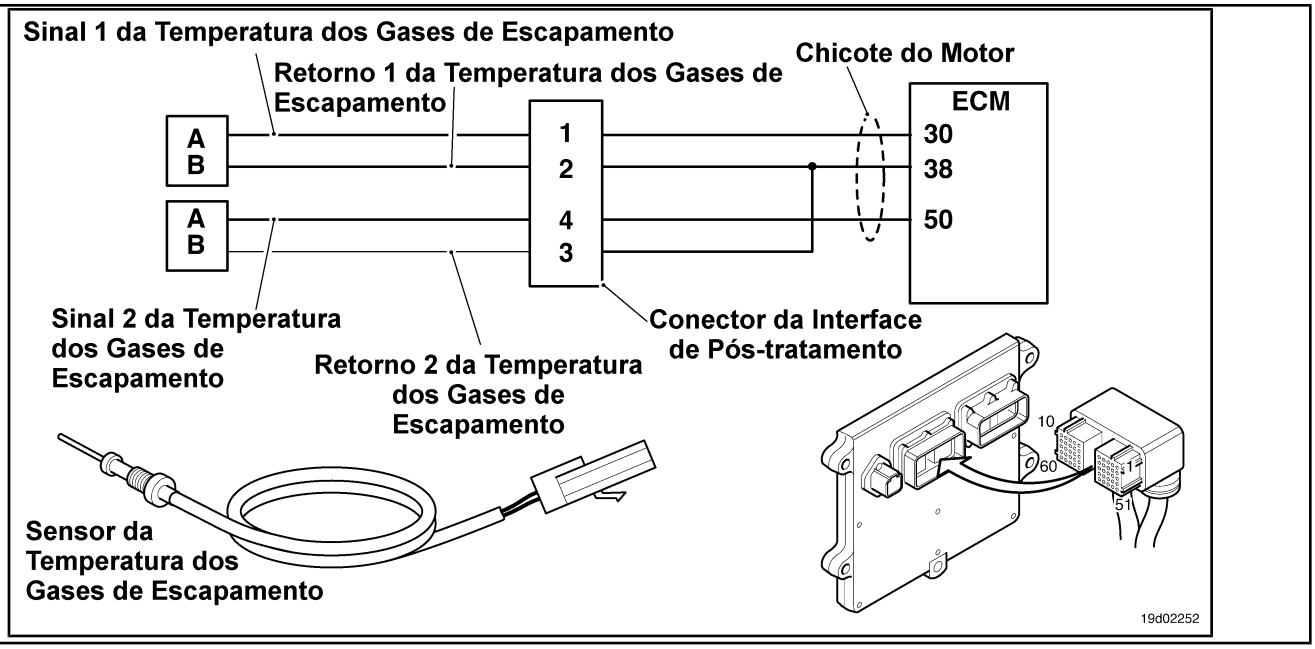
Action	Specifications / Repair	Next step
Clear the fault codes. • Use the electronic INSITE ™ service tool to clear all active and inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **NOT**	Proper troubleshooting and repair steps

Fault Code 1849

Exhaust Gas Temperature 1 - Abnormal Rate of Change

CODES	REASON	IT IS MADE
Fault Code: 1849 PID (P), SID (S): IMF: 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.	Possible non-compliance with emission standards. The standard value of the inlet temperature of the catalyst is used.

Circuit: Exhaust Gas Temperature 1



Circuit Descriptions:

Exhaust gas temperature sensor No. 1 is used by the electronic control module (ECM) to monitor the temperature of the engine exhaust gases entering the catalyst unit. The ECM monitors the voltage at the signal pin and converts it to a temperature value.

Component Location:

The catalyst inlet temperature sensor 1 is located in the after-treatment system. It is located between the outlet of the turbocharger and the entry of the catalytic converter unit into the exhaust system.

Workshop Tips:

The exhaust gas temperature 1 is monitored while the engine is warming up. If the exhaust gas temperature 1 reading does not change according to the engine's operating conditions, the exhaust gas temperature 1 sensor will be "stuck" in the operating range and this fault code will be recorded. The ECM must not detect engine rotation for a period of eight hours before performing this diagnosis. Possible causes of this fault code:

- Exhaust gas temperature sensor 1 reading "stuck" in the operating range
- High resistance in the signal and return lines of the exhaust gas temperature 1 sensor.

On-Board Diagnostic Information (OBD):

- The ECM will light the malfunction indicator lamp (MIL) for the second consecutive ignition cycle when the diagnosis is performed and fails.
- The ECM will turn off the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles in which the diagnosis is performed and not failure. The MIL lamp and the fault code can also be cleared with the electronic service tool INSITE ™.
- The fault code will be cleared from memory after 40 consecutive driving cycles in which the diagnosis is performed and approved.

SUMMARY OF FAULT DIAGNOSTICS

⚠PRECAUTION ⚠

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

⚠PRECAUTION ⚠

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch /

AMP / Metri-Pack female test lead. STEPS

		SPECIFICATIONS	SRT CODE
STEP 1: Check for sensor circuit fault codes.			
STEP 1A: Check the Fault Codes	**1665 and 1666 are registered.**	**Are Fault Codes 1665 or 1666 active?**	
STEP 2: Check the circuit and the No. 1 exhaust gas temperature sensor.			
STEP 2A:	**Inspect exhaust gas temperature sensor No. 1 and connector pins.**	**Dirty or damaged pins?**	
STEP 2B: Check the circuit response.		**Fault code 1666 active?**	
STEP 2C: Check the circuit response.		**Fault code 1665 active?**	
STEP 3: Check the ECM and the engine harness.			
STEP 3A:	**Inspect the pins of the engine harness and ECM connectors.**	**Dirty or damaged pins?**	
STEP 3B: Check the circuit response.		**Fault code 1666 active?**	
STEP 3C: Check the circuit response.		**Fault code 1665 active?**	
STEP 4: Clear the fault codes.			
STEP 4A: Check the repair.		**Are the temperature readings at the inlet and outlet of the catalyst within the 25 ° F range between them?**	
STEP 4B: Clear the fault codes.		**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check for sensor circuit fault codes.

STEP 1A: Check that Fault Codes 1665 and 1666 are registered. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for active fault codes. • Use INSITE ™ to read fault codes. Fault Codes 1665 or 1666 are active?	**YEA**	Fault diagnosis diagram for Fault Code 1665 or 1666.
	Are Fault Codes 1665 or 1666 active? **NOT**	2A

STEP 2: Check the circuit and the No. 1 exhaust gas temperature sensor.

STEP 2A: Inspect exhaust gas temperature sensor No. 1 and connector pins.

Conditions:

- Turn the ignition key off.
- Disconnect the No. 1 exhaust gas temperature sensor from the engine harness.

Action	Specifications / Repair	Next step
Check the engine harness and exhaust gas temperature sensor No. 1 for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Damage to the wire shield • Moisture inside or over the connector • Connector seals damaged or missing • Broken connector cover • Dirt or debris on the connector pins For general inspection techniques, see Connector and Component Pin Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected in the sensor or in the harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-071 .	4A
	Dirty or damaged pins? **NOT**	2B

STEP 2B: Check the circuit response. Conditions:

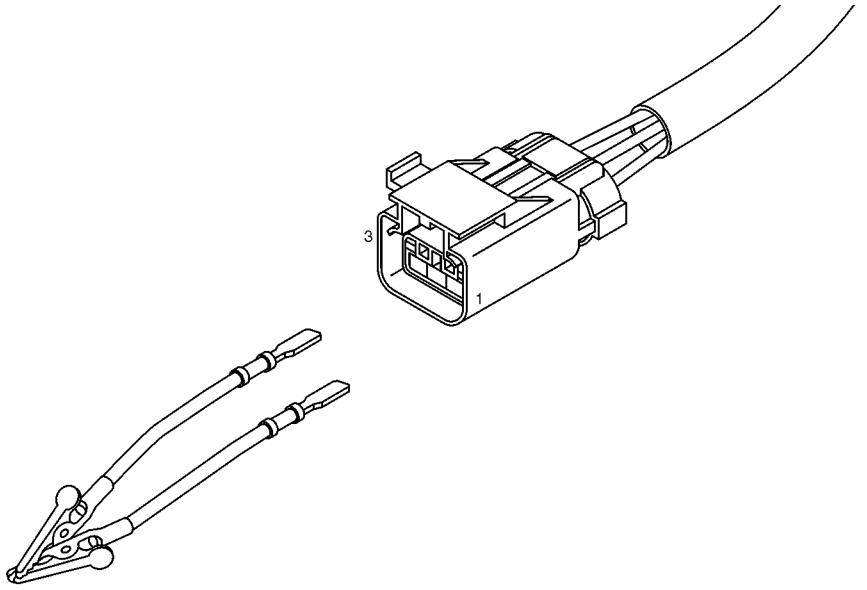
- Turn the ignition key off.
- Disconnect the No. 1 exhaust gas temperature sensor from the engine harness.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an appropriate ECM response after 30 seconds. • Use INSITE ™ to read fault codes.	Fault code 1666 active? **YEA**	2C
	Fault code 1666 active? **NOT**	3A

STEP 2C: Check the circuit response. Conditions:

- Turn the ignition key off.
- Disconnect the No. 1 exhaust gas temperature sensor from the engine harness.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Install a bridge wire between the SIGNAL and RETURN pins of the exhaust gas temperature sensor 1, on the engine harness connector. Refer to the electrical diagram for identification of the connector pins. Check for proper circuit response after 30 seconds.	Fault code 1665 active? **YES** **Repair:** Replace the exhaust gas temperature sensor No. 1. See the Procedure 019-013 .	4A
• Use INSITE ™ to read fault codes.	Fault code 1665 active? **NOT**	3A



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STEP 3: Check the ECM and the engine harness.

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

Conditions:
- Turn the ignition key off.
- Disconnect the engine harness from the ECM connector.

Action	Specifications / Repair	Next step
Check that the pins on the engine harness and ECM connectors have: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Damage to the wire shield • Moisture inside or over the connector • Connector seals damaged or missing • Broken connector cover • Dirt or debris on the connector pins For general inspection techniques, see Connector and Component Pin Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection has been detected in the ECM connector or the motor harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-043 .	4A
	Dirty or damaged pins? **NOT**	3B

STEP 3B: Check the circuit response. Conditions:

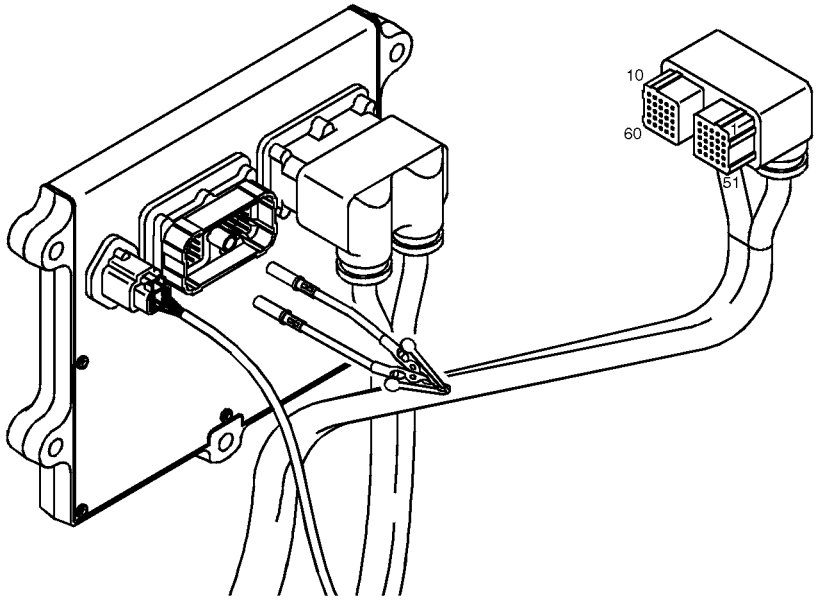
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Use INSITE ™ to read fault codes.	Fault code 1666 active? **YEA**	3C
	Fault code 1666 active? **DO NOT** **REPAIR:** Call for pre-authorization. Replace the ECM. See the Procedure 019-031 .	4A

STEP 3C: Check the circuit response. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Install a jumper wire between the SIGNAL and RETURN pins of the exhaust gas temperature sensor 1, on the ECM connector. Check for proper circuit response after 30 seconds. • Use INSITE ™ to read fault codes.	Fault code 1665 active? **YES** **Repair:** High resistance or a short circuit was detected in the engine harness. Repair or replace the engine harness. See the Procedure 019-043 .	4A
	Fault code 1665 active? **DO NOT** **REPAIR:** Call for pre-authorization. Replace the ECM. See the Procedure 019-031 .	4A



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STEP 4: Clear the fault code.

STEP 4A: Check the repair. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Start the INSITE ™ Monitor / Data Logger. • Compare the INSITE ™ readings for the catalyst inlet and outlet temperatures.	Are the temperature readings at the inlet and outlet of the catalyst within the 25 ° F range between them? **YEA**	4B
	Are the temperature readings at the inlet and outlet of the catalyst within the 25 ° F range between them? **NOT**	1A

STEP 4B: Clear the fault codes. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

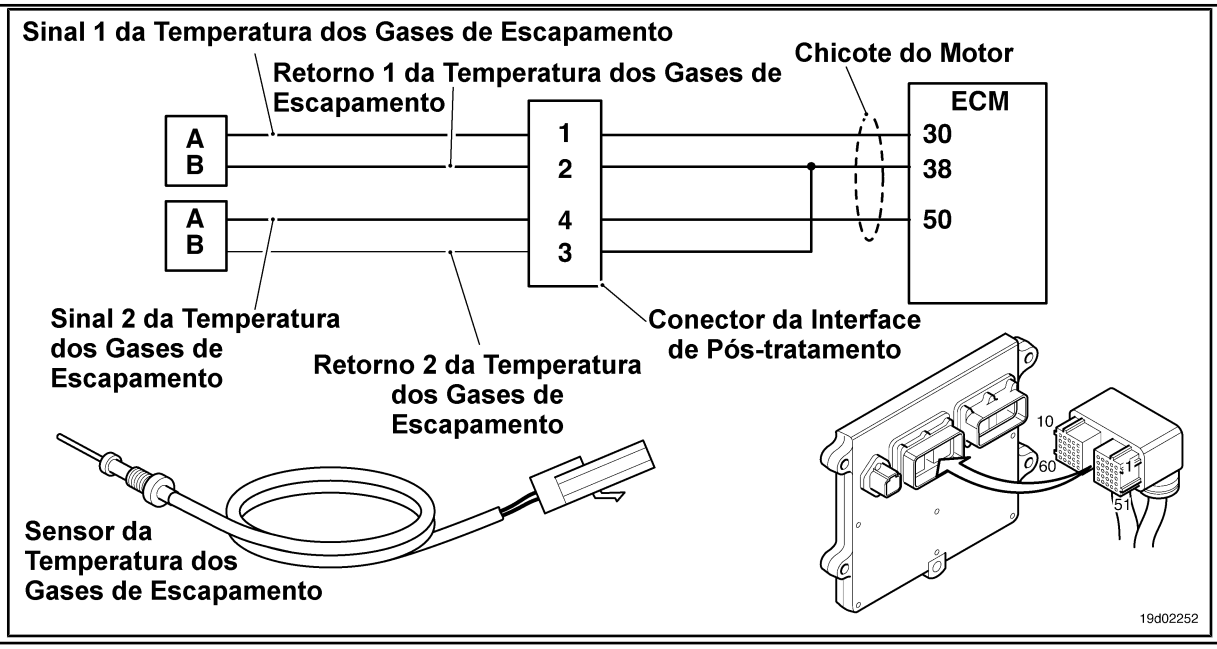
Action	Specifications / Repair	Next step
Clear the fault codes. • Use the electronic INSITE ™ service tool to clear all active and inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **NOT**	Proper troubleshooting and repair steps

Fault Code 1851

Exhaust Gas Temperature 2 - Abnormal Rate of Change

CODES	REASON	IT IS MADE
Fault Code: 1851 PID (P), SID (S): IMF: 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.	Possible non-compliance with emission standards. The standard catalyst outlet temperature value was used.

Circuit: Exhaust Gas Temperature 2



Circuit Descriptions:

Exhaust gas temperature sensor No. 2 is used by the electronic control module (ECM) to monitor the temperature of the engine exhaust gases entering the catalyst unit. The ECM monitors the voltage at the signal pin and converts it to a temperature value.

Component Location:

The catalyst inlet temperature sensor 2 is located in the after-treatment system. It is located between the outlet of the turbocharger and the outlet of the catalyst unit in the exhaust system.

Workshop Tips:

The exhaust gas temperature 2 is monitored while the engine is warming up. If the exhaust gas temperature 2 reading does not change according to the engine's operating conditions, the exhaust gas temperature 2 sensor will be "stuck" in the operating range and this fault code will be recorded. The ECM must not detect engine rotation for a period of eight hours before performing this diagnosis. Possible causes of this fault code:

- Exhaust gas temperature sensor 2 reading "stuck" in the operating range.
- High resistance in the exhaust gas temperature 2 sensor signal and return lines.

On-Board Diagnostic Information (OBD):

- The ECM will light the malfunction indicator lamp (MIL) for the second consecutive ignition cycle when the diagnosis is performed and fails.
- The ECM will turn off the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles in which the diagnosis is performed and **not** failure. The MIL lamp and the fault code can also be cleared with the electronic service tool INSITE ™.
- The fault code will be cleared from memory after 40 consecutive driving cycles in which the diagnosis is performed and approved.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch /

AMP / Metri-Pack female test lead. STEPS

		SPECIFICATIONS	SRT CODE
STEP 1: Check for sensor circuit fault codes.			
STEP 1A: Check the Fault Codes	**1674 and 1675 are registered.**	**Are Fault Codes 1674 or 1675 active?**	
STEP 2: Check the exhaust gas temperature sensor and circuit No. 2.			
STEP 2A:	**Inspect the exhaust gas temperature sensor No. 2 and the connector pins.**	**Dirty or damaged pins?**	
STEP 2B: Check the circuit response.		**Fault code 1675 active?**	
STEP 2C: Check the circuit response.		**Fault code 1674 active?**	
STEP 3: Check the ECM and the engine harness.			
STEP 3A:	**Inspect the pins of the engine harness and ECM connectors.**	**Dirty or damaged pins?**	
STEP 3B: Check the circuit response.		**Fault code 1675 active?**	
STEP 3C: Check the circuit response.		**Fault code 1674 active?**	
STEP 4: Clear the fault codes.			
STEP 4A: Check the repair.		**Are the temperature readings at the inlet and outlet of the catalyst within the 25 ° F range between them?**	
STEP 4B: Clear the fault codes.		**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check for sensor circuit fault codes.

STEP 1A: Check for fault codes. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for active fault codes. • Use INSITE ™ to read fault codes. Fault Codes 1674 or 1675 are active?	**YEA**	Fault diagnosis diagram for Fault Code 1674 or 1675.
	Are Fault Codes 1674 or 1675 active? **NOT**	2A

STEP 2: Check the exhaust gas temperature sensor and circuit No. 2.

STEP 2A: Inspect the exhaust gas temperature sensor No. 2 and the connector pins.

Conditions:

- Turn the ignition key off.
- Disconnect the exhaust gas temperature sensor No. 2 from the engine harness.

Action	Specifications / Repair	Next step
Check engine harness and exhaust gas temperature sensor No. 2 for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Damage to the wire shield • Moisture inside or over the connector • Connector seals damaged or missing • Broken connector cover • Dirt or debris on the connector pins For general inspection techniques, see Connector and Component Pin Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected in the sensor or in the harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-071 .	4A
	Dirty or damaged pins? **NOT**	2B

STEP 2B: Check the circuit response. Conditions:

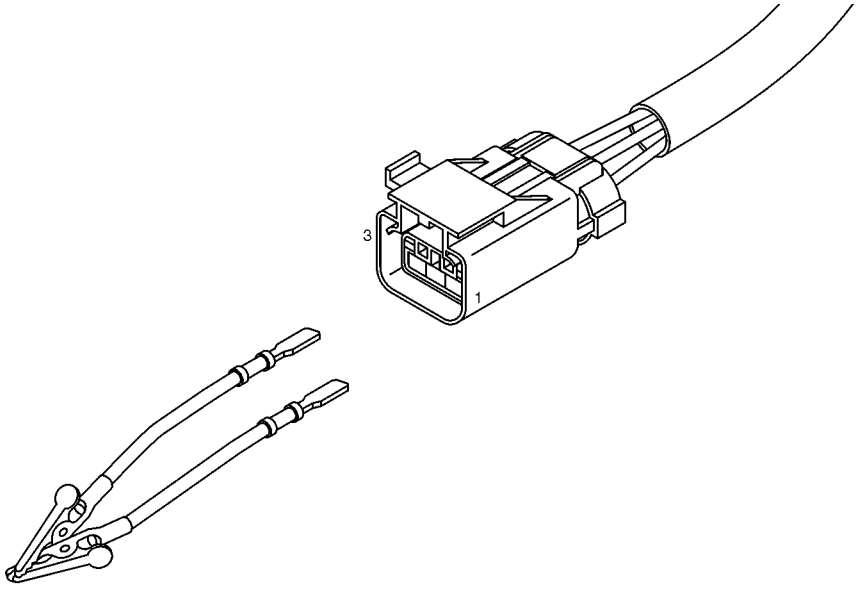
- Turn the ignition key off.
- Disconnect the exhaust gas temperature sensor No. 2 from the engine harness.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an appropriate ECM response after 30 seconds. • Use INSITE ™ to read fault codes.	Fault code 1675 active? **YEA**	2C
	Fault code 1675 active? **NOT**	3A

STEP 2C: Check the circuit response. Conditions:

- Turn the ignition key off.
- Disconnect the exhaust gas temperature sensor No. 2 from the engine harness.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Install a jumper wire between the SIGNAL and RETURN pins of the exhaust gas temperature 2 sensor, on the engine harness connector. Refer to the electrical diagram for identification of the connector pins. Check for proper circuit response after 30 seconds. • Use INSITE ™ to read fault codes.	Fault code 1674 active? **YES** **Repair:** Replace the exhaust gas temperature sensor No. 2. See the Procedure 019-013 .	4A
	Fault code 1674 active? **NOT**	3A



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STEP 3: Check the ECM and the engine harness.

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

Conditions:
- Turn the ignition key off.
- Disconnect the engine harness from the ECM connector.

Action	Specifications / Repair	Next step
Check that the pins on the engine harness and ECM connectors have: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Damage to the wire shield • Moisture inside or over the connector • Connector seals damaged or missing • Broken connector cover • Dirt or debris on the connector pins For general inspection techniques, see Connector and Component Pin Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection has been detected in the ECM connector or the motor harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-043 .	4A
	Dirty or damaged pins? **NOT**	3B

STEP 3B: Check the circuit response. Conditions:

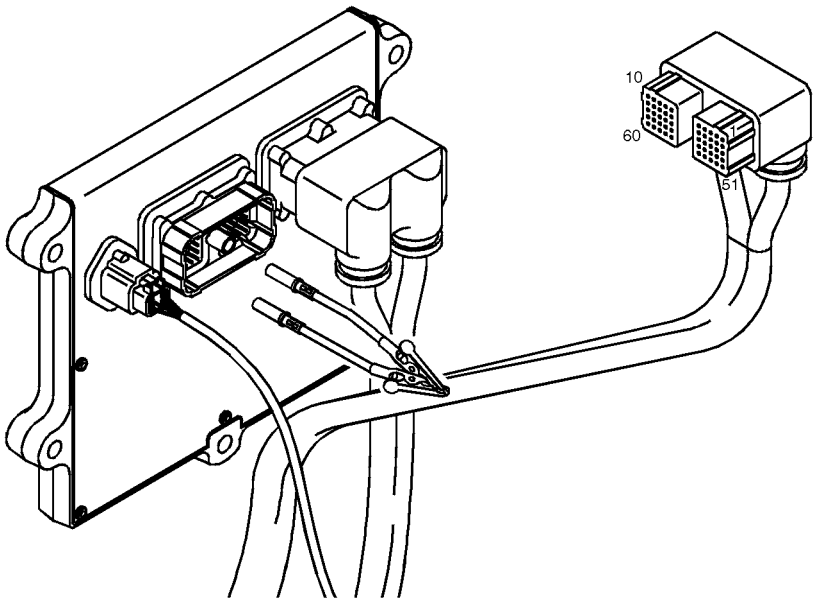
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Use INSITE ™ to read fault codes.	Fault code 1675 active? **YEA**	3C
	Fault code 1675 active? **DO NOT** **REPAIR:** Call for pre-authorization. Replace the ECM. See the Procedure 019-031 .	4A

STEP 3C: Check the circuit response. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Install a jumper wire between the SIGNAL and RETURN pins of the exhaust gas temperature 2 sensor, on the ECM connector. Check for proper circuit response after 30 seconds. • Use INSITE ™ to read fault codes.	Fault code 1674 active? **YES** **Repair:** High resistance or a short circuit was detected in the engine harness. Repair or replace the engine harness. See the Procedure 019-043 .	4A
	Fault code 1674 active? **DO NOT** **REPAIR:** Call for pre-authorization. Replace the ECM. See the Procedure 019-031 .	4A



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STEP 4: Clear the fault code.

STEP 4A: Check the repair. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Start the INSITE ™ Monitor / Data Logger. • Compare the INSITE ™ readings for the catalyst inlet and outlet temperatures.	Are the temperature readings at the inlet and outlet of the catalyst within the 25 ° F range between them? **YEA**	4B
	Are the temperature readings at the inlet and outlet of the catalyst within the 25 ° F range between them? **NOT**	1A

STEP 4B: Clear the fault codes. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

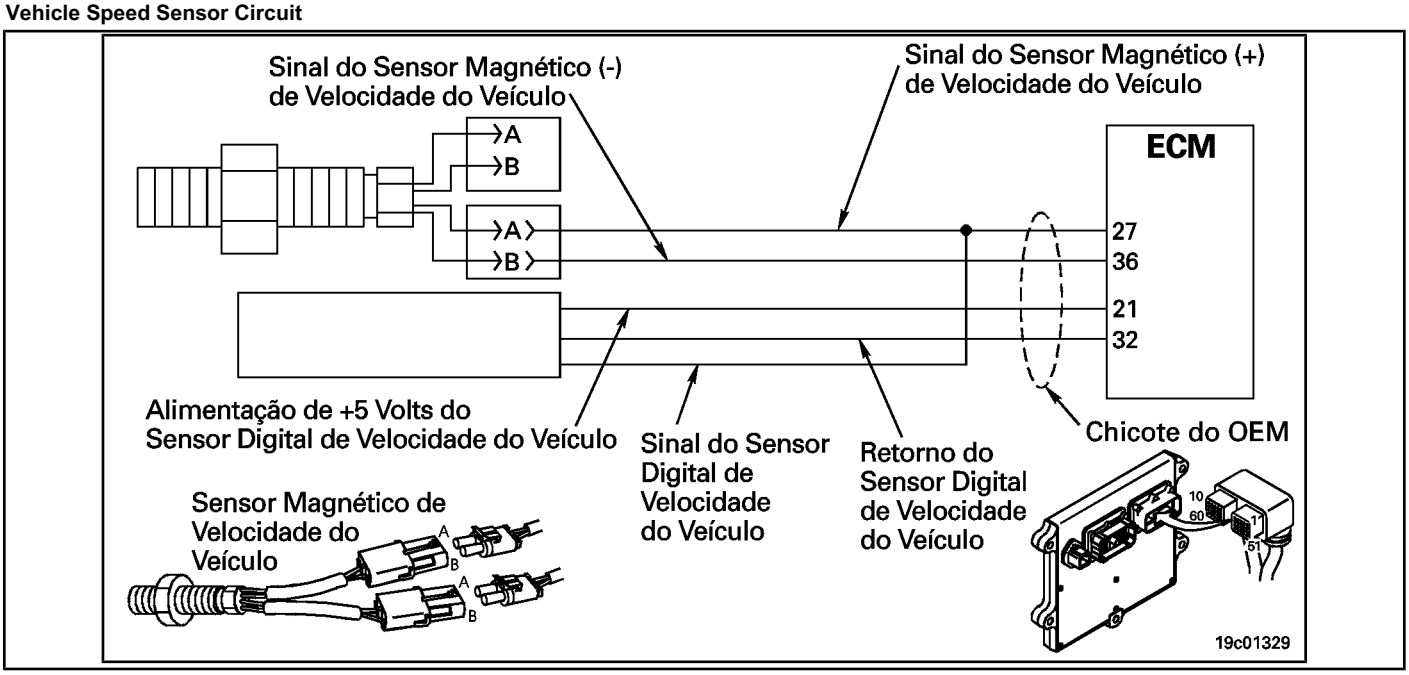
Action	Specifications / Repair	Next step
Clear the fault codes. • Use the electronic INSITE ™ service tool to clear all active and inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **NOT**	Proper troubleshooting and repair steps

Fault Code 1892

Wheel Based Vehicle Speed - Valid Data but Below Normal Range
Operation - Moderately Severe Level

CODES	REASON	IT IS MADE
Fault Code: 1892 PID (P), SID (S): P84 IMF: 1/18 Lamp: Amber SRT:	Wheel Based Vehicle Speed - Valid Data but Below Normal Operating Range - Level Moderately severe. The ECM lost the vehicle's speed signal.	The engine speed will be limited to the value of the Maximum Engine Speed parameter without the Vehicle Speed Sensor (VSS). Autopilot, Low Gear Protection and **Road Speed Governor not will work**.

Vehicle Speed Sensor Circuit



Circuit Descriptions:

The vehicle speed sensor detects the rotation of the rear axle gear in the vehicle transmission. This rotation signal is then transmitted to the electronic control module (ECM) and converted to a vehicle speed.

Component Location:

The vehicle speed sensor is located at the rear of the vehicle transmission. Refer to the OEM's troubleshooting and repair manual.

Workshop Tips:

There are several types of vehicle speed sensors. The various types include the magnetic capsule, the data link and the tachograph. Consult the OEM for the specific type installed on the vehicle.

This fault is activated when the ECM loses the vehicle's speed signal and other engine conditions indicate that the vehicle is in motion. This fault can also become active if there is a series of movements of the clutch, service brake or accelerator without the movement of the vehicle. The fault becomes inactive when the ECM receives a vehicle speed signal greater than zero.

As the vehicle speed sensor is a component installed by the OEM, this fault diagnosis procedure **not** will identify all circuit failures because the components **not** are under the control of Cummins. Sensor resistance values, datalink speed sensors and tachographs **not** are fully covered in this procedure. For more information on these components, refer to the OEM's troubleshooting and repair manual. On-Board Diagnostic Information (OBD):

- The ECM will illuminate the malfunction indicator lamp (MIL) when the diagnosis is performed and fails.
- The ECM will turn off the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles in which the diagnosis is performed and **not** failure. The MIL lamp and the fault code can also be cleared with the electronic service tool INSITE ™.
- The fault code will be cleared from memory after 40 consecutive driving cycles in which the diagnosis is performed and approved.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To avoid damage to the pins and harness, use the following test leads when making a measurement: Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch / AMP female test lead / Metri-Pack. STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check the vehicle speed sensor configuration using the INSITE ™.		
STEP 1A: Make sure that the sensor of the vehicle speed and INSITE ™ settings match.	**Does the INSITE ™ configuration match the type of vehicle speed sensor?**	
STEP 2: Check the OEM harness.		
STEP 2A: Inspect the OEM harness pins and the sensor connector pins.	**Dirty or damaged pins?**	
STEP 2B: Inspect the OEM harness connector pins on the ECM.	**Dirty or damaged pins?**	
STEP 2C: Check for a circuit open in the OEM harness.	**Less than 10 ohms?**	
STEP 2D: Check for a short circuit with the dough in the OEM whip.	**More than 100k ohms?**	
STEP 2E: Check for a short circuit between pins in the OEM harness.	**More than 100k ohms?**	
STEP 3: Check for additional OEM devices.		
STEP 3A: Check if there are additional devices in the vehicle speed sensor circuit.	**Are there any additional devices?**	
STEP 3B: Check that the gears slide on the axis.	**Is the gear or signal wheel damaged or "spinning"?**	
STEP 4: Clear the fault codes.		
STEP 4A: Disable the fault code.	**Fault code 1892 inactive?**	
STEP 4B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the vehicle speed sensor configuration using the INSITE ™.

STEP 1A: Make sure that the vehicle speed sensor and the setting on INSITE ™ are corresponding.

Conditions:
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Using INSITE ™, open the Vehicle Speed Source feature in the Settings, Features and Parameters menu. • Check that the INSITE ™ vehicle speed sensor parameter matches the vehicle sensor type.	Does the INSITE ™ configuration match the type of vehicle speed sensor? **YEA**	2A
	Does the INSITE ™ configuration match the type of vehicle speed sensor? **DO NOT** **REPAIR:** Change the ECM configuration with INSITE ™ to match the type of vehicle speed sensor.	4A

STEP 2: Check the OEM harness.

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

Conditions:
- Turn the ignition key off.
- Disconnect the vehicle speed sensor from the OEM harness.

Action	Specifications / Repair	Next step
Inspect the OEM harness and the sensor connector pins and check for: • Loose connector • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins • Damage to the wire shield • Connector cover broken. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected in the sensor or in the harness connector. Clean the connector and pins. If damaged, repair the harness, connector and pins, if possible. See the Procedure 019-071 .	4A
	Dirty or damaged pins? **NOT**	2B

STEP 2B: Inspect the OEM harness connector pins on the ECM.

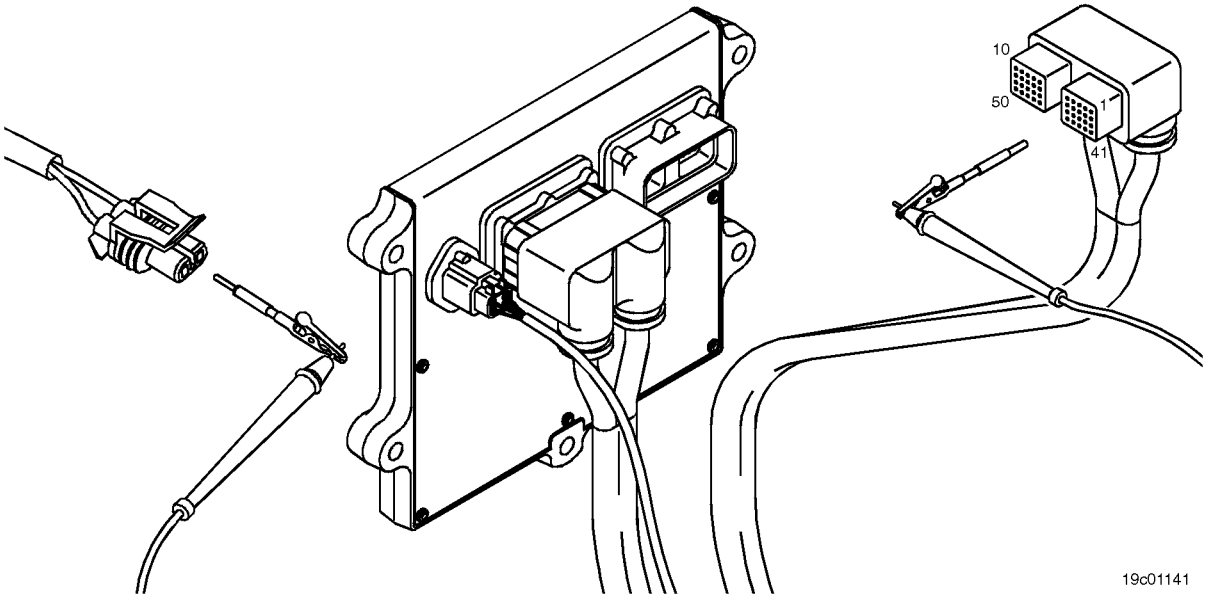
Conditions:
- Turn the ignition key off.
- Disconnect the OEM harness from the ECM.

Action	Specifications / Repair	Next step
Check that the OEM and ECM harness connectors have: • Loose connector • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins • Damage to the wire shield • Connector cover broken. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected in the sensor or in the harness connector. Clean the connector and pins. If damaged, repair the harness, connector and pins, if possible. See the Procedure 019-071 .	4A
	Dirty or damaged pins? **NOT**	2C

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

- Turn the ignition key off.
- Disconnect the OEM harness from the ECM.
- Disconnect the vehicle speed sensor from the OEM harness.

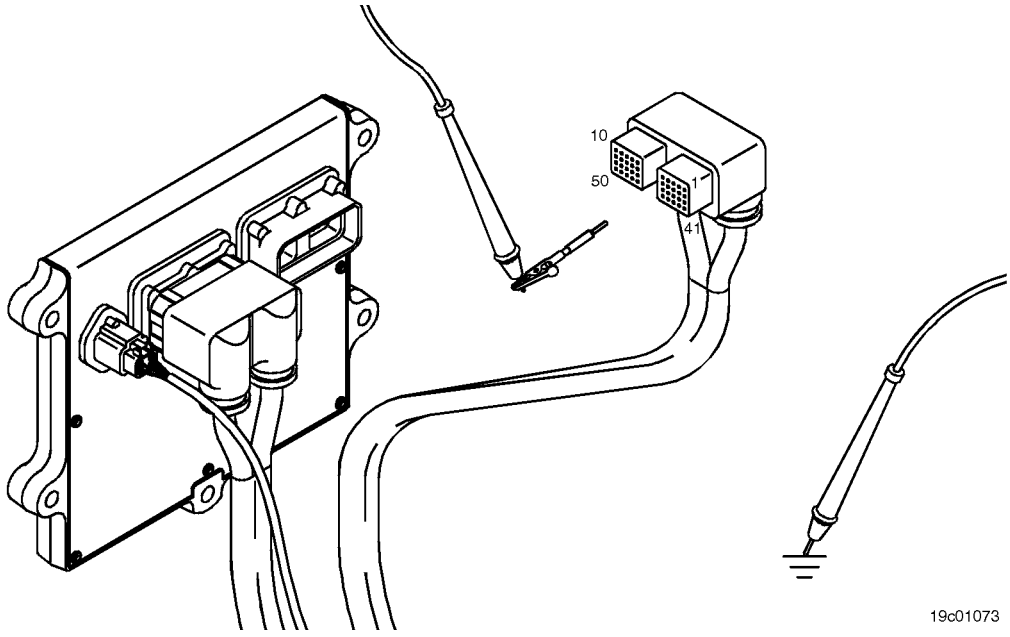
Action	Specifications / Repair	Next step
Using a multimeter, check the OEM harness for an open circuit. • Measure the wire resistance (+) of the vehicle speed magnetic SIGNAL wire between the ECM connector on the OEM harness and the vehicle speed magnetic sensor connector on the OEM harness. • Measure the wire resistance (-) of the vehicle speed magnetic SIGNAL wire between the ECM connector on the OEM harness and the vehicle speed magnetic sensor connector on the OEM harness. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	Less than 10 ohms? **YEA**	2D
	Less than 10 ohms? **DO NOT** **REPAIR:** An open circuit was detected in the OEM harness. Repair or replace the OEM harness. See the Procedure 019-071 .	4A



STEP 2D: Check the OEM harness for a short circuit with the ground. Conditions:

- Turn the ignition key off.
- Disconnect the OEM harness connector from the ECM.
- Disconnect the vehicle speed sensor from the OEM harness.

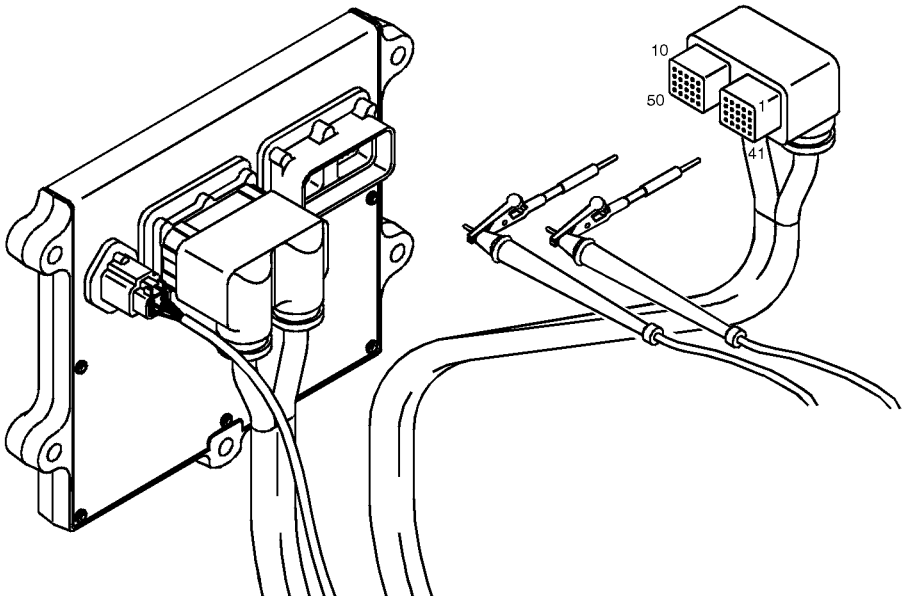
Action	Specifications / Repair	Next step
Check for a short circuit with the ground in the (+) and (-) SIGNAL circuits of the vehicle's magnetic speed sensor, in the OEM harness. • Measure the resistance between the magnetic speed sensor SIGN (+) pin on the vehicle's ECM connector and the engine block ground. • Measure the resistance between the SIGNAL pin (-) of the vehicle's speed sensor, on the ECM connector, and the mass of the engine block. Refer to the circuit diagram or electrical diagram for the identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YEA**	2E
	More than 100k ohms? **DO NOT** **REPAIR:** A short circuit was detected in the OEM harness. Repair or replace the OEM harness. See the Procedure 019-071 .	4A



STEP 2E: Check the OEM harness for a short circuit between pins. Conditions:

- Turn the ignition key off.
- Disconnect the OEM harness from the ECM.
- Disconnect the vehicle speed sensor from the OEM harness.

Action	Specifications / Repair	Next step
Using a multimeter, check the OEM harness for a short circuit between pins. • Measure the resistance and check for a short circuit between the magnetic speed sensor SIGN (+) pin on the vehicle, on the ECM connector on the OEM harness, and all other connector pins. • Measure the resistance and check for a short circuit between the magnetic speed sensor SIGN (-) pin on the vehicle, on the ECM connector on the OEM harness, and all other connector pins. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YEA**	3A
	More than 100k ohms? **DO NOT** **REPAIR:** A short circuit was detected in the OEM harness. Repair or replace the OEM harness. See the Procedure 019-071 .	4A



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STEP 3: Check for additional OEM devices.

STEP 3A: Check for additional devices on the vehicle speed sensor circuit. Conditions:

- Turn the ignition key off.

Action	Specifications / Repair	Next step
Inspect the vehicle's speed sensor circuit for any additional devices that may interfere with the speed signal.	Are there any additional devices? **YES** **Repair:** Remove the device or contact an OEM representative.	4A
	Are there any additional devices? **NOT**	3B

STEP 3B: Check that the gears slide on the shaft. Conditions:

- Turn the ignition key off.
- Remove the vehicle's speed sensor from the transmission.

Action	Specifications / Repair	Next step
Inspect the gear or signal wheel at the rear of the transmission where the speed sensor receives the speed signal. Make sure the gear or signal wheel is not damaged or sliding on the axle.	Is the gear or signal wheel damaged or "spinning"? **YES** **Repair:** Refer to the OEM troubleshooting and repair manual to repair or replace the gear or signal wheel.	4A
	Is the gear or signal wheel damaged or "spinning"? **NOT**	4A

STEP 4: Clear the fault codes.

STEP 4A: Disable the fault code. Conditions:

- Connect all components.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and start the vehicle so that the ECM can read the vehicle's speed. • Use the electronic service tool INSITE ™ to make sure that Fault Code 1892 is inactive.	Fault code 1892 inactive? **YEA**	4B
	Fault code 1892 inactive? **DO NOT** **REPAIR:** Return to the troubleshooting steps, or consult your Authorized Cummins Service Desk or OEM dealer after completing and rechecking all steps.	1A

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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

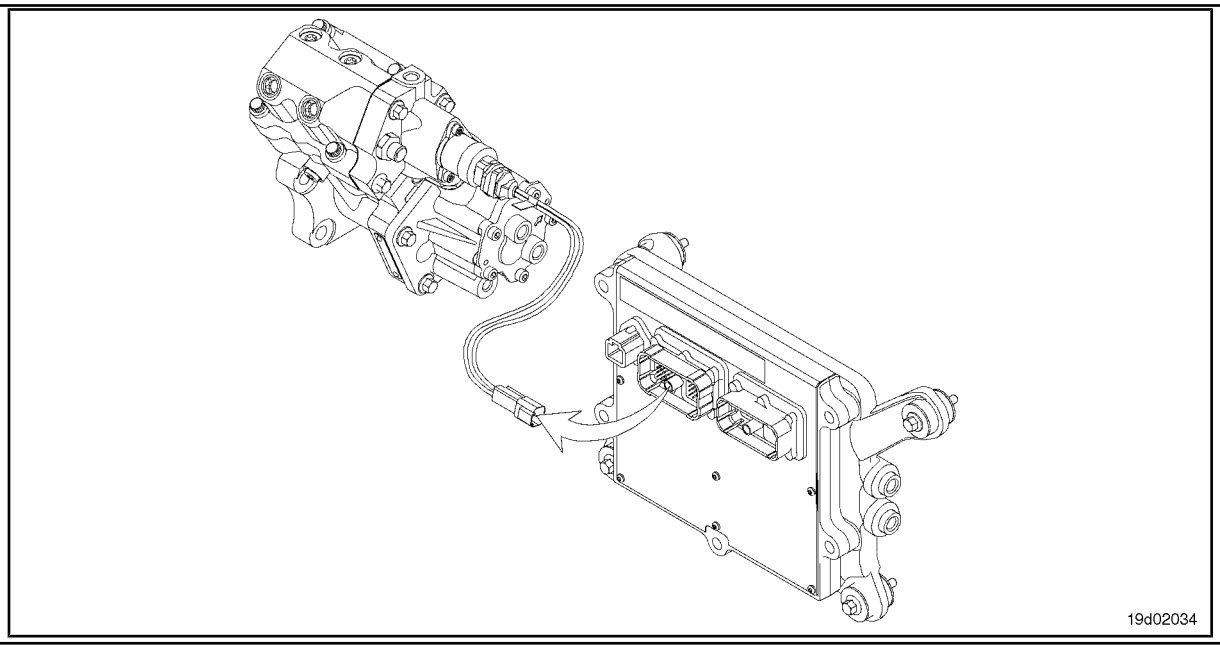
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **DO NOT** **REPAIR:** Troubleshoot any other existing fault codes.	Proper troubleshooting and repair steps

Fault Code 1911

Pressure 1 in the Injector Flow Measurement Gallery - Valid Data but Above Normal Operating Range - More Severe Level

CODES	REASON	IT IS MADE
Fault Code: 1911 PID (P), SID (S): P157 IMF: 0 Lamp: Amber SRT:	Pressure 1 in the Injection Flow Measurement Gallery - Valid Data but Above the Normal Operating Range - Most Severe Level. The fuel pressure signal indicates that it has exceeded the maximum limit of the indicated range for the engine.	No effect or possible engine noise associated with higher injection pressures (especially at idle or light load). Reduction in engine power.

Fuel System



Circuit Descriptions:

The electronic control module (ECM) monitors the operating conditions of the engine, including the reading of the fuel pressure on the common rail, and changes the flow control to increase (OPEN the fuel pump actuator) or reduce (CLOSE the actuator fuel pump) the fuel supply to the high pressure pump.

Component Location:

The fuel pump actuator is installed on the high pressure fuel pump.

Workshop Tips:

Fault Code 1911 is activated when the fuel pressure detected on the common rail exceeds the opening pressure of the fuel pressure relief valve on the common rail.

Under normal engine operating conditions, ECM calibration varies the flow control of the fuel pump actuator to achieve the correct pressure level in the common rail. System failures that cause loss of pressure control (for example, the fuel pump "stuck" actuator) can cause the pressure relief valve to open on the common rail. The fuel pressure relief valve on the common rail acts to protect

high-pressure components against over-pressurization. The engine power is reduced while the pressure on the common rail is controlled by the fuel pressure relief valve on the common rail. If the ECM detects that the fuel pressure relief valve on the common rail is open without detecting an error in the fuel pump actuator circuit, Fault Code 1911 will become active.

SUMMARY OF FAULT DIAGNOSTICS

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Read the fault codes.	Are Fault Codes 271, 272, 2311 or 1117 active, or are there high inactive counts?	
STEP 2: Check the fuel pressure sensor on the common rail.		
STEP 2A: Check that the sensor reading fuel pressure in the common rail is within the proper range.	Is the pressure equal to 0 ± 40 bar [0 ± 580 psi]?	
STEP 2B: Inspect the fuel pressure sensor signal wire and connector pins.	Dirty or damaged pins?	
STEP 3: Check the fuel pump actuator.		
STEP 3A: Check the pump actuator fuel and the harness connector pins.	Dirty or damaged pins?	
STEP 3B: Check the resistance of the fuel pump actuator.	Less than 5 ohms?	
STEP 3C: Check the pump actuator fuel for a short circuit with the grease.	More than 100k ohms?	
STEP 3D: Inspect the fuel pump actuator for damage.	Are the fuel pump actuator 'O' rings damaged?	
STEP 4: Check the engine harness.		
STEP 4A: Inspect the pins of the engine harness and ECM connectors.	Dirty or damaged pins?	
STEP 4B: Check the resistance of the engine harness.	Less than 5 ohms?	
STEP 4C: Check for a short circuit with the mass in the engine harness.	More than 100k ohms?	
STEP 4D: Check for a failure flashing in the engine harness.	Have Fault Codes 2311, 271 and / or 272 become active?	
STEP 5: Clear the fault codes.		
STEP 5A: Disable the fault code.	Fault codes inactive?	
STEP 5B: Clear the fault codes inactive.	All codes cleared?	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Read the fault codes. Conditions:

- Connect the electronic service tool INSITE ™.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Read the fault codes. • Start the engine and let it run at idle for 1 minute. • Use the electronic service tool INSITE ™ to read fault codes. • Check for fault codes related to a short with high or low voltage on the fuel pump actuator.	Are Fault Codes 271, 272, 2311 or 1117 active, or are there high inactive counts? **YEA**	Appropriate fault diagnosis diagram
	Are Fault Codes 271, 272, 2311 or 1117 active, or are there high inactive counts? **NOT**	2A

STEP 2: Check the fuel pressure sensor on the common rail.

STEP 2A: Check that the fuel pressure sensor reading on the common rail is within the suitable range.

Conditions:
- Connect the electronic service tool INSITE ™.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check that the sensor reading is in the proper range.	Is the pressure equal to 0 ± 40 bar [0 ± 580 psi]? **YEA**	2B
	Is the pressure equal to 0 ± 40 bar [0 ± 580 psi]? **DO NOT** **REPAIR:** The fuel pressure sensor is reading the fuel pressure incorrectly. Replace the fuel pressure sensor on the common rail. See the Procedure 019-115 .	4A

STEP 2B: Inspect the fuel pressure sensor signal wire and connector pins.

Conditions:
- Turn the ignition key off.
- Disconnect the ECM from the engine harness.

Action	Specifications / Repair	Next step
Inspect the fuel pressure sensor signal wire and connector pins for: • Loose connector • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins • Damage to the wire shield • Connector cover broken. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 . NOTE: Incorrect connection to the fuel pressure sensor SIGNAL wire can cause the signal reading to fluctuate and cause this fault code to become active intermittently.	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected in the sensor or in the harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins. See the Procedure 019-043 , Engine Electrical Harness.	4A
	Dirty or damaged pins? **NOT**	3A

STEP 3: Check the fuel pump actuator.

STEP 3A: Check the fuel pump actuator and harness connector pins. Conditions:

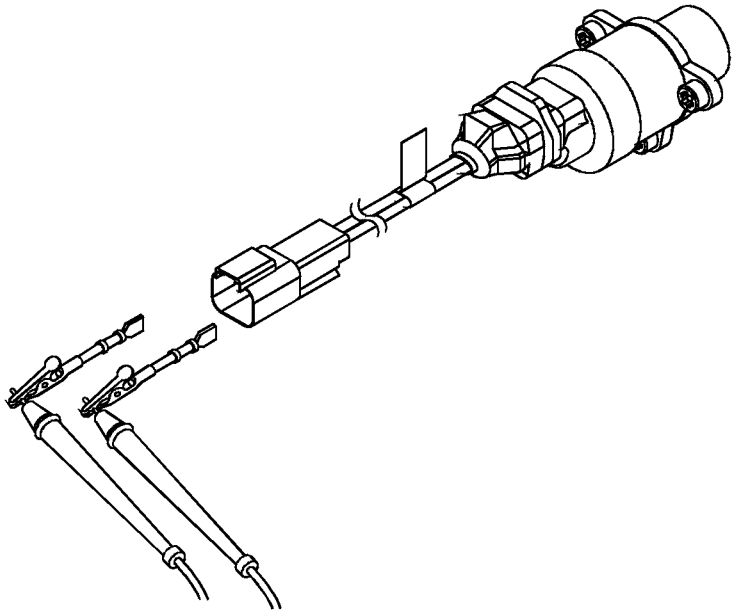
- Turn the ignition key off.
- Disconnect the fuel pump actuator from the engine harness.

Action	Specifications / Repair	Next step
Inspect the fuel pump actuator, 'pigtail' wires and engine harness connector pins for: • Loose connector • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins • Damage to the wire shield • Connector cover broken. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** Repair the connector and pins. If damaged, repair the harness, connectors and pins, if possible. See the Procedure 019-043 , Engine Electrical Harness.	5A
	Dirty or damaged pins? **NOT**	3B

STEP 3B: Check the resistance of the fuel pump actuator. Conditions:

- Turn the ignition key off.
- Disconnect the fuel pump actuator from the engine harness.

Action	Specifications / Repair	Next step
Check the resistance of the fuel pump actuator. • Measure the resistance between the SIGNAL and RETURN pins of the fuel pump actuator on the actuator connector. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	Less than 5 ohms? **YEA**	3C
	Less than 5 ohms? **DO NOT** **REPAIR:** Replace the fuel pump actuator. See the Procedure 019-117 .	5A



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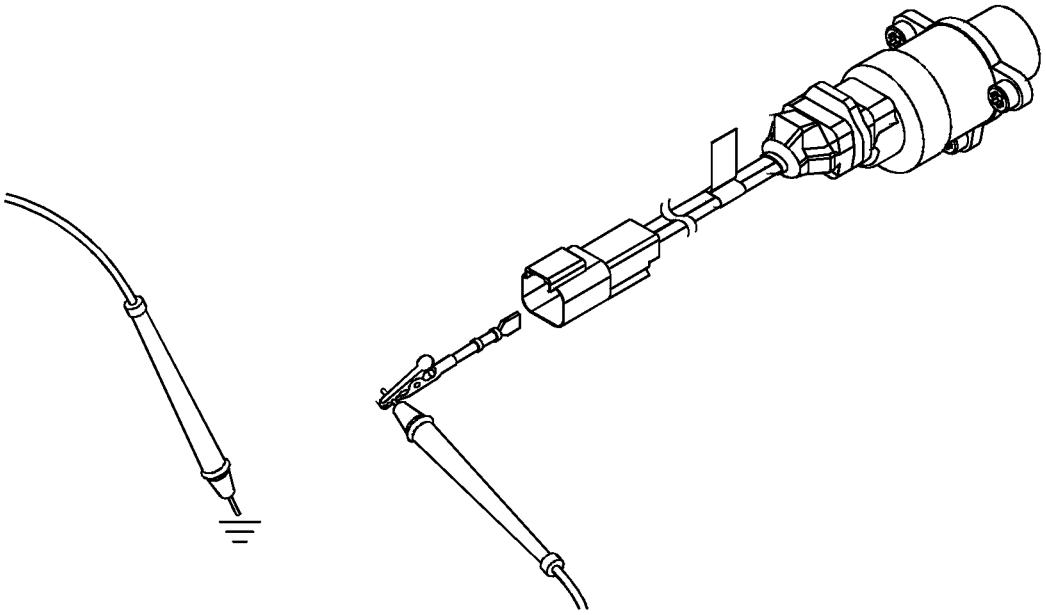
STEP 3C: Check the fuel pump actuator for an earth short. Conditions:

- Turn the ignition key off.
- Disconnect the fuel pump actuator from the engine harness.

Action	Specifications / Repair	Next step
Check the fuel pump actuator for an earth short. • Measure the resistance between the fuel pump actuator SIGN pin and the engine block ground.	More than 100 ohms? **YEA**	3D
	More than 100 ohms? **DO NOT** **REPAIR:** Replace the fuel pump actuator. See the Procedure 019-117 .	5A



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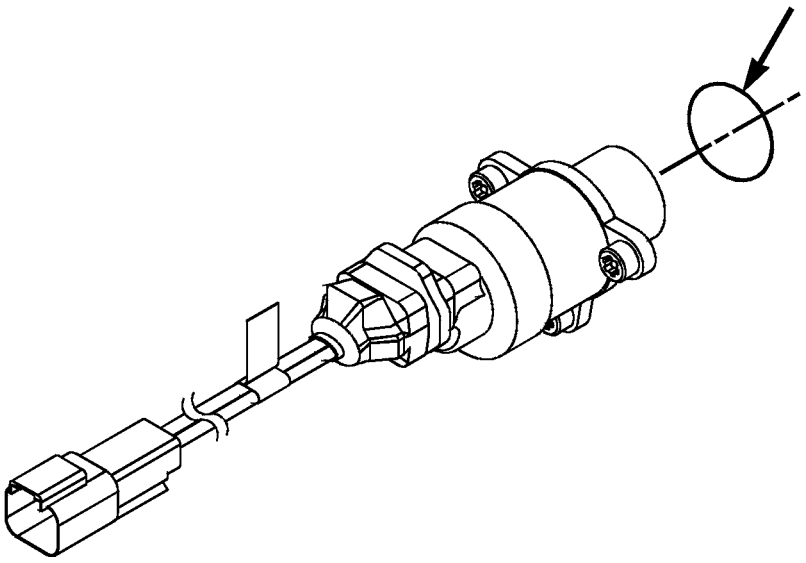
STEP 3D: Inspect the fuel pump actuator for damage.

Conditions:
- Turn the ignition key off.
- Remove the actuator from the fuel pump. See the Procedure 019-117 .

Action	Specifications / Repair	Next step
Inspect the fuel pump actuator 'O' rings for damage.	Are the fuel pump actuator 'O' rings damaged? **YES** **Repair:** Replace the fuel pump actuator 'O' rings. See the Procedure 019-117 .	5A
	Are the fuel pump actuator 'O' rings damaged? **NOT**	4A



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STEP 4: Check the engine harness.

STEP 4A: Inspect the pins of the engine harness and ECM connectors.

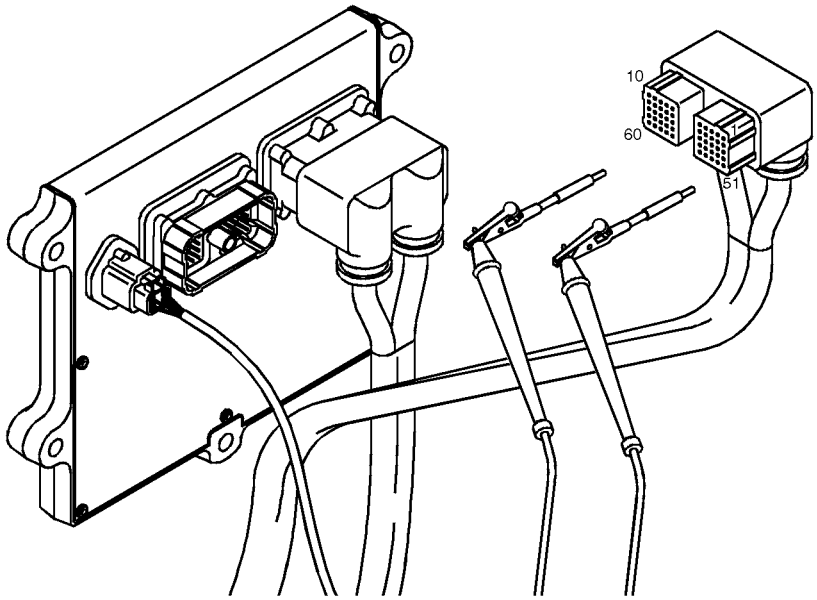
Conditions:
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.

Action	Specifications / Repair	Next step
Check that the pins on the engine harness and ECM connectors have: • Loose connector • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins • Broken connector cover • Damage to the wire shield • Damage to the connector locking tab. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection has been detected in the ECM connector or the motor harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-043 , Engine Electrical Harness.	5A
	Dirty or damaged pins? **NOT**	4B

STEP 4B: Check the resistance of the engine harness. Conditions:

- Turn the ignition key off.
- Connect the fuel pump actuator to the engine harness.
- Disconnect the engine harness from the ECM.

Action	Specifications / Repair	Next step
Check the resistance of the engine harness. • Measure the resistance between the SIGNAL and RETURN pins of the fuel pump actuator on the ECM connector on the engine harness. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	Less than 5 ohms? **YEA**	4C
	Less than 5 ohms? **DO NOT** **REPAIR:** Repair or replace the engine harness. See the Procedure 019-043 .	5A



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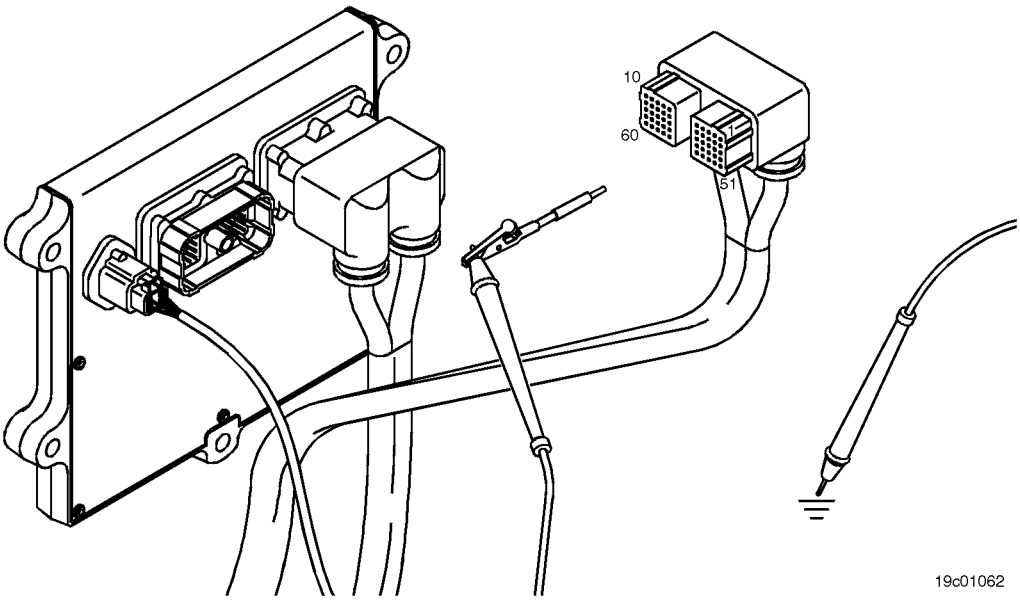
STEP 4C: Check the motor harness for a short circuit with ground. Conditions:

- Turn the ignition key off.
- Disconnect the fuel pump actuator from the engine harness.
- Disconnect the engine harness from the ECM.

Action	Specifications / Repair	Next step
Check for a short circuit with the ground in the engine harness. • Measure the resistance between the fuel pump actuator SIGN pin, the ECM connector on the engine harness, and the engine block ground.	More than 100k ohms? **YEA**	4D
	More than 100k ohms? **DO NOT** **REPAIR:** Repair or replace the engine harness. See the Procedure 019-043 .	5A



STEP 4D: Check for an intermittent fault in the engine harness. Conditions:

- Connect all components
- Turn the ignition key ON.
- Engine running at idle.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an intermittent or defective connection in the engine harness. • Flex the engine harness starting at the ECM connector on the harness and proceed to the fuel pump actuator. If the short or open circuit is induced while the engine is running, the pressure relief valve on the common rail will open.	Have Fault Codes 2311, 271 and / or 272 become active? **YES** **Repair:** An intermittent connection was detected in the engine harness. Repair or replace the engine harness. See the Procedure 019-043 .	5A
	Have Fault Codes 2311, 271 and / or 272 become active? **DO NOT** **REPAIR:** Replace the fuel pump actuator. See the Procedure 019-117 .	5A

STEP 5: Clear the fault codes.

STEP 5A: Disable the fault code. Conditions:

- Connect all components.
- Connect the electronic service tool INSITE ™.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Using the electronic service tool INSITE ™, make sure that the fault codes are inactive.	Fault codes inactive? **YEA**	4B
	Fault codes inactive? **NOT**	1A

STEP 5B: Clear the inactive fault codes. Conditions:

- Connect all components.
- Connect the electronic service tool INSITE ™.
- Turn the ignition key ON.

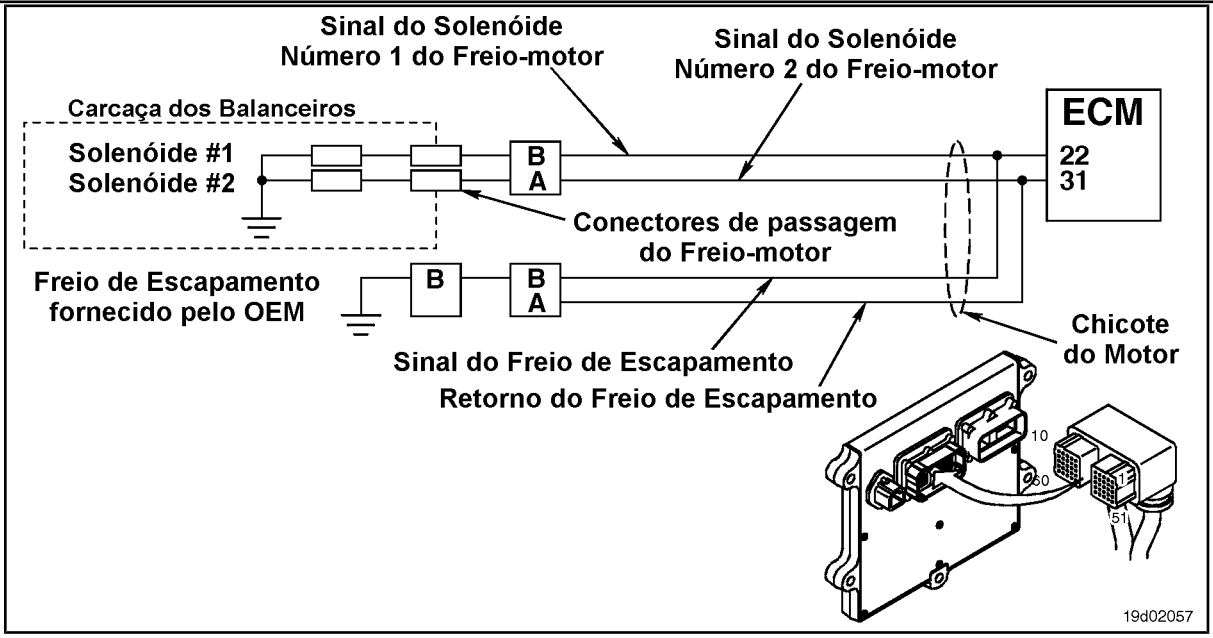
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **NOT**	Proper troubleshooting and repair steps

Fault Code 2183

Motor Brake Actuator Circuit 1 - Voltage Below Normal or with Low Voltage

CODES	REASON	IT IS MADE
Fault Code: 2183 PID (P), SID (S): S028 IMF: 4 Lamp: Amber SRT:	Motor Brake Actuator Circuit 1 - Voltage Below Normal or Low Voltage. Low voltage detected in the signal circuit of motor brake solenoid number 1.	The engine brake on cylinders 1, 2 and 3 **not** can be activated or the exhaust brake **not** will work.

Motor Brake Circuit



Circuit Descriptions:

This circuit can be used to control the exhaust brake or a motor brake, depending on the application. The ECM controls the engine brakes on cylinders 1, 2 and 3 by sending a signal from circuit number 1 to the engine brake solenoid. If an exhaust brake is installed, it will be activated by the signal line of circuit number 1 of the motor brake solenoid. There is a 2-pin Weather Pack connector located next to the number 3 injector port connector on the rear of the engine. If a motor brake is installed, there will be a bridge harness between this connector and the motor brake passage connector on the rocker frame housing. If an exhaust brake is installed, the OEM will connect a 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 by the ECM via the engine harness. The exhaust brake is an optional feature that is fitted to the exhaust system by the OEM.

Workshop Tips:

Possible causes for this fault code include a short circuit with ground in the engine harness, in the connector, or in the solenoids of the engine brakes. On-Board Diagnostic Information (OBD):

- The ECM lights up the appropriate amber or red fault lamp when the diagnosis is run and fails.
- The ECM turns off the appropriate fault lamp when the diagnosis is successfully performed.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch / AMP / Metri-Pack female test lead Part No. 3823995 - Weather-Pack male test lead. Part No. 3823996 - Weather-Pack female test lead. STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check for a passcode failure inactive.	**Fault code 2183 inactive?**	
STEP 1B: Determine the type of motor brake.	**Is the engine equipped with a compression brake?**	
STEP 2: Check the motor brake circuit and solenoid.		
STEP 2A: Check the voltage of the signal diagnostics on the motor brake pass connector.	**More than 3.75 VDC?**	
STEP 2B: Check the wiring harness on the engine brake for damage.	**Damage to the connectors or the insulation of the wires?**	
STEP 2C: Check the brake solenoid - motor for a short to ground.	**5 ohms or more?**	
STEP 3: Check the ECM and the engine harness.		
STEP 3A: Inspect the pins of the engine harness and ECM connectors.	**Dirty or damaged pins?**	
STEP 3B: Check the voltage diagnostic supply for motor brake solenoid number 1.	**More than 3.75 VDC?**	
STEP 3C: Check for a short circuit between pins and ground.	**More than 100k ohms?**	
STEP 3D: Check for a short circuit between pins in the engine harness.	**More than 100k ohms?**	
STEP 3E: Check for a security code failure inactive.	**Fault code 2183 inactive?**	
STEP 3E-1: Check that the brake exhaust is installed.	**Is the engine equipped with an exhaust brake?**	
STEP 4: Clear the fault code.		
STEP 4A: Disable the fault code.	**Fault code 2183 inactive?**	
STEP 4B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

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

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an inactive fault code. • Using INSITE ™, read the fault codes. Fault code 2183 inactive?	**YEA**	Fault Code Inactive or Intermittent, Procedure 019-362
	Fault code 2183 inactive? **NOT**	1B

STEP 1B: Determine the type of motor brake. Conditions:

- Turn the ignition key off.

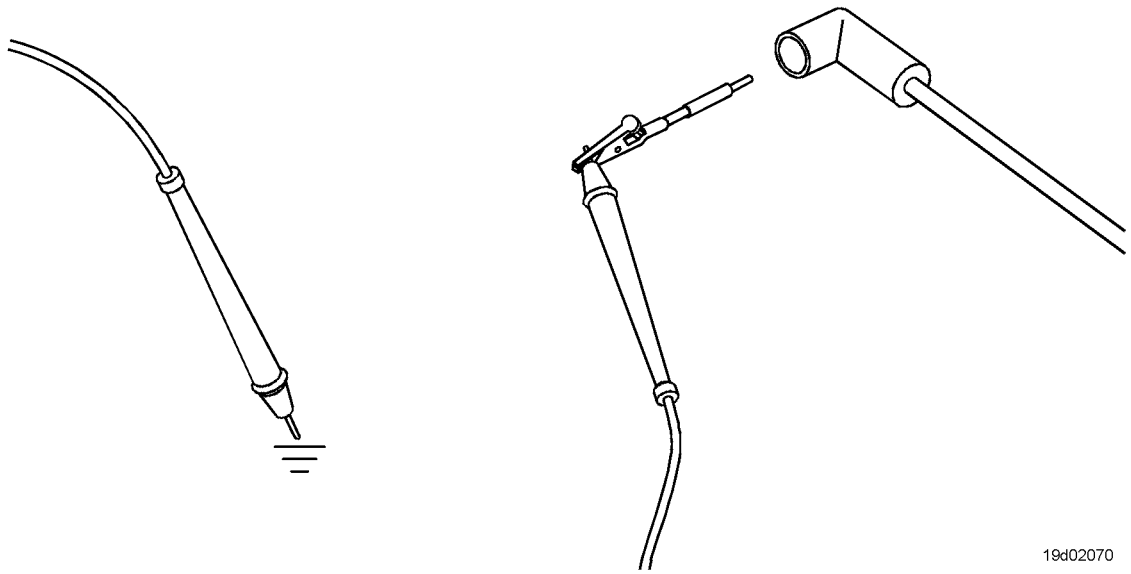
Action	Specifications / Repair	Next step
Check that the engine is equipped with a compression brake or an exhaust brake.	Is the engine equipped with a compression brake? **YEA**	2A
	Is the engine equipped with a compression brake? **DO NOT** **REPAIR:** Is the engine equipped with an exhaust brake?	3A

STEP 2: Check the motor brake circuit and solenoid.

STEP 2A: Check the diagnostic signal voltage at the motor brake pass connector. Conditions:

- Turn the ignition key off.
- Disconnect the wire from solenoid number 1 of the motor brake from the passage connector on the rocker frame.
- Turn the ignition key ON.

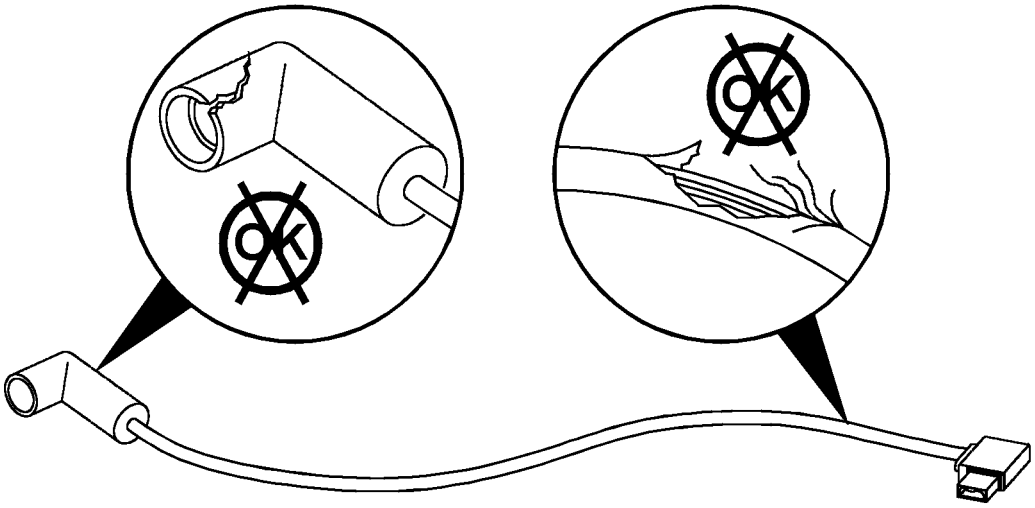
Action	Specifications / Repair	Next step
Check the diagnostic supply voltage of the motor brake solenoid number 1. • Measure the voltage between the SIGNAL pin of solenoid number 1 of the motor brake on the motor harness and the ground. Refer to the electrical diagram for identification of the connector pins.	More than 3.75 VDC? **YEA**	2B
	More than 3.75 VDC? **NOT**	3A



STEP 2B: Check the engine brake wiring harness for damage. Conditions:

- Turn the ignition key off.
- Remove the rocker cover. Refer to Procedure 003-011 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266.
- Remove the engine brake bridge harness between the pass-through connector and the engine brake solenoid.

Action	Specifications / Repair	Next step
Inspect the engine brake internal bridge harness for: • Bent or broken pins • Damage to the wire shield • Connector cover broken. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Damage to the connectors or the insulation of the wires? **YES** **Repair:** Repair or replace the engine brake harness. See the Procedure 019-043 .	4A
	Damage to the connectors or the insulation of the wires? **NOT**	2C



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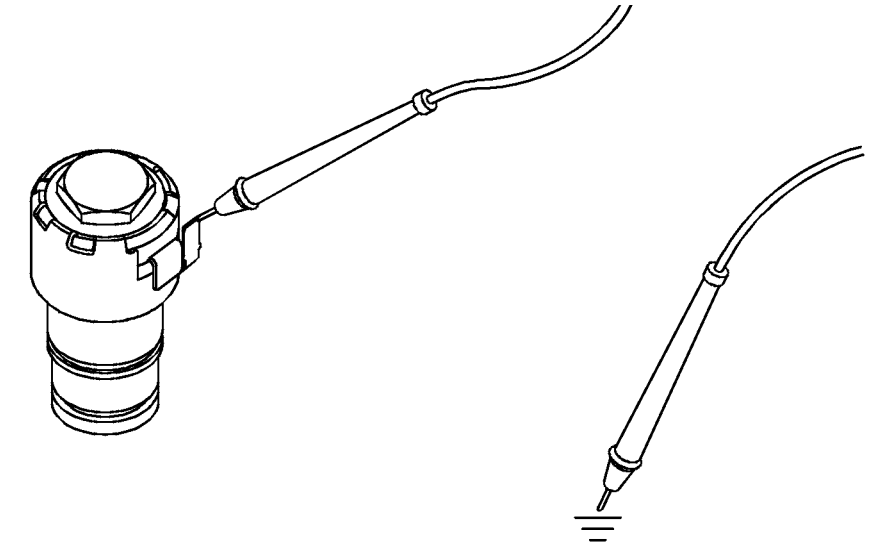
STEP 2C: Check the motor brake solenoid for a short to ground. Conditions:

- Turn the ignition key off.
- Remove the rocker cover. Refer to Procedure 003-011 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266.
- Disconnect motor brake solenoid number 1 from the motor harness.

Action	Specifications / Repair	Next step
Check the resistance of the solenoid. • Measure the resistance between the terminal pin of the motor brake solenoid number 1 and the ground. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	5 ohms or more? **YEA**	3A
	5 ohms or more? **DO NOT** **REPAIR:** Replace the motor brake solenoid. Refer to Procedure 020-012 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266.	4A



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STEP 3: Check the ECM and the engine harness.

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

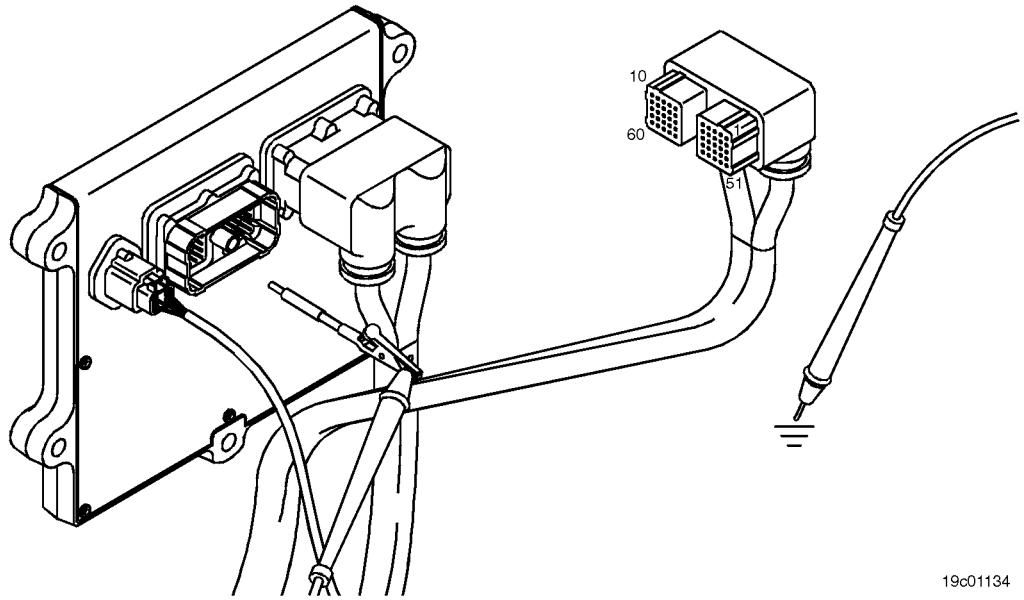
Conditions:
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.

Action	Specifications / Repair	Next step
Check that the pins on the engine harness and ECM connectors have: • Loose connector • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins • Damage to the wire shield • Connector cover broken. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected at the ECM connector or at the engine harness. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-043 .	4A
	Dirty or damaged pins? **NOT**	3B

STEP 3B: Check the diagnostic supply voltage of the motor brake solenoid number 1. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check the diagnostic supply voltage of the motor brake solenoid number 1. • Measure the voltage between the motor brake solenoid number 1 SIGN pin and the ground on the ECM connector. Refer to the electrical diagram for identification of the connector pins.	More than 3.75 VDC? **YEA**	3C
	More than 3.75 VDC? **DO NOT** **REPAIR:** Call for pre-authorization. Replace the ECM. See the Procedure 019-031 .	4A



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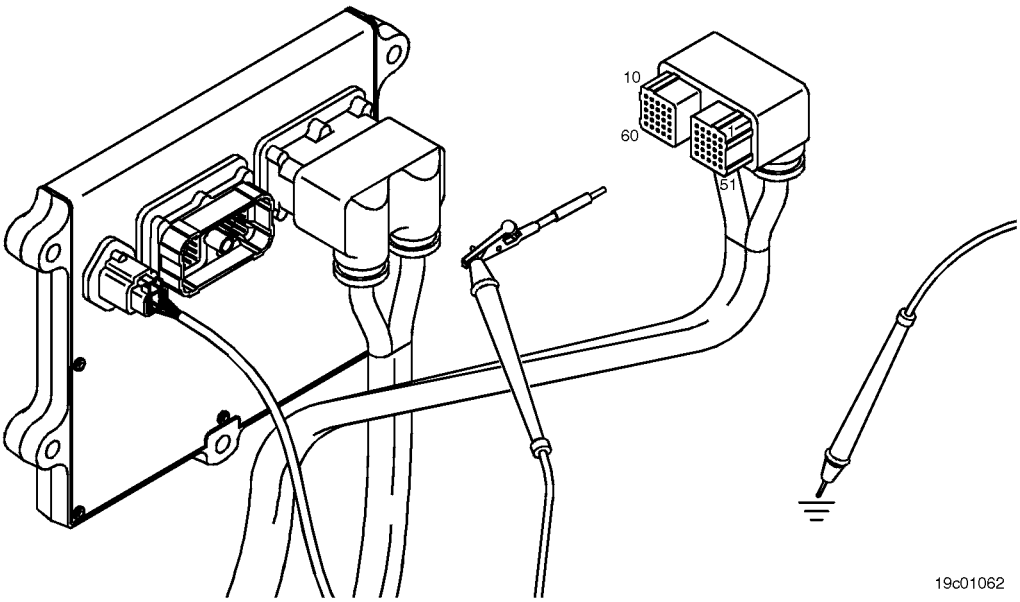
STEP 3C: Check for a short circuit between the pins and the ground. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- If equipped with a motor brake, disconnect the motor brake solenoid number 1 from the motor brake passage connector.
- If equipped with an exhaust brake, disconnect the 2-pin Weather Pack connector on the rear of the engine between lines 5 and 6 of high pressure fuel.

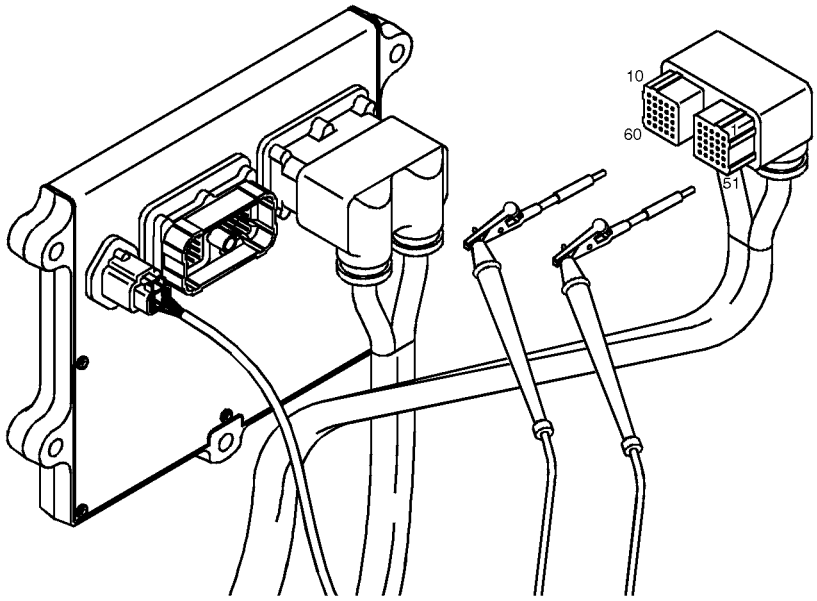
Action	Specifications / Repair	Next step
Check for a short between pins and ground. • Measure the resistance between the SIGN pin of the motor brake solenoid number 1 on the ECM connector, on the motor harness, and the ground. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YEA**	3D
	More than 100k ohms? **DO NOT** **REPAIR:** A short circuit was detected between the pins and the ground in the SIGNAL line of the motor brake actuator. Troubleshoot each harness connected in series to determine which one contains the supply circuit shorted to ground. Repair or replace the engine harness. See the Procedure 019-043 .	4A



STEP 3D: Check the motor harness for a short circuit between pins. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- If equipped with a motor brake, disconnect the motor brake solenoid number 1 from the motor brake passage connector.
- If equipped with an exhaust brake, disconnect the 2-pin Weather Pack connector on the rear of the engine between lines 5 and 6 of high pressure fuel.

Action	Specifications / Repair	Next step
Check for a short circuit between pins. • Measure the resistance between the motor brake solenoid number 1 SIGN pin on the ECM connector, on the OEM harness, and all other pins on the ECM connector. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YEA**	3E
	More than 100k ohms? **DO NOT** **REPAIR:** A short circuit between pins in the SIGNAL line of solenoid number 1 of the motor brake was detected in the motor harness. Repair or replace the engine harness. See the Procedure 019-043 .	4A



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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Using INSITE ™, read the fault codes.	Fault code 2183 inactive? **YES** **Repair:** None. Did removing and installing the connector correct the failure?	4A
	Fault code 2183 inactive? **NOT**	3E-1

STEP 3E-1: Check that the exhaust brake is installed. Conditions:

Action	Specifications / Repair	Next step
Check that the engine is equipped with an exhaust brake.	Is the engine equipped with an exhaust brake? **YES** **Repair:** Refer to the OEM troubleshooting and repair manual for wiring and circuits between Cummins wiring harness and exhaust brake.	OEM fault diagnosis manual
	Is the engine equipped with an exhaust brake? **DO NOT** **REPAIR:** All wiring has been checked and found to be correct. The ECM failed. Replace the ECM. Call for authorization. See the Procedure 019-031 .	4A

STEP 4: Clear the fault code.

STEP 4A: Disable the fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Using INSITE ™, make sure that the fault code is inactive.	Fault code 2183 inactive? **YEA**	4B
	Fault code 2183 inactive? **NOT**	1A

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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

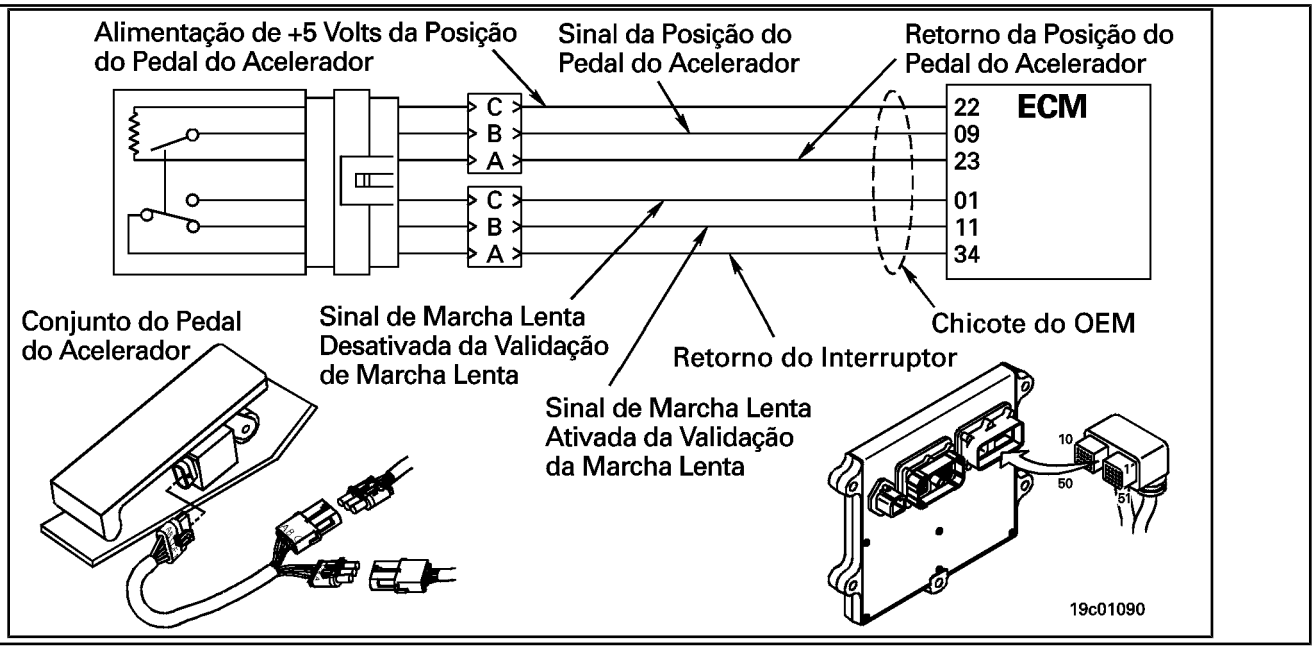
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **NOT**	Proper troubleshooting and repair steps

Fault Code 2185

Sensor Supply Voltage No. 4 Circuit - Voltage Above Normal or with High Voltage

CODES	REASON	IT IS MADE
Fault Code: 2185 PID (P), SID (S): S232 IMF: 3/3 Lamp: Amber SRT:	Sensor Supply Voltage Circuit No. 4 - Voltage Above Normal or High Voltage Detected High voltage in the +5 volt supply circuit of the accelerator pedal position sensor.	The engine will run **only** idling.

Supply Voltage Circuit for the Pedal Position Sensor or Throttle Lever



Circuit Descriptions:

The electronic control module (ECM) provides the pedal or throttle position sensor with a voltage of +5 volts.

Component Location:

The accelerator pedal / lever assembly is located in the cab.

Workshop Tips:

This fault is recorded when the ECM detects more than +5.25 volts on the +5 volt power line from the pedal position sensor or throttle lever. The cause may be a short circuit with a voltage source in the OEM harness or a short circuit with an actuator signal circuit greater than +5 volts.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3164133 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch / AMP / female test lead Metri-Pack. STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check for a passcode active fault.	**Fault code 2185 active?**	
STEP 2: Check the OEM's ECM and harness.		
STEP 2A: Inspect the ECM and the OEM harness connector pins.	**Dirty or damaged pins?**	
STEP 2B: Check for a short circuit pin to pin on the OEM harness.	**More than 100k ohms?**	
STEP 2C: Check for a short circuit pin to pin on the OEM non-switched battery power harness.	**More than 100k ohms?**	
STEP 3: Clear the fault codes.		
STEP 3A: Disable the fault code.	**Fault code 2185 inactive?**	
STEP 3B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Check for an active fault code. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an active fault code. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 2185 active? **YEA**	2A
	Fault code 2185 active? **NOT**	Fault Code Inactive or Intermittent, Procedure 019-362

STEP 2: Check the OEM's ECM and harness.

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

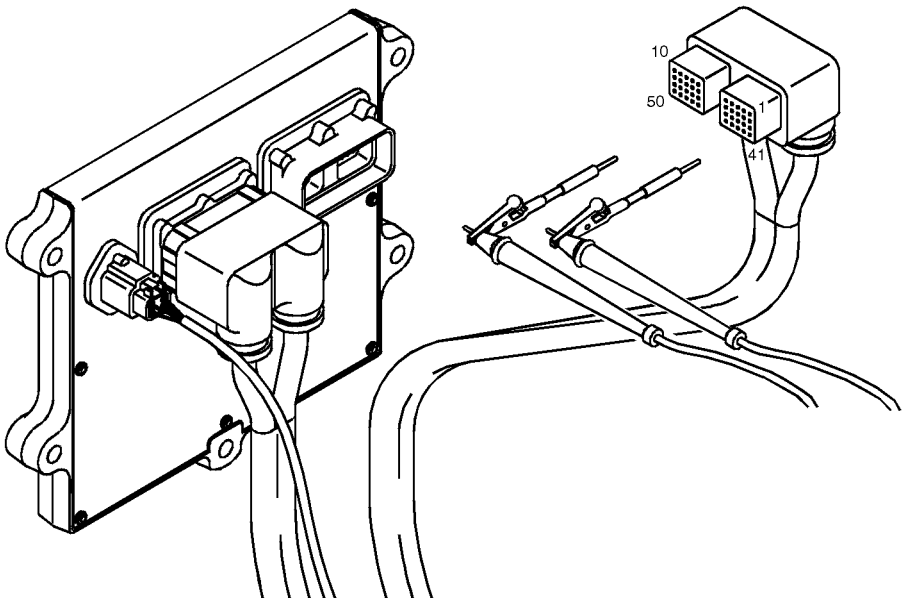
Conditions:
- Turn the ignition key off.
- Disconnect the OEM harness from the ECM.

Action	Specifications / Repair	Next step
Check that the OEM harness and ECM connector pins have: • Loose connector • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Damaged or missing connector seals • Dirt or debris on the connector pins • Broken connector cover • Damage to the wire shield • Damage to the connector locking tab. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-071 .	3A
	Dirty or damaged pins? **NOT**	2B

STEP 2B: Check the OEM harness for a pin-to-pin short. Conditions:

- Turn the ignition key off.
- Disconnect the OEM harness from the ECM.
- Disconnect the OEM harness from the pedal position sensor or throttle lever.

Action	Specifications / Repair	Next step
Check for a short circuit between pins. Measure the resistance between the +5 volt POWER pin on the pedal position sensor or throttle lever on the OEM harness ECM connector and all other pins on the OEM connector. Refer to the circuit diagram or electrical diagram for the identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YEA**	2C
	More than 100k ohms? **DO NOT** **REPAIR:** A short circuit was detected in the +5 volt power wire from the accelerator pedal. Repair or replace the OEM harness. See the Procedure 019-071 .	3A



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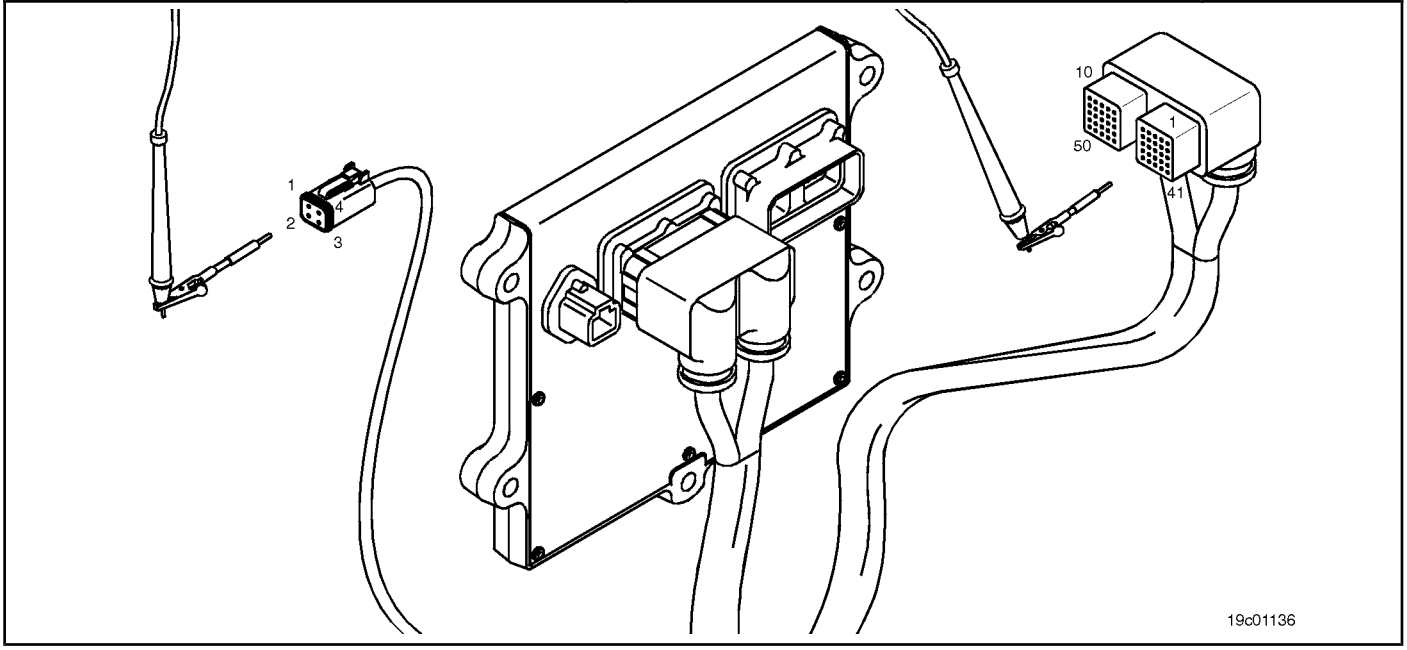
STEP 2C: Check for a short circuit in the OEM battery power harness not switched.

Conditions:
- Turn the ignition key off.
- Disconnect the OEM harness from the ECM.
- Disconnect the OEM harness from the pedal position sensor or throttle lever.
- Disconnect the OEM power harness from the ECM.

Action	Specifications / Repair	Next step
Check for a short circuit with the battery. Measure the resistance between the throttle pedal POWER pin on the OEM harness ECM connector and the ECM battery POWER (+) pin on the harness ECM connector. Refer to the circuit diagram or electrical diagram for the identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YES** **Repair:** Call for pre-authorization. Replace the ECM. See the Procedure 019-031 .	3A
	More than 100k ohms? **DO NOT** **REPAIR:** Repair or replace the OEM harness. See the Procedure 019-071 .	3A



STEP 3: Clear the fault codes.

STEP 3A: Disable the fault code. Conditions:

- Connect all components.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Using the electronic service tool INSITE ™, make sure that the fault code is inactive.	Fault code 2185 inactive? **YEA**	3B
	Fault code 2185 inactive? **DO NOT** **REPAIR:** Return to the troubleshooting steps or consult your local Cummins Authorized Service Station after checking and completing all diagnostic steps again.	1A

STEP 3B: Clear the inactive fault codes. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

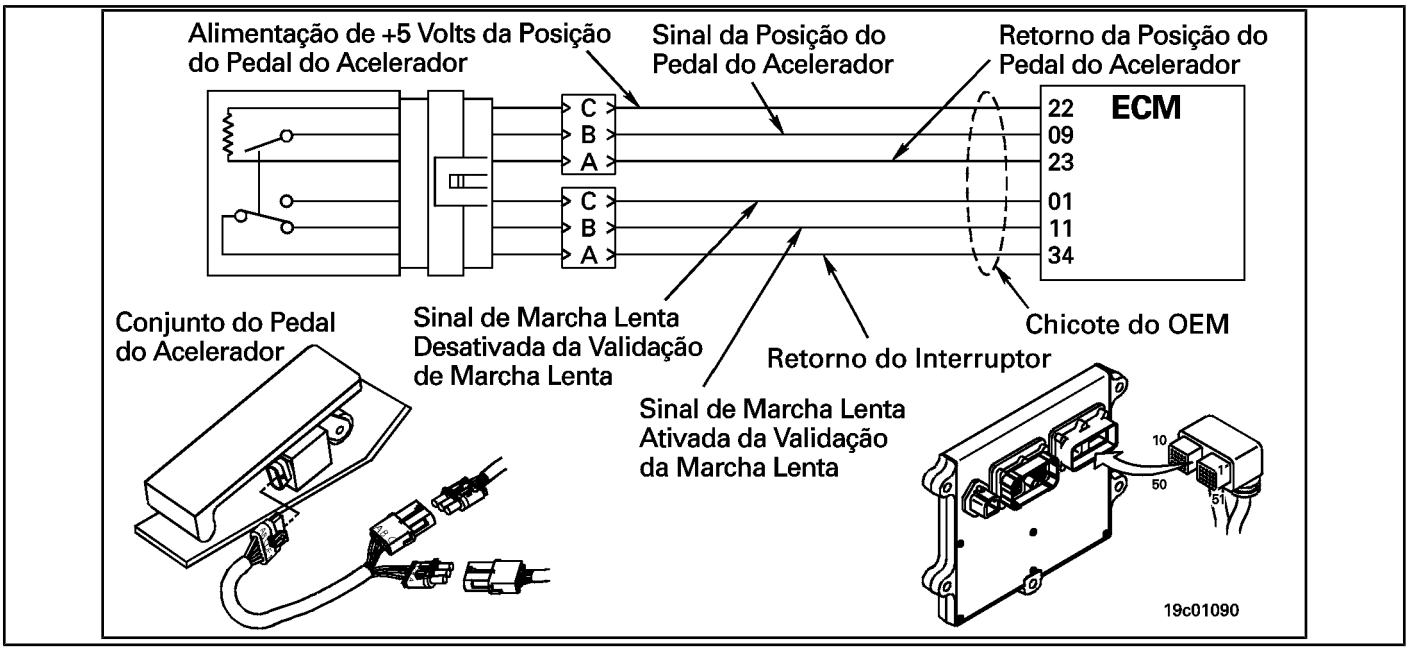
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **DO NOT** **REPAIR:** Troubleshoot any other active fault code.	Proper troubleshooting and repair steps

Fault Code 2186

Sensor Supply Voltage Circuit 4 - Voltage Below Normal or with Low Voltage

CODES	REASON	IT IS MADE
Fault Code: 2186 PID (P), SID (S): S232 IMF: 4/4 Lamp: Amber SRT:	Sensor Supply Voltage Circuit 4 - Voltage Below Normal or Low Voltage. Low voltage detected in the +5 volt supply circuit of the accelerator pedal position sensor.	Automotive: The engine will run **only** idling. Marine: Severe reduction in engine speed. Wattage **only** in emergency mode. Marine: Severe reduction in engine speed. Wattage **only** in emergency mode.

Pedal Position Sensor Power Circuit or Throttle Lever



Circuit Descriptions:

The electronic control module (ECM) provides +5 VDC to the accelerator. If the power circuit to the accelerator is damaged, the accelerator **not** will work correctly.

Component Location:

The accelerator pedal or lever assembly is located in the cab. For Marine applications, the throttle lever is usually located in the engine compartment or the rudder.

Workshop Tips:

For Marine applications, the throttle lever is usually located in the engine compartment or the rudder.

The low voltage in the +5 VDC power line of the throttle can be caused by a short circuit with ground in the power line, a short circuit between the power line and the return line, or a failure in the power supply. ECM power.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch /

AMP / Metri-Pack female test lead. STEPS

		SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.			
STEP 1A: Check for a passcode active fault.		**Fault code 2186 active?**	
STEP 2: Check the sensors and circuits connected to the supply circuit and return sensor.			
STEP 2A:	**Inspect the pedal or throttle lever position sensor and the circuit connected to the sensor supply and return circuit.**	**Dirty or damaged pins?**	
STEP 2B: Check the circuit response.		**Fault code 2186 active?**	
STEP 3: Check the OEM's ECM and harness.			
STEP 3A:	**Inspect the ECM and the OEM harness connector pins.**	**Dirty or damaged pins?**	
STEP 3B: Check for a short circuit between pins in the OEM harness.		**More than 100k ohms?**	
STEP 3B-1: Check for a short circuit between pins and ground in the OEM harness.		**More than 100k ohms?**	
STEP 4: Clear the fault codes.			
STEP 4A: Disable the fault code.		**Fault code 2186 inactive?**	
STEP 4B: Clear the fault codes inactive.		**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Check for an active fault code. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an active fault code. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 2186 active? **YEA**	2A
	Fault code 2186 active? **NOT**	Fault Code Inactive or Intermittent, Procedure 019-362 .

STEP 2: Check the sensors and circuits connected to the supply and sensor return.

STEP 2A: Inspect the pedal or throttle lever position sensor and the circuit connected to the sensor supply and return circuit.

Conditions:
- Turn the ignition key off.
- Disconnect the pedal position sensor or the throttle lever from the OEM harness.

Action	Specifications / Repair	Next step
Check that the OEM harness and ECM connector pins have: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins • Damage to the wire shield • Connector cover broken. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-071 .	4A
	Dirty or damaged pins? **NOT**	2B

STEP 2B: Check the circuit response. Conditions:

- Turn the ignition key off.
- Disconnect the pedal position sensor or the throttle lever from the OEM harness.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an appropriate ECM response after 30 seconds. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 2186 active? **YEA**	3A
	Fault code 2186 active? **DO NOT** **REPAIR:** Replace the pedal position sensor or the throttle lever. Refer to the OEM fault diagnosis manual.	4A

STEP 3: Check the OEM's ECM and harness.

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

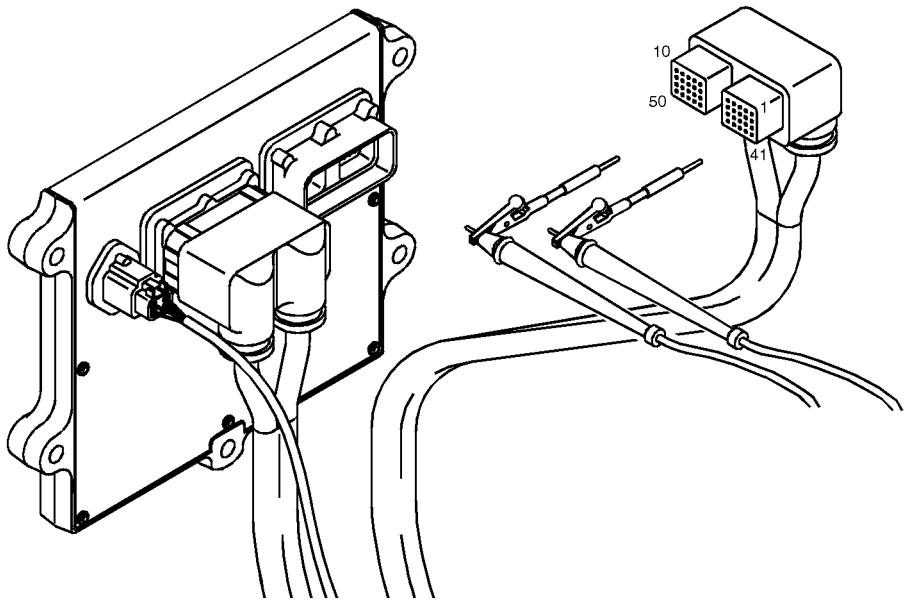
Conditions:
- Turn the ignition key off.
- Disconnect the OEM harness from the ECM.

Action	Specifications / Repair	Next step
Check that the OEM harness and ECM connector pins have: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins • Damage to the wire shield • Connector cover broken.	Dirty or damaged pins? **YES** **Repair:** Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-071 .	4A
For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **NOT**	3B

STEP 3B: Check the OEM harness for a short circuit between pins. Conditions:

- Turn the ignition key off.
- Disconnect the OEM harness from the ECM.
- Disconnect the pedal position sensor or the throttle lever from the OEM harness.

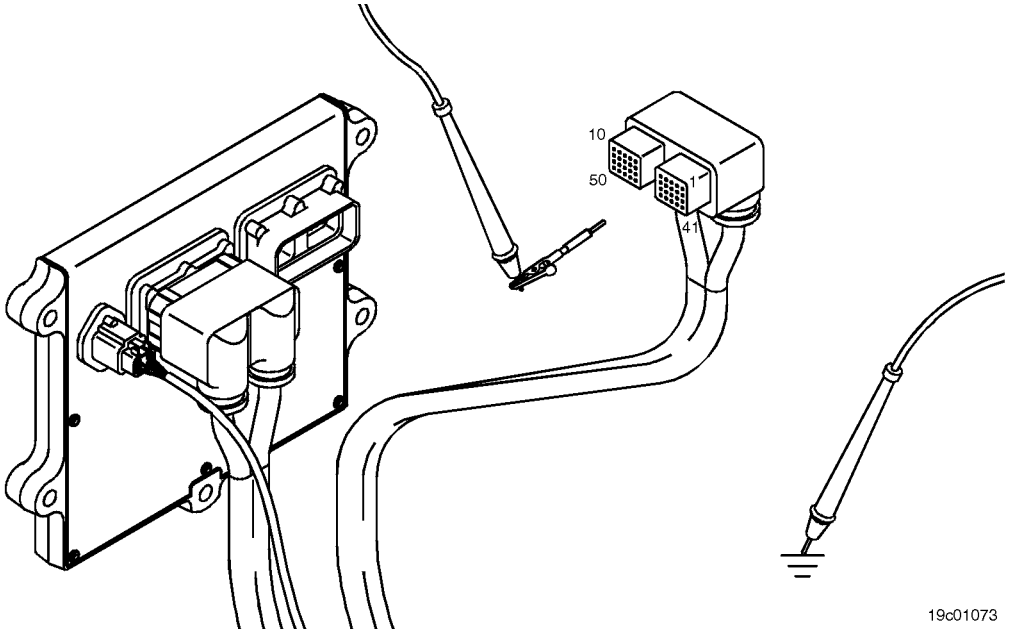
Action	Specifications / Repair	Next step
Check for a short circuit between pins. Measure the resistance between the +5 volt POWER pin on the pedal position sensor or the throttle lever, on the ECM connector on the OEM harness, and all other pins on the OEM connector. Refer to the circuit diagram or electrical diagram for the identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YEA**	3B-1
	More than 100k ohms? **DO NOT** **REPAIR:** A short circuit was detected in the +5 volt power wire from the accelerator pedal. Repair or replace the OEM harness. See the Procedure 019-071 .	4A



STEP 3B-1: Check the OEM harness for a short circuit between pins and ground. Conditions:

- Turn the ignition key off.
- Disconnect the OEM harness from the ECM.
- Disconnect the pedal position sensor or the throttle lever from the OEM harness.

Action	Specifications / Repair	Next step
Check for a short circuit with the ground. Measure the resistance between the +5 volt POWER pin on the accelerator pedal on the ECM connector, on the OEM harness, and the ground. Refer to the circuit diagram or electrical diagram for the identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YEA**	4A
	More than 100k ohms? **DO NOT** **REPAIR:** A short circuit was detected in the +5 volt power wire from the accelerator pedal. Repair or replace the OEM harness. See the Procedure 019-071 .	4A



STEP 4: Clear the fault codes.

STEP 4A: Disable the fault code. Conditions:

- Connect all components.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Using the electronic service tool INSITE ™, make sure that the fault code is inactive.	Fault code 2186 inactive? **YEA**	4B
	Fault code 2186 inactive? **NOT**	1A

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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

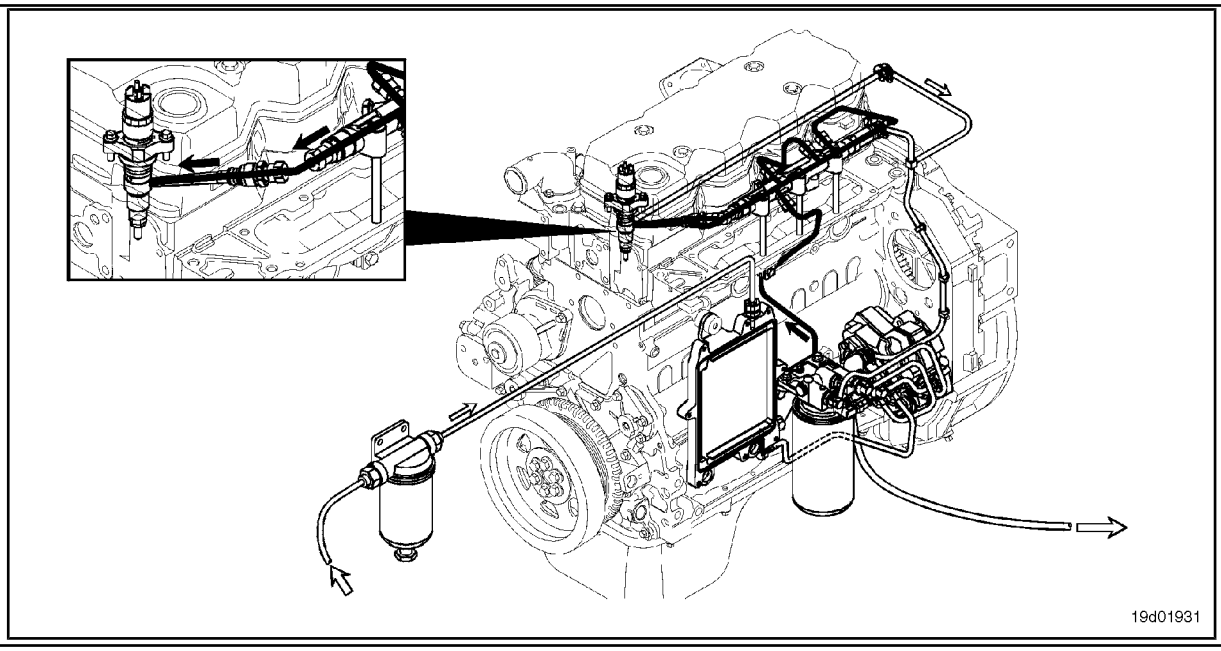
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **NOT**	Proper troubleshooting and repair steps

Fault Code 2215 (ISB / QSB - Automotive or Industrial Application)

Fuel Pump Supply Pressure - Data Valid but Below Range
Normal Operating - Moderately Severe Level

CODES	REASON	IT IS MADE
Fault Code: 2215 PID (P), SID (S): P94 IMF: 1 Lamp: Amber SRT:	Fuel pump supply pressure - data valid but below normal operating range - moderately severe level. The ECM has detected that the fuel pressure on the common rail is less than the commanded pressure.	Possible difficulty in starting; loss of power; possible smoke emission. It is possible that the engine not start it.

Fuel System



Circuit Descriptions:

The fuel pressure control circuit depends on the fuel pressure supplied to the high pressure pump by the electric transfer pump and the low pressure pump. The electronic control module (ECM) monitors the fuel pressure in the common rail and the operating conditions of the engine, changing the flow control to maintain the correct fuel pressure in the common rail. Changes in the flow control result in the opening (or closing) of the electronic fuel control actuator to supply more (or less) fuel to the high pressure pump.

The fuel flow circuit includes, in the following fuel flow order:

- Fuel tank
- OEM fuel supply line
- OEM 300 micron filter
- ECM cooling plate
- Electric transfer pump
- Fuel filter
- Gear pump
- Electronic fuel control actuator
- High pressure fuel pump
- Common rail (includes fuel pressure relief valve and pressure sensor)
- High pressure fuel lines

- High pressure fuel connectors
- Injectors
- Return to the tank.

Component Location:

The fuel pump is located at the rear of the engine, on the intake side. See the Procedure 100-002 for the detailed location of each component.

Workshop Tips:

The causes of this fault code include: High intake restriction, excess air in the fuel or loss of fuel during engine start, clogged fuel filter, low transfer pump pressure, blocked or restricted electronic fuel control actuator , system return (excessive return flow from injectors, high pressure pump, or pressure relief valve on the common rail), or violation. Fault Code 2292 is recorded when the ECM sends a signal to the electronic fuel control actuator (EFC) to open more than expected to maintain pressure on the common rail. Fault Code 2215 occurs when the ECM fully opens the electronic fuel control actuator and the pressure on the common rail is still less than the commanded.

If the drain line is completely constricted, the high pressure fuel pump will fail, causing an internal leak. There will be a restriction indication on the drain line before the fault codes occur. Fault codes are 2216, 2293 or 449. After the fault, these fault codes will become inactive and Fault Code 2215, which indicates a leak, will become active. If Fault Code 2215 diagnosis results in pump replacement and there are inactive Fault Code 2216, 2293 or 449 counts, the restriction on the drain line **must** inspected and measured. This is done to avoid the repetition of failures of the high pressure pump.

SUMMARY OF FAULT DIAGNOSTICS

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Read the fault codes.	Fault code 2266 inactive?	
STEP 2: Check the operation of the low pressure fuel system.		
STEP 2A: Check for leaks external fuel.	Are there any leaks?	
STEP 3: Check the transfer pump.		
STEP 3A: Measure the pressure of the transfer.	Does the transfer pump meet the minimum specifications?	
STEP 3B: Measure the input restriction of the transfer pump.	Less than 6 inches Hg?	
STEP 4: Check the fuel filter restriction.		
STEP 4A: Measure the pressure drop at the fuel filter.	Is the pressure drop less than 5 psi?	
STEP 5: Check the high pressure fuel system.		
STEP 5A: Check for leaks in the fuel pressure relief valve on the common rail.	Fuel return within specifications?	
STEP 5B: Check for leaks excessive fuel return from the high pressure fuel system, high pressure injectors and connectors.	Fuel leakage within specifications?	
STEP 5C: Check for return excessive fuel from the high pressure fuel pump.	Fuel return within specifications?	
STEP 6: Clear the fault codes.		
STEP 6A: Disable the fault code.	Fault codes inactive?	
STEP 6B: Clear the fault codes inactive.	All codes cleared?	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Read the fault codes. Conditions:

- Connect the electronic service tool INSITE ™.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Read the fault codes. • Start the engine and let it run at idle for 1 minute. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 2266 inactive? **YEA**	2A
	Fault code 2266 inactive? **DO NOT** **REPAIR:** Troubleshoot the applicable fault codes.	Applicable fault codes

STEP 2: Check the operation of the low pressure fuel system.

STEP 2A: Check for external fuel leaks. Conditions:

- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check for external fuel leaks. • Start the engine and let it run at idle. • Check for external fuel leaks.	Are there any leaks? **YES** **Repair:** Repair fuel leaks.	6A
	Are there any leaks? **NOT**	3A

STEP 3: Check the transfer pump.

STEP 3A: Measure the pressure of the transfer pump. Conditions:

- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Measure the performance of the transfer pump. • Refer to Procedure 005-045 in the ISB Series Engine Troubleshooting and Repair Manual and and ISB (Common Rail Fuel System), Bulletin 3653336. to measure the flow of the transfer pump.	Does the transfer pump meet the minimum specifications? **YEA**	4A
	Does the transfer pump meet the minimum specifications? **NOT**	3B

STEP 3B: Measure the transfer pump inlet restriction. Conditions:

- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Measure the inlet restriction of the transfer pump. • Refer to Procedure 006-020 in the ISB Series Engine Troubleshooting and Repair Manual and and ISB (Common Rail Fuel System), Bulletin 3653336.	Less than 6 inches Hg? **YES** **Repair:** Replace the electric fuel transfer pump. Refer to Procedure 005-045 in the ISB Series Engine Troubleshooting and Repair Manual and and ISB (Common Rail Fuel System), Bulletin 3653336.	6A
	Less than 6 inches Hg? **DO NOT** **REPAIR:** Replace the OEM fuel filter or eliminate the cause of the intake restriction.	6A

STEP 4: Check the fuel filter restriction.

STEP 4A: Measure the pressure drop in the fuel filter. Conditions:

- Turn the ignition key ON.
- Start the engine and let it run at rated speed.

Action	Specifications / Repair	Next step
Measure the pressure drop in the fuel filter. • Refer to Procedure 006-015 in the basic engine fault diagnosis and repair manual, Bulletin 3653336.	Is the pressure drop less than 5 psi? **YEA**	5A
	Is the pressure drop less than 5 psi? **DO NOT** **REPAIR:** Replace the filter on the pressure side and make sure that the fuel lines on the pressure side **not** show restriction.	6A

STEP 5: Check the high pressure fuel system.

STEP 5A: Check for leaks in the fuel pressure relief valve on the common rail. Conditions:

- Turn the ignition key off.
- Install test connections to measure the fuel return from the fuel pressure relief valve on the common rail.

Action	Specifications / Repair	Next step
Check for leaks in the fuel pressure relief valve on the common rail. • Install test connections to measure fuel return. • Test in Procedure 006-061 in the ISB Series Engine Troubleshooting and Repair Manual and and ISB (Common Rail Fuel System), Bulletin 3653336.	Fuel return within specifications? **YEA**	5B
	Fuel return within specifications? **DO NOT** **REPAIR:** Replace the pressure relief valve on the common rail. Refer to Procedure 006-061 in the ISB Series Engine Troubleshooting and Repair Manual and and ISB (Common Rail Fuel System), Bulletin 3653336.	6A

STEP 5B: Check for excessive fuel return leakage from the fuel system high-pressure fuel, high-pressure injectors and connectors.

Conditions:
- Turn the ignition key off.
- Install test connections to measure fuel return from injectors and high pressure connectors.

Action	Specifications / Repair	Next step
Check for high fuel leaks in the high pressure injectors and connectors. • Refer to Procedure 006-052 in the ISB Series Engine Troubleshooting and Repair Manual and and ISB (Common Rail Fuel System), Bulletin 3653336.	Fuel leakage within specifications? **YEA**	5C
	Fuel leakage within specifications? **DO NOT** **REPAIR:** Isolate the leak source and repair it. Refer to Procedure 006-052 in the ISB Series Engine Troubleshooting and Repair Manual and and ISB (Common Rail Fuel System), Bulletin 3653336.	6A

STEP 5C: Check for excessive fuel return from the fuel pump high pressure.

Conditions:
- Turn the ignition key off.
- Install test connections to measure the fuel return from the high pressure fuel pump.

Action	Specifications / Repair	Next step
Check for excessive fuel return from the high pressure fuel pump. • Install test connections to measure the fuel return from the fuel pump. • Test in Procedure 005-016 in the ISB Series Engine Troubleshooting and Repair Manual and and ISB (Common Rail Fuel System), Bulletin 3653336.	Fuel return within specifications? **YEA**	6A
	Fuel return within specifications? **DO NOT** **REPAIR:** Replace the high pressure fuel pump. Refer to Procedure 005-016 in the ISB Series Engine Troubleshooting and Repair Manual and and ISB (Common Rail Fuel System), Bulletin 3653336.	6A

STEP 6: Clear the fault codes.

STEP 6A: Disable the fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Check that the fault codes are inactive.	Fault codes inactive? **YEA**	6B
	Fault codes inactive? **DO NOT** **REPAIR:** Return to the troubleshooting steps or consult your local Cummins Authorized Service Station after checking and completing all diagnostic steps again.	1A

STEP 6B: Clear the inactive fault codes. Conditions:

- Connect all components.
- Do a 15-20 minute road test or run the engine on the dynamometer.
- Turn the ignition key ON.

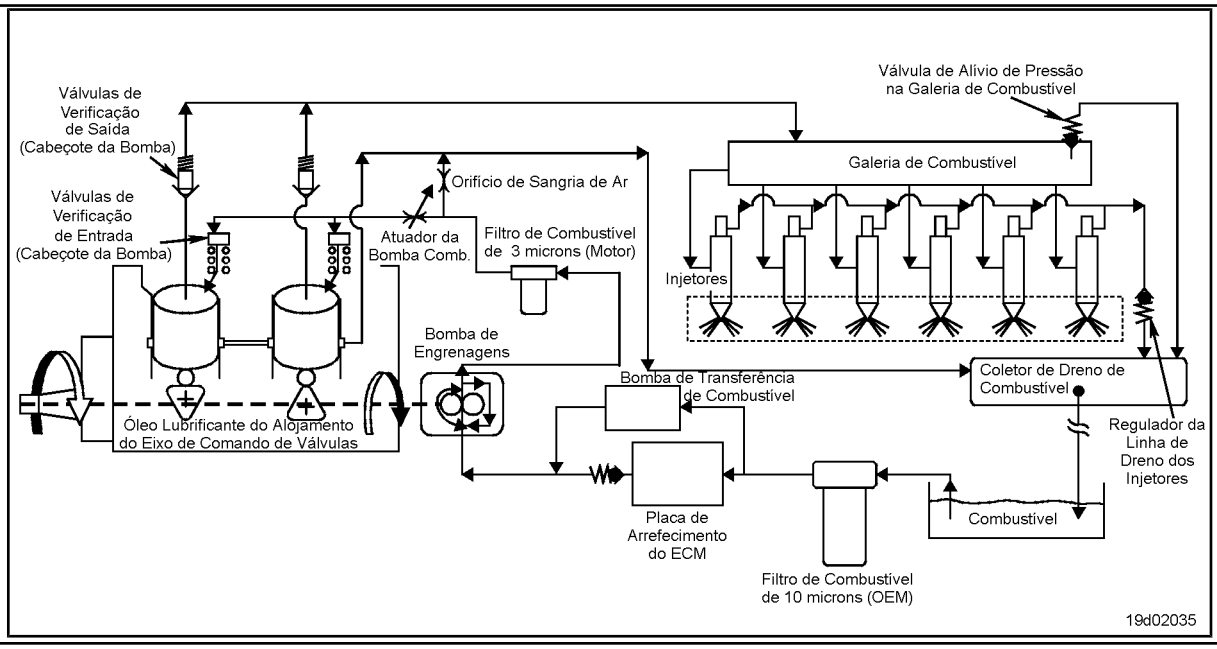
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **DO NOT** **REPAIR:** Troubleshoot any other active fault code.	Proper troubleshooting and repair steps

Fault Code 2215 (ISC / QSC / ISL / QSL - Automotive, Industrial or Maritime)

Low Fuel Pump Supply Pressure - Data Valid but Below Normal Operating Range - Moderately Severe Level

CODES	REASON	IT IS MADE
Fault Code: 2215 PID (P), SID (S): P94 IMF: 0/18 Lamp: Yellow SRT:	Low Fuel Pump Supply Pressure - Valid Data but Below Normal Operating Range - Moderately Severe Level. The ECM has detected that the fuel pressure is less than the commanded pressure.	Possible starting difficulty, loss of power, or smoke emission.

Fuel Flow Diagram



Circuit Descriptions:

The pressure control circuit is based on the pressure of the fuel delivered to the high pressure pump by the fuel gear pump. The electronic control module (ECM) monitors the fuel pressure in the common rail and the operating conditions of the engine, changing the flow control to maintain the correct fuel pressure in the common rail. Changes in the flow control result in the 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
- Fuel water removal filter (10 microns, water removal, fuel filter on the suction side)
- Engine-mounted fuel OEM connection
- Fuel supply pipe to the ECM cooling plate
- ECM cooling plate
- Fuel supply pipe for the low pressure gear pump
- Fuel supply pipe for the fuel filter on the pressure side
- Main fuel filter (3 micron, fuel filter on the pressure side)
- Fuel supply pipe for the high pressure pump

- High pressure bomb
- High pressure system (including common rail and pressure relief valve on common rail), injectors and high pressure lines.

Component Location:

The high pressure fuel pump is mounted on the gear housing on the intake side of the engine. See the Procedure 100-002 for the detailed location of each component.

Workshop Tips:

If the engine **not** start and Fault Code 2215 becomes active during start-up, but there is no engine speed sensor fault code, monitor the pressure on the common rail using INSITE ™. If the pressure on the common rail is low, check the following:

- Priming the fuel system (make sure that there is fuel in the tanks and that the system is primed)
- Fuel transfer pump pressure (see Procedure 005-045 in the ISC Engine Troubleshooting and Repair Manual, QSC8.3, ISL and QSL9, Bulletin 3653266).
- Fuel gear pump pressure (see Procedure 005-025 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266).

If the gear pump pressure is correct, test the system for leakage:

- High pressure pump leak (see Procedure 005-227 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266).
- Injector leakage (see Procedure 006-026 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266)
- Pressure relief valve on the common rail.

If Fault Code 2215 is inactive and there is no performance claim, it is possible that the vehicle has run out of fuel or the fault has become active because the engine **not** was primed after replacing the fuel filter. Clear the inactive fault codes.

Fault Code 2215 occurs when the engine is running and the pressure measured on the common rail remains at least 10 MPa [1450 psi] less than the commanded pressure. Once detected, Fault Code 2215 will remain active until the engine is stopped or until the pressure measured on the common rail is equal to the commanded pressure on the common rail. When a condition exists that causes Fault Code 2215 to activate, it is normal for the fault code to become active when the engine is under heavy load and to become inactive when the engine is under light load.

When Fault Code 2215 occurs, the fuel system lost its ability to maintain pressure on the common rail. Possible causes of this failure include:

- Fuel entry restrictions
- Fuel filter obstruction
- Low fuel gear pump output
- Leaky or leaking fuel gear pump regulator
- Decreased capacity of the high pressure pump (large leak to the drain through the high pressure pump)

- Leaking fuel pressure relief valve to drain
- Fuel pressure relief valve opens at very low pressure
- Fuel injector circuit leaking into the drain
- Pressure sensor with a reading greater than 10 MPa [1450 psi] below the actual pressure.

Intermittent ECM power connections can cause Fault Code 2215 to occur. If the engine is running with Fault Code 2215 active and Fault Codes 449 or 2311 **not** are present, check if the ECM power has intermittent connections. Fault Code 1117 may also become active if this fault condition exists.

SUMMARY OF FAULT DIAGNOSTICS

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Read the fault codes.	Are Fault Codes 275, 449, 1117 or 2311 active or are there high counts of inactive faults?	
STEP 2: Check the operation of the low pressure fuel system.		
STEP 2A: Check for leaks external fuel.	Is there an external fuel leak?	
STEP 2B: Check if it is possible to give engine start.	Does the engine start?	
STEP 2C: Check the pump pressure fuel gears.	Is the pressure of the fuel gear pump greater than 138 kPa [20 psi] during the engine start speed?	
STEP 2D: Check the pump pressure fuel transfer.	Is the pressure of the fuel transfer pump greater than 34 kPa [5 psi]?	
STEP 3: Check the low pressure fuel system.		
STEP 3A: Measure the pressure at the filter outlet on the pressure side.	Is the gear pump pressure low?	
STEP 3B: Measure the pressure at the inlet fuel filter on the pressure side.	Is the restriction on the filter high?	
STEP 3C: Measure the fuel restriction at the gear pump inlet.	Is the fuel pump intake restriction too high?	
STEP 3D: Measure the entry restriction on the OEM connection point.	Is the entry restriction at the OEM connection point too high?	
STEP 4: Check the high pressure fuel system.		
STEP 4A: Check for return fuel through the fuel injector drain line.	Is the fuel injector leakage excessive?	
STEP 4B: Check for return fuel from the fuel pump head.	Is the fuel pump leakage excessive?	
STEP 4C: Check for leaks excessive pressure relief valve on the common rail.	Is the leak in the pressure relief valve on the common rail excessive?	
STEP 4D: Inspect the fuel pump head for damage.	Has any damage been found to the fuel pumping pistons?	
STEP 5: Make sure the repair is complete.		

STEP 5A: Disable the fault code. — **Did Fault Code 2215 become active while the engine was running under load?**

STEP 5B: Clear the fault codes inactive. — **All codes cleared?**

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Read the fault codes. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Read the fault codes. • Use the electronic service tool INSITE ™ to read fault codes.	Are Fault Codes 275, 449, 1117 or 2311 active or are there high counts of inactive faults? **YEA**	Appropriate fault diagnosis diagram
	Are Fault Codes 275, 449, 1117 or 2311 active or are there high counts of inactive faults? **NOT**	2A

STEP 2: Check the operation of the low pressure fuel system.

STEP 2A: Check for external fuel leakage. Conditions:

- Engine running.

Action	Specifications / Repair	Next step
Check for external fuel leaks. • Start the engine and let it run at idle. • Check for external fuel leaks.	Is there an external fuel leak? **YES** **Repair:** Repair all fuel leaks. Refer to ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266.	5A
	Is there an external fuel leak? **NOT**	2B

STEP 2B: Check whether it is possible to start the engine. Conditions:

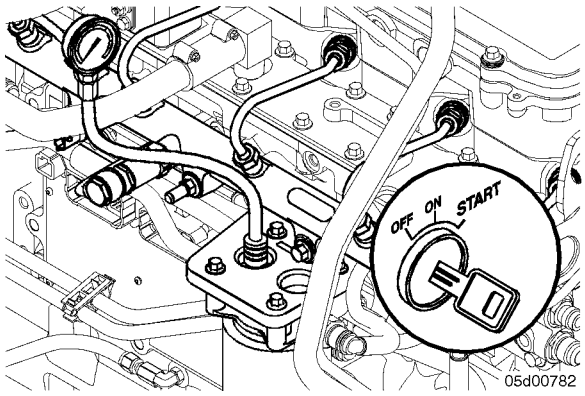
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Attempt to start the engine.	Does the engine start? **YEA**	3A
	Does the engine start? **NOT**	2C

STEP 2C: Check the pressure of the fuel gear pump. Conditions:

- Install a pressure gauge on the pressure side of the fuel filter head. Refer to Procedure 005-025 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266.
- Turn the ignition key ON.

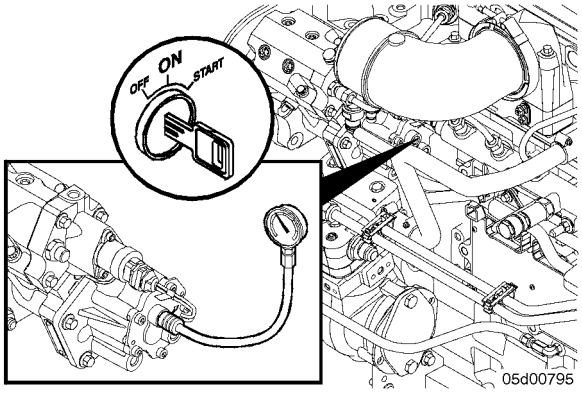
Action	Specifications / Repair	Next step
Measure the outlet pressure of the fuel gear pump during engine cranking. • The engine starting speed **must** be greater than 150 rpm.	Is the pressure of the fuel gear pump greater than 138 kPa [20 psi] during the engine start speed? **YEA**	4A
Refer to Procedure 005-025 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266.	Is the pressure of the fuel gear pump greater than 138 kPa [20 psi] during the engine start speed? **NOT**	2D



STEP 2D: Check the pressure of the fuel transfer pump. Conditions:

- Install a pressure gauge on the high pressure pump gear pump inlet port.
- Turn the ignition key ON.

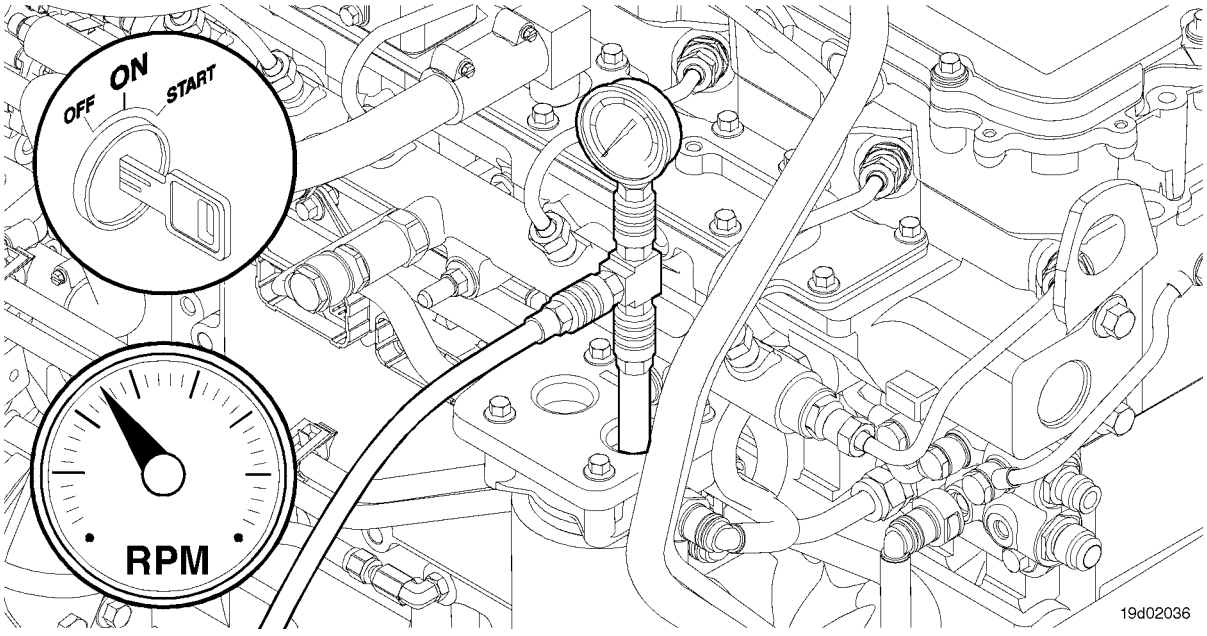
Action	Specifications / Repair	Next step
Measure the outlet pressure of the fuel transfer pump. • When the ignition key is initially turned on, the transfer pump will run for 60 seconds and then stop. Refer to Procedure 005-045 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266.	Is the pressure of the fuel transfer pump greater than 34 kPa [5 psi]? **YES** **Repair:** Replace the fuel gear pump. Refer to Procedure 005-025 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266.	4A
	Is the pressure of the fuel transfer pump greater than 34 kPa [5 psi]? **DO NOT** **REPAIR:** Check the fuel primer by making sure that the OEM fuel filter is full or that the fuel and air are purged from the low pressure fuel lines. Perform the INSITE ™ Transfer Pump Bypass Test, if necessary. If the low pressure fuel system is primed, replace the fuel transfer pump. Refer to Procedure 005-045 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266.	Complete repair



STEP 3: Check the low pressure fuel system.

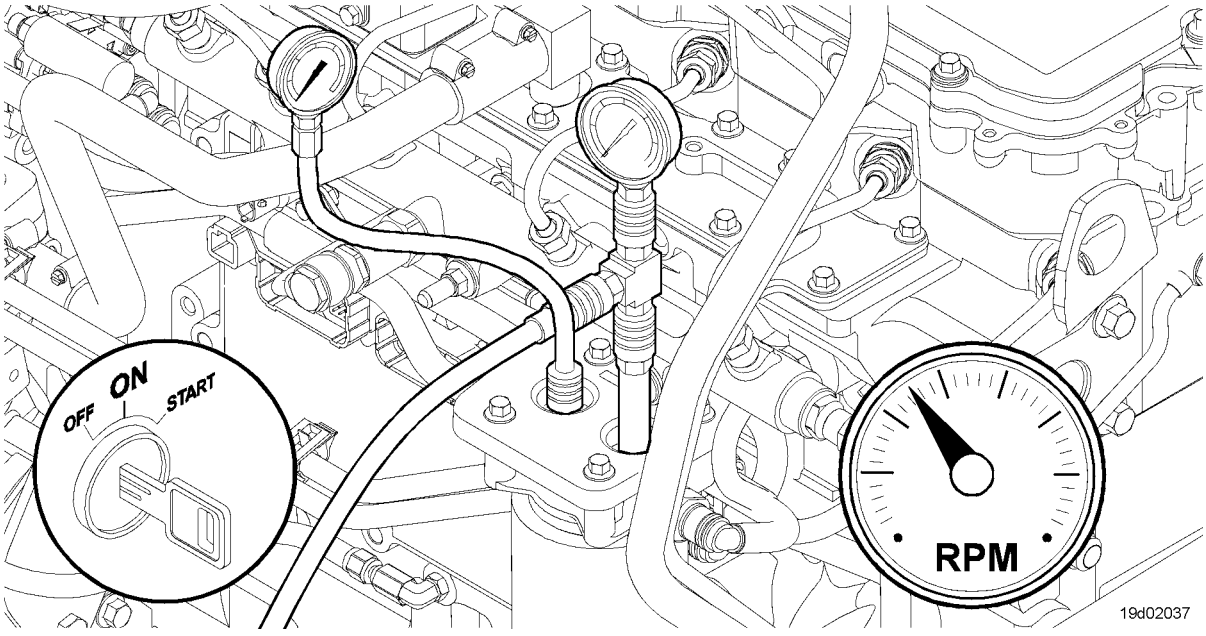
STEP 3A: Measure the pressure at the fuel filter outlet on the pressure side. Conditions:

Action	Specifications / Repair	Next step
Measure the pressure at the fuel filter outlet on the pressure side. Refer to Procedure 005-025 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266. • Install a "T" connection at the fuel filter outlet, on the pressure side. • Install a diagnostic fuel line with a 0.109 cm [0.043 inch] orifice at the "T" port. • Install a pressure gauge with a capacity of 0 to 1379 kPa [0 to 200 psi] in the "T" connection. • Start the engine. • Measure the pressure of the gear pump at maximum idle speed. Refer to Procedure 005-025 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266.	Is the gear pump pressure low? • Minimum gear pump pressure at maximum idle speed: 483 kPa [70 psi] **YEA**	3B
	Is the gear pump pressure low? • Minimum gear pump pressure at maximum idle speed: 483 kPa [70 psi] **NOT**	4A



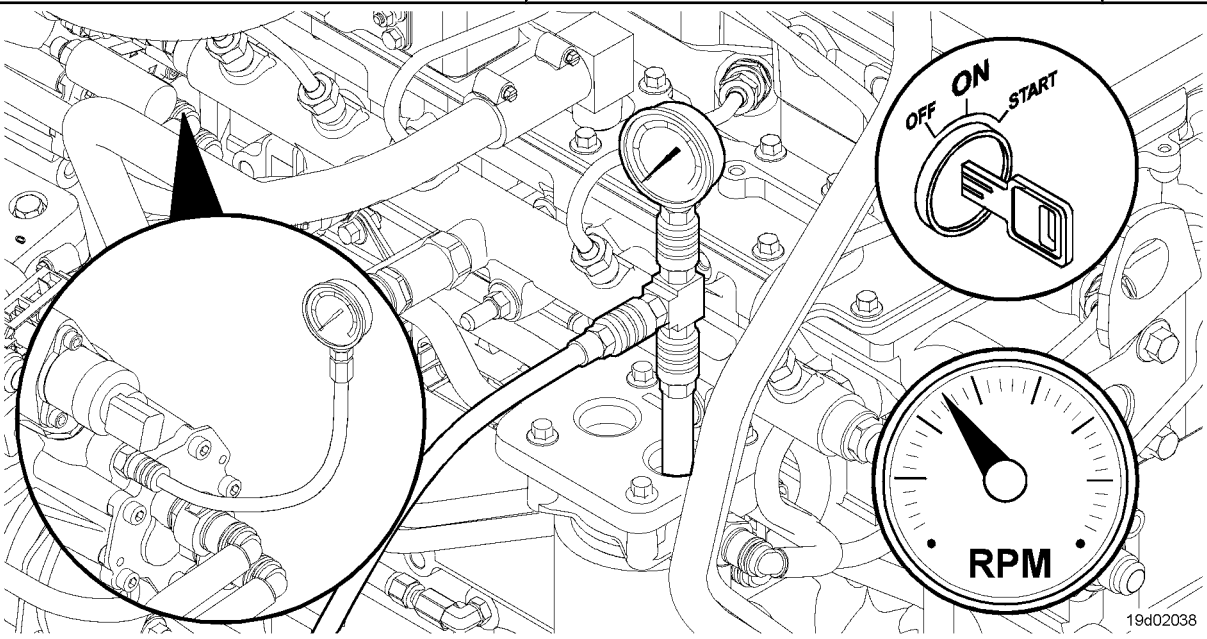
STEP 3B: Measure the pressure at the fuel filter inlet on the pressure side. Conditions:

Action	Specifications / Repair	Next step
Refer to Procedure 005-025 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266. • Install a "T" connection at the fuel filter outlet, on the pressure side. • Install a diagnostic fuel line with a 0.109 cm [0.043 inch] orifice at the "T" port. Connect the outlet of this fuel line to a container or to the vehicle's fuel tank. • Install a pressure gauge with a capacity of 0 to 1379 kPa [0 to 200 psi] in the "T" connection. • Install a 0 to 1379 kPa [0 to 200 psi] pressure gauge at the fuel filter inlet, pressure side. • Start the engine. • Measure the pressure of the gear pump at maximum idle speed.	Is the restriction on the filter high? • Maximum pressure drop in the fuel filter: 138 kPa [20 psi] **YES** **Repair:** The fuel filter is blocked. Replace the fuel filter, pressure side. Refer to Procedure 006-015 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266.	5A
	Is the restriction on the filter high? • Maximum pressure drop in the fuel filter: 138 kPa [20 psi] **NOT**	3C



STEP 3C: Measure the fuel restriction at the gear pump inlet. Conditions:

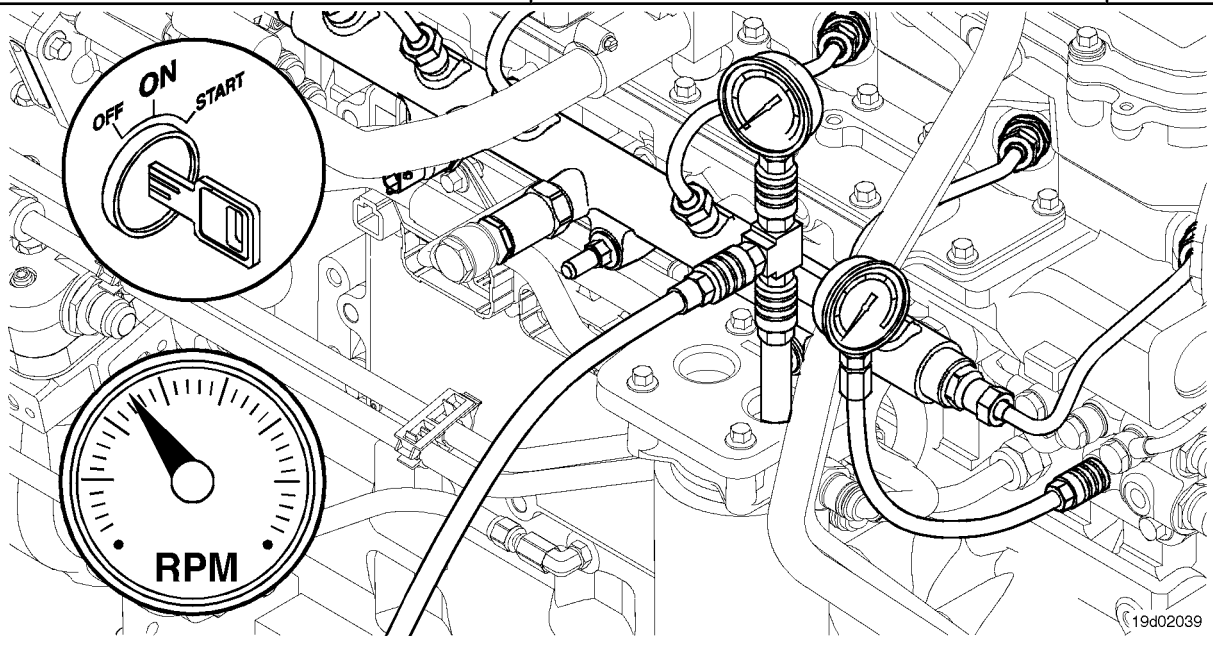
Action	Specifications / Repair	Next step
Measure the restriction at the fuel inlet. • Refer to Procedure 006-020 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266. • Install a diagnostic connection at the fuel gear pump inlet. • Install a 0 to 30 in-Hg vacuum gauge at the gear pump inlet. • Install a standard threaded M10 O-ring diagnostic connection on the fuel filter outlet port, pressure side. • Install a 0.109 cm [0.043 inch] diagnostic connection in the outlet port, pressure side. • Start the engine and let it run at maximum idle speed and measure the restriction at the gear pump inlet. If the engine **not** starts and oscillates, make sure that the fuel is primed for the gear pump. This test will be valid **only** if the engine is running.	Is the fuel pump intake restriction too high? • Maximum restriction on the gear pump inlet: 10 in-Hg **YES** **Repair:** There is a fuel restriction at a point prior to the gear pump. Correct the constraint.	3D
	Is the fuel pump intake restriction too high? • Maximum restriction on the gear pump inlet: 10 in-Hg **DO NOT** **REPAIR:** The gear pump pressure is low and **not** there is restriction at the entrance of the gear pump. The gear pump is worn out. Replace the defective gear pump. Refer to Procedure 005-025 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266.	5A



STEP 3D: Measure the input restriction at the OEM connection point. Conditions:

- Engine running.

Action	Specifications / Repair	Next step
Measure the restriction at the fuel inlet. • Refer to Procedure 006-020 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266. • Install a vacuum gauge with a capacity of 0 to 30 in-Hg at the entry point of the OEM connection. • Install a standard threaded M10 O-ring diagnostic connection on the fuel filter outlet port, pressure side. • Install a 0.109 cm [0.043 inch] diagnostic connection in the outlet port, pressure side. • Start the engine and let it run at maximum idle speed and measure the restriction at the gear pump inlet. If the engine **not** starts and oscillates, make sure that the fuel is primed for the gear pump. This test will be valid **only** if the engine is running.	Is the entry restriction at the OEM connection point too high? • Maximum restriction on OEM point entry: 6 in-Hg **YES** **Repair:** There is a fuel restriction at a point prior to the point of the OEM connection. Refer to the OEM service manual.	5A
	Is the entry restriction at the OEM connection point too high? • Maximum restriction on OEM point entry: 6 in-Hg **DO NOT** **REPAIR:** There may be a restriction between the OEM connection point and the gear pump inlet. Inspect the ECM cooling plate and the cooling plate check valve. Refer to Procedure 006-006 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266.	5A

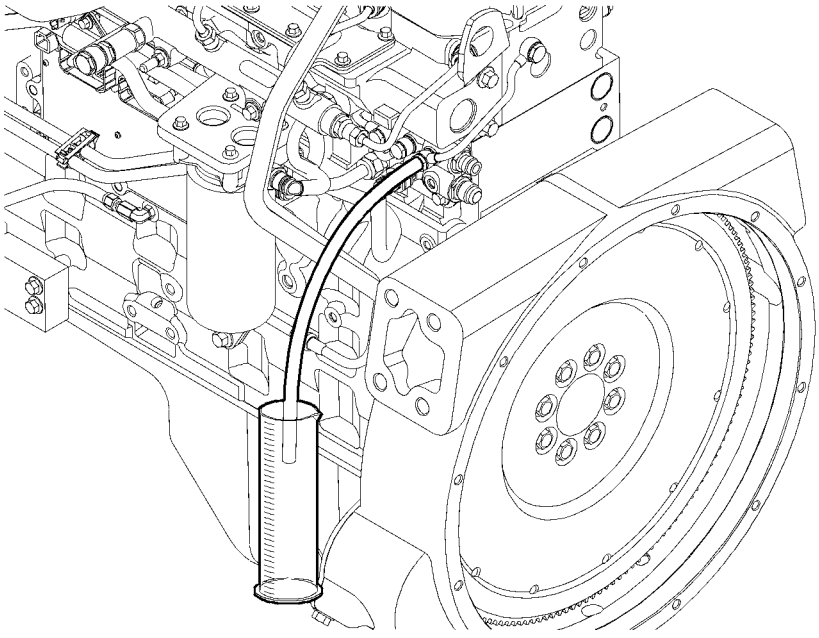


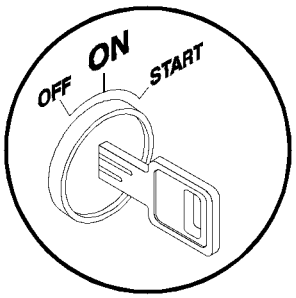
STEP 4: Check the high pressure fuel system.

STEP 4A: Check for excessive fuel return through the fuel injector drain line fuel.

Conditions:
- Turn the ignition key off.
- Install test connections to measure the fuel drain from the injectors. Refer to Procedure 006-026 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266.
- Connect a hose to the test connection to a clean graduated cylinder.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Start the engine. • Use the High Pressure Test of the INSITE ™ electronic service tool to raise the pressure on the common rail. • Measure the fuel leak in the fuel injector return line. If the engine **not** start, perform this test while the engine starts turning. Refer to Procedure 006-026 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266.	Is the fuel injector leakage excessive? • The leak in the fuel injector **not** exceed 100 cc in 30 seconds of engine rotation if it **not** start. **YES** **Repair:** Isolate the high pressure injector (s) / connector (s) that are the cause of excessive leakage. Tighten the loose high pressure fuel connectors. Refer to Procedure 006-026 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266.	5A
	Is the fuel injector leakage excessive? • The leak in the fuel injector **not** exceed 100 cc in 30 seconds of engine rotation if it **not** start. **NOT**	4B





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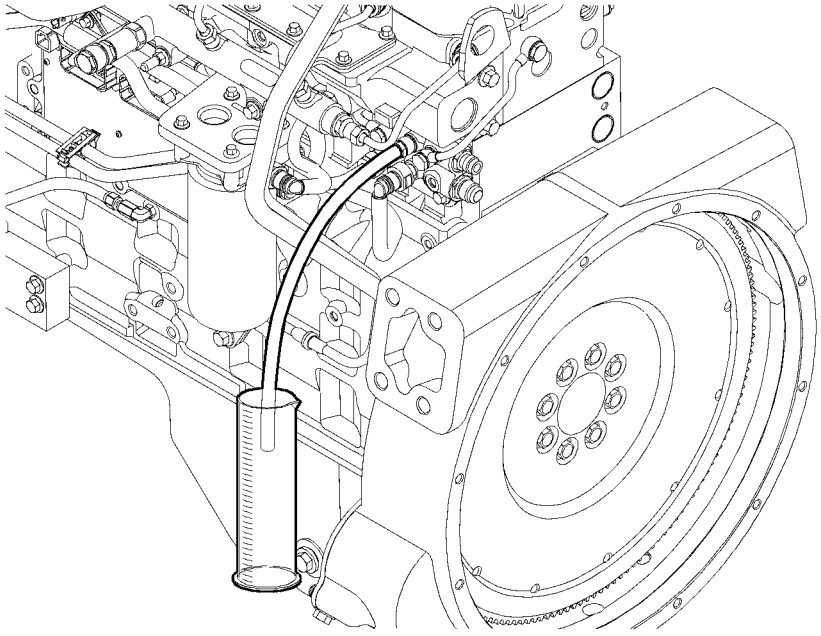
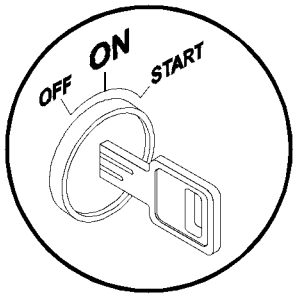
STEP 4B: Check for excessive fuel return from the high pressure pump. Conditions:

- Turn the ignition key off.
- Install test connections to measure the fuel drain from the fuel pump head. Refer to Procedure 005-227 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266.

- Connect a hose to the test connection to a clean graduated cylinder.
- Engine running.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Start the engine. • Use the Pressure Control Relief Pressure Test of the INSITE ™ electronic service tool to raise the pressure on the common rail. • Measure the fuel leak from the fuel pump head. If the engine **not** start, perform this test while the engine starts turning. Refer to Procedure 005-227 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266.	Is the fuel pump leakage excessive? • The leak at the fuel pump **not** exceed 200 cc in 30 seconds of engine rotation if it **not** start. **YES** **Repair:** Replace the fuel pump head. Refer to Procedure 005-227 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266.	5A
	Is the fuel pump leakage excessive? • The leak at the fuel pump **not** exceed 200 cc in 30 seconds of engine rotation if it **not** start. **NOT**	4C





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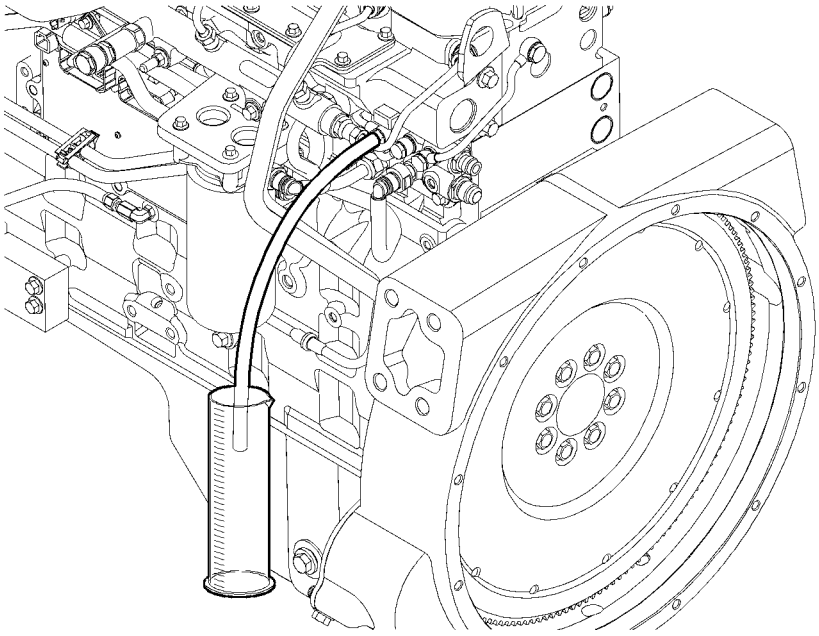
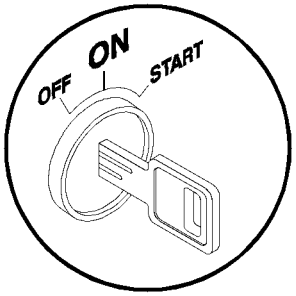
STEP 4C: Check for excessive leakage in the pressure relief valve on the common rail. Conditions:

- Turn the ignition key off.
- Install test connections to measure the fuel drain from the common rail pressure relief valve. Refer to Procedure 006-061 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266.
- Install a hose on the test connection to a clean container of sufficient capacity (example 19 liters [5 gallons]).
- Engine running.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Start the engine. • Use the Pressure Control Relief Pressure Test of the INSITE ™ electronic service tool to raise the pressure on the common rail. • Measure the fuel leak at the pressure relief valve on the common rail. If the engine not start, perform this test while the engine starts turning. Refer to Procedure 006-061 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266.	Is the leak in the pressure relief valve on the common rail excessive? • Specification: 30 drops per minute **YES** **Repair:** Replace the pressure relief valve on the common rail. Refer to Procedure 006-061 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266.	5A
	Is the leak in the pressure relief valve on the common rail excessive? • Specification: 30 drops per minute **NOT**	4D





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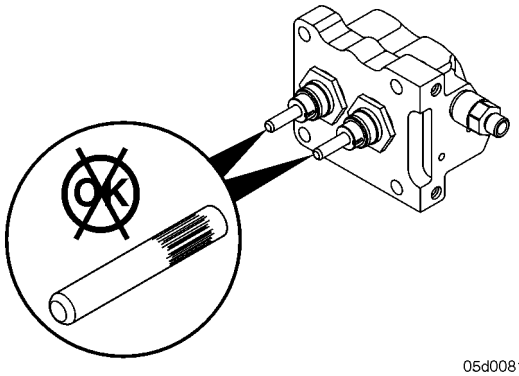
STEP 4D: Inspect the fuel pump head for damage.

Conditions:

- Remove the fuel pump head. Refer to Procedure 005-227 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266.

Action	Specifications / Repair	Next step
Inspect the fuel pump plungers for damage. Refer to Procedure 005-227 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266.	Has any damage been found to the fuel pumping pistons? **YES** **Repair:** Replace the fuel pump head. Refer to Procedure 005-227 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266.	5A
	Has any damage been found to the fuel pumping pistons? **DO NOT** **REPAIR:** Check the fault diagnosis steps again.	1A



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STEP 5: Make sure the repair is complete.

STEP 5A: Disable the fault code. Conditions:

- Engine running.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Use INSITE ™ to clear the fault code. • Perform the engine run-in test. • Use the electronic service tool INSITE ™ to read fault codes.	Did Fault Code 2215 become active while the engine was running under load? **YEA**	1A
	Did Fault Code 2215 become active while the engine was running under load? **NOT**	5B

STEP 5B: Clear the inactive fault codes. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

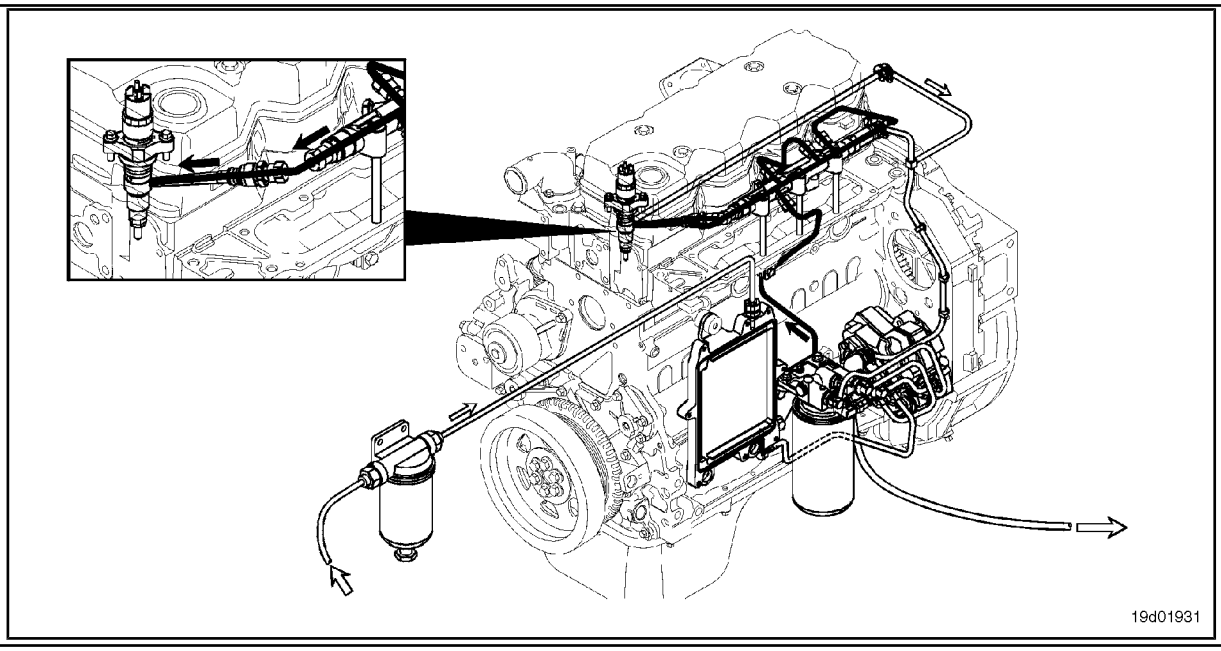
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **DO NOT** **REPAIR:** Troubleshoot any other existing fault codes.	Appropriate fault diagnosis diagrams

Fault Code 2216 (ISB / QSB - Automotive or Industrial Application)

Fuel Pump Supply Pressure - Data Valid but Above Range
Normal Operating - Moderately Severe Level

CODES	REASON	IT IS MADE
Fault Code: 2216 PID (P), SID (S): P94 IMF: 0 Lamp: Amber SRT:	Fuel pump supply pressure - data valid but above normal operating range - moderately severe level. The ECM has detected that the fuel pressure on the common rail is greater than the commanded pressure.	No effect or possible engine noise associated with higher injection pressures (especially at idle or light load). Reduction in engine power.

Fuel System



Circuit Descriptions:

The electronic control module (ECM) monitors the operating conditions of the engine, including the reading of the fuel pressure on the common rail, and changes the flow control to increase (OPEN the electronic fuel control actuator) or reduce (CLOSE the electronic fuel control actuator) the fuel supply to the high pressure pump.

Component Location:

The electronic fuel control actuator is installed in the high pressure fuel pump. See the Procedure 100-002 for the detailed location of each component.

Workshop Tips:

An excessively leaking electronic fuel control actuator will result in high fuel pressures on the common rail at idle or under light load condition, and Fault Code 2216 will be logged. A restriction on the fuel-drain-tank return line can prevent unused fuel from escaping from the high pressure fuel pump. This excess drained fuel can penetrate the pumping chamber and pressurize the common rail. Check the restriction on the fuel drain line. A high resistance or an open circuit in the electronic fuel control actuator can cause this fault to be logged. THE

presence of air in the fuel can result in pressure changes that can cause this failure to be recorded. A high supply pressure from the low pressure pump or violation of the common rail fuel pressure sensor can cause this fault to be logged.

Fault Code 2216 is activated whenever the engine is under load (non-zero fuel supply) and the measured fuel is greater than the commanded fuel pressure.

If the drain line is completely constricted, the high pressure fuel pump will fail, causing an internal leak. There will be a restriction indication on the drain line before the fault codes occur. Fault codes are 2216, 2293 or 449. After the fault, these fault codes will become inactive and Fault Code 2215, which indicates a leak, will become active. If Fault Code 2215 diagnosis results in pump replacement and there are inactive Fault Code 2216, 2293 or 449 counts, the restriction on the drain line **must** inspected and measured. This is done to avoid the repetition of failures of the high pressure pump.

SUMMARY OF FAULT DIAGNOSTICS

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Read the fault codes.	Fault code 271, 272 and / or 2311 inactive?	
STEP 2: Check the fuel pressure sensor on the common rail.		
STEP 2A: Check that the sensor reading fuel pressure on the common rail is within the proper range.	Pressure = 0 ± 40 bar?	
STEP 3: Check the operation of the low pressure fuel system.		
STEP 3A: Check for air in the fuel.	Is there air?	
STEP 3B: Check for excess fuel pressure at the transfer pump.	Less than 20 psi?	
STEP 4: Check for restriction in the fuel return drain line.		
STEP 4A: Check for excess restriction on the fuel return drain line.	Less than 2.7 psi?	
STEP 5: Check the fuel pressure relief valve for damage in the common rail.		
STEP 5A: Check for leaks in the fuel pressure relief valve on the common rail.	Fuel return within specifications?	
STEP 6: Clear the fault codes.		
STEP 6A: Disable the fault code.	Inactive fault codes	
STEP 6B: Clear the fault codes inactive.	All codes deleted	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Read the fault codes. Conditions:

- Connect the electronic service tool INSITE ™.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Read the fault codes. • Start the engine and let it run at idle for 1 minute. • Use the electronic service tool INSITE ™ to read fault codes. • Check for high or low voltage fault codes on the electronic fuel control actuator.	Fault code 271, 272 and / or 2311 inactive? **YEA**	2A
	Fault code 271, 272 and / or 2311 inactive? **DO NOT** **REPAIR:** Diagnose the fault codes for the electronic fuel control actuator.	Applicable Fault Codes 271, 272 and / or 2311

STEP 2: Check the fuel pressure sensor on the common rail.

STEP 2A: Check that the fuel pressure sensor reading on the common rail is within the suitable range.

Conditions:

- Connect the electronic service tool INSITE ™.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Use the electronic service tool INSITE ™ to read the fuel pressure on the common rail.	Pressure = 0 ± 40 bar? **YEA**	3A
	Pressure = 0 ± 40 bar? **DO NOT** **REPAIR:** Replace the sensor or repair the engine harness. See the Procedure 019-115 to replace the sensor, or the Procedure 019-360 to repair the engine harness.	6A

STEP 3: Check the operation of the low pressure fuel system.

STEP 3A: Check for air in the fuel. Conditions:

- Connect a test hose to the transfer pump outlet at the inlet of the fuel filter head and install the hose in a container.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check for air in the fuel while the transfer pump operates. • Test for air in the fuel. Refer to Procedure 006-003 in the ISB Series Engine Troubleshooting and Repair Manual and and ISB (Common Rail Fuel System), Bulletin 3653336.	Is there air? **YES** **Repair:** Repair the cause of air in the fuel. Refer to Procedure 006-003 in the ISB Series Engine Troubleshooting and Repair Manual and and ISB (Common Rail Fuel System), Bulletin 3653336.	6A
	Is there air? **NOT**	3B

STEP 3B: Check the transfer pump for excess fuel pressure. Conditions:

- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check for excess fuel pressure at the transfer pump. • Install a pressure gauge on the fuel filter head outlet port using a Compuchek® MI0, No. 3824842. • Start the engine and let it run at idle. • Measure the pressure at the fuel filter head outlet.	Less than 20 psi? **YEA**	4A
	Less than 20 psi? **DO NOT** **REPAIR:** Replace the electric fuel transfer pump. Internal pressure regulator failure. Refer to Procedure 005-045 in the ISB Series Engine Troubleshooting and Repair Manual and and ISB (Common Rail Fuel System), Bulletin 3653336.	5A

STEP 4: Check for restriction in the fuel return drain line.

STEP 4A: Check for excess restriction on the fuel return drain line. Conditions:

- Install a pressure gauge on the fuel return line banjo screw on the high pressure fuel pump drain manifold.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check for excess restriction in the fuel return drain line. • Start the engine and let it run at high idle. • Measure the restriction on the fuel return drain line. • Refer to Procedure 006-012 in the ISB Series Engine Troubleshooting and Repair Manual and and ISB (Common Rail Fuel System), Bulletin 3653336.	Less than 2.7 psi? **YES** **Repair:** Replace the electronic fuel control actuator. See the Procedure 019-102 .	5A
	Less than 2.7 psi? **DO NOT** **REPAIR:** Repair or replace the fuel return drain line. Refer to Procedure 006-013 in the ISB Series Engine Troubleshooting and Repair Manual and and ISB (Common Rail Fuel System), Bulletin 3653336.	5A

STEP 5: Check the fuel pressure relief valve for damage in the common rail.

STEP 5A: Check for leaks in the fuel pressure relief valve on the common rail. Conditions:

- Turn the ignition key off.
- Install test connections to measure the fuel return from the fuel pressure relief valve on the common rail.

Action	Specifications / Repair	Next step
Check for leaks in the fuel pressure relief valve on the common rail. NOTE: Excessive fuel pressure on the common rail can damage the fuel pressure relief valve on the common rail. • Install test connections to measure fuel return. • Test in Procedure 006-061 in the ISB Series Engine Troubleshooting and Repair Manual and and ISB (Common Rail Fuel System), Bulletin 3653336.	Fuel return within specifications? **YES** **Repair:** Replace the high pressure fuel pump. Refer to Procedure 005-016 in the ISB Series Engine Troubleshooting and Repair Manual and and ISB (Common Rail Fuel System), Bulletin 3653336.	6A
	Fuel return within specifications? **DO NOT** **REPAIR:** Replace the pressure relief valve on the common rail. Refer to Procedure 006-061 in the ISB Series Engine Troubleshooting and Repair Manual and and ISB (Common Rail Fuel System), Bulletin 3653336.	6A

STEP 6: Clear the fault codes.

STEP 6A: Disable the fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Check that the fault codes are inactive.	Fault codes inactive? **YEA**	6B
	Fault codes inactive? **DO NOT** **REPAIR:** Return to the troubleshooting steps or consult your local Cummins Authorized Service Station after checking and completing all diagnostic steps again.	1A

STEP 6B: Clear the inactive fault codes. Conditions:

- Connect all components.
- Turn the ignition key ON.

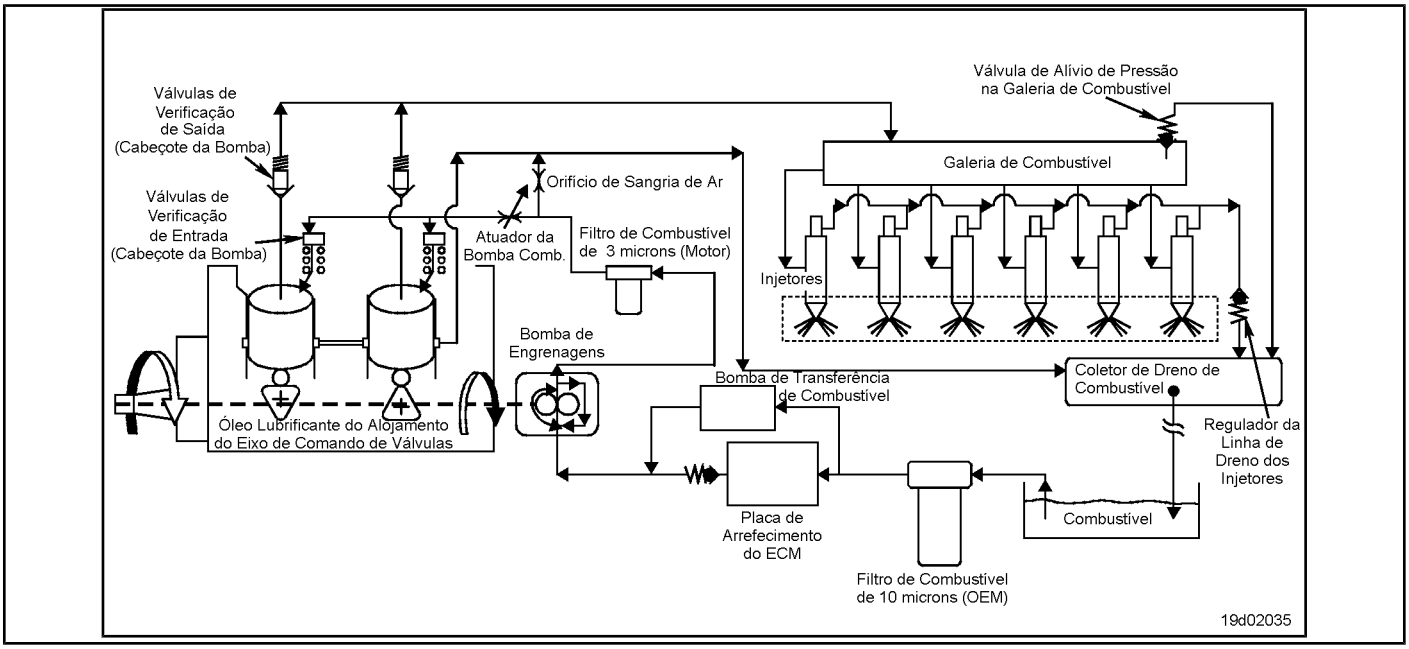
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **DO NOT** **REPAIR:** Troubleshoot any other active fault code.	Proper troubleshooting and repair steps

Fault Code 2216 (ISC / QSC / ISL / QSL - Automotive, Industrial or Maritime)

High Fuel Pump Supply Pressure - Valid Data but Above Range
Normal Operating - Moderately Severe Level

CODES	REASON	IT IS MADE
Fault Code: 2216 PID (P), SID (S): P94 IMF: 1 Lamp: Yellow SRT:	High Fuel Pump Supply Pressure - Valid Data but Above Normal Operating Range - Moderately Severe Level. The ECM has detected that the fuel pressure is higher than the command pressure.	No effect or possible engine noise associated with higher injection pressures (especially at idle or light load).

High pressure bomb



Circuit Descriptions:

The electronic control module (ECM) monitors the operating conditions of the engine, including the reading of the fuel pressure on the common rail, and changes the flow control to increase (open the fuel pump actuator) or reduce (close the actuator) fuel pump) the fuel supply to the high pressure pump.

Component Location:

The fuel pump actuator is installed on the adapter at the rear of the high pressure pump.

Workshop Tips:

A fuel pump actuator with excessive leakage, or with a damaged internal 'O' ring, will result in high fuel pressures on the common rail in idle or light load condition. If the fuel pump actuator leaks excessively, it is possible that the pressure in the common rail will reach the opening pressure of the common rail pressure relief valve and that Fault Code 449 will become active.

SUMMARY OF FAULT DIAGNOSTICS

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Read the fault codes.	**Are Fault Codes 271, 272 or 2311 active?**	
STEP 2: Check the low pressure fuel system.		
STEP 2A: Check for excess fuel pressure at the supply pump.	**Is the pressure greater than 1207 kPa [175 psi]?**	
STEP 2B: Check the pump actuator fuel.	**Is the inner 'O' ring cut or worn?**	
STEP 3: Clear the fault code.		
STEP 3A: Disable the fault code.	**Fault codes inactive?**	
STEP 3B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Read the fault codes. Conditions:

- Connect the electronic service tool INSITE ™.
- Turn the ignition key ON.

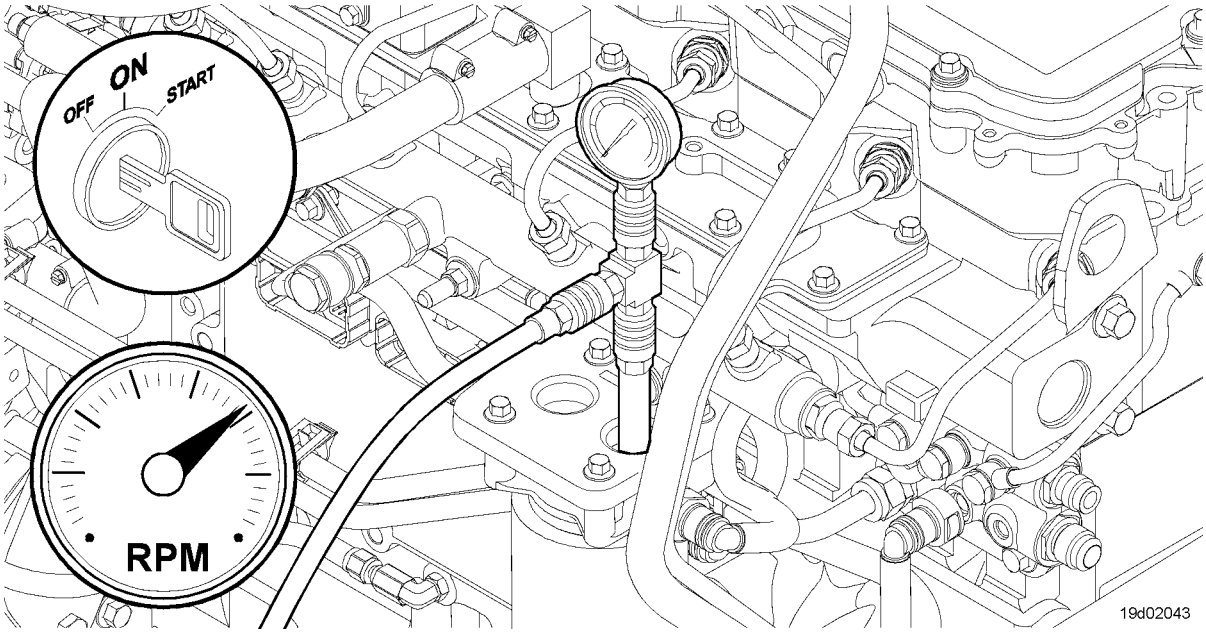
Action	Specifications / Repair	Next step
Use the electronic service tool INSITE ™ to read fault codes.	Are Fault Codes 271, 272 or 2311 active? **YEA**	Appropriate fault diagnosis diagram
	Are Fault Codes 271, 272 or 2311 active? **NOT**	2A

STEP 2: Check the low pressure fuel system.

STEP 2A: Check the supply pump for excess fuel pressure. Conditions:

- Engine running.

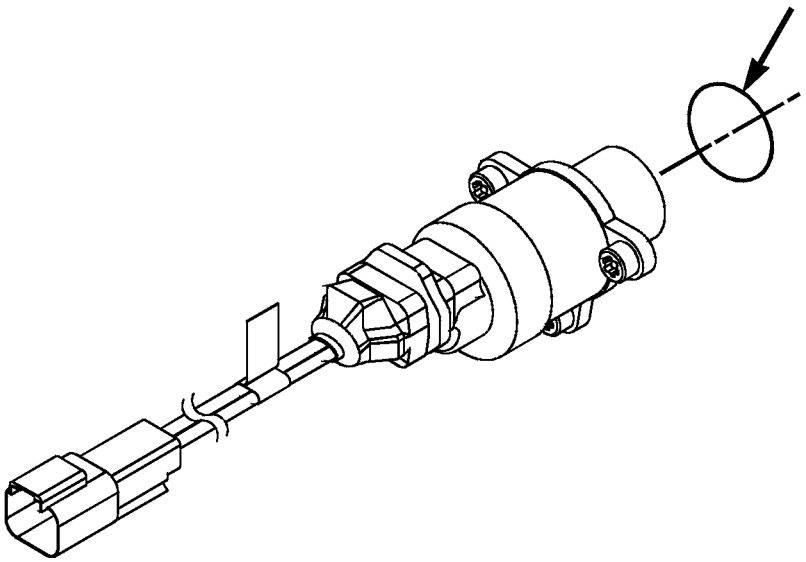
Action	Specifications / Repair	Next step
Install a standard threaded M10 'O' type diagnostic connection, No. 3824842, into the fuel filter outlet port, pressure side. Install a 0 to 2068 kPa [0 to 300 psi] pressure gauge at the fuel filter outlet, on the pressure side.	Is the pressure greater than 1207 kPa [175 psi]? **YES** **Repair:** Replace the fuel gear pump assembly.	3A
• Operate the engine at idle and measure the pressure at the gear pump outlet. Refer to Procedure 005-025 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266.	Is the pressure greater than 1207 kPa [175 psi]? **NOT**	2B



STEP 2B: Check the fuel pump actuator. Conditions:

- Turn the ignition key off.

Action	Specifications / Repair	Next step
Check the fuel pump actuator. • Remove the actuator from the fuel pump. • Inspect the inner 'O' ring of the fuel pump actuator. See the Procedure 019-117 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266.	Is the inner 'O' ring cut or worn? **YES** **Repair:** Replace the damaged 'O' ring.	3A
If that 'O' ring is cut or worn, fuel can bypass the fuel pump actuator and enter the high pressure pump.	Is the inner 'O' ring cut or worn? **DO NOT** **REPAIR:** Replace the fuel pump actuator.	3A



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STEP 3: Clear the fault code.

STEP 3A: Disable the fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Check that the fault codes are inactive.	Fault codes inactive? **YEA**	3B
	Fault codes inactive? **NOT**	1A

STEP 3B: Clear the inactive fault codes. Conditions:

- Connect all components.
- Connect the electronic service tool INSITE ™.
- Turn the ignition key ON.

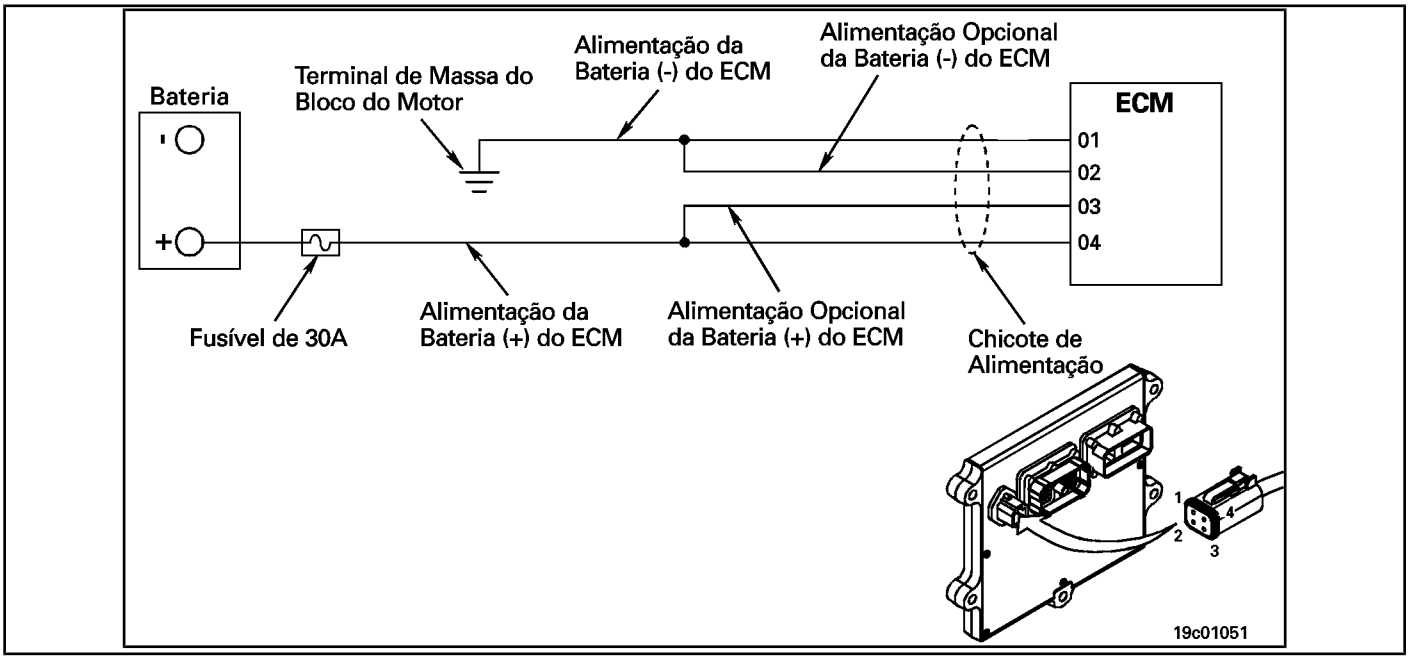
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **DO NOT** **REPAIR:** Troubleshoot any other active fault code.	Proper troubleshooting and repair steps

Fault Code 2217

Corrupted Engine Control Module Calibration Program Memory (RAM) - Existing Condition

CODES	REASON	IT IS MADE
Fault Code: 2217 PID (P), SID (S): S240 IMF: 11/31 Lamp: Amber SRT:	Corrupt Engine Control Module Calibration Program Memory (RAM) Existing Condition Severe loss of ECM data.	Possibly no noticeable performance effect, the engine will "die" or a manual start will be required. Fault information, travel information and maintenance monitor data may be inaccurate.

Non-switched Battery Power Circuit



Circuit Descriptions:

The Electronic Control Module (ECM) receives constant voltage from the batteries through non-switched wires that are connected directly to the positive (+) terminal of the batteries. There is a 30 amp fuse in the unswitched battery wires to protect the engine harness from overheating. The ECM receives information from the non-switched battery by wiring the vehicle's ignition key when it is switched on (ON position). The battery return wires are connected directly to the negative (-) battery terminal. Pins 2 and 3 are optional circuits possibly not used by the OEM. Refer to the OEM wiring diagram for detailed circuit information.

Component Location:

The ECM is located on the left side of the engine, close to its front. The ECM is connected to the battery by the ECM wiring harness. This direct link provides a constant power source for the ECM. The location of the battery varies by OEM. Refer to the OEM's troubleshooting and repair manual.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following test cable when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test cable. STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check for a passcode active fault.	**Are there other active fault codes?**	
STEP 2: Check the batteries and the harness connector.		
STEP 2A: Check the resistance of the battery power circuit.	**Less than 10 ohms?**	
STEP 2B: Check the battery voltage.	**Normal conditions: At least (+) 12 VDC? (During start-up rotation: At least (+) 6.2 VDC)?**	
STEP 2C: Check the connections of the drums.	**Tight, corrosion-free connections?**	
STEP 3: Check the OEM's fuses.		
STEP 3A: Make sure that the fuses OEM are installed correctly.	**Fuses installed correctly?**	
STEP 3B: Make sure that the fuses of the OEM are not burnt.	**Are the fuses not blown?**	
STEP 4: Check the harness connector.		
STEP 4A: Check the complementary wiring or accessory on the positive (+) battery terminal.	**Are there no damaged wires?**	
STEP 5: Recalibrate the ECM.		
STEP 5A: Recalibrate the ECM.	**Fault code 2217 inactive?**	
STEP 6: Clear the fault codes.		
STEP 6A: Disable the fault code.	**Fault code 2217 inactive?**	
STEP 5B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Check for an active fault code. Conditions:

- Turn the ignition key ON.
- Use the electronic service tool INSITE ™ to read fault codes.

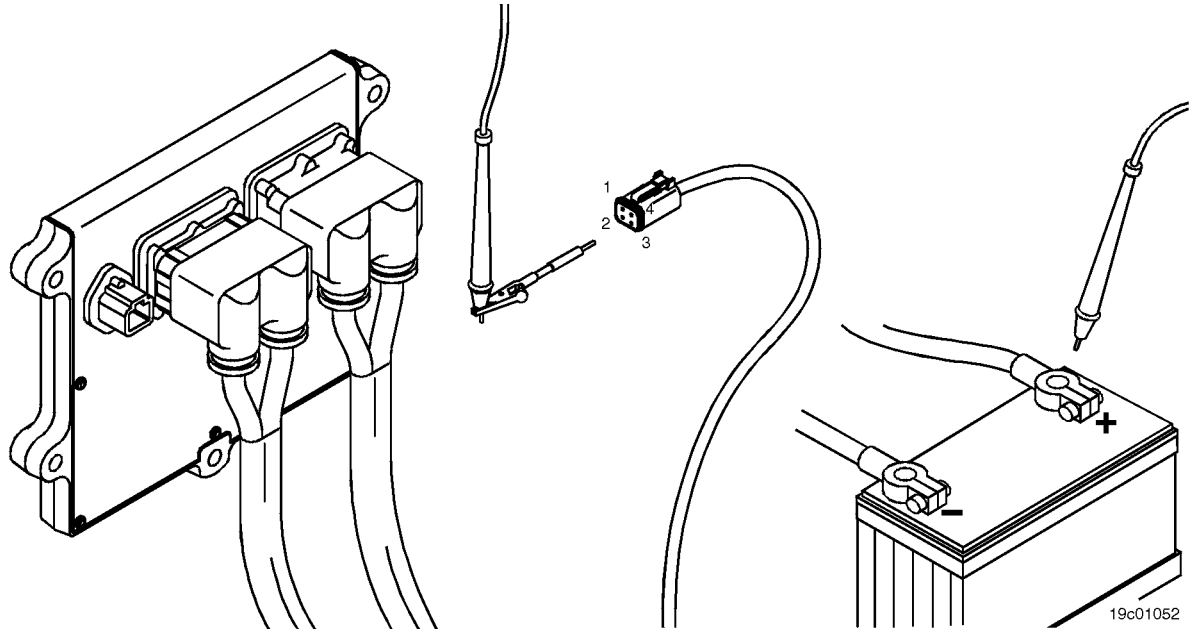
Action	Specifications / Repair	Next step
Check for an active fault code. • Use the electronic service tool INSITE ™ to read fault codes.	Are there other active fault codes? **YES** **Repair:** Troubleshoot the active fault codes.	Go to the fault diagnosis diagram for the appropriate fault code.
	Are there other active fault codes? **NOT**	2A

STEP 2: Check the batteries and the power connector.

STEP 2A: Check the resistance of the battery supply circuit. Conditions:

- Turn the ignition key off.
- Disconnect the harness connector from the ECM.

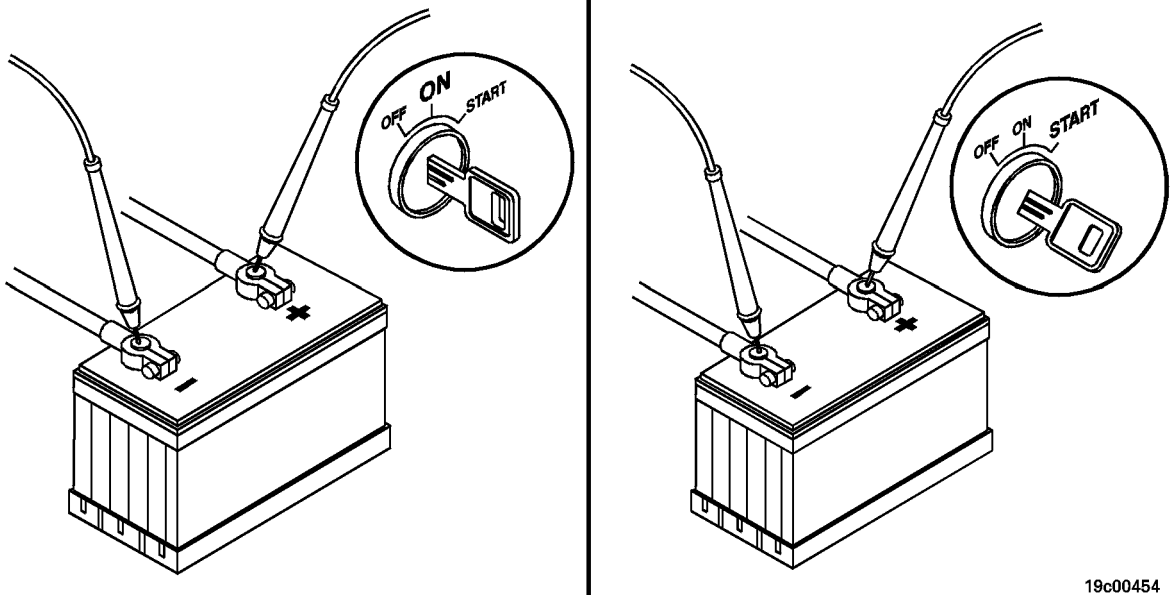
Action	Specifications / Repair	Next step
Check the resistance of the battery supply circuit. • Using a multimeter, measure the resistance between the positive (+) POWER pin of the ECM battery on the ECM connector of the harness and the positive (+) pin of the battery terminal. • Using a multimeter, measure the resistance between the negative (-) POWER pin of the ECM battery on the harness connector electric and the mass of the engine block. Refer to the circuit diagram or electrical diagram for the identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	Less than 10 ohms? **YEA**	2B
	Less than 10 ohms? **NOT**	3A



STEP 2B: Check the battery voltage. Conditions:

- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check the battery voltage. • Insert the positive (+) probe of the multimeter into the positive battery terminal. Touch the negative probe (-) of the multimeter to the negative battery terminal while starting the engine.	Normal conditions: At least (+) 12 VDC? (During start-up rotation: At least (+) 6.2 VDC)? **YEA**	2C
	Normal conditions: At least (+) 12 VDC? (During start-up rotation: At least (+) 6.2 VDC)? **DO NOT** **REPAIR:** Charge or replace the battery. Refer to the OEM's troubleshooting and repair manual.	5A



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STEP 2C: Check the battery connections. Conditions:

- Turn the ignition key off.

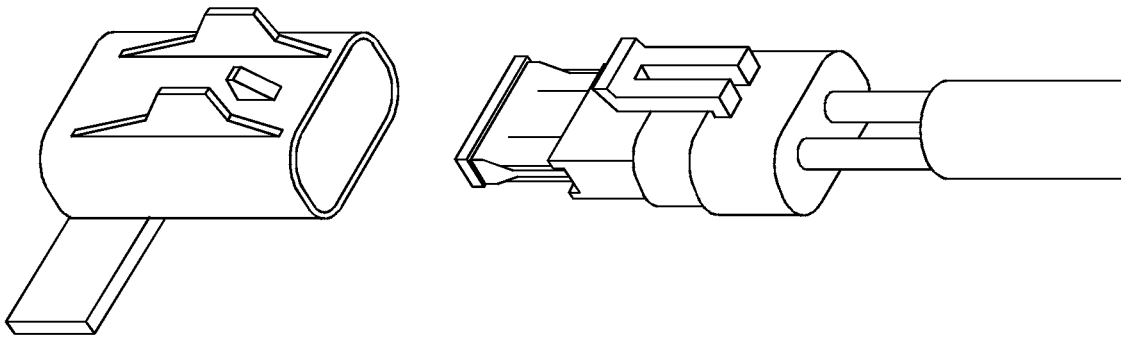
Action	Specifications / Repair	Next step
Check the battery connections. • Inspect the battery terminal connections.	Are the connections firm and free from corrosion? **YEA**	4A
	Are the connections firm and free from corrosion? **DO NOT** **REPAIR:** Tighten loose connections and clean the terminals. Refer to the OEM's troubleshooting and repair manual.	5A

STEP 3: Check the OEM's fuses.

STEP 3A: Make sure that the OEM fuses are installed correctly. Conditions:

- Turn the ignition key off.

Action	Specifications / Repair	Next step
Check that the OEM fuses are installed correctly.	Fuses installed correctly? **YEA**	3B
	Fuses installed correctly? **DO NOT** **REPAIR:** Install the fuses correctly. See the Procedure 019-198 .	5A



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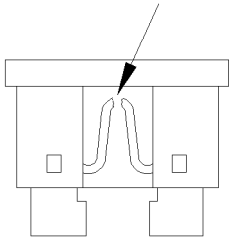
STEP 3B: Make sure that the OEM fuses are not blown. Conditions:

- Turn the ignition key off.

Action	Specifications / Repair	Next step
Make sure that the OEM fuses are not blown.	Is there a blown fuse? **YES** **Repair:** Replace the fuses.	5A
	Is there a blown fuse? **DO NOT** **REPAIR:** Repair or replace the OEM harness. See the Procedure 019-071 .	5A



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STEP 4: Check the harness connector.

STEP 4A: Check the complementary or accessory wiring at the positive (+) terminal of the battery. Conditions:

- Turn the ignition key off.

Action	Specifications / Repair	Next step
Check the complementary or accessory wiring at the positive (+) terminal of the battery. • Starting with the positive (+) terminal, follow the wiring of any implement or accessory and check if the wires have damaged insulation or installation error that may cause a short between the supply wire and the motor block.	Are there damaged wires? **YES** **Repair:** Repair or replace damaged wiring.	5A
	Are there damaged wires? **DO NOT** **REPAIR:** Make sure the wiring from the OEM power harness to the Electronic Control Module (ECM) is correct. Refer to the Original Equipment Manufacturer (OEM) wiring diagram.	5A

STEP 5: Recalibrate the ECM.

STEP 5A: Recalibrate the ECM.

Conditions:
- Connect all components.

Action	Specifications / Repair	Next step
Recalibrate the ECM. • Use the electronic service tool INSITE ™ to recalibrate the ECM.	Fault code 2217 inactive? **YEA**	6A
	Fault code 2217 inactive? **NOT**	6A

STEP 6: Clear the fault codes.

STEP 6A: Disable the fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Turn off the ignition key and wait 30 seconds.	Fault code 2217 inactive? **YEA**	5B
• Turn the ignition key ON. • Use the electronic service tool INSITE ™ to make sure Fault Code 2217 is inactive.	Fault code 2217 inactive? **DO NOT** **REPAIR:** Return to the troubleshooting steps or consult your local Cummins Authorized Service Station after checking and completing all diagnostic steps again.	1A

STEP 5B: Clear the inactive fault codes. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

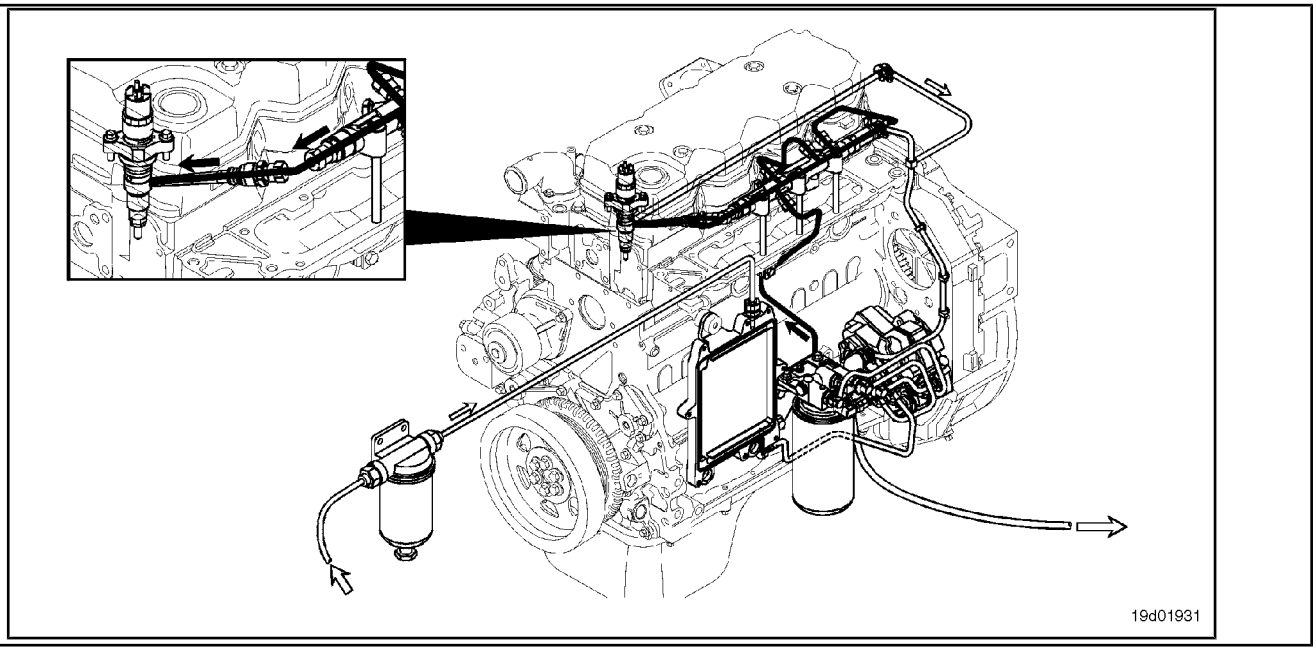
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **DO NOT** **REPAIR:** Troubleshoot any other active fault code.	Proper troubleshooting and repair steps

Fault Code 2249

Pressure 1 in the Injector Flow Measurement Gallery - Valid Data but Below Normal Operating Range - More Severe Level

CODES	REASON	IT IS MADE
Fault Code: 2249 PID (P), SID (S): P157 IMF: 1 Lamp: Amber SRT:	Pressure 1 in the Injection Flow Measurement Gallery - Valid Data but Below the Normal Operating Range - Most Severe Level The ECM has detected that the fuel pressure is less than the commanded pressure.	Possible difficulty in starting, loss of power, or emission of smoke.

Fuel Pressure in the Gallery



Circuit Descriptions:

The ECM monitors the fuel pressure in the gallery and the operating conditions of the engine, changing the flow control to maintain the proper fuel pressure in the gallery. Changes in the flow control result in the opening (or closing) of the fuel pump actuator to supply more (or less) fuel to the high pressure pump.

Component Location:

See the Procedure 100-002 to identify the location of each component.

Workshop Tips:

Fault Code 2249 is very similar to Fault Code 559 except that the fault is triggered at a different fuel pressure limit. If Fault Code 2249 is active, fault diagnosis procedures for Fault Code 559 **should** be followed.

SUMMARY OF FAULT DIAGNOSTICS

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check for fault codes relating to the fuel system.	**Fault code 2249 active?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Check the fuel system for fault codes. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

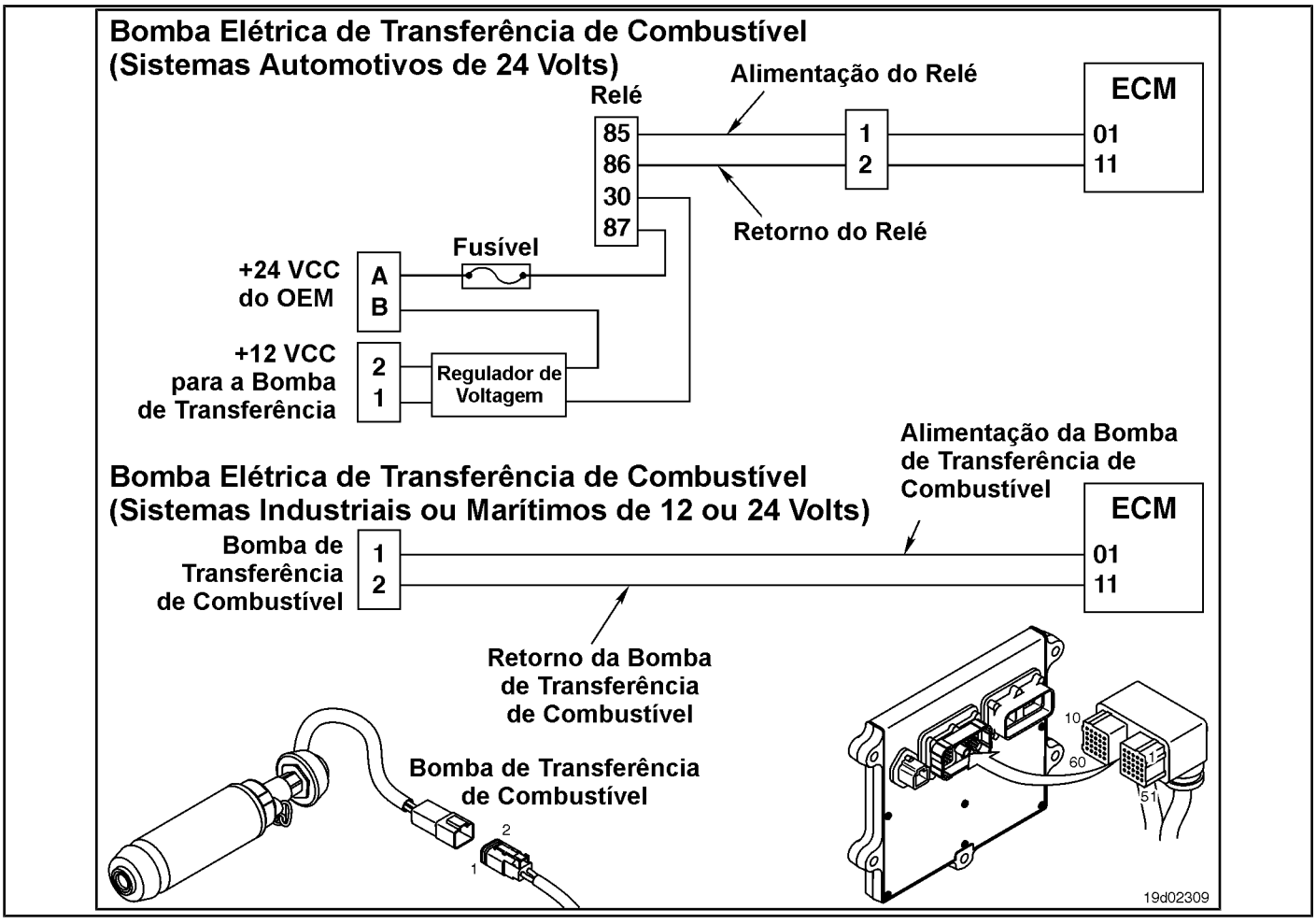
Action	Specifications / Repair	Next step
Check for fuel system fault codes. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 2249 active? **YES** **Repair:** Follow fault diagnosis procedures for Fault Code 559.	Fault diagnosis of Fault Code 559.
	Fault code 2249 active? **NOT**	Complete repair.

Fault Code 2265

Circuit of the Electric Fuel Supply Transfer Pump to the Engine - Voltage Above Normal or High Voltage

CODES	REASON	IT IS MADE
Fault Code: 2265 PID (P), SID (S): S126 IMF: 3 Lamp: Amber SRT:	Circuit of the Electric Fuel Supply Transfer Pump to the Engine - Voltage Above Normal or with High Voltage. High voltage or open circuit detected in the fuel transfer pump signal circuit.	Possible difficulty in starting the engine.

Electric Fuel Transfer Pump Circuit



Circuit Descriptions:

In Automotive 12 VDC and Industrial or Marine 24 VDC systems, the circuit is a pulse width modulation trigger in the electronic control module (ECM) that controls the electric fuel transfer pump. The fuel transfer pump is grounded at the ECM.

In Automotive 24 VDC systems, the circuit is a pulse width modulation trigger in the ECM that controls the relay of the electric fuel transfer pump. The circuit includes two additional components, a relay and a voltage regulator. The ECM controls the voltage of the relay. When the relay is activated, a source of

OEM-supplied power supplies 24 VDC to the voltage regulator. The voltage regulator reduces the voltage from 24 VDC to 12 VDC, which is then supplied to the transfer pump.

Component Location:

In both the 12 VDC and 24 VDC systems, the electric transfer pump is located behind the ECM cooling plate on the intake side of the engine. See the Procedure 100-002 for the detailed location of each component.

In Automotive 24 VDC systems, the relay is located in the harness between the voltage regulator and the OEM power supply at the lower end of the ECM. The voltage regulator is located just below the ECM.

Workshop Tips:

In Automotive 12 VDC and Industrial or Marine 24 VDC systems, this fault code becomes active if the ECM detects an open circuit when the ignition key is turned ON. The cause of this fault code is an open circuit in the fuel transfer pump electrical circuit.

If the fault code is intermittent, look for causes of an intermittent open circuit, such as loose pins and incorrect or defective connections. When the ignition key is turned on, the transfer pump service cycle increases to 100 Percent. This fault code can detect open circuit conditions only when the ignition key is turned on. If an open circuit condition is indicated after the engine is started (when the transfer pump is already running), Fault Code 2265 not will become active. In Automotive 24 VDC systems, this fault code becomes active if the ECM detects an open circuit when the ignition key is turned ON. The causes of this fault code are an open circuit in the electrical harness of the electric fuel transfer pump, or in the engine harness. This fault code not it will become active if the voltage regulator or the electric transfer pump is defective.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

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

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3823993 - Deutsch

male test lead. STEPS

		SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.			
STEP 1A: Check for a passcode failure inactive.		**Fault code 2265 inactive?**	
STEP 1B: Checking the regulator	**transfer pump voltage.**	**Is a transfer pump voltage regulator installed?**	
STEP 2: Check the relay circuit of the electric fuel transfer pump.			
STEP 2A:	**Inspect the engine harness and relay connector pins on the electric fuel transfer pump.**	**Dirty or damaged pins?**	
STEP 2B: Check for a circuit	**open in the relay of the electric fuel transfer pump.**	**Less than 400 ohms?**	
STEP 2C: Check the voltage	**diagnostic supply of the fuel transfer pump relay.**	**More than 6.0 VDC? (for 12 VDC systems) More than 18.0 VDC? (for 24 VDC systems)**	
STEP 2D: Check for a circuit	**open in the return circuit of the electric fuel transfer pump relay.**	**Less than 10 ohms?**	
STEP 3: Check the electric fuel transfer pump.			
STEP 3A:	**Inspect the engine harness and connector pins on the electric fuel transfer pump.**	**Dirty or damaged pins?**	
STEP 3B: Check for a circuit	**open on the electric fuel transfer pump.**	**Less than 20 ohms?**	
STEP 3C: Check the voltage	**supply and return circuit of the fuel transfer pump.**	**More than 6.0 VDC? (for 12 VDC systems) More than 18.0 VDC? (for 24 VDC systems)**	
STEP 3D: Check for a circuit	**open in the return circuit of the electric fuel transfer pump relay.**	**Less than 10 ohms?**	
STEP 4: Check the ECM and the engine harness.			

STEP 4A: **Inspect the pins of the engine harness and ECM connectors.** — **Dirty or damaged pins?**

STEP 4B: Check the voltage diagnostic supply of the ECM electric fuel transfer pump. — **More than 6.0 VDC? (for 12 VDC systems) More than 18.0 VDC? (for 24 VDC systems)**

STEP 4C: Check for a circuit open in the engine harness. — **Less than 10 ohms?**

STEP 4D: Check for a short circuit between pins in the engine harness. — **More than 100k ohms?**

STEP 4E: Check for a passcode failure inactive. — **Fault code 2265 inactive?**

STEP 5: Clear the fault codes.

STEP 5A: Disable the fault code. — **Fault code 2265 inactive?**

STEP 5B: Clear the fault codes inactive. — **All codes cleared?**

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

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

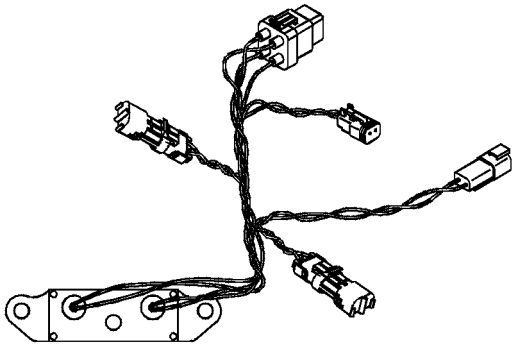
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an inactive fault code. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 2265 inactive? **YEA**	Fault Code Inactive or Intermittent, Procedure 019-362
	Fault code 2265 inactive? **NOT**	1B

STEP 1B: Check the transfer pump voltage regulator. Conditions:

- Turn the ignition key off.

Action	Specifications / Repair	Next step
Check the transfer pump voltage regulator.	Is a transfer pump voltage regulator installed? **YEA**	2A
	Is a transfer pump voltage regulator installed? **NOT**	3A



05d00766

STEP 2: Check the relay circuit of the electric fuel transfer pump.

STEP 2A: Inspect the engine harness and relay connector pins on the electric fuel transfer pump.

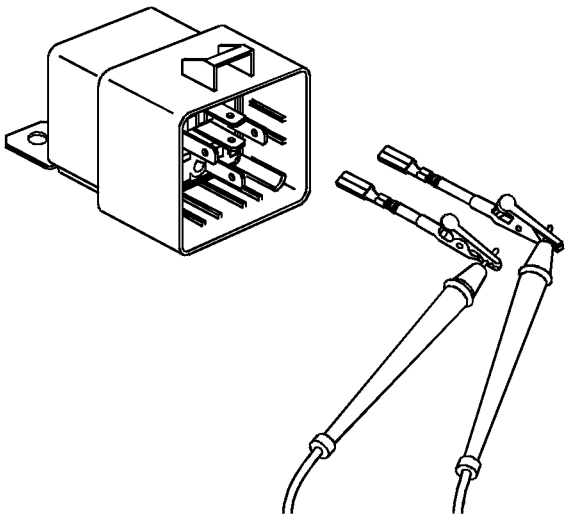
Conditions:
- Turn the ignition key off.
- Disconnect the relay of the electric fuel transfer pump from the pump harness.

Action	Specifications / Repair	Next step
Inspect the engine harness, wiring harness and relay connector pins of the electric fuel transfer pump. • Loose connectors • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins • Damage to the wire shield • Broken connector cover • Damage to the connector locking tab. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-043 .	5A
	Dirty or damaged pins? **NOT**	2B

STEP 2B: Check for an open circuit in the electric fuel transfer pump relay. Conditions:

- Turn the ignition key off.
- Disconnect the relay of the electric fuel transfer pump from the pump harness.

Action	Specifications / Repair	Next step
Check the resistance of the electric fuel transfer pump relay. • Measure the resistance between the POWER (85) and RETURN (86) pins of the electric fuel transfer pump relay. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	Less than 400 ohms? **YEA**	2C
	Less than 400 ohms? **DO NOT** **REPAIR:** A defective relay of the electric fuel transfer pump has been detected. Replace the electric fuel transfer pump relay.	5A

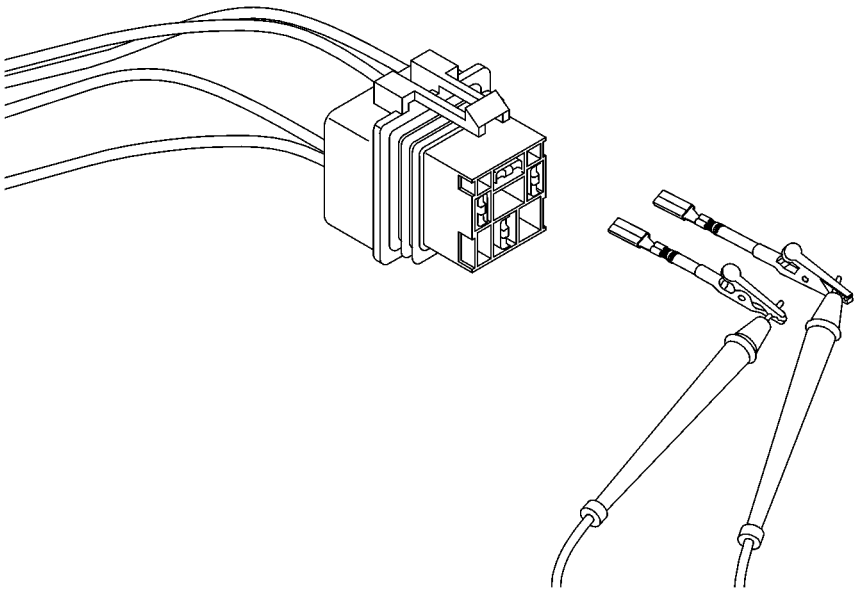


19c01174

STEP 2C: Check the diagnostic supply voltage of the transfer pump relay fuel.

Conditions:
- Turn the ignition key off.
- Disconnect the relay of the electric fuel transfer pump from the pump harness.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check the supply voltage and the return circuit. • Measure the voltage between the POWER (85) and RETURN (86) pins of the electric fuel transfer pump relay on the pump relay connector.	More than 6.0 VDC? (for 12 VDC systems) More than 18.0 VDC? (for 24 VDC systems) **YEA**	4D
	More than 6.0 VDC? (for 12 VDC systems) More than 18.0 VDC? (for 24 VDC systems) **NOT**	2D

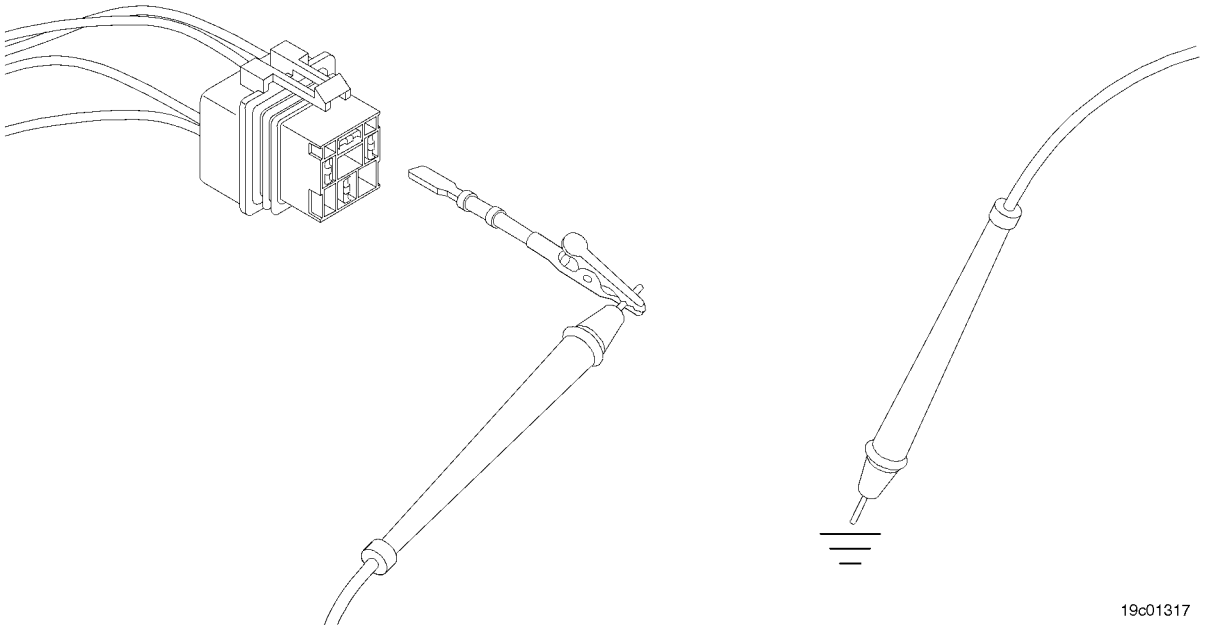


19d02116

STEP 2D: Check for an open circuit in the return circuit of the electrical pump relay fuel transfer.

Conditions:
- Turn the ignition key off.
- Disconnect the relay of the electric fuel transfer pump from the pump harness.

Action	Specifications / Repair	Next step
Check for an open circuit. • Measure the resistance between the RETURN pin (86) and ground in the relay connector of the electric fuel transfer pump. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	Less than 10 ohms? **YEA**	4A
	Less than 10 ohms? **DO NOT** **REPAIR:** An open circuit was detected in the relay circuit of the electric fuel transfer pump. Isolate the open circuit. Repair or replace the electrical harness for the electric fuel transfer pump or the engine harness. See the Procedure 019-043 .	5A



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STEP 3: Check the electric fuel transfer pump.

STEP 3A: Inspect the engine harness and connector pins on the electric fuel transfer pump.

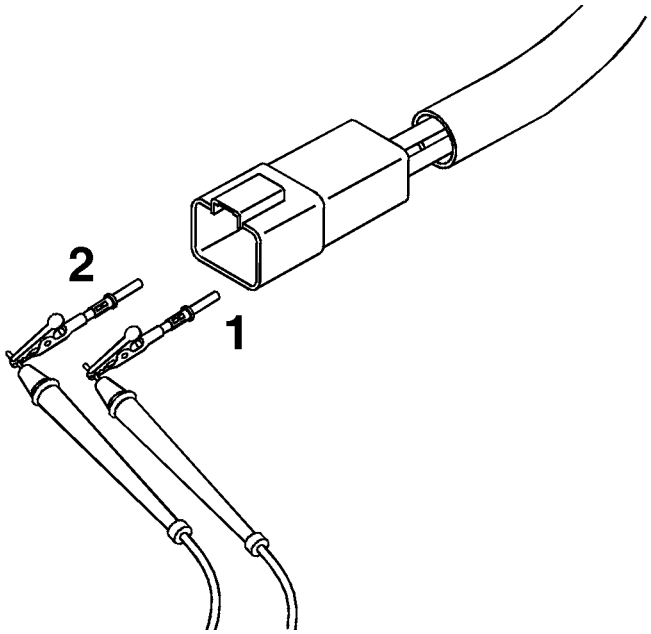
Conditions:
- Turn the ignition key off.
- Disconnect the electric fuel transfer pump from the engine harness.

Action	Specifications / Repair	Next step
Inspect the engine harness and fuel transfer pump connector pins for: • Loose connectors • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins • Damage to the wire shield • Broken connector cover • Damage to the connector locking tab. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-043 .	5A
	Dirty or damaged pins? **NOT**	3B

STEP 3B: Check for an open circuit in the electric fuel transfer pump. Conditions:

- Turn the ignition key off.
- Disconnect the electric fuel transfer pump from the engine harness.

Action	Specifications / Repair	Next step
Check for an open circuit in the electric fuel transfer pump. • Measure the resistance between the POWER and RETURN pins of the electric fuel transfer pump on the pump connector. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	Less than 20 ohms? **YEA**	3C
	Less than 20 ohms? **DO NOT** **REPAIR:** A defective electric fuel transfer pump has been detected. Replace the electric fuel transfer pump. Refer to Procedure 005-045 in the ISC, QSC8.3, ISL and QSL9 Series Engine Troubleshooting and Repair Manual, Bulletin 3653266, or in the ISB Series Engine Troubleshooting and Repair Manual, Bulletin 3666477.	5A

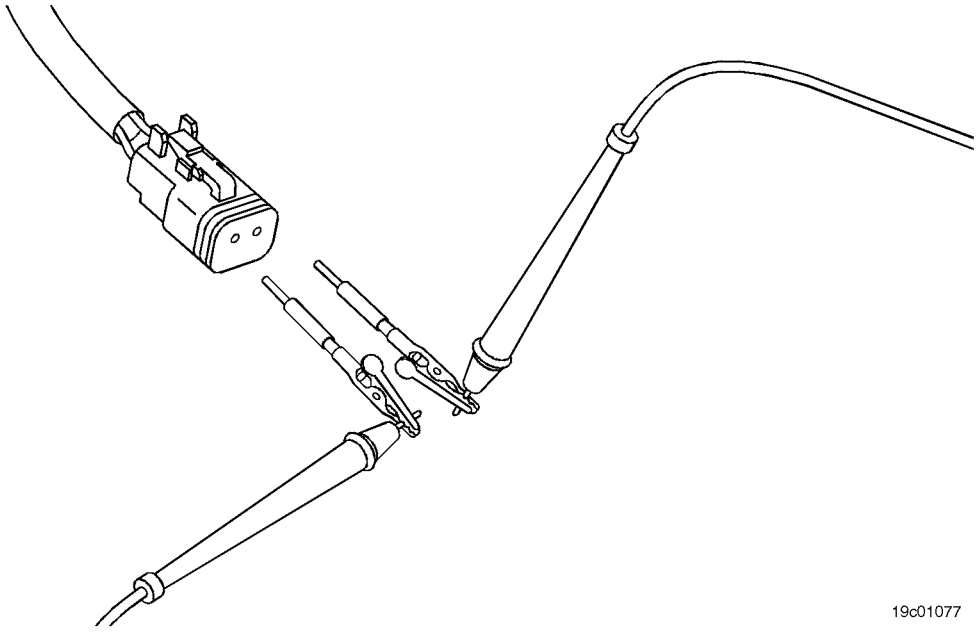


19d00716

STEP 3C: Check the supply voltage and return circuit of the transfer pump fuel.

Conditions:
- Turn the ignition key off.
- Disconnect the electric fuel transfer pump from the engine harness.
- Turn the ignition key ON.

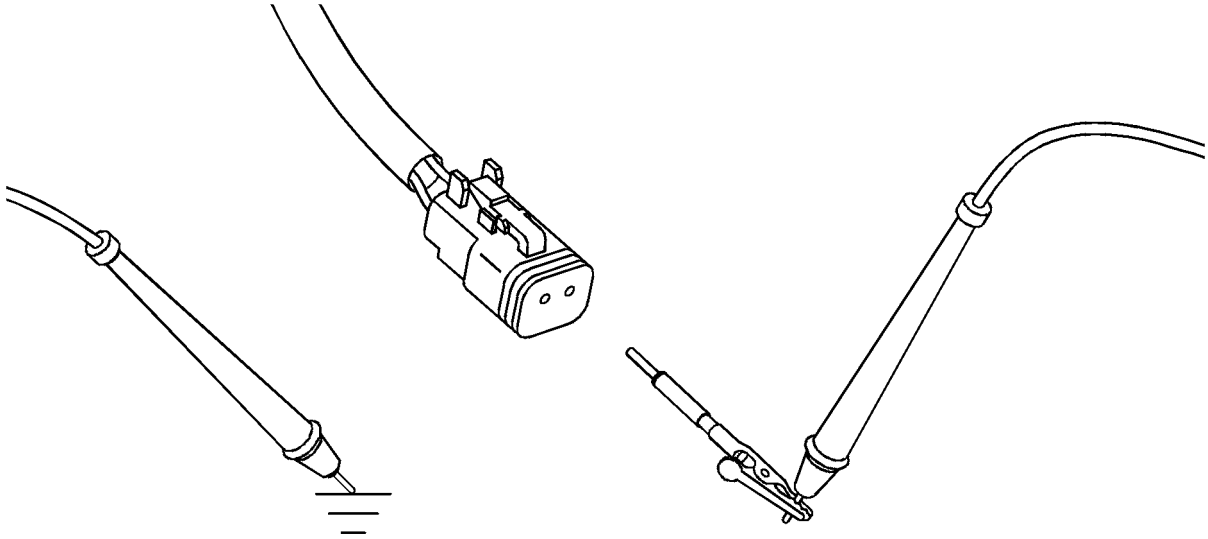
Action	Specifications / Repair	Next step
Check the supply voltage and the return circuit. • Measure the voltage between the POWER and RETURN pins of the electric fuel transfer pump on the pump connector on the engine harness.	More than 6.0 VDC? (for 12 VDC systems) More than 18.0 VDC? (for 24 VDC systems) **YEA**	4D
	More than 6.0 VDC? (for 12 VDC systems) More than 18.0 VDC? (for 24 VDC systems) **NOT**	3D



STEP 3D: Check for an open circuit in the return circuit of the electric transfer pump of fuel.

Conditions:
- Turn the ignition key off.
- Disconnect the electric fuel transfer pump from the engine harness.

Action	Specifications / Repair	Next step
Measure the resistance between the RETURN pin of the electric fuel transfer pump in the engine harness and the ground. Refer to the circuit diagram or electrical diagram for the identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	Less than 10 ohms? **YEA**	4A
	Less than 10 ohms? **DO NOT** **REPAIR:** An open circuit was detected in the engine harness. Repair or replace the engine harness. See the Procedure 019-043 .	5A



19c01078

STEP 4: Check the ECM and the engine harness.

STEP 4A: Inspect the pins of the engine harness and ECM connectors.

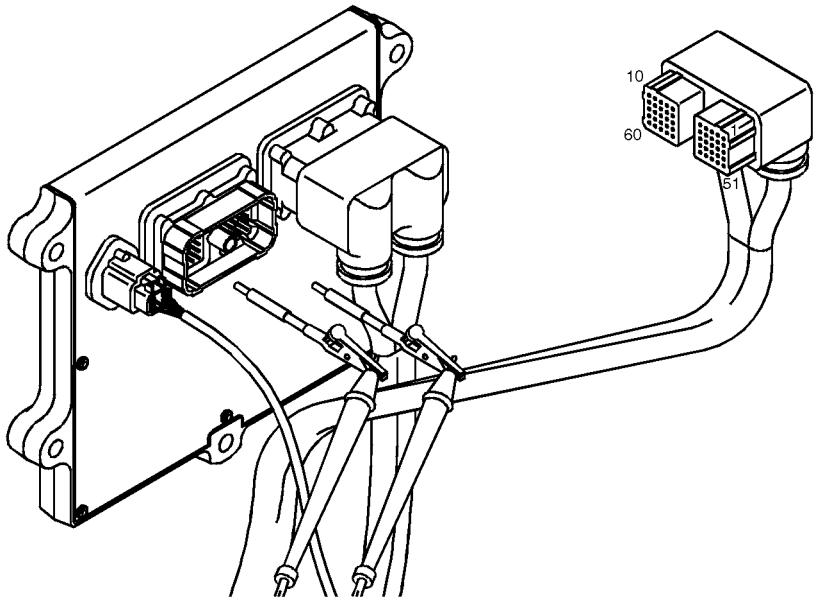
Conditions:
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.

Action	Specifications / Repair	Next step
Check that the pins on the engine harness and ECM connectors have: • Loose connectors • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins • Damage to the wire shield • Broken connector cover • Damage to the connector locking tab. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection has been detected in the ECM connector or the motor harness connector. Clean the connector pins. If damaged, repair the harness or connector pins, if possible. See the Procedure 019-043 .	5A
	Dirty or damaged pins? **NOT**	4B

STEP 4B: Check the diagnostic supply voltage of the electric transfer pump fuel from the ECM.

Conditions:
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check the supply voltage. • Measure the voltage between the POWER (1) and RETURN (11) pins of the electric fuel transfer pump on the ECM connector port on the engine harness.	More than 6.0 VDC? (for 12 VDC systems) More than 18.0 VDC? (for 24 VDC systems) **YEA**	4C
Refer to the circuit diagram or electrical diagram for the identification of the connector pins.	More than 6.0 VDC? (for 12 VDC systems) More than 18.0 VDC? (for 24 VDC systems) **DO NOT** **REPAIR:** Call for authorization. Replace the ECM. See the Procedure 019-031 .	5A

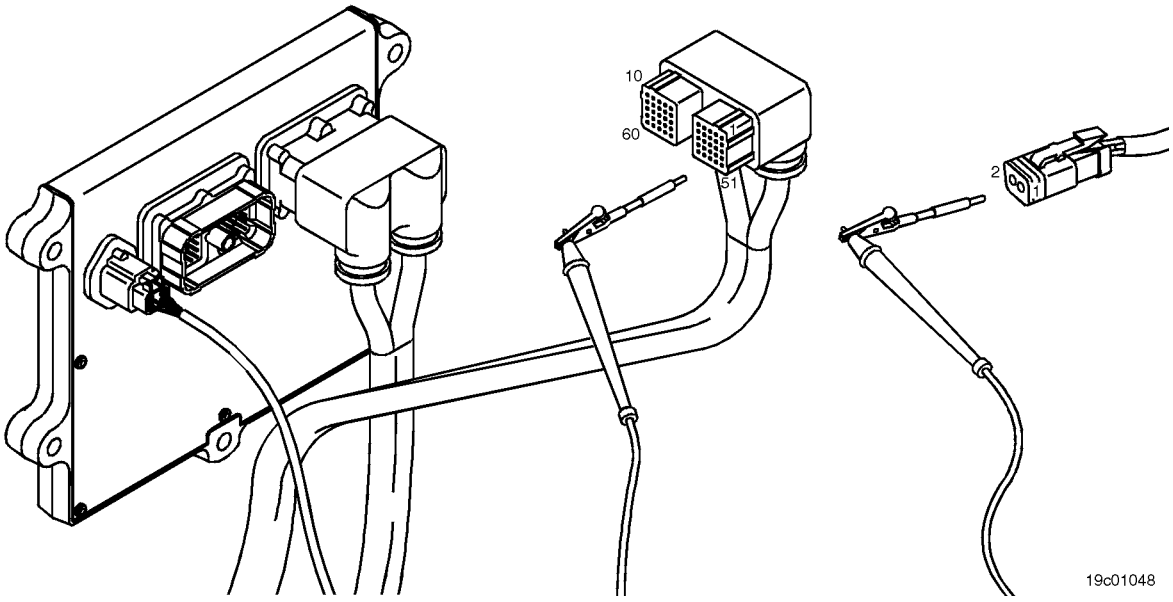


19c01079

STEP 4C: Check the motor harness for an open circuit. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Disconnect the electric fuel transfer pump from the engine harness. For Automotive 24 volt systems with the transfer pump harness, disconnect the engine harness from the electrical harness on the electric fuel transfer pump.

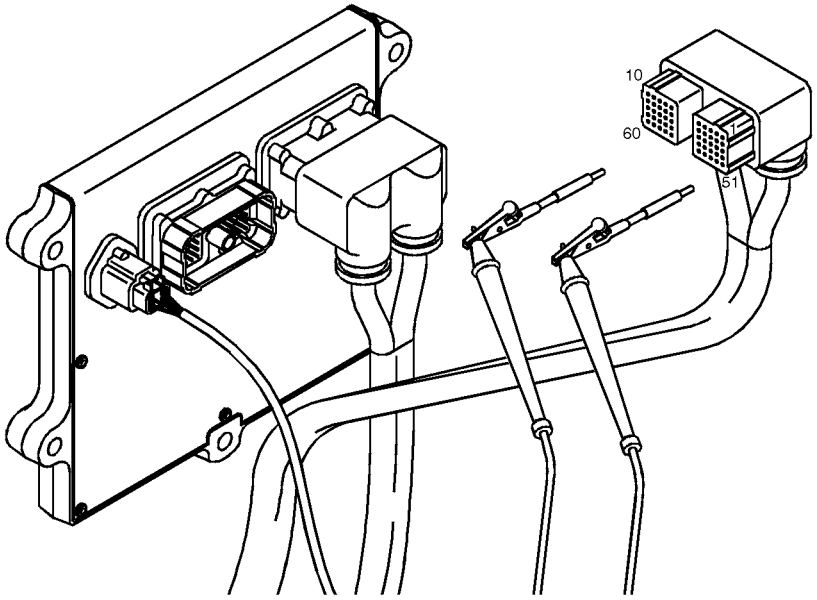
Action	Specifications / Repair	Next step
Check for an open circuit. • Measure the resistance between the POWER pin on the electric fuel transfer pump connector and the POWER pin on the ECM connector on the engine harness. Refer to the circuit diagram or electrical diagram for the identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	Less than 10 ohms? **YEA**	4D
	Less than 10 ohms? **DO NOT** **REPAIR:** An open circuit was detected in the engine harness. Repair or replace the engine harness. See the Procedure 019-043 .	5A



STEP 4D: Check the motor harness for a short circuit between pins. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Disconnect the electric fuel transfer pump from the ECM. For 24-volt Automotive systems with the transfer pump harness, disconnect the electrical harness relay from the electric fuel transfer pump.

Action	Specifications / Repair	Next step
Check for a short circuit between pins. • Measure the resistance between the POWER pin of the electric fuel transfer pump, the ECM connector on the engine harness, and all other pins on the ECM connector. Refer to the circuit diagram or electrical diagram for the identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YEA**	4E
	More than 100k ohms? **DO NOT** **REPAIR:** A short circuit between pins was detected in the engine harness. Repair or replace the engine harness. If you are troubleshooting a 24-volt automotive system, isolate the interconnections. See the Procedure 019-043 .	5A



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STEP 4E: Check for an inactive fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 2265 inactive? **YES** **Repair:** None. Did removing and installing the connector correct the failure?	5A
	Fault code 2265 inactive? **DO NOT** **REPAIR:** Call for authorization. Replace the ECM. See the Procedure 019-031 .	5A

STEP 5: Clear the fault codes.

STEP 5A: Disable the fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Using the electronic service tool INSITE ™, make sure that the fault code is inactive.	Fault code 2265 inactive? **YEA**	5B
	Fault code 2265 inactive? **DO NOT** **REPAIR:** Return to the troubleshooting steps or consult your local Cummins Authorized Service Station after checking and completing all diagnostic steps again.	1A

STEP 5B: Clear the inactive fault codes. Conditions:

- Connect all components.
- Turn the ignition key ON.

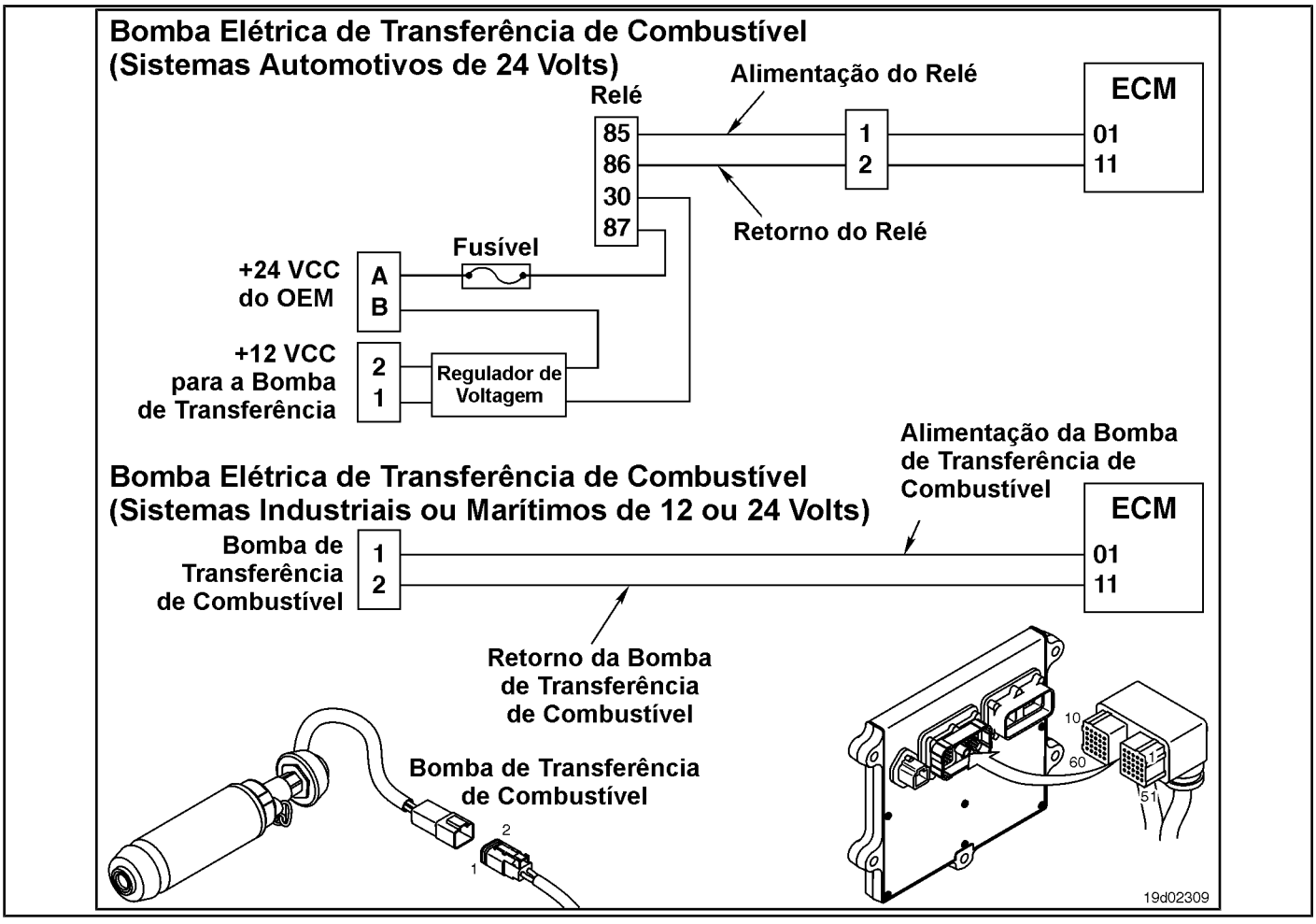
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **DO NOT** **REPAIR:** Troubleshoot any other active fault code.	Proper troubleshooting and repair steps

Fault Code 2266

Circuit of the Electric Fuel Supply Transfer Pump to the Engine - Voltage Below Normal or Low Voltage

CODES	REASON	IT IS MADE
Fault Code: 2266 PID (P), SID (S): S126 IMF: 4 Lamp: Amber SRT:	Circuit of the Electric Fuel Supply Transfer Pump to the Engine - Voltage Below Normal or Low Voltage. Low voltage signal detected in the transfer pump circuit.	Possible difficulty in starting the engine.

Electric Fuel Transfer Pump Circuit



Circuit Descriptions:

In Automotive 12 VDC and Industrial or Marine 24 VDC systems, the circuit is a pulse width modulation trigger in the electronic control module (ECM) that controls the electric fuel transfer pump. The fuel transfer pump is grounded at the ECM.

In Automotive 24 VDC systems, the circuit is a pulse width modulation trigger in the ECM that controls the relay of the electric fuel transfer pump. The circuit includes two additional components, a relay and a voltage regulator. The ECM controls the voltage of the relay. When the relay is activated, a source of

OEM-supplied power supplies 24 VDC to the voltage regulator. The voltage regulator reduces the voltage from 24 VDC to 12 VDC, which is then supplied to the transfer pump.

Component Location:

In both the 12 VDC and 24 VDC systems, the electric transfer pump is located behind the ECM cooling plate on the intake side of the engine. See the Procedure 100-002 for the detailed location of each component.

In Automotive 24 VDC systems, the relay is located in the harness between the voltage regulator and the OEM power supply at the lower end of the ECM. The voltage regulator is located just below the ECM.

Workshop Tips:

This fault code becomes active whenever the ECM detects a short circuit with high ground or current in the circuit of the electric transfer pump. The causes for this fault code are a short to ground or a low resistance value.

In Automotive 12 VDC and Industrial or Marine 24 VDC systems, when operating in very cold climates, fuel in gel form can block the transfer pump and record this fault code. Check the transfer pump and make sure that it operates at low ambient temperatures (less than

-29 ° C [-20 ° F]). This fault code can also become active if the transfer pump impeller stops or jams. When fault conditions are detected, the ECM driver for the transfer pump is turned off to protect the circuit. It is necessary to turn the ignition key off and then on again before re-testing the ECM to detect the cause of the fault code. The ECM driver is re-enabled when the ignition key is turned ON, and if the cause is no longer present, the fault code will become inactive and can be cleared. In Automotive 24 VDC systems, the ECM driver for the transfer pump relay is switched off when a short circuit with ground or a high current value is detected in the fuel transfer pump wiring harness relay circuit. The causes of this fault code are a short circuit with ground or a high current value in the electrical harness of the electric fuel transfer pump, in the relay or in the engine harness. This fault code will not become active if the voltage regulator or the electric transfer pump is defective.

NOTE: On 12 VDC systems, this fault code will also become active if the priming pump motor stops. The stop current for the priming pump motor is approximately 9 amps. A good priming pump usually works with less than 3 amps. If the fault code is intermittent, observe the snapshot data for the measured current of the priming pump. If the measured current was about 9 amps when the fault condition occurred, conclude that the rotor has stopped and replace the electric priming pump.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

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

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3823993 - Deutsch

male test lead. STEPS

		SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.			
STEP 1A: Check for a passcode failure inactive.		**Fault code 2266 inactive?**	
STEP 1B: Check the Regulator Transfer Pump Voltage		**Is a transfer pump voltage regulator installed?**	
STEP 2: Check the relay circuit of the electric fuel transfer pump.			
STEP 2A:	**Inspect the engine harness and relay connector pins on the electric fuel transfer pump.**	**Dirty or damaged pins?**	
STEP 2B: Check the circuit response.		**Fault Code 2265 active and Fault Code 2266 inactive?**	
STEP 2C: Check the fault codes and the sensor condition.		**Fault code 2266 active?**	
STEP 3: Check the electric fuel transfer pump.			
STEP 3A:	**Inspect the engine harness and connector pins on the electric fuel transfer pump.**	**Dirty or damaged pins?**	
STEP 3B: Check the circuit response.		**Fault Code 2265 active and Fault Code 2266 inactive?**	
STEP 3C: Check the fault codes and the sensor condition.		**Fault code 2266 active?**	
STEP 4: Check the engine harness.			
STEP 4A:	**Inspect the pins of the engine harness and ECM connectors.**	**Dirty or damaged pins?**	
STEP 4B: Check the ECM response.		**Fault Code 2265 active and Fault Code 2266 inactive?**	
STEP 4C: Check for a short circuit between pins in the engine harness.		**More than 100k ohms?**	
STEP 4D: Check if there is a short circuit between pins and ground.		**More than 100k ohms?**	
STEP 4E: Check for a passcode failure inactive.		**Fault code 2266 inactive?**	
STEP 5: Clear the fault codes.			

STEP 5A: Disable the fault code. **Fault code 2266 inactive?**

STEP 5B: Clear the fault codes inactive. **All codes cleared?**

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

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

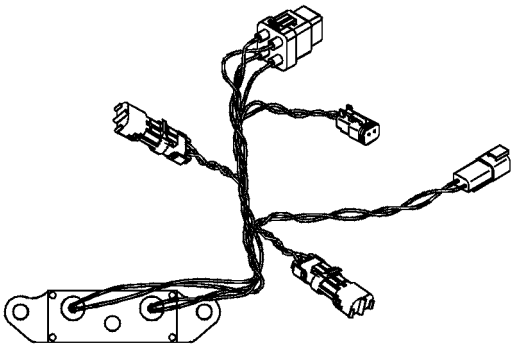
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an inactive fault code. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 2266 inactive? **YEA**	Fault Code Inactive or Intermittent, Procedure 019-362
	Fault code 2266 inactive? **NOT**	1B

STEP 1B: Check the Transfer Pump Voltage Regulator Conditions:

- Turn the ignition key off.

Action	Specifications / Repair	Next step
Check the transfer pump voltage regulator.	Is a transfer pump voltage regulator installed? **YEA**	2A
	Is a transfer pump voltage regulator installed? **NOT**	3A



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STEP 2: Check the relay circuit of the electric fuel transfer pump.

STEP 2A: Inspect the engine harness and relay connector pins on the electric fuel transfer pump.

Conditions:
- Turn the ignition key off.
- Disconnect the relay of the electric fuel transfer pump from the pump harness.
- Disconnect the electrical fuel transfer pump harness from the engine harness.

Action	Specifications / Repair	Next step
Inspect the engine harness, fuel transfer pump harness and relay pins for: • Loose connectors • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins • Damage to the wire shield • Broken connector cover • Damage to the connector locking tab. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-043 .	5A
	Dirty or damaged pins? **NOT**	2B

STEP 2B: Check the circuit response. Conditions:

- Turn the ignition key off.
- Disconnect the electric fuel transfer pump relay.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Use the electronic service tool INSITE ™ to read fault codes.	Fault Code 2265 active and Fault Code 2266 inactive? **YEA**	2C
	Fault Code 2265 active and Fault Code 2266 inactive? **NOT**	4A

STEP 2C: Check the fault codes and the condition of the sensor. Conditions:

- Turn the ignition key off.
- Connect the relay of the electric fuel transfer pump.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 2266 active? **YES** **Repair:** A defective relay of the electric fuel transfer pump has been detected. Replace the electric fuel transfer pump relay.	5A
	Fault code 2266 active? **DO NOT** **REPAIR:** None. Removing and installing the connector corrected the failure.	5A

STEP 3: Check the electric fuel transfer pump.

STEP 3A: Inspect the engine harness and connector pins on the electric fuel transfer pump.

Conditions:
- Turn the ignition key off.
- Disconnect the electric fuel transfer pump from the engine harness.

Action	Specifications / Repair	Next step
Inspect the engine harness and fuel transfer pump connector pins for: • Loose connectors • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins • Damage to the wire shield • Broken connector cover • Damage to the connector locking tab. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-043 .	5A
	Dirty or damaged pins? **NOT**	3B

STEP 3B: Check the circuit response. Conditions:

- Turn the ignition key off.
- Disconnect the electric fuel transfer pump from the engine harness.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Use the electronic service tool INSITE ™ to read fault codes.	Fault Code 2265 active and Fault Code 2266 inactive? **YEA**	3C
	Fault Code 2265 active and Fault Code 2266 inactive? **NOT**	4A

STEP 3C: Check the fault codes and the condition of the sensor. Conditions:

- Turn the ignition key off.
- Connect the electric fuel transfer pump to the engine harness.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 2266 active? A defective fuel transfer pump has been detected. Replace the electric fuel transfer pump. Refer to Procedure 005-045 in the ISC, QSC8.3, ISL and QSL9 Series Engine Troubleshooting and Repair Manual, Bulletin 3653266, or in the ISB Series Engine Troubleshooting and Repair Manual, Bulletin 3666477. **YEA**	5A
	Fault code 2266 active? **DO NOT** **REPAIR:** None. Did removing and installing the connector correct the failure?	5A

STEP 4: Check the engine harness.

STEP 4A: Inspect the pins of the engine harness and ECM connectors.

Conditions:
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.

Action	Specifications / Repair	Next step
Check that the pins on the engine harness and ECM connectors have: • Loose connectors • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins • Damage to the wire shield • Broken connector cover • Damage to the connector locking tab. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-043 .	5A
	Dirty or damaged pins? **NOT**	4B

STEP 4B: Check the ECM response. Conditions:

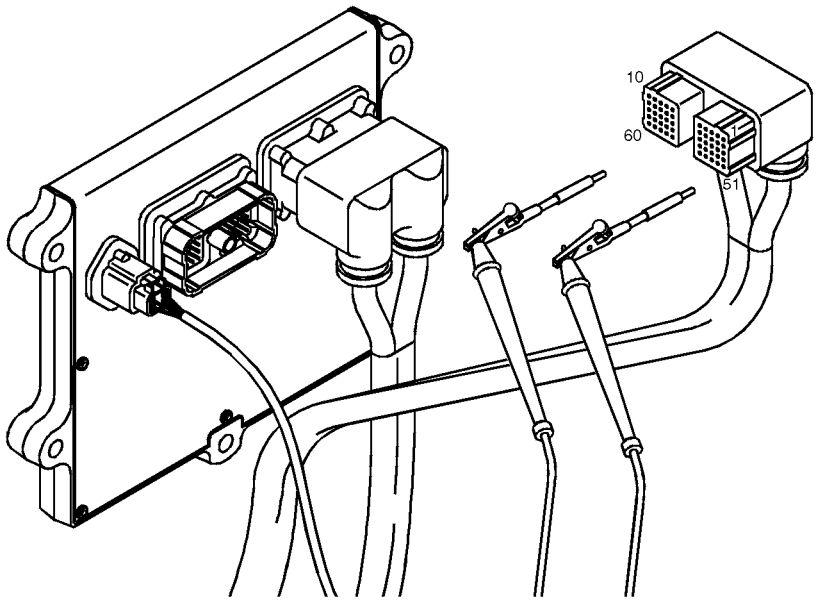
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Use the electronic service tool INSITE ™ to read fault codes.	Fault Code 2265 active and Fault Code 2266 inactive? **YEA**	4C
	Fault Code 2265 active and Fault Code 2266 inactive? **DO NOT** **REPAIR:** Call for authorization. Replace the ECM. See the Procedure 019-031 .	5A

STEP 4C: Check the motor harness for a short circuit between pins. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Disconnect the electric fuel transfer pump from the engine harness. In Automotive 24 VDC systems, disconnect the relay for the fuel transfer pump from the pump harness.

Action	Specifications / Repair	Next step
Check for a short circuit between pins. • Measure the resistance between the POWER pin of the electric fuel transfer pump on the ECM connector, on the engine harness, and all other pins on the ECM connector on the engine harness. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YEA**	4D
	More than 100k ohms? **DO NOT** **REPAIR:** A short circuit was detected between the pins in the POWER line in the engine harness. Repair or replace the engine harness. In Automotive 24 VDC systems, isolate the short circuit. Repair or replace the electrical harness for the electric fuel transfer pump or the engine harness. See the Procedure 019-043 .	5A



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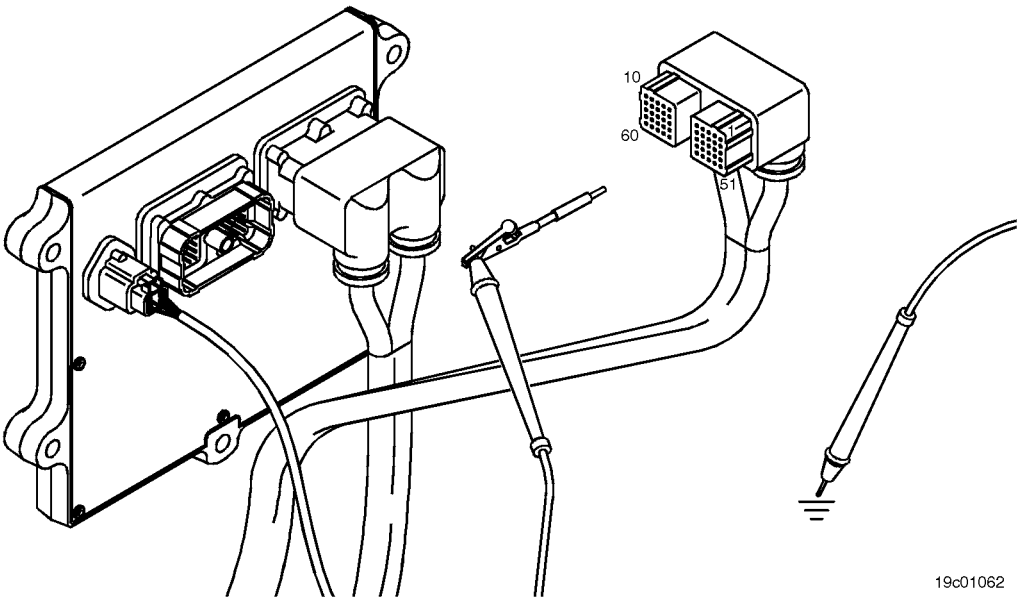
STEP 4D: Check if there is a short circuit between the pins and the ground. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Disconnect the electric fuel transfer pump from the engine harness. In Automotive 24 VDC systems, disconnect the relay for the fuel transfer pump from the pump harness.

Action	Specifications / Repair	Next step
Check for a short between pins and ground. • Measure the resistance between the POWER pin of the electric fuel transfer pump on the ECM connector, on the engine harness, and the ground. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YEA**	4E
	More than 100k ohms? **DO NOT** **REPAIR:** A short circuit was detected between the pins and the ground in the POWER line in the engine harness. Repair or replace the engine harness. In Automotive 24 VDC systems, isolate the short circuit. Repair or replace the electrical harness for the electric fuel transfer pump or the engine harness. See the Procedure 019-043 .	5A



STEP 4E: Check for an inactive fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 2266 inactive? **YES** **Repair:** None. Did removing and installing the connector correct the failure?	5A
	Fault code 2266 inactive? **DO NOT** **REPAIR:** The fault diagnosis procedures must be repeated from the beginning. A failure mode must have been detected.	1A

STEP 5: Clear the fault codes.

STEP 5A: Disable the fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Using the electronic service tool INSITE ™, make sure that the fault code is inactive.	Fault code 2266 inactive? **YEA**	5B
	Fault code 2266 inactive? **DO NOT** **REPAIR:** Return to the troubleshooting steps or consult your local Cummins Authorized Service Station after checking and completing all diagnostic steps again.	1A

STEP 5B: Clear the inactive fault codes. Conditions:

- Connect all components.
- Turn the ignition key ON.

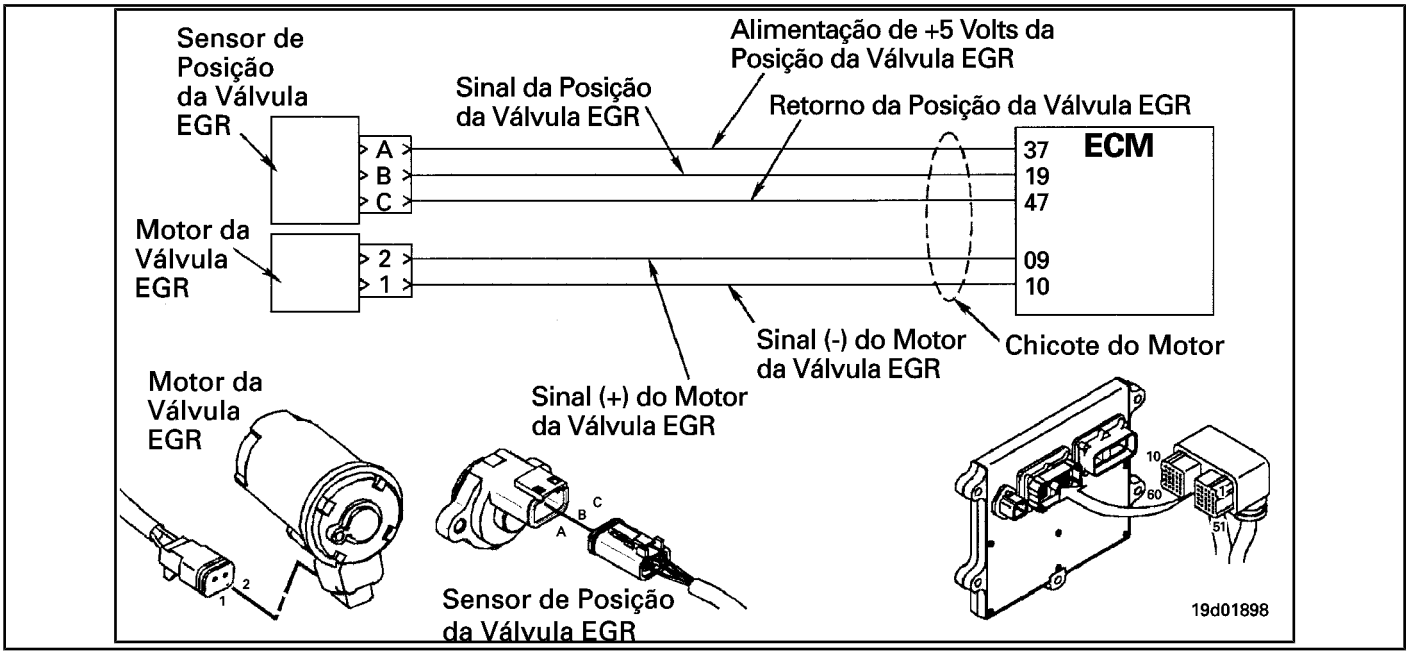
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **DO NOT** **REPAIR:** Troubleshoot any other active fault code.	Proper troubleshooting and repair steps

Fault Code 2271

EGR Valve Position Sensor Circuit - Voltage Above Normal or with High Voltage

CODES	REASON	IT IS MADE
Fault Code: 2271 PID (P), SID (S): P027 IMF: 3/3 Lamp: Amber SRT:	Exhaust Gas Recirculation Valve (EGR) Position Sensor Circuit - Voltage Above Normal or High Voltage. High voltage signal detected in the EGR valve position sensor circuit.	Possible loss of power. The power will be removed from the EGR valve motor.

EGR Valve Position Sensor Circuit



Circuit Descriptions:

The position sensor of the exhaust gas recirculation valve (EGR) provides a voltage signal to the electronic control module (ECM). The ECM converts this signal into a percentage value, from 0 to 100, indicating the position of the valve. A fully open valve is equivalent to 100 Percent.

Component Location:

The EGR valve position sensor is located on the EGR valve assembly. See the Procedure 100-002 for the detailed location of each component.

Workshop Tips:

The EGR valve position sensor shares the Engine harness Supply and Return wires with other sensors. Open circuits and short circuits in the engine harness can cause the activation of several fault codes.

Possible causes of this fault code:

- Open return on harness, connectors or sensor.
- Shorted signal wire with sensor supply or battery voltage.

- EGR valve position sensor failure
- ECM failure.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch /

AMP / Metri-Pack female test lead. STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check for fault codes sensor power supply.	**Fault code 227 active?**	
STEP 1B: Check for a passcode active fault.	**Fault code 2271 active?**	
STEP 2: Check the circuit and the EGR valve position sensor.		
STEP 2A: Inspect the pins of the engine harness and sensor connectors.	**Dirty or damaged pins?**	
STEP 2B: Check the circuit response.	**Fault Code 2271 inactive and Fault Code 2272 active?**	
STEP 2C: Check the circuitry Feed and Return of the EGR valve position sensor in the engine harness.	**4.75 to 5.25 VDC?**	
STEP 2D: Check the circuitry EGR valve position sensor feed and return on ECM.	**4.75 to 5.25 VDC?**	
STEP 3: Check the ECM.		
STEP 3A: Inspect the pins of the engine harness and ECM connectors.	**Dirty or damaged pins?**	
STEP 3B: Check the ECM response.	**Fault Code 2271 inactive and Fault Code 2272 active?**	
STEP 4: Clear the fault codes.		
STEP 4A: Disable the fault code.	**Fault code 2271 inactive?**	
STEP 4B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Check for sensor power failure codes. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for sensor power failure codes. • Start the engine and let it run at idle for 1 minute. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 227 active? **YES** **Repair:** Troubleshoot Fault Code 227.	Fault Code 227
	Fault code 227 active? **NOT**	1B

STEP 1B: Check for an active fault code. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an active fault code. • Start the engine and let it run at idle for 1 minute. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 2271 active? **YEA**	2A
	Fault code 2271 active? **NOT**	Fault Code Inactive or Intermittent, Procedure 019-362

STEP 2: Check the circuit and the EGR valve position sensor.

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

Conditions:
- Turn the ignition key off.
- Disconnect the EGR valve position sensor from the engine harness.

Action	Specifications / Repair	Next step
Inspect the engine and sensor harness connector pins and check for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins • Broken connector cover • Connector lock guide damage • Damage to the insulation of the motor wiring or harness. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** Clean the connector and pins. If damaged, repair the harness, connectors and pins, if possible.	4A
	Dirty or damaged pins? **NOT**	2B

STEP 2B: Check the circuit response. Conditions:

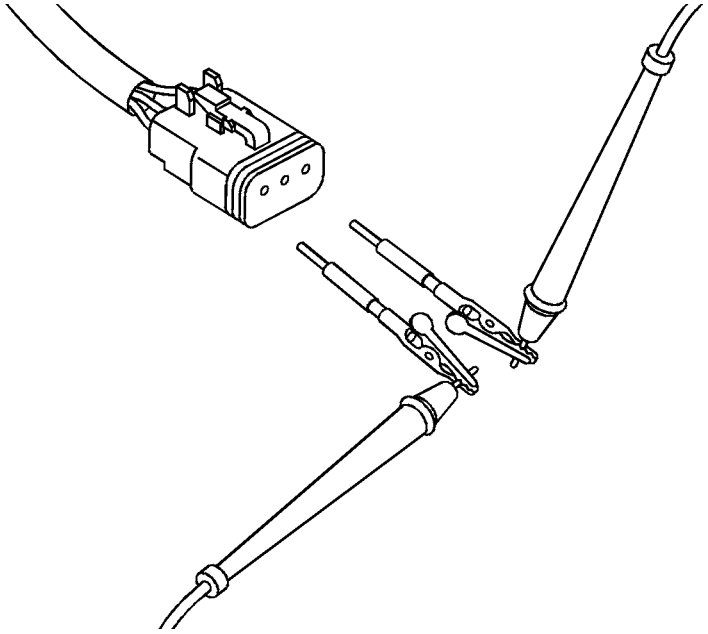
- Turn the ignition key off.
- Disconnect the EGR valve position sensor from the engine harness.
- Connect the electronic service tool INSITE ™.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check for an appropriate ECM response after 30 seconds. • Use the electronic service tool INSITE ™ to read fault codes.	Fault Code 2271 inactive and Fault Code 2272 active? **YEA**	2C
	Fault Code 2271 inactive and Fault Code 2272 active? **NOT**	3A

STEP 2C: Check the Supply and Return circuits of the EGR valve position sensor on the engine harness.

Conditions:
- Turn the ignition key off.
- Disconnect the EGR valve position sensor from the engine harness.
- Turn the ignition key ON.

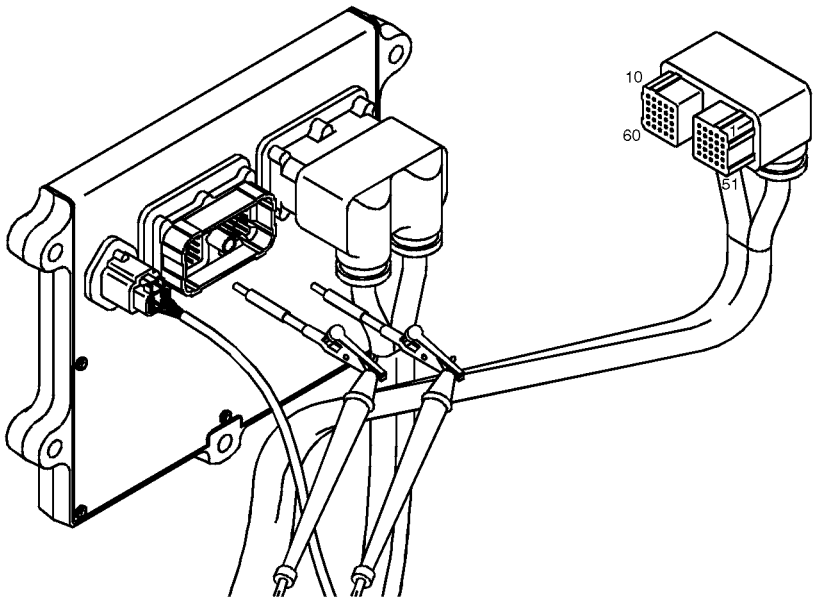
Action	Specifications / Repair	Next step
Check the Power and Return circuits of the EGR valve position sensor on the engine harness. • Measure the voltage between the +5 VDC Power pin for the EGR valve position and the EGR valve Position Return pin on the engine harness sensor connector. Refer to the Circuit Diagram or Electrical Diagram for the identification of the connector pins. Refer to the "Using the Multimeter" publication, Procedure 019-359 .	4.75 to 5.25 VDC? **YES** **Repair:** Replace the EGR valve position sensor. See the Procedure 019-372 .	4A
	4.75 to 5.25 VDC? **NOT**	2D



STEP 2D: Check the Supply and Return circuits of the EGR valve position sensor on the ECM.

Conditions:
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check the Supply and Return circuits of the EGR valve position sensor on the ECM. • Measure the voltage between the +5 volt Power pin on the EGR valve position and the EGR valve Position Return pin on the ECM port. Refer to the Circuit Diagram or Electrical Diagram for the identification of the connector pins. Refer to the "Using the Multimeter" publication, Procedure 019-359 .	4.75 to 5.25 VDC? **YES** **Repair:** Repair or replace the engine harness.	4A
	4.75 to 5.25 VDC? **DO NOT** **REPAIR:** Replace the ECM. Call for pre-authorization. See the Procedure 019-031 .	4A



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STEP 3: Check the ECM.

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

Conditions:
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.

Action	Specifications / Repair	Next step
Check that the pins on the engine harness and ECM connectors have: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins • Broken connector cover • Connector lock guide damage • Damage to the insulation of the motor wiring or harness. Refer to Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** Clean the connector and pins. If damaged, repair the harness, connectors and pins, if possible.	4A
	Dirty or damaged pins? **NOT**	3B

STEP 3B: Check the ECM response. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Connect the electronic service tool INSITE ™.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check that the ECM response is appropriate. • Use the electronic service tool INSITE ™ to read fault codes.	Fault Code 2271 inactive and Fault Code 2272 active? **YES** **Repair:** Repair or replace the engine harness.	4A
	Fault Code 2271 inactive and Fault Code 2272 active? **DO NOT** **REPAIR:** Replace the ECM. Call for pre-authorization. See the Procedure 019-031 .	4A

STEP 4: Clear the fault codes.

STEP 4A: Disable the fault code. Conditions:

- Connect all components.
- Connect the electronic service tool INSITE ™.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Use the electronic service tool INSITE ™ to make sure Fault Code 2271 is inactive.	Fault code 2271 inactive? **YEA**	4B
	Fault code 2271 inactive? **DO NOT** **REPAIR:** Return to the troubleshooting steps or consult your local Cummins Authorized Service Station after checking and completing all diagnostic steps again.	1A

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

- Connect all components.
- Connect the electronic service tool INSITE ™.
- Turn the ignition key ON.

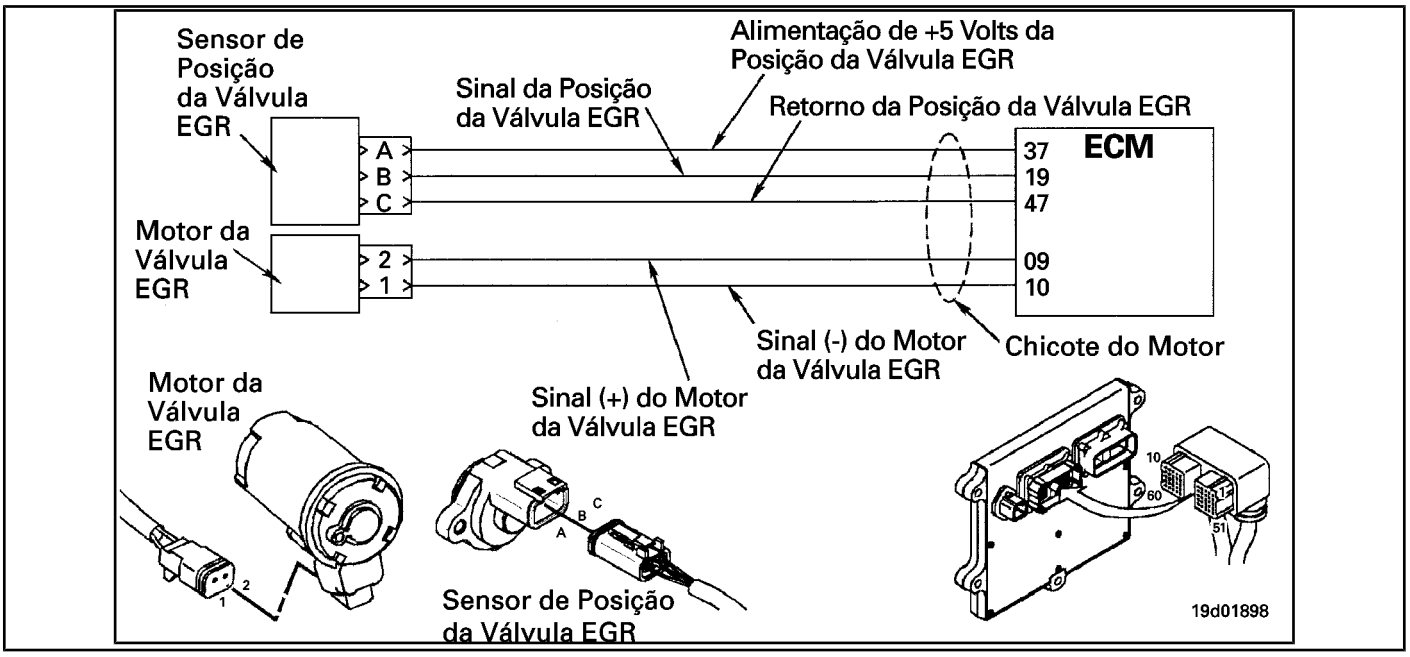
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **DO NOT** **REPAIR:** Troubleshoot any other active fault code.	Proper troubleshooting and repair steps

Fault Code 2272

EGR Valve Position Sensor Circuit - Voltage Below Normal or with Low Voltage

CODES	REASON	IT IS MADE
Fault Code: 2272 PID (P), SID (S): P027 IMF: 4/4 Lamp: Amber SRT:	Exhaust Gas Recirculation Valve (EGR) Position Sensor Circuit - Below Standard Voltage or Low Voltage. Low voltage detected in the signal circuit of the EGR valve position sensor.	Possible loss of power. The power will be removed from the EGR valve motor.

EGR Valve Position Sensor Circuit



Circuit Descriptions:

The EGR valve position sensor provides a voltage signal to the electronic control module (ECM). The ECM converts this signal into a percentage value, from 0 to 100, indicating the position of the valve. A fully open valve is equivalent to 100 Percent.

Component Location:

The EGR valve position sensor is located on the EGR valve assembly. See the Procedure 100-002 to identify the location of each component.

Workshop Tips:

The EGR valve position sensor shares the motor harness supply and return wires with other sensors. Open circuits and short circuits in the engine harness can cause the activation of several fault codes.

Possible causes of this fault code:

- Signal circuit open or shorted with ground
- Supply circuit open or shorted with ground

- Short-circuit between sensor and ground.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch /

AMP / Metri-Pack female test lead. STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check for fault codes sensor power supply.	**Fault code 187 active?**	
STEP 1B: Check for a passcode active fault.	**Fault code 2272 active?**	
STEP 2: Check the circuit and the EGR valve position sensor.		
STEP 2A: Inspect the pins of the engine harness and sensor connectors.	**Dirty or damaged pins?**	
STEP 2B: Check the circuitry supply and return of the EGR valve position sensor in the harness.	**4.75 to 5.25 VDC?**	
STEP 2C: Check the circuit response.	**Fault Code 2272 inactive and Fault Code 2271 active?**	
STEP 2D: Check the ECM response.	**Fault Code 2272 inactive and Fault Code 2271 active?**	
STEP 3: Check the ECM.		
STEP 3A: Inspect the pins of the engine harness and ECM connectors.	**Dirty or damaged pins?**	
STEP 3B: Check the voltage supply and the sensor return circuit.	**4.75 to 5.25 VDC?**	
STEP 4: Clear the fault codes.		
STEP 4A: Disable the fault code.	**Fault code 2272 inactive?**	
STEP 4B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Check for sensor power failure codes. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for sensor power failure codes. • Start the engine and let it run at idle for 1 minute. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 187 active? **YES** **Repair:** Troubleshoot Fault Code 187.	Refer to the fault symptom diagram for Fault Code 187
	Fault code 187 active? **NOT**	1B

STEP 1B: Check for an active fault code. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an active fault code. • Start the engine and let it run at idle for 1 minute. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 2272 active? **YEA**	2A
	Fault code 2272 active? **NOT**	Fault Code Inactive or Intermittent, Procedure 019-362

STEP 2: Check the circuit and the EGR valve position sensor.

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

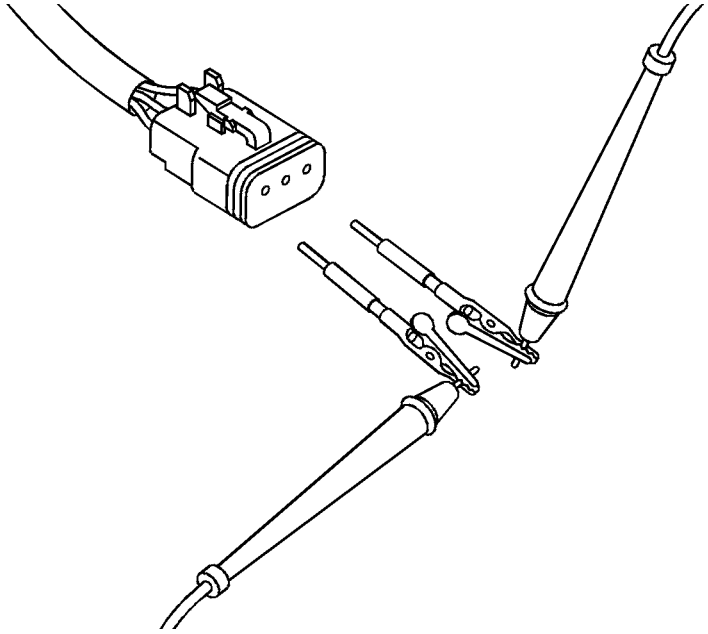
Conditions:
- Turn the ignition key off.
- Disconnect the EGR valve position sensor from the engine harness.

Action	Specifications / Repair	Next step
Inspect the engine and sensor harness connector pins and check for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins • Broken connector cover • Damage to the insulation of the wires or the harness • Damage to the connector locking tab. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** Clean the connectors and pins. If damaged, repair the harness, connectors and pins, if possible.	4A
	Dirty or damaged pins? **NOT**	2B

STEP 2B: Check the Supply and Return circuits of the EGR valve position sensor on the engine harness.

Conditions:
- Turn the ignition key off.
- Disconnect the EGR valve position sensor from the engine harness.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check the Power and Return circuits of the EGR valve position sensor on the engine harness. • Measure the voltage between the +5 VDC Power pin for the EGR valve position and the EGR valve Position Return pin on the engine harness sensor connector. Refer to the Circuit Diagram or Electrical Diagram for the identification of the connector pins. Refer to the "Using the Multimeter" publication, Procedure 019-359 .	4.75 to 5.25 VDC? **YEA**	2C
	4.75 to 5.25 VDC? **NOT**	3A



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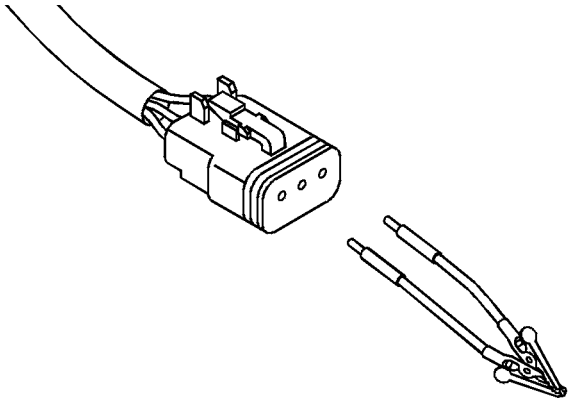
STEP 2C: Check the circuit response. Conditions:

- Turn the ignition key off.
- Disconnect the EGR valve position sensor from the engine harness.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check the circuit response. • Install a jumper wire between the +5 VDC POWER pin of the EGR valve position and the EGR valve position SIGN pin on the engine harness sensor connector. • Use the electronic service tool INSITE ™ to determine if the fault code becomes inactive and to read the fault code. Refer to the Circuit Diagram or Electrical Diagram for the identification of the connector pins.	Fault Code 2272 inactive and Fault Code 2271 active? **YES** **Repair:** Replace the EGR valve position sensor. See the Procedure 019-372 .	4A
	Fault Code 2272 inactive and Fault Code 2271 active? **NOT**	2D



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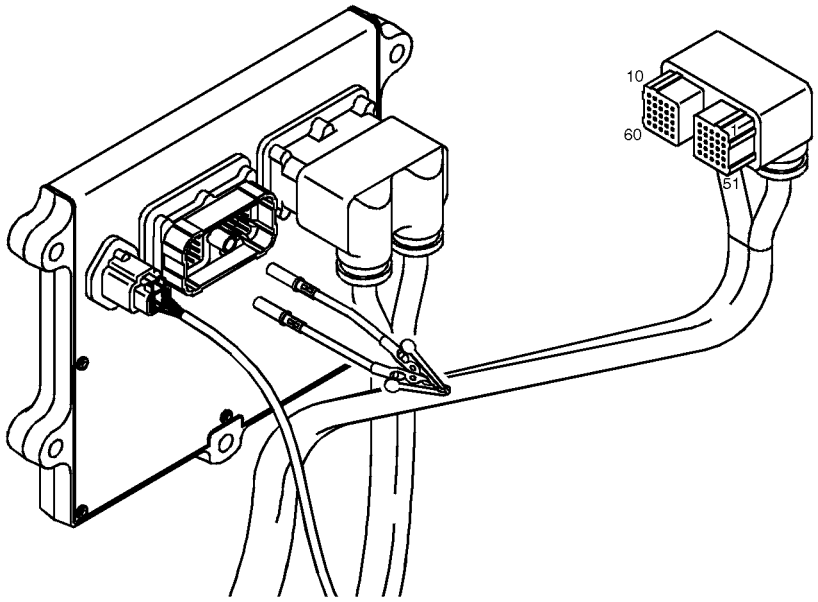
STEP 2D: Check the ECM response. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check the ECM response. • Install a jumper wire between the +5 VDC POWER pin of the EGR valve position and the EGR valve position SIGN pin on the ECM port. • Check for an appropriate ECM response after 30 seconds. • Use the electronic service tool INSITE ™ to read fault codes. Refer to the Circuit Diagram or Electrical Diagram for the identification of the connector pins.	Fault Code 2272 inactive and Fault Code 2271 active? **YES** **Repair:** Repair or replace the engine harness.	4A
	Fault Code 2272 inactive and Fault Code 2271 active? **DO NOT** **REPAIR:** Replace the ECM. Call for pre-authorization. See the Procedure 019-031 .	4A



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STEP 3: Check the ECM.

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

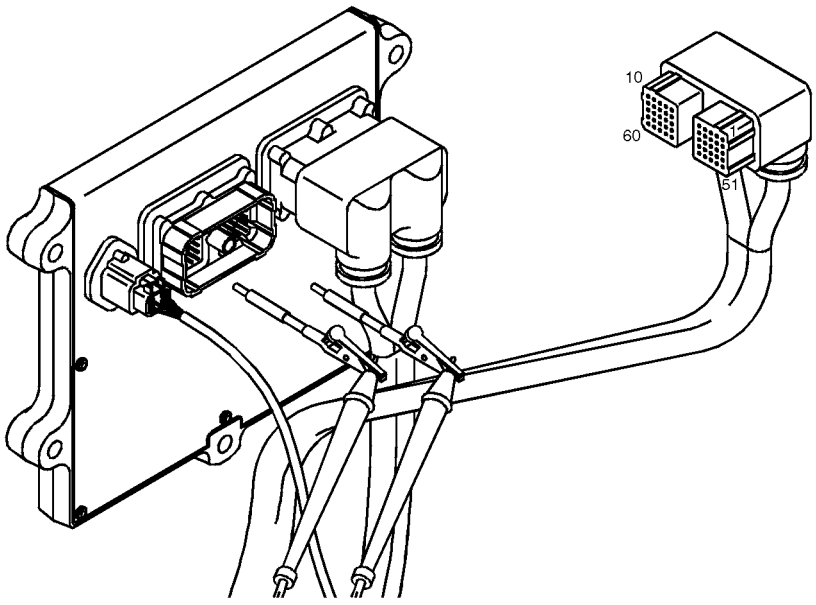
Conditions:
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.

Action	Specifications / Repair	Next step
Check that the pins on the engine harness and ECM connectors have: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins • Broken connector cover • Damage to the insulation of the wires or the harness • Damage to the connector locking tab. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** Clean the connectors and pins. If damaged, repair the harness, connectors and pins, if possible.	4A
	Dirty or damaged pins? **NOT**	3B

STEP 3B: Check the supply voltage and the sensor return circuit. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check the sensor supply voltage and the return circuit at the ECM. • Measure the voltage between the +5 VDC POWER pin on the turbocharger and the RETURN pin on the turbocharger on the ECM port. Refer to the Circuit Diagram or Electrical Diagram for the identification of the connector pins. Refer to the "Using the Multimeter" publication, Procedure 019-359 .	4.75 to 5.25 VDC? **YES** **Repair:** Repair or replace the engine harness.	4A
	4.75 to 5.25 VDC? **DO NOT** **REPAIR:** Replace the ECM. Call for pre-authorization. See the Procedure 019-031 .	4A



19c01079

STEP 4: Clear the fault codes.

STEP 4A: Disable the fault code. Conditions:

- Connect all components.
- Connect the electronic service tool INSITE ™.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Make sure Fault Code 2272 is inactive.	Fault code 2272 inactive? **YEA**	4B
	Fault code 2272 inactive? **DO NOT** **REPAIR:** Return to the troubleshooting steps or consult your local Cummins Authorized Service Station after checking and completing all diagnostic steps again.	1A

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

- Connect all components.
- Connect the electronic service tool INSITE ™.
- Turn the ignition key ON.

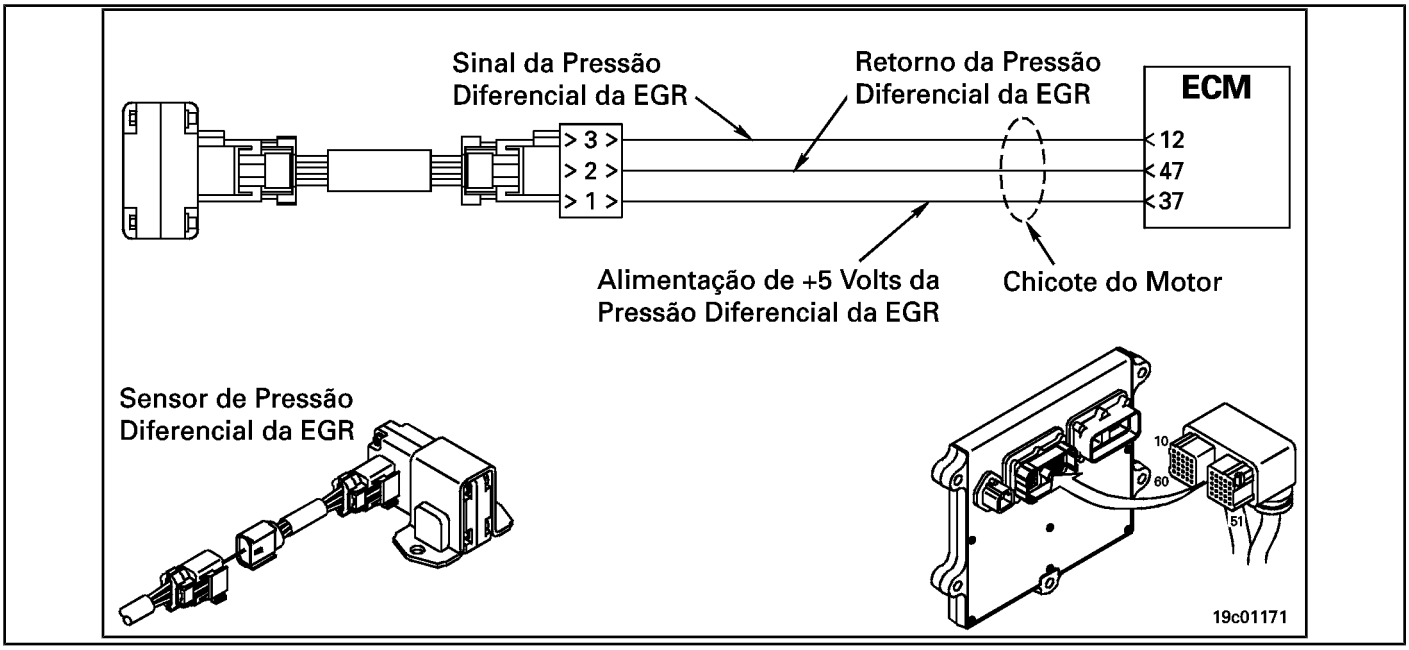
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **DO NOT** **REPAIR:** Troubleshoot any other active fault code.	Proper troubleshooting and repair steps

Fault Code 2273

EGR Valve Differential Pressure Sensor Circuit - With High Voltage

CODES	REASON	IT IS MADE
Fault Code: 2273 PID (P), SID (S): P411 IMF: 3/3 Lamp: Amber SRT:	EGR valve differential pressure sensor circuit - with high voltage. High voltage detected in the EGR valve differential pressure sensor circuit.	The EGR valve will be closed.

EGR Valve Differential Pressure Sensor Circuit



Circuit Descriptions:

The differential pressure sensor circuit of the exhaust gas recirculation valve (EGR) has two ports that detect a pressure drop between the EGR gas inlet and the inlet connection. The electronic control module (ECM) uses this pressure drop to calculate the amount of gas from the EGR entering the intake manifold. This calculation helps to determine the commanded position of the EGR valve (and the GV turbocharger) that will control the amount of gas flow from the EGR to the engine.

Component Location:

The EGR valve differential pressure sensor is mounted on the intake air turbine side. See the Procedure 100-002 to identify the location of each component.

NOTE: The sensor is connected to the engine harness using a small pigtail harness. The pigtail whip is permanently attached to the sensor. **Not** try to remove the connector attached to the sensor body or this could damage the sensor.

Workshop Tips:

The EGR differential pressure sensor shares the motor harness supply and return wires with other sensors. Open circuits and short circuits in the engine harness can cause the activation of several fault codes. Before fault diagnosis of Fault Code 2273, check for other faults. Possible causes of this fault code:

- Open return on harness, connectors or sensor.
- Shorted signal circuit with sensor supply or battery voltage.
- Power circuit shorted with battery voltage.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch / AMP / Metri-Pack female test lead Part No. 3164596 - Framatome male test lead. STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check for multiple fault codes.	**Fault code 227 active?**	
STEP 1B: Read the fault codes.	**Fault code 2273 active?**	
STEP 2: Check the EGR circuit and differential pressure sensor.		
STEP 2A: Inspect the engine harness and EGR differential pressure sensor connector pins.	**Dirty or damaged pins?**	
STEP 2B: Check the circuit response.	**Fault Code 2273 inactive and Fault Code 2274 active?**	
STEP 2C: Check the circuit supply and return of the EGR differential pressure sensor in the harness.	**4.75 to 5.25 VDC?**	
STEP 2D: Check the circuit EGR differential pressure sensor supply and return to ECM.	**4.75 to 5.25 VDC?**	
STEP 3: Check the ECM.		
STEP 3A: Inspect the pins of the engine harness and ECM connectors.	**Dirty or damaged pins?**	
STEP 3B: Check the ECM response.	**Fault Code 2273 inactive and Fault Code 2274 active?**	
STEP 4: Clear the fault codes.		
STEP 4A: Disable the fault code.	**Fault code 2273 inactive?**	
STEP 4B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Check for multiple fault codes. Conditions:

- Connect the electronic service tool INSITE ™.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check for multiple fault codes. • Start the engine and let it run at idle for 1 minute. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 227 active? **YES** **Repair:** Troubleshoot Fault Code 227.	Fault Code 227
	Fault code 227 active? **NOT**	1B

STEP 1B: Read the fault codes. Conditions:

- Connect the electronic service tool INSITE ™.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Read the fault codes. • Start the engine and let it run at idle for 1 minute. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 2273 active? **YEA**	2A
	Fault code 2273 active? **NOT**	Fault Code Inactive or Intermittent, Procedure 019-362

STEP 2: Check the EGR circuit and differential pressure sensor.

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

Conditions:
- Turn the ignition key off.
- Disconnect the EGR differential pressure sensor from the engine harness.

Action	Specifications / Repair	Next step
Inspect the engine harness and EGR differential pressure sensor connector pins and check for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** Clean the connector and pins. If damaged, repair the harness, connectors and pins, if possible. See Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	4A
	Dirty or damaged pins? **NOT**	2B

STEP 2B: Check the circuit response. Conditions:

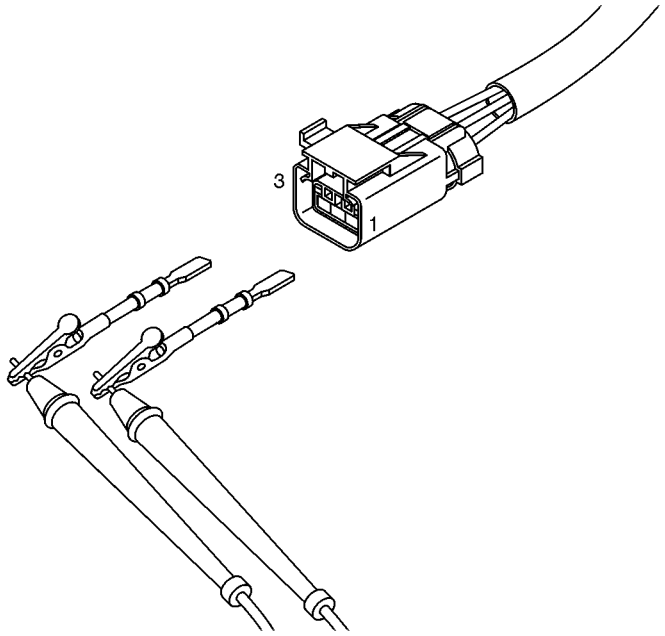
- Turn the ignition key off.
- Disconnect the EGR differential pressure sensor from the engine harness.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an appropriate ECM response after 30 seconds. • Use the electronic service tool INSITE ™ to read fault codes.	Fault Code 2273 inactive and Fault Code 2274 active? **YEA**	2C
	Fault Code 2273 inactive and Fault Code 2274 active? **NOT**	3A

STEP 2C: Check the supply and return circuit of the EGR differential pressure sensor at whip.

Conditions:
- Turn the ignition key off.
- Disconnect the EGR differential pressure sensor from the engine harness.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check the supply and return circuit of the EGR differential pressure sensor in the harness. • Measure the voltage between the EGR differential pressure +5 volt power pin and the EGR differential pressure return pin on the engine harness sensor connector.	4.75 to 5.25 VDC? **YES** **Repair:** Replace the EGR differential pressure sensor. See the Procedure 019-370 .	4A
	4.75 to 5.25 VDC? **NOT**	2D



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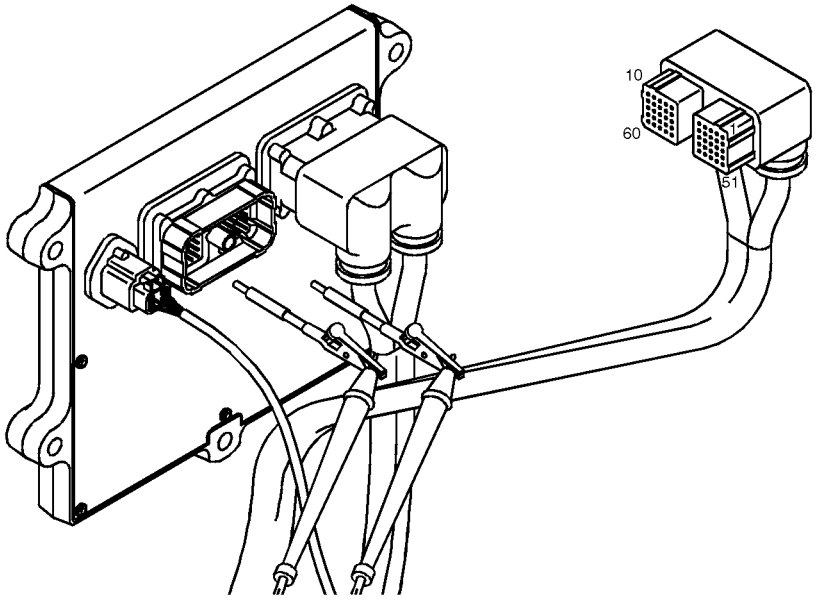
STEP 2D: Check the supply and return circuit of the EGR differential pressure sensor at ECM.

Conditions:
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check the EGR differential pressure sensor supply and return circuit on the ECM. • Measure the voltage between the EGR DIFFERENTIAL PRESSURE +5 V POWER pin and the EGR DIFFERENTIAL PRESSURE RETURN pin on the ECM port.	4.75 to 5.25 VDC? **YES** **Repair:** Repair or replace the engine harness. See Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	4A
	4.75 to 5.25 VDC? **DO NOT** **REPAIR:** Replace the ECM. Call for authorization. See the Procedure 019-031 .	4A



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STEP 3: Check the ECM.

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

Conditions:
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.

Action	Specifications / Repair	Next step
Check the pins of the engine harness and ECM connectors for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** Clean the connectors and pins. If damaged, repair the harness, connectors and pins, if possible. See Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	4A
	Dirty or damaged pins? **NOT**	3B

STEP 3B: Check the ECM response. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check that the ECM response is appropriate. • Use the electronic service tool INSITE ™ to read fault codes.	Fault Code 2273 inactive and Fault Code 2274 active? **YES** **Repair:** Repair or replace the engine harness. See Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	4A
	Fault Code 2273 inactive and Fault Code 2274 active? **DO NOT** **REPAIR:** Replace the ECM. Call for authorization. See the Procedure 019-031 .	4A

STEP 4: Clear the fault codes.

STEP 4A: Disable the fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Make sure Fault Code 2273 is inactive.	Fault code 2273 inactive? **YEA**	4B
	Fault code 2273 inactive? **NOT**	1A

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

- Connect all components.
- Turn the ignition key ON.

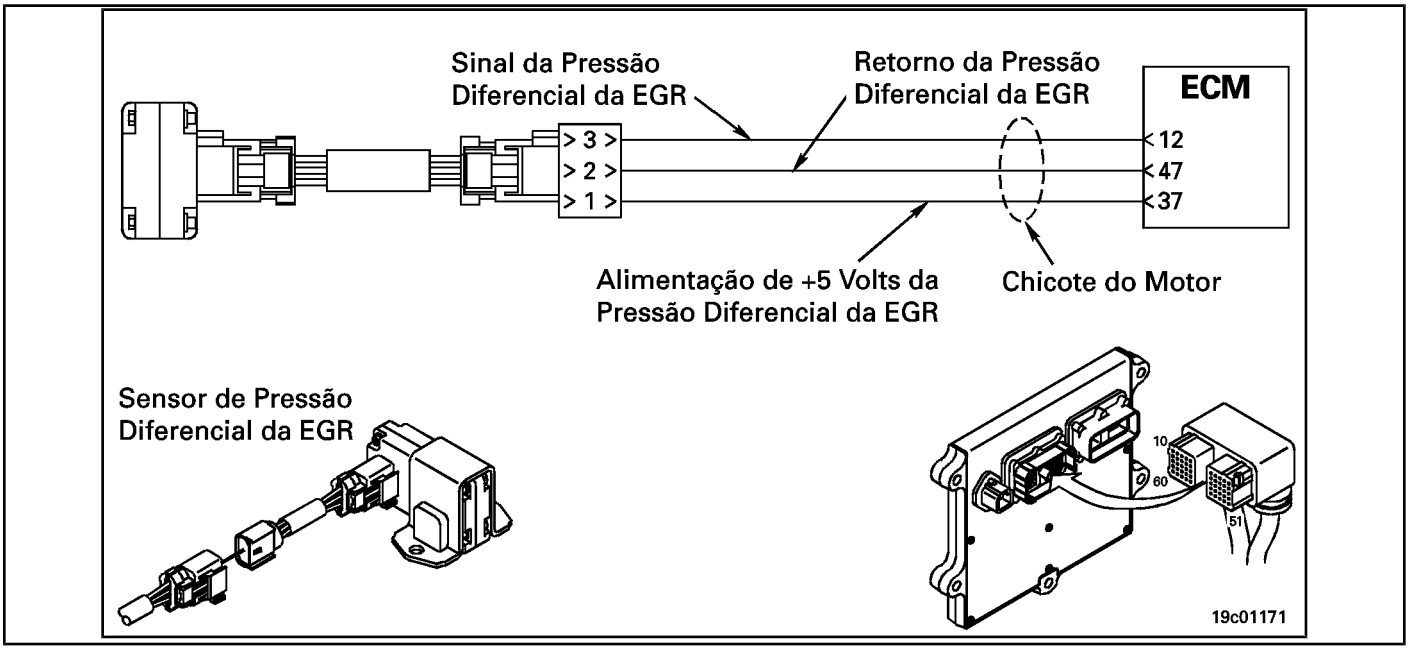
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **NOT**	Proper troubleshooting and repair steps

Fault Code 2274

EGR Valve Differential Pressure Sensor Circuit - Low Voltage

CODES	REASON	IT IS MADE
Fault Code: 2274 PID (P), SID (S): P411 IMF: 4/4 Lamp: Amber SRT:	EGR valve differential pressure sensor circuit - low voltage. Low voltage signal detected in the EGR valve differential pressure sensor circuit.	The EGR valve will be closed.

EGR Valve Differential Pressure Sensor Circuit



Circuit Descriptions:

Exhaust gas recirculation. The EGR valve differential pressure sensor circuit has two ports that detect a pressure drop between the EGR gas inlet and the inlet connection. The electronic control module (ECM) uses this pressure drop to calculate the amount of EGR gas that enters the intake manifold. This calculation helps to determine the commanded position of the EGR valve (and the GV turbocharger) that will control the amount of gas flow from the EGR to the engine.

Component Location:

The differential pressure sensor of the EGR valve is mounted on the inlet connection side. See the Procedure 100-002 to identify the location of each component.

NOTE: The sensor is connected to the engine harness using a small pigtail harness. The pigtail whip is permanently attached to the sensor. **Not** try to remove the connector attached to the sensor body or this could damage the sensor.

Workshop Tips:

The differential pressure sensor of the EGR valve shares the motor harness supply and return wires with other sensors. Open circuits and short circuits in the engine harness can cause the activation of several fault codes. Before diagnosing fault code 2274, check for other faults.

- Open signal circuit at engine harness, connections or sensor

- Supply circuit open or shorted with ground
- Short-circuit between sensor and ground.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following test cable when making a measurement:

Part No. 3164596 - Framatome male test lead. STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check for multiple fault codes.	**Fault code 187 active?**	
STEP 1B: Read the fault codes.	**Fault code 2274 active?**	
STEP 2: Check the EGR valve differential pressure circuit and sensor.		
STEP 2A: Inspect the pins of the engine harness and sensor connectors.	**Dirty or damaged pins?**	
STEP 2B: Check the voltage sensor power.	**4.75 to 5.25 VDC?**	
STEP 2C: Check the circuit response.	**Fault Code 2274 inactive and Fault Code 2273 active?**	
STEP 3: Check the ECM.		
STEP 3A: Inspect the pins of the engine harness and ECM connectors.	**Dirty or damaged pins?**	
STEP 3B: Check the ECM response.	**Fault Code 2274 inactive and Fault Code 2273 active?**	
STEP 4: Clear the fault codes.		
STEP 4A: Disable the fault code.	**Fault code 2274 inactive?**	
STEP 4B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Check for multiple fault codes. Conditions:

- Connect the electronic service tool INSITE ™.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check for multiple fault codes. • Start the engine and let it run at idle for 1 minute. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 187 active? **YES** **Repair:** Troubleshoot Fault Code 187.	Fault Code 187
	Fault code 187 active? **NOT**	1B

STEP 1B: Read the fault codes. Conditions:

- Connect all components.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Read the fault codes. • Start the engine and let it run at idle for 1 minute. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 2274 active? **YEA**	2A
	Fault code 2274 active? **NOT**	Fault Code Inactive or Intermittent, Procedure 019-362

STEP 2: Check the EGR valve differential pressure circuit and sensor.

STEP 2A: Inspect the EGR valve differential pressure sensor and the connector pins.

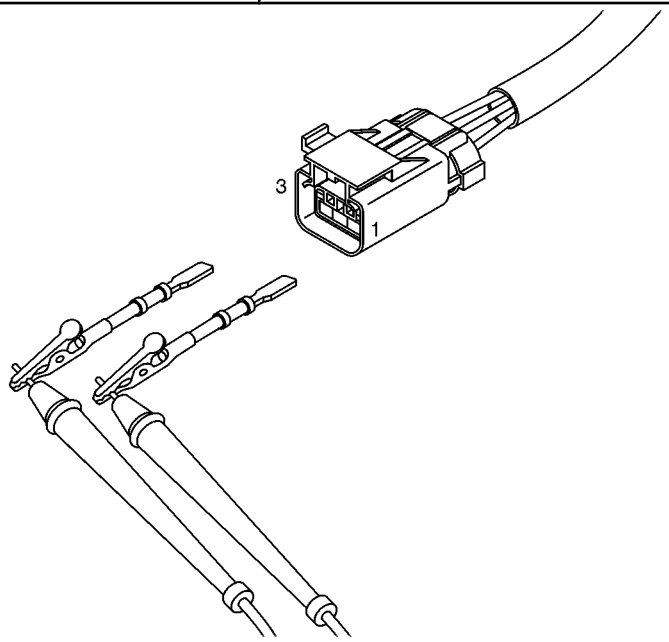
Conditions:
- Turn the ignition key off.
- Disconnect the EGR valve differential pressure sensor from the engine harness.

Action	Specifications / Repair	Next step
Inspect the EGR valve differential pressure sensor and connector pins and check for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** Clean the connectors and pins. If damaged, repair the harness, connectors and pins, if possible. See Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	4A
	Dirty or damaged pins? **NOT**	2B

STEP 2B: Check the sensor supply voltage. Conditions:

- Turn the ignition key off.
- Disconnect the EGR valve differential pressure sensor from the engine harness.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check the sensor supply voltage. • Measure the voltage between the EGR differential pressure +5 volt power pin and the EGR differential pressure return pin on the engine harness sensor connector.	4.75 to 5.25 VDC? **YEA**	2C
	4.75 to 5.25 VDC? **NOT**	3A



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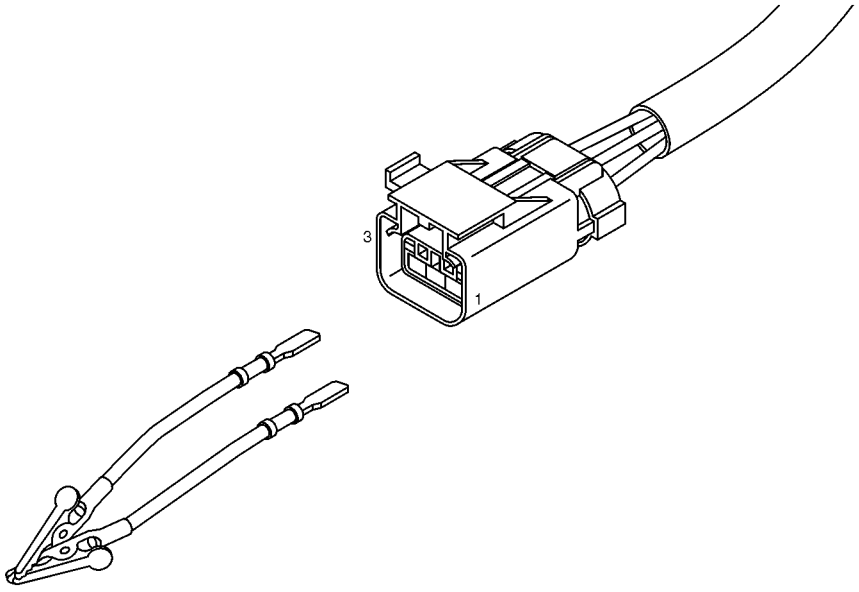
STEP 2C: Check the circuit response. Conditions:

- Disconnect the EGR valve differential pressure sensor from the engine harness.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check the circuit response. • Install a jumper wire between the EGR differential pressure +5 volt power pin and the EGR differential pressure signal pin, on the engine harness sensor connector. • Check for an appropriate ECM response after 30 seconds. • Use the electronic service tool INSITE ™ to read fault codes.	Fault Code 2274 inactive and Fault Code 2273 active? **YES** **Repair:** Replace the EGR valve differential pressure sensor. See the Procedure 019-370 .	4A
	Fault Code 2274 inactive and Fault Code 2273 active? **NOT**	3A



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STEP 3: Check the ECM.

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

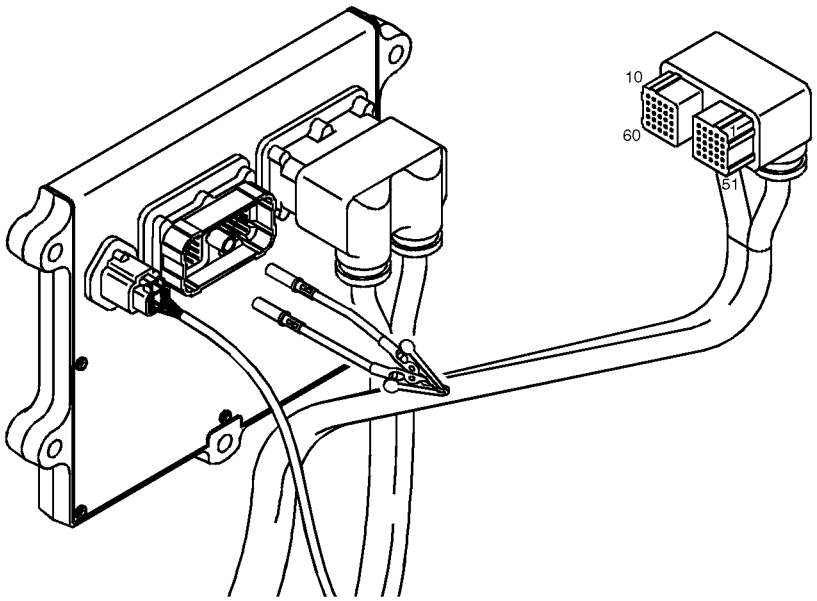
Conditions:
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.

Action	Specifications / Repair	Next step
Check the pins of the engine harness and ECM connectors for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** Clean the connectors and pins. If damaged, repair the harness, connectors and pins, if possible. See Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	4A
	Dirty or damaged pins? **NOT**	3B

STEP 3B: Check the ECM response. Conditions:

- Disconnect the engine harness from the ECM.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check that the ECM response is appropriate. • Install a bridge wire between the EGR differential pressure +5 volt power pin and the EGR differential pressure signal pin on the ECM port. • Check for an appropriate ECM response after 30 seconds. • Use the electronic service tool INSITE ™ to read fault codes.	Fault Code 2274 inactive and Fault Code 2273 active? **YES** **Repair:** Repair or replace the engine harness. See Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	4A
	Fault Code 2274 inactive and Fault Code 2273 active? **DO NOT** **REPAIR:** Replace the ECM. Call for authorization. See the Procedure 019-031 .	Complete repair



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STEP 4: Clear the fault codes.

STEP 4A: Disable the fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Make sure Fault Code 2274 is inactive.	Fault code 2274 inactive? **YEA**	4B
	Fault code 2274 inactive? **NOT**	1A

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

- Connect all components.
- Turn the ignition key ON.

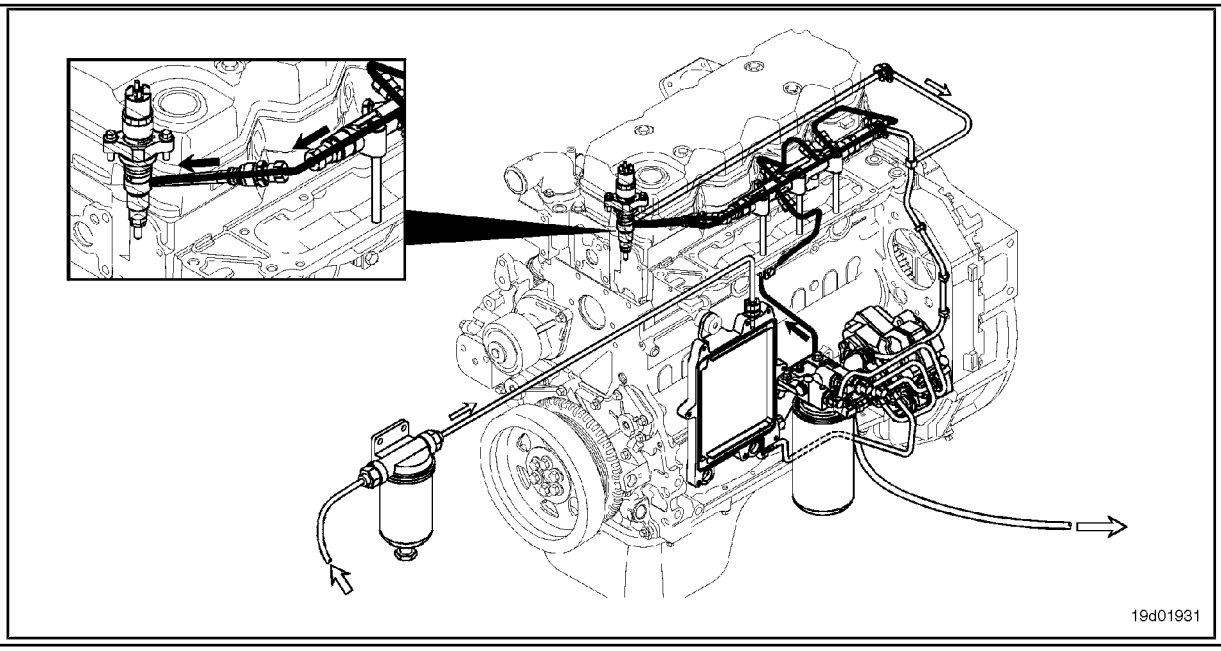
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **NOT**	Proper troubleshooting and repair steps

Fault Code 2292

Fuel Inlet Measuring Device - Valid Data but Above Range
Normal Operating - Moderately Severe Level

CODES	REASON	IT IS MADE
Fault Code: 2292 PID (P), SID (S): IMF: 16 Lamp: Amber SRT:	Fuel Inlet Measurement Device - Valid Data but Above Normal Operating Range - Moderately Severe Level. The flow demand is greater than expected.	Possible difficulty in starting; loss of power; possible smoke emission. Engine de-powering.

Fuel System



Circuit Descriptions:

The fuel pressure control circuit depends on the fuel pressure supplied to the high pressure pump by the electric transfer pump and the low pressure pump. The electronic control module (ECM) monitors the fuel pressure in the common rail and the operating conditions of the engine, changing the flow control to maintain the correct fuel pressure in the common rail. Changes in the flow control result in the opening (or closing) of the electronic fuel control actuator to supply more (or less) fuel to the high pressure pump.

The fuel flow circuit includes, in the following fuel flow order:

- Fuel tank
- OEM fuel supply line
- OEM 300 micron filter
- ECM cooling plate
- Electric transfer pump
- Fuel filter
- Gear pump
- Electronic fuel control actuator
- High pressure fuel pump
- Common rail (includes the common rail pressure relief valve and pressure sensor)
- High pressure fuel lines
- High pressure fuel connectors (HPCs)

- Injectors
- Return to the tank.

Component Location:

The electronic fuel control actuator is located on the fuel pump. See the Procedure 100-002 to identify the location of each component.

Workshop Tips:

The causes of this fault code include: High input restriction, clogged fuel filter, low transfer pump pressure, low resistance to the electronic fuel control actuator, stuck or restricted fuel control electronic actuator, system return (excessive return flow from injectors, high pressure pump or pressure relief valve on the common rail), or violation.

Fault Code 2292 is recorded when the ECM sends a signal to the electronic fuel control actuator (EFC) to open more than expected to maintain pressure on the common rail. Fault Code 2215 occurs when the ECM fully opens the electronic fuel control actuator and the pressure on the common rail is still less than the commanded.

After the repair is done, this fault code will require approximately 15 to 20 minutes of road testing or on the dynamometer to become inactive.

SUMMARY OF FAULT DIAGNOSTICS

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Read the fault codes.	Fault code 2215 or 2266 inactive?	
STEP 2: Check the operation of the low pressure fuel system.		
STEP 2A: Check for leaks external fuel.	Are there any leaks?	
STEP 3: Check the transfer pump.		
STEP 3A: Measure the pressure of the transfer.	Does the transfer pump meet the minimum specifications?	
STEP 3B: Measure the input restriction of the transfer pump.	Less than 152 mm-Hg [6 in-Hg]?	
STEP 4: Check the fuel filter restriction.		
STEP 4A: Measure the pressure drop at the fuel filter.	Is the pressure drop less than 34 kPa [5 psi]?	
STEP 5: Check the high pressure fuel system.		
STEP 5A: Check for leaks in the fuel pressure relief valve on the common rail.	Fuel return within specifications?	
STEP 5B: Check for leaks excessive fuel return from the high pressure fuel system, high pressure injectors and connectors.	Fuel leakage within specifications?	
STEP 5C: Check for return excessive fuel from the high pressure fuel pump.	Fuel return within specifications?	
STEP 6: Clear the fault codes.		
STEP 6A: Disable the fault code.	Fault codes inactive?	
STEP 6B: Clear the fault codes inactive.	All codes cleared?	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Read the fault codes. Conditions:

- Connect the electronic service tool INSITE ™.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Read the fault codes. • Start the engine and let it run at idle for 1 minute. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 2215 or 2266 inactive? **YEA**	2A
	Fault code 2215 or 2266 inactive? **DO NOT** **REPAIR:** Troubleshoot the applicable fault codes.	Applicable fault codes

STEP 2: Check the operation of the low pressure fuel system.

STEP 2A: Check for external fuel leaks. Conditions:

- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check for external fuel leaks. • Start the engine and let it run at idle. • Check for external fuel leaks.	Are there any leaks? **YES** **Repair:** Repair fuel leaks.	6A
	Are there any leaks? **NOT**	3A

STEP 3: Check the transfer pump.

STEP 3A: Measure the pressure of the transfer pump. Conditions:

- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Measure the performance of the transfer pump. • Refer to Procedure 005-045 in the ISB Series Engine Troubleshooting and Repair Manual and and ISB (Common Rail Fuel System), Bulletin 3653336. to measure the flow of the transfer pump.	Does the transfer pump meet the minimum specifications? **YEA**	4A
	Does the transfer pump meet the minimum specifications? **NOT**	3B

STEP 3B: Measure the transfer pump inlet restriction. Conditions:

- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Measure the inlet restriction of the transfer pump. • Refer to Procedure 006-020 in the ISB Series Engine Troubleshooting and Repair Manual and and ISB (Common Rail Fuel System), Bulletin 3653336.	Less than 6 inches Hg? **YES** **Repair:** Replace the electric transfer pump. Refer to Procedure 005-045 in the ISB Series Engine Troubleshooting and Repair Manual and and ISB (Common Rail Fuel System), Bulletin 3653336, to measure the flow of the transfer pump.	6A
	Less than 152 mm-Hg [6 in-Hg]? **DO NOT** **REPAIR:** Replace the OEM fuel filter or eliminate the cause of the intake restriction.	6A

STEP 4: Check the fuel filter restriction.

STEP 4A: Measure the pressure drop in the fuel filter. Conditions:

- Turn the ignition key ON.
- Start the engine and let it run at rated speed.

Action	Specifications / Repair	Next step
Measure the pressure drop in the fuel filter. • Refer to Procedure 006-015 in the ISB Series Engine Troubleshooting and Repair Manual and and ISB (Common Rail Fuel System), Bulletin 3653336.	Is the pressure drop less than 34 kPa [5 psi]? **YEA**	5A
	Is the pressure drop less than 34 kPa [5 psi]? **DO NOT** **REPAIR:** Replace the filter on the pressure side and make sure that the fuel lines on the pressure side **not** show restriction.	6A

STEP 5: Check the high pressure fuel system.

STEP 5A: Check for leaks in the fuel pressure relief valve on the common rail. Conditions:

- Turn the ignition key off.
- Install test connections to measure the fuel return from the fuel pressure relief valve on the common rail.

Action	Specifications / Repair	Next step
Check for leaks in the fuel pressure relief valve on the common rail. • Install test connections to measure fuel return. • Test in Procedure 006-061 in the ISB Series Engine Troubleshooting and Repair Manual and and ISB (Common Rail Fuel System), Bulletin 3653336.	Fuel return within specifications? **YEA**	5B
	Fuel return within specifications? **DO NOT** **REPAIR:** Replace the pressure relief valve on the common rail. Refer to Procedure 006-061 in the ISB Series Engine Troubleshooting and Repair Manual and and ISB (Common Rail Fuel System), Bulletin 3653336.	6A

STEP 5B: Check for excessive fuel return leakage from the fuel system high-pressure fuel, high-pressure injectors and connectors.

Conditions:
- Turn the ignition key off.
- Install test connections to measure fuel return from injectors and high pressure connectors.

Action	Specifications / Repair	Next step
Check for high fuel leaks in the high pressure injectors and connectors. • Refer to Procedure 006-052 in the ISB Series Engine Troubleshooting and Repair Manual and and ISB (Common Rail Fuel System), Bulletin 3653336.	Fuel leakage within specifications? **YEA**	5C
	Fuel leakage within specifications? **DO NOT** **REPAIR:** Isolate the leak source and repair it. Refer to Procedure 006-052 in the ISB Series Engine Troubleshooting and Repair Manual and and ISB (Common Rail Fuel System), Bulletin 3653336.	6A

STEP 5C: Check for excessive fuel return from the fuel pump high pressure.

Conditions:
- Turn the ignition key off.
- Install test connections to measure the fuel return from the high pressure fuel pump.

Action	Specifications / Repair	Next step
Check for excessive fuel return from the high pressure fuel pump. • Install test connections to measure the fuel return from the fuel pump. • Test in Procedure 005-016 in the ISB Series Engine Troubleshooting and Repair Manual and and ISB (Common Rail Fuel System), Bulletin 3653336.	Fuel return within specifications? **YEA**	6A
	Fuel return within specifications? **DO NOT** **REPAIR:** Replace the high pressure fuel pump. Refer to Procedure 005-016 in the ISB Series Engine Troubleshooting and Repair Manual and and ISB (Common Rail Fuel System), Bulletin 3653336.	6A

STEP 6: Clear the fault codes.

STEP 6A: Disable the fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Do a 15-20 minute road test or run the engine on the dynamometer. • Check that the fault codes are inactive.	Fault codes inactive? **YEA**	6B
	Fault codes inactive? **DO NOT** **REPAIR:** Return to the troubleshooting steps or consult your local Cummins Authorized Service Station after checking and completing all diagnostic steps again.	1A

STEP 6B: Clear the inactive fault codes. Conditions:

- Connect all components.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **DO NOT** **REPAIR:** Troubleshoot any other active fault code.	Proper troubleshooting and repair steps

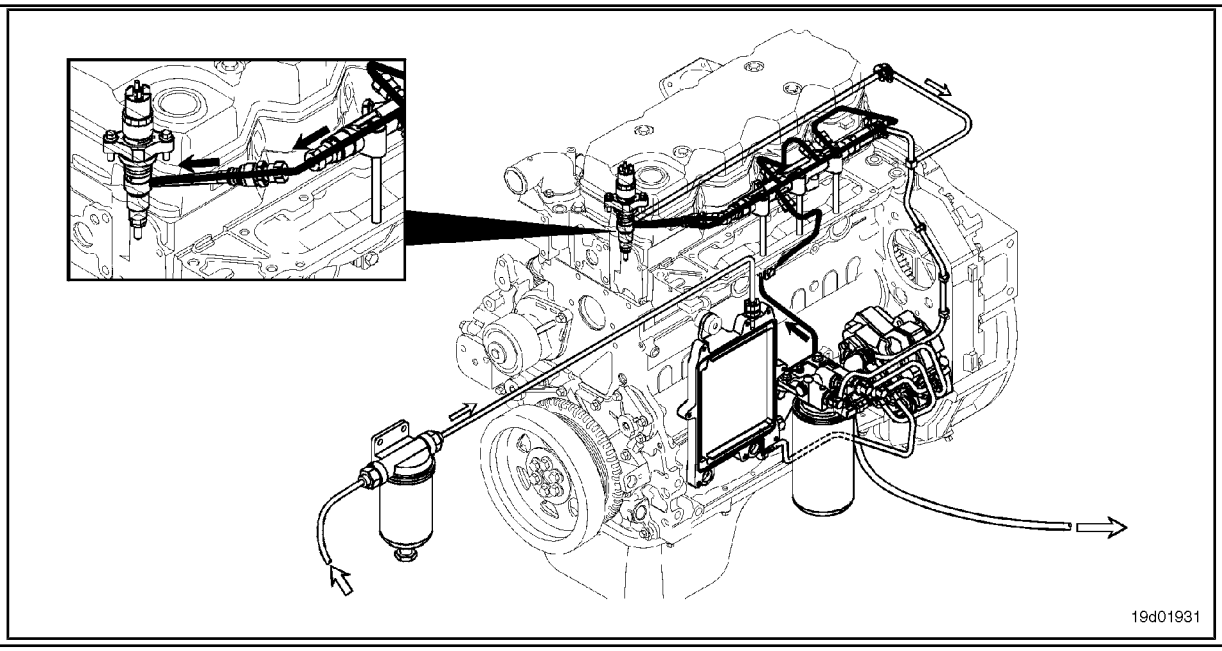
Fault Code 2293

Fuel Intake Measuring Device Flow Demand Less than Expected - Valid Data but Below Normal Operating Range - Moderately Level

Severe

CODES	REASON	IT IS MADE
Fault Code: 2293 PID (P), SID (S): IMF: 18 Lamp: Amber SRT:	Flow demand of the fuel inlet measuring device less than expected - valid data but below the normal operating range - moderately severe level. The flow demand is less than expected.	No effect or possible engine noise associated with higher injection pressures (especially at idle or light load). Engine de-powering.

Fuel System



Circuit Descriptions:

The electronic control module (ECM) monitors the operating conditions of the engine, including the reading of the fuel pressure on the common rail, and changes the flow control to increase (OPEN the electronic fuel control actuator) or reduce (CLOSE the electronic fuel control actuator) the fuel supply to the high pressure pump.

Component Location:

The electronic fuel control actuator is installed in the high pressure fuel pump. See the Procedure 100-002 for the detailed location of each component.

Workshop Tips:

Fault Code 2293 is activated when the electronic fuel control actuator is closed more than expected to reduce the fuel pressure on the common rail.

An excessively leaking electronic fuel control actuator can result in high fuel pressures on the common rail in idle or light load conditions. A constraint on the return line

fuel-drain-tank can prevent unused fuel from escaping from the high pressure fuel pump. This excess drained fuel can penetrate the pumping chamber and pressurize the common rail. Check the restriction on the fuel drain line. A high resistance or an open circuit in the electronic fuel control actuator can cause this fault to be logged. The presence of air in the fuel can result in pressure changes that can cause this failure to be recorded. A high supply pressure from the transfer pump or violation of the fuel pressure sensor on the common rail can cause this failure to be logged.

After the repair is done, this fault code will require approximately 15 to 20 minutes of road testing or on the dynamometer to become inactive.

SUMMARY OF FAULT DIAGNOSTICS

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Read the fault codes.	**Fault code 271, 272 and / or 2311 inactive?**	
STEP 2: Check the fuel pressure sensor on the common rail.		
STEP 2A: Check that the sensor reading fuel pressure on the common rail is within the proper range.	**Pressure = 0 ± 40 bar [0 ± 580 psi]?**	
STEP 3: Check the operation of the low pressure fuel system.		
STEP 3A: Check for air in the fuel.	**Is there air?**	
STEP 3B: Check for excess fuel pressure at the transfer pump.	**Less than 20 psi?**	
STEP 4: Check for restriction in the fuel return drain line.		
STEP 4A: Check for excess restriction on the fuel return drain line.	**Less than 2.7 psi?**	
STEP 5: Clear the fault codes.		
STEP 5A: Disable the fault code.	**Fault codes inactive?**	
STEP 5B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Read the fault codes. Conditions:

- Connect the electronic service tool INSITE ™.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Read the fault codes. • Start the engine and let it run at idle for 1 minute.	Fault code 271, 272 and / or 2311 inactive? **YEA**	2A
• Use the electronic service tool INSITE ™ to read fault codes. • Check for high or low voltage fault codes on the electronic fuel control actuator.	Fault code 271, 272 and / or 2311 inactive? **DO NOT** **REPAIR:** Diagnose the fault codes for the electronic fuel control actuator.	Applicable Fault Codes 271, 272 and / or 2311

STEP 2: Check the fuel pressure sensor on the common rail.

STEP 2A: Check that the fuel pressure sensor reading on the common rail is within the suitable range.

Conditions:
- Connect the electronic service tool INSITE ™.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Use the electronic service tool INSITE ™ to read the fuel pressure on the common rail.	Pressure = 0 ± 40 bar? **YEA**	3A
	Pressure = 0 ± 40 bar? **DO NOT** **REPAIR:** Replace the sensor or repair the engine harness. See the Procedure 019-115 to replace the sensor, or the Procedure 019-360 to repair the engine harness.	5A

STEP 3: Check the operation of the low pressure fuel system.

STEP 3A: Check for air in the fuel. Conditions:

- Connect a test hose to the fuel filter head inlet and insert the hose into a container.
- Turn the ignition key ON. (The electric transfer pump will run for approximately 1 minute.)

Action	Specifications / Repair	Next step
Check for air in the fuel while the transfer pump operates. • Test for air in the fuel. Refer to Procedure 006-003 in the ISB Series Engine Troubleshooting and Repair Manual and and ISB (Common Rail Fuel System), Bulletin 3653336.	Is there air? **YES** **Repair:** Repair the cause of air in the fuel. Refer to Procedure 006-003 in the ISB Series Engine Troubleshooting and Repair Manual and and ISB (Common Rail Fuel System), Bulletin 3653336.	5A
	Is there air? **NOT**	3B

STEP 3B: Check the transfer pump for excess fuel pressure. Conditions:

- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check for excess fuel pressure at the transfer pump. • Install a pressure gauge on the fuel filter head inlet port using a Compuchek® MI0, No. 3824842. • Start the engine and let it run at idle. • Measure the pressure at the fuel filter head outlet.	Less than 20 psi? **YEA**	4A
	Less than 20 psi? **DO NOT** **REPAIR:** Replace the electric fuel transfer pump. Internal pressure regulator failure. Refer to Procedure 005-045 in the ISB Series Engine Troubleshooting and Repair Manual and and ISB (Common Rail Fuel System), Bulletin 3653336.	5A

STEP 4: Check for restriction in the fuel return drain line.

STEP 4A: Check for excess restriction on the fuel return drain line. Conditions:

- Install a pressure gauge on the fuel return line banjo screw on the high pressure fuel pump drain manifold.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check for excess restriction in the fuel return drain line. • Start the engine and let it run at high idle. • Measure the restriction on the fuel return drain line. • Refer to Procedure 006-012 in the ISB Series Engine Troubleshooting and Repair Manual and and ISB (Common Rail Fuel System), Bulletin 3653336.	Less than 2.7 psi? **YES** **Repair:** Test the electronic fuel control actuator circuit and check for high resistance or an open circuit. Replace the electronic fuel control actuator. See the Procedure 019-117 .	5A
	Less than 2.7 psi? **DO NOT** **REPAIR:** Repair or replace the fuel return drain line. Refer to Procedure 006-013 in the Series Engine Troubleshooting and Repair Manual (Common Rail Fuel System), Bulletin 3653336.	5A

STEP 5: Clear the fault codes.

STEP 5A: Disable the fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Do a 15-20 minute road test or run the engine on the dynamometer. • Make sure that the fault codes are inactive.	Fault codes inactive? **YEA**	5B
	Fault codes inactive? **DO NOT** **REPAIR:** Return to the troubleshooting steps or consult your local Cummins Authorized Service Station after checking and completing all diagnostic steps again.	1A

STEP 5B: Clear the inactive fault codes. Conditions:

- Connect all components.
- Turn the ignition key ON.

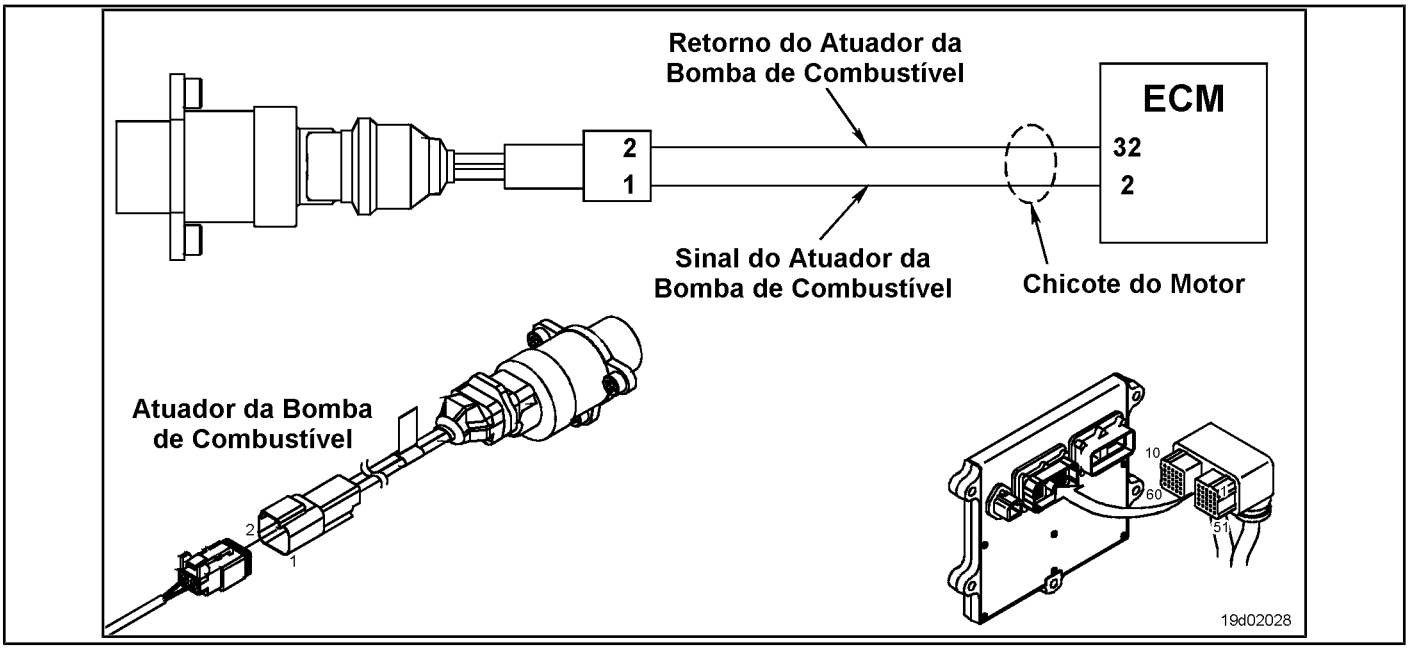
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **DO NOT** **REPAIR:** Troubleshoot any other active fault code.	Proper troubleshooting and repair steps

Fault Code 2311

Fuel Supply Actuator Circuit Error 1 - Existing Condition

CODES	REASON	IT IS MADE
Fault Code: 2311 PID (P), SID (S): S018 IMF: 11/31 Lamp: Amber SRT:	Fuel Supply Actuator Circuit Error 1 - Existing Condition The resistance in the fuel pump actuator circuit is too high or too low.	Possible loss of power.

Fuel Pump Actuator Circuit



Circuit Descriptions:

The circuit is a pulse width modulation (PWM) actuator in the electronic control module (ECM) that controls the electronic fuel control actuator. The actuator is grounded to the ECM. The ECM varies the current for this valve to provide the correct fuel flow to the high pressure pump based on the engine's operating conditions. The valve on the electronic fuel control actuator is a normally open valve. The high resistance in the circuit can make the fuel pressure higher than that commanded under light loads and record Fault Code 2216.

Component Location:

The fuel pump actuator valve is located in the engine mounted fuel pump housing. See the Procedure 100-002 to identify the location of each component.

Workshop Tips:

If this fault code occurs during a road or marine test, check that all connectors are clean and free from corrosion before replacing components. This fault code can become active for any of the following reasons:

- High resistance in the fuel pump actuator
- High resistance of the engine harness
- Loose, worn or corroded connectors or pins.

- Fuel pump actuator with low internal resistance
- Fuel pump actuator or engine harness with a short to ground
- Intermittent circuit failures that cause the fuel pressure to exceed the opening pressure of the fuel pressure relief valve on the common rail.

If there is an intermittent problem in the fuel pump actuator electrical circuit, it is possible for the fault code to become active and then inactive during normal engine operation. For example, if a faulty connection results in an open circuit or an intermittent short, the normally open valve will open in a fraction of a second while the circuit is faulty, causing the valve to open. relief pressure on the common rail. After the event that caused the pressure relief valve to open on the common rail, the ECM will attempt to reset the pressure relief valve on the common rail, as long as the fuel pump actuator circuit is still

not is defective.

After any event that opens the pressure relief valve on the common rail, the valve will regulate the fuel pressure to approximately 90 mPa [13053 psi]. If the ECM is still able to control the fuel pressure, the following situations will occur:

- The measured fuel pressure will be reduced to 60 mPa [8702.3 psi] as the ECM prepares to readjust the pressure relief valve on the common rail.
- When the pressure is 60 mPa [8702.3 psi] and the engine speed is greater than 1200 rpm, the ECM will momentarily close the fuel pump actuator. This will reduce the pressure on the common rail (to less than 2 mPa [290 psi] for a fraction of a second) so that the pressure relief valve on the common rail is readjusted. Under light loads, especially if the engine is accelerated while the drive line **not** is coupled, the engine's power drop will be noticeable as the ECM tries to readjust the fuel pressure relief valve on the common rail.

- When the ECM detects that the pressure relief valve on the common rail is reset, the engine will run in the normal operating range and Fault Code 2311 will become inactive.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following test cable when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test cable STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Read the fault codes.	**Fault Codes 271 or 272 active or high inactive code counts?**	
STEP 2: Check the fuel pump actuator valve.		
STEP 2A: Inspect the fuel pump actuator and harness connector pins.	**Dirty or damaged pins?**	
STEP 2B: Check the resistance of the fuel pump actuator.	**Less than 5 ohms?**	
STEP 2C: Check the pump actuator fuel for a short circuit with the grease.	**More than 100k ohms?**	
STEP 3: Check the engine harness.		
STEP 3A: Inspect the engine harness and ECM connector pins.	**Dirty or damaged pins?**	
STEP 3B: Check the resistance of the engine harness.	**Less than 5 ohms?**	
STEP 3C: Check for a short circuit with the mass in the engine harness.	**More than 100k ohms?**	
STEP 3D: Check for a fault flashing in the engine harness.	**Have Fault Codes 2311, 271 and / or 272 become active?**	
STEP 4: Clear the fault codes.		
STEP 4A: Disable the fault code.	**Fault code 2311 inactive?**	
STEP 4B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Read the fault codes. Conditions:

- Make sure the fuel pump actuator is connected to the engine harness.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Read the fault codes. • Start the engine and let it run at idle for 1 minute. • Use INSITE ™ to read fault codes.	Fault Codes 271 or 272 active or high inactive code counts? **YEA**	Appropriate fault diagnosis diagram
	Fault Codes 271 or 272 active or high inactive code counts? **NOT**	2A

STEP 2: Check the fuel pump actuator.

STEP 2A: Inspect the fuel pump actuator and harness connector pins.

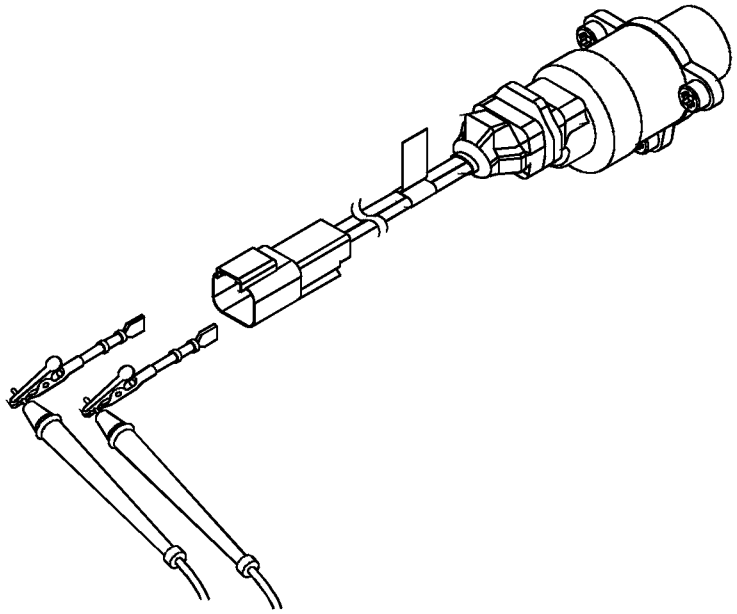
Conditions:
- Turn the ignition key off.
- Disconnect the fuel pump actuator from the engine harness.

Action	Specifications / Repair	Next step
Inspect the fuel pump actuator, 'pigtail' wires and engine harness connector pins for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Damaged or missing connector seals • Dirt or debris on the connector pins • Damage to the wire shield • Broken connector cover • Damage to the connector locking tab. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** Repair the connector and pins. If damaged, repair the harness, connectors and pins, if possible. See the Procedure 019-043 .	4A
	Dirty or damaged pins? **NOT**	2B

STEP 2B: Check the resistance of the fuel pump actuator. Conditions:

- Turn the ignition key off.
- Disconnect the fuel pump actuator from the engine harness.

Action	Specifications / Repair	Next step
Check the resistance of the fuel pump actuator. • Measure the resistance between the SIGNAL and RETURN pins of the fuel pump actuator on the actuator connector. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	Less than 5 ohms? **YEA**	2C
	Less than 5 ohms? **DO NOT** **REPAIR:** Replace the fuel pump actuator. See the Procedure 019-117 .	4A



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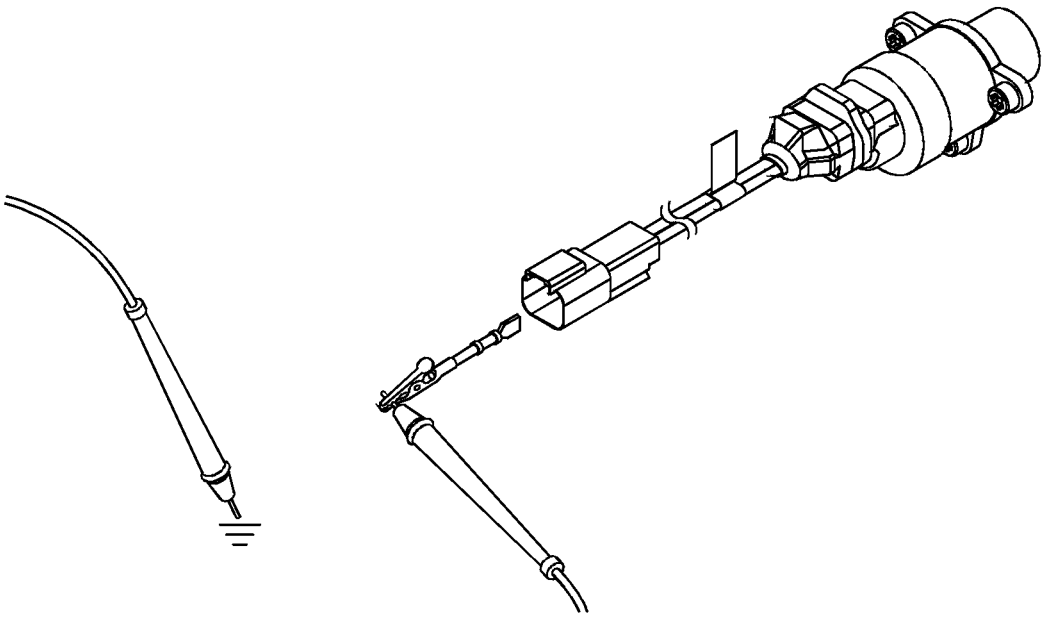
STEP 2C: Check the fuel pump actuator for an earth short. Conditions:

- Turn the ignition key off.
- Disconnect the fuel pump actuator from the engine harness.

Action	Specifications / Repair	Next step
Check the resistance of the fuel pump actuator. • Measure the resistance between the fuel pump actuator SIGN pin and the engine block ground. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YEA**	3A
	More than 100k ohms? **DO NOT** **REPAIR:** Replace the defective 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.

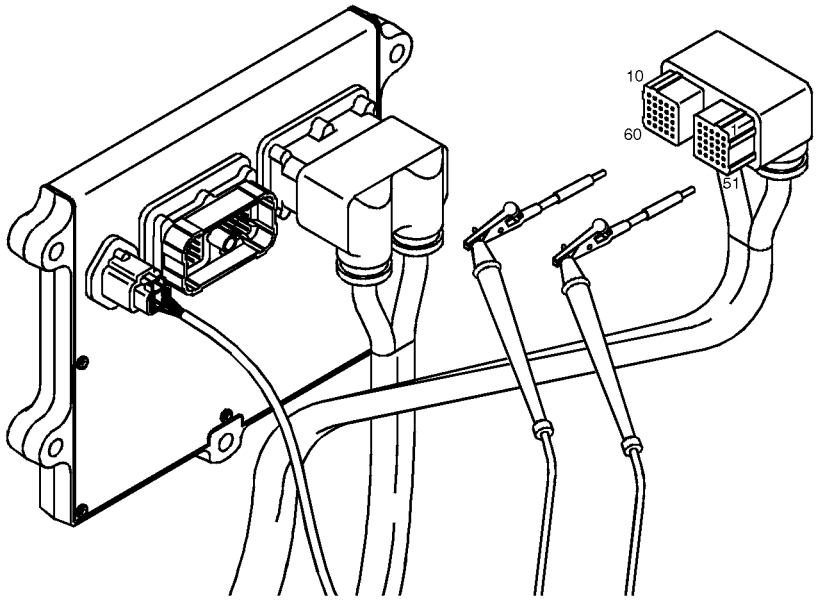
Conditions:
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.

Action	Specifications / Repair	Next step
Inspect the engine harness and ECM connector pins for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Damaged or missing connector seals • Dirt or debris on the connector pins • Damage to the wire shield • Broken connector cover • Damage to the connector locking tab. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection has been detected in the ECM connector or the motor harness connector. Clean the connector pins. If damaged, repair the harness, connectors and pins, if possible. See the Procedure 019-043 .	4A
	Dirty or damaged pins? **NOT**	3B

STEP 3B: Check the resistance of the engine harness. Conditions:

- Turn the ignition key off.
- Reconnect the fuel pump actuator to the engine harness.
- Disconnect the engine harness from the ECM.

Action	Specifications / Repair	Next step
Check the resistance of the engine harness. • Measure the resistance between the SIGNAL and RETURN pins of the fuel pump actuator on the engine harness ECM connector. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	Less than 5 ohms? **YEA**	3C
	Less than 5 ohms? **DO NOT** **REPAIR:** Repair or replace the engine harness. See the Procedure 019-043 .	4A



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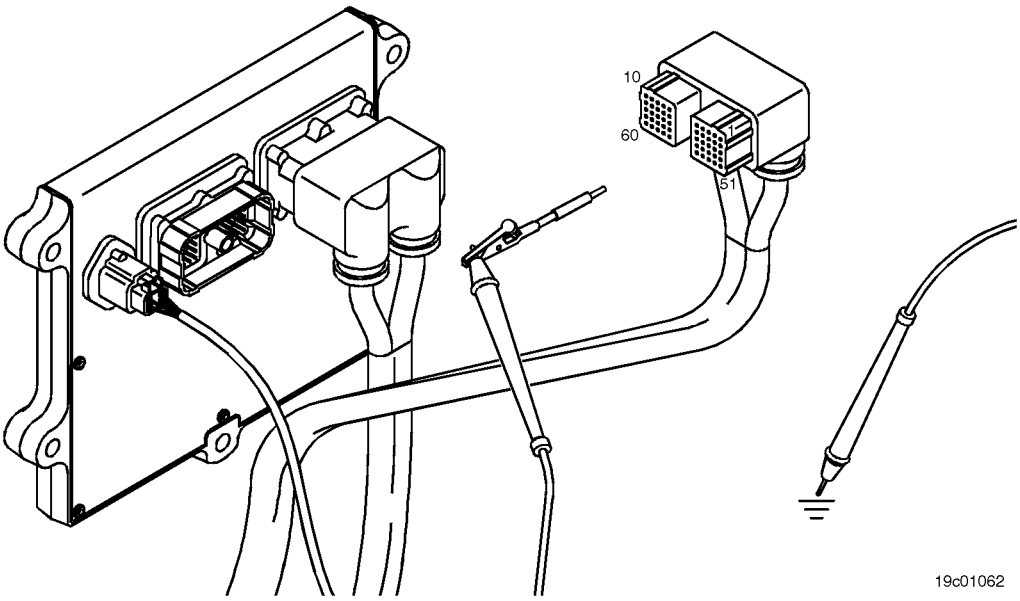
STEP 3C: Check the motor harness for a short circuit with ground. Conditions:

- Turn the ignition key off.
- Disconnect the fuel pump actuator from the engine harness.
- Disconnect the engine harness from the ECM.

Action	Specifications / Repair	Next step
Check the engine harness and the resistance of the fuel pump actuator. • Measure the resistance between the fuel pump actuator SIGN pin on the engine harness ECM connector and the engine block ground.	More than 100k ohms? **YEA**	3D
	More than 100k ohms? **DO NOT** **REPAIR:** Repair or replace the engine harness. See the Procedure 019-043 .	4A



STEP 3D: Check for an intermittent fault in the engine harness. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Engine running at idle.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an intermittent connection or failure in the engine harness. • Handle the engine harness starting at the harness ECM connector and proceed to the fuel pump actuator. If there is a short or induced open circuit while the engine is running, the pressure relief valve on the common rail will open.	Have Fault Codes 2311, 271 and / or 272 become active? **YES** **Repair:** An intermittent connection was detected in the engine harness. Repair or replace the engine harness. See the Procedure 019-043 .	4A
	Have Fault Codes 2311, 271 and / or 272 become active? **DO NOT** **REPAIR:** Replace the fuel pump actuator. See the Procedure 019-117 .	4A

STEP 4: Clear the fault codes.

STEP 4A: Disable the fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Use INSITE ™ to check if the fault code is inactive.	Fault code 2311 inactive? **YEA**	4B
	Fault code 2311 inactive? **DO NOT** **REPAIR:** Return to the troubleshooting steps or consult your local Cummins Authorized Service Station after checking and completing all diagnostic steps again.	1A

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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

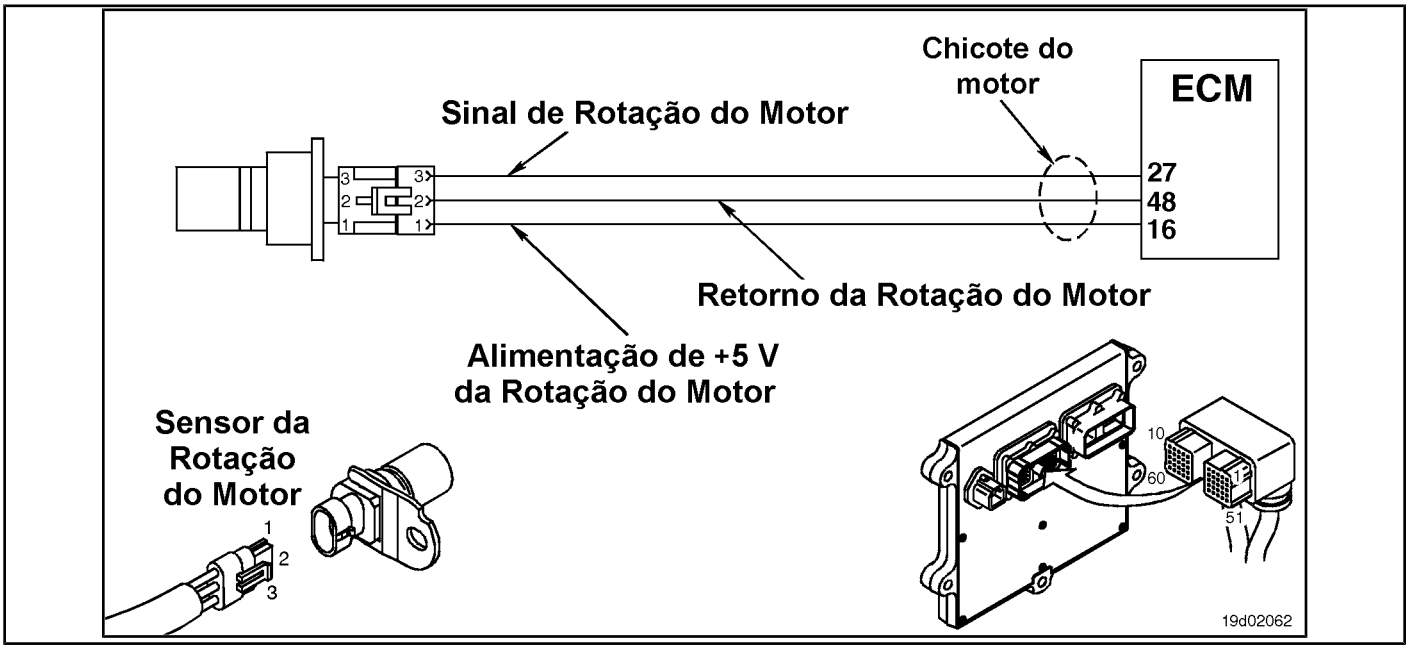
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **DO NOT** **REPAIR:** Troubleshoot any other active fault code.	Proper troubleshooting and repair steps

Fault Code 2321

Engine Rotation / Crankshaft Position - Invalid, Intermittent or Incorrect

CODES	REASON	IT IS MADE
Fault Code: 2321 PID (P), SID (S): P190 IMF: 2 Lamp: No SRT:	Engine Crankshaft Rotation / Position - Invalid, Intermittent or Incorrect Data. Intermittent synchronization of the engine speed sensor in the crankshaft.	Automotive and marine applications: The engine may experience misfire as the control changes from the primary speed sensor to the backup sensor. The engine power is reduced while the engine is running with the backup speed sensor.

Number 1 Rotation / Motor Position Sensor Circuit



Circuit Descriptions:

The crankshaft speed sensor provides the electronic control module (ECM) with information about the engine speed. The sensor is powered by +5 VDC. The sensor generates the signal by detecting the movement of the reference teeth cast on the engine timing pulley mounted on the crankshaft.

Component Location:

The engine speed sensor is located on the intake side of the engine, between cylinders number 5 and number 6, on the crankshaft centerline. For ISB and QSB5.9 engines, the crankshaft rotation sensor is located on the intake side of the engine, behind the vibration damper and close to the signal wheel. See the Procedure 100-002 for the detailed location of each component.

Workshop Tips:

During engine operation, the electronic control module (ECM) monitors the signal from the primary speed sensor (crankshaft speed sensor). Fault Code 689 will become active and turn on the yellow lamp (marine applications not use lamps) if the signal from the primary rotation sensor not is present or is degraded for more than three consecutive seconds. Meanwhile, if the signal from the primary engine speed sensor not is present or is degraded for a few moments (less than three seconds), the ECM will stop injection events based on the primary engine speed sensor and resume injection events using the backup speed sensor. Engine power will be reduced as long as injection events are based

on the reserve rotation sensor. If the signal from the primary engine speed sensor returns, the ECM will automatically stop 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 loss of signal from the primary speed sensor, this fault code will become active. The vehicle operator may experience an intermittent "misfire" if injection events are interrupted while the ECM switches from control based on the primary sensor to the secondary speed sensor. In addition, the operator may experience intermittent "power loss" if an "error" on the signal of the primary speed sensor, make the engine use the reserve speed sensor for injection control intermittently. This fault code becomes active whenever the ECM detects a persistent loss of the primary engine speed sensor signal for a short period.

This fault code becomes inactive when the ignition key is turned on or if the ECM not detect a loss of signal from the primary engine speed sensor for at least 20 minutes. The conditions that can cause this failure are:

- Intermittent loss of signal from the primary engine speed sensor; the most likely cause is an intermittent open circuit or a short circuit that can occur due to problems with the speed sensor connector.
- The air gap in the sensor that is marginally too small or too large. The actions to be taken if this failure is

intermittent are:

- Look for intermittent connections in the engine harness, in the primary engine speed sensor circuit
- Look for loose connections on the ECM connector where the pins not can be locked in the socket
- Look for spots on the engine harness that are worn and close to a component that could cause an intermittent short circuit

- Look for wear on the rotation sensor connector pins
- Inspect the reference wheel for damage.

SUMMARY OF FAULT DIAGNOSTICS

STEPS		SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.			
STEP 1A: Check for a passcode active fault.		Is Fault Code 689 active or are there high counts of inactive fault codes?	
STEP 2: Check the primary rotation sensor circuit (cranks).			
STEP 2A:	Inspect the pins of the primary rotation sensor connector (crankshaft sensor).	Dirty or damaged pins?	
STEP 2B:	Inspect the engine harness.	Damaged wiring insulation?	
STEP 2C:	Inspect the primary speed sensor circuit (crankshaft sensor) at the engine harness ECM connector.	Dirty or damaged pins?	
STEP 2D:	Inspect the engine harness.	Damaged wiring insulation?	
STEP 3: Test the vehicle.			
STEP 3A: Run the rolling test to determine if there is a fault condition.		Did Fault Code 2321 become active while the engine was running?	
STEP 3B:	Inspect the air gap and the reference wheel.	Is the air gap within specification?	
STEP 3C: Handle the engine harness to test for an intermittent harness fault condition.		Does Fault Code 2321 status change from inactive to active during engine harness flexing?	
STEP 4: Clear the fault codes.			
STEP 4A: Disable the fault code.		Fault code 2321 inactive?	
STEP 4B: Clear the fault codes inactive.		All codes cleared?	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Check for an active fault code. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an active fault code. • Use the electronic service tool INSITE ™ to read fault codes.	Is Fault Code 689 active or are there high counts of inactive fault codes? If Fault Code 689 has a high number of inactive counts, there is probably an intermittent (short or open) circuit problem in the primary rotation sensor circuit. **YEA**	Refer to Fault Code 689 fault diagnosis diagram
	Is Fault Code 689 active or are there high counts of inactive fault codes? **NOT**	2A

STEP 2: Check the primary rotation sensor circuit (cranks).

STEP 2A: Inspect the pins of the primary rotation sensor connector (crankshaft sensor).

Conditions:
- Turn the ignition key off.
- Disconnect the primary speed sensor from the engine harness.

Action	Specifications / Repair	Next step
Inspect the engine harness and the actuator connector pins and check for: • Loose connector • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins • Broken connector cover • Damage to the wire shield • Damage to the connector locking tab. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected in the sensor or in the harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-043 .	4A
	Dirty or damaged pins? **NOT**	2B

STEP 2B: Inspect the engine harness.

Conditions:
- Turn the ignition key off.
- Disconnect the primary speed sensor (crankshaft sensor) from the engine harness.

Action	Specifications / Repair	Next step
Carefully inspect the engine harness near the primary speed sensor. • Look for points where the wiring harness insulation is damaged allowing intermittent shorts with the block or nearby components.	Damaged wiring insulation? **YES** **Repair:** Repair or replace the engine harness. See the Procedure 019-043 .	4A
	Damaged wiring insulation? **NOT**	2C

STEP 2C: Inspect the primary speed sensor circuit (crankshaft sensor) at the engine harness ECM connector.

Conditions:
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.

Action	Specifications / Repair	Next step
Inspect the engine harness and ECM connector pins for: • Loose connector • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins • Broken connector cover • Damage to the wire shield • Damage to the connector locking tab. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection has been detected in the ECM connector or the motor harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-043 .	4A
	Dirty or damaged pins? **NOT**	2D

STEP 2D: Inspect the engine harness.

Conditions:
- Turn the ignition key off.
- Disconnect the primary speed sensor (crankshaft sensor) from the engine harness.

Action	Specifications / Repair	Next step
Carefully inspect the engine harness near the ECM connector. • Look for points where the wiring harness insulation is damaged allowing intermittent shorts with the engine block or nearby components.	Damaged wiring insulation? **YES** **Repair:** Repair or replace the engine harness. See the Procedure 019-043 .	4A
	Damaged wiring insulation? **NOT**	3A

STEP 3: Test the vehicle.

STEP 3A: Run the run test to determine if there is a fault condition. Conditions:

- Connect the primary speed sensor (crankshaft sensor) to the engine harness.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Start the engine. With the engine running, accelerate the engine several times. • Use the electronic service tool INSITE ™ to observe fault codes.	Did Fault Code 2321 become active while the engine was running? **YEA**	3B
	Did Fault Code 2321 become active while the engine was running? **NOT**	4A

STEP 3B: Inspect the air gap and the reference wheel.

Conditions:
- Turn the ignition key off.

Action	Specifications / Repair	Next step
Remove the primary engine speed sensor (crankshaft sensor) from the engine block and measure the air gap at various points in the crankshaft rotation. • See the Procedure 019-365 .	Is the air gap within specifications? • Minimum Air Gap: 0.96 mm [0.038 in] • Maximum Air Gap: 2.25 mm [0.089 in] • Maximum eccentricity of the reference wheel: 0.5 mm [0.02 in] **YEA**	3C
	Is the air gap within specifications? • Minimum Air Gap: 0.96 mm [0.038 in] • Maximum Air Gap: 2.25 mm [0.089 in] • Maximum eccentricity of the reference wheel: 0.5 mm [0.02 in] **DO NOT** **REPAIR:** Replace or chock the sensor if the air gap is out of specification. Replace the reference wheel if its eccentricity is excessive.	4A

STEP 3C: Manipulate the engine harness to test for an intermittent fault condition in the whip.

Conditions:
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Use the electronic service tool INSITE ™ to monitor the status of Fault Code 2321. • Start the engine and let it run at idle. • Starting with the ECM connector, manually flex the engine harness. Continue flexing from the ECM connector towards the engine speed sensor connector.	Does Fault Code 2321 status change from inactive to active during engine harness flexing? **YES** **Repair:** An intermittent connection was detected in the engine harness. Repair or replace the engine harness. See the Procedure 019-043 .	4A
	Does Fault Code 2321 status change from inactive to active during engine harness flexing? **NOT**	4A

STEP 4: Clear the fault codes.

STEP 4A: Disable the fault code. Conditions:

- Connect all components.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Using the electronic service tool INSITE ™, make sure that the fault code is inactive.	Fault code 2321 inactive? **YEA**	4B
	Fault code 2321 inactive? **DO NOT** **REPAIR:** Return to the troubleshooting steps or consult your local Cummins Authorized Service Station after checking and completing all diagnostic steps again.	1A

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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

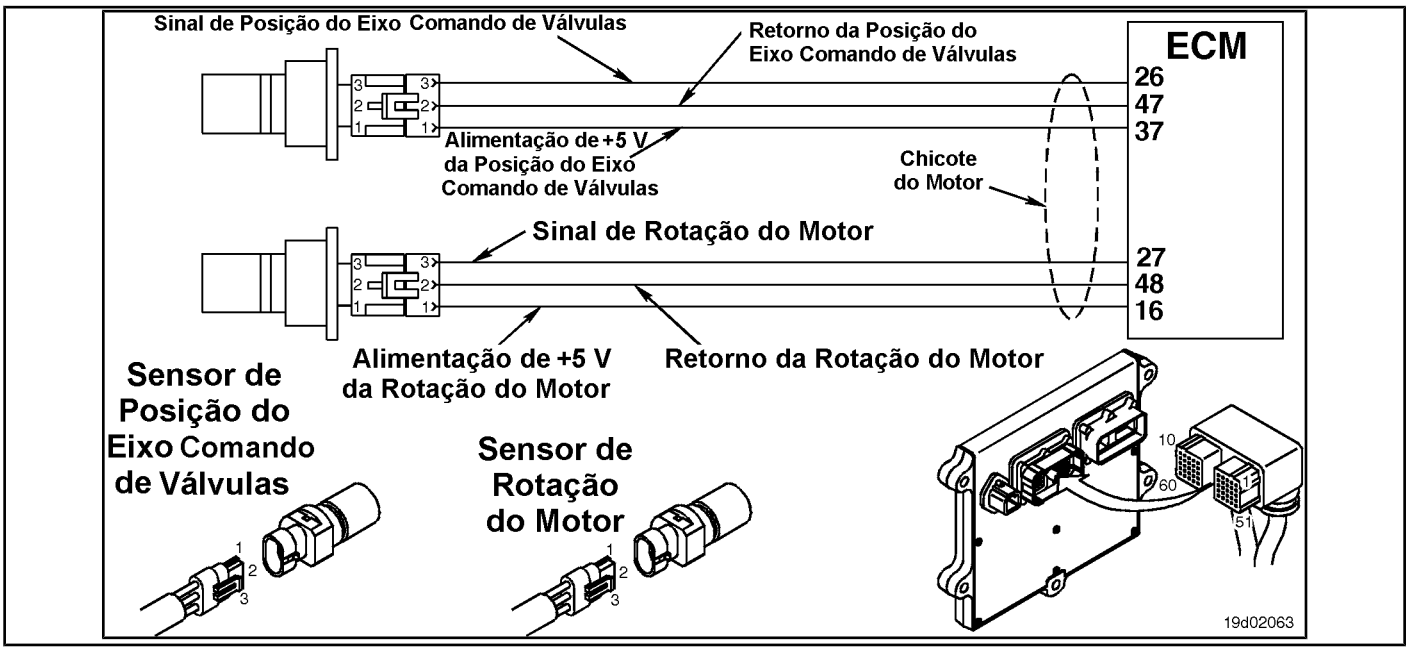
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **DO NOT** **REPAIR:** Troubleshoot any other active fault code.	Appropriate fault diagnosis diagrams

Fault Code 2322

Rotation Reserve / Motor Position Number 2 Sensor - Invalid, Intermittent Data or Incorrect

CODES	REASON	IT IS MADE
Fault Code: 2322 PID (P), SID (S): S64 IMF: 2 Lamp: No SRT:	Rotation Reserve Sensor / Engine Position Number 2 - Invalid, Intermittent or Incorrect Data Intermittent synchronization of the engine rotation sensor on the camshaft.	Automotive and marine applications: Potential loss of power.

Rotation Reserve Sensor / Motor Position Number 2 Circuit



Circuit Descriptions:

The engine position sensor in the camshaft provides the electronic control module (ECM) with information about the engine position. The sensor is powered by (+) 5 VDC. The sensor generates the signal by detecting the movement of machined reference teeth on a signal wheel mounted on the camshaft.

Component Location:

The camshaft position sensor is located below the fuel pump at the rear of the gear housing. See the Procedure 100-002 to identify the location of each component.

Workshop Tips:

During engine operation, the ECM monitors the signal from the secondary speed sensor (crankshaft speed sensor). Fault Code 778 will become active and turn on the yellow lamp (marine applications **not** use lamps) if the secondary rotation sensor signal **not** is present or is degraded for more than three continuous seconds. If over a period of time, the ECM detects several incidents of signal loss from the secondary rotation sensor but the signal loss is short-lived, that fault code will become active. As the signal from the secondary engine speed sensor **not** is used for normal engine operation, it is possible that the vehicle operator **not** notice any symptoms related to this problem.

This fault code becomes active whenever the ECM detects a persistent loss of signal from the secondary engine speed sensor for a short period.

This fault code becomes inactive when the ignition key is turned on or if the ECM not detect a loss of signal from the secondary engine speed sensor for at least 20 minutes. The conditions that can cause this failure are:

- Intermittent loss of signal from the primary engine speed sensor; the most likely cause is an intermittent open circuit or a short circuit that can occur due to problems with the speed sensor connector.
- Sensor air gap that is marginally too small or too large, or the reference wheel has excessive eccentricity.

The actions to be taken if this failure is intermittent are:

- Look for intermittent connections in the engine harness on the secondary engine speed sensor circuit
- Look for loose connections on the ECM connector where the pins not can be locked in the socket
- Look for spots on the engine harness that are worn and close to a component that could cause an intermittent short circuit

- Look for wear on the rotation sensor connector pins
- Inspect the reference wheel for damage.

SUMMARY OF FAULT DIAGNOSTICS

STEPS		SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.			
STEP 1A: Check for a passcode active fault.		Is Fault Code 778 active or are there high counts of inactive fault codes?	
STEP 2: Check the secondary rotation sensor circuit (camshaft sensor valves).			
STEP 2A:	Inspect the secondary engine speed sensor (camshaft sensor) and connector pins.	Dirty or damaged pins?	
STEP 2B:	Inspect the engine harness.	Damaged wiring insulation?	
STEP 2C:	Inspect the secondary speed sensor circuit (camshaft sensor) at the engine harness connector.	Dirty or damaged pins?	
STEP 2D:	Inspect the engine harness.	Damaged wiring insulation?	
STEP 3: Test the vehicle.			
STEP 3A: Take the road test to determine if there is a fault condition.		Did Fault Code 2322 become active while the engine was running?	
STEP 3B:	Inspect the air gap and the reference wheel.	Is the air gap within specification?	
STEP 3C: Handle the engine harness to test for an intermittent harness fault condition.		Does Fault Code 2322 status change from inactive to active during engine harness handling?	
STEP 4: Clear the fault codes.			
STEP 4A: Disable the fault code.		Fault code 2322 inactive?	
STEP 4B: Clear the fault codes inactive.		All codes cleared?	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Check for an active fault code. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an active fault code. • Use INSITE ™ to read fault codes. Fault Code 778 is active or there are high counts of inactive fault codes? If Fault Code 778 has a high number of inactive counts, there is probably an intermittent (short or open) circuit problem in the primary speed sensor circuit. **YEA**		Refer to Fault Code 778 fault diagnosis diagram
	Is Fault Code 689 active or are there high counts of inactive fault codes? **NOT**	2A

STEP 2: Check the secondary rotation sensor circuit (camshaft sensor valves).

STEP 2A: Inspect the secondary engine speed sensor (camshaft sensor) and connector pins.

Conditions:
- Turn the ignition key off.
- Disconnect the secondary speed sensor from the engine harness.

Action	Specifications / Repair	Next step
Inspect the motor harness and actuator connector pins for: • Loose connector • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Damaged or missing connector seals • Dirt or debris on the connector pins • Broken connector cover • Damage to the wire shield • Damage to the connector locking tab. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected in the sensor or in the harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-043 .	4A
	Dirty or damaged pins? **NOT**	2B

STEP 2B: Inspect the engine harness.

Conditions:
- Turn the ignition key off.
- Disconnect the secondary speed sensor from the engine harness.

Action	Specifications / Repair	Next step
Carefully inspect the engine harness near the speed sensor. Look for points where the wiring harness insulation is damaged allowing intermittent shorts with the block or nearby components.	Damaged wiring insulation? **YES** **Repair:** Repair or replace the engine harness. See the Procedure 019-043 .	4A
	Damaged wiring insulation? **NOT**	2C

STEP 2C: Inspect the secondary speed sensor circuit (camshaft sensor) at the engine harness ECM connector.

Conditions:
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.

Action	Specifications / Repair	Next step
Inspect the engine harness ECM connector pins for: • Loose connector • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Damaged or missing connector seals • Dirt or debris on the connector pins • Broken connector cover • Damage to the wire shield • Damage to the connector locking tab. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection has been detected in the ECM connector or the motor harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-043 .	4A
	Dirty or damaged pins? **NOT**	2D

STEP 2D: Inspect the engine harness.

Conditions:
- Turn the ignition key off.
- Disconnect the secondary speed sensor from the engine harness.

Action	Specifications / Repair	Next step
Carefully inspect the engine harness near the ECM connector. Look for points where the wiring harness insulation is damaged allowing intermittent shorts with the engine block or nearby components.	Damaged wiring insulation? **YES** **Repair:** Repair or replace the engine harness. See the Procedure 019-043 .	4A
	Damaged wiring insulation? **NOT**	3A

STEP 3: Test the vehicle.

STEP 3A: Perform the road test to determine if a fault condition exists. Conditions:

- Connect the secondary speed sensor (camshaft sensor) to the engine harness.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
With the engine running, accelerate the engine several times. • Use INSITE ™ to observe fault codes.	Did Fault Code 2322 become active while the engine was running? **YEA**	3B
	Did Fault Code 2322 become active while the engine was running? **NOT**	4A

STEP 3B: Inspect the air gap and the reference wheel.

Conditions:
- Turn the ignition key off.

Action	Specifications / Repair	Next step
Remove the secondary engine speed sensor (camshaft sensor) from the gear housing and measure the air gap at various points in the crankshaft revolution. • See the Procedure 019-363 .	Is the air gap within specifications? • Minimum Air Gap: 0.96 mm [0.038 in] • Maximum Air Gap: 2.25 mm [0.089 in] • Maximum eccentricity of the reference wheel: 0.5 mm [0.02 in] **YEA**	3C
	Is the air gap within specifications? • Minimum Air Gap: 0.96 mm [0.038 in] • Maximum Air Gap: 2.25 mm [0.089 in] • Maximum eccentricity of the reference wheel: 0.5 mm [0.02 in] **DO NOT** **REPAIR:** Replace or chock the sensor if the air gap is out of specification. Replace the reference wheel if its eccentricity is excessive.	4A

STEP 3C: Manipulate the engine harness to test for an intermittent fault condition in the whip.

Conditions:
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Use INSITE ™ to monitor the status of Fault Code 2322. • Start the engine and let it run at idle. • Starting with the ECM connector, manually inspect the engine harness. Continue the inspection from the ECM connector towards the engine speed sensor connector.	Does Fault Code 2322 status change from inactive to active during engine harness handling? **YES** **Repair:** An intermittent connection was detected in the engine harness. Repair or replace the engine harness. See the Procedure 019-043 .	4A
	Does Fault Code 2322 status change from inactive to active during engine harness handling? **NOT**	4A

STEP 4: Clear the fault codes.

STEP 4A: Disable the fault code. Conditions:

- Connect all components.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Use INSITE ™ to check if the fault code is inactive.	Fault code 2322 inactive? **YEA**	4B
	Fault code 2322 inactive? **DO NOT** **REPAIR:** Return to the troubleshooting steps or consult your local Cummins Authorized Service Station after checking and completing all diagnostic steps again.	1A

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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

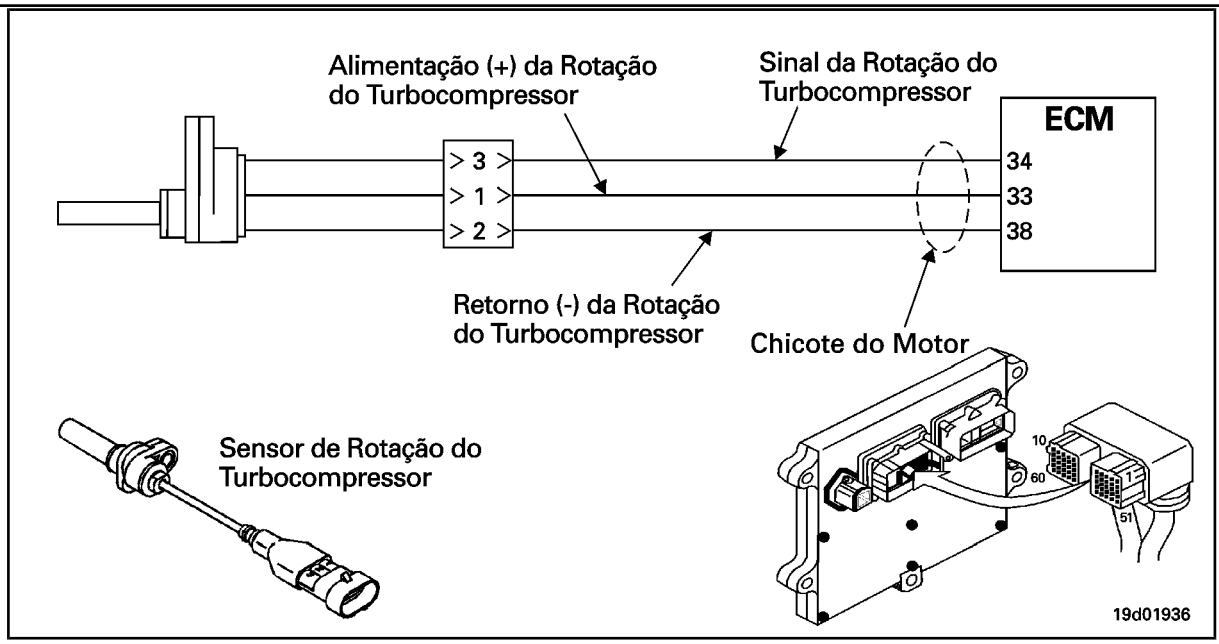
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **DO NOT** **REPAIR:** Troubleshoot any other active fault code.	Appropriate fault diagnosis diagrams

Fault Code 2345 (ISB / QSB - Automotive or Industrial Application)

Turbocharger Rotation - Invalid Rate of Change Detected

CODES	REASON	IT IS MADE
Fault Code: 2345 PID (P), SID (S): P103 IMF: 10/10 Lamp: Amber SRT:	Invalid rate of change of turbocharger rotation detected. The turbocharger speed sensor has detected an incorrect speed value.	Possibly, the estimated low power speed of the turbocharger will be used.

Turbocharger Rotation Sensor Circuit



Circuit Descriptions:

The electronic control module (ECM) supplies +5 VDC to the signal pin of the turbocharger rotation sensor. The internal circuit of the turbocharger rotation sensor detects the movement of the blades of the turbocharger compressor and emits a rotation signal. This signal is used by the ECM for the engine controls.

Component Location:

The turbocharger speed sensor is located in the turbocharger compressor housing. See the Procedure 100-002 for the detailed location of each component.

Workshop Tips:

This fault will become active if the engine is running and the turbocharger's rotation signal changes faster than the turbocharger's capacity can handle. This can be caused by a blown or missing blade from the compressor or a damaged compressor wheel.

SUMMARY OF FAULT DIAGNOSTICS

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check for other fault codes.		
STEP 1A: Check for fault codes active or inactive.	**Fault Codes 687, 595, 2387, 2386, 2385, 2384, 2383, 2382 and / or 2381 active or inactive?**	
STEP 2: Check the turbocharger.		
STEP 2A: Check the wheel for damage turbocharger compressor.	**Bent or damaged turbocharger compressor blades?**	
STEP 3: Clear the fault codes.		
STEP 3A: Disable the fault code.	**Fault code 2345 inactive?**	
STEP 3B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check for other fault codes.

STEP 1A: Check for active or inactive fault codes. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for active or inactive fault codes. • Use the electronic service tool INSITE ™ to read fault codes.	Fault Codes 687, 595, 2387, 2386, 2385, 2384, 2383, 2382 and / or 2381 active or inactive? **YES** **Repair:** Troubleshoot fault codes starting with the code with the most counts.	Proper troubleshooting and repair steps
	Fault Codes 687, 595, 2387, 2386, 2385, 2384, 2383, 2382 and / or 2381 active or inactive? **NOT**	2A

STEP 2: Check the turbocharger.

STEP 2A: Check the turbocharger compressor wheel for damage. Conditions:

- Turn the ignition key off.
- Remove the inlet line from the turbocharger compressor.

Action	Specifications / Repair	Next step
Inspect the turbocharger compressor wheel and blades. • Refer to Procedure 010-033 in the basic engine fault diagnosis and repair manual, Bulletin 3653336.	Bent or damaged turbocharger compressor blades? **YES** **Repair:** Replace the turbocharger. Refer to Procedure 010-033 in the basic engine fault diagnosis and repair manual, Bulletin 3653336.	3A
	Bent or damaged turbocharger compressor blades? **NOT**	3A

STEP 3: Clear the fault codes.

STEP 3A: Disable the fault code. Conditions:

- Connect all components.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Using the electronic service tool INSITE ™, make sure that the fault code is inactive.	Fault code 2345 inactive? **YEA**	3B
	Fault code 2345 inactive? **NOT**	1A

STEP 3B: Clear the inactive fault codes. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

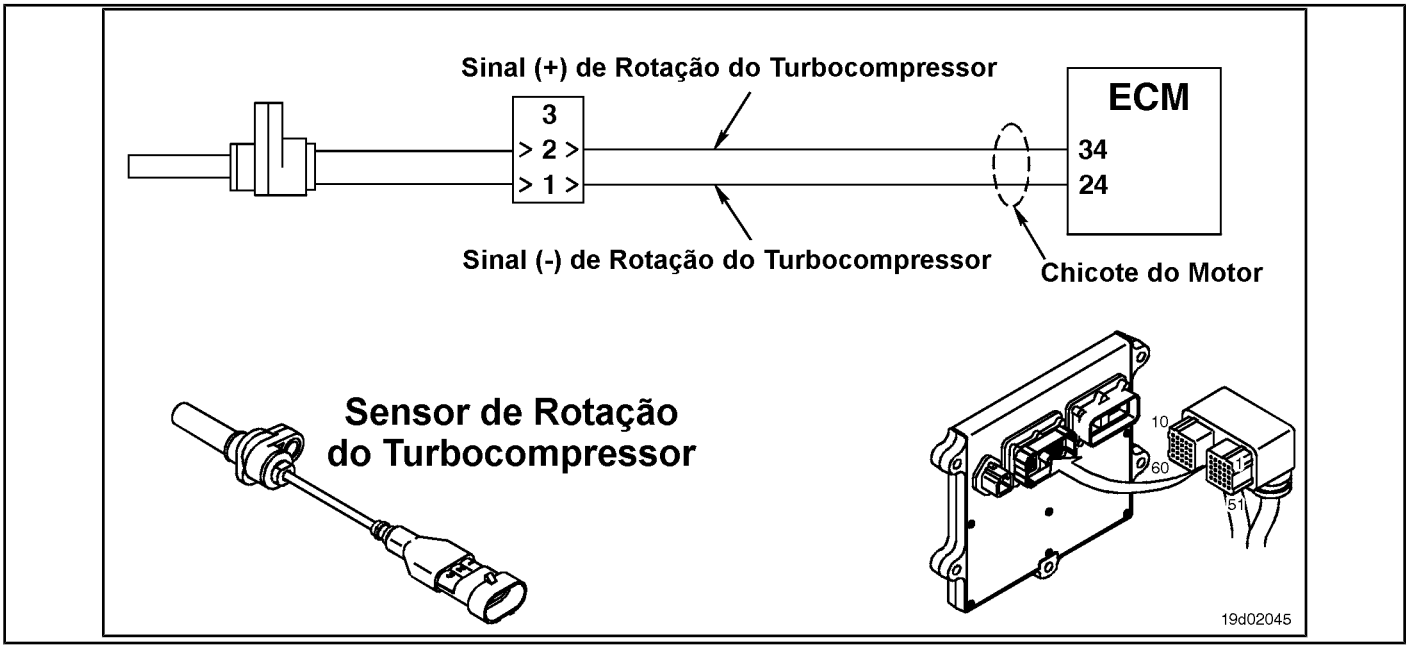
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **NOT**	Proper troubleshooting and repair steps

Fault Code 2345 (ISC / QSC / ISL / QSL - Automotive, Industrial or Maritime)

Invalid Turbocharger Speed Change Rate Detected - Abnormal Rate of Turbocharger Change

CODES	REASON	IT IS MADE
Fault Code: 2345 PID (P), SID (S): P103 IMF: 10/10 Lamp: Amber SRT:	Invalid Turbocharger Rotation Rate Detected - Abnormal Rate of Change. The turbocharger speed sensor has detected an incorrect speed value.	Engine de-powering.

Turbocharger Rotation Sensor Circuit



Circuit Descriptions:

The turbocharger speed sensor is a speed sensor reluctance variable. It consists of a coil wire and an iron core. A signal is generated as the turbocharger shaft rotates. The reference mark on the turbocharger shaft is a flat surface in the center of the shaft.

Component Location:

The turbocharger speed sensor is located in the central housing of the turbocharger. See the Procedure 100-002 for the detailed location of each component.

Workshop Tips:

This fault will become active if the engine is running and the turbocharger's rotation signal changes faster than the turbocharger's capacity can handle. This fault code can be caused by an intermittent connection of the turbocharger rotation sensor, incorrect clearance of the turbocharger rotation sensor or a defective turbocharger rotation sensor.

SUMMARY OF FAULT DIAGNOSTICS

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check for other fault codes.		
STEP 1A: Check for fault codes active or inactive.	**Fault Codes 595 and / or 687 active or inactive?**	
STEP 2: Check the turbocharger.		
STEP 2A: Inspect the turbocharger speed sensor and electrical connections.	**Dirty or damaged pins?**	
STEP 2B: Inspect the turbocharger speed sensor.	**Found damage to the turbocharger speed sensor?**	
STEP 2C: Check for a passcode failure inactive.	**Fault code 2345 inactive?**	
STEP 3: Clear the fault codes.		
STEP 3A: Disable the fault code.	**Fault code 2345 inactive?**	
STEP 3B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check for other fault codes.

STEP 1A: Check for active or inactive fault codes. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for active or inactive fault codes. • Use the electronic service tool INSITE ™ to read fault codes.	Fault Codes 595 and / or 687 active or inactive? **YES** **Repair:** Troubleshoot fault codes starting with the code with the most counts.	Proper troubleshooting and repair steps
	Fault Codes 595 and / or 687 active or inactive? **NOT**	2A

STEP 2: Check the turbocharger.

STEP 2A: Inspect the turbocharger speed sensor and electrical connections.

Conditions:
- Turn the ignition key off.
- Disconnect the turbocharger speed sensor from the engine harness.

Action	Specifications / Repair	Next step
Inspect the engine harness and turbocharger speed sensor connections for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Damage to the wire shield • Moisture inside or over the connector • Connector seals damaged or missing • Broken connector cover • Dirt or debris on the connector pins. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected in the sensor or in the harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-043 .	3A
	Dirty or damaged pins? **NOT**	2B

STEP 2B: Inspect the turbocharger speed sensor.

Conditions:
- Turn the ignition key off.
- Disconnect the turbocharger speed sensor from the engine harness.
- Remove the turbocharger rotation sensor from the turbocharger housing. See the Procedure 019-390 .

Action	Specifications / Repair	Next step
Inspect the tip of the turbocharger rotation sensor for: • Cuts or scratches on the sensor tip • Cuts or scratches in the sensor body • Cracks in the sensor mounting wafer.	Found damage to the turbocharger speed sensor? **YES** **Repair:** Replace the turbocharger speed sensor. See the Procedure 019-390 .	3A
	Found damage to the turbocharger speed sensor? **NOT**	2C

STEP 2C: Check for an inactive fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. Engine specific condition / action test. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 2345 inactive? **YES** **Repair:** None. Did removing and installing the connector correct the failure?	3A
	Fault code 2345 inactive? **NOT**	Fault Code 595

STEP 3: Clear the fault codes.

STEP 3A: Disable the fault code. Conditions:

- Connect all components.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Using the electronic service tool INSITE ™, make sure that the fault code is inactive.	Fault code 2345 inactive? **YEA**	3B
	Fault code 2345 inactive? **NOT**	1A

STEP 3B: Clear the inactive fault codes. Conditions:

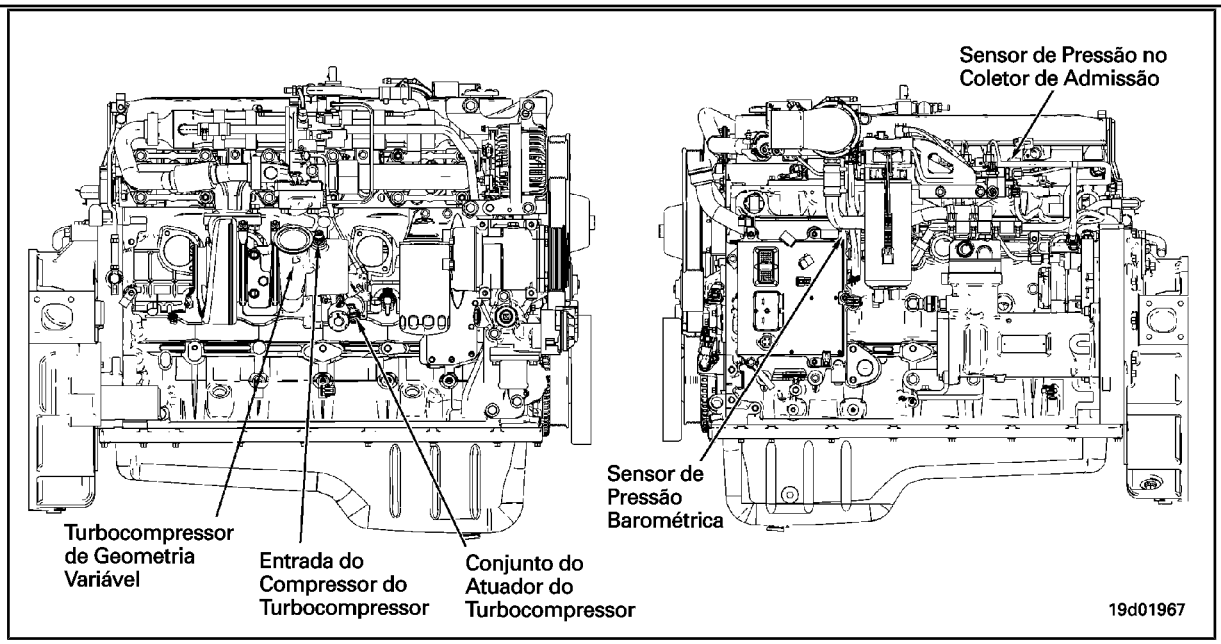
- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **NOT**	Proper troubleshooting and repair steps

Fault Code 2346 (ISB / QSB - Automotive or Industrial Application)

Exhaust Gas Temperature - Above Normal Value

CODES	REASON	IT IS MADE
Fault Code: 2346 PID (P), SID (S): IMF: 1/15 Lamp: Amber SRT:	Exhaust gas temperature - above normal. The electronic control system calculated a high exhaust temperature.	Reduction in engine output power in an attempt to decrease the calculated value of the exhaust gas temperature.



Circuit Descriptions:

The exhaust temperature is a calculated value that the electronic control module (ECM) provides based on the operating conditions of the engine, such as temperature and pressure in the intake manifold, engine speed, fuel flow and pressure of the recirculation valve of the exhaust gases (EGR).

Component Location:

The engine **not** it has a physical exhaust gas temperature sensor. The exhaust gas temperature is the calculated value of the gas temperature before it enters the turbocharger and is also known as the temperature at the turbine inlet.

Workshop Tips:

The most common cause of this fault code is low boost pressure. Low pressure can be caused by several factors:

- Air-to-air cooler leak
- Damaged cooler pipe or hose
- Loose air-to-air cooler clamps
- Inlet manifold pressure sensor failure
- Defective variable geometry turbocharger. NOTE: This fault code is likely **not** will become active in the unloaded engine condition and in the workshop. The engine **must** be under load for this fault code to be triggered, and to verify that the fault has been corrected.

SUMMARY OF FAULT DIAGNOSTICS

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check for fault codes active.	**Are there any fault codes active?**	
STEP 1B: Check for fault codes inactive.	**Fault Codes 153, 122, 2973, 2359, 2273 and 155 inactive?**	
STEP 2: Check the air component system.		
STEP 2A: Check for leaks in the air entrance.	**Is there an air leak or are the clamps loose?**	
STEP 2B: Inspect the compressor and turbocharger turbine blades.	**Damaged turbocharger blades?**	
STEP 2C: Perform the operational test of the turbocharger of the INSITE ™ electronic service tool.	**Has the turbocharger passed the operational test?**	
STEP 3: Clear the fault codes.		
STEP 3A: Disable the fault code.	**Fault code 2346 inactive?**	
STEP 3B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Check for active fault codes. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for active fault codes. • Use the electronic service tool INSITE ™ to read fault codes.	Are there any fault codes active? **YEA**	Troubleshoot active fault codes
	Are there any fault codes active? **NOT**	1B

STEP 1B: Check for inactive fault codes. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for inactive fault codes. • Use the electronic service tool INSITE ™ to read fault codes.	Fault codes 153, 122, 2973, 2359, 2273 and 155 inactive? **YEA**	Troubleshoot and repair fault codes with the highest counts
	Fault codes 153, 122, 2973, 2359, 2273 and 155 inactive? **NOT**	2A

STEP 2: Check the air component system.

STEP 2A: Check the air intake for leaks. Conditions:

- Turn the ignition key off.

Action	Specifications / Repair	Next step
Check for leaks in the air intake. • Check for leaks in the air-to-air cooler, hoses and piping. • Check that the clamp torque is correct.	Is there an air leak or are the clamps loose? **YES** **Repair:** Repair air leaks.	3A
	Is there an air leak or are the clamps loose? **NOT**	2B

STEP 2B: Inspect the compressor and turbocharger turbine blades.

Conditions:
- Stop the engine.
- Turn the ignition key off.
- Remove the intake and exhaust connections from the turbocharger.

Action	Specifications / Repair	Next step
Check the compressor and turbocharger turbine blades for damage or wear.	Damaged turbocharger blades? **YES** **Repair:** Replace the turbocharger. Refer to Procedure 010-033 in the ISB Series Engine Troubleshooting and Repair Manual and, ISB and QSB5.9 ((Common Rail Fuel System), Bulletin 3653336.	3A
	Damaged turbocharger blades? **NOT**	2C

STEP 2C: Perform the turbocharger operational test of the INSITE ™ electronic service tool. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Operate the turbocharger on the INSITE ™ electronic service tool. • Start the engine and let it run at idle.	Has the turbocharger passed the operational test? **YEA**	3A
• Perform the EGR / TGV Operational Test with the INSITE ™ electronic service tool.	Has the turbocharger passed the operational test? **DO NOT** **REPAIR:** Replace the turbocharger. Refer to Procedure 010-033 in the ISB Series Engine Troubleshooting and Repair Manual and, ISB and QSB5.9 ((Common Rail Fuel System), Bulletin 3653336.	3A

STEP 3: Clear the fault codes.

STEP 3A: Disable the fault code. Conditions:

- Connect all components.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Using the electronic service tool INSITE ™, make sure that the fault code is inactive.	Fault code 2346 inactive? **YEA**	3B
	Fault code 2346 inactive? **NOT**	1A

STEP 3: Clear the inactive fault codes.

Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

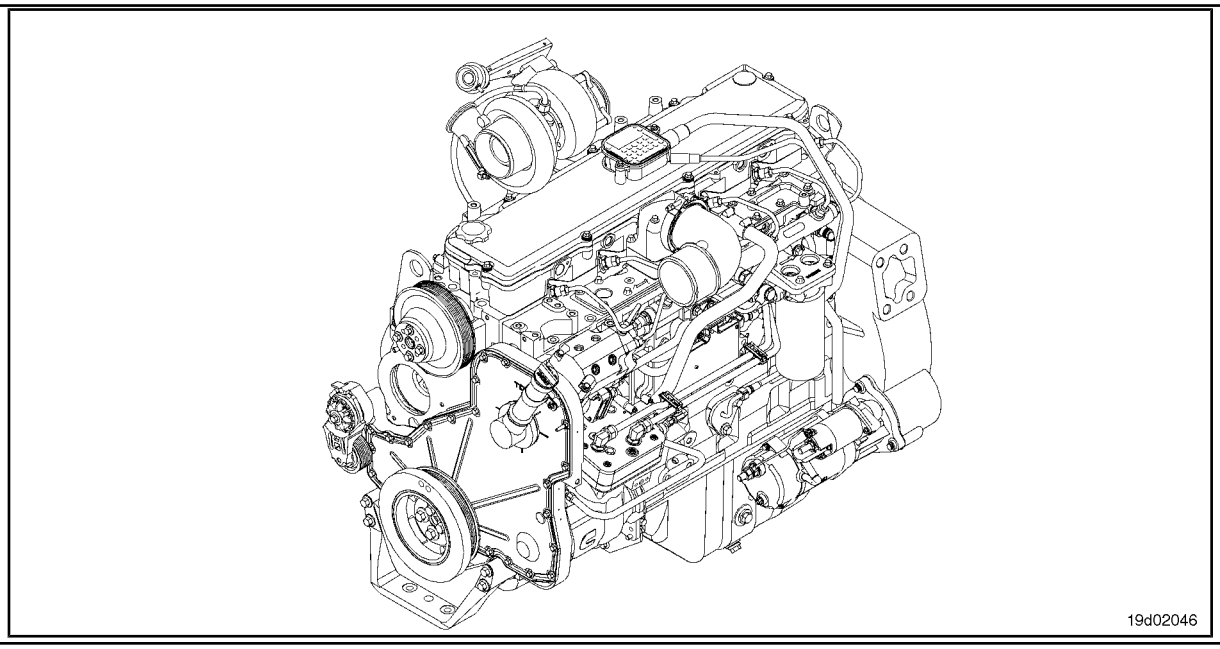
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **NOT**	Proper troubleshooting and repair steps

Fault Code 2346 (ISC / QSC / ISL / QSL - Automotive, Industrial or Maritime)

Temperature (Calculated) at Turbocharger Compressor Inlet - Data Above Normal Range - Less Severe Level

CODES	REASON	IT IS MADE
Fault Code: 2346 PID (P), SID (S): IMF: 0/15 Lamp: No SRT:	Temperature (Calculated) at Turbocharger Compressor Inlet - Data Above Normal Range - Least Severe Level. The inlet temperature of the turbocharger turbine has exceeded the engine protection limit.	Engine de-powering.

Turbocharger Turbine Inlet Temperature (Calculated)



Circuit Descriptions:

The exhaust gas temperature is calculated by the electronic control module (ECM). The exhaust gas temperature, or temperature at the turbine inlet, is calculated by the electronic control module based on the operating conditions of the engine, such as air temperature in the intake manifold, engine speed, injection timing, pressure in the manifold inlet and fuel flow.

Component Location:

The system **not** it has a physical exhaust gas temperature sensor. The exhaust gas temperature is the calculated value of the gas temperature before it enters the turbocharger and is also known as the temperature at the turbine inlet.

NOTE: Some OEMs install pyrometers on the chassis. Pyrometers measure the temperature at the outlet of the turbine or the gas that leaves the turbocharger and **not** match the monitored value with the Exhaust Gas Temperature parameter of the INSITE ™ electronic service tool.

Workshop Tips:

The most common cause of this fault code is low boost pressure. Low pressure can be caused by several factors: leakage in the air-to-air cooler, defective air-to-air cooler tubing or hose, loose air-to-air cooler clamps, inlet manifold pressure sensor failure, variable geometry turbocharger failure, or turbocharger control valve failure. NOTE: This code probably not will be activated with the engine unloaded in the workshop. The engine must be under load for this fault code to be triggered and to determine whether the fault has been found and repaired.

SUMMARY OF FAULT DIAGNOSTICS

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check for fault codes active.	Are there any fault codes active?	
STEP 1B: Check for fault codes inactive.	Fault code 2973 inactive?	
STEP 2: Check the air component system.		
STEP 2A: Check the air-to-air cooler, the clamps, hoses and tubing.	Is there an air leak or are the clamps loose?	
STEP 2B: Inspect the compressor and turbocharger turbine blades.	Any damage found to the turbocharger blades?	
STEP 2C: Check that the tie rod stroke of the variable geometry turbocharger actuator is correct.	Does the turbocharger actuator rod expand between 6.9 and 7.7 mm [0.271 and 0.303 in]?	
STEP 2C-1: Check for leaks and inspect the air lines.	Are there any air leaks in the system?	
STEP 2C-2: Check for pressure air in the turbocharger control valve.	Is there air pressure from the vehicle's air tank at the outlet of the turbocharger control valve?	
STEP 2C-3: Check for pressure air at the outlet of the turbocharger control valve.	Is it possible to hear air escaping from the outlet of the turbocharger control valve?	
STEP 2C-4: Check that the course of actuator turbocharger is correct.	Is the stroke of the turbocharger actuator rod at least 12 mm [0.472 in]?	
STEP 3: Clear the fault codes.		
STEP 3A: Disable the fault code.	Fault code 2346 inactive?	
STEP 3B: Clear the fault codes inactive.	All codes cleared?	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Check for active fault codes. Conditions:

- Connect the electronic service tool INSITE ™.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check for active fault codes. • Use the electronic service tool INSITE ™ to read fault codes.	Are there any fault codes active? **YEA**	Diagnose the active fault codes.
	Are there any fault codes active? **NOT**	1B

STEP 1B: Check for inactive fault codes. Conditions:

- Connect the electronic service tool INSITE ™.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check for inactive fault codes. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 2973 inactive? **YEA**	Fault Code 2973
	Fault code 2973 inactive? **NOT**	2A

STEP 2: Check the air component system.

STEP 2A: Check the air-to-air cooler, clamps, hoses and piping. Conditions:

- Turn the ignition key off.

Action	Specifications / Repair	Next step
Check for leaks in the air-to-air cooler, hoses and piping. Check that the clamp torque is correct.	Is there an air leak or are the clamps loose? **YES** **Repair:** Repair air leaks.	3A
	Is there an air leak or are the clamps loose? **NOT**	2B

STEP 2B: Inspect the compressor and turbocharger turbine blades.

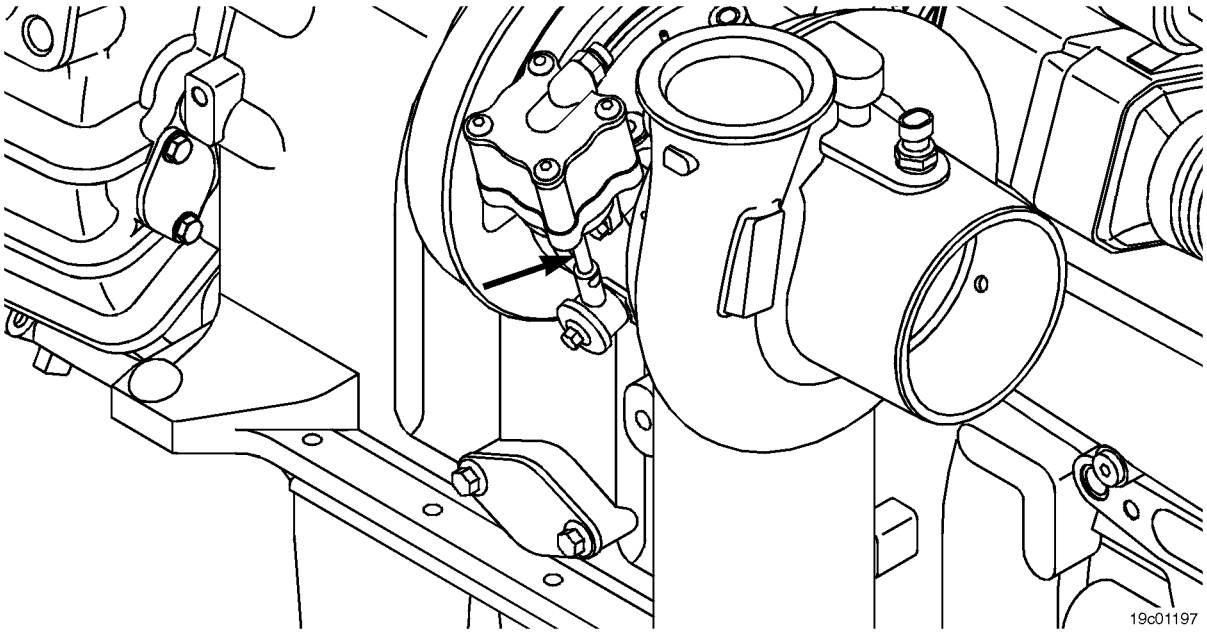
Conditions:
- Stop the engine.
- Turn the ignition key off.
- Remove the intake and exhaust connections from the turbocharger.

Action	Specifications / Repair	Next step
Check the compressor and turbocharger turbine blades for damage or wear.	Any damage found to the turbocharger blades? **YES** **Repair:** Replace the turbocharger. Refer to Procedure 010-033 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266.	3A
	Any damage found to the turbocharger blades? **NOT**	2C

STEP 2C: Check that the stroke of the variable geometry turbocharger actuator rod is right.

Conditions:
- Stop the engine.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.
- Check that the vehicle's air tanks are fully charged.

Action	Specifications / Repair	Next step
Start the Turbocharger Actuator Test using the electronic service tool INSITE ™. • Adjust the delay timer in the Turbocharger Actuator Test so that the movement of the rod can be observed. • Select the Retract Actuator position with the INSITE ™ electronic service tool. • Identify or mark the actuator base to identify the variable geometry turbo actuator rod. • Select the Expand Actuator position with the INSITE ™ electronic service tool. • Measure the rod stroke by measuring the distance between the base of the turbocharger actuator and the identification mark. NOTE: The turbocharger actuator must move quickly. If the movement of the actuator rod is slow, there may be a problem with the air supply or mechanical problems with the variable geometry turbocharger assembly.	The turbocharger actuator rod expands between 6.9 and 7.7 mm [0.271 and 0.303 in]? **YEA**	3A
	The turbocharger actuator rod expands between 6.9 and 7.7 mm [0.271 and 0.303 in]? **NOT**	2C-1



STEP 2C-1: Check for air leaks and inspect the air lines. Conditions:

- Stop the engine.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.
- Check that the vehicle's air tanks are fully charged.

Action	Specifications / Repair	Next step
Test the Turbocharger Actuator using the electronic service tool INSITE ™. Select the Expand Actuator position. Listen carefully and check for air leaks in the following components: • Turbocharger control valve • Inlet connection of the turbocharger control valve • Outlet connection of the turbocharger control valve • Inlet connection of the turbocharger actuator • Turbocharger actuator. • All air lines, including the OEM supply line for the turbocharger control valve and the turbocharger control valve for the turbocharger actuator	Are there any air leaks in the system? **YES** **Repair:** Repair air leaks.	3A
	Are there any air leaks in the system? **NOT**	2C-2

STEP 2C-2: Check for air pressure in the turbocharger control valve. Conditions:

- Stop the engine.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.
- Check that the vehicle's air tanks are fully charged.

Action	Specifications / Repair	Next step
Remove the air line connection at the outlet of the turbocharger control valve. Install a Compuchek® M12 connection at the outlet of the turbocharger control valve. Install an air pressure indicator with a minimum reading capacity of 1034 kPa [150 psi]. Test the Turbocharger Actuator with the INSITE ™ electronic service tool. Select the Expand Actuator position.	Is there air pressure from the vehicle's air tank at the outlet of the turbocharger control valve? **YEA**	2C-3
	Is there air pressure from the vehicle's air tank at the outlet of the turbocharger control valve? **DO NOT** **REPAIR:** Repair the air supply from the OEM air tanks.	3A

STEP 2C-3: Check for air pressure at the outlet of the turbocharger control valve. Conditions:

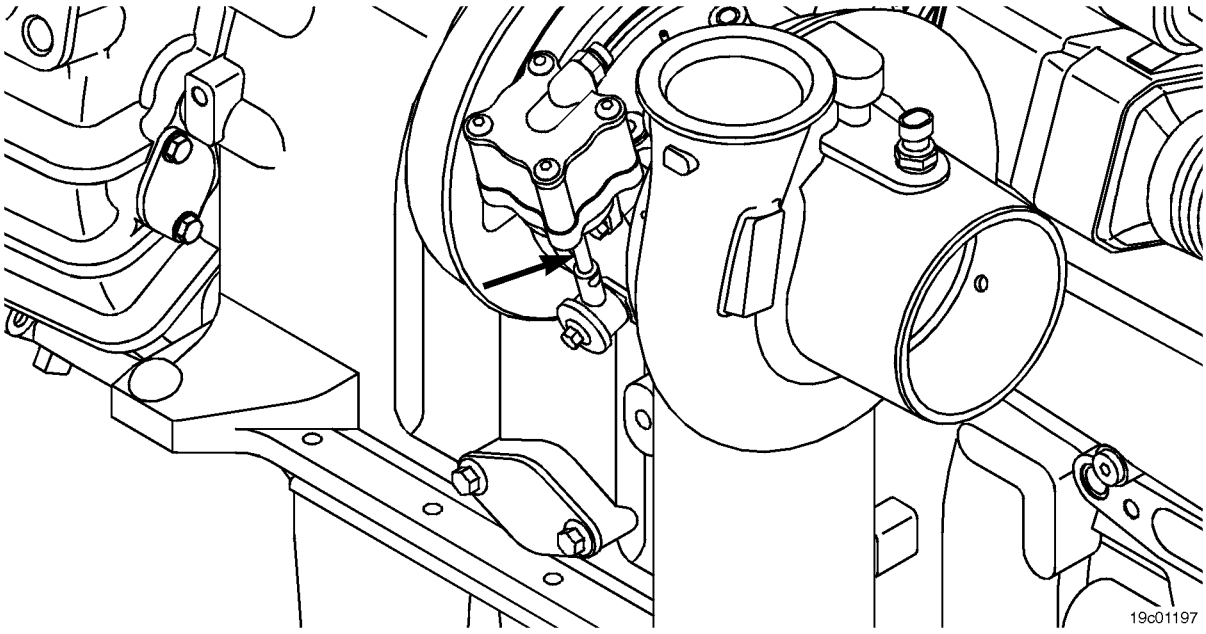
- Stop the engine.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.
- Check that the vehicle's air tanks are fully charged.

Action	Specifications / Repair	Next step
Start the Turbocharger Actuator Test using the electronic service tool INSITE ™. • Select the Retract Actuator position. • Remove the air line connection at the outlet of the turbocharger control valve.	Is it possible to hear air escaping from the outlet of the turbocharger control valve? **YES** **Repair:** Replace the turbocharger control valve. See the Procedure 019-388 .	3A
	Is it possible to hear air escaping from the outlet of the turbocharger control valve? **NOT**	2C-4

STEP 2C-4: Check that the travel of the turbocharger actuator is correct. Conditions:

- Stop the engine.
- Remove the variable geometry turbocharger actuator rod.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.
- Check that the vehicle's air tanks are fully charged.

Action	Specifications / Repair	Next step
Test the Turbocharger Actuator using the electronic service tool INSITE ™. • Select the Expand Actuator position.	Is the stroke of the turbocharger actuator rod at least 12 mm [0.472 in]? **YES** **Repair:** Replace the turbocharger assembly. Refer to Procedure 010-033 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266.	3A
	Is the stroke of the turbocharger actuator rod at least 12 mm [0.472 in]? **DO NOT** **REPAIR:** Replace the turbocharger actuator. Refer to Procedure 010-113 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266.	3A



STEP 3: Clear the fault codes.

STEP 3A: Disable the fault code. Conditions:

- Connect all components.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Use the electronic service tool INSITE ™ to read fault codes. NOTE: Unless the fault is a defective barometric pressure sensor or pressure in the intake manifold, this code is likely not will be activated in the "no air" condition in the workshop. Most likely, the engine will need to be under load for this fault code to be triggered and to determine whether the fault has been found and repaired.	Fault code 2346 inactive? **YEA**	3B
	Fault code 2346 inactive? **DO NOT** **REPAIR:** Return to the troubleshooting steps or consult your local Cummins Authorized Service Station after checking and completing all steps again.	1A

STEP 3B: Clear the inactive fault codes. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

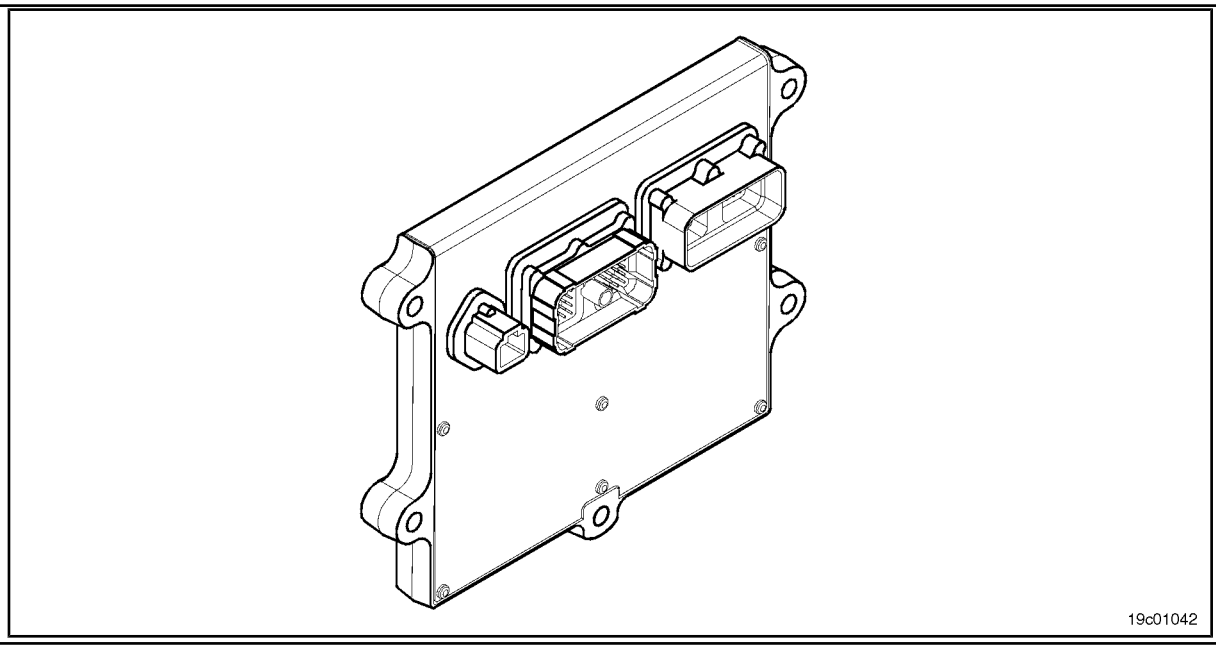
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete Repair
	All codes cleared? **DO NOT** **REPAIR:** Troubleshoot any other active fault code.	Proper troubleshooting and repair steps

Fault Code 2347 (ISB / QSB - Automotive or Industrial Application)

Turbocharger Compressor Output Temperature - Above Normal Value

CODES	REASON	IT IS MADE
Fault Code: 2347 PID (P), SID (S): S151 IMF: 0/15 Lamp: Amber SRT:	Turbocharger compressor outlet temperature - above normal. The ECM calculated a high outlet temperature from the turbocharger compressor.	Fuel will be limited in an attempt to reduce the calculated outlet temperature of the turbocharger compressor.

Air Temperature Sensor Circuit at Turbocharger Compressor Inlet



Circuit Descriptions:

The outlet air temperature of the turbocharger compressor is calculated by the ECM based on the operating conditions of the engine such as: temperature at the intake of the turbocharger compressor, barometric pressure, turbocharger rotation, engine rotation, intake air temperature at the collector pressure and pressure in the intake manifold.

Component Location:

The engine **not** it has a physical sensor for the outlet temperature of the turbocharger compressor. The outlet temperature of the turbocharger compressor is a calculated value of the air temperature after the air is compressed by the turbocharger but before it is mixed in the exhaust gas recirculation valve (EGR) into the system, and before entering the cooler air-to-air.

Workshop Tips:

The possible causes of high outlet temperature of the turbocharger compressor are:

- Leaks in the air intake between the air filter and the turbocharger, allowing hot air under the hood to enter the turbocharger compressor
- Incorrect turbocharger inlet air temperature sensor output
- Incorrect output of the sensors used to calculate the outlet temperature of the turbocharger compressor, such as ambient air pressure and turbocharger rotation.

NOTE: This code probably **not** will be activated with the engine unloaded in the workshop. The engine **must** be under load for this fault code to be triggered and to determine whether the fault has been found and repaired.

SUMMARY OF FAULT DIAGNOSTICS

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check for fault codes active.	**Are there any fault codes active?**	
STEP 1B: Check for fault codes inactive.	**Fault Codes 245, 295, 433, 488, 595, 2345 and / or 2973 inactive?**	
STEP 2: Check the air intake system.		
STEP 2A: Check for leaks in the air entrance.	**Is there an air leak?**	
STEP 2B: Perform the operational test of the turbocharger of the INSITE ™ electronic service tool.	**Has the turbocharger passed the operational test?**	
STEP 3: Check the compressor's inlet temperature sensor turbocharger.		
STEP 3A: Compare the sensor reading with ambient conditions.	**The reading of the turbocharger compressor inlet temperature sensor is within the range of 10** **Percent the indication of the temperature sensor on the intake manifold and the ambient air temperature?**	
STEP 4: Clear the fault codes.		
STEP 4A: Disable the fault code.	**Fault code 2347 inactive?**	
STEP 4B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Check for active fault codes. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for active fault codes. • Use the electronic service tool INSITE ™ to read fault codes.	Are there any fault codes active? **YEA**	Troubleshoot active fault codes
	Are there any fault codes active? **NOT**	1B

STEP 1B: Check for inactive fault codes. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for inactive fault codes. • Use the electronic service tool INSITE ™ to read fault codes.	Fault codes 245, 295, 433, 488, 595, 2345 and / or 2973 inactive? **YEA**	Troubleshoot and repair inactive fault codes
	Fault codes 245, 295, 433, 488, 595, 2345 and / or 2973 inactive? **NOT**	2A

STEP 2: Check the air intake system.

STEP 2A: Check the air intake for leaks. Conditions:

- Turn the ignition key off.

Action	Specifications / Repair	Next step
Leaks in the air inlet between the air filter and the turbocharger can raise the inlet temperature of the turbocharger compressor. • Check for air leaks between the air filter and the turbocharger compressor inlet.	Is there an air leak? **YES** **Repair:** Repair air leaks.	4A
	Is there an air leak? **NOT**	2B

STEP 2B: Test the turbocharger of the INSITE ™ electronic service tool. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.
- Start the engine and let it run at idle.

Action	Specifications / Repair	Next step
Perform the EGR / TGV Operational Test with the INSITE ™ electronic service tool. • Perform the Turbocharger Operational Test.	Has the turbocharger passed the operational test? **YEA**	3A
	Has the turbocharger passed the operational test? **DO NOT** **REPAIR:** Replace the variable geometry turbocharger. Refer to Procedure 010-033 in the basic engine fault diagnosis and repair manual, Bulletin 3653336.	4A

STEP 3: Check the compressor's inlet temperature sensor turbocharger.

STEP 3A: Compare the sensor reading with the ambient conditions. Conditions:

- Make sure the engine is cool.
- Remove the inlet temperature sensor from the turbocharger compressor from the engine.
- Connect the inlet temperature sensor of the turbocharger compressor to the engine harness.
- Connect the electronic service tool INSITE ™.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Compare the sensor reading to the ambient conditions. • Using the INSITE ™ Monitor / Data Logger, compare the reading of the turbocharger compressor inlet temperature sensor with the temperature sensor reading on the intake manifold. • The reading of the turbocharger compressor inlet temperature sensor must be in the range of 10 Percent reading of the temperature sensor in the intake manifold and 10 Percent reading the ambient air temperature.	The reading of the turbocharger compressor inlet temperature sensor is within the range of 10 Percent the indication of the temperature sensor on the intake manifold and the ambient air temperature? **YEA**	4A
	The reading of the turbocharger compressor inlet temperature sensor is within the range of 10 Percent the indication of the temperature sensor on the intake manifold and the ambient air temperature? **DO NOT** **REPAIR:** Replace the turbocharger compressor inlet air temperature sensor. See the Procedure 019-395 .	4A

STEP 4: Clear the fault codes.

STEP 4A: Disable the fault code. Conditions:

- Connect all components.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Using the electronic service tool INSITE ™, make sure that the fault code is inactive.	Fault code 2347 inactive? **YEA**	4B
	Fault code 2347 inactive? **NOT**	1A

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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

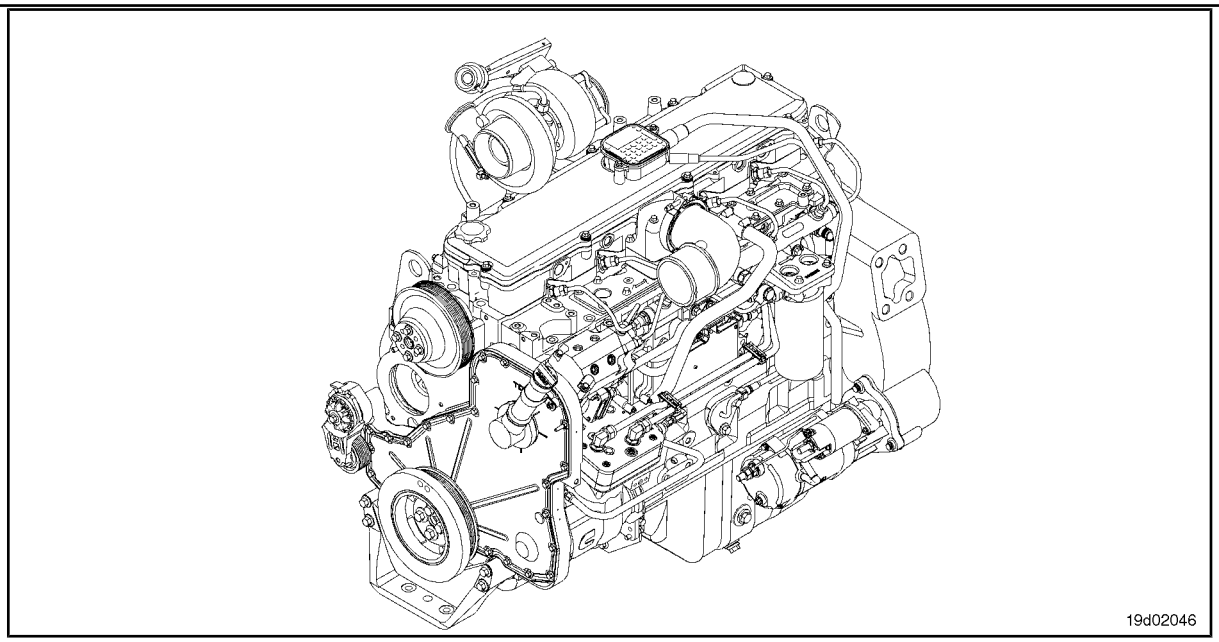
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **NOT**	Proper troubleshooting and repair steps

Fault Code 2347 (ISC / QSC / ISL / QSL - Automotive, Industrial or Maritime)

Turbocharger Compressor Output (Calculated) Temperature - Data Above Normal Range - Less Severe Level

CODES	REASON	IT IS MADE
Fault Code: 2347 PID (P), SID (S): IMF: 0/15 Lamp: No SRT:	Turbocharger Compressor Output (Calculated) Temperature - Data Above Normal Range - Less Severe Level.	Engine de-powering.

Turbocharger Compressor Outlet Air Temperature



Circuit Descriptions:

The outlet air temperature of the turbocharger compressor is calculated by the electronic control module (ECM). The air temperature at the outlet of the turbocharger compressor is calculated by the ECM based on the operating conditions of the engine, such as: air temperature at the intake of the turbocharger compressor, barometric pressure, turbocharger rotation, engine rotation, air temperature at intake manifold and pressure in the intake manifold.

Component Location:

The system **not** it has a physical temperature sensor for the exhaust air of the turbocharger compressor. The outlet air temperature of the turbocharger compressor is a calculated value of the air temperature after it is compressed by the turbocharger compressor.

Workshop Tips:

Possible causes of this fault code:

- Intake air leaks allowing hot air under the hood to enter the intake system
- Incorrect pressure readings on the intake manifold
- High turbocharger speed readings
- Incorrect barometric pressure readings

- Turbocharger control valve "stuck"
- Variable geometry turbocharger "stuck".

NOTE: Unless the fault is a defective barometric pressure sensor or pressure in the intake manifold, this code is likely **not** will be activated in the "no air" condition in the workshop. Most likely, the engine will need to be under load for this fault code to be triggered and to determine whether the fault has been found and repaired.

SUMMARY OF FAULT DIAGNOSTICS

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check for fault codes active.	Are there any fault codes active?	
STEP 1B: Check for fault codes inactive.	Are Fault Codes 595 or 2973 inactive?	
STEP 2: Check the air component system.		
STEP 2A: Check the restriction of admission to the turbocharger inlet.	Air restriction is greater than 635 mm H_2O [25 in H_2O] for a used air filter, or 254 mm H_2O [105 in H_2O] for a new air filter?	
STEP 2B: Check the air intake under the hood.	Is the turbocharger air intake pipe damaged?	
STEP 2C: Check the air-to-air cooler, the clamps, hoses and tubes.	Air-to-air cooler connection loose or air-to-air cooler failure?	
STEP 2D: Inspect the compressor and turbocharger turbine blades.	Damage to the turbine or turbocharger compressor blades?	
STEP 2E: Check that the tie rod stroke of the variable geometry turbocharger actuator is correct.	Does the turbocharger actuator rod expand between 6.9 and 7.7 mm [0.271 and 0.303 in]?	
STEP 2D-1: Check for leaks and inspect the air lines.	Are there any air leaks in the system?	
STEP 2D-2: Check for pressure air in the turbocharger control valve.	Is there air pressure from the vehicle's air tank at the outlet of the turbocharger control valve?	
STEP 2D-3: Check for pressure air at the outlet of the turbocharger control valve.	Is it possible to hear air escaping from the outlet of the turbocharger control valve?	
STEP 2D-4: Check that the course of actuator turbocharger is correct.	Is the stroke of the turbocharger actuator rod at least 12 mm [0.472 in]?	
STEP 3: Clear the fault codes.		
STEP 3A: Disable the fault code.	Fault code 2347 inactive?	
STEP 3B: Clear the fault codes inactive.	All codes cleared?	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Check for active fault codes. Conditions:

- Connect the electronic service tool INSITE ™.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check for active fault codes. • Use the electronic service tool INSITE ™ to read fault codes.	Are there any fault codes active? **YEA**	Diagnose the active fault codes.
	Are there any fault codes active? **NOT**	1B

STEP 1B: Check for inactive fault codes. Conditions:

- Connect the electronic service tool INSITE ™.
- Turn the ignition key ON.

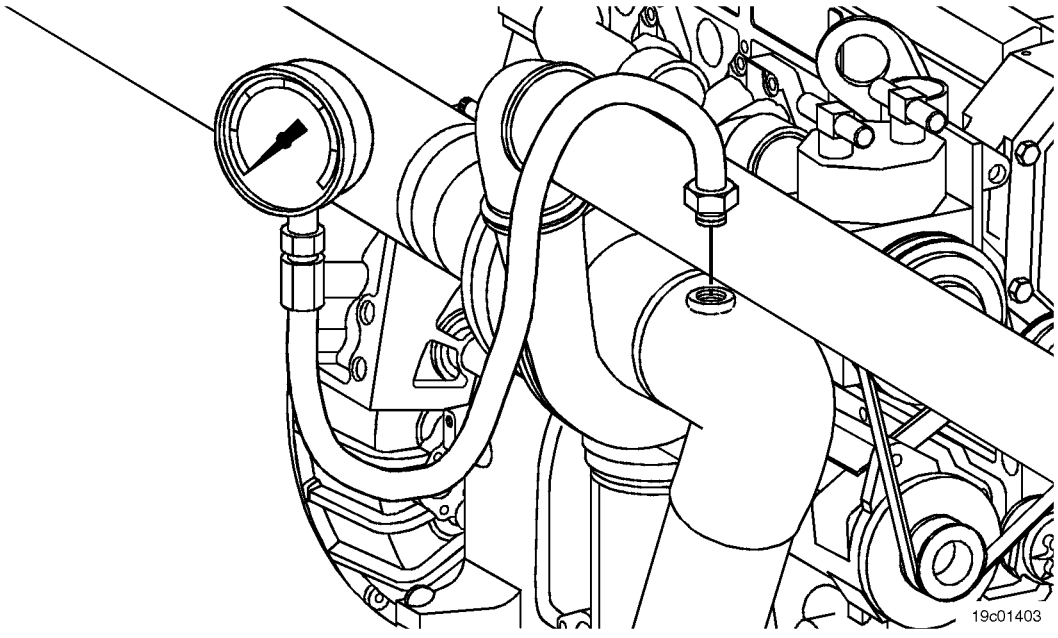
Action	Specifications / Repair	Next step
Check for inactive fault codes. • Use the electronic service tool INSITE ™ to read fault codes.	Are Fault Codes 595 or 2973 inactive? **YEA**	Troubleshoot inactive fault codes starting with the code with the most counts.
	Are Fault Codes 595 or 2973 inactive? **NOT**	2B

STEP 2: Check the air component system.

STEP 2A: Check the intake restriction at the turbocharger inlet. Conditions:

- Turn the ignition key ON.
- Operate the engine at the rated power and speed.

Action	Specifications / Repair	Next step
Check the restriction on the intake system by installing a vacuum gauge on the air system. Refer to the Operation and Maintenance Manual.	Air restriction is greater than 635 mm H_2O [25 in H_2O] for a used air filter, or 254 mm H_2O [10 in H_2O] for a new air filter? **YES** **Repair:** Correct the cause of the high intake air restriction. Check for a clogged air filter or restricted air intake pipe.	Complete repair
	Air intake restriction is greater than 635 mm H_2O [25 in H_2O] for a used air filter, or 254 mm [10 in H_2O] for a new filter? **NOT**	2B



STEP 2B: Check the air intake tubing under the hood. Conditions:

- Stop the engine.
- Turn the ignition key off.

Action	Specifications / Repair	Next step
Inspect the turbocharger air inlet piping for damage or holes that could allow hot air to enter the hood at the turbocharger intake. Refer to the Operation and Maintenance Manual.	Is the turbocharger air intake pipe damaged? **YES** **Repair:** Repair the air intake pipe.	3A
	Is the turbocharger air intake pipe damaged? **NOT**	2C

STEP 2C: Check the air-to-air cooler, clamps, hoses and piping. Conditions:

- Stop the engine.
- Turn the ignition key off.

Action	Specifications / Repair	Next step
Check for leaks in the air cooler clamps, hoses and pipes. Test the air-to-air cooler pressure.	Air-to-air cooler connection loose or air-to-air cooler failure? **YES** **Repair:** Repair the air-to-air connections or cooler.	3A
	Air-to-air cooler connection loose or air-to-air cooler failure? **NOT**	2D

STEP 2D: Inspect the compressor and turbocharger turbine blades.

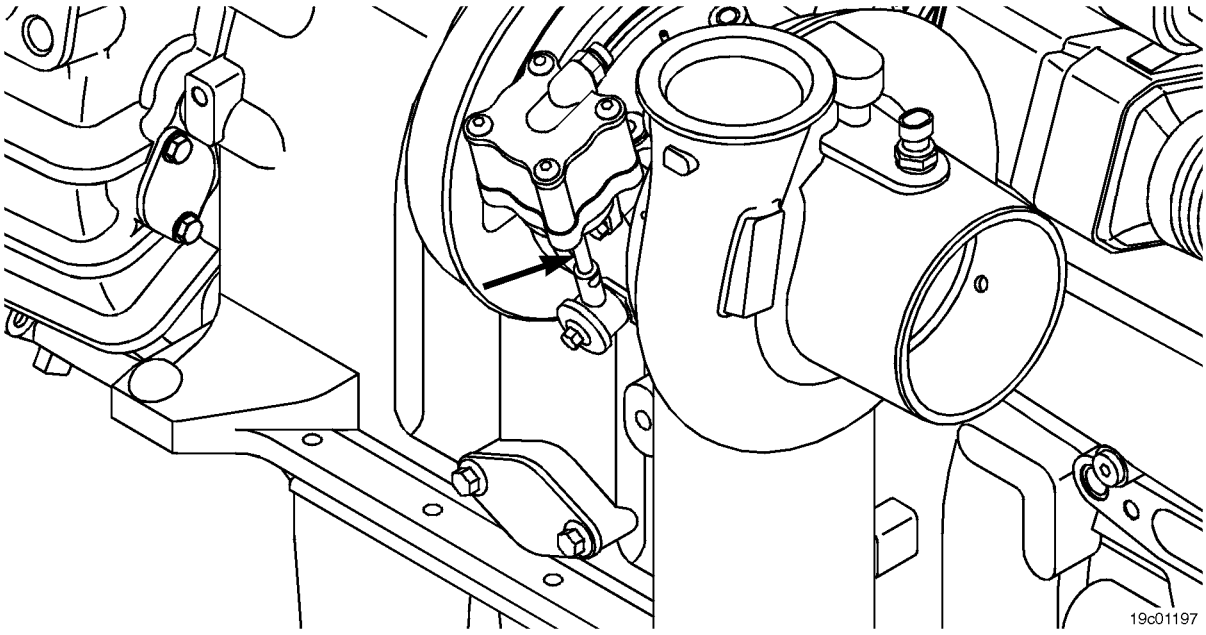
Conditions:
- Stop the engine.
- Turn the ignition key off.

Action	Specifications / Repair	Next step
Remove the exhaust and intake connections from the turbocharger. Inspect the turbine and turbocharger compressor blades for damage. Check the compressor and turbocharger turbine blades for damage or wear.	Damage to the turbine or turbocharger compressor blades? **YES** **Repair:** Replace the turbocharger. Refer to Procedure 010-033 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266. Call for authorization.	3A
	Damage to the turbine or turbocharger compressor blades? **NOT**	2E

STEP 2E: Check that the stroke of the variable geometry turbocharger actuator rod is right.

Conditions:
- Stop the engine.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.
- Check that the vehicle's air tanks are fully charged.

Action	Specifications / Repair	Next step
Start the Turbocharger Actuator Test using the electronic service tool INSITE ™. • Adjust the delay timer in the Turbocharger Actuator Test so that the rod movement can be observed. • Select the Retract Actuator position with the INSITE ™ electronic service tool. • Identify or mark the actuator base to identify the variable geometry turbo actuator rod. • Select the Expand Actuator position with the INSITE ™ electronic service tool. • Measure the rod stroke by measuring the distance between the base of the turbocharger actuator and the identification mark. NOTE: The turbocharger actuator must move quickly. If the movement of the actuator rod is slow, there may be a problem with the air supply or mechanical problems with the variable geometry turbocharger assembly.	The turbocharger actuator rod expands between 6.9 and 7.7 mm [0.271 and 0.303 in]? **YEA**	2F
	The turbocharger actuator rod expands between 6.9 and 7.7 mm [0.271 and 0.303 in]? **NOT**	2E-1



STEP 2E-1: Check for air leaks and inspect the air lines. Conditions:

- Stop the engine.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.
- Check that the vehicle's air tanks are fully charged.

Action	Specifications / Repair	Next step
Test the Turbocharger Actuator using the electronic service tool INSITE ™. Select the Expand Actuator position. Listen carefully and check for air leaks in the following components: • Turbocharger control valve • Inlet connection of the turbocharger control valve • Outlet connection of the turbocharger control valve • Inlet connection of the turbocharger actuator • Turbocharger actuator. • All air lines, including the OEM supply line for the turbocharger control valve and the turbocharger control valve for the turbocharger actuator	Are there any air leaks in the system? **YES** **Repair:** Repair air leaks.	3A
	Are there any air leaks in the system? **NOT**	2E-2

STEP 2E-2: Check for air pressure in the turbocharger control valve. Conditions:

- Stop the engine.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.
- Check that the vehicle's air tanks are fully charged.

Action	Specifications / Repair	Next step
Remove the air line connection at the outlet of the turbocharger control valve. Install a Compuchek® M12 connection at the outlet of the turbocharger control valve. Install an air pressure indicator with a minimum reading capacity of 1034 kPa [150 psi]. Test the Turbocharger Actuator with the INSITE ™ electronic service tool. Select the Expand Actuator position.	Is there air pressure from the vehicle's air tank at the outlet of the turbocharger control valve? **YEA**	2E-3
	Is there air pressure from the vehicle's air tank at the outlet of the turbocharger control valve? **DO NOT** **REPAIR:** Repair the air supply from the OEM air tanks.	3A

STEP 2E-3: Check for air pressure at the outlet of the turbocharger control valve. Conditions:

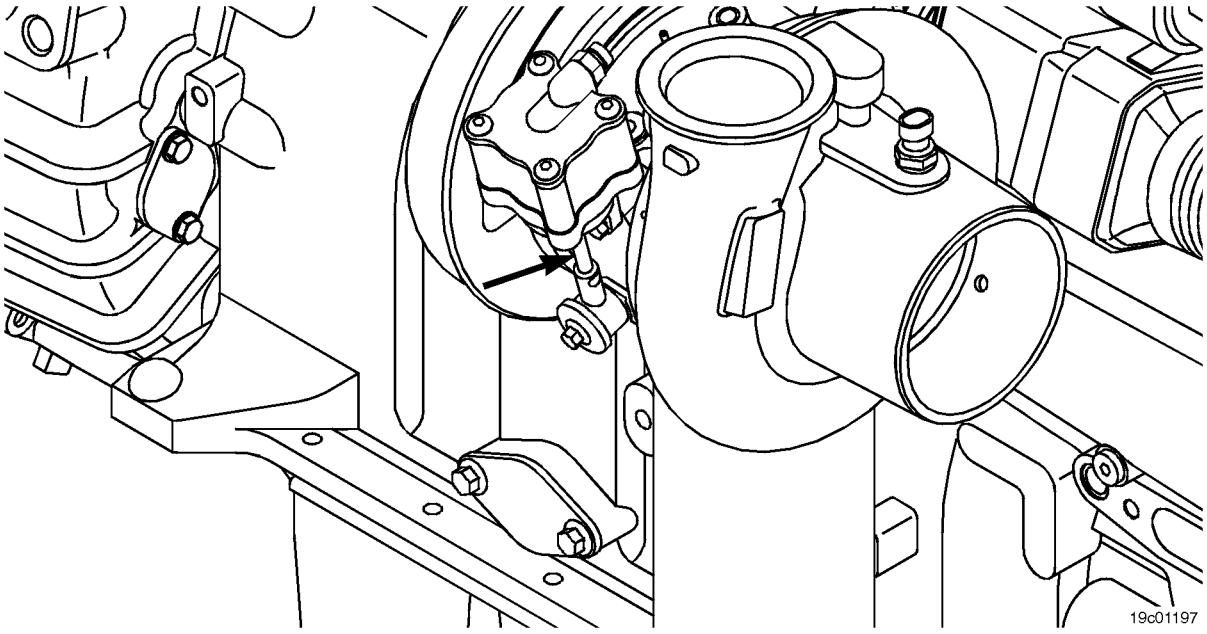
- Stop the engine.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.
- Check that the vehicle's air tanks are fully charged.

Action	Specifications / Repair	Next step
Start the Turbocharger Actuator Test using the electronic service tool INSITE ™. • Select the Retract Actuator position. • Remove the air line connection at the outlet of the turbocharger control valve.	Is it possible to hear air escaping from the outlet of the turbocharger control valve? **YES** **Repair:** Replace the turbocharger control valve. See the Procedure 019-388 .	3A
	Is it possible to hear air escaping from the outlet of the turbocharger control valve? **NOT**	2E-4

STEP 2E-4: Check that the travel of the turbocharger actuator is correct. Conditions:

- Stop the engine.
- Disconnect the variable geometry turbocharger actuator rod from the turbocharger shaft.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.
- Check that the vehicle's air tanks are fully charged.

Action	Specifications / Repair	Next step
Test the Turbocharger Actuator using the electronic service tool INSITE ™. • Select the Expand Actuator position.	Is the stroke of the turbocharger actuator rod at least 12 mm [0.472 in]? **YES** **Repair:** Replace the turbocharger assembly. Refer to Procedure 010-033 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266.	3A
	Is the stroke of the turbocharger actuator rod at least 12 mm [0.472 in]? **DO NOT** **REPAIR:** Replace the turbocharger actuator. Refer to Procedure 010-113 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266.	3A



STEP 3: Clear the fault codes.

STEP 3A: Disable the fault code. Conditions:

- Connect all components.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Use the electronic service tool INSITE ™ to read fault codes. NOTE: Unless the fault is a defective barometric pressure sensor or pressure in the intake manifold, this code is likely **not** will be activated in the "no air" condition in the workshop. Most likely, the engine will need to be under load for this fault code to be triggered and to determine whether the fault has been found and repaired.	Fault code 2347 inactive? **YEA**	3B
	Fault code 2347 inactive? **DO NOT** **REPAIR:** Return to the troubleshooting steps or consult your local Cummins Authorized Service Station after checking and completing all steps again.	1A

STEP 3B: Clear the inactive fault codes. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

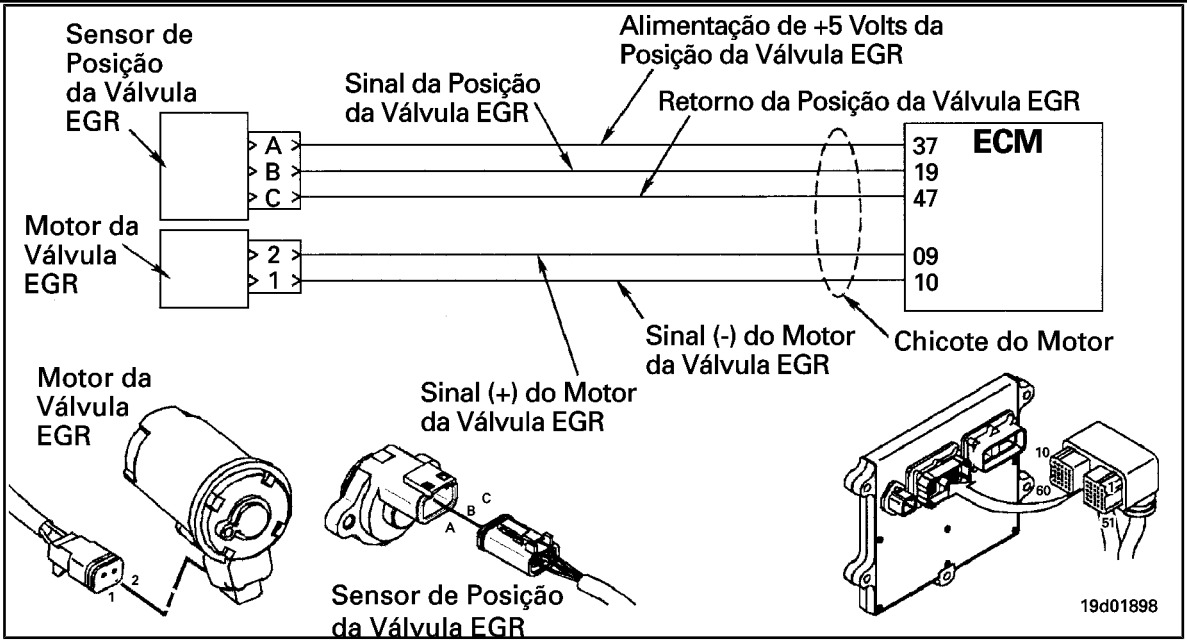
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **DO NOT** **REPAIR:** Troubleshoot any other active fault code.	Proper troubleshooting and repair steps

Fault Code 2348

Failure in the Automatic EGR Valve Calibration Procedure

CODES	REASON	IT IS MADE
Fault Code: 2348 PID (P), SID (S): P027 IMF: 13/13 Lamp: Amber SRT:	EGR valve failure during the automatic calibration procedure - out of calibration.	Possible loss of power. The power will be removed from the EGR valve motor.

EGR Valve Circuit



Circuit Descriptions:

The electronic control module (ECM) periodically checks and adjusts the zero position of the EGR valve position sensor when it is closed. This self-calibration feature adjusts for the purpose of detecting wear and variation from one unit to another of the position sensors and valve sets. This fault is recorded if the position sensor reading is outside the automatic 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 on the exhaust manifold. See the Procedure 100-002 for the detailed location of each component.

Workshop Tips:

A possible cause for this code could be an internal failure of the EGR valve assembly causing the valve **not** close completely.

When diagnosing faults from inactive counts of this fault code, it may be useful to run the EGR Valve Test on the INSITE ™ electronic service tool to identify a "stuck" EGR valve.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following test cable when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test cable STEPS

		SPECIFICATIONS	SRT CODE
STEP 1: Check the engine harness.			
STEP 1A:	**Inspect the pins of the engine harness and ECM connectors.**	**Dirty or damaged pins?**	
STEP 1B: Check for a short circuit	**on the EGR valve position sensor signal.**	**More than 100k ohms?**	
STEP 2: Check the EGR valve position sensor.			
STEP 2A:	**Inspect the EGR valve position sensor and the harness connector pins.**	**Dirty or damaged pins?**	
STEP 2B: Check the signal voltage of the	**EGR valve position sensor.**	**Less than 0.1 VDC?**	
STEP 3: Clear the fault codes.			
STEP 3A: Disable the fault code.		**Fault code 2348 inactive?**	
STEP 3B: Clear the fault codes	**inactive.**	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the engine harness.

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

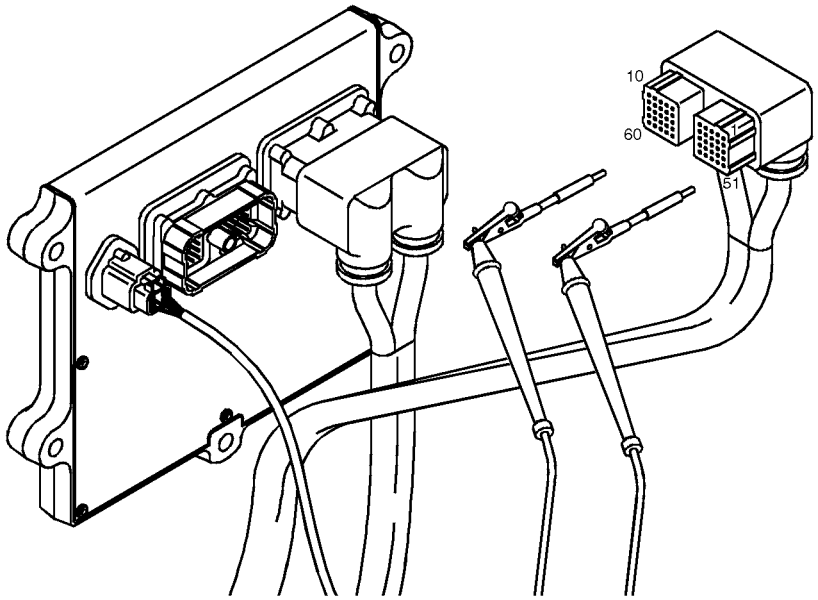
Conditions:
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.

Action	Specifications / Repair	Next step
Check that the ECM and the engine harness connector pins have: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins • Broken connector cover • Damage to the insulation of the wires or the harness • Damage to the connector locking tab. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	3A
	Dirty or damaged pins? **NOT**	1B

STEP 1B: Check for a short circuit in the EGR valve position sensor signal. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Disconnect the EGR valve position sensor from the engine harness.

Action	Specifications / Repair	Next step
Check the harness for a short circuit. • Measure the resistance between the EGR valve position signal pin on the engine harness ECM connector and all other connector pins. Refer to the circuit diagram or electrical diagram for the identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YEA**	2A
	More than 100k ohms? **DO NOT** **REPAIR:** Repair or replace the engine harness. See the Procedure 019-043 . See Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	3A



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STEP 2: Check the EGR valve position sensor.

STEP 2A: Inspect the EGR valve position sensor and the harness connector pins.

Conditions:
- Turn the ignition key off.
- Disconnect the EGR valve position sensor from the engine harness.

Action	Specifications / Repair	Next step
Inspect the harness connector pins and the EGR valve position sensor for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins • Broken connector cover • Damage to the insulation of the wires or the harness • Damage to the connector locking tab. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	3A
	Dirty or damaged pins? **NOT**	2B

STEP 2B: Check the signal voltage of the EGR valve position sensor. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Turn the ignition key ON.
- Connect the INSITE ™ electronic service tool to the OEM SAE J1939 or SAE J1970 datalink connector.

Action	Specifications / Repair	Next step
Using the INSITE ™ Monitor / Data Logger, check the signal voltage of the EGR valve position sensor.	Less than 0.1 VDC? **YES** **Repair:** Replace the EGR valve assembly. Refer to Procedure 011-022 in the ISBe, ISB and QSB5.9 (Common Rail Fuel System) Engine Troubleshooting and Repair Manual, Bulletin 3653336.	3A
	Less than 0.1 VDC? **DO NOT** **REPAIR:** Replace the ECM. Call for authorization. See the Procedure 019-031 .	3A

STEP 3: Clear the fault codes.

STEP 3A: Disable the fault code. Conditions:

- Connect all components.
- Connect the electronic service tool INSITE ™.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Using the electronic service tool INSITE ™, make sure that the fault code is inactive.	Fault code 2348 inactive? **YEA**	3B
	Fault code 2348 inactive? **NOT**	1A

STEP 3B: Clear the inactive fault codes. Conditions:

- Connect all components.
- Connect the electronic service tool INSITE ™.
- Turn the ignition key ON.

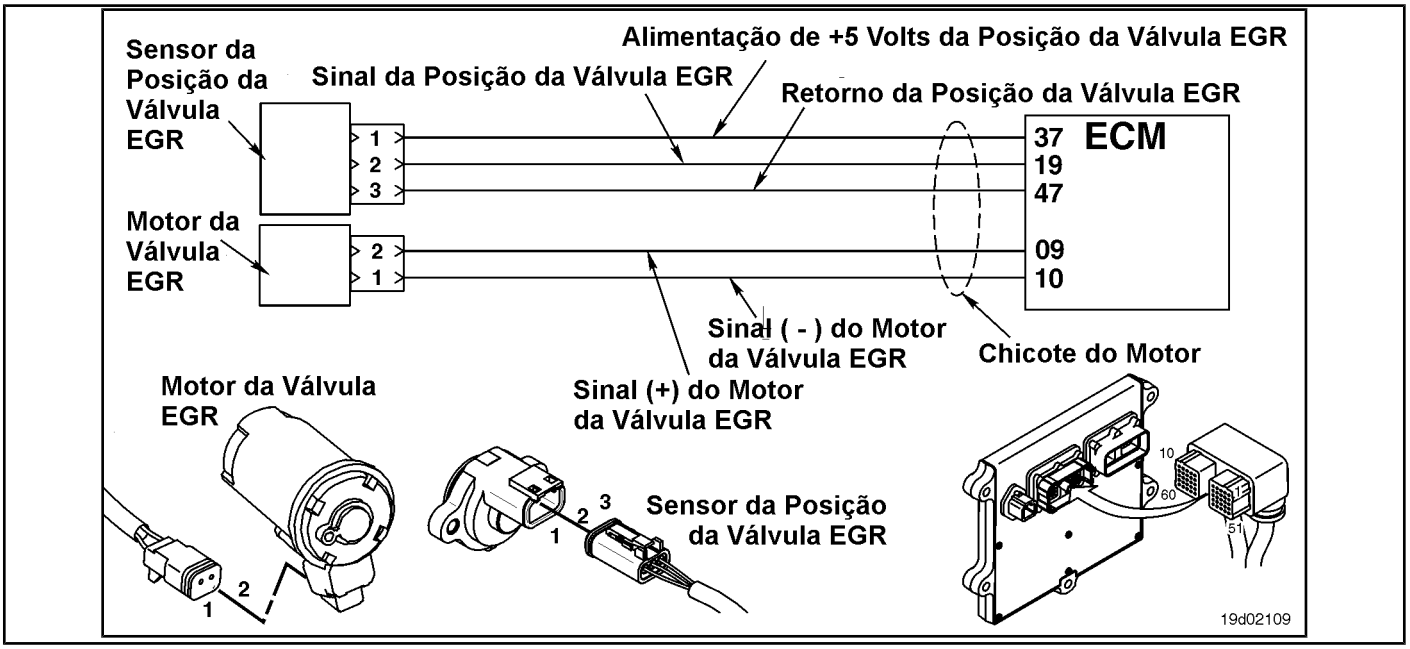
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **NOT**	Proper troubleshooting and repair steps

Fault Code 2349

EGR Valve Control Circuit - Current Below Normal or Open Circuit

CODES	REASON	IT IS MADE
Fault Code: 2349 PID (P), SID (S): S146 IMF: 5/5 Lamp: Amber SRT:	EGR Valve Control Circuit - Current Below Normal or Open Circuit. High voltage or open circuit detected in the EGR valve motor circuit.	Possible loss of power. Power removed from the EGR valve motor.

EGR Valve Control Circuit - High Voltage or Open



Circuit Descriptions:

The electronic control module (ECM) controls the EGR valve, opening and closing it based on the various operating conditions. The EGR valve is opened and closed by a DC motor that receives voltage from the ECM in the (+) and (-) signal circuits of the EGR valve motor. To open the valve, the motor receives voltage in the (+) signal circuit of the EGR valve motor. To close the valve, the motor receives voltage in the signal circuit (-) of the EGR valve motor.

Component Location:

The EGR valve engine is located on the exhaust side of the engine and is coupled to the EGR valve assembly, which is mounted on the exhaust manifold. See the Procedure 100-002 for the detailed location of each component.

Workshop Tips:

The ECM monitors the voltage level of this circuit and records a fault code if the voltage level indicates an open circuit or if there is a short circuit with the voltage source. This fault is ever set as inactive when the ignition key is turned on. If the fault condition occurs again while the ignition key is in the ON position, the fault code will be activated. Since active faults are set to inactive when the ignition key is turned on ("ON"), this fault and repair symptom diagram should be used to repair active and inactive faults. The possible causes of this failure are:

- Output terminals (+) or (-) of the EGR valve motor shorted with a voltage source in the engine harness or ECM

• An open circuit in the motor harness, connectors, motor or ECM. NOTE: **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.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch /

AMP / Metri-Pack female test lead. STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Read the fault codes.	**Fault code 2349 active?**	
STEP 2: Check the EGR valve circuit and motor.		
STEP 2A: Inspect the engine and EGR valve connector pins.	**Dirty or damaged pins?**	
STEP 2B: Check for a circuit open on the EGR valve motor.	**Less than 15 ohms?**	
STEP 3: Check the engine harness.		
STEP 3A: Inspect the pins of the engine harness and ECM connectors.	**Dirty or damaged pins?**	
STEP 3B: Check for a circuit open in the engine harness.	**Less than 10 ohms?**	
STEP 3C: Check for a short circuit pin to pin on the engine harness.	**More than 100k ohms?**	
STEP 3D: Check for a short circuit with a voltage source in the engine harness.	**Less than 1.5 VDC?**	
STEP 3E: Check for a security code failure inactive.	**Fault code 2349 inactive?**	
STEP 4: Clear the fault codes.		
STEP 4A: Disable the fault code.	**Fault code 2349 inactive?**	
STEP 4B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Read the fault codes. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an active fault code. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 2349 active? **YEA**	2A
	Fault code 2349 active? **NOT**	Fault Code Inactive or Intermittent, Procedure 019-362 .

STEP 2: Check the EGR valve circuit and motor.

STEP 2A: Inspect the engine and EGR valve connector pins.

Conditions:

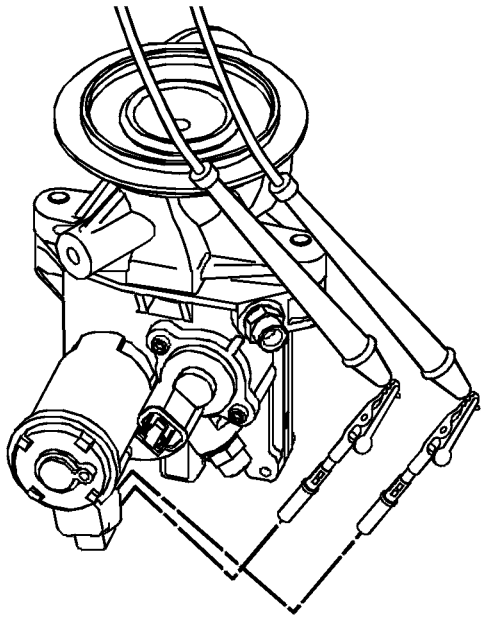
- Turn the ignition key off.
- Disconnect the engine from the EGR valve on the engine harness.

Action	Specifications / Repair	Next step
Check the pins of the motor harness connectors and the EGR valve motor for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins • Broken connector cover • Damage to the insulation of the wires or the harness • Damage to the connector locking tab. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-362 .	4A
	Dirty or damaged pins? **NOT**	2B

STEP 2B: Check for an open circuit in the EGR valve motor. Conditions:

- Turn the ignition key off.
- Disconnect the engine from the EGR valve on the engine harness.

Action	Specifications / Repair	Next step
Check for an open circuit in the EGR valve motor. • Measure the resistance between the EGR valve motor SIGN (+) pin and the EGR valve motor SIGN (-) pin, on the EGR valve motor connector. See Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	Less than 15 ohms? **YEA**	3A
	Less than 15 ohms? **DO NOT** **REPAIR:** Replace the EGR valve assembly. Refer to Procedure 011-022 in the ISBe, ISB and QSB5.9 (Common Rail Fuel System) Engine Troubleshooting and Repair Manual, Bulletin 3653336.	4A



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STEP 3: Check the engine harness.

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

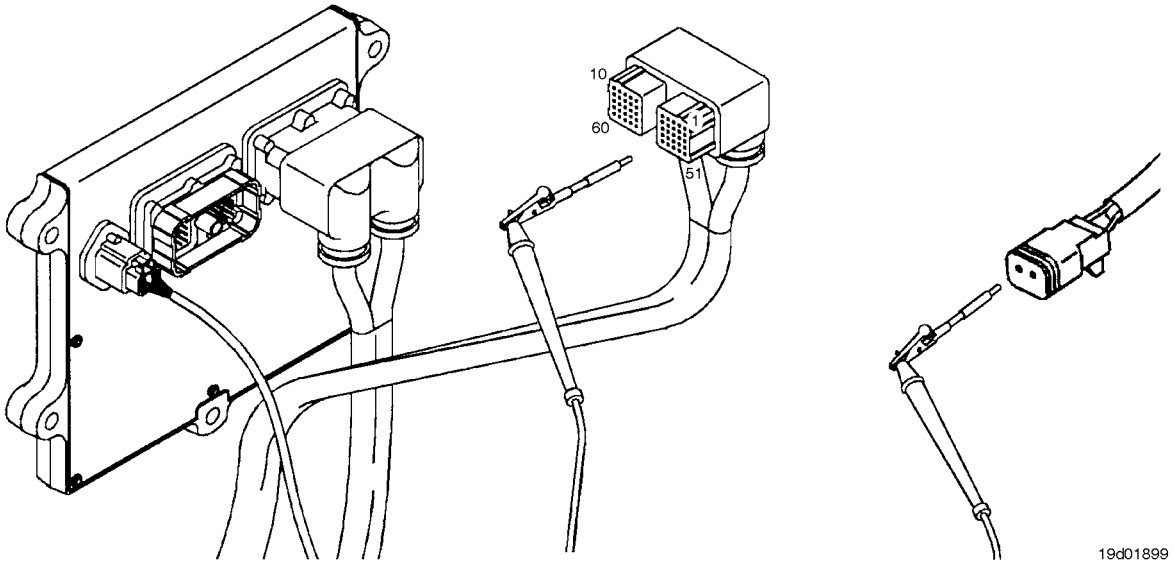
Conditions:
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.

Action	Specifications / Repair	Next step
Check the pins of the engine harness and ECM connectors for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins • Broken connector cover • Damage to the insulation of the wires or the harness • Damage to the connector locking tab. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-362 . Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible.	4A
	Dirty or damaged pins? **NOT**	3B

STEP 3B: Check the motor harness for an open circuit. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Disconnect the engine from the EGR valve on the engine harness.

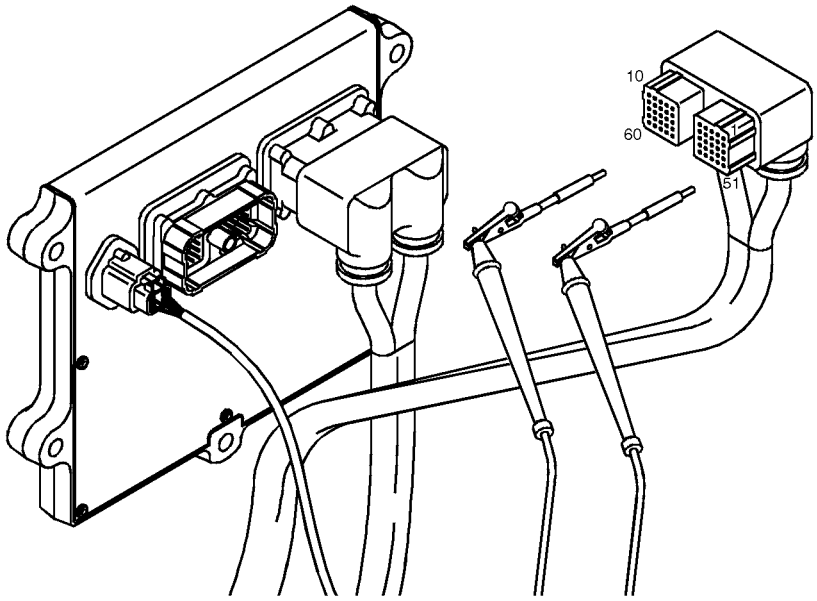
Action	Specifications / Repair	Next step
Check for an open circuit in the engine harness. • Measure the resistance between the EGR valve engine SIGN (+) pin, on the engine harness ECM connector, and the EGR valve SIGN (-) pin on the EGR valve engine engine connector motor. • Measure the resistance between the EGR valve engine SIGNAL pin (-), on the engine harness ECM connector, and the EGR valve engine SIGNAL pin (-), on the engine harness EGR valve connector motor. Refer to the circuit diagram or electrical diagram for the identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	Less than 10 ohms? **YEA**	3C
	Less than 10 ohms? **DO NOT** **REPAIR:** Repair or replace the engine harness. See the Procedure 019-043 .	4A



STEP 3C: Check for pin-to-pin short in the engine harness. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Disconnect the engine from the EGR valve on the engine harness.

Action	Specifications / Repair	Next step
Check for a short circuit between pins. • Measure the resistance between the EGR valve engine SIGN (+) pin on the engine harness ECM connector, and all other pins on the ECM connector. • Measure the resistance between the EGR valve's engine SIGN (-) pin, on the engine harness ECM connector, and all other pins on the ECM connector. Refer to the circuit diagram or electrical diagram for the identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YEA**	3D
	More than 100k ohms? **DO NOT** **REPAIR:** Repair or replace the engine harness. See the Procedure 019-043 .	4A



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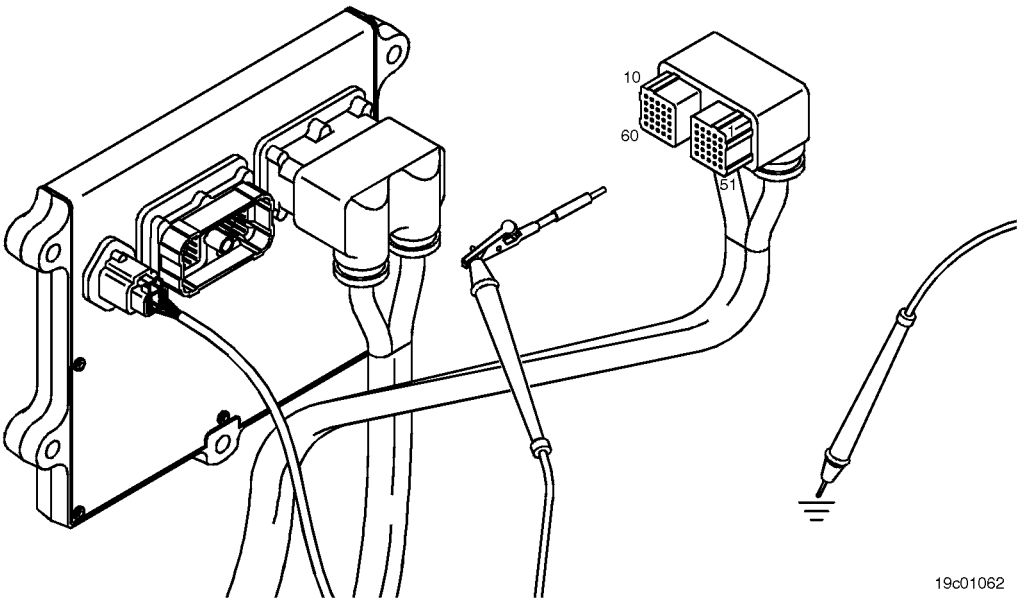
STEP 3D: Check the motor harness for a short circuit with a voltage source. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Connect the engine to the engine harness EGR valve.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check the motor harness for a short circuit with a voltage source. • Measure the voltage between the EGR valve engine SIGN (+) pin, on the engine harness ECM connector, and the engine block ground. • Measure the resistance between the EGR valve engine SIGN (-) pin, on the engine harness ECM connector, and the engine block ground. Refer to the circuit diagram or electrical diagram for the identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 . Refer to the "Using the Multimeter" publication, Procedure 019-359 .	Less than 1.5 VDC? **YEA**	3E
	Less than 1.5 VDC? **DO NOT** **REPAIR:** Repair or replace the engine harness. See the Procedure 019-043 .	4A



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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 2349 inactive? **YES** **Repair:** None. Did removing and installing the connector correct the failure?	4A
	Fault code 2349 inactive? **DO NOT** **REPAIR:** Call for pre-authorization. Replace the electronic engine control module. See the Procedure 019-031 .	4A

STEP 4: Clear the fault codes.

STEP 4A: Disable the fault code. Conditions:

- Connect all components.
- Connect the electronic service tool INSITE ™.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Using the electronic service tool INSITE ™, make sure that the fault code is inactive.	Fault code 2349 inactive? **YEA**	4B
	Fault code 2349 inactive? **NOT**	1A

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

- Connect all components.
- Connect the electronic service tool INSITE ™.
- Turn the ignition key ON.

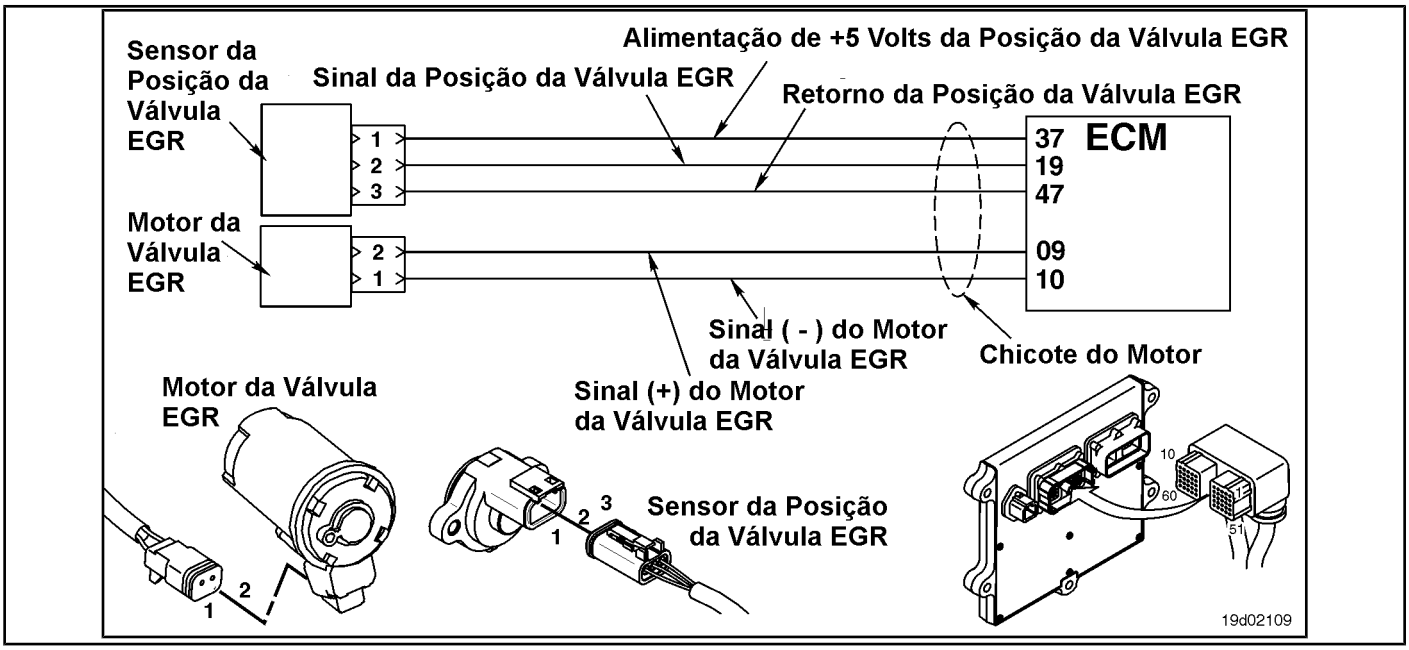
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **NOT**	Proper troubleshooting and repair steps

Fault Code 2351

EGR Valve Control Circuit - Voltage Below Normal or Low Voltage

CODES	REASON	IT IS MADE
Fault Code: 2351 PID (P), SID (S): S146 IMF: 4/4 Lamp: Amber SRT:	EGR Valve Control Circuit - Voltage Below Normal or Low Voltage. Low voltage detected in the EGR valve motor circuit.	Possible loss of power. Power removed from the EGR valve motor.

EGR Valve Control Circuit



Circuit Descriptions:

The electronic control module (ECM) controls the EGR valve, opening and closing it based on the various operating conditions. The EGR valve is opened and closed by a DC motor that receives voltage from the ECM in the (+) and (-) signal circuits of the EGR valve motor. To open the valve, the motor receives voltage in the (+) signal circuit of the EGR valve motor. To close the valve, the motor receives voltage in the signal circuit (-) of the EGR valve motor.

Component Location:

The EGR valve engine is located on the exhaust side of the engine and is coupled to the EGR valve assembly, which is mounted on the exhaust manifold. See the Procedure 100-002 for the detailed location of each component.

Workshop Tips:

The ECM monitors the circuit voltage and records a fault code if the voltage level indicates a short with the ground. This fault is always set to inactive when the ignition key is turned on. If this circuit fails, the fault code **not** will be set to active until the valve has been actuated. For these reasons, this fault diagnosis diagram **must** be used for active and inactive fault codes. This also means that

only way to make sure the repair is efficient is to run the INSITE ™ EGR Valve Test. Only running the engine can **not** be sufficient to ensure that the repair is efficient.

A possible cause of this failure is a short with the ground of the EGR valve motor output terminals (+ or -) in the harness, in the EGR valve motor or in the ECM.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch /

AMP / Metri-Pack female test lead. STEPS

		SPECIFICATIONS	SRT CODE
STEP 1: Check the EGR valve circuit and motor.			
STEP 1A:	**Inspect the engine and EGR valve connector pins.**	**Dirty or damaged pins?**	
STEP 1B: Check that the valve motor	**EGR has a short circuit with the ground.**	**More than 100k ohms?**	
STEP 2: Check the engine harness.			
STEP 2A:	**Inspect the pins of the engine harness and ECM connectors.**	**Dirty or damaged pins?**	
STEP 2B: Check for a short circuit	**with the mass in the engine harness.**	**More than 100k ohms?**	
STEP 2C: Check for a short circuit	**pin to pin on the engine harness.**	**More than 100k ohms?**	
STEP 2D: Check for a passcode	**failure inactive.**	**Fault code 2351 inactive?**	
STEP 3: Clear the fault codes.			
STEP 3A: Disable the fault code.		**Fault code 2351 inactive?**	
STEP 3B: Clear the fault codes	**inactive.**	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the EGR valve circuit and motor.

STEP 1A: Inspect the engine and EGR valve connector pins.

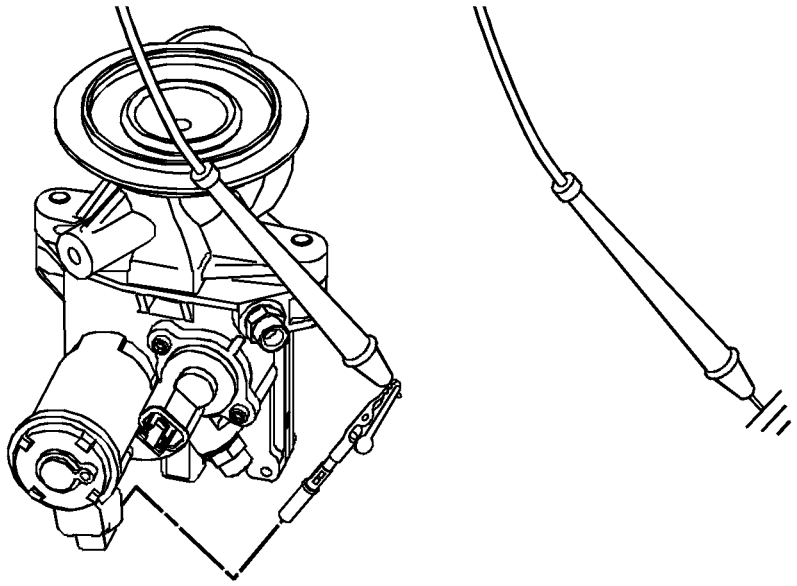
Conditions:
- Turn the ignition key off.
- Disconnect the engine from the EGR valve on the engine harness.

Action	Specifications / Repair	Next step
Check the pins of the motor harness connectors and the EGR valve motor for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins • Broken connector cover • Damage to the insulation of the wires or the harness • Damage to the connector locking tab. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible.	3A
	Dirty or damaged pins? **NOT**	1B

STEP 1B: Check if the motor of the EGR valve has a short to ground. Conditions:

- Turn the ignition key off.
- Disconnect the engine from the EGR valve on the engine harness.

Action	Specifications / Repair	Next step
Check if the EGR valve motor has a short circuit with the ground. • Measure the resistance between the EGR valve engine signal pin (+) and the engine block ground. • Measure the resistance between the EGR valve engine signal pin (-) and the engine block ground. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YEA**	2A
	More than 100k ohms? **DO NOT** **REPAIR:** Replace the EGR valve assembly. Refer to Procedure 011-022 in the ISBe, ISB and QSB5.9 (Common Rail Fuel System) Engine Troubleshooting and Repair Manual, Bulletin 3653336.	3A



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STEP 2: Check the engine harness.

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

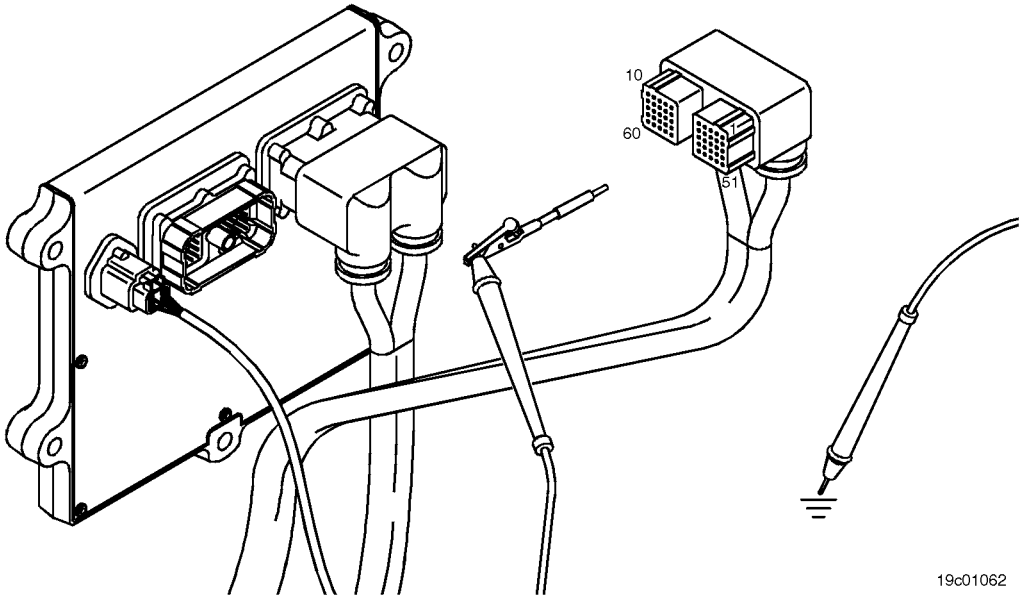
Conditions:
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.

Action	Specifications / Repair	Next step
Check the pins of the engine harness and ECM connectors for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins • Broken connector cover • Damage to the insulation of the wires or the harness • Damage to the connector locking tab. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-362 .	3A
	Dirty or damaged pins? **NOT**	2B

STEP 2B: Check the motor harness for a short circuit with ground. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Disconnect the engine from the EGR valve on the engine harness.

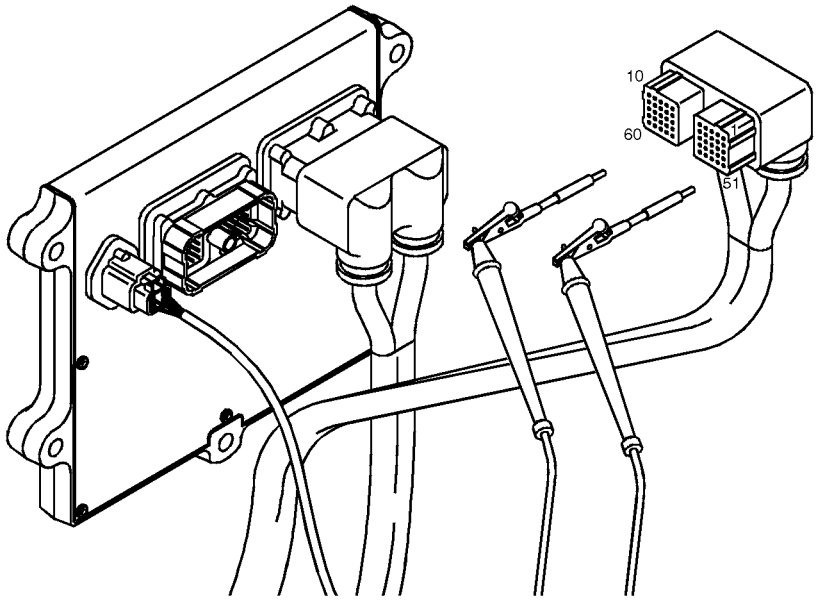
Action	Specifications / Repair	Next step
Check for a short circuit with the ground in the engine harness. • Measure the resistance between the EGR valve engine SIGN (+) pin, on the engine harness ECM connector, and the engine block ground. • Measure the resistance between the EGR valve engine SIGN (-) pin, on the engine harness ECM connector, and the engine block ground. Refer to the circuit diagram or electrical diagram for the identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YEA**	2C
	More than 100k ohms? **DO NOT** **REPAIR:** Repair or replace the engine harness. See the Procedure 019-043 .	3A



STEP 2C: Check for pin-to-pin short in the engine harness. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Disconnect the engine from the EGR valve on the engine harness.

Action	Specifications / Repair	Next step
Check for a short circuit between pins. • Measure the resistance between the EGR valve engine SIGN (+) pin on the engine harness ECM connector, and all other pins on the ECM connector. • Measure the resistance between the EGR valve's engine SIGN (-) pin, on the engine harness ECM connector, and all other pins on the ECM connector. Refer to the circuit diagram or electrical diagram for the identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YEA**	2D
	More than 100k ohms? **DO NOT** **REPAIR:** Repair or replace the engine harness. See the Procedure 019-043 .	3A



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STEP 2D: Check for an inactive fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 2351 inactive? **YES** **Repair:** None. Did removing and installing the connector correct the failure?	3A
	Fault code 2351 inactive? **DO NOT** **REPAIR:** Call for pre-authorization. Replace the electronic engine control module. See the Procedure 019-031 .	3A

STEP 3: Clear the fault codes.

STEP 3A: Disable the fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.
- Engine coolant temperature above 82 ° C [180 ° F].
- Motor **not** working.

Action	Specifications / Repair	Next step
Disable the fault code. Test the EGR Valve of the INSITE ™ electronic service tool. NOTE: Be sure to command the valve to "open" and "close". NOTE: Only run the engine to make sure the repair was **efficient not** it is enough. The EGR Valve Test **must** be carried out to ensure that the repair was efficient. • Using the electronic service tool INSITE ™, make sure that the fault code is inactive.	Fault code 2351 inactive? **YEA**	3B
	Fault code 2351 inactive? **NOT**	1A

STEP 3B: Clear the inactive fault codes. Conditions:

- Connect all components.
- Connect the electronic service tool INSITE ™.
- Turn the ignition key ON.

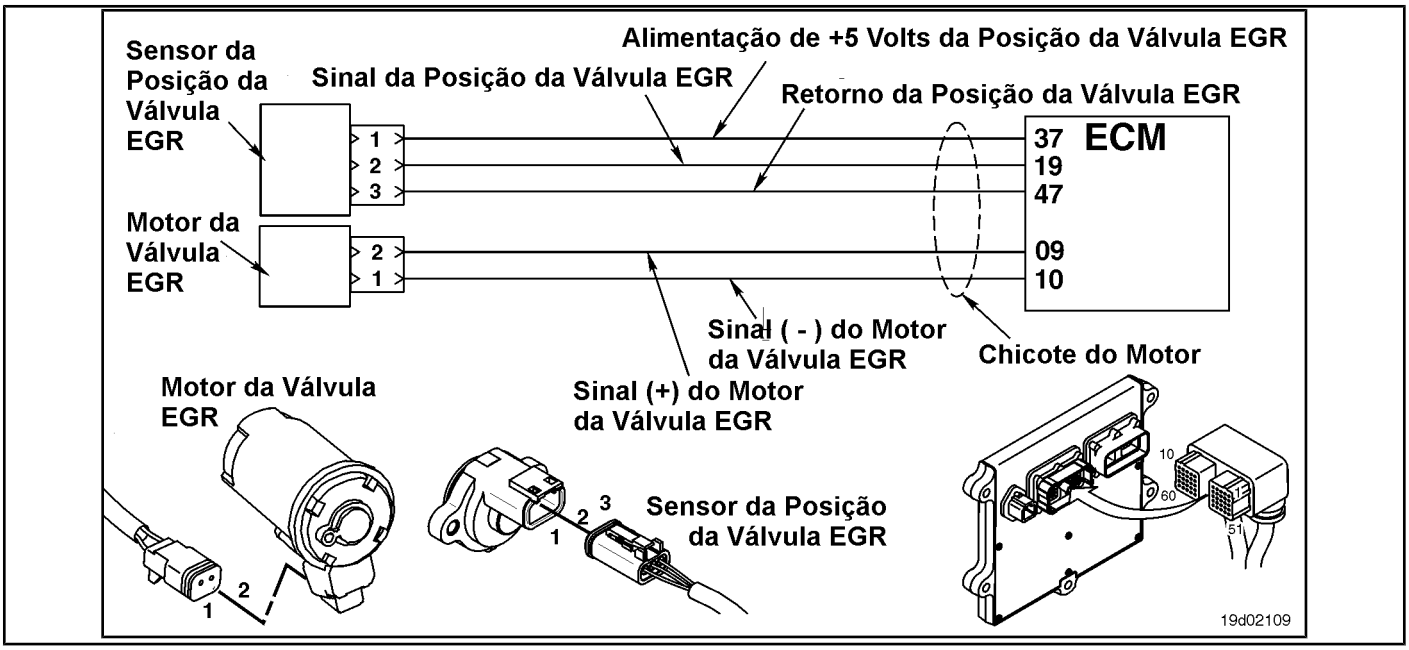
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **NOT**	Proper troubleshooting and repair steps

Fault Code 2352

EGR Valve Control Circuit - Voltage Above Normal or High Voltage

CODES	REASON	IT IS MADE
Fault Code: 2352 PID (P), SID (S): S146 IMF: 3/3 Lamp: Amber SRT:	EGR Valve Control Circuit - Voltage Above Normal or with High Voltage. High voltage detected in the EGR valve motor circuit.	Possible loss of power. The power will be removed from the EGR valve motor.

EGR Valve Control Circuit



Circuit Descriptions:

The electronic control module (ECM) controls the EGR valve, opening and closing it based on the various operating conditions. The EGR valve is opened and closed by a DC motor that receives voltage from the ECM in the (+) and (-) signal circuits of the EGR valve motor. To open the valve, the motor receives voltage in the (+) signal circuit of the EGR valve motor. To close the valve, the motor receives voltage in the signal circuit (-) of the EGR valve motor.

Component Location:

The EGR valve engine is located on the exhaust side of the engine and is coupled to the EGR valve assembly, which is mounted on the exhaust manifold. See the Procedure 100-002 for the detailed location of each component.

Workshop Tips:

The ECM monitors the circuit voltage and records a fault code if the voltage level indicates a short with the ground. This fault is **ever** set as inactive when the ignition key is turned on. If this circuit fails, the fault code **not** will be set to active until the valve has been actuated. For these reasons, this fault diagnosis diagram **must** be used for active and inactive fault codes. This also means that

only way to make sure the repair is efficient is to perform the EGR Valve Test of the INSITE ™ electronic service tool. Only running the engine can **not** be sufficient to ensure that the repair is efficient.

A possible cause of this failure is a short of the terminals (+ or -) of the EGR valve motor with a voltage source in the harness or in the ECM.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch /

AMP / Metri-Pack female test lead. STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check the engine harness.		
STEP 1A: Inspect the pins of the engine harness and ECM connectors.	**Dirty or damaged pins?**	
STEP 1B: Check for a short circuit with a voltage source.	**Less than 1.5 VDC?**	
STEP 1C: Check for a short circuit pin to pin on the engine harness.	**More than 100k ohms?**	
STEP 1D: Check for a passcode failure inactive.	**Fault code 2352 inactive?**	
STEP 2: Clear the fault codes.		
STEP 2A: Disable the fault code.	**Fault code 2352 inactive?**	
STEP 2B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the engine harness.

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

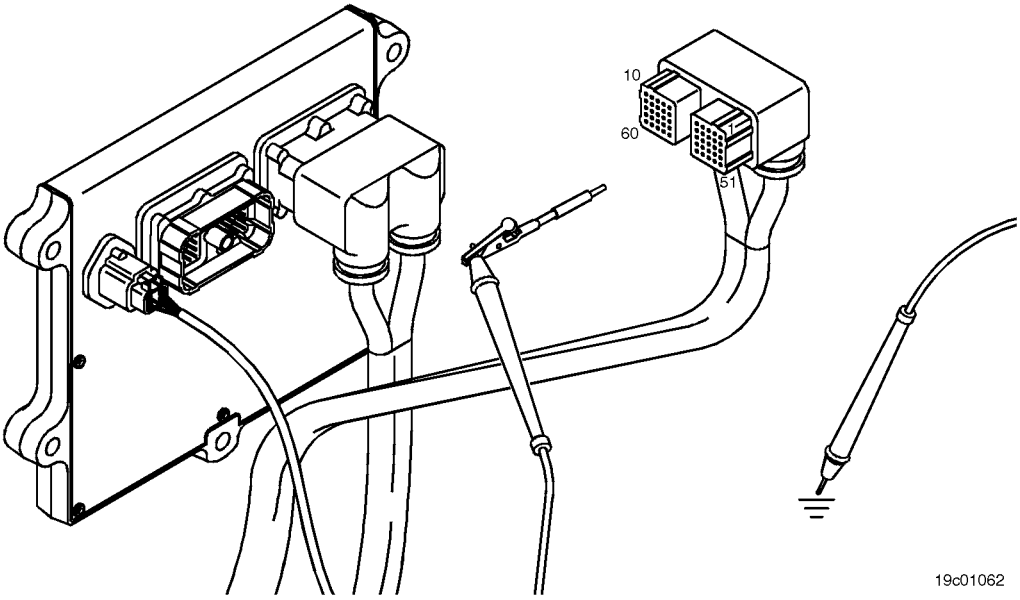
Conditions:
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.

Action	Specifications / Repair	Next step
Check the pins of the engine harness and ECM connectors for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins • Broken connector cover • Damage to the insulation of the wires or the harness • Damage to the connector locking tab. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-362 .	2A
	Dirty or damaged pins? **NOT**	1B

STEP 1B: Check for a short circuit with a voltage source. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Connect the engine to the engine harness EGR valve.
- Turn the ignition key ON.

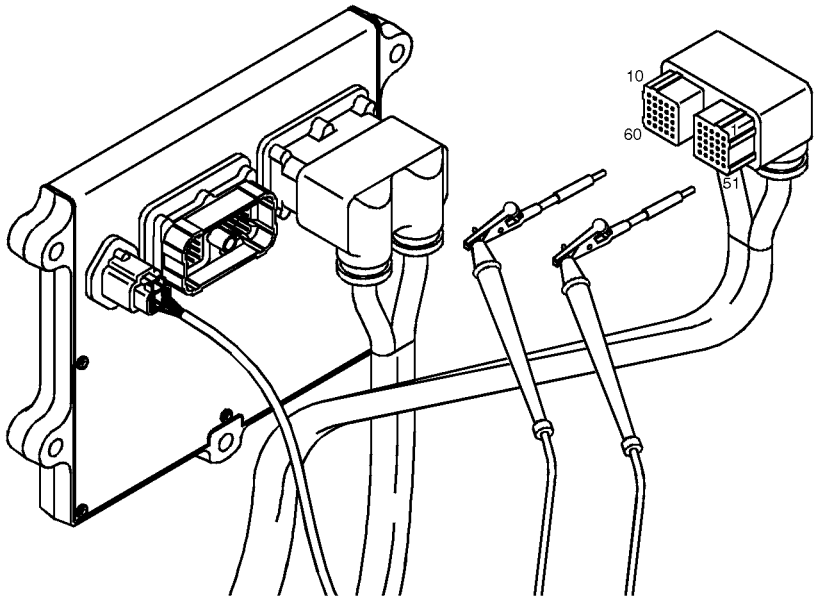
Action	Specifications / Repair	Next step
Check for a short circuit with a voltage source. • Measure the voltage between the EGR valve engine SIGN (+) pin, on the ECM connector, on the engine harness, and the engine block ground. • Measure the resistance between the EGR valve engine SIGN (-) pin, on the engine harness ECM connector, and the engine block ground. Refer to the circuit diagram or electrical diagram for the identification of the connector pins. Refer to the circuit diagram or electrical diagram for the identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 . Refer to the "Using the Multimeter" publication, Procedure 019-359 .	Less than 1.5 VDC? **YEA**	1C
	Less than 1.5 VDC? **DO NOT** **REPAIR:** Repair or replace the engine harness. See the Procedure 019-043 .	2A



STEP 1C: Check for pin-to-pin short in the engine harness. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Disconnect the engine from the EGR valve on the engine harness.

Action	Specifications / Repair	Next step
Check for a short circuit between pins. • Measure the resistance between the EGR valve engine SIGN (+) pin on the engine harness ECM connector, and all other pins on the ECM connector. • Measure the resistance between the EGR valve's engine SIGN (-) pin, on the engine harness ECM connector, and all other pins on the ECM connector. Refer to the circuit diagram or electrical diagram for the identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YEA**	1D
	More than 100k ohms? **DO NOT** **REPAIR:** Repair or replace the engine harness. See the Procedure 019-043 .	2A



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STEP 1D: Check for an inactive fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 2352 inactive? **YES** **Repair:** None. Did removing and installing the connector correct the failure?	2A
	Fault code 2352 inactive? **DO NOT** **REPAIR:** Call for pre-authorization. Replace the electronic engine control module. See the Procedure 019-031 .	2A

STEP 2: Clear the fault codes.

STEP 2A: Disable the fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.
- Engine coolant temperature above 82 ° C [180 ° F].
- Motor **not** working.

Action	Specifications / Repair	Next step
Disable the fault code. Test the EGR Valve of the INSITE ™ electronic service tool. NOTE: Be sure to command the valve to "open" and "close". NOTE: Only run the engine to make sure the repair was efficient **not** it is enough. The EGR Valve Test **must** be carried out to ensure that the repair was efficient. • Test the EGR Valve of the INSITE ™ electronic service tool. • Using the electronic service tool INSITE ™, make sure that the fault code is inactive.	Fault code 2352 inactive? **YEA**	2B
	Fault code 2352 inactive? **NOT**	1A

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

- Connect all components.
- Connect the electronic service tool INSITE ™.
- Turn the ignition key ON.

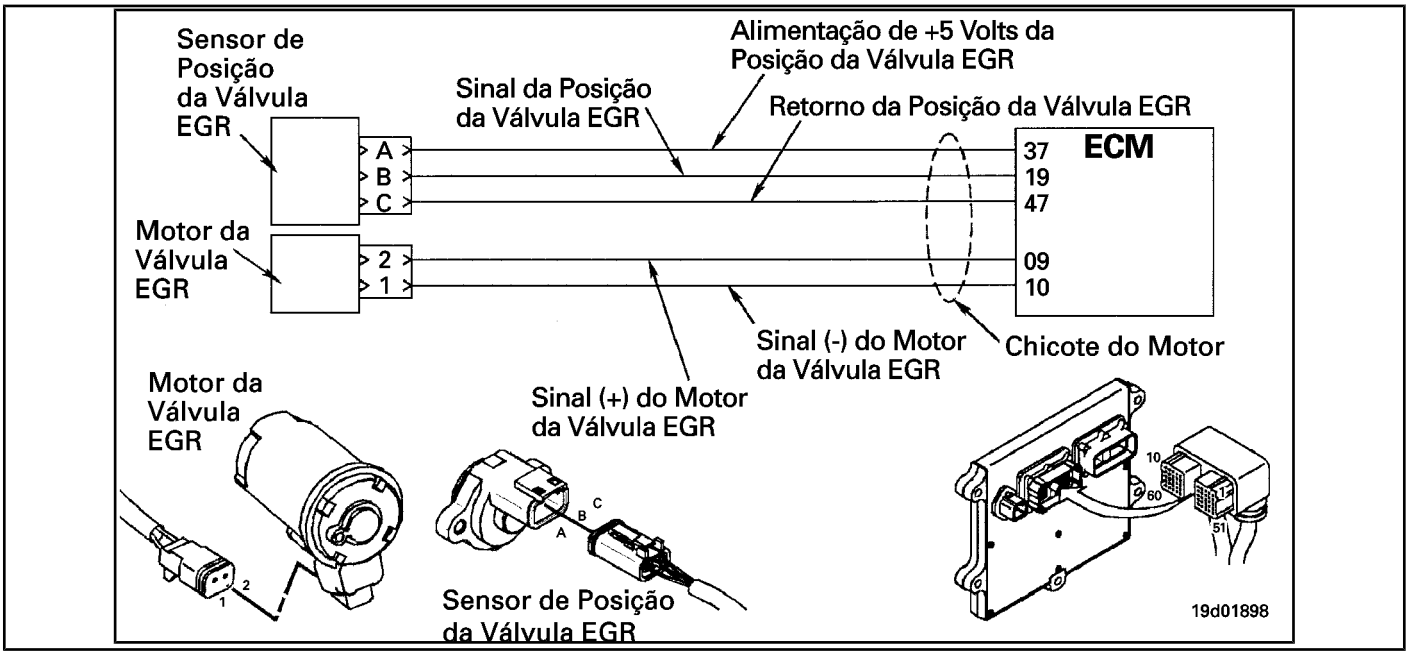
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **NOT**	Proper troubleshooting and repair steps

Fault Code 2353

EGR Valve Control Circuit - Current Above Normal or Grounded Circuit

CODES	REASON	IT IS MADE
Fault Code: 2353 PID (P), SID (S): S146 IMF: 6/6 Lamp: Amber SRT:	Exhaust gas recirculation valve (EGR) control circuit - current above normal or grounded circuit. Excess current detected in the EGR valve motor output circuit.	Possible loss of power. The power will be removed from the EGR valve motor.

EGR Valve Motor Output Circuit



Circuit Descriptions:

The electronic control module (ECM) controls the EGR valve, opening and closing it based on the various operating conditions. The EGR valve is opened and closed by a DC motor that receives voltage from the ECM in the (+) and (-) signal circuits of the EGR valve motor. To open the valve, the motor receives voltage in the (+) signal circuit of the EGR valve motor. To close the valve, the motor receives voltage in the signal circuit (-) of the EGR valve motor.

Component Location:

The EGR valve engine is located on the exhaust side of the engine and is coupled to the EGR valve assembly, which is mounted on the exhaust manifold. See the Procedure 100-002 for a detailed view of each component.

Workshop Tips:

The ECM monitors the current level in this circuit. If the ECM detects excess current during a calibrated period of time, it logs this failure. The possible causes of this failure are:

- Terminals (+) or (-) of the EGR valve motor shorted in the engine harness, EGR valve motor or ECM
- Low internal resistance in the EGR valve motor.

SUMMARY OF FAULT DIAGNOSTICS

⚠PRECAUTION ⚠

To reduce the possibility of damage to the pins and the harness, use the following test cable when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test cable STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check for a passcode active fault.	**Fault code 2353 active?**	
STEP 2: Check the EGR valve circuit and motor.		
STEP 2A: Inspect the pins of the EGR valve motor connectors and the motor harness.	**Dirty or damaged pins?**	
STEP 2B: Check the resistance of the motor of the EGR valve.	**More than 0.5 ohms?**	
STEP 3: Check the engine harness.		
STEP 3A: Check for a short circuit in the engine harness.	**More than 100k ohms?**	
STEP 4: Check the EGR valve assembly.		
STEP 4A: Test the EGR Valve of electronic INSITE ™ service tool.	**The position of the EGR valve is 100 Percent when open?**	
STEP 4B: Test the EGR Valve of electronic INSITE ™ service tool.	**The position of the EGR valve is less than 10 Percent when closed?**	
STEP 5: Clear the fault codes.		
STEP 5A: Disable the fault code.	**Fault code 2353 inactive?**	
STEP 5B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Check for an active fault code. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an active fault code. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 2353 active? **YEA**	2A
	Fault code 2353 active? **NOT**	Fault Code Inactive or Intermittent, Procedure 019-362

STEP 2: Check the EGR valve circuit and motor.

STEP 2A: Inspect the pins of the EGR valve motor connectors and the motor harness.

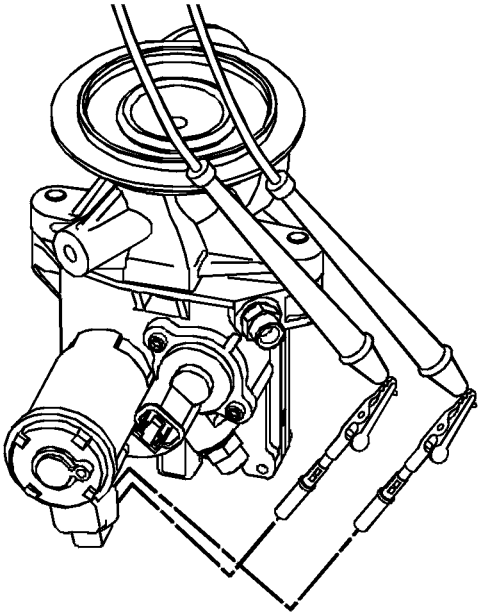
Conditions:
- Turn the ignition key off.
- Disconnect the EGR valve motor from the engine harness.

Action	Specifications / Repair	Next step
Check that the engine harness and the valve engine connector pins have: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins • Broken connector cover • Damage to the insulation of the wires or the harness • Damage to the connector locking tab. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-362 .	5A
	Dirty or damaged pins? **NOT**	2B

STEP 2B: Check the motor resistance of the EGR valve. Conditions:

- Turn the ignition key off.
- Disconnect the EGR valve motor from the engine harness.
- Make sure that the multimeter is calibrated to zero before measuring resistance.

Action	Specifications / Repair	Next step
Check the resistance of the EGR valve motor. • Measure the resistance between the EGR valve motor SIGN (+) pin and the EGR valve motor SIGN (-) pin, on the EGR valve motor connector. Refer to the circuit diagram or electrical diagram for the identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 0.5 ohms? **YEA**	3A
	More than 0.5 ohms? **DO NOT** **REPAIR:** Replace the EGR valve assembly. Refer to Procedure 011-002 in the ISB Series Engine Troubleshooting and Repair Manual and and ISB (Common Rail Fuel System), Bulletin 3653336.	5A



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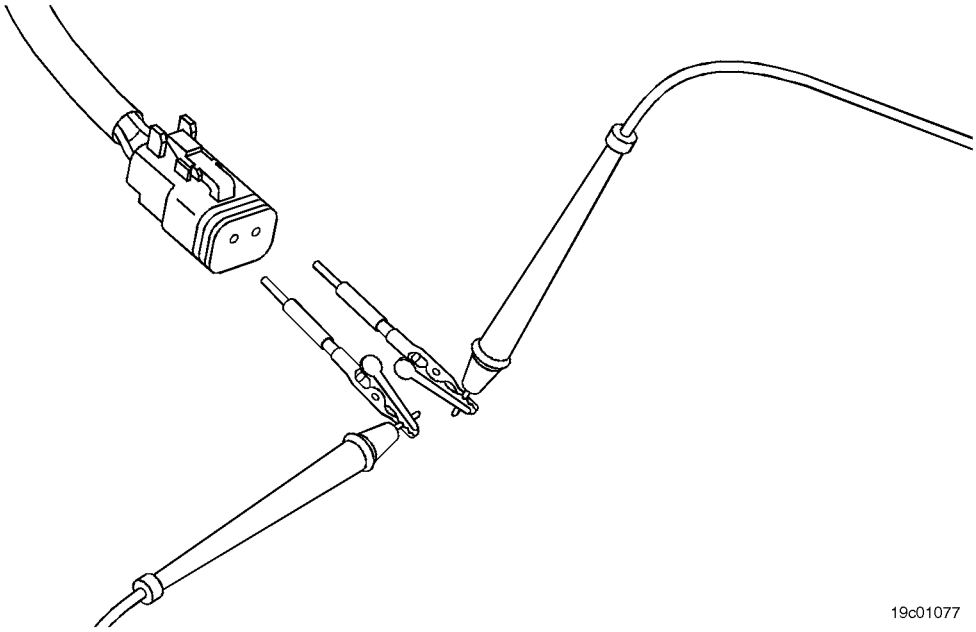
STEP 3: Check the engine harness.

STEP 3A: Check the motor harness for a short circuit. Conditions:

- Turn the ignition key off.
- Disconnect the EGR valve motor from the engine harness.
- Disconnect the engine harness from the ECM.

Action	Specifications / Repair	Next step
Check the motor harness for a short circuit. • Measure the resistance between the EGR valve engine SIGN (+) pin and the EGR valve engine SIGN (-) pin, on the engine harness EGR valve connector. Refer to the circuit diagram or electrical diagram for the identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YEA**	4A
	More than 100k ohms? **DO NOT** **REPAIR:** Repair or replace the engine harness. See the Procedure 019-043 . See Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	5A



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STEP 4: Check the EGR valve assembly.

STEP 4A: Test the EGR Valve of the INSITE ™ electronic service tool. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.
- Engine coolant temperature of at least 82 ° C [180 ° F].

Action	Specifications / Repair	Next step
Test the EGR Valve of the INSITE ™ electronic service tool. • Open the EGR valve.	The position of the EGR valve is 100 Percent when open? **YEA**	4B
	The position of the EGR valve is 100 Percent when open? **DO NOT** **REPAIR:** Replace the EGR valve assembly. Refer to Procedure 011-022 in the ISBe, ISB and QSB5.9 (Common Rail Fuel System) Engine Troubleshooting and Repair Manual, Bulletin 3653336.	5A

STEP 4B: Test the EGR Valve of the INSITE ™ electronic service tool. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.
- Engine coolant temperature of at least 82 ° C [180 ° F].

Action	Specifications / Repair	Next step
Test the EGR Valve of the INSITE ™ electronic service tool. • Close the EGR valve.	The position of the EGR valve is less than 10 Percent when closed? **YEA**	5A
	The position of the EGR valve is less than 10 Percent when closed? **DO NOT** **REPAIR:** Replace the EGR valve assembly. Refer to Procedure 011-022 in the ISBe, ISB and QSB5.9 (Common Rail Fuel System) Engine Troubleshooting and Repair Manual, Bulletin 3653336.	5A

STEP 5: Clear the fault codes.

STEP 5A: Disable the fault code. Conditions:

- Connect all components.
- Connect the electronic service tool INSITE ™.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Using the electronic service tool INSITE ™, make sure that the fault code is inactive.	Fault code 2353 inactive? **YEA**	5B
	Fault code 2353 inactive? **DO NOT** **REPAIR:** Return to the troubleshooting steps or consult your local Cummins Authorized Service Station after checking and completing all diagnostic steps again.	1A

STEP 5B: Clear the inactive fault codes. Conditions:

- Connect all components.
- Connect the electronic service tool INSITE ™.
- Turn the ignition key ON.

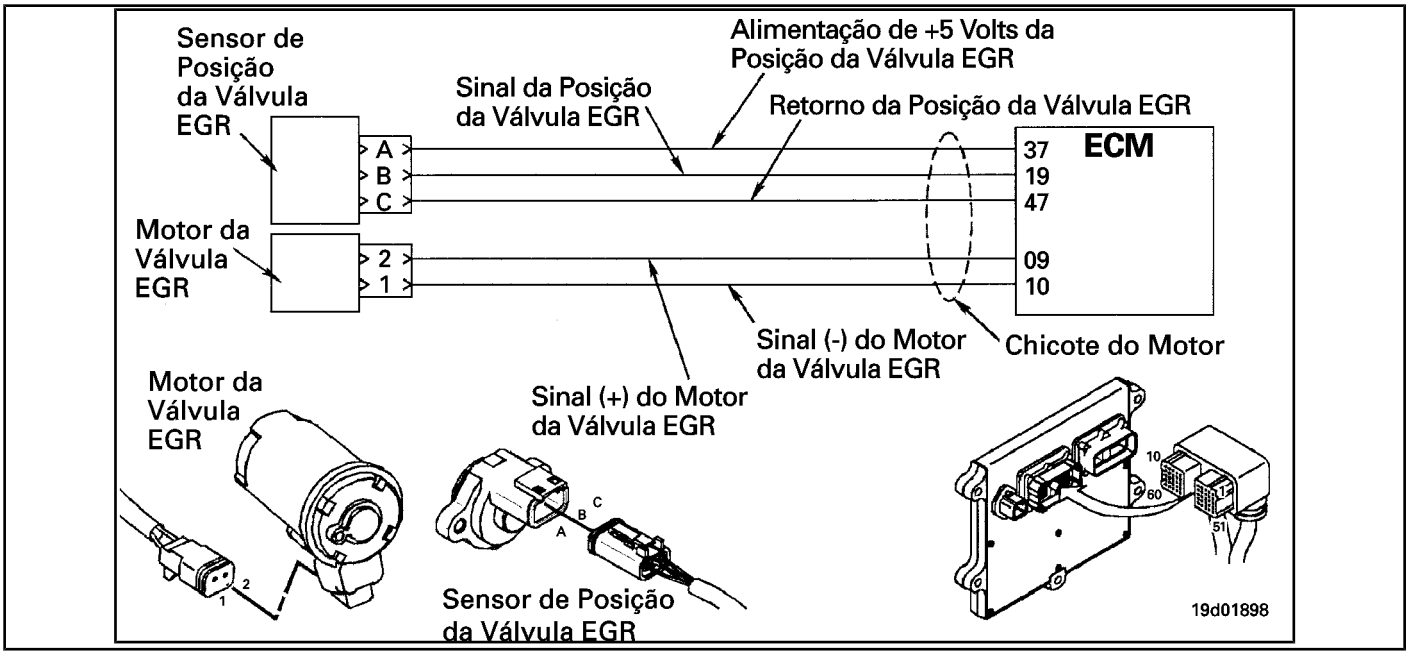
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **DO NOT** **REPAIR:** Troubleshoot any other active fault code.	Proper troubleshooting and repair steps

Fault Code 2357

EGR Valve Control - Mechanical System Does Not Respond Correctly or Outside Adjustment

CODES	REASON	IT IS MADE
Fault Code: 2357 PID (P), SID (S): S146 IMF: 7/7 Lamp: Amber SRT:	Control of the Exhaust Gas Recirculation Valve (EGR) - Mechanical System **Not** Responds Correctly or Out of Fit. The EGR valve motor **not** respond or delay to respond.	Possible loss of power. The power will be removed from the EGR valve motor.

EGR Valve Control Circuit



Circuit Descriptions:

The electronic control module (ECM) controls the EGR valve, opening and closing it based on the various operating conditions. The EGR valve is opened and closed by a DC motor that receives voltage from the ECM in the (+) signal circuit of the EGR valve motor. To open the valve, the motor receives voltage in the (+) signal circuit of the EGR valve motor. To close the valve, the motor receives voltage in the signal circuit (-) of the EGR valve motor.

Component Location:

The EGR valve engine is located on the exhaust side of the engine and is coupled to the EGR valve assembly, which is mounted on the exhaust manifold. See the Procedure 100-002 for the detailed location of each component.

Workshop Tips:

The ECM monitors the valve's duty cycle and records a fault code if the duty cycle is too high. This fault is **ever** set as inactive when the ignition key is turned on. If there is a fault, the fault code
not will be set to active until the valve has been actuated. For these reasons, this fault diagnosis diagram **must** be used for active and inactive fault codes. This also means that **only** way of

ensuring that the repair is efficient is to perform the INSITE ™ EGR Valve Test. Only running the engine can **not** be sufficient to ensure that the repair is efficient. The possible causes of this failure are:

- Defect in the EGR valve position sensor; mechanical or electrical failure
- The EGR valve assembly failed to require a high current to drive the valve, such as a stuck or stuck valve.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following test cable when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test cable STEPS

		SPECIFICATIONS	SRT CODE
STEP 1: Check the engine harness.			
STEP 1A:	Inspect the pins of the engine harness and ECM connectors.	Dirty or damaged pins?	
STEP 1B:	Check for a short circuit on the EGR valve position sensor signal.	More than 100k ohms?	
STEP 2: Check the ECM.			
STEP 2A:	Check the signal voltage of the EGR valve position sensor.	Less than 0.1 VDC?	
STEP 3: Check the EGR valve assembly.			
STEP 3A:	Test the EGR Valve of electronic INSITE ™ service tool.	The position of the EGR valve is 100 Percent when open?	
STEP 3B:	Test the EGR Valve of electronic INSITE ™ service tool.	The position of the EGR valve is less than 10 Percent when closed?	
STEP 4: Clear the fault codes.			
STEP 4A:	Disable the fault code.	Fault code 2357 inactive?	
STEP 4B:	Clear the fault codes inactive.	All codes cleared?	

FAULT DIAGNOSTIC STEP

STEP 1: Check the engine harness.

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

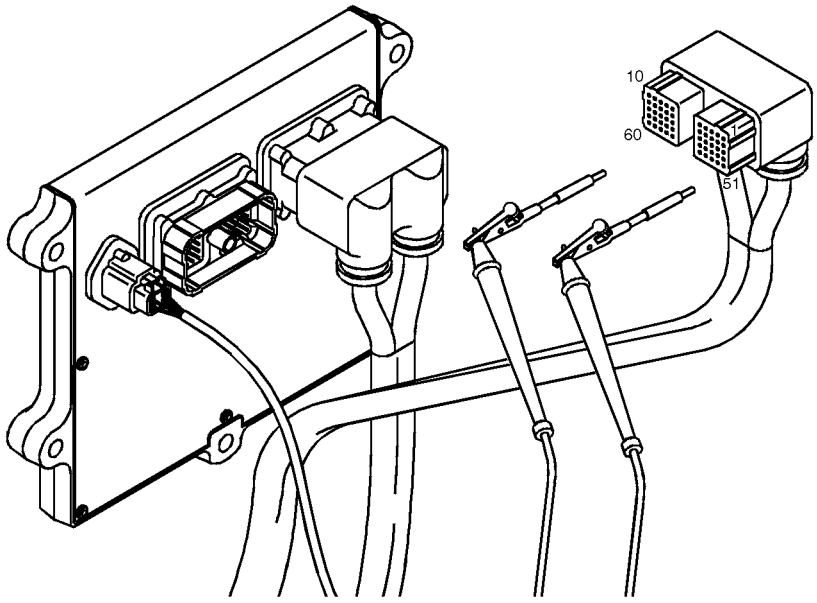
Conditions:
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.

Action	Specifications / Repair	Next step
Check the pins of the engine harness and ECM connectors for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins • Broken connector cover • Damage to the insulation of the wires or the harness • Damage to the connector locking tab. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	3A
	Dirty or damaged pins? **NOT**	1B

STEP 1B: Check for a short circuit in the EGR valve position sensor signal. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Disconnect the EGR valve position sensor from the engine harness.

Action	Specifications / Repair	Next step
Check the motor harness for a short circuit. • Measure the resistance between the EGR valve position SIGN pin on the engine harness ECM connector, and all other connector pins. Refer to the circuit diagram or electrical diagram for the identification of the connector pins. See Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YEA**	2A
	More than 100k ohms? **DO NOT** **REPAIR:** Repair or replace the engine harness. See the Procedure 019-043 .	3A



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STEP 2: Check the ECM.

STEP 2A: Check the signal voltage of the EGR valve position sensor. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Turn the ignition key ON.
- Connect the INSITE ™ electronic service tool to the SAE J1939 or SAE J1587 datalink connector.

Action	Specifications / Repair	Next step
Using the INSITE ™ Monitor / Data Logger, check the signal voltage of the EGR valve position sensor.	Less than 0.1 VDC? **YEA**	3A
	Less than 0.1 VDC? **DO NOT** **REPAIR:** Replace the ECM. Call for pre-authorization. See the Procedure 019-031 .	3A

STEP 3: Check the EGR valve assembly.

STEP 3A: Test the EGR Valve of the INSITE ™ electronic service tool. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.
- Engine coolant temperature above 82 ° C [180 ° F].
- Motor **not** working.

Action	Specifications / Repair	Next step
Test the EGR Valve of the INSITE ™ electronic service tool. • Open the EGR valve.	The position of the EGR valve is 100 Percent when open? **YEA**	3B
	The position of the EGR valve is 100 Percent when open? **DO NOT** **REPAIR:** Replace the EGR valve assembly. Refer to Procedure 011-022 in the ISBe, ISB and QSB5.9 (Common Rail Fuel System) Engine Troubleshooting and Repair Manual, Bulletin 3653336.	4A

STEP 3B: Test the EGR Valve of the INSITE ™ electronic service tool. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.
- Engine coolant temperature above 82 ° C [180 ° F].
- Motor **not** working.

Action	Specifications / Repair	Next step
Test the EGR Valve of the INSITE ™ electronic service tool. • Close the EGR valve.	The position of the EGR valve is less than 10 Percent when closed? **YEA**	4A
	The position of the EGR valve is less than 10 Percent when closed? **DO NOT** **REPAIR:** Replace the EGR valve assembly. Refer to Procedure 011-022 in the ISBe, ISB and QSB5.9 (Common Rail Fuel System) Engine Troubleshooting and Repair Manual, Bulletin 3653336.	4A

STEP 4: Clear the fault codes.

STEP 4A: Disable the fault code. Conditions:

- Connect all components.
- Connect the electronic service tool INSITE ™.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Using the electronic service tool INSITE ™, make sure that the fault code is inactive.	Fault code 2357 inactive? **YEA**	4B
	Fault code 2357 inactive? **DO NOT** **REPAIR:** Return to the troubleshooting steps or consult your local Cummins Authorized Service Station after checking and completing all diagnostic steps again.	1A

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

- Connect all components.
- Connect the electronic service tool INSITE ™.
- Turn the ignition key ON.

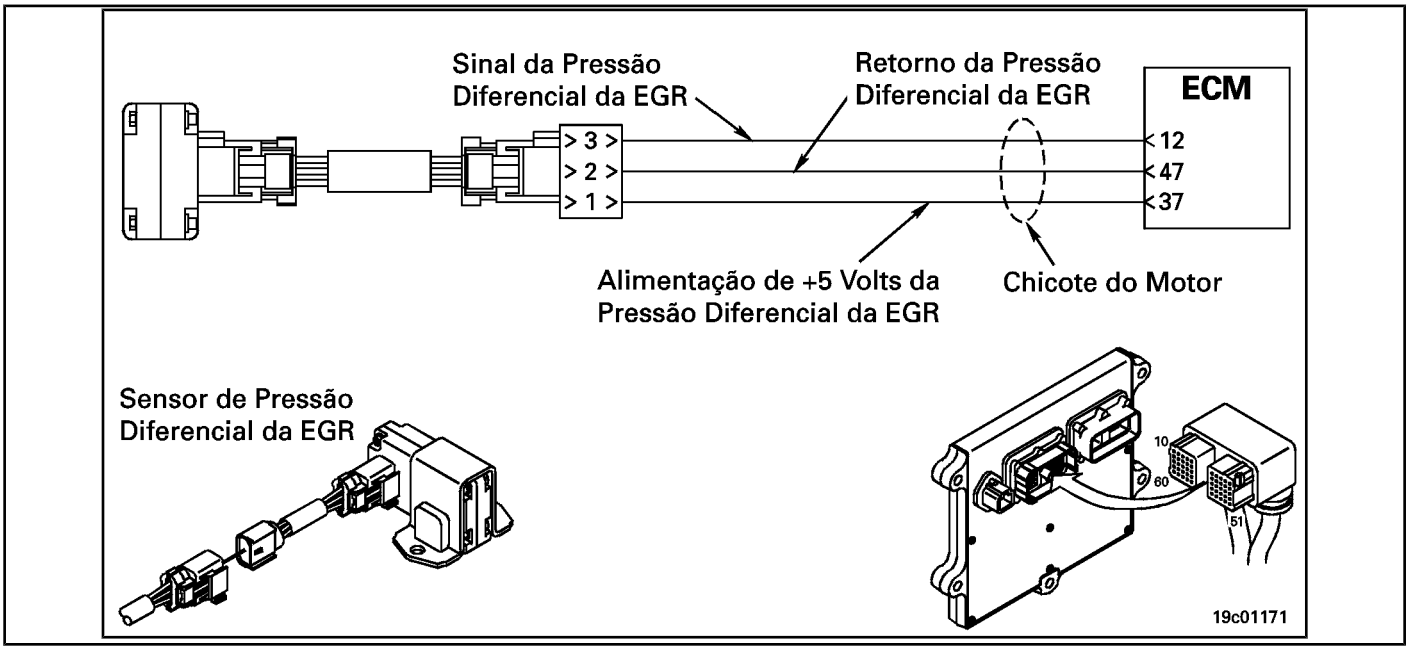
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **DO NOT** **REPAIR:** Troubleshoot any other active fault code.	Proper troubleshooting and repair steps

Fault Code 2359

EGR Differential Pressure Sensor - Valid Data But Above Normal Range Operation - Moderately Severe Level

CODES	REASON	IT IS MADE
Fault Code: 2359 PID (P), SID (S): P411 IMF: 0/16 Lamp: Amber SRT:	Exhaust Gas Recirculation Valve Differential Pressure (EGR) Sensor - Valid Data But Above Normal Operating Range - Moderately Severe Level. Failure in the automatic calibration procedure of the EGR differential pressure sensor, or the EGR differential pressure reading **not** is valid for the operating conditions of the engine.	The EGR valve will be closed.

EGR Valve Differential Pressure Sensor Circuit



Circuit Descriptions:

The differential pressure sensor of the exhaust gas recirculation valve (EGR) measures the pressure drop of the exhaust gases in the differential pressure orifice of the EGR valve. This pressure drop is used to calculate the amount of flow from the EGR valve to the intake manifold.

Component Location:

The differential pressure sensor of the EGR valve is mounted on the air intake connection on the intake side of the engine. See the Procedure 100-002 for the detailed location of each component. NOTE: The sensor is connected to the engine harness using a small pigtail harness. The pigtail whip is permanently attached to the sensor. **Not** try to remove the connector attached to the sensor body or this could damage the sensor.

Workshop Tips:

Possible causes of this fault code:

- Defect in EGR valve differential pressure sensor
- Obstruction or leakage in the EGR high or low differential pressure orifice
- EGR valve clamped in open or closed position
- A defective hose from the EGR valve connection pipe
- A leak in the hoses or connection tubes of the EGR valve
- A defective variable geometry turbocharger
- A defective variable geometry actuator.

NOTE: If Fault Code 2359 is activated after cycling the ignition key and the engine **not** is working, the fault code will become inactive **only** if the following conditions are met:

- Engine coolant temperature greater than 67 ° C [154 ° F]
- Air temperature in the intake manifold greater than 16 ° C [60 ° F]
- The ignition key switches between ON and OFF positions
- The EGR valve differential pressure sensor reading is within a set limit close to zero.

SUMMARY OF FAULT DIAGNOSTICS

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check for other fault codes.		
STEP 1A: Check for fault codes active or inactive.	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 are active, or are there high inactive code counts?	
STEP 2: Check the differential pressure of the EGR valve.		
STEP 2A: Check the differential pressure of the EGR valve with the ignition key on.	Fault code 2359 active?	
STEP 2A-1: Check that the differential pressure of the EGR valve are blocked.	Are there any debris blocking one of the holes?	
STEP 3: Check the pressure holes for leaks or obstruction by debris differential and mounting surfaces of the EGR valve.		
STEP 3A: Check for leaks in the differential pressure ports of the EGR valve.	Has a leak been detected on the mounting surface of the EGR differential pressure sensor?	
STEP 3B: Check that the differential pressure of the EGR valve are blocked.	Are there any debris blocking one of the holes?	
STEP 4: Check the air component system.		
STEP 4A: Inspect the air component system for leaks in the intake manifold, air-to-air cooler or EGR.	Was any leak detected?	
STEP 4B: Perform the Operational Test of EGR / Turbocharger valve of INSITE ™ electronic service tool.	Was the EGR / Turbocharger Operational Test successful?	
STEP 5: Clear the fault codes.		
STEP 5A: Disable the fault code.	Fault code 2359 inactive?	
STEP 5B: Clear the fault codes inactive.	All codes cleared?	
STEP 6: Clear the fault codes.		
STEP 6A: Make sure the passcode failure does not become active under normal operation.	Does Fault Code 2359 become active during load operation?	
STEP 6B: Clear the fault codes inactive.	All codes cleared?	

FAULT DIAGNOSTIC STEP

STEP 1: Check for other fault codes.

STEP 1A: Check for active or inactive fault codes. Conditions:

- Connect the electronic service tool INSITE ™.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check for active fault codes or high inactive fault code counts? • Use the electronic service tool INSITE ™ to read 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 are active, or are there high inactive code counts? **YES** **Repair:** Troubleshoot fault codes starting with the code with the most counts.	Proper troubleshooting and repair steps
	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 are active, or are there high inactive code counts? **NOT**	2A

STEP 2: Check the differential pressure of the EGR valve.

STEP 2A: Check the differential pressure of the EGR valve with the ignition key on. Conditions:

- Connect the electronic service tool INSITE ™.
- Turn the ignition key ON.
- Motor **not** working.
- Exhaust fans disconnected or turned off.

Action	Specifications / Repair	Next step
Check that the engine coolant temperature is greater than 67 ° C [154 ° F] and that the air temperature in the intake manifold is greater than 16 ° C [60 ° F]. • Turn the ignition key off for 30 seconds. NOTE: The engine **should not** functioning before the ignition key is turned off. If the engine is running, turn the ignition key off for 30 seconds, turn it on again for 30 seconds, and then turn it off again. • Turn on the ignition key and wait 30 seconds. • Use the electronic service tool INSITE ™ to check fault codes.	Fault code 2359 active? **YEA**	2A-1
	Fault code 2359 active? **NOT**	3A

STEP 2A-1: Check that the differential pressure holes in the EGR valve are not blocked. Conditions:

- Turn the ignition key off.

Action	Specifications / Repair	Next step
Remove the differential pressure sensor from the EGR valve. • Inspect the EGR valve differential pressure holes for obstructions.	Are there any debris blocking one of the holes? **YES** **Repair:** Remove debris or replace the intake air connection. Refer to Procedure 010-080 in the ISB Series Engine Troubleshooting and Repair Manual and ISB (Common Rail Fuel System), Bulletin 3653336.	5A
	Are there any debris blocking one of the holes? **DO NOT** **REPAIR:** Replace the EGR differential pressure sensor. See the Procedure 019-370 .	5A

STEP 3: Check the pressure holes for leaks or obstruction by debris differential and mounting surfaces of the EGR valve.

STEP 3A: Check for leaks in the differential pressure ports of the EGR valve. Conditions:

- Turn the ignition key off.

Action	Specifications / Repair	Next step
Check the EGR valve differential pressure sensor mounting surface for leaks. • Leaks must be easily detected by the presence of traces of waste.	Has a leak been detected on the mounting surface of the EGR differential pressure sensor? **YES** **Repair:** Inspect the EGR valve mounting surface and differential pressure sensor to locate the source of the leak. Repair or replace components that are suspected of leaking.	6A
	Has a leak been detected on the mounting surface of the EGR differential pressure sensor? **NOT**	3B

STEP 3B: Check that the differential pressure ports on the EGR valve are not blocked. Conditions:

- Turn the ignition key off.

Action	Specifications / Repair	Next step
Remove the differential pressure sensor from the EGR valve. • Inspect the EGR valve differential pressure holes for obstructions.	Are there any debris blocking one of the holes? **YES** **Repair:** Remove debris or replace the intake air connection. Refer to Procedure 010-080 in the ISB Series Engine Troubleshooting and Repair Manual and and ISB (Common Rail Fuel System), Bulletin 3653336.	6A
	Are there any debris blocking one of the holes? **NOT**	4A

STEP 4: Check the air component system.

STEP 4A: Inspect the air component system for leaks in the intake manifold, air-to-air cooler or EGR.

Conditions:
- Turn the ignition key off.

Action	Specifications / Repair	Next step
Inspect the air component system for leaks in the intake manifold, air-to-air cooler or EGR. Perform the following inspections: • Air-to-air cooler - See Procedure 010-027 in the ISB Series Engine Troubleshooting and Repair Manual and and ISB (Common Rail Fuel System), Bulletin 3653336. • Air inlet and exhaust - See Procedure 010-024 in the ISB Series Engine Troubleshooting and Repair Manual and and ISB (Common Rail Fuel System), Bulletin 3653336. • EGR connection tubes and hoses.	Was any leak detected? **YES** **Repair:** Repair leaks.	6A
	Was any leak detected? **NOT**	4B

STEP 4B: Perform the Operational Test of the EGR Valve / Turbocharger of the electronic tool INSITE ™ service.

Conditions:
- Turn the ignition key ON.
- Perform the Operational Test of the EGR / Turbocharger valve of the INSITE ™ electronic service tool.
- Start the engine and let it run at idle.

Action	Specifications / Repair	Next step
Perform the EGR / TGV Operational Test with the INSITE ™ electronic service tool. • Select the All Components option under Test Options.	Was the EGR / Turbocharger Operational Test successful? **YEA**	6A
	Was the EGR / Turbocharger Operational Test successful? **DO NOT** **REPAIR:** Repair or replace the suspect component. Refer to Procedure 011-022 in the ISBe, ISB and QSB5.9 (Common Rail Fuel System) Engine Troubleshooting and Repair Manual, Bulletin 3653336.	6A

STEP 5: Clear the fault codes.

STEP 5A: Disable the fault code. Conditions:

- Connect all components.
- Connect the electronic service tool INSITE ™.
- Turn the ignition key ON.
- Engine coolant temperature above 67 ° C [154 ° F].
- Air temperature in the intake manifold equal to or greater than 16 ° C [60 ° F].
- Motor **not** working.

Action	Specifications / Repair	Next step
Use the INSITE ™ electronic service tool to verify that the engine coolant temperature is greater than 67 ° C [154 ° F], and that the air temperature in the intake manifold is greater than 16 ° C [60 ° F]. • Turn the ignition key off for 30 seconds. • Turn the ignition key ON. • Check the fault codes.	Fault code 2359 inactive? **YEA**	5B
	Fault code 2359 inactive? **DO NOT** **REPAIR:** Return to the troubleshooting steps or consult your local Cummins Authorized Service Station after checking and completing all diagnostic steps again.	1A

STEP 5B: Clear the inactive fault codes. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **DO NOT** **REPAIR:** Troubleshoot any other active fault code.	Proper troubleshooting and repair steps

STEP 6: Clear the fault codes.

STEP 6A: Make sure that the fault code does not become active under normal operation. Conditions:

- Connect all components.

Action	Specifications / Repair	Next step
Talk to the driver to determine under what conditions and load the truck was being driven when this failure occurred. Try to reproduce these conditions to verify that the fault does not become active. Operate the engine under the same conditions and load identified by the driver and make sure Fault Code 2359 not become active. NOTE: Some faults activate Fault Code 2359 during normal operation and force the fault code to become active when the ignition key is turned on. This step is necessary to ensure that the correct component has been repaired or replaced.	Does Fault Code 2359 become active during load operation? **YES** **Repair:** Return to the troubleshooting steps or consult your local Cummins Authorized Service Station after checking and completing all diagnostic steps again.	1A
	Does Fault Code 2359 become active during load operation? **NOT**	6B

STEP 6B: Clear the inactive fault codes. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

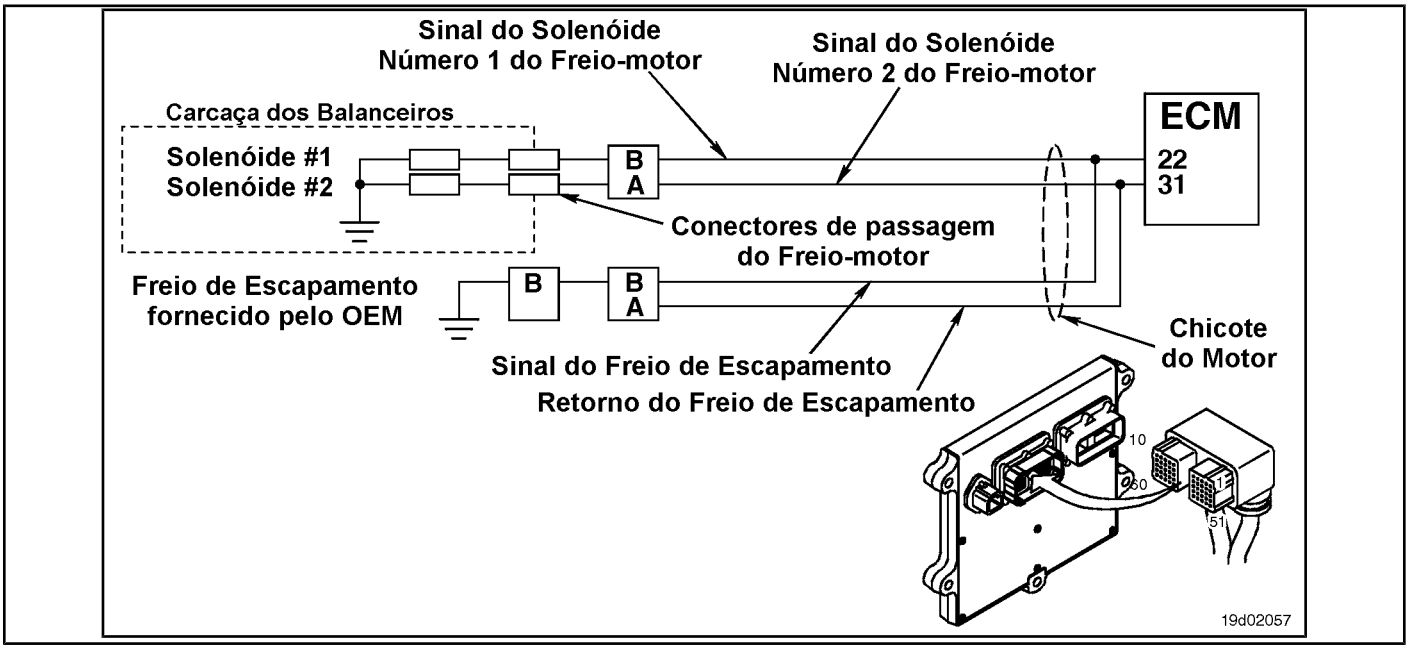
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **DO NOT** **REPAIR:** Troubleshoot any other active fault code.	Proper troubleshooting and repair steps

Fault Code 2362

Motor Brake Actuator No. 1 Circuit - Voltage Below Normal or Voltage Low

CODES	REASON	IT IS MADE
Fault Code: 2362 PID (P), SID (S): S028 IMF: 4 Lamp: Amber SRT:	Motor Brake Actuator Circuit No. 1 - Voltage Below Normal or Low Voltage Low voltage detected in circuit number 1 of the motor brake solenoid signal.	The engine brake on cylinders 1, 2 and 3 **not** can be activated or the exhaust brake **not** will work.

Motor Brake Circuit



Circuit Descriptions:

This circuit can be used to control the exhaust brake or a motor-brake, depending on the application. The ECM controls the engine brakes on cylinders 1, 2 and 3 by sending a signal from circuit number 1 to the engine brake solenoid. If an exhaust brake is installed, it will be activated by the signal line of circuit number 1 of the motor brake solenoid. There is a 2-pin Weather Pack connector located next to the number 3 injector port connector on the rear of the engine. If a motor brake is installed, there will be a bridge harness between this connector and the motor brake passage connector on the rocker frame housing. If an exhaust brake is installed, the OEM will connect a 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 by the ECM via the engine harness. The exhaust brake is an optional feature that is fitted to the exhaust system by the OEM.

Workshop Tips:

Possible causes for this fault code include a short circuit with ground in the engine harness, in the connector, or in the solenoids of the engine brakes.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch / AMP / Metri-Pack female test lead Part No. 3823995 - Weather-Pack male test lead. Part No. 3823996 - Weather-Pack female test lead. STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check for a passcode failure inactive.	**Fault code 2362 inactive?**	
STEP 1B: Determine the type of motor brake.	**Is the engine equipped with a compression brake?**	
STEP 2: Check the motor brake circuit and solenoid.		
STEP 2A: Check the signal voltage of diagnostics on the motor brake pass connector.	**More than 3.75 VDC?**	
STEP 2B: Check the wiring harness on the engine brake for damage.	**Damage to the connectors or the insulation of the wires?**	
STEP 2C: Check the brake solenoid - motor for a short to ground.	**5 ohms or more?**	
STEP 3: Check the ECM and the engine harness.		
STEP 3A: Inspect the engine harness and ECM connector pins.	**Dirty or damaged pins?**	
STEP 3B: Check the voltage diagnostic supply for motor brake solenoid number 1.	**More than 3.75 VDC?**	
STEP 3C: Check for a short pin circuit with ground.	**More than 100k ohms?**	
STEP 3D: Check for a short circuit between pins in the engine harness.	**More than 100k ohms?**	
STEP 3E: Check for a security code failure inactive.	**Fault code 2362 inactive?**	
STEP 3E-1: Check that the brake exhaust is installed.	**Is the engine equipped with an exhaust brake?**	
STEP 4: Clear the fault code.		
STEP 4A: Disable the fault code.	**Fault code 2362 inactive?**	
STEP 4B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

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

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an inactive fault code. • Using INSITE ™, read the fault codes. Fault code 2362 inactive?	**YEA**	Fault Code Inactive or Intermittent, Procedure 019-362
	Fault code 2362 inactive? **NOT**	1B

STEP 1B: Determine the type of motor brake. Conditions:

- Turn the ignition key off.

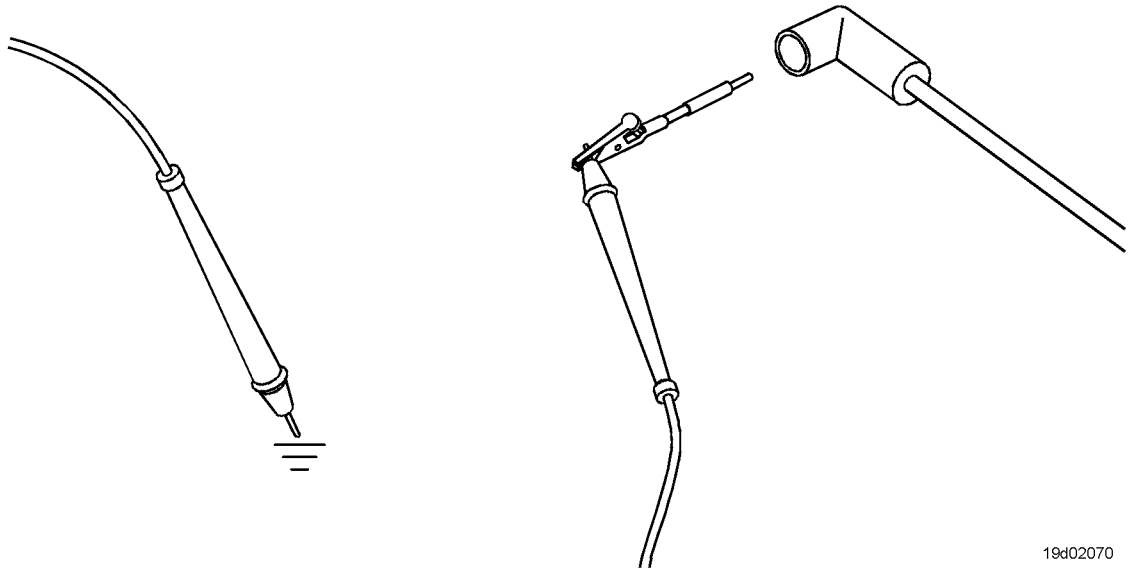
Action	Specifications / Repair	Next step
Determine whether the engine is equipped with a compression brake or an exhaust brake.	Is the engine equipped with a compression brake? **YEA**	2A
	Is the engine equipped with a compression brake? **DO NOT** **REPAIR:** Is the engine equipped with an exhaust brake?	3A

STEP 2: Check the motor brake circuit and solenoid.

STEP 2A: Check the diagnostic signal voltage at the motor brake pass connector. Conditions:

- Turn the ignition key off.
- Disconnect the wire from the motor brake solenoid number 1 from the passage connector on the rocker frame housing.
- Turn the ignition key ON.

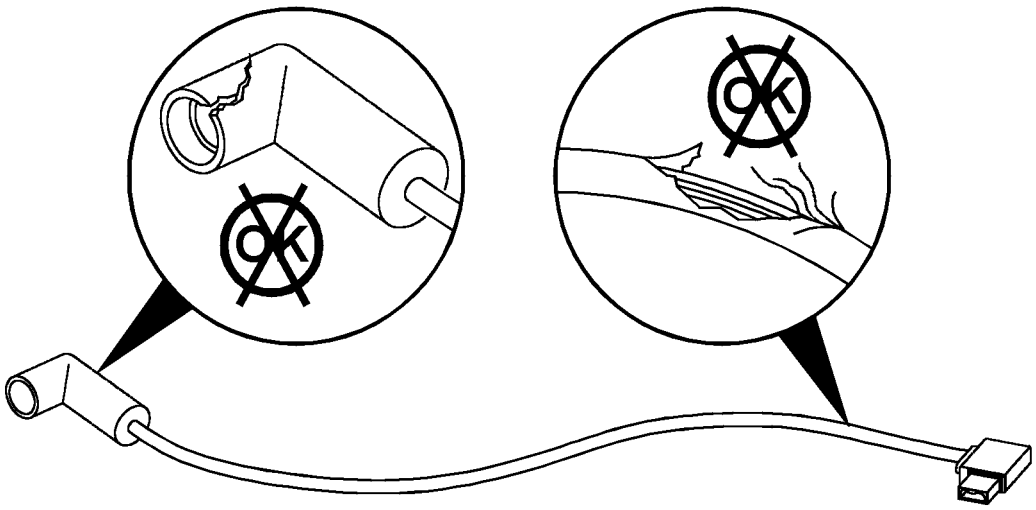
Action	Specifications / Repair	Next step
Check the diagnostic supply voltage of the motor brake solenoid number 1. • Measure the voltage between the SIGNAL pin of solenoid number 1 of the motor brake on the motor harness and the ground. Refer to the electrical diagram for identification of the connector pins.	More than 3.75 VDC? **YEA**	2B
	More than 3.75 VDC? **NOT**	3A



STEP 2B: Check the engine brake wiring harness for damage. Conditions:

- Turn the ignition key off.
- Remove the rocker cover. Refer to Procedure 003-011 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266.
- Remove the engine brake bridge harness between the pass-through connector and the engine brake solenoid.

Action	Specifications / Repair	Next step
Inspect the engine brake internal bridge harness for: • Bent or broken pins • Damage to the wire shield • Connector cover broken. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Damage to the connectors or the insulation of the wires? **YES** **Repair:** Repair or replace the engine brake harness. See the Procedure 019-043 .	4A
	Damage to the connectors or the insulation of the wires? **NOT**	2C



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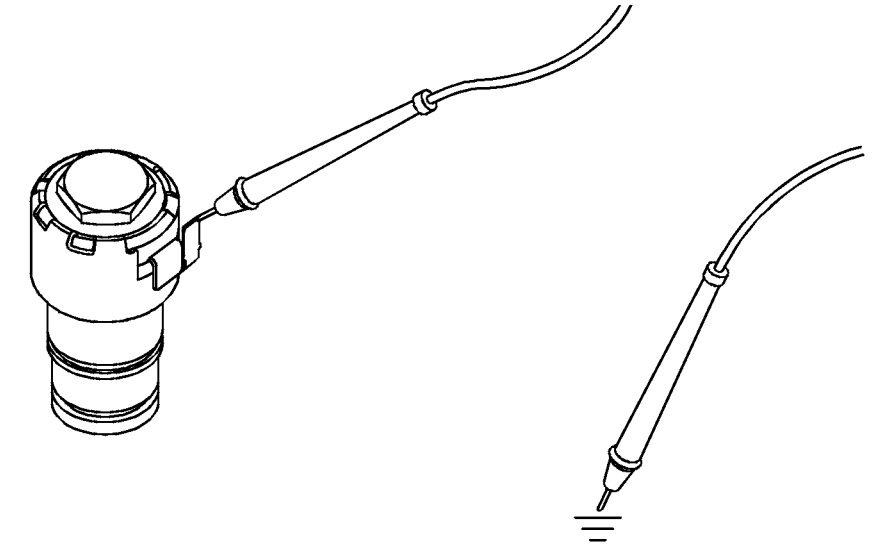
STEP 2C: Check the motor brake solenoid for a short to ground. Conditions:

- Turn the ignition key off.
- Remove the rocker cover. Refer to Procedure 003-011 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266.
- Disconnect the motor brake harness from the number 1 solenoid of the motor brake.

Action	Specifications / Repair	Next step
Check the resistance of the solenoid. • Measure the resistance between the terminal pin of the motor brake solenoid number 1 and the ground. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	5 ohms or more? **YEA**	3A
	5 ohms or more? **DO NOT** **REPAIR:** Replace the motor brake solenoid. Refer to Procedure 020-012 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266.	4A



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STEP 3: Check the ECM and the engine harness.

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

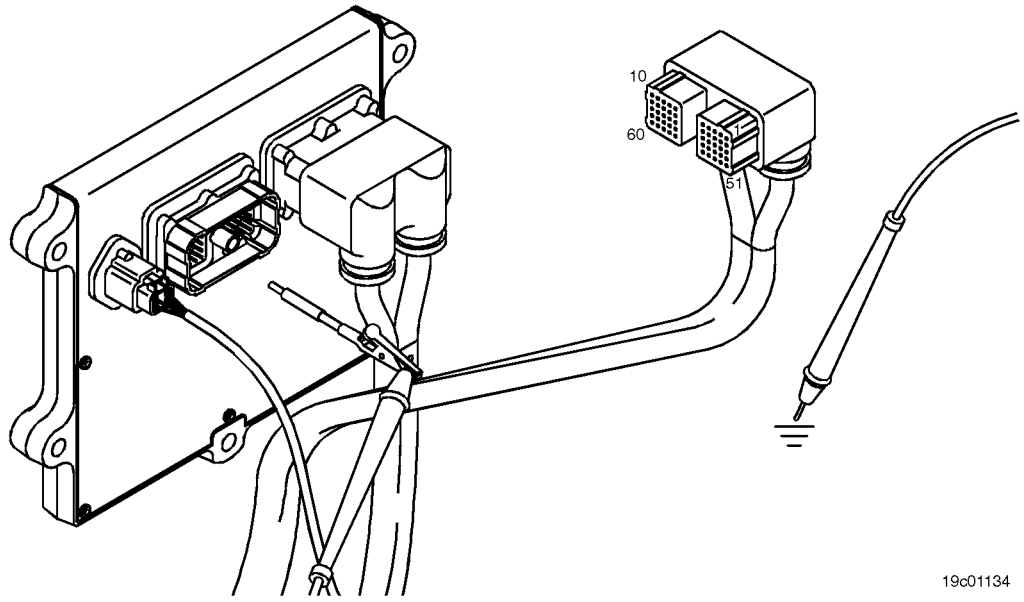
Conditions:
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.

Action	Specifications / Repair	Next step
Inspect the engine harness and ECM connector pins for: • Loose connector • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Damaged or missing connector seals • Dirt or debris on the connector pins • Damage to the wire shield • Connector cover broken. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected at the ECM connector or at the engine harness. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-043 .	4A
	Dirty or damaged pins? **NOT**	3B

STEP 3B: Check the diagnostic supply voltage of the motor brake solenoid number 1. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Turn the ignition key ON.

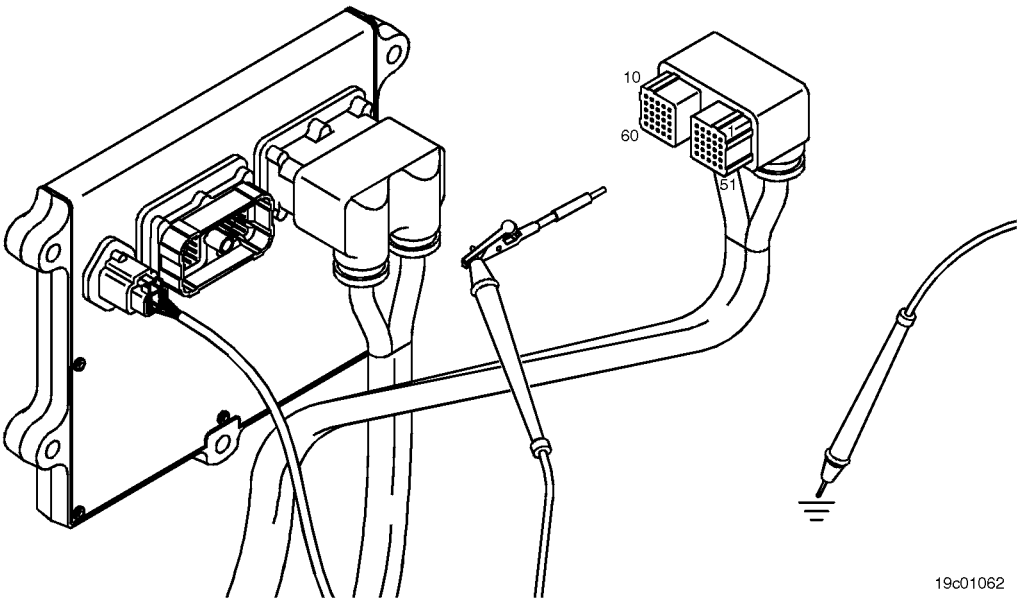
Action	Specifications / Repair	Next step
Check the diagnostic supply voltage of the motor brake solenoid number 1. • Measure the voltage between the motor brake solenoid number 1 SIGN pin and the ground on the ECM connector. Refer to the electrical diagram for identification of the connector pins.	More than 3.75 VDC? **YEA**	3C
	More than 3.75 VDC? **DO NOT** **REPAIR:** Call for pre-authorization. Replace the ECM. See the Procedure 019-031 .	4A



STEP 3C: Check if there is a pin short with the ground. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- If equipped with a motor brake, disconnect the motor brake solenoid number 1 from the motor brake passage connector.
- If equipped with an exhaust brake, disconnect the 2-pin Weather Pack connector on the rear of the engine between lines 5 and 6 of high pressure fuel.

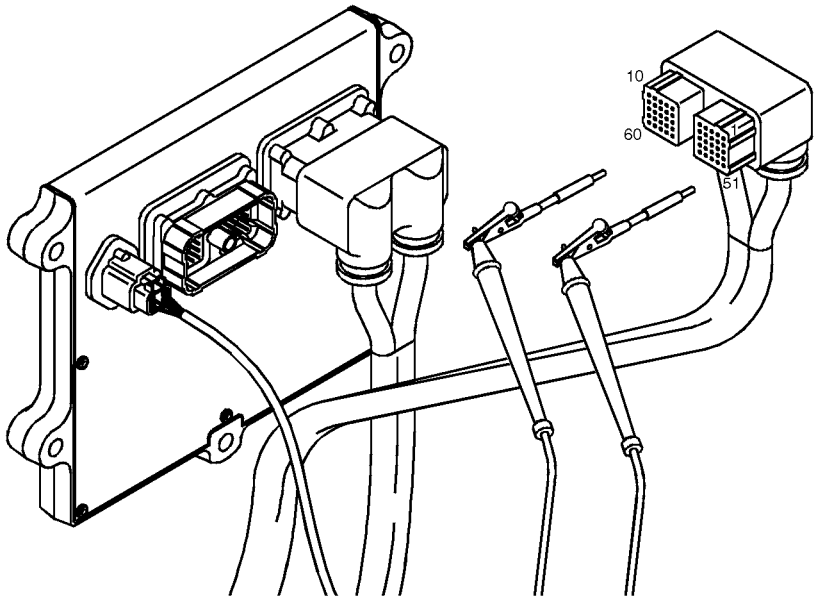
Action	Specifications / Repair	Next step
Check for a short between pins and ground. • Measure the resistance between the motor brake solenoid number 1 SIGN pin on the motor harness ECM connector and earth. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YEA**	3D
	More than 100k ohms? **DO NOT** **REPAIR:** A short circuit was detected between the pins and the ground in the SIGNAL line of the motor brake actuator. Troubleshoot each harness connected in series to determine which one contains the supply circuit shorted to ground. Repair or replace the engine harness. See the Procedure 019-043 .	4A



STEP 3D: Check the motor harness for a short circuit between pins. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- If equipped with a motor brake, disconnect the motor brake solenoid number 1 from the motor brake passage connector.
- If equipped with an exhaust brake, disconnect the 2-pin Weather Pack connector on the rear of the engine between lines 5 and 6 of high pressure fuel.

Action	Specifications / Repair	Next step
Check for a short circuit between pins. • Measure the resistance between the motor brake solenoid number 1 SIGN pin on the OEM harness ECM connector and all other ECM connector pins. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YEA**	3E
	More than 100k ohms? **DO NOT** **REPAIR:** A short circuit between pins in the SIGNAL line of solenoid number 1 of the motor brake was detected in the motor harness. Repair or replace the engine harness. See the Procedure 019-043 .	4A



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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Using INSITE ™, read the fault codes.	Fault code 2362 inactive? **YES** **Repair:** None. Did removing and installing the connector correct the failure?	4A
	Fault code 2362 inactive? **NOT**	3E-1

STEP 3E-1: Check that the exhaust brake is installed. Conditions:

Action	Specifications / Repair	Next step
Check that the engine is equipped with an exhaust brake.	Is the engine equipped with an exhaust brake? **YES** **Repair:** Refer to the OEM troubleshooting and repair manual for wiring and circuits between Cummins wiring harness and exhaust brake.	OEM fault diagnosis manual
	Is the engine equipped with an exhaust brake? **DO NOT** **REPAIR:** All wiring has been checked and found to be correct. The ECM failed. Replace the ECM. Call for authorization. See the Procedure 019-031 .	4A

STEP 4: Clear the fault code.

STEP 4A: Disable the fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Using INSITE ™, check that the fault code is inactive.	Fault code 2362 inactive? **YEA**	4B
	Fault code 2362 inactive? **NOT**	1A

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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

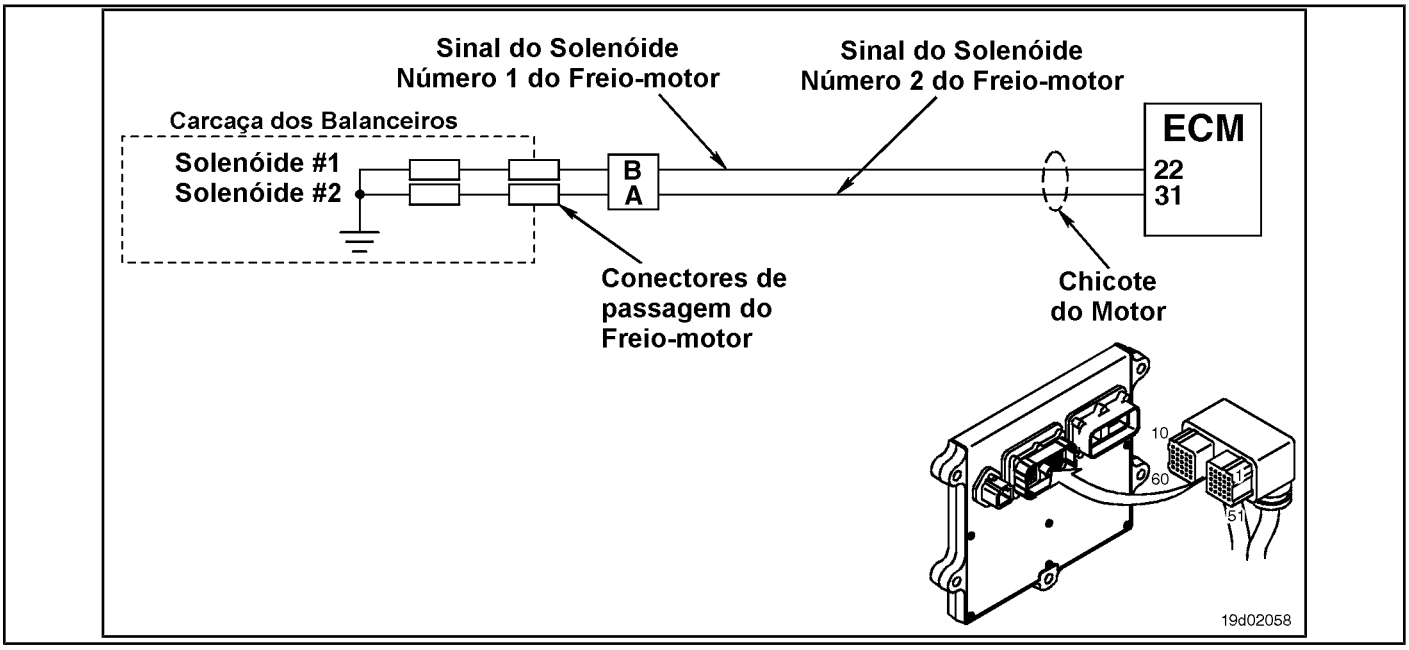
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **NOT**	Proper troubleshooting and repair steps

Fault Code 2363

Motor Brake Actuator Circuit No. 2 - Voltage Below Normal or With Voltage Low

CODES	REASON	IT IS MADE
Fault Code: 2363 PID (P), SID (S): S029 IMF: 4 Lamp: Amber SRT:	Motor Brake Actuator Circuit No. 2 - Voltage Below Normal or Low Voltage Low voltage detected in circuit number 2 of the motor brake solenoid signal.	The engine brake on cylinders 4, 5 and 6 not can be activated.

Motor Brake Actuator Circuit No. 1



Circuit Descriptions:

The ECM controls the engine brakes on cylinders 4, 5 and 6 by sending a signal from circuit number 2 to the engine brake solenoid. There is a 2-pin Weather Pack connector located next to the injector pass connector number
3, at the rear of the engine. There is a wiring harness between this connector and the motor brake pass connectors on the rocker housing.

Component Location:

The engine brake solenoids are located under the valve cover. The engine brake solenoids are controlled by the ECM via the engine harness.

Workshop Tips:

Possible causes for this fault code include a short circuit with ground in the engine harness, in the connectors, or in the solenoids of the engine brakes.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch / AMP / Metri-Pack female test lead Part No. 3823995 - Weather-Pack male test lead. Part No. 3823996 - Weather-Pack female test lead. STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check for a passcode failure inactive.	Fault code 2362 inactive?	
STEP 2: Check the motor brake circuit and solenoid.		
STEP 2A: Check the signal voltage of diagnostics on the motor brake pass connector.	More than 3.75 VDC?	
STEP 2B: Check the wiring harness on the engine brake for damage.	Damage to the connectors or the insulation of the wires?	
STEP 2C: Check the brake solenoid - motor for a short to ground.	5 ohms or more?	
STEP 3: Check the ECM and the engine harness.		
STEP 3A: Inspect the engine harness and ECM connector pins.	Dirty or damaged pins?	
STEP 3B: Check the voltage diagnostic supply for motor brake solenoid number 2.	More than 3.75 VDC?	
STEP 3C: Check for a short pin circuit with ground.	More than 100k ohms?	
STEP 3D: Check for a short circuit between pins in the engine harness.	More than 100k ohms?	
STEP 3E: Check for a security code failure inactive.	Fault code 2363 inactive?	
STEP 4: Clear the fault code.		
STEP 4A: Disable the fault code.	Fault code 2363 inactive?	
STEP 4B: Clear the fault codes inactive.	All codes cleared?	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

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

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

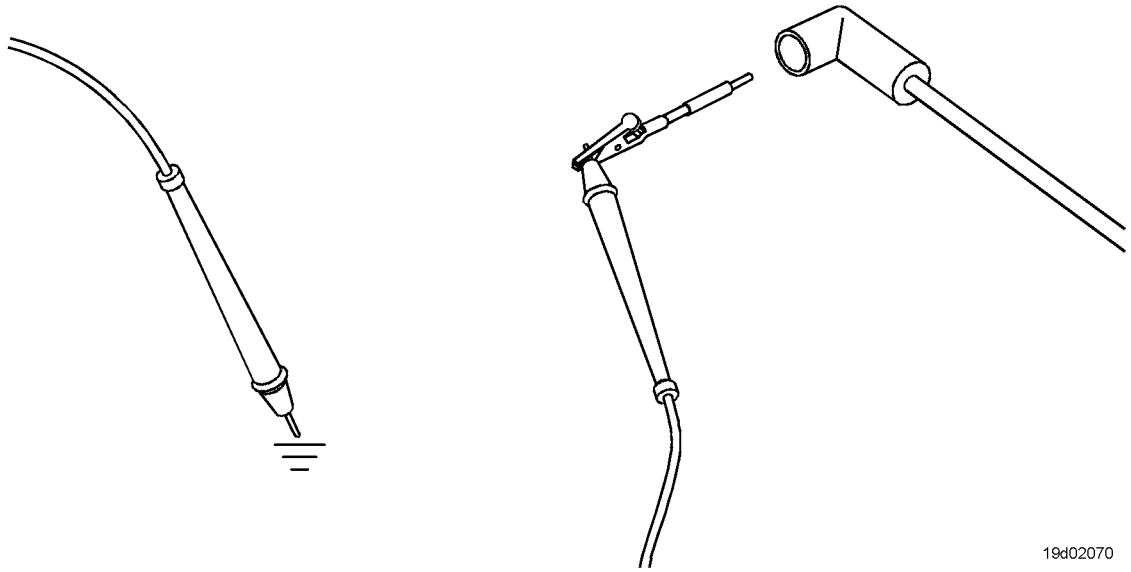
Action	Specifications / Repair	Next step
Check for an inactive fault code. • Using INSITE ™, read the fault codes. Fault code 2362 inactive?	**YEA**	Fault Code Inactive or Intermittent, Procedure 019-362
	Fault code 2362 inactive? **NOT**	2A

STEP 2: Check the motor brake circuit and solenoid.

STEP 2A: Check the diagnostic signal voltage at the motor brake pass connector. Conditions:

- Turn the ignition key off.
- Disconnect the wire from solenoid number 2 of the motor brake from the passage connector on the rocker frame housing.
- Turn the ignition key ON.

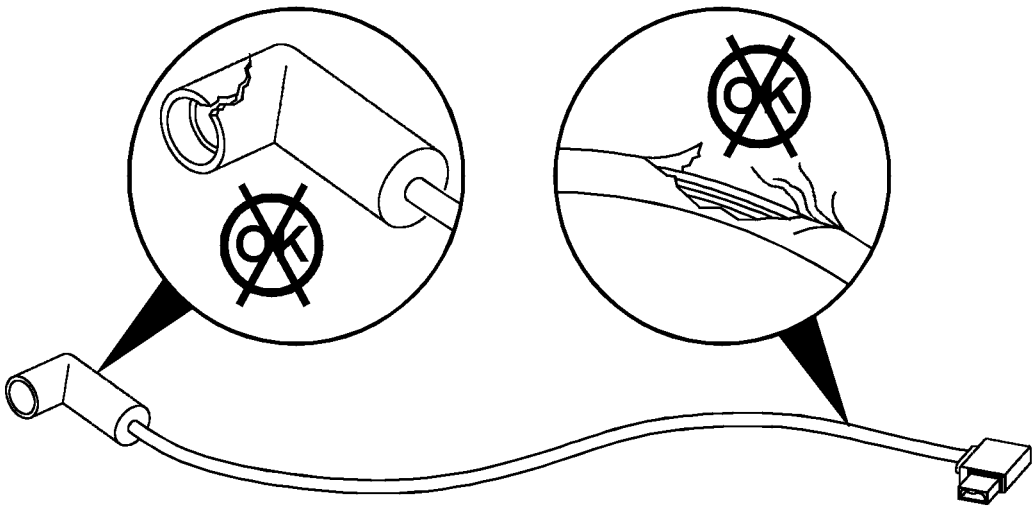
Action	Specifications / Repair	Next step
Check the diagnostic supply voltage of the motor brake solenoid number 2. • Measure the voltage between the SIGNAL pin of solenoid number 2 of the motor brake on the motor harness and the ground. Refer to the electrical diagram for identification of the connector pins.	More than 3.75 VDC? **YEA**	2B
	More than 3.75 VDC? **NOT**	3A



STEP 2B: Check the engine brake wiring harness for damage. Conditions:

- Turn the ignition key off.
- Remove the rocker cover. Refer to Procedure 003-011 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266.
- Remove the engine brake bridge harness between the pass-through connector and the engine brake solenoid.

Action	Specifications / Repair	Next step
Inspect the engine brake internal bridge harness for: • Bent or broken pins • Damage to the wire shield • Connector cover broken. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Damage to the connectors or the insulation of the wires? **YES** **Repair:** Repair or replace the engine brake harness. See the Procedure 019-043 .	4A
	Damage to the connectors or the insulation of the wires? **NOT**	2C



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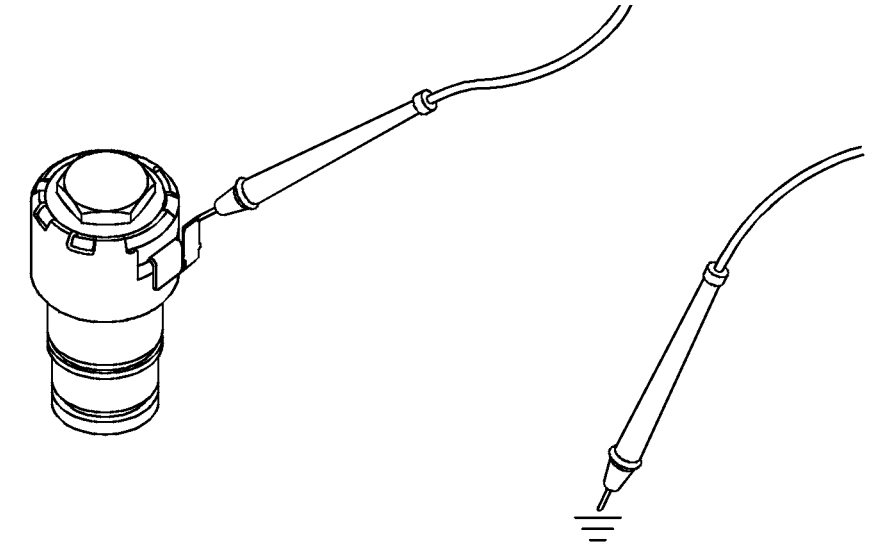
STEP 2C: Check the motor brake solenoid for a short to ground. Conditions:

- Turn the ignition key off.
- Remove the rocker cover. Refer to Procedure 003-011 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266.
- Disconnect the motor brake harness from the number 2 solenoid of the motor brake.

Action	Specifications / Repair	Next step
Check the resistance of the solenoid. • Measure the resistance between the terminal pin of the motor brake solenoid number 2 and the ground. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	5 ohms or more? **YEA**	3A
	5 ohms or more? **DO NOT** **REPAIR:** Replace the motor brake solenoid. Refer to Procedure 020-012 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266.	4A



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STEP 3: Check the ECM and the engine harness.

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

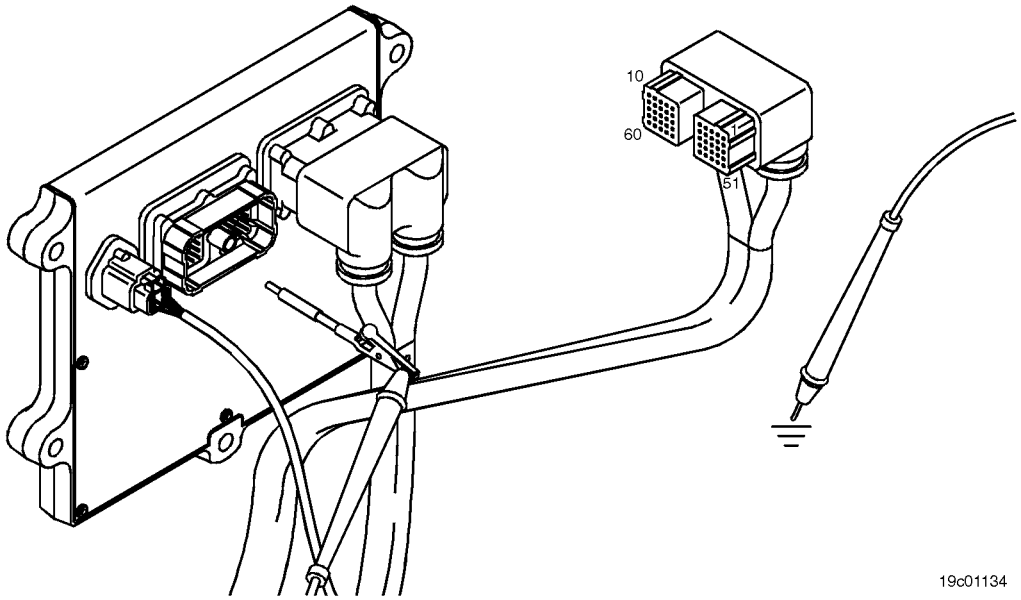
Conditions:
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.

Action	Specifications / Repair	Next step
Inspect the engine harness and ECM connector pins for: • Loose connector • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Damaged or missing connector seals • Dirt or debris on the connector pins • Damage to the wire shield • Connector cover broken. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected at the ECM connector or at the engine harness. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-043 .	4A
	Dirty or damaged pins? **NOT**	3B

STEP 3B: Check the diagnostic supply voltage of the motor brake solenoid number 2. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Turn the ignition key ON.

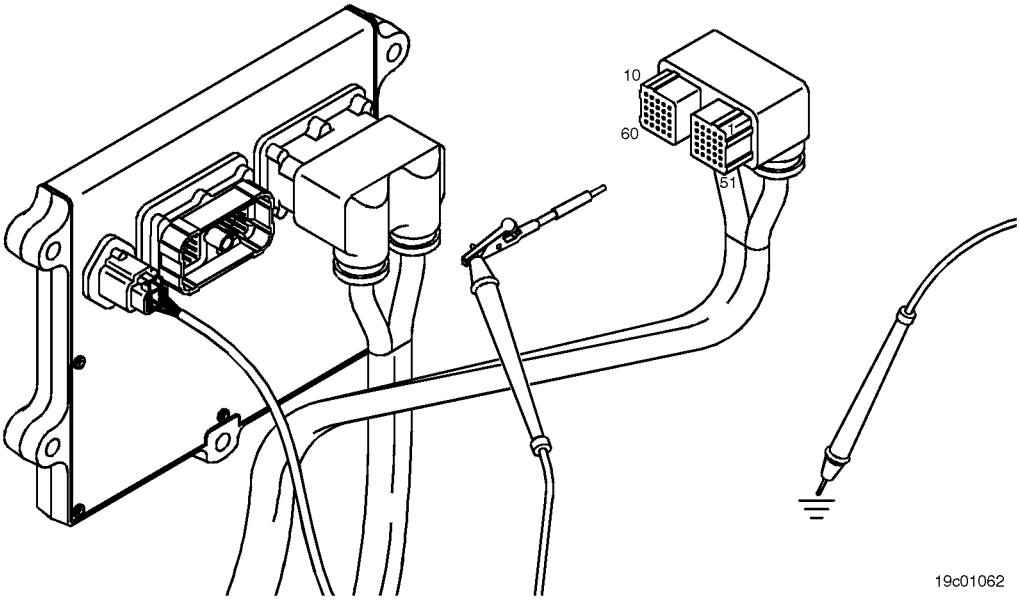
Action	Specifications / Repair	Next step
Check the diagnostic supply voltage of the motor brake solenoid number 2. • Measure the voltage between the SIGNAL pin of solenoid number 2 of the motor brake and the ground in the ECM connector. Refer to the electrical diagram for identification of the connector pins.	More than 3.75 VDC? **YEA**	3C
	More than 3.75 VDC? **DO NOT** **REPAIR:** Call for pre-authorization. Replace the ECM. See the Procedure 019-031 .	4A



STEP 3C: Check if there is a pin short with the ground. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Disconnect the number 2 wire from the motor brake solenoid to the passage of the motor brake.

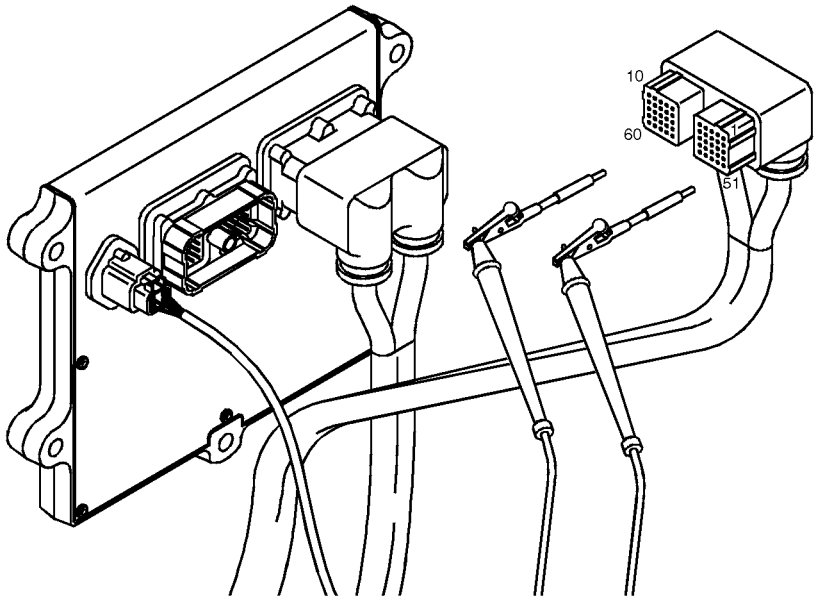
Action	Specifications / Repair	Next step
Check for a short between pins and ground. • Measure the resistance between the motor brake solenoid number 2 SIGN pin on the motor harness ECM connector and earth. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YEA**	3D
	More than 100k ohms? **DO NOT** **REPAIR:** A short circuit was detected between the pins and the ground in the SIGNAL line of the motor brake actuator. Troubleshoot each harness connected in series to determine which one contains the supply circuit shorted to ground. Repair or replace the engine harness. See the Procedure 019-043 .	4A



STEP 3D: Check the motor harness for a short circuit between pins. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Disconnect the number 2 wire from the motor brake solenoid to the passage of the motor brake.

Action	Specifications / Repair	Next step
Check for a short circuit between pins. • Measure the resistance between the motor brake solenoid number 2 SIGN pin on the OEM harness ECM connector and all other ECM connector pins. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YEA**	3E
	More than 100k ohms? **DO NOT** **REPAIR:** A short circuit between pins in the SIGNAL line of solenoid number 2 of the motor brake was detected in the motor harness. Repair or replace the engine harness. See the Procedure 019-043 .	4A



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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Using INSITE ™, read the fault codes.	Fault code 2363 inactive? **YES** **Repair:** None. Did removing and installing the connector correct the failure?	4A
	Fault code 2363 inactive? **DO NOT** **REPAIR:** Call for pre-authorization. Replace the ECM. See the Procedure 019-031 .	4A

STEP 4: Clear the fault code.

STEP 4A: Disable the fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Using INSITE ™, check that the fault code is inactive.	Fault code 2363 inactive? **YEA**	4B
	Fault code 2363 inactive? **NOT**	1A

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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

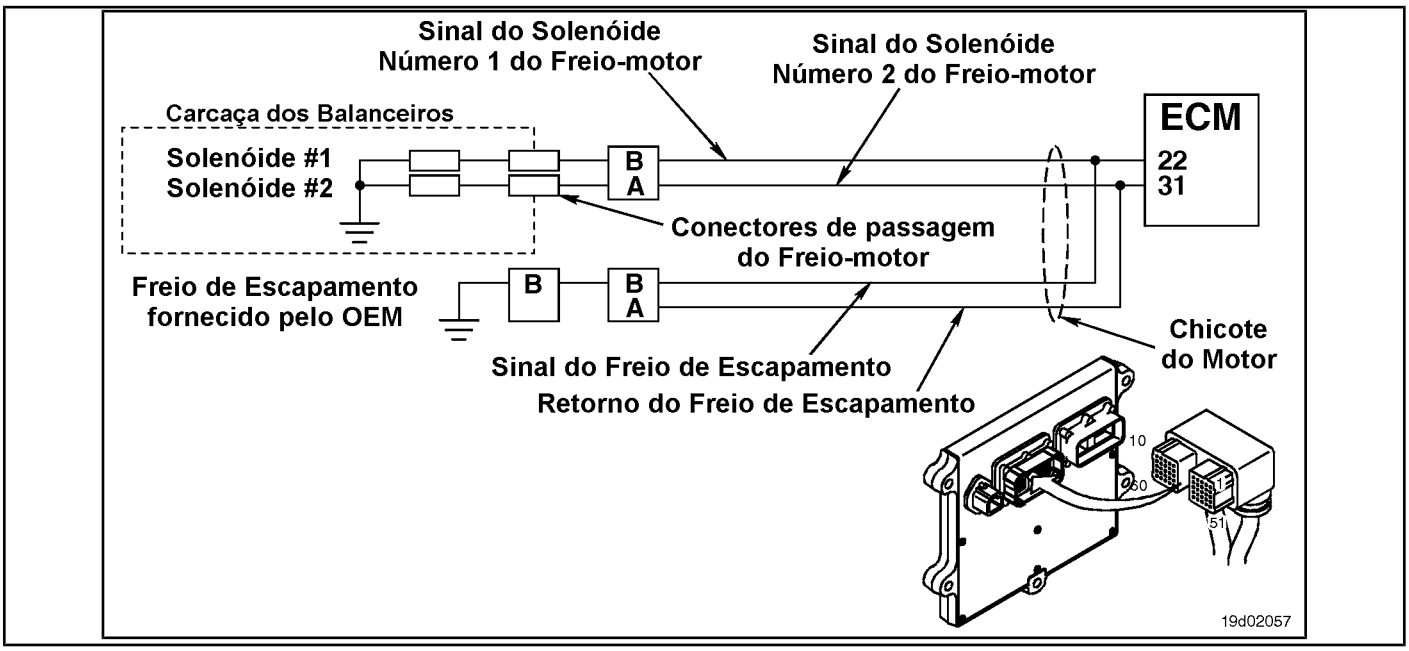
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **NOT**	Proper troubleshooting and repair steps

Fault Code 2366

Motor Brake Actuator Circuit No. 1 - Voltage Above Normal or with Voltage High

CODES	REASON	IT IS MADE
Fault Code: 2366 PID (P), SID (S): S028 IMF: 3 Lamp: Amber SRT:	Motor Brake Actuator Circuit No. 1 - Voltage Above Normal or High Voltage An open circuit or high voltage is detected in the motor brake solenoid signal circuit number 1.	The engine brake on cylinders 1, 2 and 3 **not** can be activated or the exhaust brake **not** will work.

Motor Brake Circuit



Circuit Descriptions:

This circuit can be used to control the exhaust brake or a motor-brake, depending on the application. The ECM controls the engine brakes on cylinders 1, 2 and 3 by sending a signal from circuit number 1 to the engine brake solenoid. If an exhaust brake is installed, it will be activated by the signal line of circuit number 1 of the motor brake solenoid. There is a 2-pin Weather Pack connector located next to the number 3 injector port connector on the rear of the engine. If a motor brake is installed, there will be a bridge harness between this connector and the motor brake passage connector on the rocker frame housing. If an exhaust brake is installed, the OEM will connect a 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 by the ECM via the engine harness. The exhaust brake is an optional feature that is fitted to the exhaust system by the OEM.

Workshop Tips:

Possible causes of this fault code:

- Open circuit on engine harness, brake harness or engine brake solenoids
- Short circuit with a voltage source in the engine harness

- ECM failure.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch / AMP / Metri-Pack female test lead Part No. 3823995 - Weather-Pack male test lead. Part No. 3823996 - Weather-Pack female test lead. STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check for a passcode failure inactive.	**Fault code 2366 inactive?**	
STEP 1B: Determine the type of motor brake.	**Is the engine equipped with a compression brake?**	
STEP 2: Check the motor brake circuit and solenoid.		
STEP 2A: Check the brake solenoid - motor for an open circuit.	**Between 5 and 15 ohms?**	
STEP 2B: Check the signal voltage of diagnosis on the motor-brake actuator.	**More than 3.75 VDC?**	
STEP 3: Check the ECM and the engine harness.		
STEP 3A: Inspect the engine harness and ECM connector pins.	**Dirty or damaged pins?**	
STEP 3B: Check the voltage diagnostic supply for motor brake solenoid number 2.	**More than 3.75 VDC?**	
STEP 3C: Check for a circuit open in the engine harness.	**Less than 10 ohms?**	
STEP 3D: Check for a short circuit between pins in the engine harness.	**More than 100k ohms?**	
STEP 3E: Check for a security code failure inactive.	**Fault code 2366 inactive?**	
STEP 3E-1: Check that the brake exhaust is installed.	**Is the engine equipped with an exhaust brake?**	
STEP 4: Clear the fault code.		
STEP 4A: Disable the fault code.	**Fault code 2366 inactive?**	
STEP 4B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

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

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an inactive fault code. • Using INSITE ™, read the fault codes. Fault code 2366 inactive?	**YEA**	Fault Code Inactive or Intermittent, Procedure 019-362 .
	Fault code 2366 inactive? **NOT**	1B

STEP 1B: Determine the type of motor brake. Conditions:

- Turn the ignition key off.

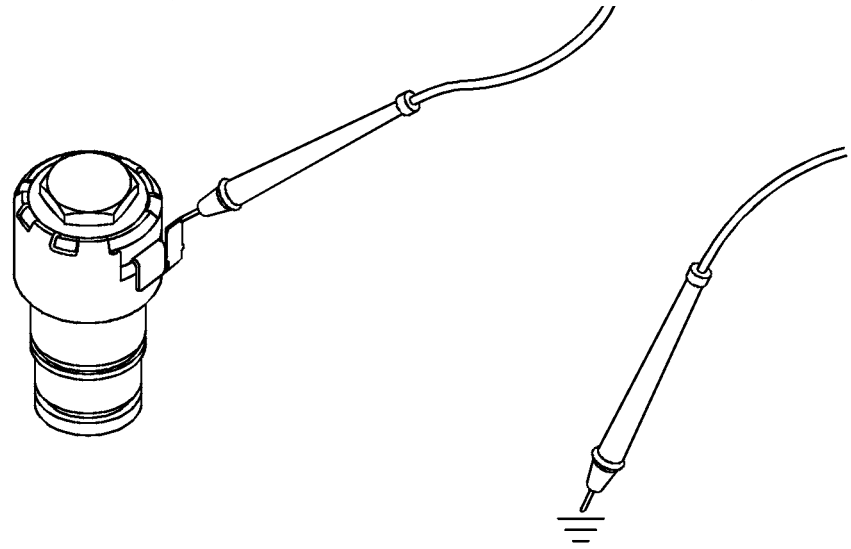
Action	Specifications / Repair	Next step
Determine whether the engine is equipped with a compression brake or an exhaust brake.	Is the engine equipped with a compression brake? **YEA**	2A
	Is the engine equipped with a compression brake? **DO NOT** **REPAIR:** Is the engine equipped with an exhaust brake?	3A

STEP 2: Check the motor brake circuit and solenoid.

STEP 2A: Check the motor brake solenoid for an open circuit. Conditions:

- Turn the ignition key off.
- Remove the rocker cover. Refer to Procedure 003-011 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266.
- Disconnect the motor brake harness from the number 2 solenoid of the motor brake.

Action	Specifications / Repair	Next step
Check the resistance of the solenoid. • Measure the resistance between the solenoid terminal pin and ground. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	Between 5 and 15 ohms? **YEA**	2B
	Between 5 and 15 ohms? **DO NOT** **REPAIR:** Replace the motor brake solenoid. Refer to Procedure 020-012 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266.	4A



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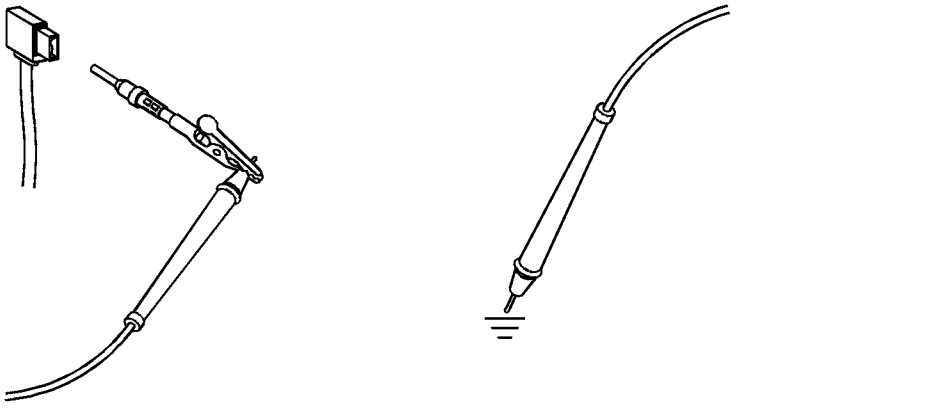
STEP 2B: Check the diagnostic signal voltage on the motor brake actuator. Conditions:

- Turn the ignition key off.
- Remove the rocker cover. Refer to Procedure 003-011 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266.
- Disconnect the number 2 wire from the motor brake solenoid.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check the diagnostic supply voltage of the motor brake solenoid number 2. • Measure the voltage between the SIGNAL pin of solenoid number 2 of the motor brake on the motor harness and the ground. Refer to the electrical diagram for identification of the connector pins.	More than 3.75 VDC? **YEA**	3D
	More than 3.75 VDC? **NOT**	3A



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STEP 3: Check the ECM and the engine harness.

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

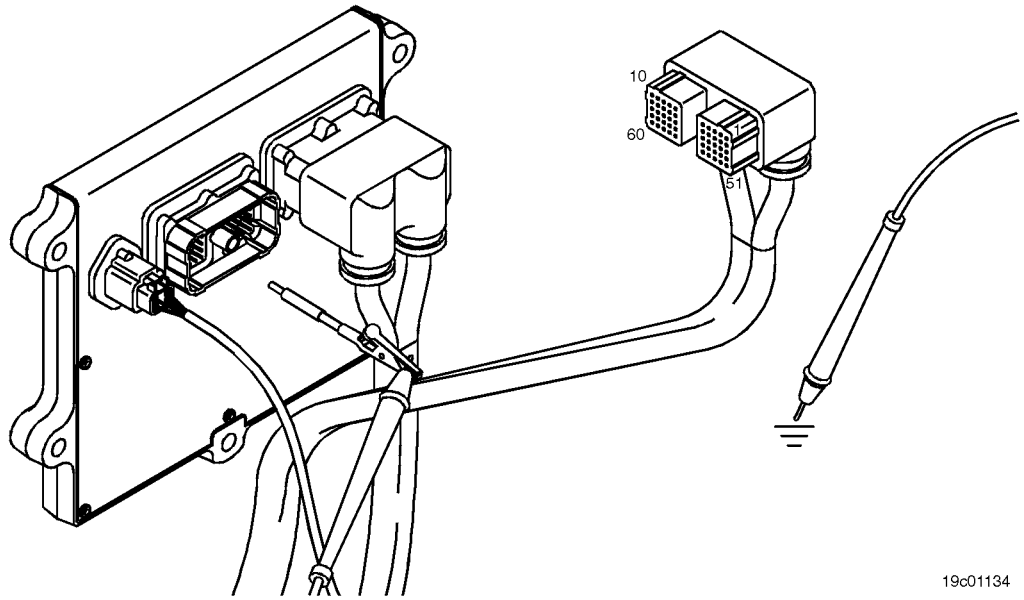
Conditions:
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.

Action	Specifications / Repair	Next step
Inspect the engine and ECM harness pins for: • Loose connector • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Damaged or missing connector seals • Dirt or debris on the connector pins • Damage to the wire shield • Connector cover broken. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected at the ECM connector or at the engine harness. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-043 .	4A
	Dirty or damaged pins? **NOT**	3B

STEP 3B: Check the diagnostic supply voltage of the motor brake solenoid number 2. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Turn the ignition key ON.

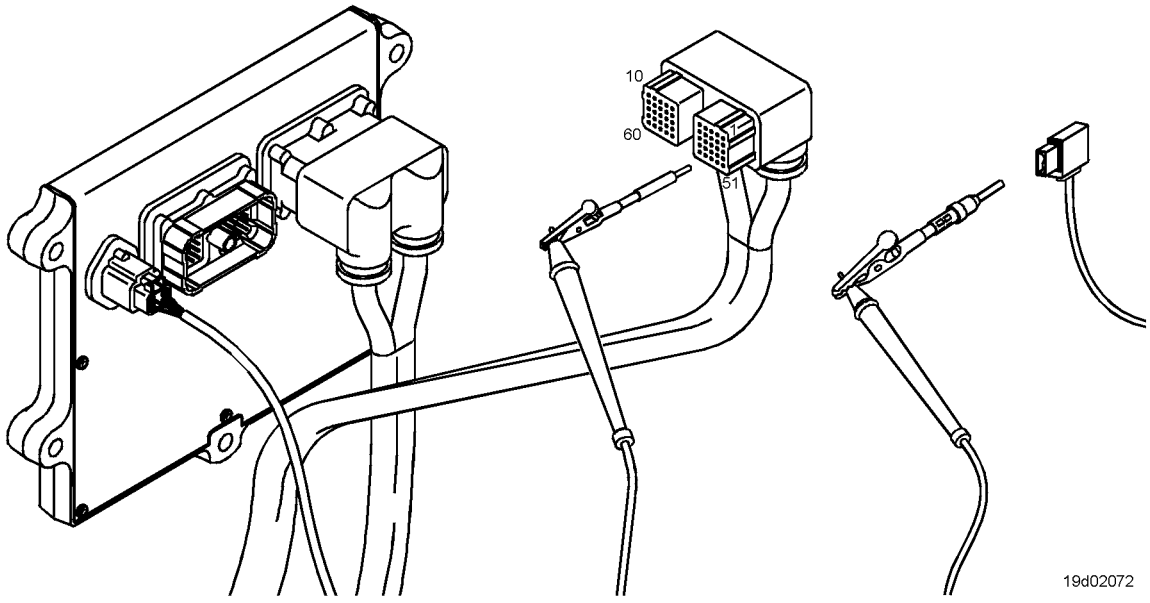
Action	Specifications / Repair	Next step
Check the diagnostic supply voltage of the motor brake solenoid number 2. • Measure the voltage between the SIGNAL pin of solenoid number 2 of the motor brake and the ground in the ECM connector. Refer to the electrical diagram for identification of the connector pins.	More than 3.75 VDC? **YEA**	3C
	More than 3.75 VDC? **DO NOT** **REPAIR:** Call for pre-authorization. Replace the ECM. See the Procedure 019-031 .	4A



STEP 3C: Check the motor harness for an open circuit. Conditions:

- Turn the ignition key off.
- Remove the rocker cover. Refer to Procedure 003-011 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266.
- If equipped with motor brakes, disconnect the number 2 wire from the motor brake solenoid.
- If equipped with an exhaust brake, disconnect the 2-pin Weather Pack connector on the rear of the engine between lines 5 and 6 of high pressure fuel.
- Disconnect the engine harness from the ECM.

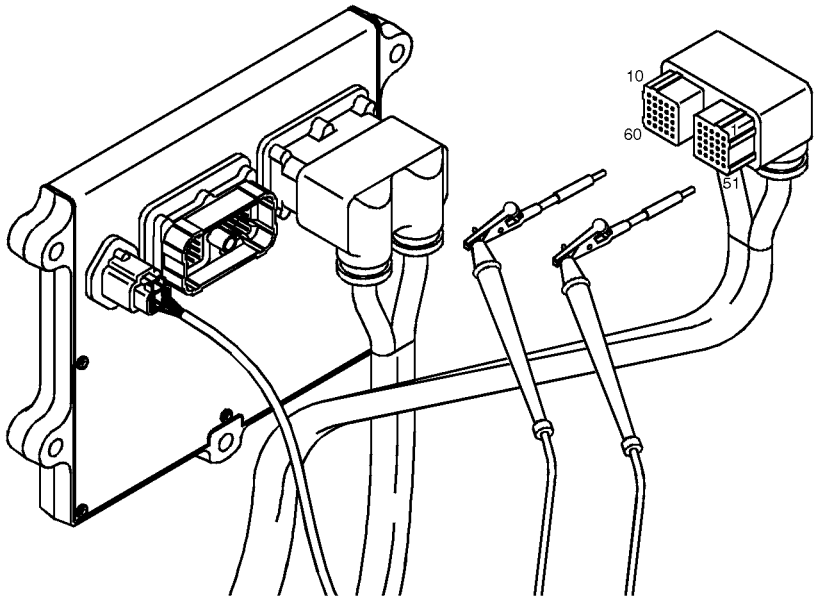
Action	Specifications / Repair	Next step
Check for an open circuit. • If equipped with motor brakes, measure the resistance between the motor brake solenoid SIGNAL wire 2 on the motor brake solenoid and the motor brake solenoid SIGNAL wire 2 on the ECM connector. • If equipped with an exhaust brake, measure the resistance between the motor brake solenoid SIGNAL wire 2, on the 2-pin Weather Pack connector, and the motor brake solenoid SIGNAL wire 2, on the ECM connector. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	Less than 10 ohms? **YEA**	3D
	Less than 10 ohms? **DO NOT** **REPAIR:** An open circuit was detected in the number 2 SIGNAL wire of the motor brake solenoid, in the motor harness. The open circuit is found in one of the following harnesses: • The main engine harness between the 2-pin ECM connector on the rear of the engine • The engine-brake bridge harness between the 2-pin engine harness connector on the rear of the engine and the rocker frame housing • The internal motor-brake harness between the rocker frame and the motor-brake solenoid. Troubleshoot all harnesses connected in series to determine which one contains the open circuit. Repair or replace the engine harness. See the Procedure 019-043 .	4A



STEP 3D: Check the motor harness for a short circuit between pins. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- If equipped with a motor brake, disconnect the number 1 wire from the motor brake solenoid of the motor brake passage connector.
- If equipped with an exhaust brake, disconnect the 2-pin Weather Pack connector on the rear of the engine between lines 5 and 6 of high pressure fuel.

Action	Specifications / Repair	Next step
Check for a short circuit between pins. • Measure the resistance between the motor brake solenoid number 1 SIGN pin on the OEM harness ECM connector and all other ECM connector pins. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YEA**	3E
	More than 100k ohms? **DO NOT** **REPAIR:** A short circuit between pins was detected in the motor harness on the SIGNAL line number 1 of the motor brake solenoid. Repair or replace the engine harness. See the Procedure 019-043 .	4A



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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Using INSITE ™, read the fault codes.	Fault code 2366 inactive? **YES** **Repair:** None. Did removing and installing the connector correct the failure?	4A
	Fault code 2366 inactive? **NOT**	3E-1

STEP 3E-1: Check that the exhaust brake is installed. Conditions:

Action	Specifications / Repair	Next step
Check that the engine is equipped with an exhaust brake.	Is the engine equipped with an exhaust brake? **YES** **Repair:** Refer to the OEM troubleshooting and repair manual for wiring and circuits between Cummins wiring harness and exhaust brake.	OEM fault diagnosis manual
	Is the engine equipped with an exhaust brake? **DO NOT** **REPAIR:** All wiring has been checked and found to be correct. The ECM failed. Call for pre-authorization. Replace the ECM. See the Procedure 019-031 .	4A

STEP 4: Clear the fault code.

STEP 4A: Disable the fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Using INSITE ™, check that the fault code is inactive.	Fault code 2366 inactive? **YEA**	4B
	Fault code 2366 inactive? **NOT**	1A

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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

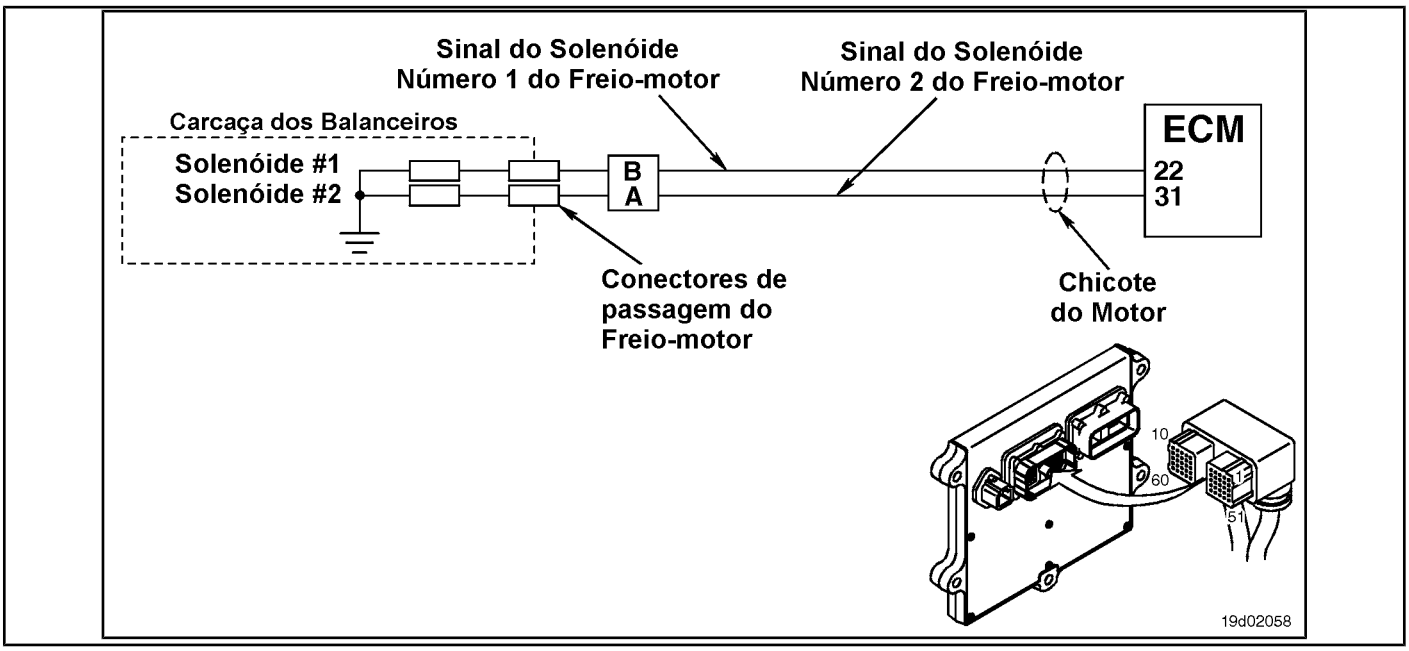
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **NOT**	Proper troubleshooting and repair steps

Fault Code 2367

Motor Brake Actuator Circuit No. 2 - Voltage Above Normal or Voltage High

CODES	REASON	IT IS MADE
Fault Code: 2367 PID (P), SID (S): S029 IMF: 3 Lamp: Amber SRT:	Motor Brake Actuator Circuit No. 2 - Voltage Above Normal or High Voltage An open circuit or high voltage is detected in the motor brake solenoid signal circuit number 2.	The engine brake on cylinders 4, 5 and 6 not can be activated.

Motor Brake Circuit



Circuit Descriptions:

The ECM controls the engine brakes on cylinders 4, 5 and 6 by sending a signal from circuit number 2 to the engine brake solenoid. There is a 2-pin Weather Pack connector located next to the injector pass connector number
3, at the rear of the engine. There is a wiring harness between this connector and the motor brake pass connectors on the rocker housing.

Component Location:

The engine brake solenoids are located under the valve cover. The engine brake solenoids are controlled by the ECM via the engine harness.

Workshop Tips:

Possible causes of this fault code:

- Open circuit on engine harness, brake harness or engine brake solenoids
- Short circuit with a voltage source in the engine harness
- ECM failure.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch / AMP / Metri-Pack female test lead Part No. 3823995 - Weather-Pack male test lead. Part No. 3823996 - Weather-Pack female test lead. STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check for a passcode failure inactive.	**Fault code 2367 inactive?**	
STEP 2: Check the motor brake circuit and solenoid.		
STEP 2A: Check the brake solenoid - motor for an open circuit.	**Between 5 and 15 ohms?**	
STEP 2B: Check the signal voltage of diagnosis on the motor-brake actuator.	**More than 3.75 VDC?**	
STEP 3: Check the ECM and the engine harness.		
STEP 3A: Inspect the engine harness and ECM connector pins.	**Dirty or damaged pins?**	
STEP 3B: Check the voltage diagnostic supply for motor brake solenoid number 2.	**More than 3.75 VDC?**	
STEP 3C: Check for a circuit open in the engine harness.	**Less than 10 ohms?**	
STEP 3D: Check for a short circuit between pins in the engine harness.	**More than 100k ohms?**	
STEP 3E: Check for a security code failure inactive.	**Fault code 2367 inactive?**	
STEP 4: Clear the fault code.		
STEP 4A: Disable the fault code.	**Fault code 2367 inactive?**	
STEP 4B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

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

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

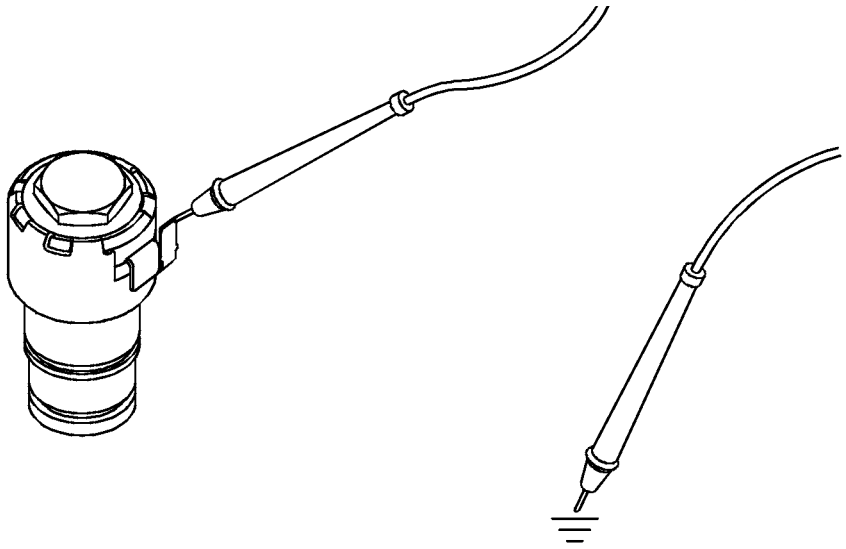
Action	Specifications / Repair	Next step
Check for an inactive fault code. • Using INSITE ™, read the fault codes. Fault code 2367 inactive?	**YEA**	Fault Code Inactive or Intermittent, Procedure 019-362 .
	Fault code 2367 inactive? **NOT**	2A

STEP 2: Check the motor brake circuit and solenoid.

STEP 2A: Check the motor brake solenoid for an open circuit. Conditions:

- Turn the ignition key off.
- Remove the rocker cover. Refer to Procedure 003-011 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266.
- Disconnect the motor brake harness from the number 2 solenoid of the motor brake.

Action	Specifications / Repair	Next step
Check the resistance of the solenoid. • Measure the resistance between the solenoid terminal pin and ground. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	Between 5 and 15 ohms? **YEA**	2B
	Between 5 and 15 ohms? **DO NOT** **REPAIR:** Replace the motor brake solenoid. Refer to Procedure 020-012 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266.	4A



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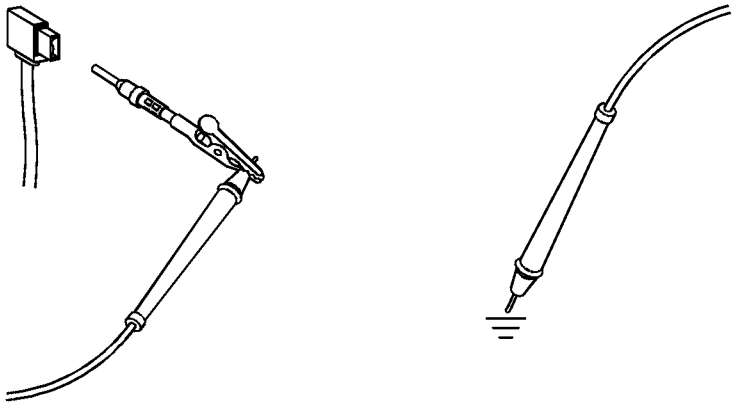
STEP 2B: Check the diagnostic signal voltage on the motor brake actuator. Conditions:

- Turn the ignition key off.
- Remove the rocker cover. Refer to Procedure 003-011 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266.
- Disconnect the number 2 wire from the motor brake solenoid.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check the diagnostic supply voltage of the motor brake solenoid number 2. • Measure the voltage between the SIGNAL pin of solenoid number 2 of the motor brake on the motor harness and the ground. Refer to the electrical diagram for identification of the connector pins.	More than 3.75 VDC? **YEA**	3D
	More than 3.75 VDC? **NOT**	3A



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STEP 3: Check the ECM and the engine harness.

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

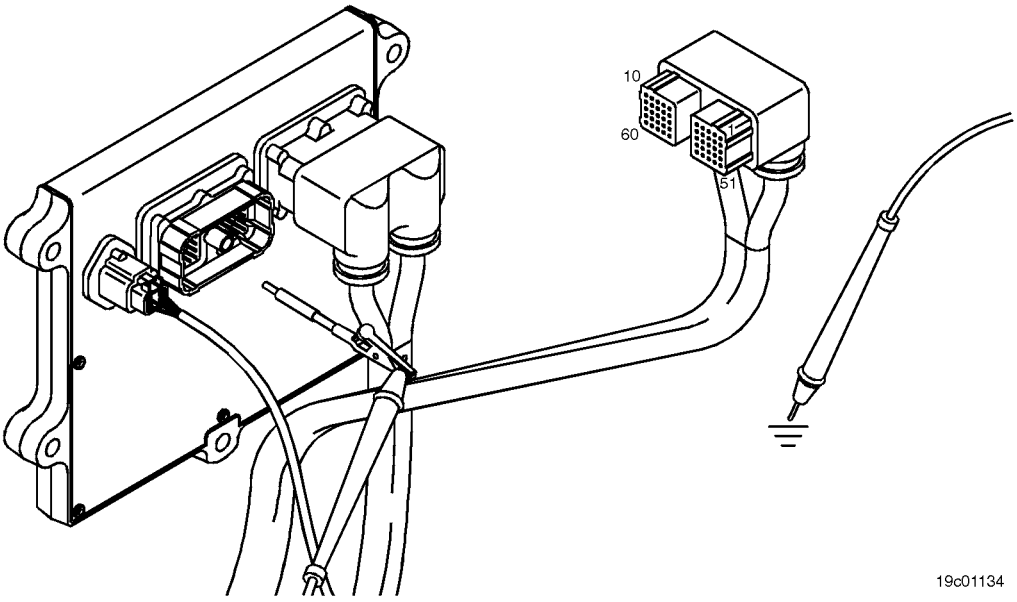
Conditions:
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.

Action	Specifications / Repair	Next step
Inspect the engine and ECM harness pins for: • Loose connector • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Damaged or missing connector seals • Dirt or debris on the connector pins • Damage to the wire shield • Connector cover broken. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected at the ECM connector or at the engine harness. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-043 .	4A
	Dirty or damaged pins? **NOT**	3B

STEP 3B: Check the diagnostic supply voltage of the motor brake solenoid number 2. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Turn the ignition key ON.

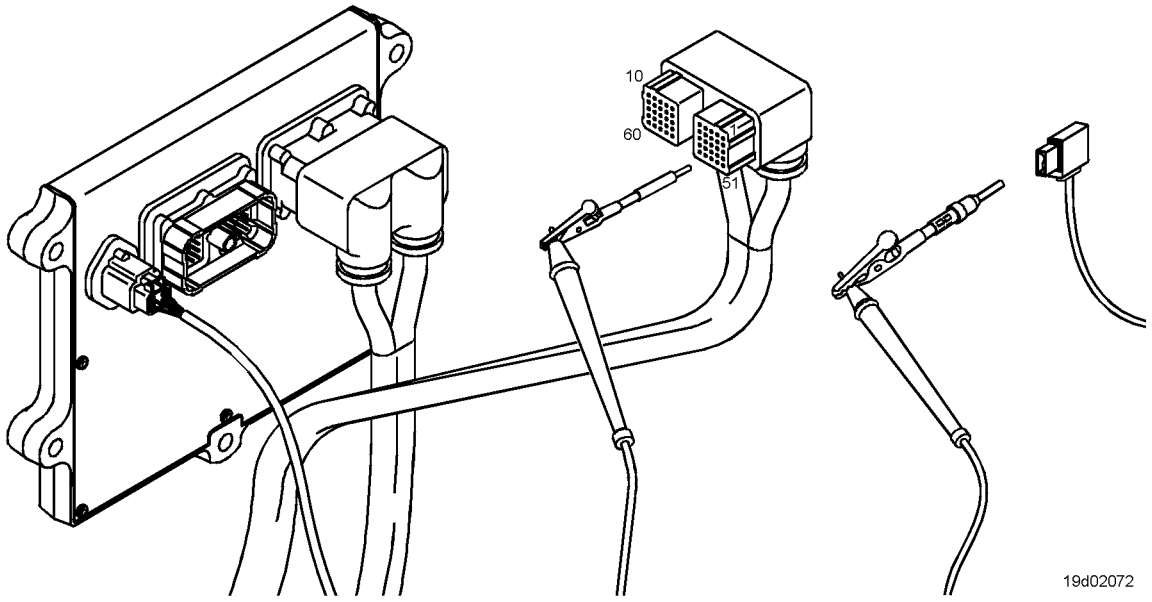
Action	Specifications / Repair	Next step
Check the diagnostic supply voltage of the motor brake solenoid number 2. • Measure the voltage between the SIGNAL pin of solenoid number 2 of the motor brake and the ground in the ECM connector. Refer to the electrical diagram for identification of the connector pins.	More than 3.75 VDC? **YEA**	3C
	More than 3.75 VDC? **DO NOT** **REPAIR:** Call for pre-authorization. Replace the ECM. See the Procedure 019-031 .	4A



STEP 3C: Check the motor harness for an open circuit. Conditions:

- Turn the ignition key off.
- Remove the rocker cover. Refer to Procedure 003-011 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266.
- Disconnect the engine harness from the ECM.
- Disconnect the number 2 wire from the motor brake solenoid.

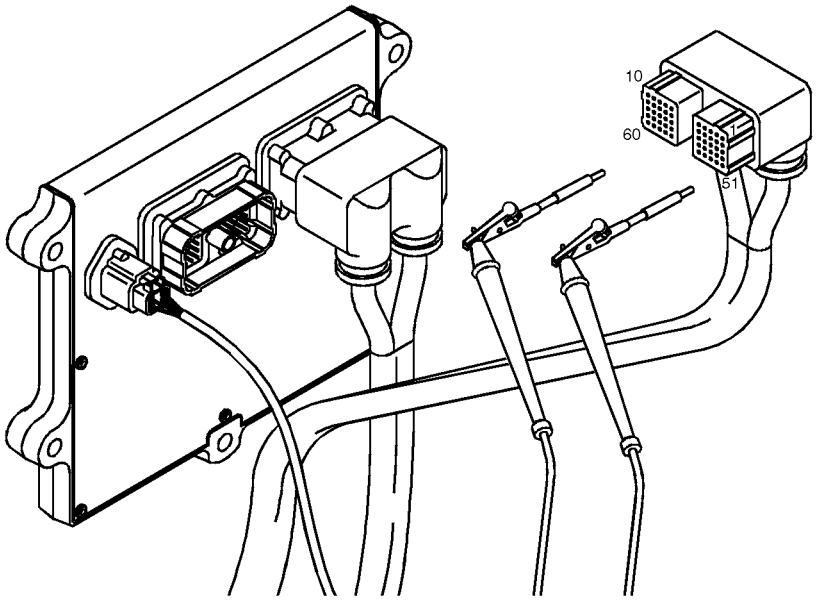
Action	Specifications / Repair	Next step
Check for an open circuit. • Measure the resistance between the brake motor solenoid SIGNAL wire 2 on the motor brake solenoid and the motor brake solenoid SIGNAL wire 2 on the ECM connector. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	Less than 10 ohms? **YEA**	3D
	Less than 10 ohms? **DO NOT** **REPAIR:** An open circuit was detected in the number 2 SIGNAL wire of the motor brake solenoid, in the motor harness. The open circuit is found in one of the following harnesses: • The main engine harness between the 2-pin ECM connector on the rear of the engine • The engine-brake bridge harness between the 2-pin engine harness connector on the rear of the engine and the rocker frame housing • The internal motor-brake harness between the rocker frame and the motor-brake solenoid. Troubleshoot all harnesses connected in series to determine which one contains the open circuit. Repair or replace the engine harness. See the Procedure 019-043 .	4A



STEP 3D: Check the motor harness for a short circuit between pins. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Disconnect the number 2 wire from the motor brake solenoid to the passage of motor-brake.

Action	Specifications / Repair	Next step
Check for a short circuit between pins. • Measure the resistance between the motor brake solenoid number 2 SIGN pin on the OEM harness ECM connector and all other ECM connector pins. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YEA**	3E
	More than 100k ohms? **DO NOT** **REPAIR:** A short circuit between pins in the SIGNAL line number 2 of the motor brake solenoid was detected in the motor harness. Repair or replace the engine harness. See the Procedure 019-043 .	4A



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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Using INSITE ™, read the fault codes.	Fault code 2367 inactive? **YES** **Repair:** None. Did removing and installing the connector correct the failure?	4A
	Fault code 2367 inactive? **DO NOT** **REPAIR:** Call for pre-authorization. Replace the ECM. See the Procedure 019-031 .	4A

STEP 4: Clear the fault code.

STEP 4A: Disable the fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Using INSITE ™, check that the fault code is inactive.	Fault code 2367 inactive? **YEA**	4B
	Fault code 2367 inactive? **NOT**	1A

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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

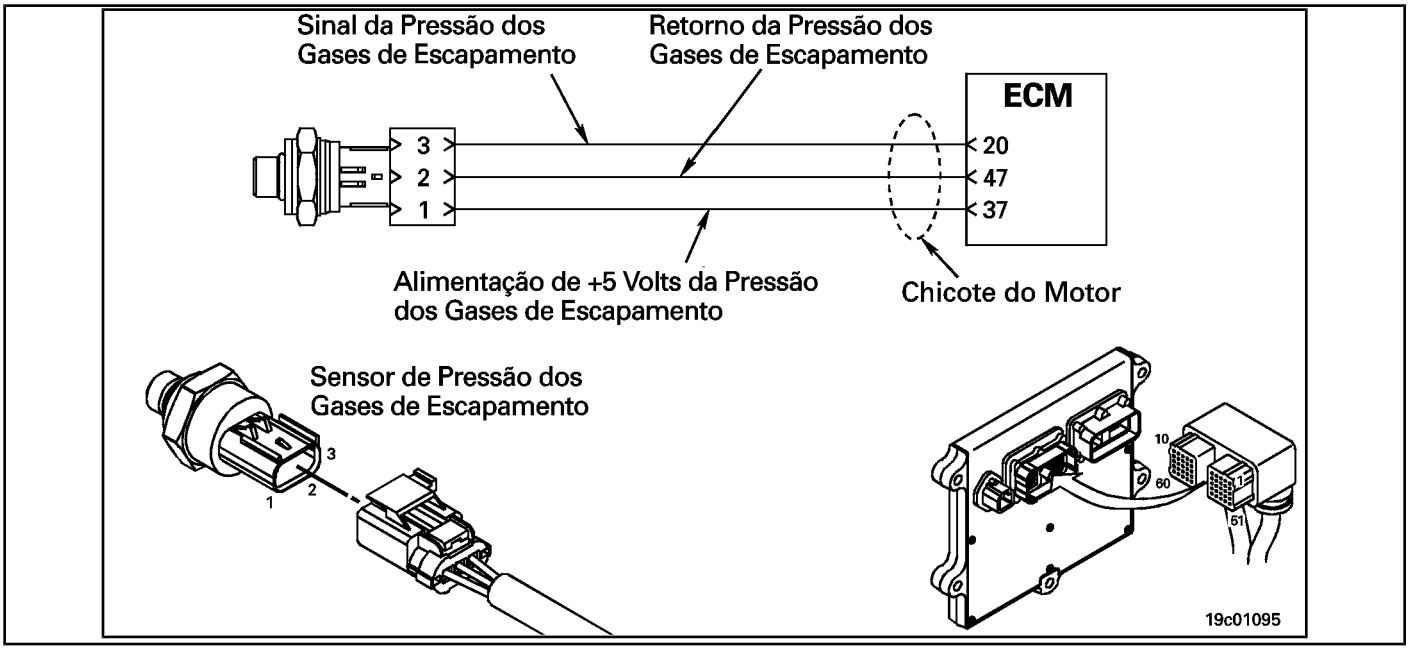
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **NOT**	Proper troubleshooting and repair steps

Fault Code 2373

Exhaust Gas Pressure Sensor Circuit - With High Voltage

CODES	REASON	IT IS MADE
Fault Code: 2373 PID (P), SID (S): P095 IMF: 3/3 Lamp: Amber SRT:	Exhaust gas pressure sensor circuit - with high voltage. High voltage detected in the exhaust gas pressure sensor circuit.	Engine de-powering.

Exhaust Pressure Sensor Circuit



Circuit Descriptions:

The exhaust pressure sensor measures the exhaust gas pressure of the collector and transmits this information to the ECM via the engine harness. This information is used by the ECM to control emissions and the operation of the EGR valve. If the exhaust gas pressure becomes too high, a de-powering condition will occur.

Component Location:

The exhaust pressure sensor is located on the EGR valve cooler on the exhaust side of the engine. See the Procedure 100-002 for the detailed location of each component.

Workshop Tips:

The exhaust pressure sensor shares the engine harness supply and return wires with other sensors. Open circuits and short circuits in the engine harness can cause the activation of several fault codes.

Possible causes of this fault code:

- Shorted signal wire with sensor supply or battery voltage.
- Return circuit open on harness, connectors or sensor.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3164596 - Framatome male test lead. Part No. 3164597 - Framatome male test lead Part No. 3822917 - Deutsch / AMP / Metri-Pack female test lead. STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check for fault codes sensor power supply.	**Fault code 227 active?**	
STEP 1B: Check for a passcode active fault.	**Fault code 2373 active?**	
STEP 2: Check the exhaust gas pressure circuit and sensor.		
STEP 2A: Inspect the exhaust pressure sensor and connector pins.	**Dirty or damaged pins?**	
STEP 2B: Check the circuit response.	**Fault Code 2374 active and Fault Code 2373 inactive?**	
STEP 2C: Check the voltage sensor supply and the return circuit in the engine harness.	**4.75 to 5.25 VDC?**	
STEP 2D: Check the voltage sensor supply and the return circuit in the ECM.	**4.75 to 5.25 VDC?**	
STEP 3: Check the ECM.		
STEP 3A: Inspect the pins of the engine harness and ECM connectors.	**Dirty or damaged pins?**	
STEP 3B: Check the ECM response.	**Fault Code 2374 active and Fault Code 2373 inactive?**	
STEP 4: Clear the fault codes.		
STEP 4A: Disable the fault code.	**Fault code 2373 inactive?**	
STEP 4B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Check for sensor power failure codes. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for sensor power failure codes. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 227 active? **YEA**	Fault Code 227
	Fault code 227 active? **NOT**	1B

STEP 1B: Check for an active fault code. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an active fault code. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 2373 active? **YEA**	2A
	Fault code 2373 active? **NOT**	Fault Code Inactive or Intermittent, Procedure 019-362

STEP 2: Check the exhaust gas pressure circuit and sensor.

STEP 2A: Inspect the exhaust pressure sensor and connector pins.

Conditions:
- Turn the ignition key off.
- Disconnect the exhaust pressure sensor from the engine harness.

Action	Specifications / Repair	Next step
Inspect the engine and sensor harness connector pins for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins • Broken connector cover • Damage to the insulation of the wires or the harness • Damage to the connector locking tab. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. Refer to Resistance Measurements Using a Multimeter and Electrical Diagram, Procedure 019-360 .	4A
	Dirty or damaged pins? **NOT**	2B

STEP 2B: Check the circuit response. Conditions:

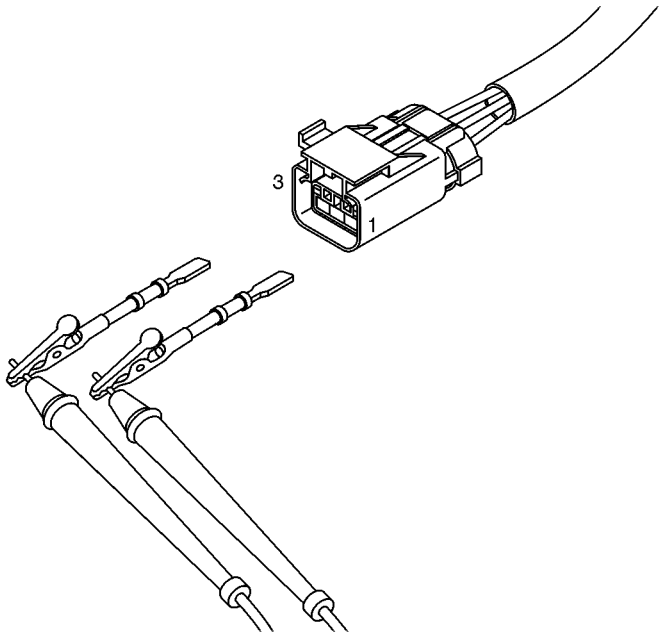
- Turn the ignition key off.
- Disconnect the exhaust pressure sensor from the engine harness.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an appropriate ECM response after 30 seconds. • Use the electronic service tool INSITE ™ to read fault codes.	Fault Code 2374 active and Fault Code 2373 inactive? **YEA**	2C
	Fault Code 2374 active and Fault Code 2373 inactive? **NOT**	3A

STEP 2C: Check the sensor supply voltage and the return circuit in the engine harness. Conditions:

- Turn the ignition key off.
- Disconnect the exhaust pressure sensor from the engine harness.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check the supply voltage and the return circuit. • Measure the voltage between the 5-volt POWER pin of the exhaust gas pressure and the RETURN pin of the exhaust gas pressure in the sensor connector on the engine harness.	4.75 to 5.25 VDC? **YES** **Repair:** Replace the exhaust pressure sensor. See the Procedure 019-376 .	4A
	4.75 to 5.25 VDC? **NOT**	2D



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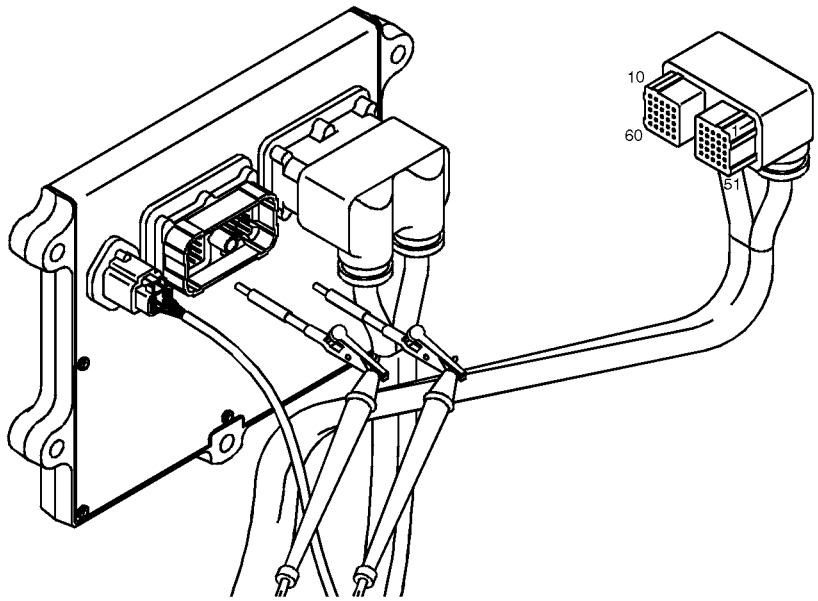
STEP 2D: Check the sensor supply voltage and the return circuit on the ECM. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check the supply voltage and the return circuit. • Measure the voltage between the 5-volt POWER pin of the exhaust gas pressure and the RETURN pin of the exhaust gas pressure on the ECM port.	4.75 to 5.25 VDC? **YES** **Repair:** Repair or replace the engine harness. See Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	4A
	4.75 to 5.25 VDC? See Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 . **DO NOT** **REPAIR:** Replace the ECM. Call for authorization. See the Procedure 019-031 .	4A



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STEP 3: Check the ECM.

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

Conditions:
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.

Action	Specifications / Repair	Next step
Check the pins of the engine harness and ECM connectors for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins • Broken connector cover • Damage to the insulation of the wires or the harness • Damage to the connector locking tab. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	4A
	Dirty or damaged pins? **NOT**	3B

STEP 3B: Check the ECM response. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an appropriate ECM response after 30 seconds. • Use the electronic service tool INSITE ™ to read fault codes.	Fault Code 2374 active and Fault Code 2373 inactive? **YES** **Repair:** Repair or replace the engine harness. See Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	4A
	Fault Code 2374 active and Fault Code 2373 inactive? **DO NOT** **REPAIR:** Replace the ECM. Call for authorization. See the Procedure 019-031 .	4A

STEP 4: Clear the fault codes.

STEP 4A: Disable the fault code. Conditions:

- Connect all components.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Using the electronic service tool INSITE ™, make sure that the fault code is inactive.	Fault code 2373 inactive? **YEA**	4B
	Fault code 2373 inactive? **NOT**	1A

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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

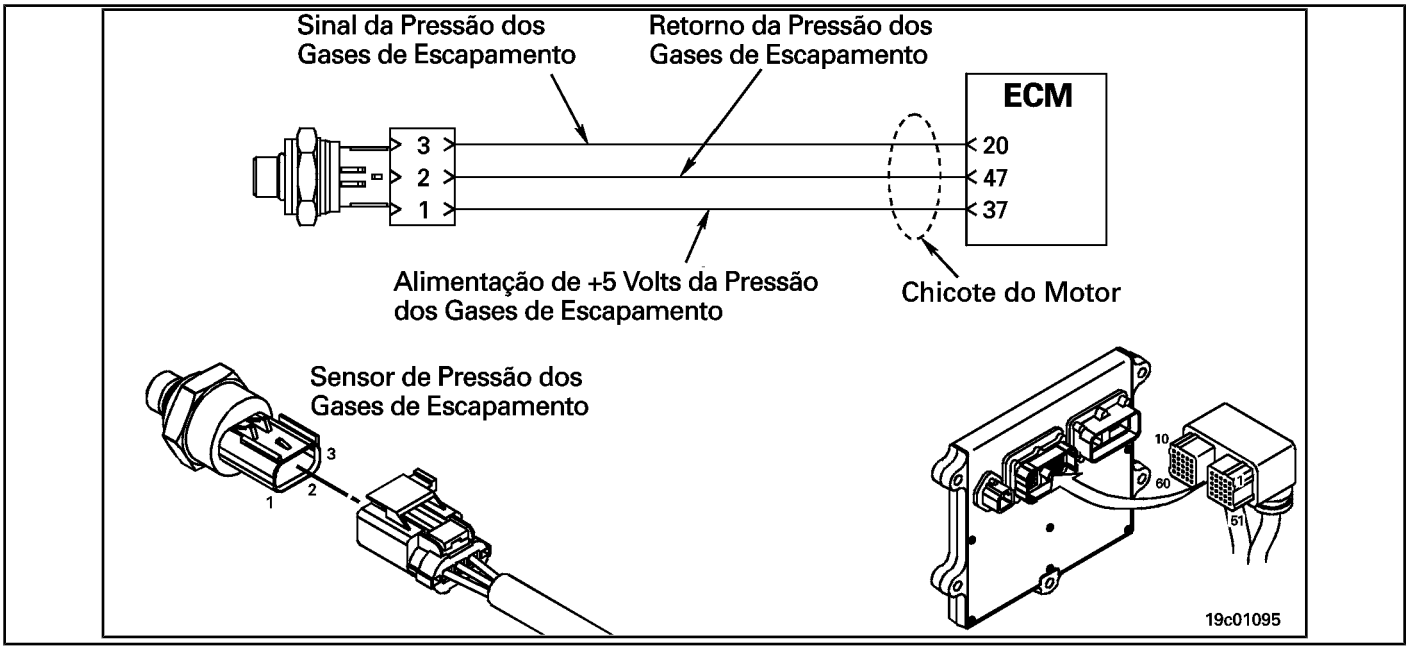
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **NOT**	Proper troubleshooting and repair steps

Fault Code 2374

Exhaust Gas Pressure Sensor Circuit - Low Voltage

CODES	REASON	IT IS MADE
Fault Code: 2374 PID (P), SID (S): P095 IMF: 4/4 Lamp: Amber SRT:	Exhaust gas pressure sensor circuit - low voltage. Low voltage detected in the exhaust gas pressure sensor circuit.	Engine de-powering.

Exhaust Pressure Sensor Circuit



Circuit Descriptions:

The exhaust pressure sensor measures the exhaust gas pressure in the exhaust manifold and transmits the information to the ECM via the engine harness. This information is used by the ECM to control emissions and valve operation. If the exhaust gas pressure becomes too low, a de-powering condition will occur.

Component Location:

The exhaust pressure sensor is located on the EGR valve cooler on the exhaust side of the engine. See the Procedure 100-002 for the detailed location of each component.

Workshop Tips:

The exhaust pressure sensor shares the engine harness supply and return wires with other sensors. Open circuits and short circuits in the engine harness can cause the activation of several fault codes.

Possible causes of this fault code:

- Signal wire open or shorted with ground in the harness
- Supply line open or shorted with grease.
- Short-circuit between sensor and ground.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following test cable when making a measurement:

Part No. 3164596 - Framatome male test lead. STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check for fault codes sensor power supply.	**Fault code 187 active?**	
STEP 1B: Check for a passcode active fault.	**Fault code 2374 active?**	
STEP 2: Check the exhaust gas pressure circuit and sensor.		
STEP 2A: Inspect the exhaust pressure sensor and connector pins.	**Dirty or damaged pins?**	
STEP 2B: Check the voltage supply and the sensor return circuit.	**4.75 to 5.25 VDC?**	
STEP 2C: Check the circuit response.	**Fault Code 2373 active and Fault Code 2374 inactive?**	
STEP 2D: Check the ECM response.	**Fault Code 2373 active and Fault Code 2374 inactive?**	
STEP 3: Check the ECM.		
STEP 3A: Inspect the pins of the engine harness and ECM connectors.	**Dirty or damaged pins?**	
STEP 3B: Check the ECM response.	**Fault Code 2373 active and Fault Code 2374 inactive?**	
STEP 4: Clear the fault codes.		
STEP 4A: Disable the fault code.	**Fault code 2374 inactive?**	
STEP 4B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Check for sensor power failure codes. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for sensor power failure codes. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 187 active? **YEA**	Fault Code 187
	Fault code 187 active? **NOT**	1B

STEP 1B: Check for an active fault code. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an active fault code. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 2374 active? **YEA**	2A
	Fault code 2374 active? **DO NOT** **REPAIR:** Inactive or Intermittent Fault Code, Procedure 019-362 .	4A

STEP 2: Check the exhaust gas pressure circuit and sensor.

STEP 2A: Inspect the exhaust pressure sensor and connector pins.

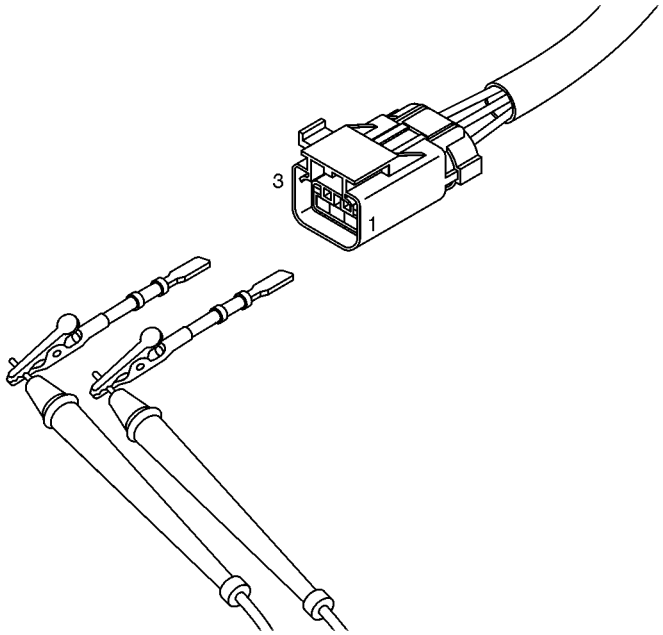
Conditions:
- Turn the ignition key off.
- Disconnect the exhaust pressure sensor from the engine harness.

Action	Specifications / Repair	Next step
Inspect the engine and sensor harness connector pins for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins • Broken connector cover • Damage to the insulation of the wires or the harness • Damage to the connector locking tab. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	4A
	Dirty or damaged pins? **NOT**	2B

STEP 2B: Check the supply voltage and the sensor return circuit. Conditions:

- Turn the ignition key off.
- Disconnect the exhaust pressure sensor from the engine harness.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check the supply voltage and the return circuit. • Measure the voltage between the 5-volt POWER pin of the exhaust gas pressure and the RETURN pin of the exhaust gas pressure in the sensor connector on the engine harness.	4.75 to 5.25 VDC? For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 . **YEA**	2C
	4.75 to 5.25 VDC? See Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 . **NOT**	3A



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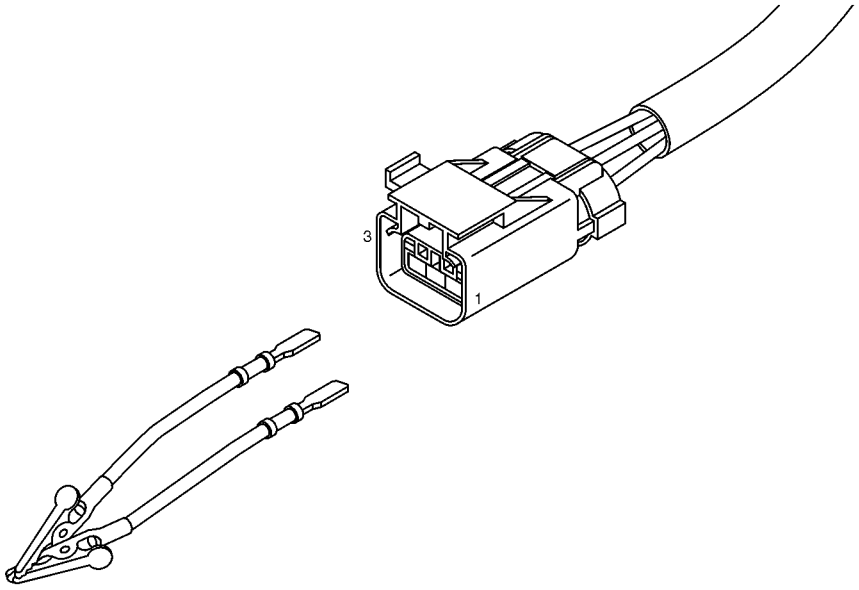
STEP 2C: Check the circuit response. Conditions:

- Turn the ignition key off.
- Disconnect the exhaust pressure sensor from the engine harness.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check the circuit response. • Install a bridge wire between the 5-volt POWER pin for the exhaust gas pressure and the SIGN pin for the exhaust gas pressure, on the sensor connector on the engine harness. • Check for an appropriate ECM response after 30 seconds. • Read fault codes using INSITE ™.	Fault Code 2373 active and Fault Code 2374 inactive? **YES** **Repair:** Replace the exhaust pressure sensor. See the Procedure 019-376 .	4A
	Fault Code 2373 active and Fault Code 2374 inactive? **NOT**	2D



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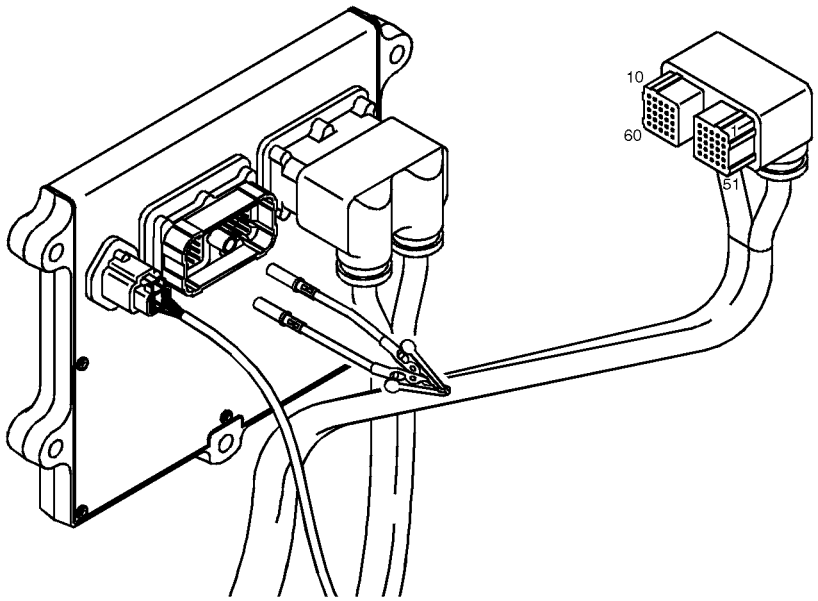
STEP 2D: Check the ECM response. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check the ECM response. • Install a bridge wire between the 5-volt POWER pin for the exhaust gas pressure and the SIGN pin for the exhaust gas pressure on the ECM port. • Check for an appropriate ECM response after 30 seconds. • Use the electronic service tool INSITE ™ to read fault codes.	Fault Code 2373 active and Fault Code 2374 inactive? **YES** **Repair:** Repair or replace the engine harness. See Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	4A
	Fault Code 2373 active and Fault Code 2374 inactive? **DO NOT** **REPAIR:** Replace the ECM. Call for authorization. See the Procedure 019-031 .	4A



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STEP 3: Check the ECM.

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

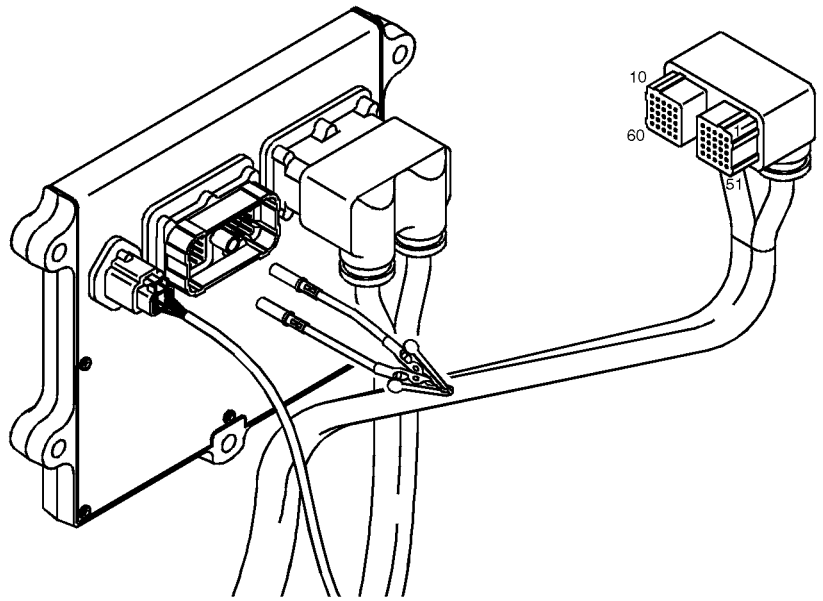
Conditions:
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.

Action	Specifications / Repair	Next step
Check the pins of the engine harness and ECM connectors for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins • Broken connector cover • Damage to the insulation of the wires or the harness • Damage to the connector locking tab. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	4A
	Dirty or damaged pins? **NOT**	3B

STEP 3B: Check the ECM response. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check the ECM response. • Install a bridge wire between the 5-volt POWER pin for the exhaust gas pressure and the SIGN pin for the exhaust gas pressure on the ECM port. • Check for an appropriate ECM response after 30 seconds. • Use the electronic service tool INSITE ™ to read fault codes.	Fault Code 2373 active and Fault Code 2374 inactive? **YES** **Repair:** Repair or replace the engine harness. See Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	4A
	Fault Code 2373 active and Fault Code 2374 inactive? **DO NOT** **REPAIR:** Replace the ECM. Call for authorization. See the Procedure 019-031 .	4A



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STEP 4: Clear the fault codes.

STEP 4A: Disable the fault code. Conditions:

- Connect all components.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Using the electronic service tool INSITE ™, make sure that the fault code is inactive.	Fault code 2374 inactive? **YEA**	4B
	Fault code 2374 inactive? **NOT**	1A

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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

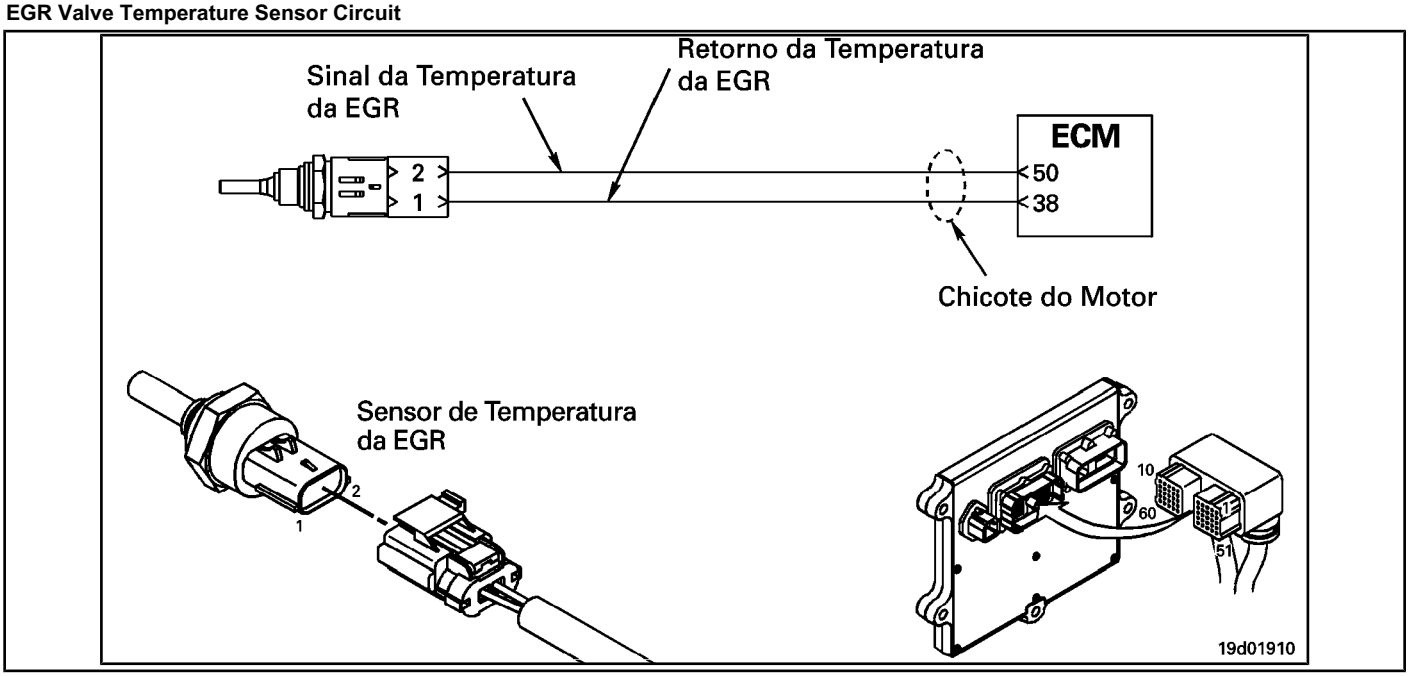
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **NOT**	Proper troubleshooting and repair steps

Fault Code 2375

Exhaust Gas Recirculation Temperature (EGR) Sensor Circuit - Voltage Above Normal or High Voltage

CODES	REASON	IT IS MADE
Fault Code: 2375 PID (P), SID (S): P412 IMF: 3 Lamp: Amber SRT:	EGR Temperature Sensor Circuit - Voltage Above Normal or High Voltage. High voltage detected in the EGR valve temperature sensor signal circuit.	The EGR valve will be closed.

EGR Valve Temperature Sensor Circuit



Circuit Descriptions:

The EGR valve temperature sensor is used to measure the temperature of the exhaust gases leaving the EGR cooler. The ECM uses this temperature to control the engine's emission levels.

Component Location:

The EGR valve temperature sensor is located on the intake air turbine at the front of the engine. See the Procedure 100-002 for the detailed location of each component.

Workshop Tips:

This fault code will be activated if the sensor signal voltage is above the normal sensor operating range and the ECM has commanded the opening of the EGR valve. This fault code **not** will become active if the ECM has commanded the EGR valve to close. However, once activated, the fault code will remain active regardless of whether the EGR valve is open or closed.

The EGR valve temperature sensor shares the engine harness return wires with other sensors. An open return can cause the activation of several fault codes. Before diagnosing Fault Code 2375, check for multiple fault codes. Possible causes of this fault code:

- Open return circuit in harness, connectors, sensor or ECM
- Open or short-circuit signal with 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

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3164596 - Framatome male test lead. Part No. 3164597 - Framatome male test lead Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch / AMP / Metri-Pack female test lead. STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check for a passcode failure inactive.	**Fault code 2375 inactive?**	
STEP 2: Check the EGR valve temperature circuit and sensor.		
STEP 2A: Inspect the EGR valve temperature sensor and connector pins.	**Dirty or damaged pins?**	
STEP 2B: Check the resistance of the sensor.	**200 ohms to 2.4M ohms?**	
STEP 2C: Check the fault codes and the sensor condition.	**Fault code 2375 active?**	
STEP 3: Check the ECM and the engine harness.		
STEP 3A: Inspect the pins of the engine harness and ECM connectors.	**Dirty or damaged pins?**	
STEP 3B: Check the ECM response.	**Fault Code 2376 active and Fault Code 2375 inactive?**	
STEP 3C: Check for a circuit open in the engine harness.	**Less than 10 ohms?**	
STEP 3C-1: Check for a circuit open in the engine harness.	**Less than 10 ohms?**	
STEP 3D: Check for a short circuit between pins in the engine harness.	**More than 100k ohms?**	
STEP 3E: Check for a security code failure inactive.	**Fault code 2375 inactive?**	
STEP 4: Clear the fault codes.		
STEP 4A: Disable the fault code.	**Fault code 2375 inactive?**	
STEP 4B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

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

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an active fault code. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 2375 inactive? **YEA**	Fault Code Inactive or Intermittent, Procedure 019-362
	Fault code 2375 inactive? **NOT**	2A

STEP 2: Check the EGR valve temperature circuit and sensor.

STEP 2A: Inspect the EGR valve temperature sensor and connector pins.

Conditions:

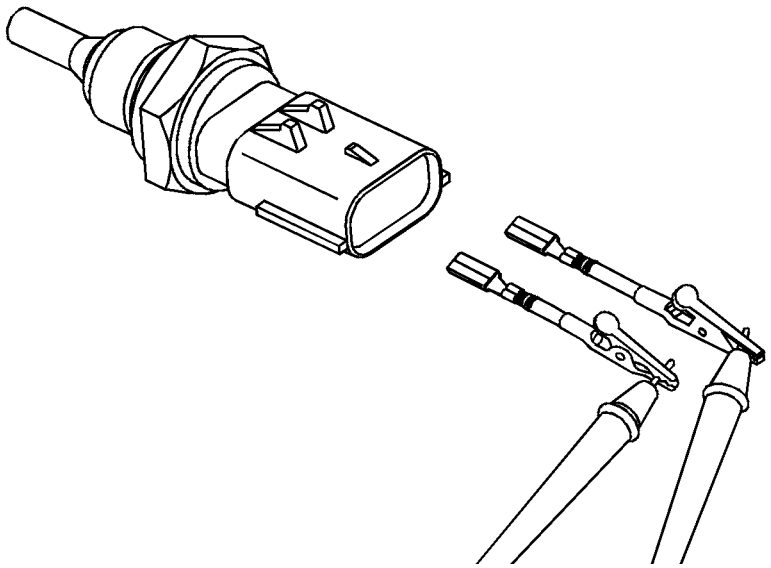
- Turn the ignition key off.
- Disconnect the EGR temperature sensor from the engine harness.

Action	Specifications / Repair	Next step
Inspect the engine and sensor harness connector pins for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins • Broken connector cover • Connector lock guide damage • Damage to the insulation of the motor wiring or harness. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected in the sensor or in the harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 . See the Procedure 019-043 .	4A
	Dirty or damaged pins? **NOT**	2B

STEP 2B: Check the resistance of the sensor. Conditions:

- Turn the ignition key off.
- Disconnect the EGR temperature sensor from the engine harness.

Action	Specifications / Repair	Next step
Check the resistance of the sensor. • Measure the resistance between the SIGN and RETURN pins of the EGR temperature sensor. Refer to the circuit diagram or electrical diagram for the identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	200 ohms to 2.4M ohms? **YEA**	2C
	200 ohms to 2.4M ohms? **DO NOT** **REPAIR:** Replace the EGR temperature sensor. See the Procedure 019-378 .	4A



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STEP 2C: Check the fault codes and the condition of the sensor. Conditions:

- Turn the ignition key off.
- Connect the EGR temperature sensor to the engine harness.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 2375 active? **YEA**	3A
	Fault code 2375 active? **DO NOT** **REPAIR:** None. Did removing and installing the connector correct the failure?	4A

STEP 3: Check the ECM and the engine harness.

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

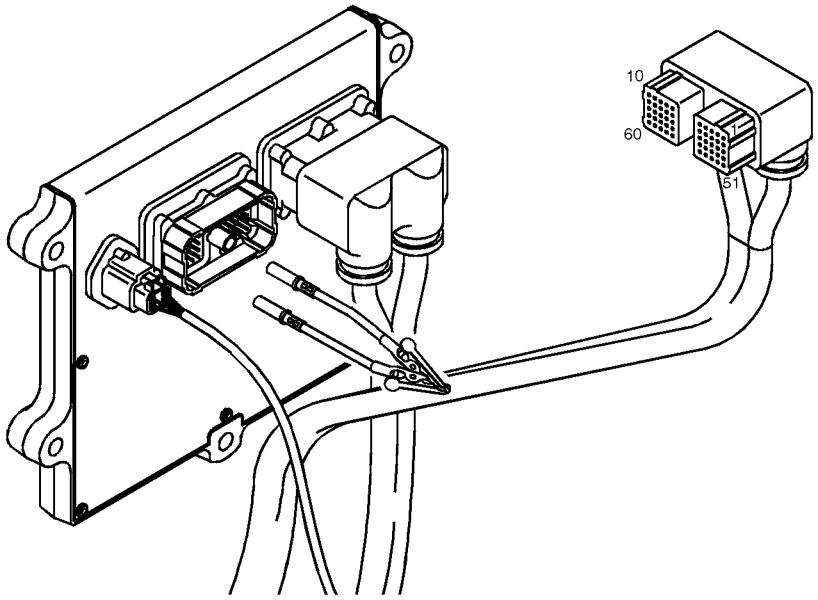
Conditions:
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.

Action	Specifications / Repair	Next step
Check the pins of the engine harness and ECM connectors for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins • Broken connector cover • Connector lock guide damage • Damage to the insulation of the motor wiring or harness. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection has been detected in the ECM connector or the motor harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 . See the Procedure 019-043 .	4A
	Dirty or damaged pins? **NOT**	3B

STEP 3B: Check the ECM response. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Install a jumper wire between the SIGN and RETURN pins of the EGR temperature sensor, on the ECM connector. • Check for proper circuit response after 30 seconds.	Fault Code 2376 active and Fault Code 2375 inactive? **YEA**	3C
• Use the electronic service tool INSITE ™ to read fault codes. Refer to the circuit diagram or electrical diagram for the identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	Fault Code 2376 active and Fault Code 2375 inactive? **DO NOT** **REPAIR:** Call for pre-authorization. Replace the ECM. See the Procedure 019-031 .	4A



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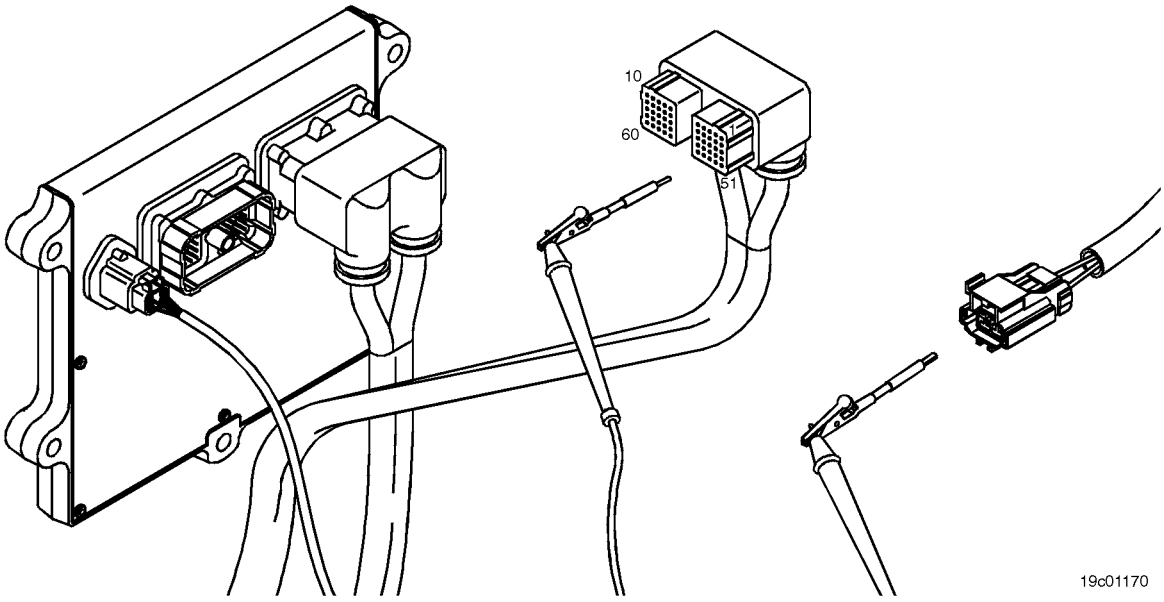
STEP 3C: Check the motor harness (s) for an open circuit. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Disconnect the EGR temperature sensor from the engine harness.

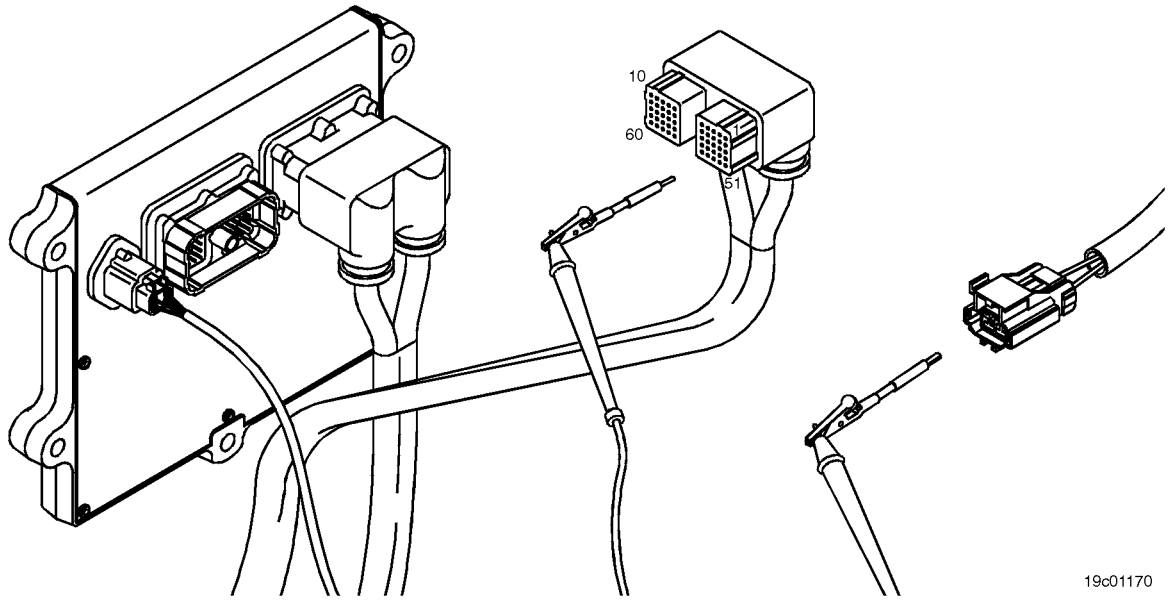
Action	Specifications / Repair	Next step
Check for an open circuit. • Measure the resistance between the EGR temperature sensor RETURN pin on the engine harness ECM connector and the EGR temperature sensor RETURN pin on the engine harness connector. Refer to the circuit diagram or electrical diagram for the identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	Less than 10 ohms? **YEA**	3C-1
	Less than 10 ohms? **DO NOT** **REPAIR:** An open return circuit was detected in the engine harness. Repair or replace the engine harness. See Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 . See the Procedure 019-043 .	4A



STEP 3C-1: Check the motor harness for an open circuit. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Disconnect the EGR temperature sensor from the engine harness.

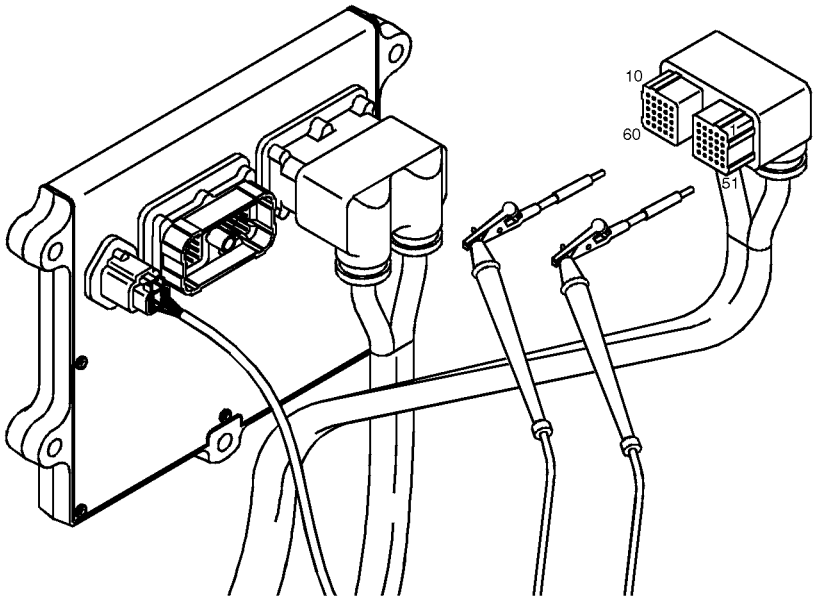
Action	Specifications / Repair	Next step
Check for an open circuit. • Measure the resistance between the EGR temperature sensor SIGN pin on the ECM connector on the engine harness and the EGR temperature sensor SIGN pin on the engine harness connector. Refer to the circuit diagram or electrical diagram for the identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	Less than 10 ohms? **YEA**	3D
	Less than 10 ohms? **DO NOT** **REPAIR:** An open circuit was detected in the signal wire of the engine harness. Repair or replace the engine harness. See Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 . See the Procedure 019-043 , Engine Electrical Harness.	4A



STEP 3D: Check the motor harness for a short circuit between pins. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Disconnect the EGR temperature sensor from the engine harness.

Action	Specifications / Repair	Next step
Check for a short circuit between pins. • Measure the resistance between the EGR temperature sensor SIGN pin, on the ECM connector on the engine harness, and all other pins on the ECM connector on the engine harness. Refer to the circuit diagram or electrical diagram for the identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YEA**	3E
	More than 100k ohms? **DO NOT** **REPAIR:** A short circuit was detected between pins in the signal line of the motor harness. Repair or replace the engine harness. See Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 . See the Procedure 019-043 .	4A



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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 2375 inactive? **YES** **Repair:** None. Did removing and installing the connector correct the failure?	4A
	Fault code 2375 inactive? **DO NOT** **REPAIR:** The fault diagnosis procedures must be repeated from the beginning. A failure mode must have been detected.	1A

STEP 4: Clear the fault codes.

STEP 4A: Disable the fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Using the electronic service tool INSITE ™, make sure that the fault code is inactive.	Fault code 2375 inactive? **YEA**	4B
	Fault code 2375 inactive? **DO NOT** **REPAIR:** Return to the troubleshooting steps or consult your local Cummins Authorized Service Station after checking and completing all diagnostic steps again.	1A

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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

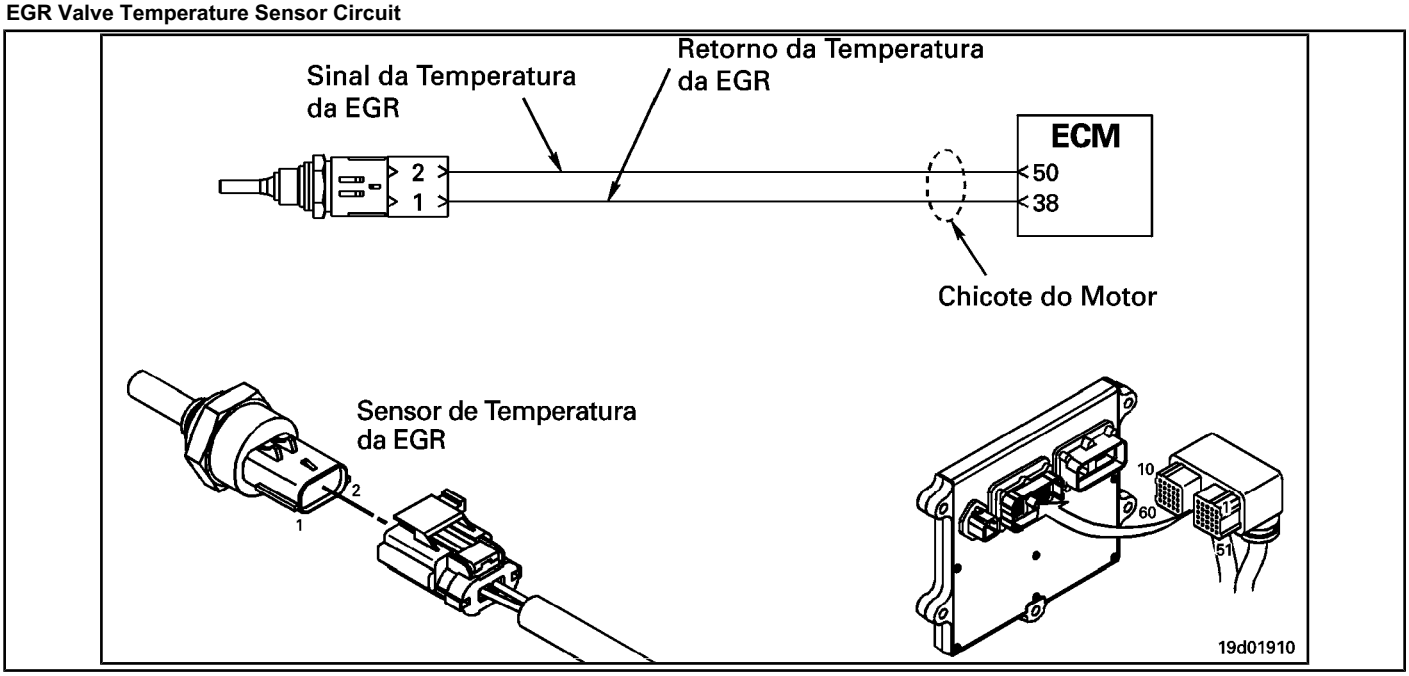
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **DO NOT** **REPAIR:** Troubleshoot any other active fault code.	Proper troubleshooting and repair steps

Fault Code 2376

Exhaust Gas Recirculation Valve (EGR) Temperature Sensor Circuit - Voltage Below Normal or Low Voltage

CODES	REASON	IT IS MADE
Fault Code: 2376 PID (P), SID (S): P412 IMF: 4/4 Lamp: Amber SRT:	Exhaust Gas Recirculation Valve (EGR) Temperature Sensor Circuit - Voltage Below Normal or Low Voltage. Low voltage signal detected in the EGR valve temperature sensor circuit.	The EGR valve will be closed.

EGR Valve Temperature Sensor Circuit



Circuit Descriptions:

The EGR valve temperature sensor is used to measure the temperature of the exhaust gases leaving the EGR cooler. The ECM uses this temperature to control the engine's emission levels.

Component Location:

The EGR valve temperature sensor is located on the intake air turbine at the front of the engine. See the Procedure 100-002 for the detailed location of each component.

Workshop Tips:

This fault code will be activated if the sensor signal voltage is below the normal sensor operating range and the ECM has commanded the opening of the EGR valve. This fault code **not** will become active if the ECM has commanded the EGR valve to close. However, once activated, the fault code will remain active regardless of whether the EGR valve is open or closed.

The EGR valve temperature sensor shares the engine harness return wires with other sensors. A shorted return can cause the activation of several fault codes. Before diagnosing Fault Code 2376, check for multiple fault codes. Possible causes of this fault code:

- Short-circuited signal with ground in the harness or ECM
- Signal shorted with feedback 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

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following test cable when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test cable STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check for a passcode failure inactive.	**Fault code 2376 inactive?**	
STEP 2: Check the EGR valve temperature circuit and sensor.		
STEP 2A: Inspect the EGR valve temperature sensor and connector pins.	**Dirty or damaged pins?**	
STEP 2B: Check the circuit response.	**Fault Code 2375 active and Fault Code 2376 inactive?**	
STEP 2C: Check the fault codes and the sensor condition.	**Fault code 2376 active?**	
STEP 3: Check the ECM and the engine harness.		
STEP 3A: Inspect the pins of the engine harness and ECM connectors.	**Dirty or damaged pins?**	
STEP 3B: Check the ECM response.	**Fault Code 2375 active and Fault Code 2376 inactive?**	
STEP 3C: Check for a short circuit between pins in the engine harness.	**More than 100k ohms?**	
STEP 3D: Check if there is a short circuit between pins and ground.	**More than 100k ohms?**	
STEP 3E: Check for a security code failure inactive.	**Fault code 2376 inactive?**	
STEP 4: Clear the fault codes.		
STEP 4A: Disable the fault code.	**Fault code 2376 inactive?**	
STEP 4B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

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

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an inactive fault code. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 2376 inactive? **YEA**	Fault Code Inactive or Intermittent, Procedure 019-362
	Fault code 2376 inactive? **NOT**	2A

STEP 2: Check the EGR valve temperature circuit and sensor.

STEP 2A: Inspect the EGR valve temperature sensor and connector pins.

Conditions:
- Turn the ignition key off.
- Disconnect the EGR temperature sensor from the engine harness.

Action	Specifications / Repair	Next step
Inspect the engine and sensor harness connector pins for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins • Broken connector cover • Connector lock guide damage • Damage to the insulation of the motor wiring or harness. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected in the sensor or in the harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 . See the Procedure 019-043 .	4A
	Dirty or damaged pins? **NOT**	2B

STEP 2B: Check the resistance of the sensor. Conditions:

- Turn the ignition key off.
- Disconnect the EGR temperature sensor from the engine harness.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an appropriate ECM response after 30 seconds. • Use the electronic service tool INSITE ™ to read fault codes.	Fault Code 2375 active and Fault Code 2376 inactive? **YEA**	2C
	Fault Code 2375 active and Fault Code 2376 inactive? **NOT**	3A

STEP 2C: Check the fault codes and the condition of the sensor. Conditions:

- Turn the ignition key off.
- Connect the EGR temperature sensor to the engine harness.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 2376 active? **YES** **Repair:** A defective sensor has been detected. Replace the EGR temperature sensor. See the Procedure 019-378 .	4A
	Fault code 2376 active? **DO NOT** **REPAIR:** None. Did removing and installing the connector correct the failure?	4A

STEP 3: Check the ECM and the engine harness.

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

Conditions:
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.

Action	Specifications / Repair	Next step
Check the pins of the engine harness and ECM connectors for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins • Broken connector cover • Connector lock guide damage • Damage to the insulation of the motor wiring or harness. For general inspection techniques, see Component and Connector Pin Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected at the harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-362 . See the Procedure 019-043 .	4A
	Dirty or damaged pins? **NOT**	3B

STEP 3B: Check the ECM response. Conditions:

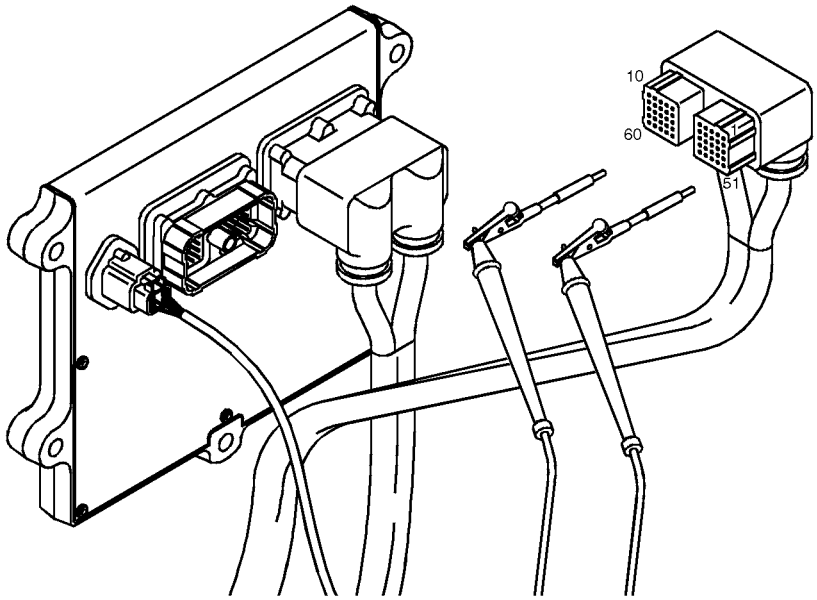
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an appropriate ECM response after 30 seconds. • Use the electronic service tool INSITE ™ to read fault codes.	Fault Code 2375 active and Fault Code 2376 inactive? **YEA**	3C
	Fault Code 2375 active and Fault Code 2376 inactive? **DO NOT** **REPAIR:** Call for pre-authorization. Replace the ECM. See the Procedure 019-031 .	4A

STEP 3C: Check the motor harness for a short circuit between pins. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Disconnect the EGR temperature sensor from the engine harness.

Action	Specifications / Repair	Next step
Check for a short circuit between pins. • Measure the resistance between the EGR temperature sensor SIGN pin, on the ECM connector on the engine harness, and all other pins on the ECM connector on the engine harness. Refer to the circuit diagram or electrical diagram for the identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YEA**	3D
	More than 100k ohms? **DO NOT** **REPAIR:** A short circuit was detected between pins in the signal line of the motor harness. Repair or replace the engine harness. See the Procedure 019-043 .	4A



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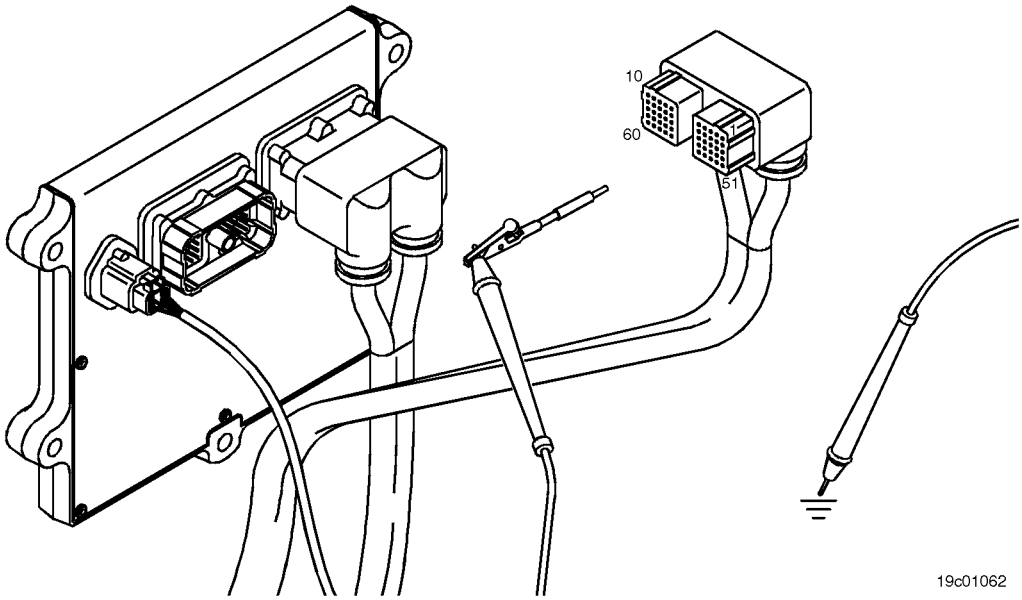
STEP 3D: Check if there is a short circuit between the pins and the ground. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Disconnect the EGR temperature sensor from the engine harness.

Action	Specifications / Repair	Next step
Check for a short between pins and ground. • Measure the resistance between the temperature sensor SIGN pin on the EGR valve, the ECM connector on the engine harness, and the earth. Refer to the circuit diagram or electrical diagram for the identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YEA**	3E
	More than 100k ohms? **DO NOT** **REPAIR:** A short circuit was detected between the pins and the ground in the signal line in the motor harness. Repair or replace the engine harness. See the Procedure 019-043 .	4A



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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 2376 inactive? **YES** **Repair:** None. Removing and installing the connector corrected the failure.	4A
	Fault code 2376 inactive? **DO NOT** **REPAIR:** The fault diagnosis procedures must be repeated from the beginning. A failure mode must have been detected.	1A

STEP 4: Clear the fault codes.

STEP 4A: Disable the fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Using the electronic service tool INSITE ™, make sure that the fault code is inactive.	Fault code 2376 inactive? **YEA**	4B
	Fault code 2376 inactive? **DO NOT** **REPAIR:** Return to the troubleshooting steps or consult your local Cummins Authorized Service Station after checking and completing all diagnostic steps again.	1A

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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

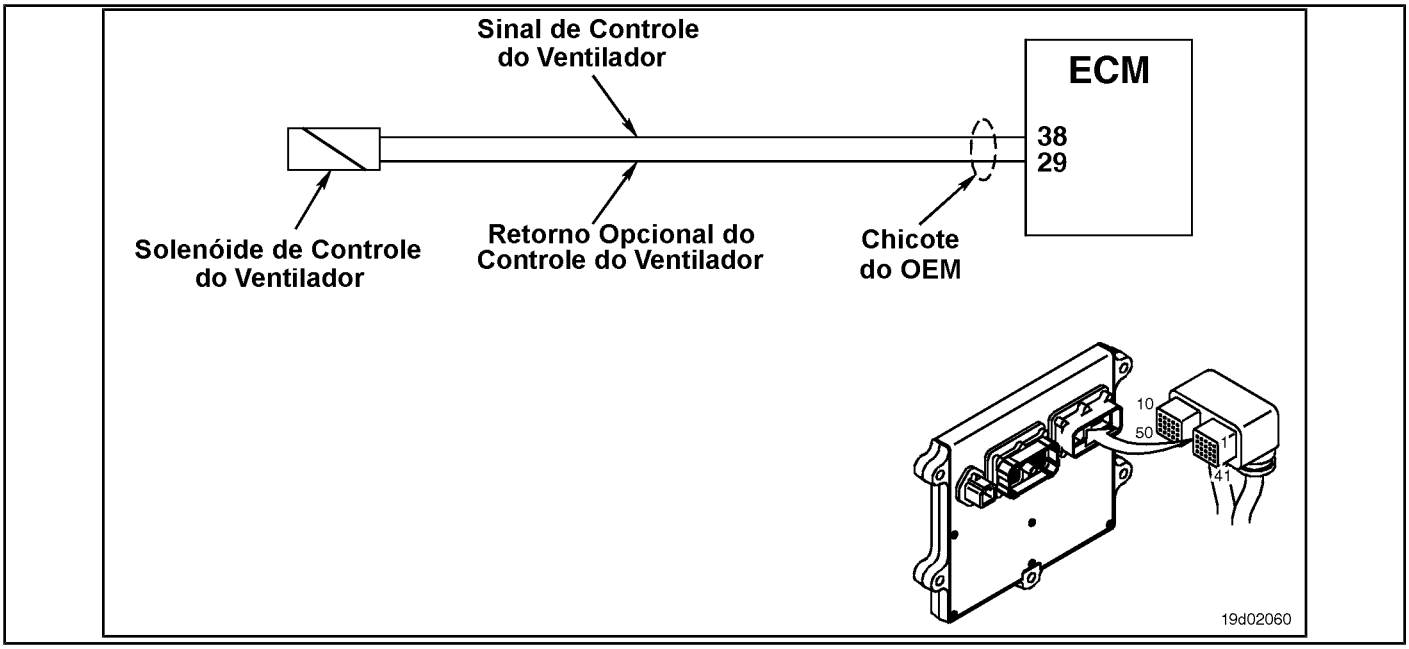
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **DO NOT** **REPAIR:** Troubleshoot any other active fault code.	Proper troubleshooting and repair steps

Fault Code 2377

Fan Control Circuit - Voltage Above Normal or High Voltage

CODES	REASON	IT IS MADE
Fault Code: 2377 PID (P), SID (S): S033 IMF: 3 Lamp: Amber SRT:	Fan Control Circuit - Voltage Above Normal or High Voltage An open circuit or high voltage is detected in the fan control circuit.	The fan may remain on continuously or **not** work.

Fan Control Circuit



Circuit Descriptions:

The electronic control module (ECM) provides a signal to the fan control solenoid to turn the fan on and off. There are two types of fans supported by this signal; variable speed and ON / OFF type. The electronic service tool INSITE ™ can be used to determine which type of fan is configured for use. The fan control circuit varies with the OEM. Some OEMs may use a return solenoid connected to the ECM or a return connected to the engine block or chassis ground.

Component Location:

The location of the fan clutch solenoid varies by OEM. Consult the appropriate OEM service literature for location.

Workshop Tips:

The ECM monitors the voltage level on this circuit. When the ECM sends a low signal command from the fan, it expects the voltage level to be approximately 0 volts. If the ECM detects a high voltage, this failure will be logged.

If Fault Code 2377 is still active after the following diagnostic steps, refer to the OEM service literature for procedures for checking open circuit or short circuit with ground in the fan clutch device. The possible causes of this failure are:

- Open circuit in engine harness or fan control solenoid
- Short circuit with a voltage source in the OEM harness
- ECM failure.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch /

AMP / Metri-Pack female test lead. STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check for a passcode failure inactive.	**Fault code 2377 inactive?**	
STEP 2: Check the fan solenoid and control circuit.		
STEP 2A: Inspect the fan control solenoid and connector pins.	**Dirty or damaged pins?**	
STEP 2B: Check for a circuit open on the fan control solenoid.	**Less than 10k ohms?**	
STEP 2C: Check the voltage diagnostic supply, supply line and fan control solenoid return circuit.	**More than 5.0 VDC?**	
STEP 2D: Check for a circuit open in the return circuit of the fan control solenoid.	**Less than 10 ohms?**	
STEP 3: Check the OEM's ECM and harness.		
STEP 3A: Inspect the ECM and the OEM harness connector pins.	**Dirty or damaged pins?**	
STEP 3B: Check for a circuit open in the fan control solenoid signal circuit.	**Less than 10 ohms?**	
STEP 3C: Check for a short circuit between pins in the OEM harness.	**More than 100k ohms?**	
STEP 3D: Check for a passcode failure inactive.	**Fault code 2377 inactive?**	
STEP 4: Clear the fault code.		
STEP 4A: Disable the fault code.	**Fault code 2377 inactive?**	
STEP 4B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

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

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an inactive fault code. • Using INSITE ™, read the fault codes. Fault code 2377 inactive?	**YEA**	Fault Code Inactive or Intermittent, Procedure 019-362
	Fault code 2377 inactive? **NOT**	2A

STEP 2: Check the fan solenoid and control circuit.

STEP 2A: Inspect the fan control solenoid and connector pins.

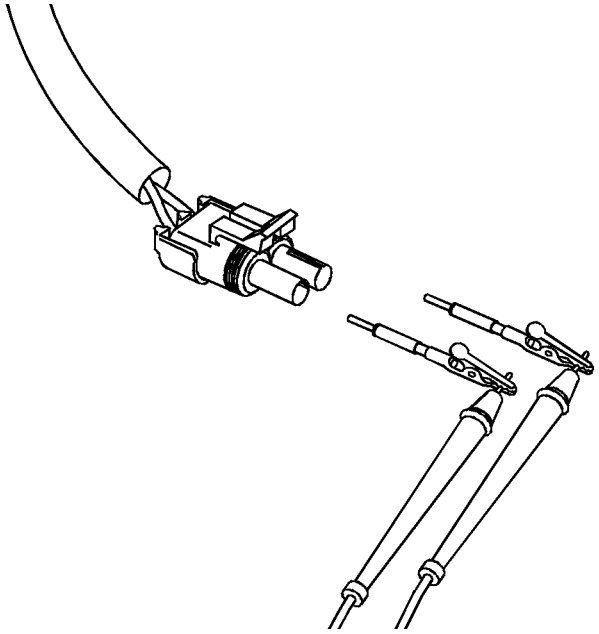
Conditions:
- Turn the ignition key off.
- Disconnect the OEM harness fan solenoid.

Action	Specifications / Repair	Next step
Inspect the OEM harness connector and fan solenoid pins for: • Loose connector • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Damaged or missing connector seals • Dirt or debris on the connector pins • Damage to the wire shield • Connector cover broken.	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected in the sensor or in the harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-071 .	4A
For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **NOT**	2B

STEP 2B: Check the fan control solenoid for an open circuit. Conditions:

- Turn the ignition key off.
- Disconnect the OEM harness fan control solenoid.

Action	Specifications / Repair	Next step
Check the resistance of the fan control solenoid. • Measure the resistance between the SIGNAL and RETURN pins of the fan control solenoid on the fan control solenoid connector. Refer to the electrical diagram for identification of the connector pins.	Less than 10k ohms? **YEA**	2C
	Less than 10k ohms? **DO NOT** **REPAIR:** An open circuit was detected in the fan control solenoid circuit. Replace the fan control solenoid. Refer to the OEM fault diagnosis manual.	4A



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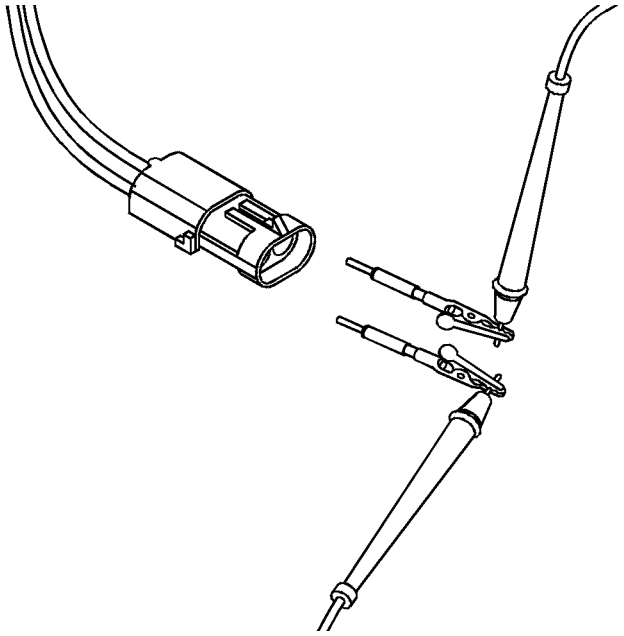
STEP 2C: Check the diagnostic supply voltage, supply line and circuit return of the fan control solenoid.

Conditions:
- Turn the ignition key off.
- Disconnect the OEM harness fan control solenoid.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check the supply voltage and return circuit for diagnosis of the fan control solenoid. • Measure the voltage between the SIGNAL and RETURN pins of the fan control solenoid on the OEM harness fan control solenoid connector.	More than 5.0 VDC? **YEA**	3C
	More than 5.0 VDC? **NOT**	2D



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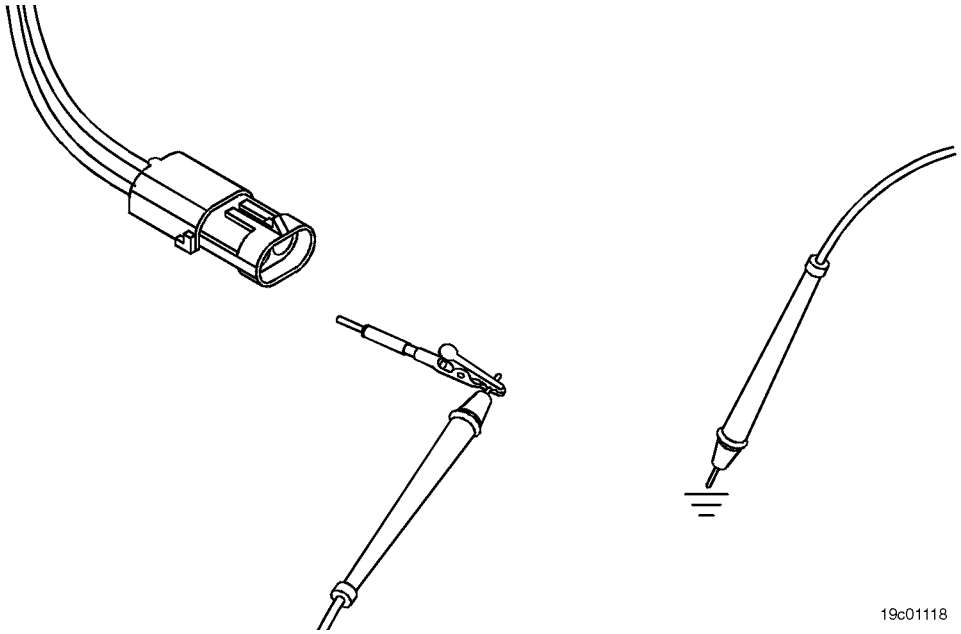
STEP 2D: Check for an open circuit in the return circuit of the control solenoid of the fan.

Conditions:
- Turn the ignition key off.
- Disconnect the fan control solenoid from the engine harness.

Action	Specifications / Repair	Next step
Check for an open circuit. • Measure the resistance between the RETURN pin of the fan control solenoid on the engine harness and the ground. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	Less than 10 ohms? **YEA**	3A
	Less than 10 ohms? **DO NOT** **REPAIR:** An open circuit was detected on the RETURN wire. Refer to the OEM wiring diagram for the RETURN wire configuration. If the RETURN wire is connected to the ECM, repair or replace the OEM harness. See the Procedure 019-071 . If the RETURN wire is grounded to the chassis or to the engine block ground, repair the source of the defective connection. Clean, repair or replace the OEM harness. See the Procedure 019-071 .	4A



STEP 3: Check the OEM's ECM and harness.

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

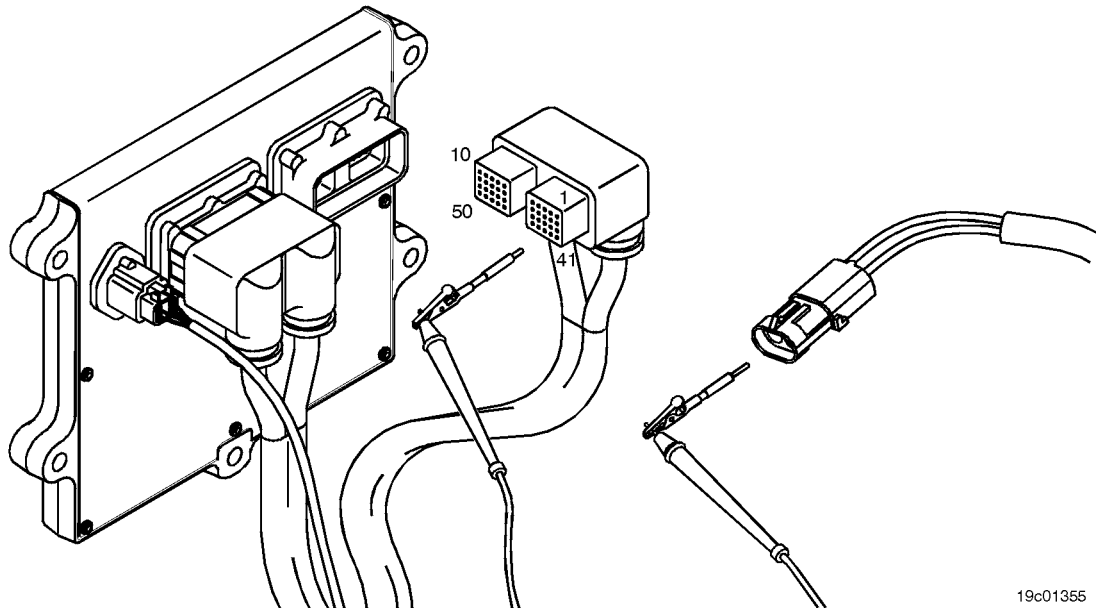
Conditions:
- Turn the ignition key off.
- Disconnect the OEM harness from the ECM.

Action	Specifications / Repair	Next step
Inspect the OEM harness and ECM connector pins for: • Loose connector • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Damaged or missing connector seals • Dirt or debris on the connector pins • Damage to the wire shield • Connector cover broken. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected at the ECM connector or the OEM harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-071 .	4A
	Dirty or damaged pins? **NOT**	3B

STEP 3B: Check the fan control solenoid signal circuit for an open circuit. Conditions:

- Turn the ignition key off.
- Disconnect the OEM harness from the ECM.
- Disconnect the OEM harness fan control solenoid.

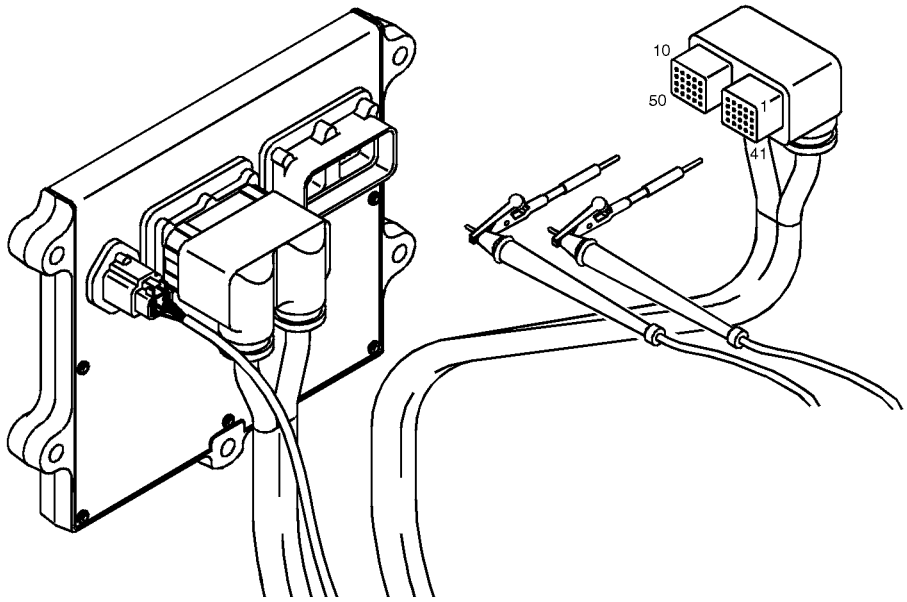
Action	Specifications / Repair	Next step
Check for an open circuit. • Measure the resistance between the fan control solenoid SIGN pin on the OEM harness ECM connector and the fan control solenoid SIGN pin on the OEM harness solenoid connector. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	Less than 10 ohms? **YEA**	3C
	Less than 10 ohms? **DO NOT** **REPAIR:** An open SIGNAL circuit was detected in the fan control solenoid circuit in the OEM harness. Repair or replace the OEM harness. See the Procedure 019-071 .	4A



STEP 3C: Check the OEM harness for a short circuit between pins. Conditions:

- Turn the ignition key off.
- Disconnect the OEM harness from the ECM connector.
- Disconnect the OEM harness fan control solenoid.

Action	Specifications / Repair	Next step
Check for a short circuit between pins. • Measure the resistance between the fan control solenoid SIGN pin on the OEM harness ECM connector and all other pins on the OEM connector. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YEA**	3D
	More than 100k ohms? **DO NOT** **REPAIR:** A short circuit between pins was detected in the SIGNAL line of the fan control solenoid in the OEM harness. Repair or replace the OEM harness. See the Procedure 019-071 .	4A



STEP 3D: Check for an inactive fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Using INSITE ™, read the fault codes.	Fault code 2377 inactive? **YES** **Repair:** None. Did removing and installing the connector correct the failure?	4A
	Fault code 2377 inactive? **DO NOT** **REPAIR:** Replace the ECM. Call for authorization. See the Procedure 019-031 .	4A

STEP 4: Clear the fault code.

STEP 4A: Disable the fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Using INSITE ™, check that the fault code is inactive.	Fault code 2377 inactive? **YEA**	4B
	Fault code 2377 inactive? **NOT**	1A

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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

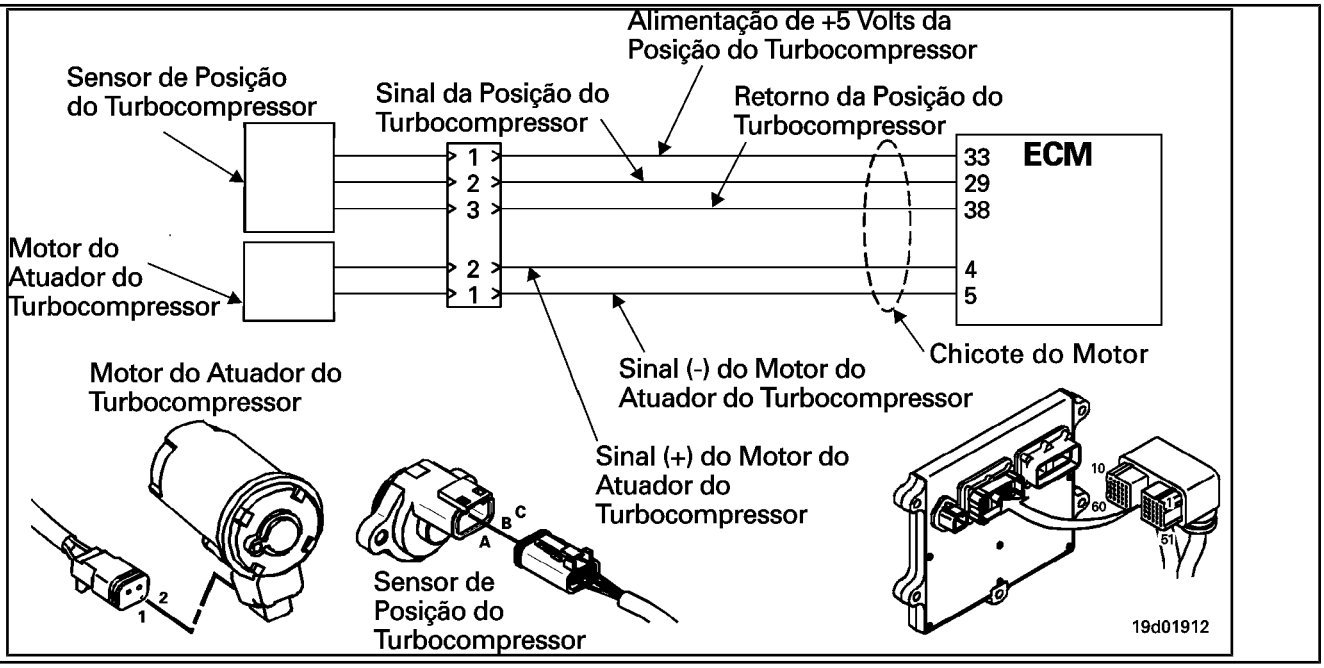
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **NOT**	Proper troubleshooting and repair steps

Fault Code 2381

Turbocharger Position Sensor Circuit - High Voltage

CODES	REASON	IT IS MADE
Fault Code: 2381 PID (P), SID (S): IMF: 4/4 Lamp: Amber SRT:	Turbocharger position sensor circuit - with high voltage. High voltage signal detected in the turbocharger position sensor circuit.	Possible loss of power. The power will be removed from the engine of the turbocharger actuator. The turbocharger will open.

Turbocharger Position Sensor Circuit



Circuit Descriptions:

The turbocharger's position sensor provides a voltage signal to the electronic control module (ECM). The ECM converts this signal into a percentage value, from 0 to 100, indicating the position of the turbocharger actuator. A fully enclosed turbocharger equals 100 Percent.

Component Location:

The turbocharger position sensor is located on the TGV actuator assembly. See the Procedure 100-002 for the detailed location of each component.

Workshop Tips:

The turbocharger position sensor shares the engine harness supply and return wires with other sensors. Open and short circuits in the engine harness can cause several fault codes to be activated. The possible causes of this failure are:

- Return circuit open at harness, connectors or sensor
- Shorted signal wire with sensor supply or battery voltage.
- ECM failure.
- Defect in the TGV position sensor.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch /

AMP / Metri-Pack female test lead. STEPS

		SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.			
STEP 1A: Check for fault codes	**sensor power supply.**	**Fault code 386 active?**	
STEP 1B: Check for a passcode	**active fault.**	**Fault code 2381 active?**	
STEP 2: Check the circuit and the turbocharger position sensor.			
STEP 2A:	**Inspect the pins of the turbocharger and harness position sensor connectors.**	**Dirty or damaged pins?**	
STEP 2B: Check the circuit response.		**Fault Code 2381 inactive and Fault Code 2382 active?**	
STEP 2C: Check the circuit of the	**the turbocharger position sensor in the harness.**	**4.75 to 5.25 VDC?**	
STEP 2D: Check the circuit	**turbocharger position sensor feed and return in ECM.**	**4.75 to 5.25 VDC?**	
STEP 3: Check the ECM.			
STEP 3A:	**Inspect the pins of the engine harness and ECM connectors.**	**Dirty or damaged pins?**	
STEP 3B: Check the ECM response.		**Fault Code 2381 inactive and Fault Code 2382 active?**	
STEP 4: Clear the fault codes.			
STEP 4A: Disable the fault code.		**Fault code 2381 inactive?**	
STEP 4B: Clear the fault codes	**inactive.**	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Check for sensor power failure codes. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for sensor power failure codes. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 386 active? **YEA**	Fault Code 386
	Fault code 386 active? **NOT**	1B

STEP 1B: Check for an active fault code. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an active fault code. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 2381 active? **YEA**	2A
	Fault code 2381 active? **NOT**	Fault Code Inactive or Intermittent, Procedure 019-362 .

STEP 2: Check the circuit and the turbocharger position sensor.

STEP 2A: Inspect the pins of the turbocharger and harness position sensor connectors.

Conditions:
- Turn the ignition key off.
- Disconnect the turbocharger position sensor from the engine harness.

Action	Specifications / Repair	Next step
Inspect the engine harness and turbocharger position sensor connector pins for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins • Broken connector cover • Damage to the insulation of the wires or the harness • Damage to the connector locking tab. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	4A
	Dirty or damaged pins? **NOT**	2B

STEP 2B: Check the circuit response. Conditions:

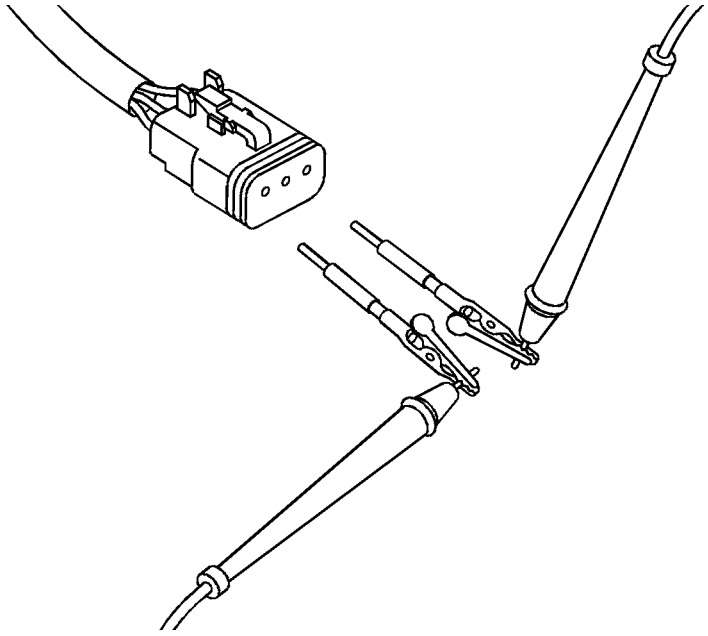
- Turn the ignition key off.
- Disconnect the turbocharger position sensor from the engine harness.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an appropriate ECM response after 30 seconds. • Use the electronic service tool INSITE ™ to read fault codes.	Fault Code 2381 inactive and Fault Code 2382 active? **YEA**	2C
	Fault Code 2381 inactive and Fault Code 2382 active? **NOT**	3A

STEP 2C: Check the supply and return circuit of the turbocharger position sensor in the whip.

Conditions:
- Turn the ignition key off.
- Disconnect the turbocharger position sensor from the engine harness.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check the supply voltage of the turbocharger position sensor and the return circuit in the harness. • Measure the voltage between the +5 volt Power pin from the turbocharger position and the Return pin from the turbocharger position, on the sensor connector on the engine harness.	4.75 to 5.25 VDC? **YES** **Repair:** Replace the turbocharger position sensor. See the Procedure 019-405 .	4A
	4.75 to 5.25 VDC? **NOT**	2D



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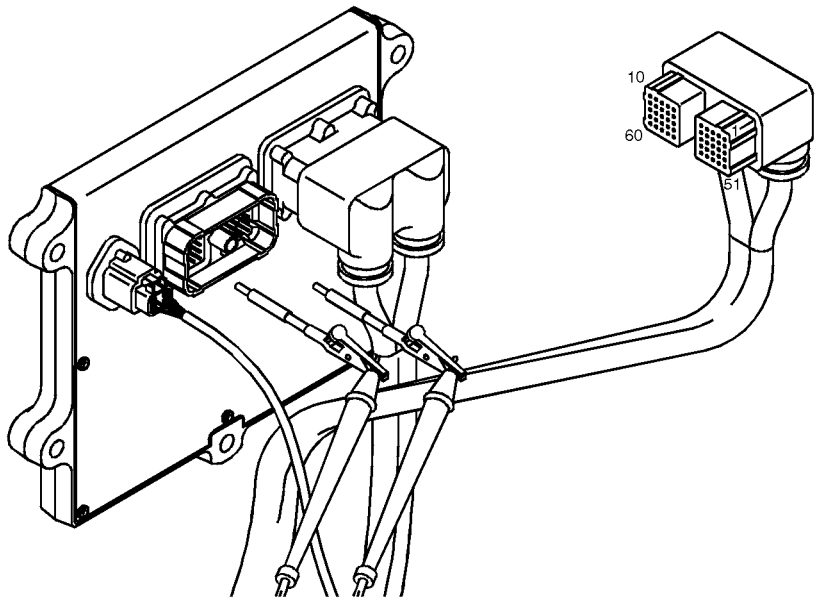
STEP 2D: Check the turbocharger position sensor supply and return circuit in the ECM.

Conditions:
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check the supply and return circuit of the turbocharger position sensor on the ECM. • Measure the voltage between the +5 volt POWER pin of the turbocharger position sensor and the RETURN pin of the turbocharger position sensor on the ECM port.	4.75 to 5.25 VDC? **YES** **Repair:** Repair or replace the engine harness. See Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	4A
	4.75 to 5.25 VDC? **DO NOT** **REPAIR:** Replace the ECM. Call for authorization. See the Procedure 019-031 .	4A



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STEP 3: Check the ECM.

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

Conditions:
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.

Action	Specifications / Repair	Next step
Check the pins of the engine harness and ECM connectors for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361.	Dirty or damaged pins? **YES** **Repair:** Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	4A
	Dirty or damaged pins? **NOT**	3B

STEP 3B: Check the ECM response. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an appropriate ECM response after 30 seconds. • Use the electronic service tool INSITE ™ to read fault codes.	Fault Code 2381 inactive and Fault Code 2382 active? **YES** **Repair:** Repair or replace the engine harness. See Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	4A
	Fault Code 2381 inactive and Fault Code 2382 active? **DO NOT** **REPAIR:** Replace the ECM. Call for authorization. See the Procedure 019-031 .	Complete repair

STEP 4: Clear the fault codes.

STEP 4A: Disable the fault code. Conditions:

- Connect all components.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Using the electronic service tool INSITE ™, make sure that the fault code is inactive.	Fault code 2381 inactive? **YEA**	4B
	Fault code 2381 inactive? **NOT**	1A

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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

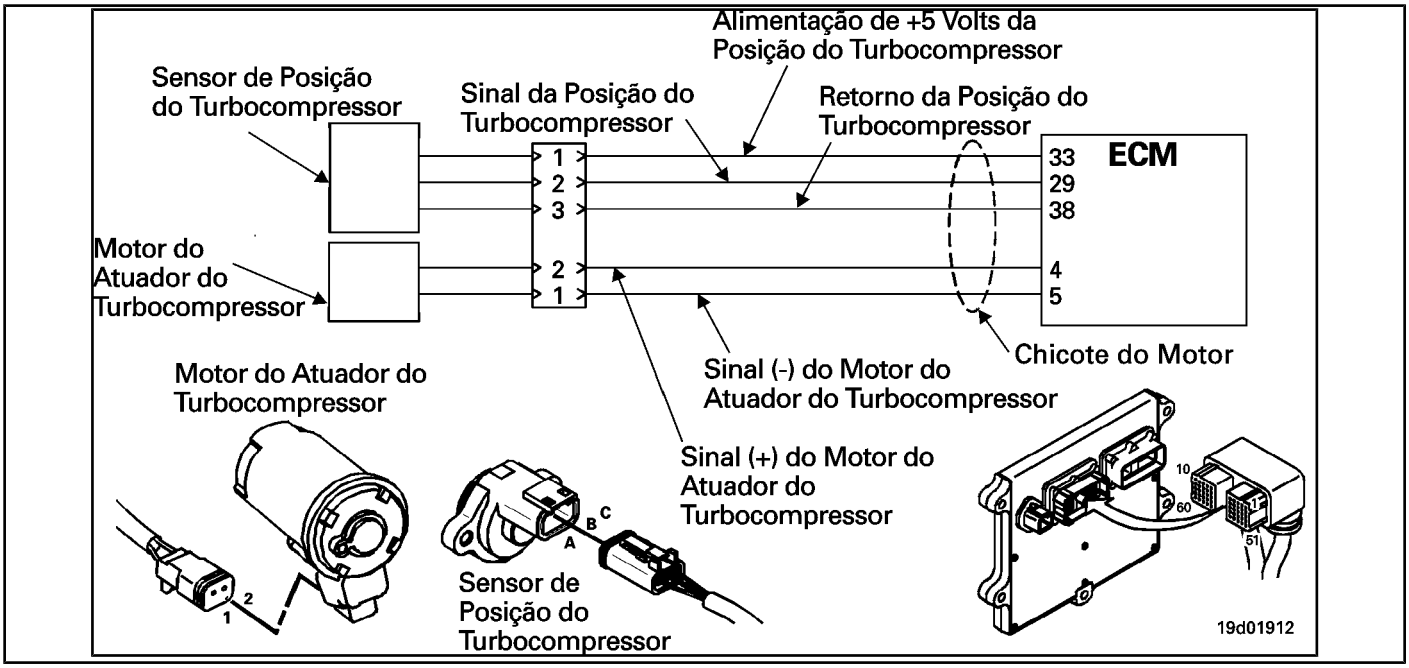
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **NOT**	Proper troubleshooting and repair steps

Fault Code 2382

Turbocharger Position Sensor Circuit - Low Voltage

CODES	REASON	IT IS MADE
Fault Code: 2382 PID (P), SID (S): IMF: 4/4 Lamp: Amber SRT:	Turbocharger position sensor circuit - low voltage. Low voltage signal detected in the turbocharger position sensor circuit.	Possible loss of power. The power will be removed from the engine of the turbocharger actuator. The turbocharger will open.

Turbocharger Position Sensor Circuit



Circuit Descriptions:

The turbocharger's position sensor provides a voltage signal to the electronic control module (ECM). The ECM converts this signal into a percentage value, from 0 to 100 Percent, indicating the position of the turbocharger. A fully enclosed turbocharger equals 100 Percent.

Component Location:

The turbocharger position sensor is located on the TGV actuator assembly. See the Procedure 100-002 for the detailed location of each component.

Workshop Tips:

The turbocharger position sensor shares the engine harness supply and return wires with other sensors. Open and short circuits in the engine harness can cause several fault codes to be activated. The possible causes of this failure are:

- Signal circuit open or shorted with ground
- Supply circuit open or shorted with ground
- Short-circuit between sensor and ground.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch /

AMP / Metri-Pack female test lead. STEPS

		SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.			
STEP 1A: Check for fault codes	**sensor power supply.**	**Fault code 352 active?**	
STEP 1B: Check for a passcode	**active fault.**	**Fault code 2382 active?**	
STEP 2: Check the circuit and the turbocharger position sensor.			
STEP 2A:	**Inspect the pins of the turbocharger and harness position sensor connectors.**	**Dirty or damaged pins?**	
STEP 2B: Check the voltage	**supply and the sensor return circuit.**	**4.75 to 5.25 VDC?**	
STEP 2C: Check the circuit response.		**Fault Code 2381 active and Fault Code 2382 inactive?**	
STEP 3: Check the engine harness.			
STEP 3A:	**Inspect the pins of the engine harness and ECM connectors.**	**Dirty or damaged pins?**	
STEP 3B: Check the ECM response.		**Fault Code 2381 active and Fault Code 2382 inactive?**	
STEP 4: Clear the fault codes.			
STEP 4A: Disable the fault code.		**Fault code 2382 inactive?**	
STEP 4B: Clear the fault codes	**inactive.**	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Check for sensor power failure codes. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for sensor power failure codes. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 352 active? **YEA**	Fault Code 352
	Fault code 352 active? **NOT**	1B

STEP 1B: Check for an active fault code. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an active fault code. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 2382 active? **YEA**	2A
	Fault code 2382 active? **NOT**	Fault Code Inactive or Intermittent, Procedure 019-362.

STEP 2: Check the circuit and the turbocharger position sensor.

STEP 2A: Inspect the pins of the turbocharger and harness position sensor connectors.

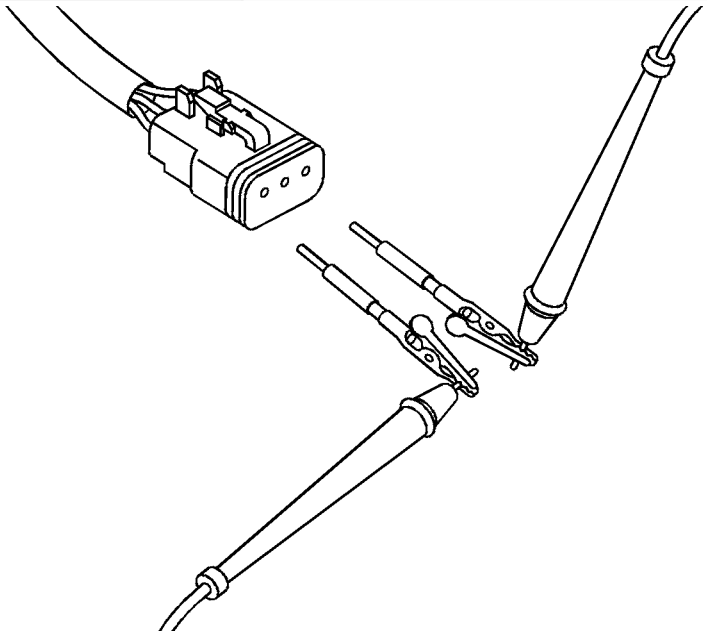
Conditions:
- Turn the ignition key off.
- Disconnect the turbocharger position sensor from the engine harness.

Action	Specifications / Repair	Next step
Inspect the engine harness and turbocharger position sensor connector pins for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins • Broken connector cover • Connector lock guide damage • Damage to the insulation of the wires or the engine harness. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	4A
	Dirty or damaged pins? **NOT**	2B

STEP 2B: Check the supply voltage and the sensor return circuit. Conditions:

- Turn the ignition key off.
- Disconnect the turbocharger position sensor from the engine harness.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check the supply voltage and the sensor feedback circuit. • Measure the voltage between the +5 volt Power pin from the turbocharger position and the Return pin from the turbocharger position, on the sensor connector on the engine harness.	4.75 to 5.25 VDC? **YEA**	2C
	4.75 to 5.25 VDC? **NOT**	3A



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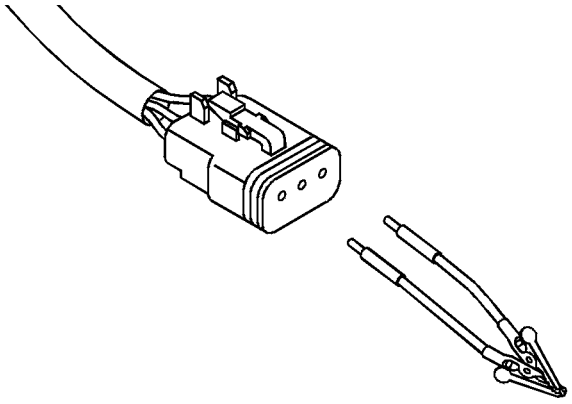
STEP 2C: Check the circuit response. Conditions:

- Turn the ignition key off.
- Disconnect the turbocharger position sensor from the engine harness.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check the circuit response. • Measure the voltage between the +5 volts Power pin on the turbocharger and the Signal pin on the turbocharger. turbocharger, on the sensor connector on the engine harness. Check for an appropriate ECM response after 30 seconds. • Use the electronic service tool INSITE ™ to read fault codes.	Fault Code 2381 active and Fault Code 2382 inactive? **YES** **Repair:** Replace the turbocharger position sensor. See the Procedure 019-405 .	4A
	Fault Code 2381 active and Fault Code 2382 inactive? **NOT**	3A



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STEP 3: Check the engine harness.

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

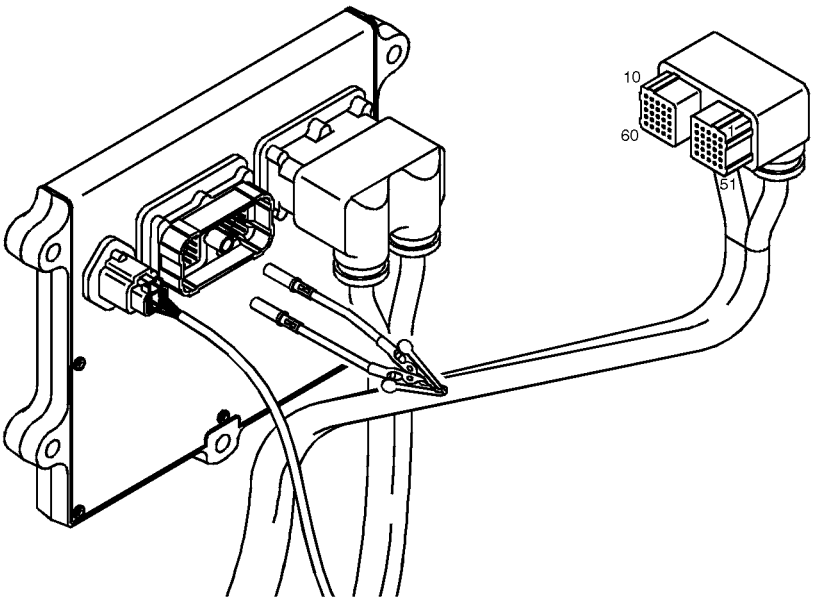
Conditions:
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.

Action	Specifications / Repair	Next step
Check the pins of the engine harness and ECM connectors for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins • Broken connector cover • Connector lock guide damage • Damage to the insulation of the wires or the engine harness.	Dirty or damaged pins? **YES** **Repair:** Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	4A
For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **NOT**	3B

STEP 3B: Check the ECM response. Conditions:

- Turn the ignition key off.
- Disconnect the turbocharger position sensor from the engine harness.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check the circuit response. • Install a jumper wire between the +5 volt power pin on the turbocharger and the Signal pin on the turbocharger on the ECM port: Check for an appropriate ECM response after 30 seconds. • Use the electronic service tool INSITE ™ to read fault codes.	Fault Code 2381 active and Fault Code 2382 inactive? **YES** **Repair:** Repair or replace the engine harness. See Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	4A
	Fault Code 2381 active and Fault Code 2382 inactive? **DO NOT** **REPAIR:** Replace the ECM. Call for authorization. See the Procedure 019-031 .	4A



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STEP 4: Clear the fault codes.

STEP 4A: Disable the fault code. Conditions:

- Connect all components.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Using the electronic service tool INSITE ™, make sure that the fault code is inactive.	Fault code 2382 inactive? **YEA**	4B
	Fault code 2382 inactive? **NOT**	1A

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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

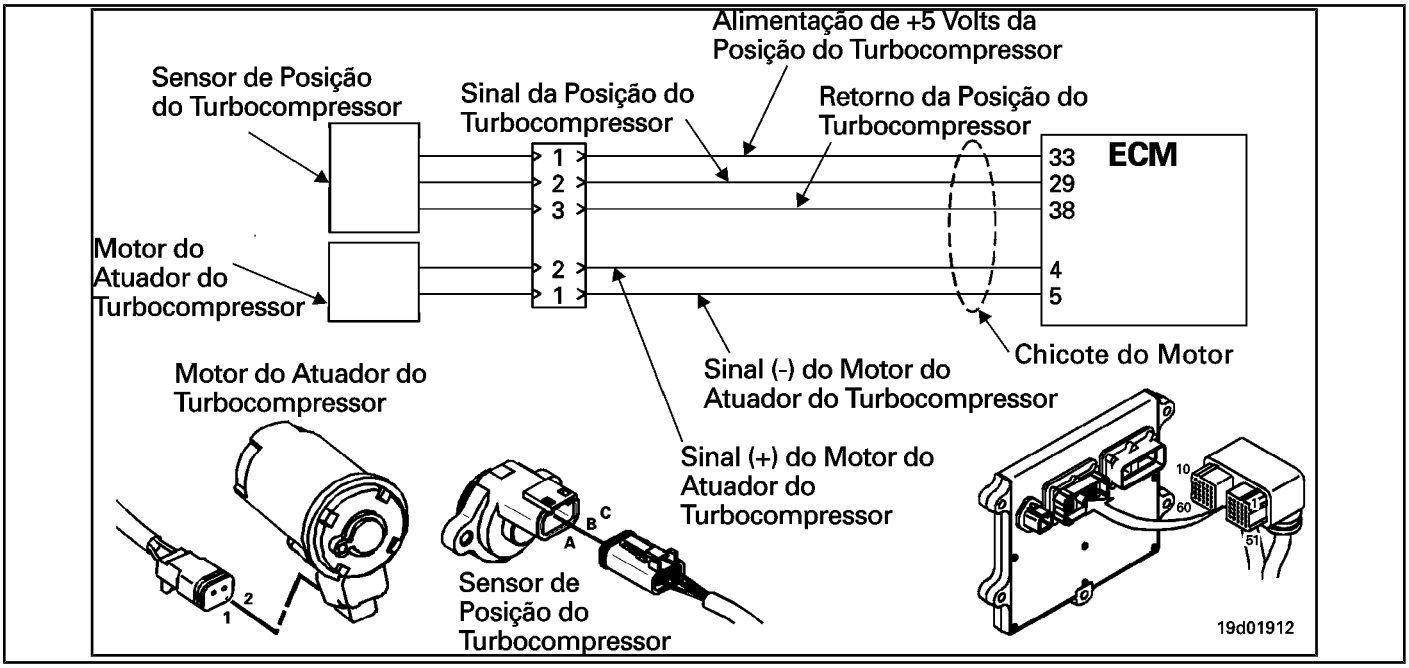
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **NOT**	Proper troubleshooting and repair steps

Fault Code 2383

Variable Geometry Turbocharger Actuator Circuit - Current Below Normal or Open Circuit

CODES	REASON	IT IS MADE
Fault Code: 2383 PID (P), SID (S): S027 IMF: 5/5 Lamp: Amber SRT:	Variable Geometry Turbocharger Actuator Circuit - Current Below Normal or Open Circuit.	Possible loss of power. The power will be removed from the engine of the turbocharger actuator.

Turbocharger Actuator Circuit



Circuit Descriptions:

The electronic control module (ECM) controls the turbocharger actuator, which alters the air flow of the turbocharger based on various engine operating conditions. The sliding spray nozzle of the turbocharger is operated by the turbocharger actuator motor. The actuator is a motor powered by direct current (DC) 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 on the turbocharger bearing housing. See the Procedure 100-002 for the detailed location of each component.

Workshop Tips:

The ECM monitors the voltage level of this circuit and records a fault code if the voltage level indicates an open circuit or short circuit with the voltage source. This fault is **ever** set as inactive when the ignition key is turned on. If the fault condition occurs again while the ignition key is in the ON position, the fault code will be activated. Since faults are deactivated when the ignition key is turned on, this fault symptom diagram should be used to diagnose active and inactive faults. The possible causes of this failure are:

- An open circuit in the motor harness, connectors, motor or ECM

- Shorted (+ or -) signal terminals of the turbocharger actuator motor with 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.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following test cable when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test cable STEPS

		SPECIFICATIONS	SRT CODE
STEP 1: Check the turbocharger actuator circuit and motor.			
STEP 1A:	**Inspect the engine connector pins on the turbocharger and harness actuator.**	**Dirty or damaged pins?**	
STEP 1B: Check for a circuit	**open on the turbocharger actuator motor.**	**Less than 15 ohms?**	
STEP 2: Check the engine harness.			
STEP 2A:	**Inspect the pins of the engine harness and ECM connectors.**	**Dirty or damaged pins?**	
STEP 2B: Check for a circuit	**open in the engine harness.**	**Less than 10 ohms?**	
STEP 2C: Check for a short circuit	**in the engine harness.**	**More than 100k ohms?**	
STEP 2D: Check for a short circuit	**with an external voltage source.**	**Less than 1.5 VDC?**	
STEP 2E: Check for a passcode	**failure inactive.**	**Fault code 2383 inactive?**	
STEP 3: Clear the fault codes.			
STEP 3A: Disable the fault code.		**Fault code 2383 inactive?**	
STEP 3B: Clear the fault codes	**inactive.**	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the turbocharger actuator circuit and motor.

STEP 1A: Inspect the engine connector pins on the turbocharger and harness actuator.

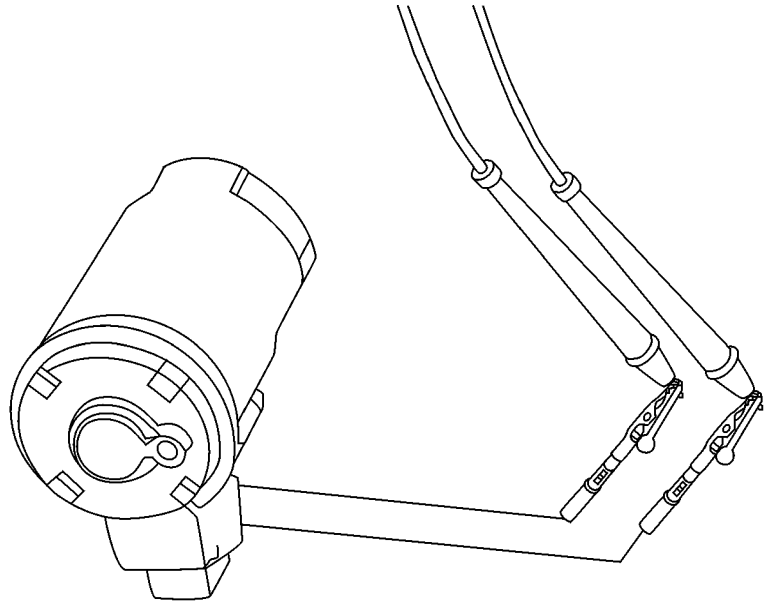
Conditions:
- Turn the ignition key off.
- Disconnect the turbocharger actuator motor from the engine harness.

Action	Specifications / Repair	Next step
Inspect the engine harness connector and turbocharger actuator motor pins for: • Corroded pins. • Bent or broken pins. • Pins twisted back or expanded. • Damage to the wire shield. • Moisture inside or over the connector. • Connector seals damaged or missing. • Connector cover broken. • Dirt or debris on the connector pins. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected in the sensor or in the harness connector pins. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	3A
	Dirty or damaged pins? **NOT**	1B

STEP 1B: Check for an open circuit in the turbocharger actuator motor. Conditions:

- Turn the ignition key off.
- Disconnect the turbocharger actuator motor from the engine harness.

Action	Specifications / Repair	Next step
Check for an open circuit in the turbocharger actuator motor. • Measure the resistance between the turbocharger actuator engine SIGN (+) pin and the turbocharger actuator SIGN (-) pin on the turbocharger actuator connector. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	Less than 15 ohms? **YEA**	2A
	Less than 15 ohms? **DO NOT** **REPAIR:** An open circuit was detected in the turbocharger actuator motor. Replace the turbocharger. Refer to Procedure 010-033.	3A



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STEP 2: Check the engine harness.

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

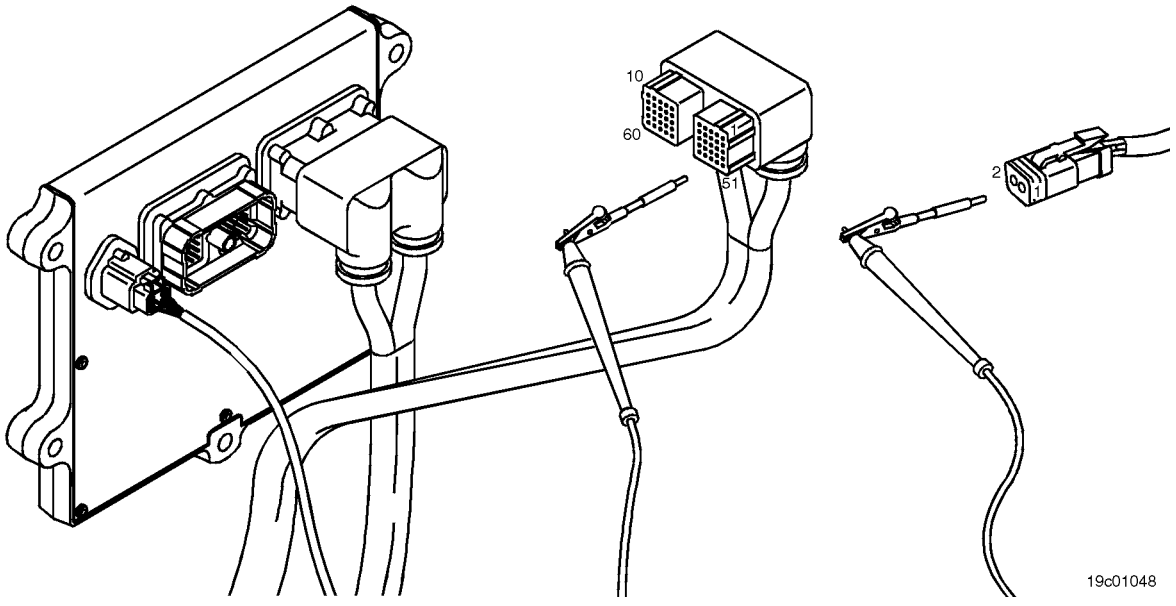
Conditions:
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.

Action	Specifications / Repair	Next step
Check the pins of the engine harness and ECM connectors for: • Corroded pins. • Bent or broken pins. • Pins twisted back or expanded. • Damage to the wire shield. • Moisture inside or over the connector. • Connector seals damaged or missing. • Connector cover broken. • Dirt or debris on the connector pins. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected in the sensor or in the harness connector pins. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible.	3A
	Dirty or damaged pins? **NOT**	2B

STEP 2B: Check the motor harness for an open circuit. Conditions:

- Turn the ignition key off.
- Disconnect the turbocharger actuator motor from the engine harness.
- Disconnect the engine harness from the ECM.

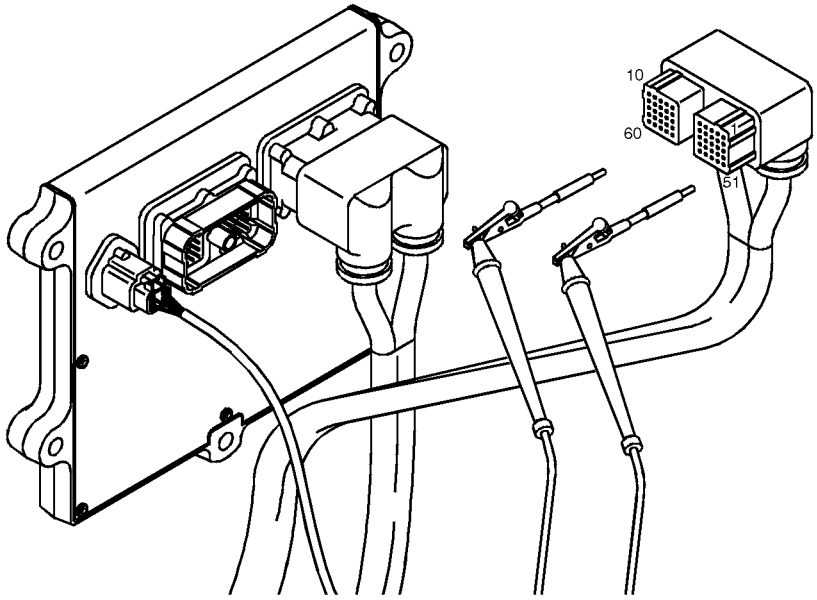
Action	Specifications / Repair	Next step
Check for an open circuit in the engine harness. • Measure the resistance between the turbocharger actuator engine SIGN (+) pin, on the engine harness ECM connector, and the turbocharger actuator SIGN (+) pin, on the harness actuator engine connector the engine. • Measure the resistance between the turbocharger actuator engine SIGN (-) pin, on the engine harness ECM connector, and the turbocharger actuator (SIGN) pin, on the harness actuator engine connector the engine. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	Less than 10 ohms? **YEA**	2C
	Less than 10 ohms? **DO NOT** **REPAIR:** Repair or replace the engine harness. See Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 . See the Procedure 019-043 .	3A



STEP 2C: Check the motor harness for a short circuit. Conditions:

- Turn the ignition key off.
- Disconnect the turbocharger actuator motor from the engine harness.
- Disconnect the engine harness from the ECM.

Action	Specifications / Repair	Next step
Check the motor harness for a short circuit. • Measure the resistance between the (+) signal pin on the turbocharger actuator motor and all other pins on the ECM connector on the engine harness. • Measure the resistance between the turbocharger actuator engine SIGN (-) pin and all other ECM connector pins on the engine harness. Refer to the circuit diagram or electrical diagram for the identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YEA**	2D
	More than 100k ohms? **DO NOT** **REPAIR:** Repair or replace the engine harness. See Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 . See the Procedure 019-043 .	3A



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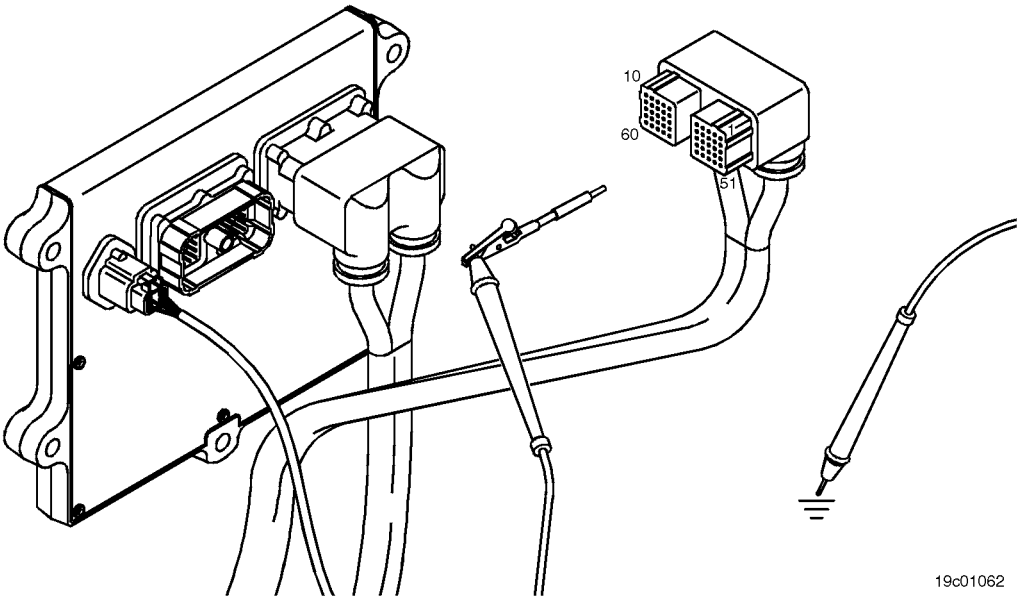
STEP 2D: Check for a short circuit with an external voltage source. Conditions:

- Turn the ignition key off.
- Disconnect the turbocharger actuator motor from the engine harness.
- Disconnect the engine harness from the ECM.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check for a short circuit with an external voltage source. • Measure the voltage between the turbocharger actuator engine SIGN (+) pin, the ECM connector on the engine harness, and the engine block ground. • Measure the voltage between the turbocharger actuator engine SIGNAL pin (-), the ECM connector on the engine harness, and the engine block ground. Refer to the circuit diagram or electrical diagram for the identification of the connector pins. Refer to the "Using the Multimeter" publication, Procedure 019-360 .	Less than 1.5 VDC? **YEA**	2E
	Less than 1.5 VDC? **DO NOT** **REPAIR:** Repair or replace the engine harness. See Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 . See the Procedure 019-043 .	3A



STEP 2E: Check for an inactive fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Using the electronic service tool INSITE ™, make sure that the fault code is inactive.	Fault code 2383 inactive? **YES** **Repair:** None. Did removing and reinstalling the connector correct the failure?	3A
	Fault code 2383 inactive? **DO NOT** **REPAIR:** The fault diagnosis procedures must be repeated from the beginning. A failure mode must have been detected. Replace the electronic engine control module. See the Procedure 019-031 .	3A

STEP 3: Clear the fault codes.

STEP 3A: Disable the fault code. Conditions:

- Connect all components.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Using the electronic service tool INSITE ™, make sure that the fault code is inactive.	Fault code 2383 inactive? **YEA**	3B
	Fault code 2383 inactive? **DO NOT** **REPAIR:** Return to the troubleshooting steps or consult your local Cummins Authorized Service Station after checking and completing all diagnostic steps again.	1A

STEP 3B: Clear the inactive fault codes. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

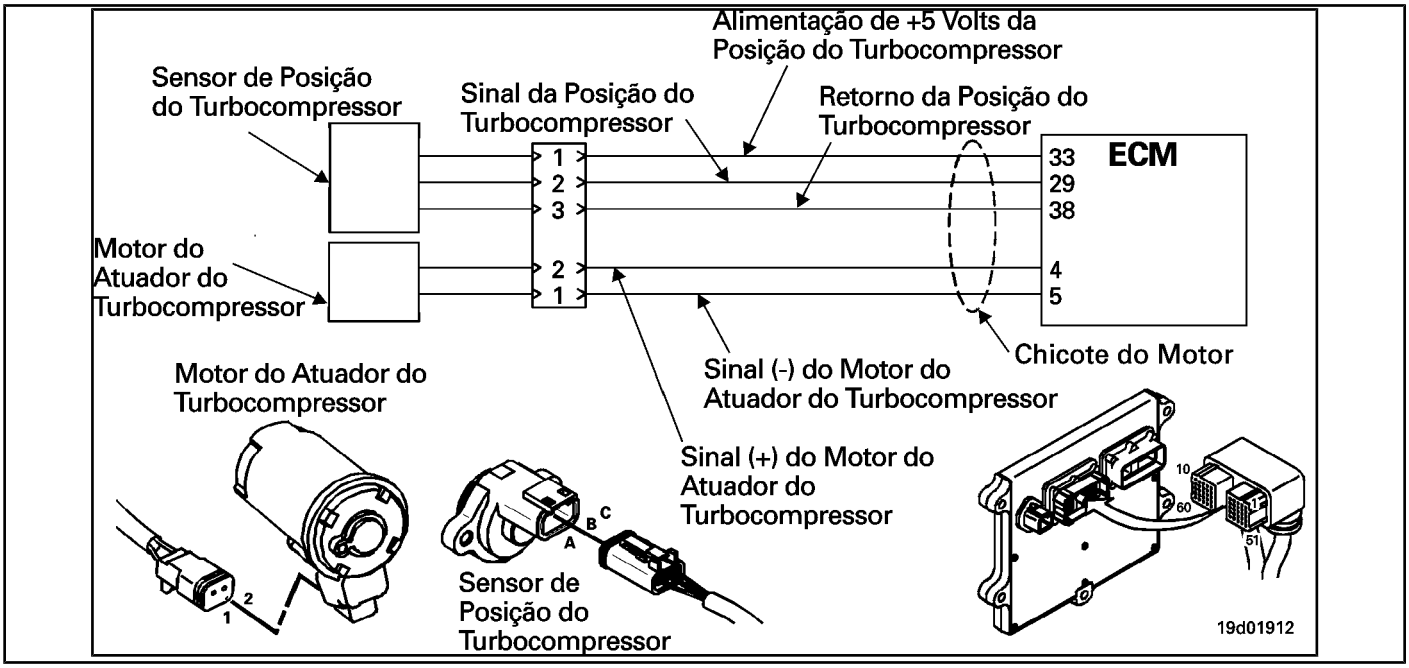
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **DO NOT** **REPAIR:** Troubleshoot any other active fault code.	Proper troubleshooting and repair steps

Fault Code 2384 (ISB / QSB - Automotive and Industrial Application)

TGV Actuator Drive Circuit - Voltage Below Normal or with Voltage Low

CODES	REASON	IT IS MADE
Fault Code: 2384 PID (P), SID (S): S027 IMF: 4/4 Lamp: Amber SRT:	TGV actuator driving circuit - voltage below normal or low voltage.	Possible loss of power. The power will be removed from the engine of the turbocharger actuator.

Turbocharger Actuator Motor Circuit



Circuit Descriptions:

The electronic control module (ECM) controls the engine of the turbocharger actuator, which changes the airflow of the turbocharger based on various engine operating conditions. The sliding spray nozzle of the turbocharger is driven by the engine of the turbocharger actuator. The actuator is a motor powered by direct current (DC) 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 on the turbocharger bearing housing. See the Procedure 100-002 for the detailed location of each component.

Workshop Tips:

A possible cause for this failure is a short with the mass of the signal terminals (+ or -) of the turbocharger actuator in the harness, engine or ECM.

Not supply voltage of any kind to the exhaust gas recirculation valve (EGR) engine. This circuit uses a pulse width modulated signal and direct voltage can permanently damage the motor.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch /

AMP / Metri-Pack female test lead. STEPS

		SPECIFICATIONS	SRT CODE
STEP 1: Check the turbocharger actuator circuit and motor.			
STEP 1A:	**Inspect the engine connector pins on the turbocharger and harness actuator.**	**Dirty or damaged pins?**	
STEP 1B:	**Check for a short circuit with the grease on the turbocharger actuator.**	**More than 100k ohms?**	
STEP 2: Check the engine harness.			
STEP 2A:	**Inspect the pins of the engine harness and ECM connectors.**	**Dirty or damaged pins?**	
STEP 2B:	**Check for a short circuit with the mass in the engine harness.**	**More than 100k ohms?**	
STEP 2C:	**Check for a short circuit pin to pin on the engine harness.**	**More than 100k ohms?**	
STEP 2D:	**Check for a passcode failure inactive.**	**Fault code 2384 inactive?**	
STEP 3: Clear the fault codes.			
STEP 3A:	**Disable the fault code.**	**Fault code 2384 inactive?**	
STEP 3B:	**Clear the fault codes inactive.**	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the turbocharger actuator circuit and motor.

STEP 1A: Inspect the engine connector pins on the turbocharger and harness actuator.

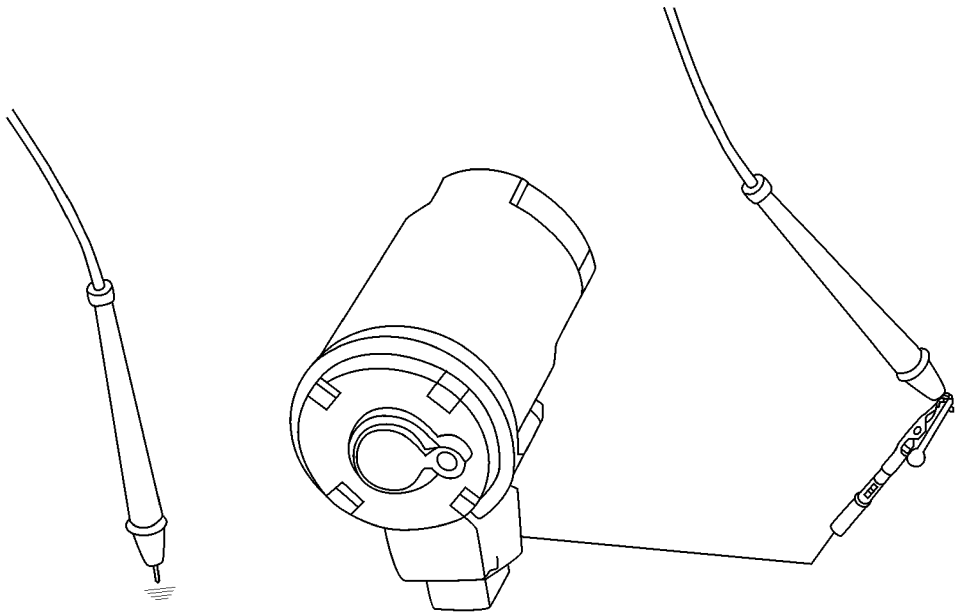
Conditions:
- Turn the ignition key off.
- Disconnect the turbocharger actuator motor from the engine harness.

Action	Specifications / Repair	Next step
Inspect the engine harness connector and turbocharger actuator motor pins for: • Corroded pins. • Bent or broken pins. • Pins twisted back or expanded. • Damage to the wire shield. • Moisture inside or over the connector. • Connector seals damaged or missing. • Connector cover broken. • Dirt or debris on the connector pins. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected in the sensor or in the harness connector pins. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-043 .	3A
	Dirty or damaged pins? **NOT**	1B

STEP 1B: Check for a short circuit with the ground in the turbocharger actuator. Conditions:

- Turn the ignition key off.
- Disconnect the turbocharger actuator motor from the engine harness.

Action	Specifications / Repair	Next step
Check for a short circuit in the turbocharger actuator motor. • Measure the resistance between the engine pin (+) pin on the turbocharger actuator, on the engine harness ECM connector, and the engine block ground. • Measure the resistance between the engine pin (-) pin on the turbocharger actuator, on the engine harness ECM connector, and the engine block ground. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YEA**	2A
	More than 100k ohms? **DO NOT** **REPAIR:** Replace the turbocharger. Refer to Procedure 010-033 in the ISB Series Engine Troubleshooting and Repair Manual and and ISB (Common Rail Fuel System), Bulletin 3653336.	3A



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STEP 2: Check the engine harness.

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

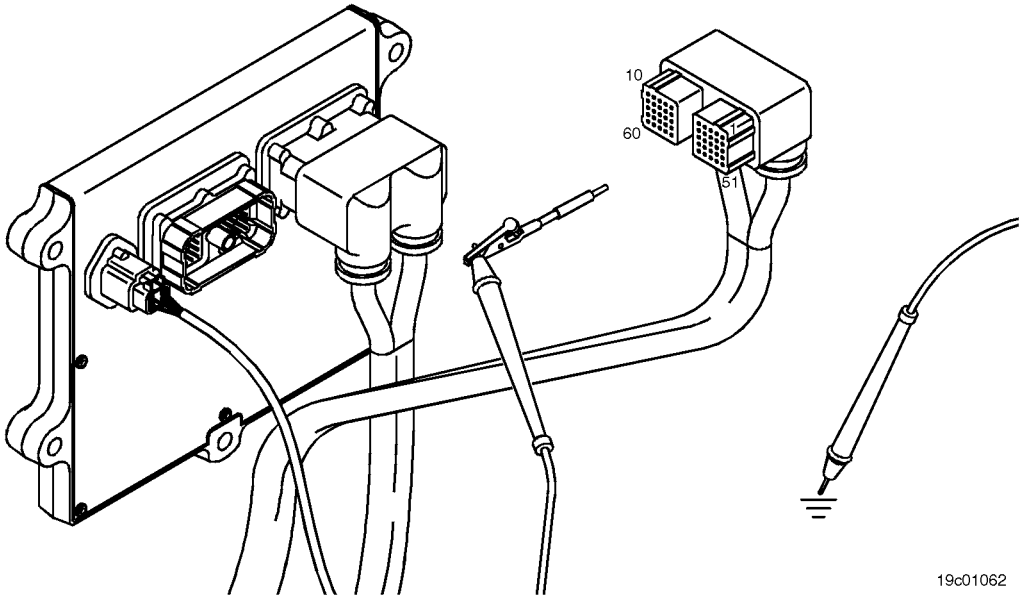
Conditions:
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.

Action	Specifications / Repair	Next step
Check the pins of the engine harness and ECM connectors for: • Corroded pins. • Bent or broken pins. • Pins twisted back or expanded. • Damage to the wire shield. • Moisture inside or over the connector. • Connector seals damaged or missing. • Connector cover broken. • Dirt or debris on the connector pins. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-043 .	3A
	Dirty or damaged pins? **NOT**	2B

STEP 2B: Check the motor harness for a short circuit with ground. Conditions:

- Turn the ignition key off.
- Disconnect the turbocharger actuator motor from the engine harness.
- Disconnect the engine harness from the ECM.

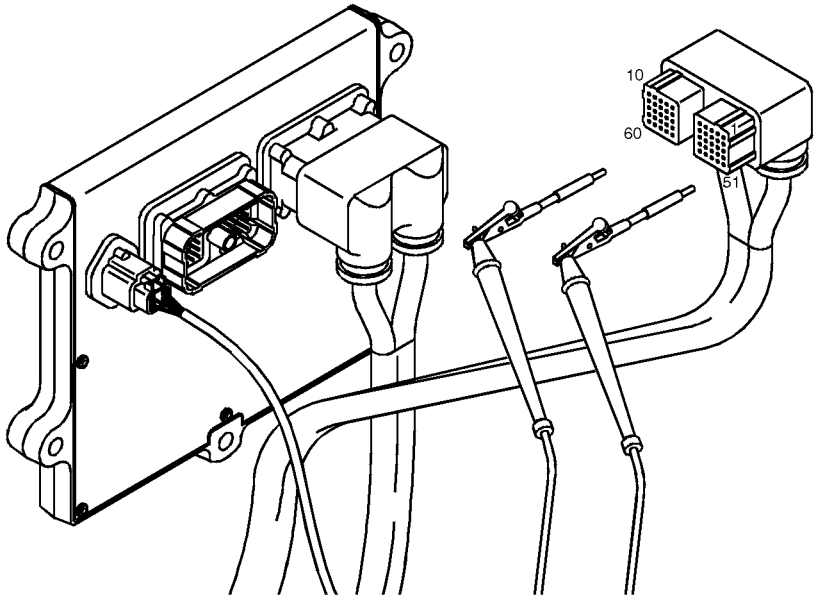
Action	Specifications / Repair	Next step
Check for a short circuit with the ground in the engine harness. • Measure the resistance between the engine pin (+) pin on the turbocharger actuator, on the engine harness ECM connector, and the engine block ground. • Measure the resistance between the engine pin (-) pin on the turbocharger actuator, on the engine harness ECM connector, and the engine block ground. Refer to the circuit diagram or electrical diagram for the identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YEA**	2C
	More than 100k ohms? **DO NOT** **REPAIR:** Repair or replace the engine harness. See the Procedure 019-043 .	3A



STEP 2C: Check for pin-to-pin short in the engine harness. Conditions:

- Turn the ignition key off.
- Disconnect the turbocharger actuator motor from the engine harness.
- Disconnect the engine harness from the ECM.

Action	Specifications / Repair	Next step
Check for pin-to-pin short in the engine harness. • Measure the resistance between the (+) signal pin on the turbocharger actuator motor and all other pins on the ECM connector on the engine harness. • Measure the resistance between the turbocharger actuator motor signal (-) pin and all other pins of the ECM connector on the engine harness. Refer to the circuit diagram or electrical diagram for the identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YEA**	2D
	More than 100k ohms? **DO NOT** **REPAIR:** Repair or replace the engine harness. See the Procedure 019-043 .	3A



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STEP 2D: Check for an inactive fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Using the electronic service tool INSITE ™, make sure that the fault code is inactive.	Fault code 2384 inactive? **YES** **Repair:** None. Did removing and reinstalling the connector correct the failure?	3A
	Fault code 2384 inactive? **DO NOT** **REPAIR:** The fault diagnosis procedures must be repeated from the beginning. A failure mode must have been detected. Replace the electronic engine control module. See the Procedure 019-031 .	3A

STEP 3: Clear the fault codes.

STEP 3A: Disable the fault code. Conditions:

- Connect all components.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Using the electronic service tool INSITE ™, make sure that the fault code is inactive.	Fault code 2384 inactive? **YEA**	3B
	Fault code 2384 inactive? **DO NOT** **REPAIR:** Return to the troubleshooting steps or consult your local Cummins Authorized Service Station after checking and completing all diagnostic steps again.	1A

STEP 3B: Clear the inactive fault codes. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

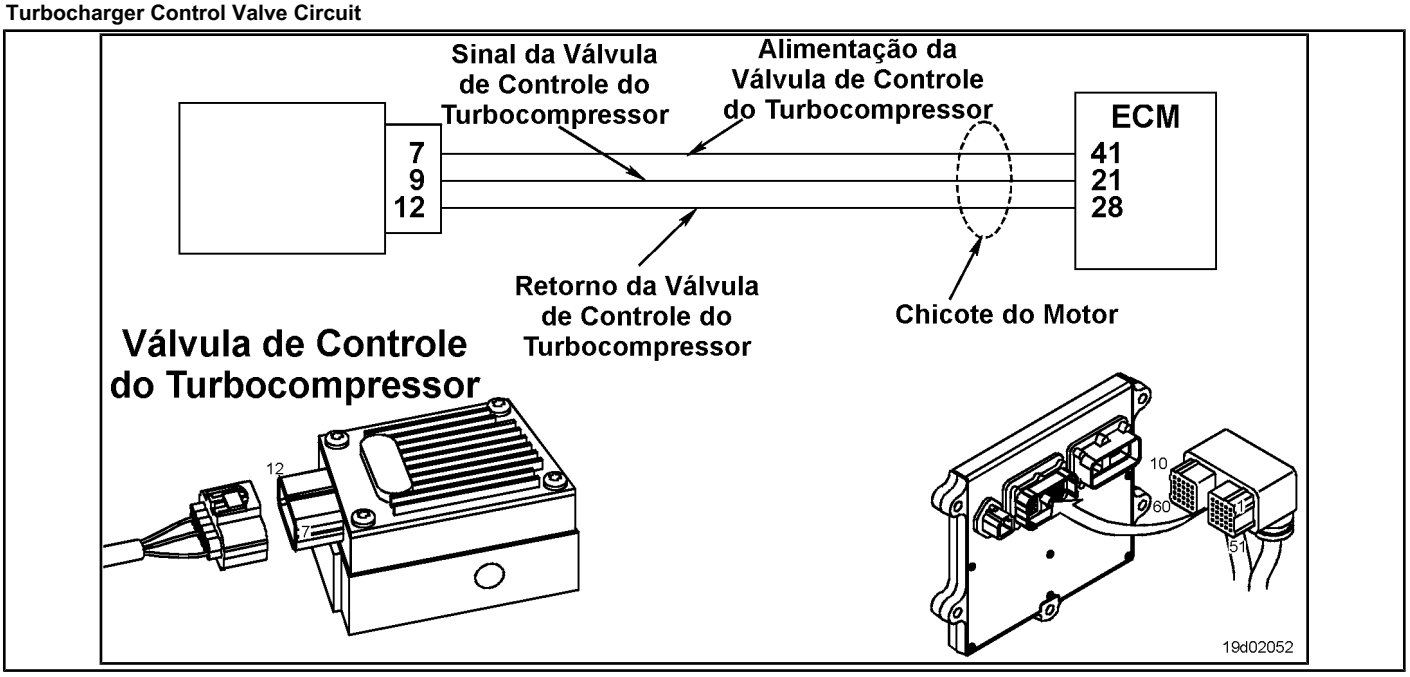
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **DO NOT** **REPAIR:** Troubleshoot any other active fault code.	Proper troubleshooting and repair steps

Fault Code 2384 (ISC / QSC / ISL / QSL - Automotive, Industrial or Maritime)

TGV Actuator - Voltage Below Normal or Low Voltage

CODES	REASON	IT IS MADE
Fault Code: 2384 PID (P), SID (S): S027 IMF: 4 Lamp: Amber SRT:	TGV Actuator - Voltage Below Normal or Low Voltage. Low voltage detected in the turbocharger control valve circuit.	The variable geometry turbocharger will open.

Turbocharger Control Valve Circuit



Circuit Descriptions:

The electronic control module (ECM) controls the position of the variable geometry actuator with the turbocharger control valve. The turbocharger control valve controls the air pressure for the variable geometry actuator when commanded by the ECM. ECM commands are sent to the control valve via the signal from the engine harness turbocharger control valve on the ECM.

Component Location:

The turbocharger control valve is located on the fuel pump side of the engine. It is mounted between fuel lines number 5 and number 6 in the intake air manifold. See the Procedure 100-002
for the detailed location of each component.

Workshop Tips:

The control of the turbocharger control valve can be monitored by the electronic service tool INSITE ™. This parameter represents the ECM command for the turbocharger control valve, which in turn controls the position of the variable geometry actuator. Possible causes of this fault code:

- Short circuit of the signal with the mass.
- Short circuit with ground in the turbocharger control valve.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch /

AMP / Metri-Pack female test lead. STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check for a passcode active fault.	**Fault code 2384 active?**	
STEP 2: Check the turbocharger control valve circuit.		
STEP 2A: Inspect the turbocharger control valve and connector pins.	**Dirty or damaged pins?**	
STEP 2B: Check the circuit response.	**Fault Code 2385 active and Fault Code 2384 inactive?**	
STEP 2C: Check the fault codes and the sensor condition.	**Fault code 2384 active?**	
STEP 3: Check the ECM and the engine harness.		
STEP 3A: Inspect the pins of the engine harness and ECM connectors.	**Dirty or damaged pins?**	
STEP 3B: Check the ECM response.	**Fault Code 2385 active and Fault Code 2384 inactive?**	
STEP 3C: Check for a short circuit between pins in the engine harness.	**More than 100k ohms?**	
STEP 3D: Check if there is a short circuit between pins and ground.	**More than 100k ohms?**	
STEP 3E: Check for a security code failure inactive.	**Fault code 2384 inactive?**	
STEP 4: Clear the fault code.		
STEP 4A: Disable the fault code.	**Fault code 2384 inactive?**	
STEP 4B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Check for an active fault code. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an active fault code. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 2384 active? **YEA**	2A
	Fault code 2384 active? **NOT**	Fault Code Inactive or Intermittent, Procedure 019-362

STEP 2: Check the turbocharger control valve circuit.

STEP 2A: Inspect the turbocharger control valve and connector pins.

Conditions:
- Turn the ignition key off.
- Disconnect the turbocharger control valve from the engine harness.

Action	Specifications / Repair	Next step
Inspect the pins of the engine harness connectors and the turbocharger control valve for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins • Damage to the wire shield • Connector cover broken. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A defective connection was detected at the connector of the turbocharger control valve or at the engine harness. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-043 .	4A
	Dirty or damaged pins? **NOT**	2B

STEP 2B: Check the circuit response. Conditions:

- Turn the ignition key off.
- Disconnect the turbocharger control valve from the engine harness.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Use the electronic service tool INSITE ™ to read fault codes.	Fault Code 2385 active and Fault Code 2384 inactive? **YEA**	2C
	Fault Code 2385 active and Fault Code 2384 inactive? **NOT**	3A

STEP 2C: Check the fault codes and the condition of the sensor. Conditions:

- Turn the ignition key off.
- Connect the turbocharger control valve to the engine harness.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 2384 active? **YES** **Repair:** A defective turbocharger control valve has been detected. Replace the turbocharger control valve. See the Procedure 019-388 .	4A
	Fault code 2384 active? **DO NOT** **REPAIR:** None. Did removing and installing the connector correct the failure?	4A

STEP 3: Check the ECM and the engine harness.

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

Conditions:
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.

Action	Specifications / Repair	Next step
Inspect the pins of the engine harness connectors and the turbocharger control valve for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins • Damage to the wire shield • Connector cover broken. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A defective connection was detected at the connector of the turbocharger control valve or at the engine harness. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-043 .	4A
	Dirty or damaged pins? **NOT**	3B

STEP 3B: Check the ECM response. Conditions:

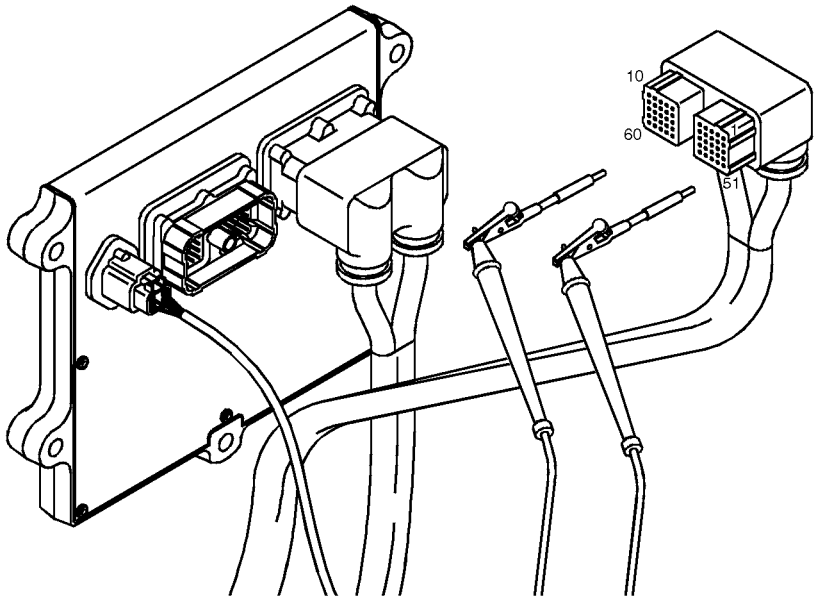
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Use the electronic service tool INSITE ™ to read fault codes.	Fault Code 2385 active and Fault Code 2384 inactive? **YEA**	3C
	Fault Code 2385 active and Fault Code 2384 inactive? **DO NOT** **REPAIR:** Call for pre-authorization. Replace the ECM. See the Procedure 019-031 .	4A

STEP 3C: Check the motor harness for a short circuit between pins. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Disconnect the turbocharger control valve from the engine harness.

Action	Specifications / Repair	Next step
Check for a short circuit between pins. • Measure the resistance between the SIGN pin on the turbocharger control valve, on the ECM connector on the engine harness, and all other pins on the ECM connector on the engine harness. Refer to the circuit diagram or electrical diagram for the identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YEA**	3D
	More than 100k ohms? **DO NOT** **REPAIR:** A short circuit was detected between pins in the SIGNAL line in the motor harness. Repair or replace the engine harness. See the Procedure 019-043 .	4A



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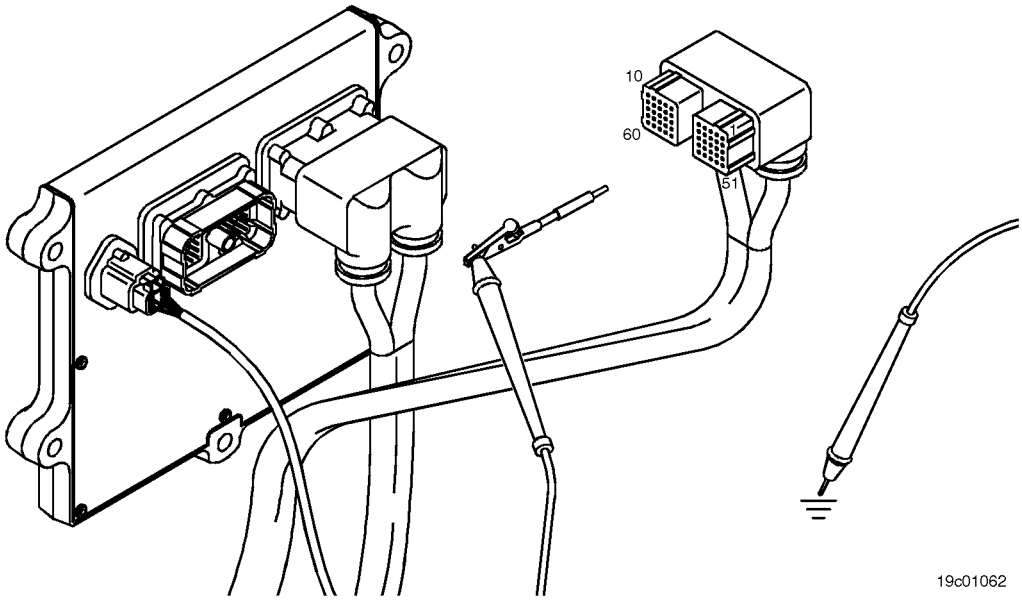
STEP 3D: Check if there is a short circuit between the pins and the ground. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Disconnect the turbocharger control valve from the engine harness.

Action	Specifications / Repair	Next step
Check for a short between pins and ground. • Measure the resistance between the SIGN pin of the turbocharger control valve, the ECM connector on the engine harness, and the ground. Refer to the circuit diagram or electrical diagram for the identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YEA**	3E
	More than 100k ohms? **DO NOT** **REPAIR:** A short circuit was detected between the pins and the ground in the SIGNAL line in the motor harness. Repair or replace the engine harness. See the Procedure 019-043 .	4A



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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 2384 inactive? **YES** **Repair:** None. Did removing and installing the connector correct the failure?	4A
	Fault code 2384 inactive? **DO NOT** **REPAIR:** The fault diagnosis procedures must be repeated from the beginning. A failure mode must have been detected.	1A

STEP 4: Clear the fault code.

STEP 4A: Disable the fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Using the electronic service tool INSITE ™, make sure that the fault code is inactive.	Fault code 2384 inactive? **YEA**	4B
	Fault code 2384 inactive? **NOT**	1A

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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

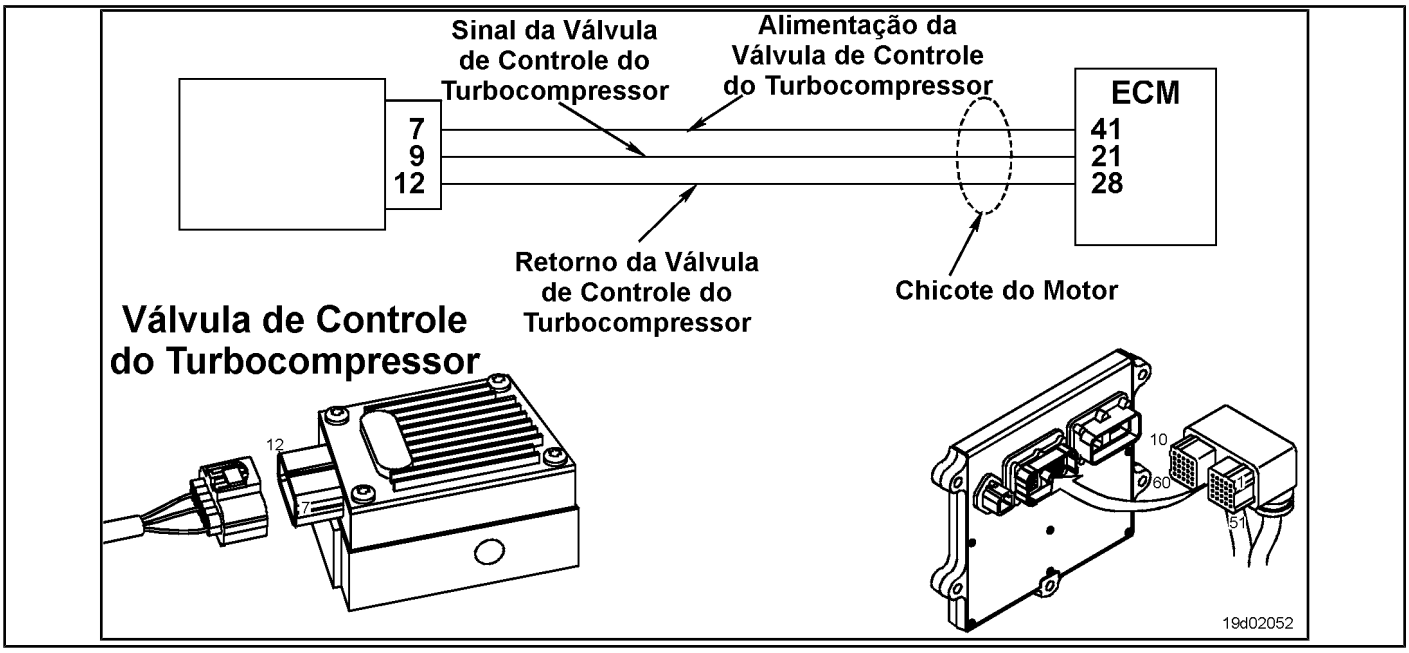
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **NOT**	Proper troubleshooting and repair steps

Fault Code 2385 (ISB / QSB - Automotive or Industrial Application)

TGV (Variable Geometry Turbocharger) Actuator - Voltage Above Normal or with High Voltage

CODES	REASON	IT IS MADE
Fault Code: 2385 PID (P), SID (S): S027 IMF: 3 Lamp: Amber SRT:	TGV actuator (Variable Geometry Turbocharger) - Voltage Above Normal or with High Voltage. An open circuit or high voltage was detected in the turbocharger control valve circuit.	The variable geometry turbocharger can be in the open or closed position.

Turbocharger Control Valve Circuit



Circuit Descriptions:

The electronic control module (ECM) controls the position of the variable geometry actuator with the turbocharger control valve. The turbocharger control valve controls the air pressure for the variable geometry actuator when commanded by the ECM. ECM commands are sent to the control valve via the signal from the engine harness turbocharger control valve on the ECM.

Component Location:

The turbocharger control valve is located on the fuel pump side of the engine. It is mounted between fuel lines number 5 and number 6 in the intake air manifold. See the Procedure 100-002
for the detailed location of each component.

Workshop Tips:

The control of the turbocharger control valve can be monitored by the electronic service tool INSITE ™. This parameter represents the ECM command for the turbocharger control valve, which in turn controls the position of the variable geometry actuator. Possible causes of this fault code:

- Open circuit in motor harness or connectors
- Open circuit on the turbocharger control valve
- Signal short circuit with a voltage source in the motor harness.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch /

AMP / Metri-Pack female test lead. STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check for a passcode active fault.	**Fault code 2385 active?**	
STEP 2: Check the turbocharger control circuit and valve.		
STEP 2A: Check the control valve of the turbocharger and the connector pins.	**Dirty or damaged pins?**	
STEP 2B: Check the voltage of the signal diagnosis and the return circuit of the turbocharger control valve.	**More than 5 VDC?**	
STEP 2C: Check the circuit response.	**Fault Code 2384 active and Fault Code 2385 inactive?**	
STEP 2D: Check the fault codes and the sensor condition.	**Fault code 2385 active?**	
STEP 3: Check the engine control module and the engine harness.		
STEP 3A: Inspect the connector pins on the engine control module and the engine harness.	**Dirty or damaged pins?**	
STEP 3A-1: Check the voltage supply and the sensor return circuit.	**More than 5 VDC?**	
STEP 3A-2: Check for a code fault active.	**Fault code 2385 inactive?**	
STEP 3B: Check the voltage diagnostic supply to the turbocharger control valve.	**More than 5 VDC?**	
STEP 3B-1: Check the response of the electronic engine control module.	**Fault Code 2384 active and Fault Code 2385 inactive?**	
STEP 3B-2: Check for a code fault active.	**Fault code 2385 inactive?**	
STEP 4: Clear the fault code.		
STEP 4A: Disable the fault code.	**Fault code 2385 inactive?**	
STEP 4B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Check for an active fault code. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an active fault code. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 2385 active? **YEA**	2A
	Fault code 2385 active? **NOT**	Fault Code Inactive or Intermittent, Procedure 019-362

STEP 2: Check the turbocharger control circuit and valve.

STEP 2A: Inspect the turbocharger control valve and connector pins.

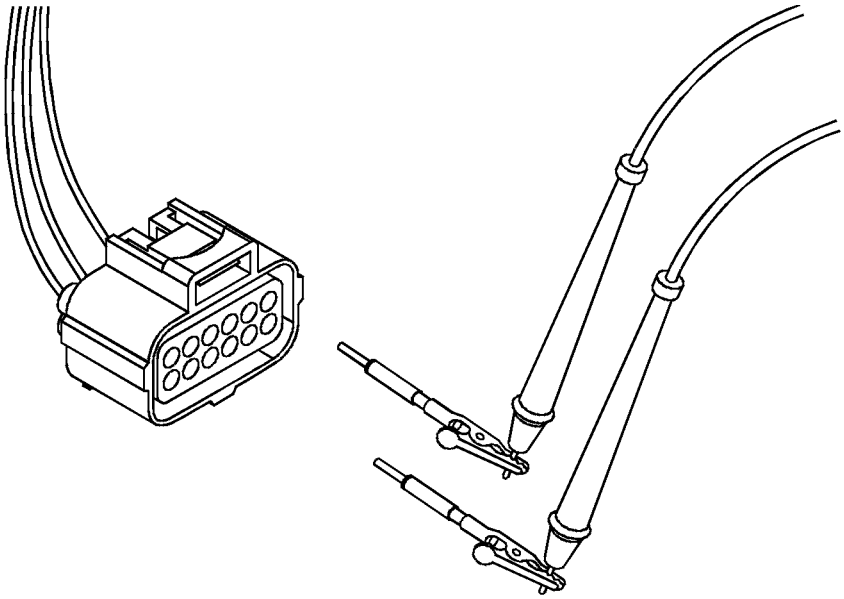
Conditions:
- Turn the ignition key off.
- Disconnect the turbocharger control valve from the engine harness.

Action	Specifications / Repair	Next step
Inspect the pins of the engine harness connectors and the turbocharger control valve for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins. • Damage to the wire shield • Broken connector cover • Damage to the connector locking tab. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected in the sensor or in the harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-043 .	4A
	Dirty or damaged pins? **NOT**	2B

STEP 2B: Check the diagnostic signal voltage and the control valve return circuit of the turbocharger.

Conditions:
- Turn the ignition key off.
- Disconnect the turbocharger control valve from the engine harness.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check the diagnostic voltage and the return circuit of the turbocharger control valve. • Measure the diagnostic supply voltage between the SIGNAL and RETURN pins of the turbocharger control valve on the engine harness turbocharger control valve connector. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 5 VDC? **YEA**	2C
	More than 5 VDC? **NOT**	3A



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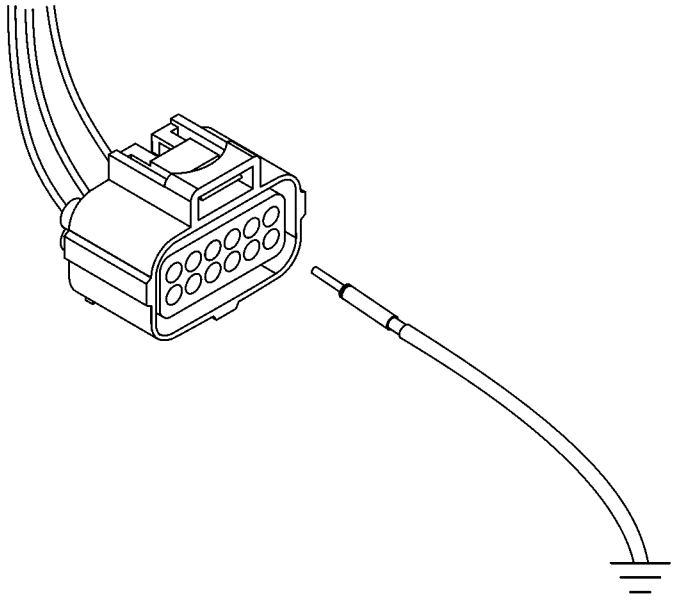
STEP 2C: Check the circuit response. Conditions:

- Turn the ignition key off.
- Disconnect the turbocharger control valve from the engine harness.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Install a jumper wire between the SIGN pin of the turbocharger control valve, on the connector of the turbocharger control valve. turbocharger in the engine harness, and the mass of the engine block. Check for proper circuit response after 15 seconds. • Use the electronic service tool INSITE ™ to read fault codes.	Fault Code 2384 active and Fault Code 2385 inactive? **YEA**	2D
	Fault Code 2384 active and Fault Code 2385 inactive? **NOT**	3B



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STEP 2D: Check the fault codes and the condition of the sensor. Conditions:

- Turn the ignition key off.
- Connect the turbocharger control valve to the engine harness.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 2385 active? **YES** **Repair:** A defective turbocharger control valve has been detected. Clean, repair or replace the engine harness. Replace the turbocharger control valve. See the Procedure 019-388 .	4A
	Fault code 2385 active? **DO NOT** **REPAIR:** None. Did removing and reinstalling the connector correct the failure?	4A

STEP 3: Check the engine control module and the engine harness.

STEP 3A: Inspect the connector pins on the engine control module and the engine harness.

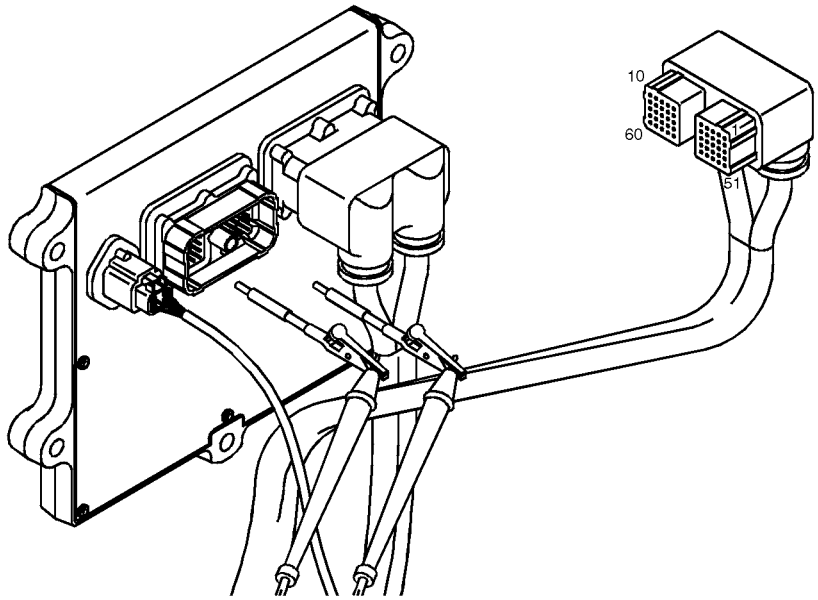
Conditions:
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.

Action	Specifications / Repair	Next step
Inspect the engine harness and ECM connector pins for: • Loose connector • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins • Damage to the wire shield • Broken connector cover • Damage to the connector locking tab. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected at the ECM connector or at the engine harness. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-043 .	4A
	Dirty or damaged pins? **NOT**	3A-2

STEP 3A-1: Check the supply voltage and the sensor return circuit. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check the diagnostic voltage of the turbocharger control valve. • Measure the voltage between the SIGNAL and RETURN pins of the turbocharger control valve on the ECM connector. Refer to the electrical diagram for identification of the connector pins.	More than 5 VDC? **YEA**	3A-2
	More than 5 VDC? **DO NOT** **REPAIR:** Call for pre-authorization. Replace the engine electronics module. See the Procedure 019-031 .	4A



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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 2385 inactive? **YES** **Repair:** None. Did removing and reinstalling the connector correct the failure?	4A
	Fault code 2385 inactive? **DO NOT** **REPAIR:** An open signal or feedback circuit was detected in the engine harness. Repair or replace the engine harness. See the Procedure 019-043 .	4A

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

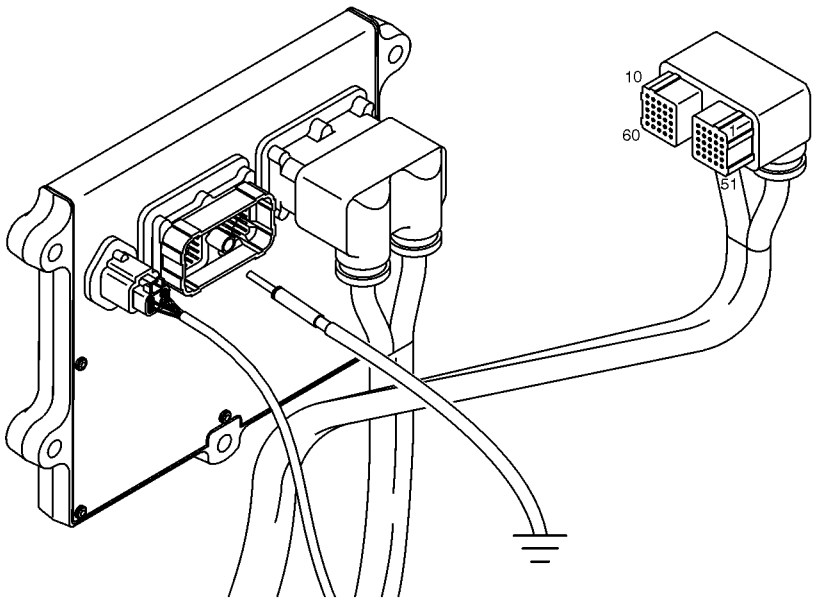
Conditions:
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.

Action	Specifications / Repair	Next step
Inspect the pins of the engine harness connectors and the electronic control module for: • Loose connector • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins. • Damage to the wire shield • Broken connector cover • Damage to the connector locking tab. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A defective connection was detected in the connector of the electronic engine control module or in the engine harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-043 .	4A
	Dirty or damaged pins? **NOT**	3B-1

STEP 3B-1: Check the response of the electronic engine control module. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Install a bridge wire between the SIGN pin of the turbocharger control valve and the ground of the engine block, on the ECM connector on the engine harness. Check for proper circuit response after 30 seconds. • Use the electronic service tool INSITE ™ to read fault codes.	Fault Code 2384 active and Fault Code 2385 inactive? **YEA**	3B-2
	Fault Code 2384 active and Fault Code 2385 inactive? **DO NOT** **REPAIR:** Call for pre-authorization. Replace the engine electronics module. See the Procedure 019-031 .	4A



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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 2385 inactive? **YES** **Repair:** None. Did removing and installing the connector correct the failure?	4A
	Fault code 2385 inactive? **DO NOT** **REPAIR:** A short circuit was detected between pins in the signal line in the motor harness. Repair or replace the engine harness. See the Procedure 019-043 .	4A

STEP 4: Clear the fault code.

STEP 4A: Disable the fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Using the electronic service tool INSITE ™, make sure that the fault code is inactive.	Fault code 2385 inactive? **YEA**	4B
	Fault code 2385 inactive? **DO NOT** **REPAIR:** Return to the troubleshooting steps or consult your local Cummins Authorized Service Station after checking and completing all diagnostic steps again.	1A

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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

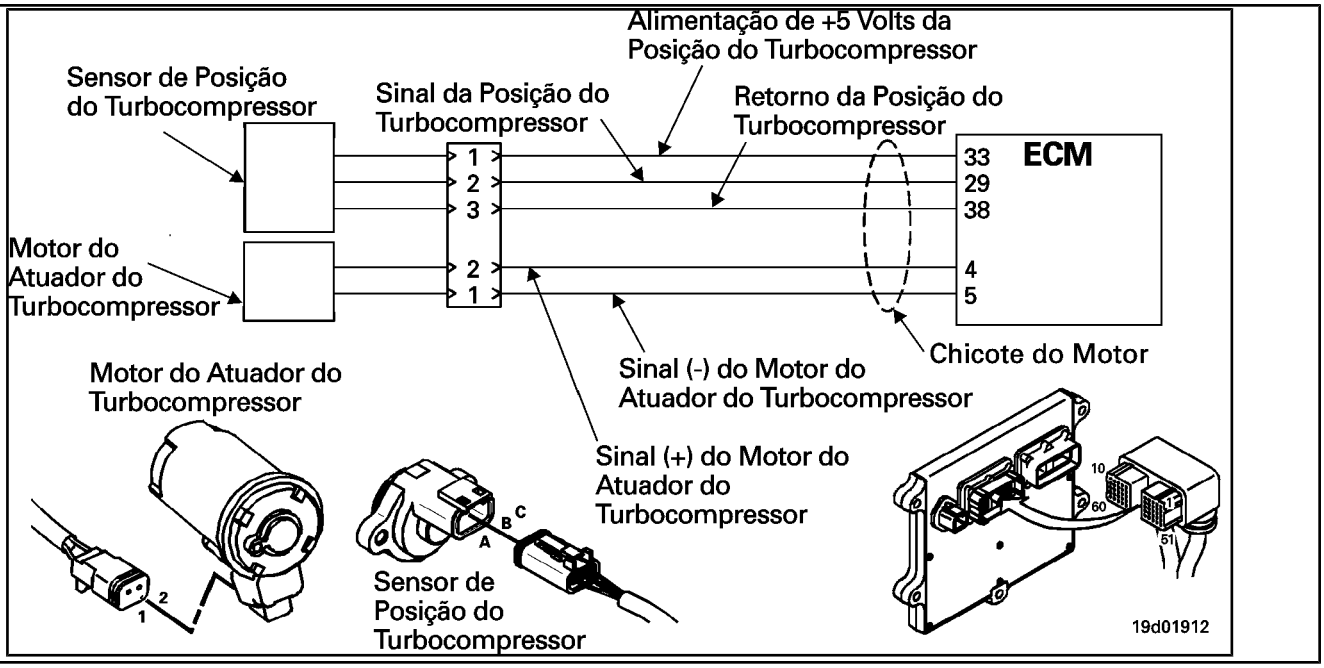
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **DO NOT** **REPAIR:** Troubleshoot any other active fault code.	Proper troubleshooting and repair steps

Fault Code 2385 (ISC / QSC / ISL / QSL - Automotive, Industrial or Maritime)

TGV Actuator Drive Circuit - Voltage Above Normal or with High Voltage

CODES	REASON	IT IS MADE
Fault Code: 2385 PID (P), SID (S): S027 IMF: 3/3 Lamp: Amber SRT:	TGV actuator driving circuit - Voltage above normal or with high voltage.	Possible loss of power. The power will be removed from the engine of the turbocharger actuator.

Turbocharger Actuator Motor Circuit



Circuit Descriptions:

The ECM controls the engine of the turbocharger actuator, which changes the airflow of the turbocharger based on various engine operating conditions. The sliding spray nozzle of the turbocharger is driven by the engine of the turbocharger actuator. The actuator is a motor powered by direct current (DC) 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 on the turbocharger bearing housing. See the Procedure 100-002 for the detailed location of each component.

Workshop Tips:

A possible cause for this failure is a short with a voltage source of the signal terminals (+ or -) of the turbocharger actuator in the harness or ECM.

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.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch /

AMP / Metri-Pack female test lead. STEPS

		SPECIFICATIONS	SRT CODE
STEP 1: Check the engine harness.			
STEP 1A:	**Inspect the pins of the engine harness and ECM connectors.**	**Dirty or damaged pins?**	
STEP 1B: Check for a short circuit	**with a voltage source.**	**Less than 1.5 VDC?**	
STEP 1C: Check for a short circuit	**pin to pin on the engine harness.**	**More than 100k ohms?**	
STEP 1D: Check for a passcode	**failure inactive.**	**Fault code 2385 inactive?**	
STEP 2: Clear the fault codes.			
STEP 2A: Disable the fault code.		**Fault code 2385 inactive?**	
STEP 2B: Clear the fault codes	**inactive.**	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the engine harness.

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

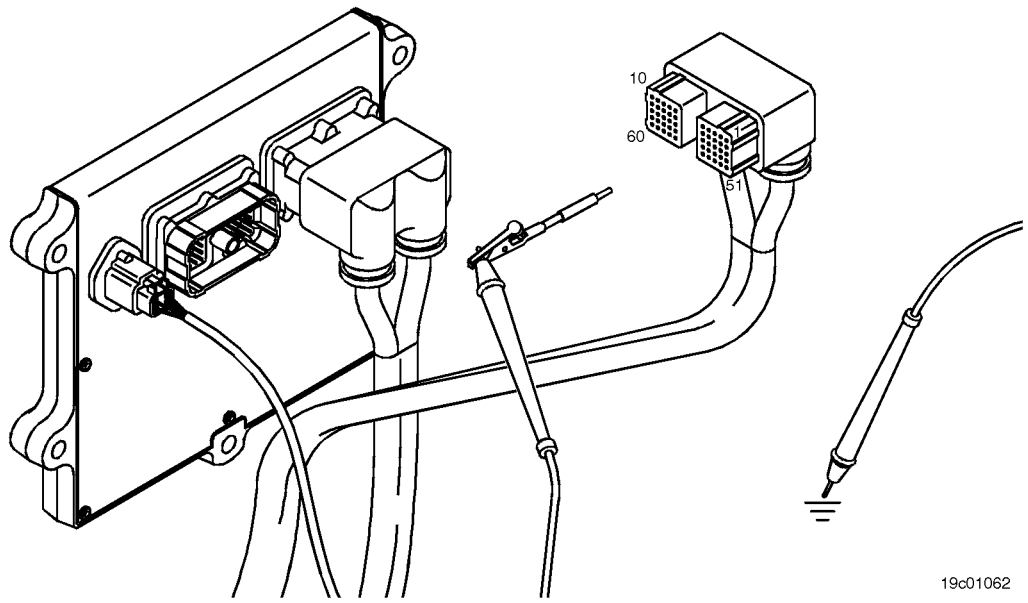
Conditions:
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.

Action	Specifications / Repair	Next step
Check the pins of the engine harness and ECM connectors for: • Corroded pins. • Bent or broken pins. • Pins twisted back or expanded. • Damage to the wire shield. • Moisture inside or over the connector. • Connector seals damaged or missing. • Connector cover broken. • Dirt or debris on the connector pins. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected in the sensor or in the harness connector pins. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible.	2A
	Dirty or damaged pins? **NOT**	1B

STEP 1B: Check for a short circuit with a voltage source. Conditions:

- Turn the ignition key off.
- Disconnect the turbocharger actuator motor from the engine harness.
- Disconnect the engine harness from the ECM.
- Turn the ignition key ON.

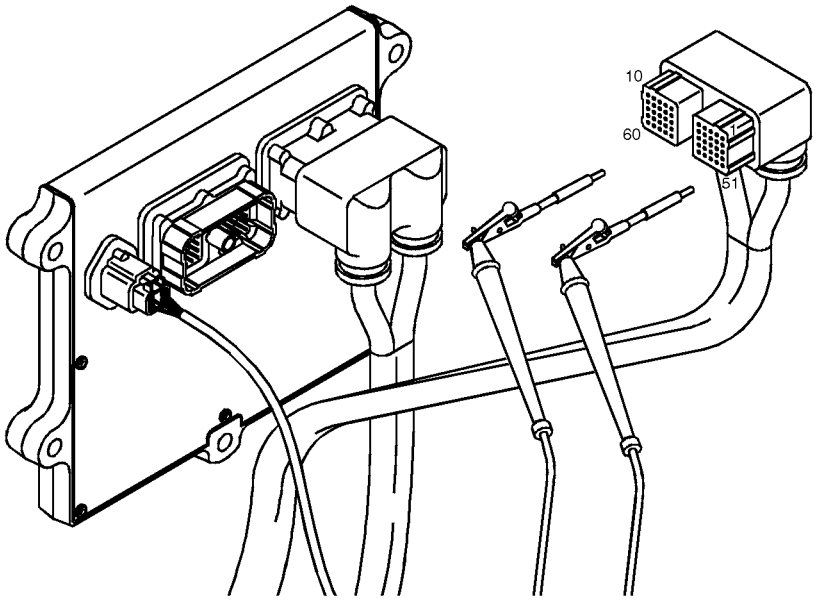
Action	Specifications / Repair	Next step
Check for a short circuit with a voltage source. • Measure the voltage between the turbocharger actuator engine SIGN (+) pin, the ECM connector on the engine harness, and the engine block ground. • Measure the voltage between the second (-) SIGNAL pin on the turbocharger actuator motor, on the ECM connector on the engine harness, and the mass of the engine block. Refer to the electrical diagram for identification of the connector pins. Refer to the "Using the Multimeter" publication, Procedure 019-359 .	Less than 1.5 VDC? **YEA**	1C
	Less than 1.5 VDC? **DO NOT** **REPAIR:** Repair or replace the engine harness. See the Procedure 019-043 .	2A



STEP 1C: Check for pin-to-pin short in the engine harness. Conditions:

- Turn the ignition key off.
- Disconnect the turbocharger actuator motor from the engine harness.
- Disconnect the engine harness from the ECM.

Action	Specifications / Repair	Next step
Check for pin-to-pin short in the engine harness. • Measure the resistance between the turbocharger actuator engine SIGN (+) pin and all other pins of the ECM connector on the engine harness. • Measure the resistance between the turbocharger actuator engine SIGN (-) pin and all other ECM connector pins on the engine harness. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YEA**	1D
	More than 100k ohms? **DO NOT** **REPAIR:** Repair or replace the engine harness. See the Procedure 019-043 .	2A



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STEP 1D: Check for an inactive fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Use the electronic service tool INSITE ™ to make sure that the fault code is inactive.	Fault code 2385 inactive? **YES** **Repair:** None. Did removing and reinstalling the connector correct the failure?	2A
	Fault code 2385 inactive? **DO NOT** **REPAIR:** The fault diagnosis procedures must be repeated from the beginning. A failure mode must have been detected. Replace the electronic engine control module. See the Procedure 019-031 .	2A

STEP 2: Clear the fault codes.

STEP 2A: Disable the fault code. Conditions:

- Connect all components.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Use INSITE ™ to check if the fault code is inactive.	Fault code 2385 inactive? **YEA**	2B
	Fault code 2385 inactive? **DO NOT** **REPAIR:** Return to the troubleshooting steps or consult your local Cummins Authorized Service Station after checking and completing all diagnostic steps again.	1A

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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

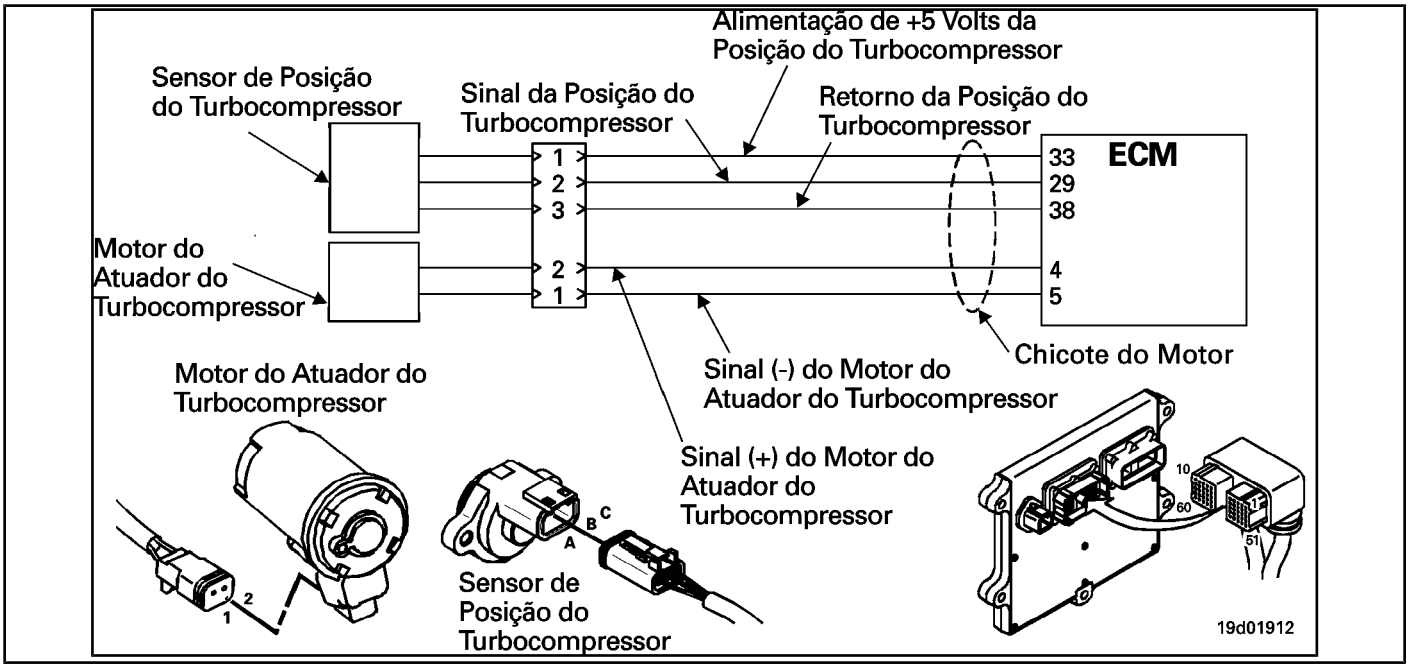
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **DO NOT** **REPAIR:** Troubleshoot any other active fault code.	Proper troubleshooting and repair steps

Fault Code 2386

Turbocharger Actuator Motor Circuit - Current Above Normal

CODES	REASON	IT IS MADE
Fault Code: 2386 PID (P), SID (S): IMF: 6/6 Lamp: Amber SRT:	Turbocharger actuator motor circuit - current above normal. Excessive current detected in the engine circuit of the turbocharger actuator.	Possible loss of power. The power will be removed from the engine of the turbocharger actuator.

Turbocharger Actuator Motor Circuit



Circuit Descriptions:

The electronic control module (ECM) controls the engine of the turbocharger actuator, which changes the airflow of the turbocharger based on various engine operating conditions. The sliding spray nozzle of the turbocharger is driven by the engine of the turbocharger actuator. The actuator is a motor powered by VCC current 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 on the turbocharger bearing housing. See the Procedure 100-002 for the detailed location of each component.

Workshop Tips:

The ECM monitors the current level in this circuit. If the ECM detects excess current during a calibrated period of time, it logs this failure. The possible causes of this failure are:

- Turbocharger actuator motor signal terminals (+ or -) in the engine harness, turbocharger actuator motor or ECM
- Low internal resistance of the turbocharger actuator motor.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch /

AMP / Metri-Pack female test lead. STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check for a passcode active fault.	**Fault code 2386 active?**	
STEP 2: Check the turbocharger actuator circuit and motor.		
STEP 2A: Inspect the engine connector pins on the turbocharger and harness actuator.	**Dirty or damaged pins?**	
STEP 2B: Check the resistance of the motor of the turbocharger actuator.	**More than 0.5 ohms?**	
STEP 3: Check the engine harness.		
STEP 3A: Inspect the pins of the engine harness and ECM connectors.	**Dirty or damaged pins?**	
STEP 3B: Check for a short circuit in the engine harness.	**More than 100k ohms?**	
STEP 4: Check the Turbocharger Actuator Motor Assembly. (Connected turbocharger)		
STEP 4A: Perform the Actuator Test Turbocharger from INSITE ™ electronic service tool.	**Actuator position equal to 100 Percent when open?**	
STEP 4B: Perform the Actuator Test Turbocharger from INSITE ™ electronic service tool.	**Actuator position less than 10 Percent when closed?**	
STEP 5: Check the Turbocharger Actuator Motor Assembly. (Disconnected from the turbocharger)		
STEP 5A: Perform the Actuator Test Turbocharger from INSITE ™ electronic service tool.	**Actuator position equal to 100 Percent when open?**	
STEP 5B: Perform the Actuator Test Turbocharger from INSITE ™ electronic service tool.	**Actuator position less than 10 Percent when closed?**	
STEP 6: Clear the fault codes.		
STEP 6A: Disable the fault code.	**Fault code 2386 inactive?**	
STEP 6B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Check for an active fault code. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an active fault code. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 2386 active? **YEA**	2A
	Fault code 2386 active? **NOT**	Fault Code Inactive or Intermittent, Procedure 019-362

STEP 2: Check the turbocharger actuator circuit and motor.

STEP 2A: Inspect the engine connector pins on the turbocharger and harness actuator.

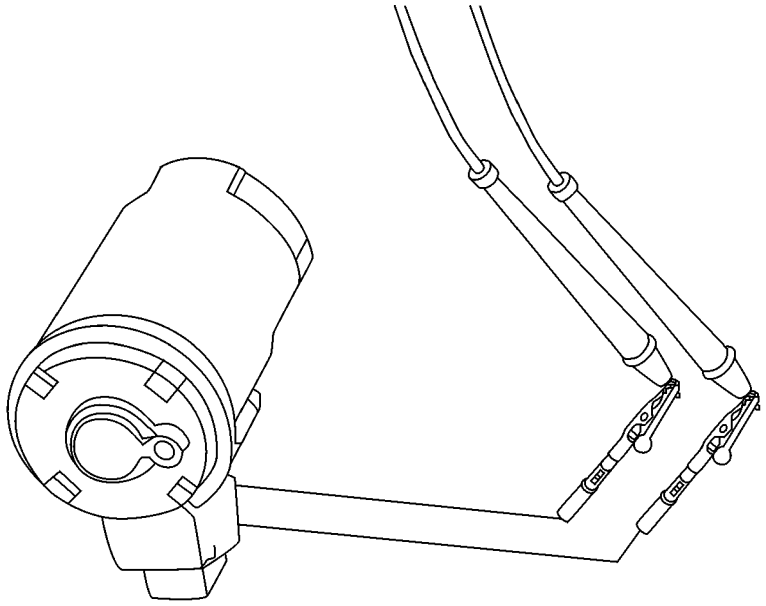
Conditions:
- Turn the ignition key off.
- Disconnect the turbocharger actuator motor from the engine harness.

Action	Specifications / Repair	Next step
Inspect the engine harness connector and turbocharger actuator motor pins for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins • Broken connector cover • Connector lock guide damage • Damage to the insulation of the wires or the engine harness. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. Refer to Resistance Measurements Using a Multimeter and Electrical Diagram, Procedure 019-360 .	5A
	Dirty or damaged pins? **NOT**	2B

STEP 2B: Check the resistance of the turbocharger actuator motor. Conditions:

- Turn the ignition key off.
- Disconnect the turbocharger actuator motor from the engine harness.

Action	Specifications / Repair	Next step
Check the resistance of the turbocharger actuator motor. • Measure the resistance between the (+) and (-) SIGN pins of the actuator motor turbocharger, on the engine connector of the turbocharger actuator.	More than 0.5 ohms? **YEA**	3A
	More than 0.5 ohms? **DO NOT** **REPAIR:** Replace the turbocharger actuator assembly. See the Procedure 019-388 .	5A



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STEP 3: Check the engine harness.

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

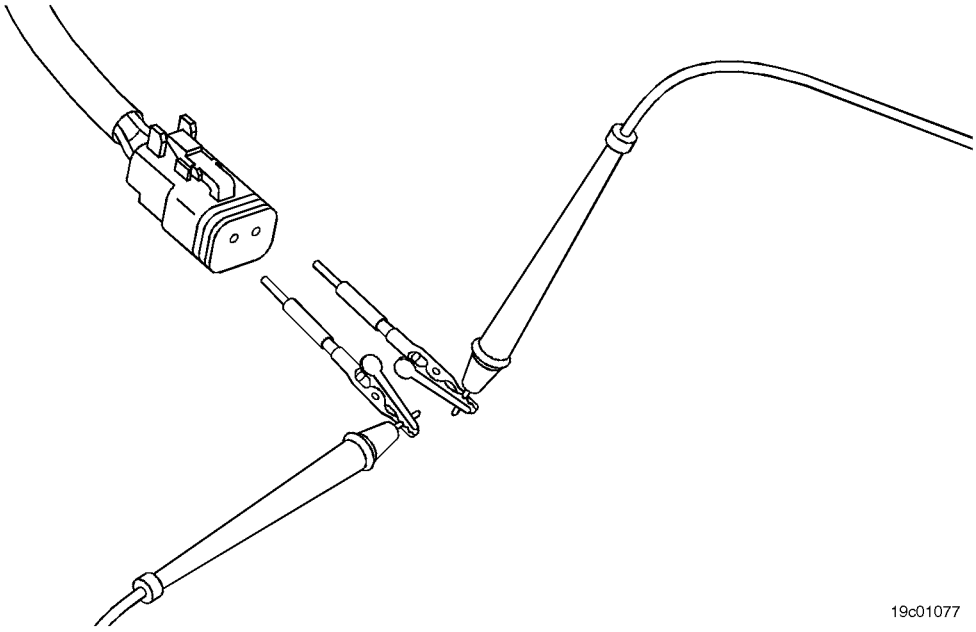
Conditions:
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.

Action	Specifications / Repair	Next step
Check the pins of the engine harness and ECM connectors for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins • Broken connector cover • Connector lock guide damage • Damage to the insulation of the wires or the engine harness.	Dirty or damaged pins? **YES** **Repair:** Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	5A
For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **NOT**	3B

STEP 3B: Check the motor harness for a short circuit. Conditions:

- Turn the ignition key off.
- Disconnect the turbocharger actuator motor from the engine harness.
- Disconnect the engine harness from the ECM.

Action	Specifications / Repair	Next step
Check the motor harness for a short circuit. • Measure the resistance between the (+) and (-) SIGN pins of the actuator motor turbocharger, on the engine connector of the turbocharger actuator, side of the engine harness.	More than 100k ohms? For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 . **YEA**	4A
	More than 100k ohms? **DO NOT** **REPAIR:** Repair or replace the engine harness. See Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	5A



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STEP 4: Check the Turbocharger Actuator Motor Assembly. (Connected to turbocharger)

STEP 4A: Test the Turbocharger Actuator of the INSITE ™ electronic service tool. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Test the Turbocharger Actuator of the INSITE ™ electronic service tool. • Select the option “Open Actuator”.	Actuator position equal to 100 Percent when open? **YEA**	4B
	Actuator position equal to 100 Percent when open? **NOT**	5A

STEP 4B: Test the Turbocharger Actuator of the INSITE ™ electronic service tool. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Test the Turbocharger Actuator of the INSITE ™ electronic service tool. • Select the “Close Actuator” option.	Actuator position less than 10 Percent when closed? **YEA**	6A
	Actuator position less than 10 Percent when closed? **NOT**	5B

STEP 5: Check the Turbocharger Actuator Motor Assembly. (Unplugged turbocharger)

STEP 5A: Test the Turbocharger Actuator of the INSITE ™ electronic service tool. Conditions:

- Turn the ignition key off.
- Remove the turbocharger actuator motor assembly from the turbocharger.
- Connect all electrical components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Test the Turbocharger Actuator of the INSITE ™ electronic service tool. • Select the option “Open Actuator”.	Actuator position equal to 100 Percent when open? **YES** **Repair:** Replace the turbocharger. Refer to Procedure 010-033 in the ISB Series Engine Troubleshooting and Repair Manual and, ISB and QSB5.9 ((Common Rail Fuel System), Bulletin 3653336.	6A
	Actuator position equal to 100 Percent when open? **DO NOT** **REPAIR:** Replace the turbocharger actuator motor assembly. See the Procedure 019-388 .	6A

STEP 5B: Test the Turbocharger Actuator of the INSITE ™ electronic service tool. Conditions:

- Turn the ignition key off.
- Remove the turbocharger actuator motor assembly from the turbocharger.
- Connect all electrical components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Test the Turbocharger Actuator of the INSITE ™ electronic service tool. • Select the “Close Actuator” option.	Actuator position less than 10 Percent when closed? **YES** **Repair:** Repair or replace the turbocharger. Refer to Procedure 010-033 in the ISB Series Engine Troubleshooting and Repair Manual and, ISB and QSB5.9 ((Common Rail Fuel System), Bulletin 3653336.	6A
	Actuator position less than 10 Percent when closed? **DO NOT** **REPAIR:** Replace the turbocharger actuator motor assembly. See the Procedure 019-388 .	6A

STEP 6: Clear the fault codes.

STEP 6A: Disable the fault code. Conditions:

- Connect all components.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Using the electronic service tool INSITE ™, make sure that the fault code is inactive.	Fault code 2386 inactive? **YEA**	6B
	Fault code 2386 inactive? **NOT**	1A

STEP 6B: Clear the inactive fault codes. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

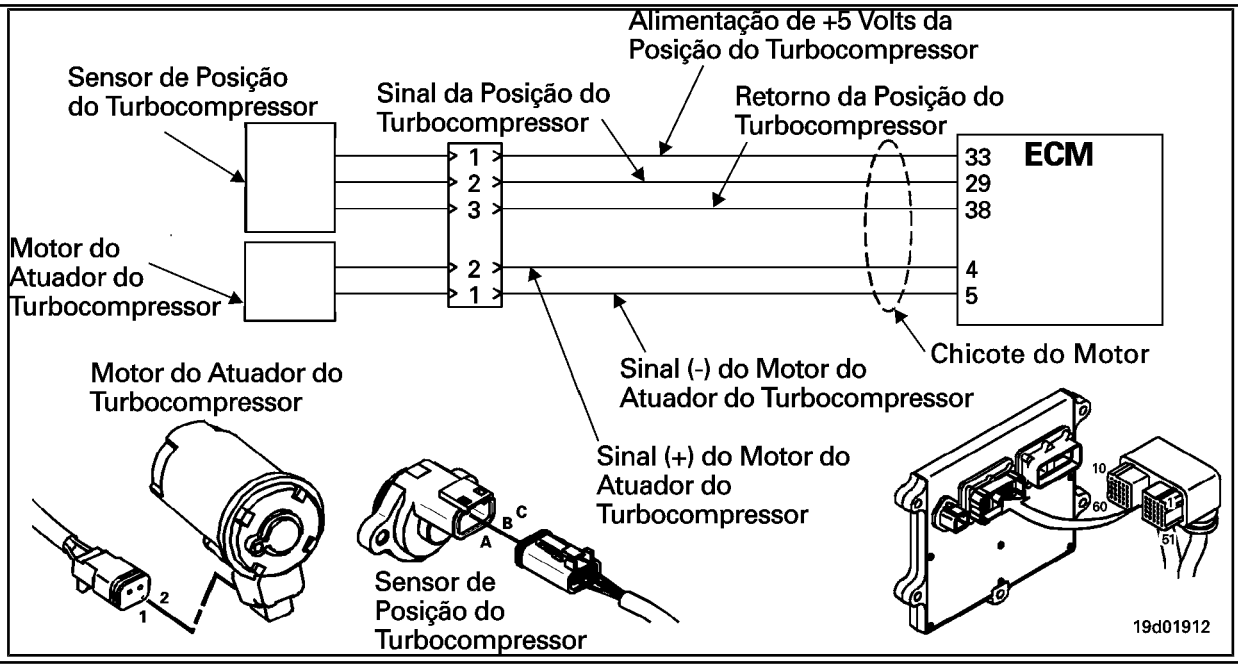
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **NOT**	Proper troubleshooting and repair steps

Fault Code 2387

Turbocharger Actuator Engine - Mechanical System Does Not Respond Correctly

CODES	REASON	IT IS MADE
Fault Code: 2387 PID (P), SID (S): S146 IMF: 7/7 Lamp: Amber SRT:	Turbocharger actuator motor - the **mechanical system not is responding** correctly or is out of adjustment. The **turbocharger actuator not is responding or** responds slowly.	Possible loss of power. The power will be removed from the engine of the turbocharger actuator.

Turbocharger Actuator Motor Circuit



Circuit Descriptions:

The electronic control module (ECM) controls the engine of the turbocharger actuator, which changes the airflow of the turbocharger based on various engine operating conditions. The sliding spray nozzle of the turbocharger is driven by the engine of the turbocharger actuator. The actuator is a motor powered by direct current (DC) 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 on the turbocharger bearing housing. See the Procedure 100-002 for the detailed location of each component.

Workshop Tips:

The possible causes of this failure are:

- Turbocharger position sensor defect, mechanical or electrical failure
- The turbocharger actuator motor assembly fails to require a high current to operate the turbocharger, such as a clogged turbocharger.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch /

AMP / Metri-Pack female test lead. STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check for a passcode active fault.	**Fault code 2387 active?**	
STEP 2: Check the circuit and the turbocharger position sensor.		
STEP 2A: Inspect the pins of the engine harness connectors and the turbocharger position sensor.	**Dirty or damaged pins?**	
STEP 2B: Check for a short circuit on the turbocharger position sensor signal.	**More than 100k ohms?**	
STEP 3: Check the ECM.		
STEP 3A: Check the signal voltage of the turbocharger position sensor.	**Less than 0.1 VDC?**	
STEP 4: Check the Turbocharger Actuator Motor Assembly. (Connected to the turbocharger)		
STEP 4A: Perform the Actuator Test Turbocharger from INSITE ™ electronic service tool.	**Actuator position equal to 100 Percent when open?**	
STEP 4B: Perform the Actuator Test Turbocharger from INSITE ™ electronic service tool.	**Actuator position less than 10 Percent when closed?**	
STEP 5: Check the turbocharger actuator motor assembly (disconnected turbocharger).		
STEP 5A: Perform the Actuator Test Turbocharger from INSITE ™ electronic service tool.	**Actuator position equal to 100 Percent when open?**	
STEP 5B: Perform the Actuator Test Turbocharger from INSITE ™ electronic service tool.	**Actuator position less than 10 Percent when closed?**	
STEP 6: Clear the fault codes.		
STEP 6A: Disable the fault code.	**Fault code 2387 inactive?**	
STEP 6B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Check for an active fault code. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an active fault code. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 2387 active? **YEA**	2A
	Fault code 2387 active? **NOT**	Fault Code Inactive or Intermittent, Procedure 019-362

STEP 2: Check the circuit and the turbocharger position sensor.

STEP 2A: Inspect the pins of the engine harness connectors and the turbocharger position sensor.

Conditions:

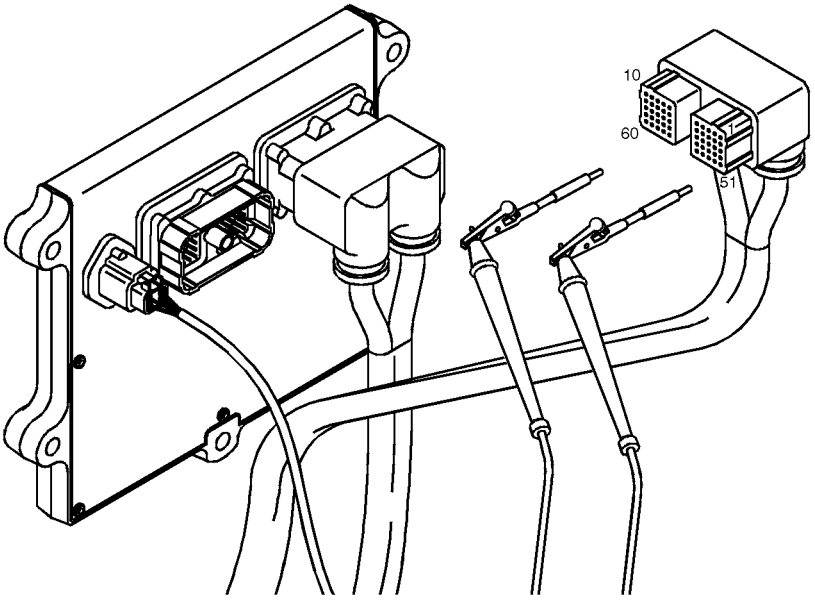
- Turn the ignition key off.
- Disconnect the turbocharger position sensor from the engine harness.

Action	Specifications / Repair	Next step
Inspect the engine harness connector and turbocharger position sensor pins for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins • Broken connector cover • Connector lock guide damage • Damage to the insulation of the wires or the engine harness. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	6A
	Dirty or damaged pins? **NOT**	2B

STEP 2B: Check the turbocharger position sensor signal for a short circuit. Conditions:

- Turn the ignition key off.
- Disconnect the turbocharger position sensor from the engine harness.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check the motor harness for a short circuit. • Measure the resistance between the +5 volts POWER pin on the turbocharger, the ECM connector on the engine harness, and all other connector pins.	More than 100k ohms? **YEA**	3A
	More than 100k ohms? **DO NOT** **REPAIR:** Repair or replace the engine harness. See Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	6A



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STEP 3: Check the ECM.

STEP 3A: Check the signal voltage of the turbocharger position sensor. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Turn the ignition key ON.
- Connect the INSITE ™ electronic service tool to the SAE J1939 or SAE J1587 datalink connector.

Action	Specifications / Repair	Next step
Using the INSITE ™ Monitor / Data Logger, check the signal voltage of the turbocharger position sensor.	Less than 0.1 VDC? **YEA**	4A
	Less than 0.1 VDC? **DO NOT** **REPAIR:** Replace the ECM. Call for authorization. See the Procedure 019-031 .	Complete repair

STEP 4: Check the Turbocharger Actuator Motor Assembly.

(Connected to the turbocharger)

STEP 4A: Test the Turbocharger Actuator of the INSITE ™ electronic service tool. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Test the Turbocharger Actuator of the INSITE ™ electronic service tool. • Open the turbocharger actuator.	Actuator position equal to 100 Percent when open? **YEA**	4B
	Actuator position equal to 100 Percent when open? **NOT**	5A

STEP 4B: Test the Turbocharger Actuator of the INSITE ™ electronic service tool. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Test the Turbocharger Actuator of the INSITE ™ electronic service tool. • Select the “Close Actuator” option.	Actuator position less than 10 Percent when closed? **YEA**	6A
	Actuator position less than 10 Percent when closed? **NOT**	5B

STEP 5: Check the turbocharger actuator motor assembly (disconnected turbocharger).

STEP 5A: Test the Turbocharger Actuator of the INSITE ™ electronic service tool. Conditions:

- Turn the ignition key off.
- Remove the turbocharger actuator motor assembly from the turbocharger.
- Connect all electrical components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Test the Turbocharger Actuator of the INSITE ™ electronic service tool. • Select the option “Open Actuator”.	Actuator position equal to 100 Percent when open? **YES** **Repair:** Repair or replace the turbocharger. Refer to Procedure 010-033 in the ISB Series Engine Troubleshooting and Repair Manual and, ISB and QSB5.9 ((Common Rail Fuel System), Bulletin 3653336.	6A
	Actuator position equal to 100 Percent when open? **DO NOT** **REPAIR:** Replace the turbocharger actuator motor assembly. See the Procedure 019-388 .	6A

STEP 5B: Test the Turbocharger Actuator of the INSITE ™ electronic service tool. Conditions:

- Turn the ignition key off.
- Remove the turbocharger actuator motor assembly from the turbocharger.
- Connect all electrical components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Test the Turbocharger Actuator of the INSITE ™ electronic service tool. • Select the “Close Actuator” option.	Actuator position less than 10 Percent when closed? **YES** **Repair:** Repair or replace the turbocharger. Refer to Procedure 010-033 in the ISB Series Engine Troubleshooting and Repair Manual and, ISB and QSB5.9 ((Common Rail Fuel System), Bulletin 3653336.	6A
	Actuator position less than 10 Percent when closed? **DO NOT** **REPAIR:** Replace the turbocharger actuator motor assembly. See the Procedure 019-388 .	6A

STEP 6: Clear the fault codes.

STEP 6A: Disable the fault code. Conditions:

- Connect all components.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Using the electronic service tool INSITE ™, make sure that the fault code is inactive.	Fault code 2387 inactive? **YEA**	6B
	Fault code 2387 inactive? **NOT**	1A

STEP 6B: Clear the inactive fault codes. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

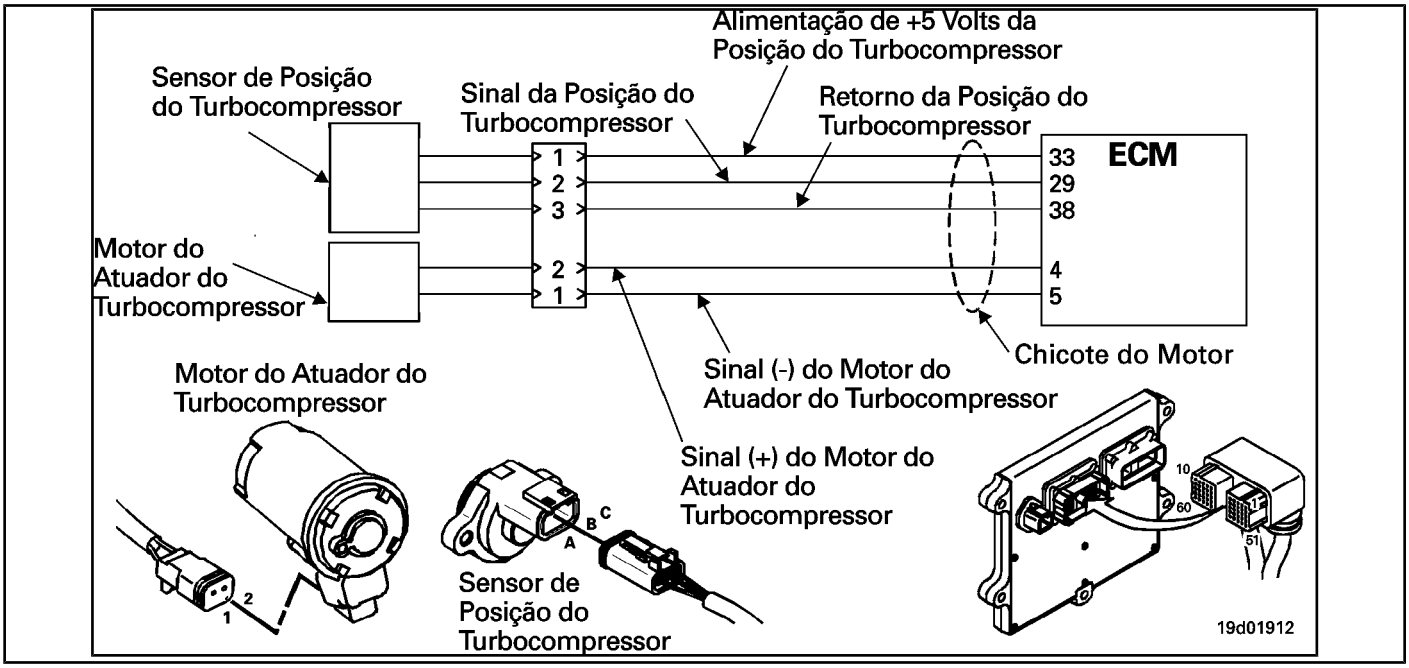
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **NOT**	Proper troubleshooting and repair steps

Fault Code 2388

Variable Geometry Turbocharger Actuator Position Failure During Automatic Calibration Procedure - Out of Calibration

CODES	REASON	IT IS MADE
Fault Code: 2388 PID (P), SID (S): S269 IMF: 13/13 Lamp: Amber SRT:	Variable Geometry Turbocharger Actuator Position Failure During Automatic Calibration Procedure - Out of Calibration.	Possible power loss from the variable geometry turbocharger. The variable geometry turbocharger actuator will remain open or closed.

Turbocharger Actuator Motor Circuit



Circuit Descriptions:

The electronic control module (ECM) periodically checks and adjusts the zero position of the turbocharger position sensor when it is closed. The automatic calibration feature makes adjustment for wear and variation from unit to unit of position sensors and actuator assemblies. This fault is recorded if the position sensor reading is outside the calibrated limits.

Component Location:

The turbocharger position sensor is mounted on the turbocharger actuator assembly in the turbocharger bearing housing. See the Procedure 100-002 for the detailed location of each component.

Workshop Tips:

A possible cause for this code could be an internal turbocharger failure causing the turbocharger actuator **not** close completely.

When diagnosing faults from inactive counts of this fault code, it may be useful to run the Turbocharger Actuator Test on the INSITE ™ electronic service tool to determine if the turbocharger actuator is "stuck".

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch /

AMP / Metri-Pack female test lead. STEPS

		SPECIFICATIONS	SRT CODE
STEP 1: Check the harness.			
STEP 1A:	**Inspect the connector pins of the electronic control module and the engine harness.**	**Dirty or damaged pins?**	
STEP 1B: Check for a short circuit	**in the engine harness.**	**More than 100k ohms?**	
STEP 2: Check the turbocharger position sensor.			
STEP 2A:	**Inspect the pins of the engine harness connectors and the turbocharger position sensor.**	**Dirty or damaged pins?**	
STEP 2B: Check the signal voltage of the	**turbocharger position sensor.**	**Less than 0.1 VDC?**	
STEP 3: Clear the fault codes.			
STEP 3A: Disable the fault code.		**Fault code 2388 inactive?**	
STEP 3B: Clear the fault codes	**inactive.**	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the harness.

STEP 1A: Inspect the connector pins of the electronic control module and the engine harness.

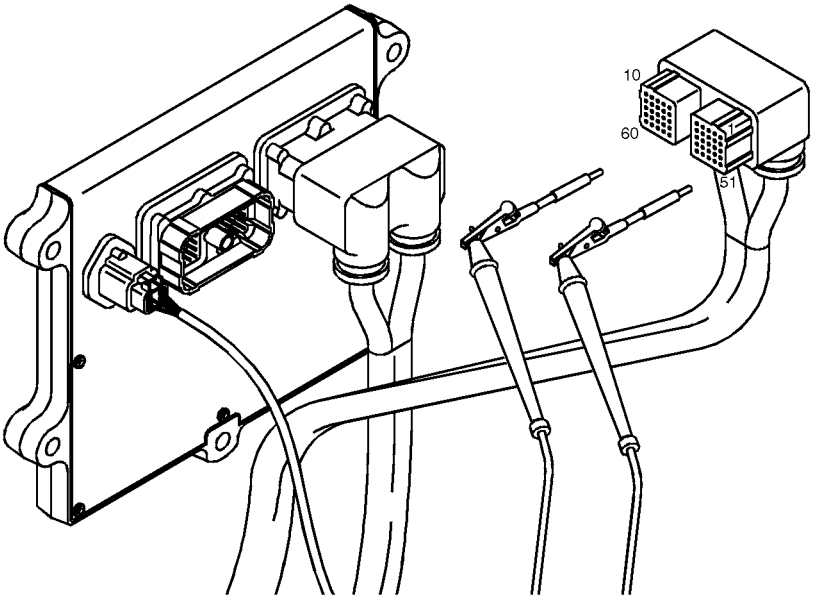
Conditions:
- Turn the ignition key off.
- Disconnect the electronic control module from the engine harness.

Action	Specifications / Repair	Next step
Check the pins of the engine harness and ECM connectors for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins • Broken connector cover • Connector lock guide damage • Damage to the insulation of the wires or the engine harness. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. If damaged, repair the harness, connector or pins, if possible. See Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	3A
	Dirty or damaged pins? **NOT**	1B

STEP 1B: Check the motor harness for a short circuit. Conditions:

- Turn the ignition key off.
- Disconnect the turbocharger position sensor from the engine harness.
- Disconnect the electronic control module from the engine harness.

Action	Specifications / Repair	Next step
Check the motor harness for a short circuit. • Measure the resistance between the turbocharger position signal pin, on the engine harness ECM connector´, and all other connector pins. See Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YEA**	2A
	More than 100k ohms? **DO NOT** **REPAIR:** Repair or replace the engine harness. See Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	3A



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STEP 2: Check the turbocharger position sensor.

STEP 2A: Inspect the pins of the engine harness connectors and the turbocharger position sensor.

Conditions:
- Turn the ignition key off.
- Disconnect the turbocharger position sensor from the engine harness.

Action	Specifications / Repair	Next step
Inspect the engine harness connector and turbocharger position sensor pins for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Moisture inside or over the connector • Connector seals damaged or missing • Dirt or debris on the connector pins • Broken connector cover • Connector lock guide damage • Damage to the insulation of the wires or the engine harness. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible.	3A
	Dirty or damaged pins? **NOT**	2B

STEP 2B: Check the signal voltage of the turbocharger position sensor. Conditions:

- Turn the ignition key off.
- Disconnect the electronic control module from the engine harness.
- Turn the ignition key ON.
- Connect the INSITE ™ electronic service tool to the SAEJ1939 or SAEJ1587 / 1708 datalink connector.

Action	Specifications / Repair	Next step
Use the INSITE ™ Monitor / Data Logger to check the signal voltage of the turbocharger position sensor.	Less than 0.1 VDC? **YES** **Repair:** Replace the turbocharger. Refer to Procedure 010-033 for the turbocharger in the ISB Series Engine Troubleshooting and Repair Manual and, ISB and QSB5.9 (Common Rail Fuel System), Bulletin 3653336.	3A
	Less than 0.1 VDC? **DO NOT** **REPAIR:** Replace the electronic engine control module. Call for authorization. See the Procedure 019-031 .	3A

STEP 3: Clear the fault codes.

STEP 3A: Disable the fault code. Conditions:

- Connect all components.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Using the electronic service tool INSITE ™, make sure that the fault code is inactive.	Fault code 2388 inactive? **YEA**	3B
	Fault code 2388 inactive? **DO NOT** **REPAIR:** Return to the troubleshooting steps or consult your local Cummins Authorized Service Station after checking and completing all diagnostic steps again.	1A

STEP 3B: Clear the inactive fault codes. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

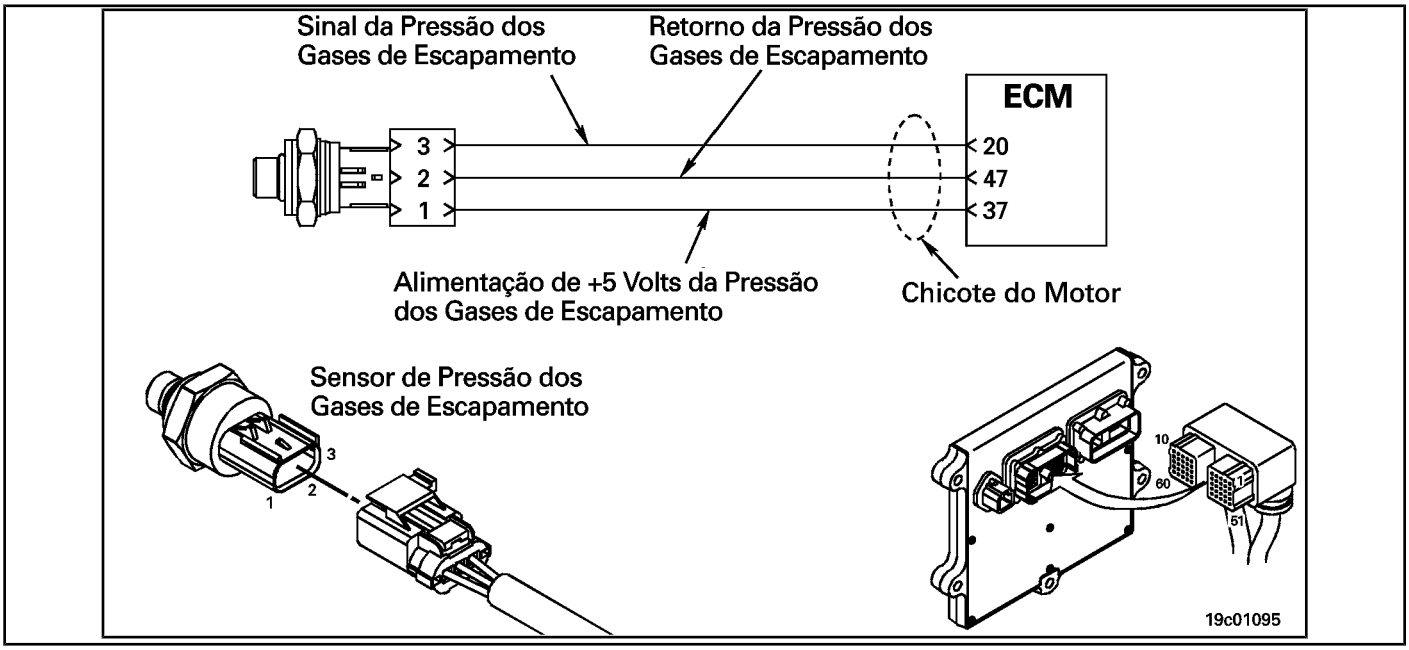
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **DO NOT** **REPAIR:** Troubleshoot any other active fault code.	Proper troubleshooting and repair steps

Fault Code 2554

Exhaust Gas Pressure Sensor Circuit - Invalid, Intermittent or Incorrect

CODES	REASON	IT IS MADE
Fault Code: 2554 PID (P), SID (S): P095 IMF: 2/2 Lamp: Amber SRT:	Exhaust pressure sensor circuit - invalid, intermittent or incorrect data. The ECM has detected an error in the signal from the exhaust pressure sensor.	Engine de-powering. The exhaust gas recirculation valve (EGR) will be closed.

Exhaust Pressure Sensor Circuit



Circuit Descriptions:

The exhaust gas pressure is used by the electronic control module (ECM) to monitor the engine's exhaust gas pressure. This information is used by the ECM to control emissions and the operation of the EGR valve.

Component Location:

The exhaust pressure sensor is located above the EGR valve cooler on the exhaust side of the engine. See the Procedure 100-002 for the detailed location of each component.

Workshop Tips:

When the ignition key is turned on, before the engine starts, the pressure readings on the intake manifold, barometric pressure and exhaust gas pressure are compared. This fault code occurs if the exhaust pressure sensor reading is different from the other two pressures. This check is done **only** once after the ignition key is turned on. This failure **not** will occur while the engine is running.

SUMMARY OF FAULT DIAGNOSTICS

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check for a valid fault code.		
STEP 1A: Check the Fault Code 2554 is active.	**Fault code 2554 inactive?**	
STEP 1B: Check for condensation or foreign materials.	**Fault code 2554 active?**	
STEP 2: Clear the fault codes.		
STEP 2A: Disable the fault code.	**Fault code 2554 inactive?**	
STEP 2B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check for a valid fault code.

STEP 1A: Check that Fault Code 2554 is active. Conditions:

- Turn the ignition key off for at least 30 seconds.
- Turn the ignition key ON.
- Connect the electronic service tool.

Action	Specifications / Repair	Next step
Check for an active fault code. • Wait 30 seconds after turning on the ignition key.	Fault code 2554 active? **YEA**	1B
	Fault code 2554 active? **NOT**	2A

STEP 1B: Check for condensation or foreign matter. Conditions:

- Turn the ignition key off.

Action	Specifications / Repair	Next step
Check for condensation or foreign matter. • Remove the exhaust pressure sensor, pedestal and exhaust pressure sensor tube. Refer to Procedure 011-027 in the ISB Series Engine Troubleshooting and Repair Manual and ISB (Common Rail Fuel System), Bulletin 3653336.	Fault code 2554 active? **YES** **Repair:** Replace the exhaust pressure sensor. See the Procedure 019-376 .	2A
• Check for condensation or foreign matter. • Clean all removed components. • Install the removed components. • Turn the ignition key ON. • Wait 30 seconds after turning on the ignition key.	Fault code 2554 active? **NOT**	2A

STEP 2: Clear the fault codes.

STEP 2A: Disable the fault code. Conditions:

- Connect all components.
- Turn the ignition key ON or set the Run / Stop switch to the Run position.
- Connect the electronic service tool.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Use the electronic service tool INSITE ™ to make sure that the fault code is inactive.	Fault code 2554 inactive? **YEA**	2B
	Fault code 2554 inactive? **DO NOT** **REPAIR:** Return to the troubleshooting steps or consult your local Cummins Authorized Service Station after checking and completing all diagnostic steps again.	1A

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

- Connect all components.
- Turn the ignition key ON or set the Run / Stop switch to the Run position.
- Connect the electronic service tool.

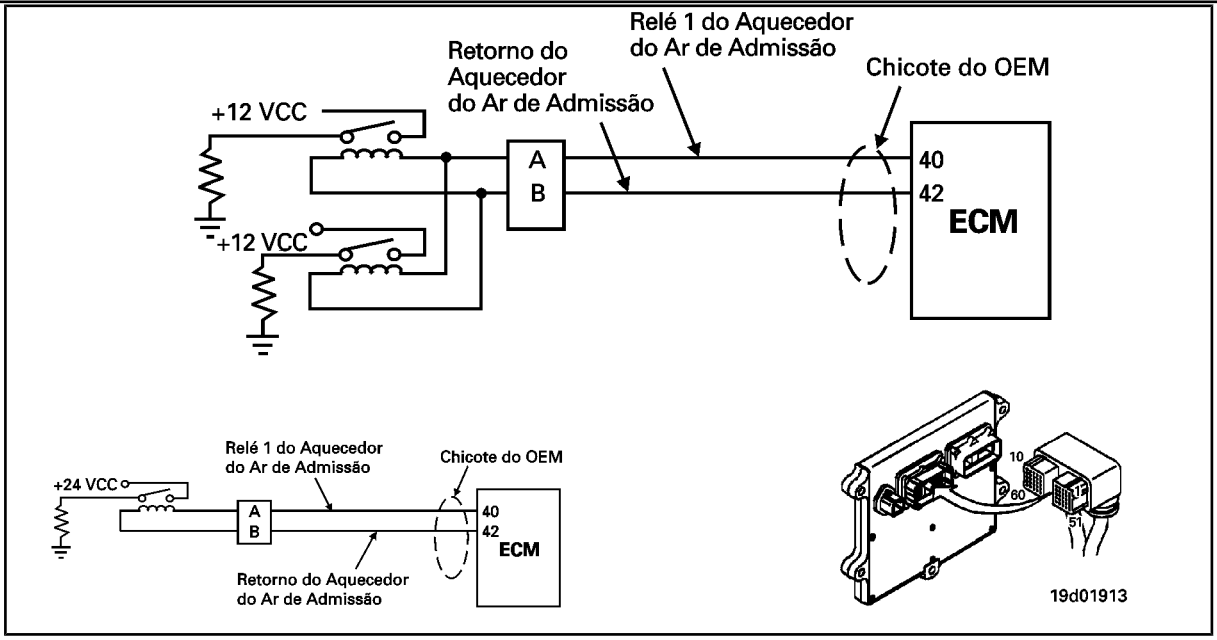
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **DO NOT** **REPAIR:** Troubleshoot any other active fault code.	Proper troubleshooting and repair steps

Fault Code 2555

Inlet Air Heater Circuit No. 1 - Voltage Above Normal or With High Voltage

CODES	REASON	IT IS MADE
Fault Code: 2555 PID (P), SID (S): S070 IMF: 3 Lamp: Amber SRT:	Inlet Air Heater Circuit No. 1 - Voltage Above Normal or High Voltage Detected High voltage in the inlet air heater signal circuit.	Intake air heaters can remain on or off at all times.

Intake Air Heater Circuit No. 1



Circuit Descriptions:

The intake air heater improves engine start and control of white smoke emission in very low temperature environments. The ECM controls the relays that alternate the supply of the intake air heater. 12 volt systems have two relays and 24 volt systems require **only** a relay.

Component Location:

The intake air heater is located at the intake manifold air inlet connection. The location of the intake air heater relays varies by OEM. Refer to Section E to identify the location of each component.

Workshop Tips:

Possible causes of this fault code:

- Inlet air heater relay signal wire not connected to relay
- The return wire from the intake air heater relay not connected to the relay
- Open circuit in the inlet air heater relay signal wire
- Open circuit in the return wire of the intake air heater relay
- Inlet air heater signal wire shorted with a voltage source.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch /

AMP / Metri-Pack female test lead. STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check for a passcode failure inactive.	**Fault code 2555 inactive?**	
STEP 2: Check the intake air heater circuit and relay.		
STEP 2A: Inspect the intake air heater relay and electrical connections.	**Dirty or damaged pins?**	
STEP 2B: Check for a circuit open in the intake air heater relay.	**Less than 100 ohms?**	
STEP 2C: Check the voltage supply line and the return air heater return circuit.	**More than 3.75 VDC?**	
STEP 2D: Check for a circuit open in the return circuit of the intake air heater relay.	**Less than 10 ohms?**	
STEP 3: Check the OEM's ECM and harness.		
STEP 3A: Inspect the ECM and the OEM harness connector pins.	**Dirty or damaged pins?**	
STEP 3B: Check for a circuit open in the OEM harness.	**Less than 10 ohms?**	
STEP 3C: Check for a short circuit between pins in the OEM harness.	**More than 100k ohms?**	
STEP 3D: Check for a passcode failure inactive.	**Fault code 2555 inactive?**	
STEP 4: Clear the fault code.		
STEP 4A: Disable the fault code.	**Fault code 2555 inactive?**	
STEP 4B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

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

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an inactive fault code. • Using INSITE ™, read the fault codes. Fault code 2555 inactive?	**YEA**	Fault Code Inactive or Intermittent, Procedure 019-362 .
	Fault code 2555 inactive? **NOT**	2A

STEP 2: Check the intake air heater circuit and relay.

STEP 2A: Inspect the intake air heater relay and electrical connections.

Conditions:

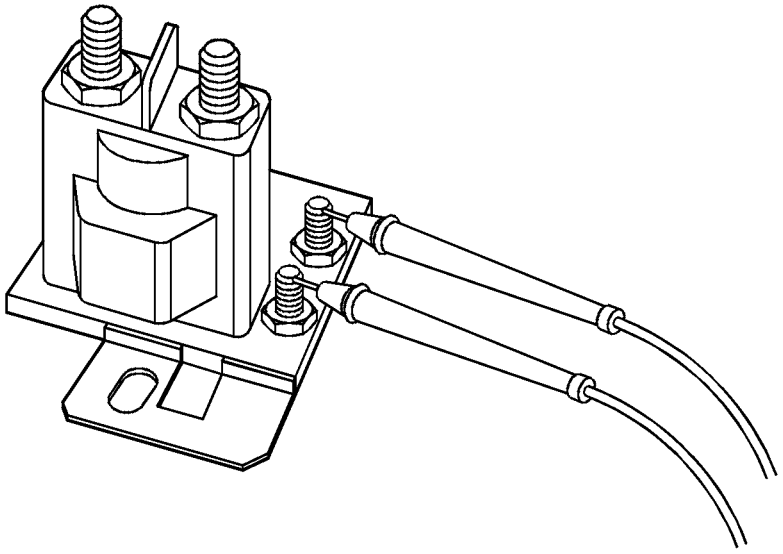
- Turn the ignition key off.
- Disconnect the inlet air heater relays from the OEM harness.

Action	Specifications / Repair	Next step
Inspect the OEM harness and the intake air heater relay connections for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Damage to the wire shield • Moisture inside or over the connector • Damaged or missing connector seals • Broken connector cover • Dirt or debris on the connector pins. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected in the sensor or in the harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-071 .	4A
	Dirty or damaged pins? **NOT**	2B

STEP 2B: Check for an open circuit in the intake air heater relay. Conditions:

- Turn the ignition key off.
- Disconnect the inlet air heater relays from the OEM harness.

Action	Specifications / Repair	Next step
Check the resistance of the intake air heater relay. • Measure the resistance between the SIGNAL and RETURN pins of the intake air heater in the intake air heater relay. **NOTE:** For 12 volt systems, the two relays must be checked. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	Less than 100 ohms? **YEA**	2C
	Less than 100 ohms? **DO NOT** **REPAIR:** An open circuit was detected in the intake air heater relay. Replace the intake air heater relay. Refer to the OEM's troubleshooting and repair manual.	4A

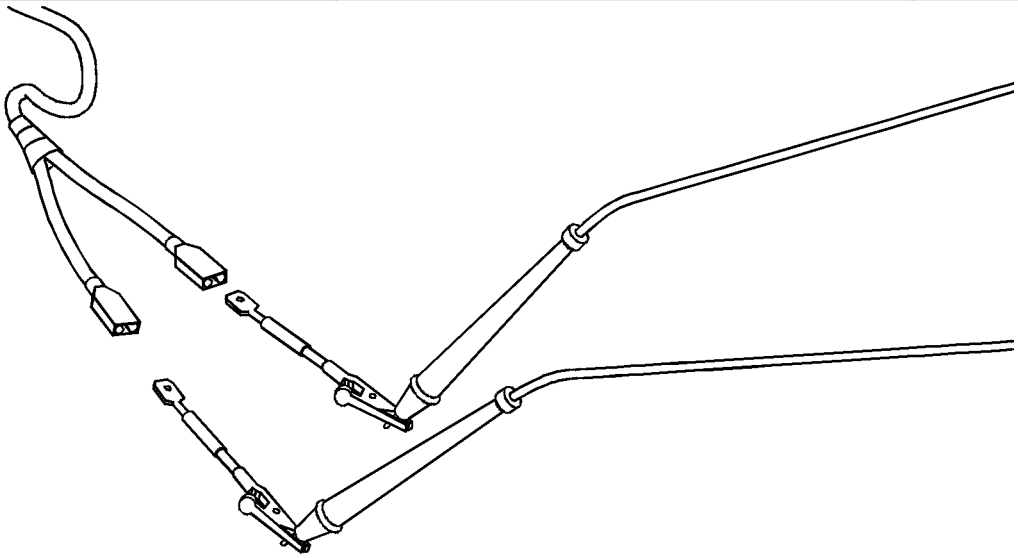


19d02048

STEP 2C: Check the diagnostic voltage, the supply line and the return circuit of the intake air heater.

Conditions:
- Turn the ignition key off.
- Disconnect the intake air heater relay from the OEM harness.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check the supply voltage and return circuit of the intake air heater. • Measure the voltage between the SIGNAL and RETURN lines of the inlet air heater relay on the OEM harness inlet air heater relay connector. **NOTE:** For 12 volt systems, both cables must be tested.	More than 3.75 VDC? **YEA**	3C
	More than 3.75 VDC? **NOT**	2D



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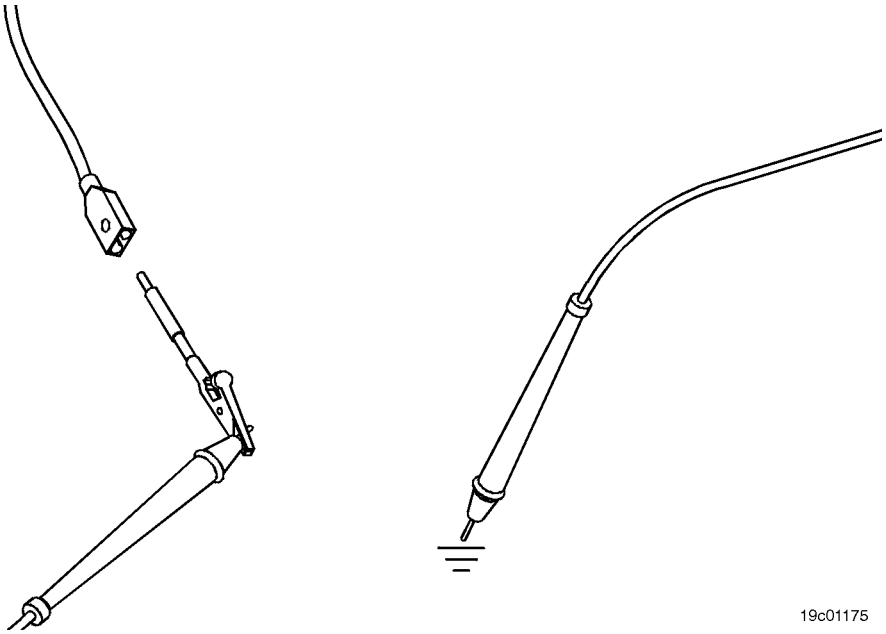
STEP 2D: Check for an open circuit in the return circuit of the air heater relay admission.

Conditions:
- Turn the ignition key off.
- Disconnect the intake air heater relay from the OEM harness.

Action	Specifications / Repair	Next step
Check for an open circuit. • Measure the resistance between the RETURN pin on the intake air heater relay, on the intake air heater relay connector, and ground. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	Less than 10 ohms? **YEA**	3A
	Less than 10 ohms? **DO NOT** **REPAIR:** An open circuit was detected on the RETURN wire. Refer to the OEM wiring diagram for the RETURN wire configuration. If the RETURN wire is connected to the ECM, repair or replace the OEM harness. See the Procedure 019-071 . If the RETURN wire is grounded to the chassis or to the engine block ground, repair the source of the defective connection. Clean, repair or replace the OEM harness, if possible. See the Procedure 019-071 .	4A



19c01175

STEP 3: Check the OEM's ECM and harness.

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

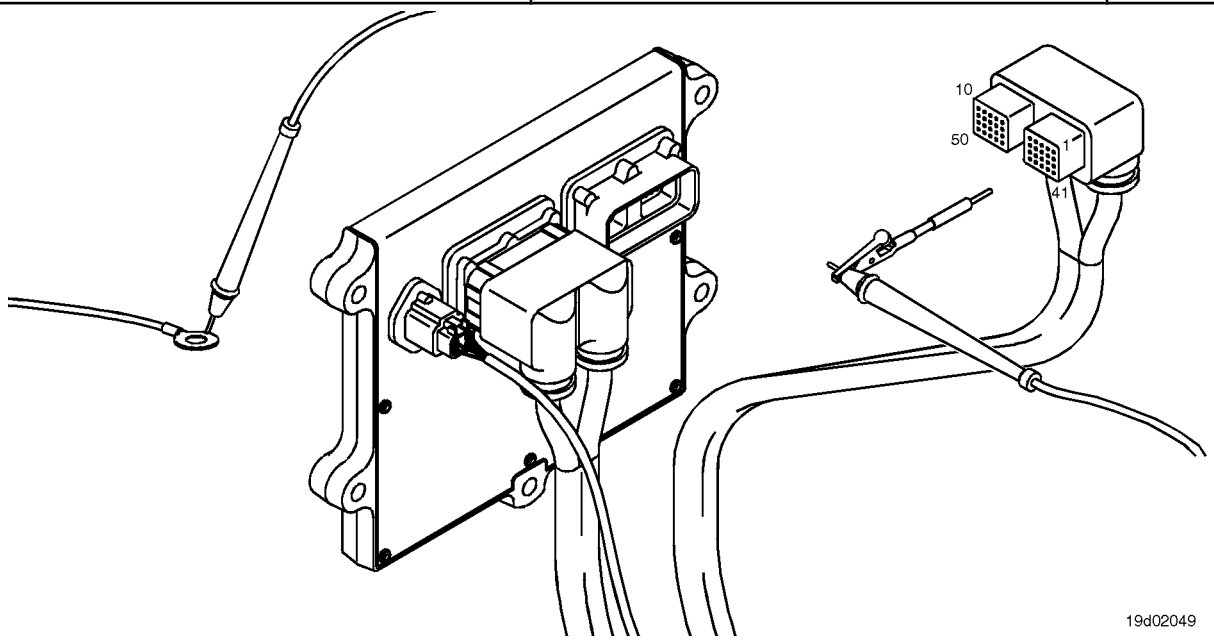
Conditions:
- Turn the ignition key off.
- Disconnect the OEM harness from the ECM.

Action	Specifications / Repair	Next step
Inspect the OEM and ECM harness connector pins for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Damage to the wire shield • Moisture inside or over the connector • Damaged or missing connector seals • Broken connector cover • Dirt or debris on the connector pins. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected at the ECM connector or the OEM harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-071 .	4A
	Dirty or damaged pins? **NOT**	3B

STEP 3B: Check the OEM harness for an open circuit. Conditions:

- Turn the ignition key off.
- Disconnect the OEM harness from the ECM.
- Disconnect the intake air heater relay from the OEM harness.

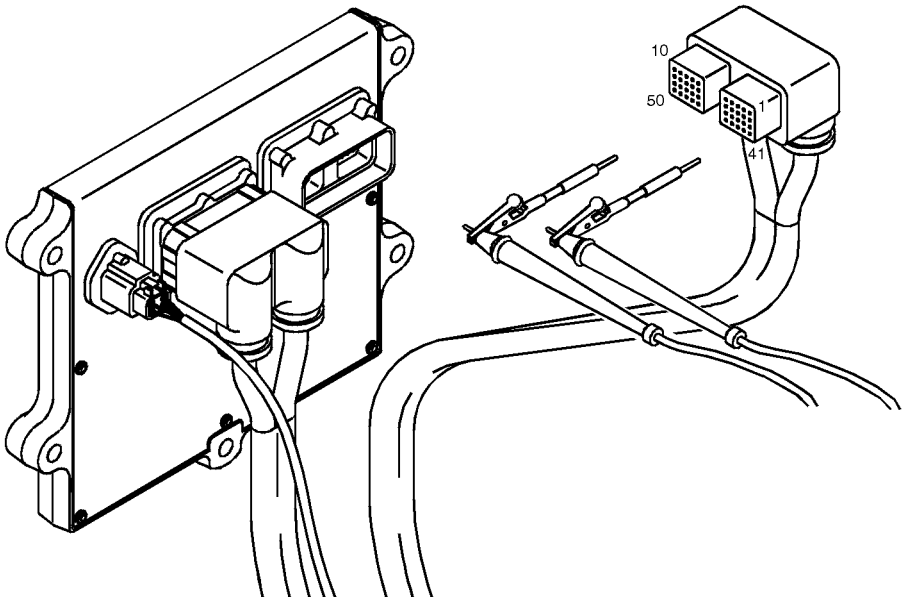
Action	Specifications / Repair	Next step
Check for an open circuit. • Measure the resistance between the intake air heater relay SIGN pin on the OEM harness ECM connector and the intake air heater relay connector SIGN pin on the OEM harness. **NOTE:** For 12 volt systems, both cables must be tested. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	Less than 10 ohms? **YEA**	3C
	Less than 10 ohms? **DO NOT** **REPAIR:** An open circuit was detected in the SIGNAL wire of the intake air heater relay in the OEM harness. Repair or replace the OEM harness. See the Procedure 019-071 .	4A



STEP 3C: Check the OEM harness for a short circuit between pins. Conditions:

- Turn the ignition key off.
- Disconnect the OEM harness from the ECM.
- Disconnect the inlet air heater from the OEM harness.

Action	Specifications / Repair	Next step
Check for a short circuit between pins. • Measure the resistance between the SIGN pin of the intake air heater relay, on the OEM harness ECM connector, and all other pins on the ECM connector. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YEA**	3D
	More than 100k ohms? **DO NOT** **REPAIR:** A short circuit between pins was detected in the SIGNAL line of the intake air heater relay in the OEM harness. Repair or replace the OEM harness. See the Procedure 019-071 .	4A



19c01056

STEP 3D: Check for an inactive fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Using INSITE ™, read the fault codes.	Fault code 2555 inactive? **YES** **Repair:** None. Did removing and installing the connector correct the failure?	4A
	Fault code 2555 inactive? **DO NOT** **REPAIR:** Replace the ECM. Call for authorization. See the Procedure 019-031 .	4A

STEP 4: Clear the fault code.

STEP 4A: Disable the fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Using INSITE ™, check that the fault code is inactive.	Fault code 2555 inactive? **YEA**	4B
	Fault code 2555 inactive? **NOT**	1A

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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

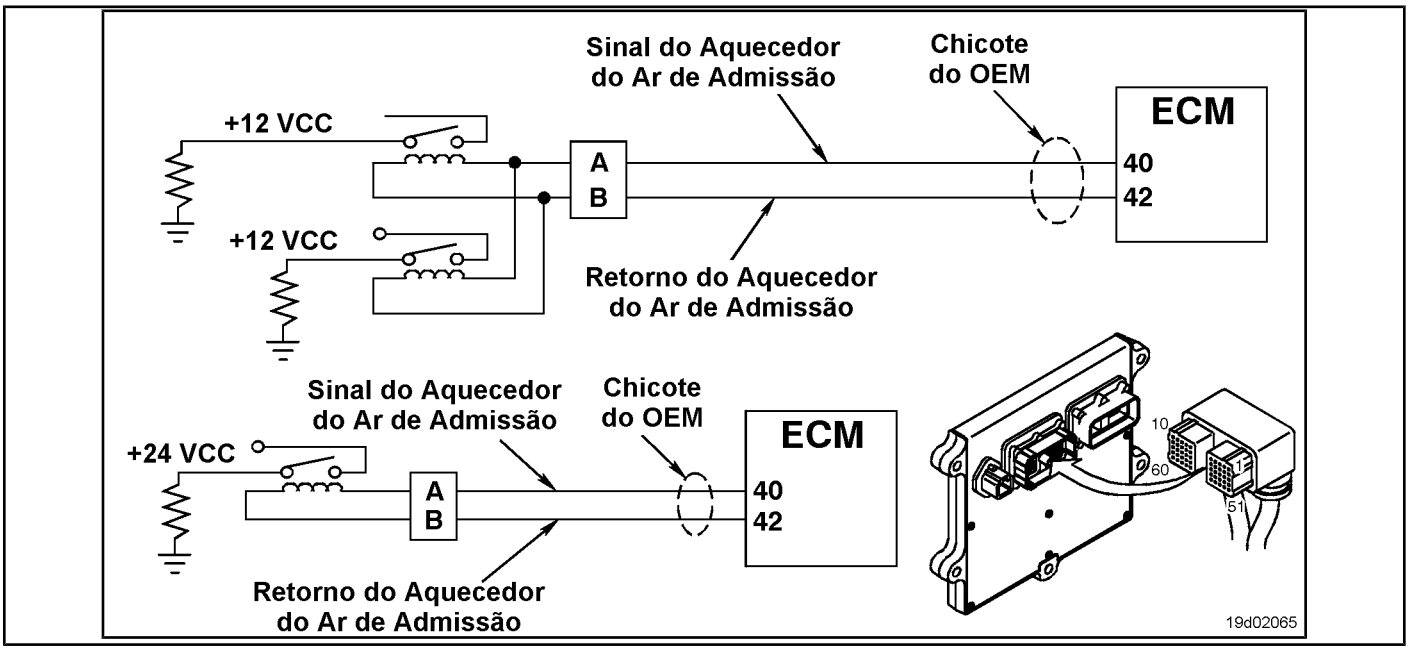
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **NOT**	Proper troubleshooting and repair steps

Fault Code 2556

Intake Air Heater Circuit No. 1 - Voltage Below Normal or With Low Voltage

CODES	REASON	IT IS MADE
Fault Code: 2556 PID (P), SID (S): S070 IMF: 4 Lamp: Amber SRT:	Inlet Air Heater Circuit No. 1 - Voltage Below Normal or Low Voltage Low voltage detected in the inlet air heater signal circuit.	Intake air heaters can remain on or off at all times.

Intake Air Heater Circuit No. 1



Circuit Descriptions:

The intake air heater improves engine start and control of white smoke emission in very low temperature environments. The ECM controls the relays that alternate the supply of the intake air heater. 12 volt systems have two relays and 24 volt systems require **only** a relay.

Component Location:

The intake air heater is located at the intake manifold air inlet connection. The location of the intake air heater relays varies by OEM. Refer to Section E to identify the location of each component.

Workshop Tips:

Possible causes of this fault code:

- A relay shorted from the intake air heater
- The supply air heater supply relay wire is shorted to ground.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch /

AMP / Metri-Pack female test lead. STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check for a passcode failure inactive.	**Fault code 2556 inactive?**	
STEP 2: Check the intake air heater circuit and relay.		
STEP 2A: Inspect the intake air heater relay and electrical connections.	**Dirty or damaged pins?**	
STEP 2B: Check the circuit response.	**Fault Code 2555 active and Fault Code 2556 inactive?**	
STEP 2C: Check the fault codes and the sensor condition.	**Fault code 2556 active?**	
STEP 3: Check the OEM's ECM and harness.		
STEP 3A: Inspect the ECM and the OEM harness connector pins.	**Dirty or damaged pins?**	
STEP 3B: Check for a short pin circuit with ground.	**More than 100k ohms?**	
STEP 3C: Check for a short circuit between pins in the OEM harness.	**More than 100k ohms?**	
STEP 3D: Check for a passcode failure inactive.	**Fault code 2556 inactive?**	
STEP 4: Clear the fault code.		
STEP 4A: Disable the fault code.	**Fault code 2556 inactive?**	
STEP 4B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

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

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an inactive fault code. • Using INSITE ™, read the fault codes. Fault code 2556 inactive?	**YEA**	Fault Code Inactive or Intermittent, Procedure 019-362
	Fault code 2556 inactive? **NOT**	2A

STEP 2: Check the intake air heater circuit and relay.

STEP 2A: Inspect the intake air heater relay and electrical connections.

Conditions:
- Turn the ignition key off.
- Disconnect the inlet air heater relays from the OEM harness.

Action	Specifications / Repair	Next step
Inspect the OEM harness and the intake air heater relay connections for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Damage to the wire shield • Moisture inside or over the connector • Damaged or missing connector seals • Broken connector cover • Dirt or debris on the connector pins. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected in the sensor or in the harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-071 .	4A
	Dirty or damaged pins? **NOT**	2B

STEP 2B: Check the circuit response. Conditions:

- Turn the ignition key off.
- Disconnect the intake air heater relays from the engine harness.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Using INSITE ™, read the fault codes.	Fault Code 2555 active and Fault Code 2556 inactive? **YEA**	2C
	Fault Code 2555 active and Fault Code 2556 inactive? **NOT**	3A

STEP 2C: Check the fault codes and the condition of the sensor. Conditions:

- Turn the ignition key off.
- Connect the intake air heater relay to the engine harness.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Using INSITE ™, read the fault codes.	Fault code 2556 active? **YES** **Repair:** A defective inlet air heater relay has been detected. Replace the defective inlet heater relay. Refer to the OEM's troubleshooting and repair manual.	4A
	Fault code 2556 active? **DO NOT** **REPAIR:** None. Did removing and installing the connector correct the failure?	4A

STEP 3: Check the OEM's ECM and harness.

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

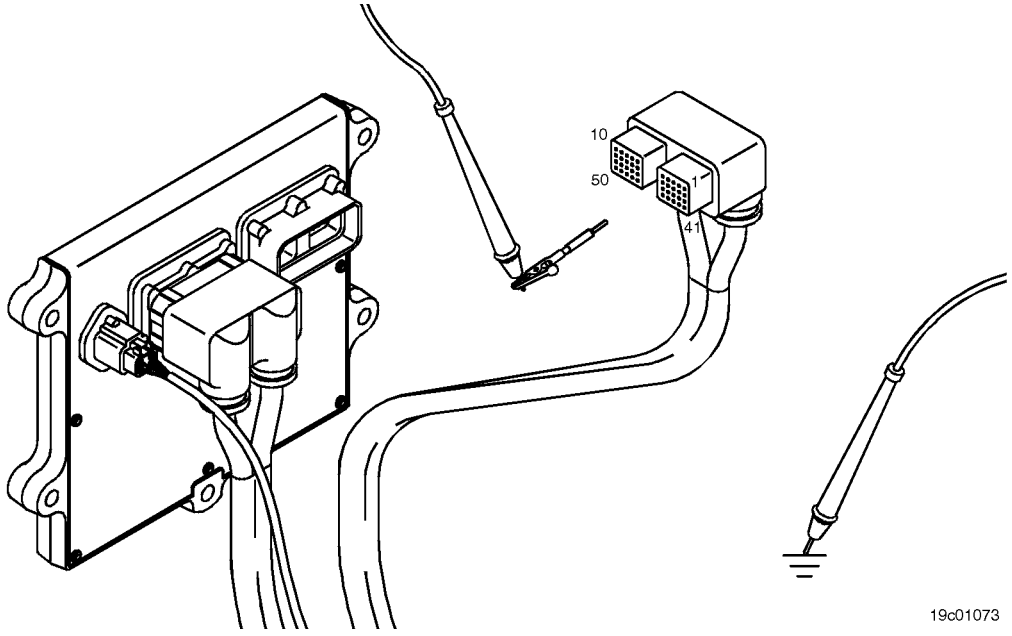
Conditions:
- Turn the ignition key off.
- Disconnect the OEM harness from the ECM.

Action	Specifications / Repair	Next step
Inspect the OEM and ECM harness connector pins for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Damage to the wire shield • Moisture inside or over the connector • Damaged or missing connector seals • Broken connector cover • Dirt or debris on the connector pins. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected in the sensor or in the harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-071 .	4A
	Dirty or damaged pins? **NOT**	3B

STEP 3B: Check if there is a pin short with the ground. Conditions:

- Turn the ignition key off.
- Disconnect the OEM harness from the ECM.
- Disconnect the intake air heater relay from the OEM harness.

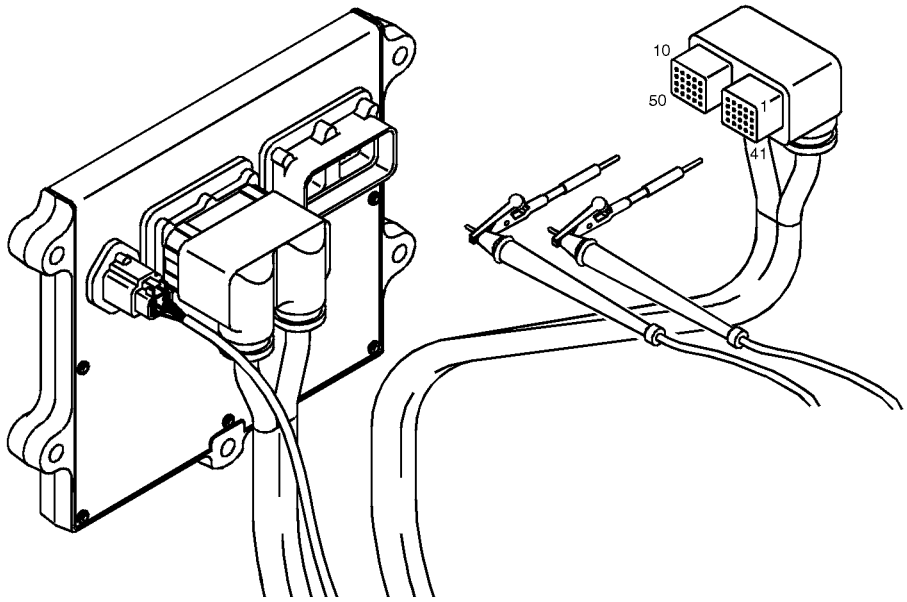
Action	Specifications / Repair	Next step
Check for a short between pins and ground. • Measure the resistance between the intake air heater relay SIGN pin, on the OEM harness ECM connector, and ground. **NOTE:** For 12 volt systems, both cables must be tested. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YEA**	3C
	More than 100k ohms? **DO NOT** **REPAIR:** A short circuit was detected between pins and ground in the line of the inlet air heater relay in the OEM harness. Repair or replace the OEM harness. See the Procedure 019-071 .	4A



STEP 3C: Check the OEM harness for a short circuit between pins. Conditions:

- Turn the ignition key off.
- Disconnect the OEM harness from the ECM.
- Disconnect the intake air heater relay from the OEM harness.

Action	Specifications / Repair	Next step
Check for a short circuit between pins. • Measure the resistance between the intake air heater relay SIGN pin, the OEM harness ECM connector, and all other OEM connector pins. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YEA**	3D
	More than 100k ohms? **DO NOT** **REPAIR:** A short circuit was detected between pins in the SIGNAL line of the intake air heater in the OEM harness. Repair or replace the OEM harness. See the Procedure 019-071 .	4A



STEP 3D: Check for an inactive fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Using INSITE ™, read the fault codes.	Fault code 2556 inactive? **YES** **Repair:** None. Did removing and installing the connector correct the failure?	4A
	Fault code 2556 inactive? **DO NOT** **REPAIR:** Replace the ECM. Call for authorization. See the Procedure 019-031 .	4A

STEP 4: Clear the fault code.

STEP 4A: Disable the fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Using INSITE ™, check that the fault code is inactive.	Fault code 2556 inactive? **YEA**	4B
	Fault code 2556 inactive? **NOT**	1A

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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

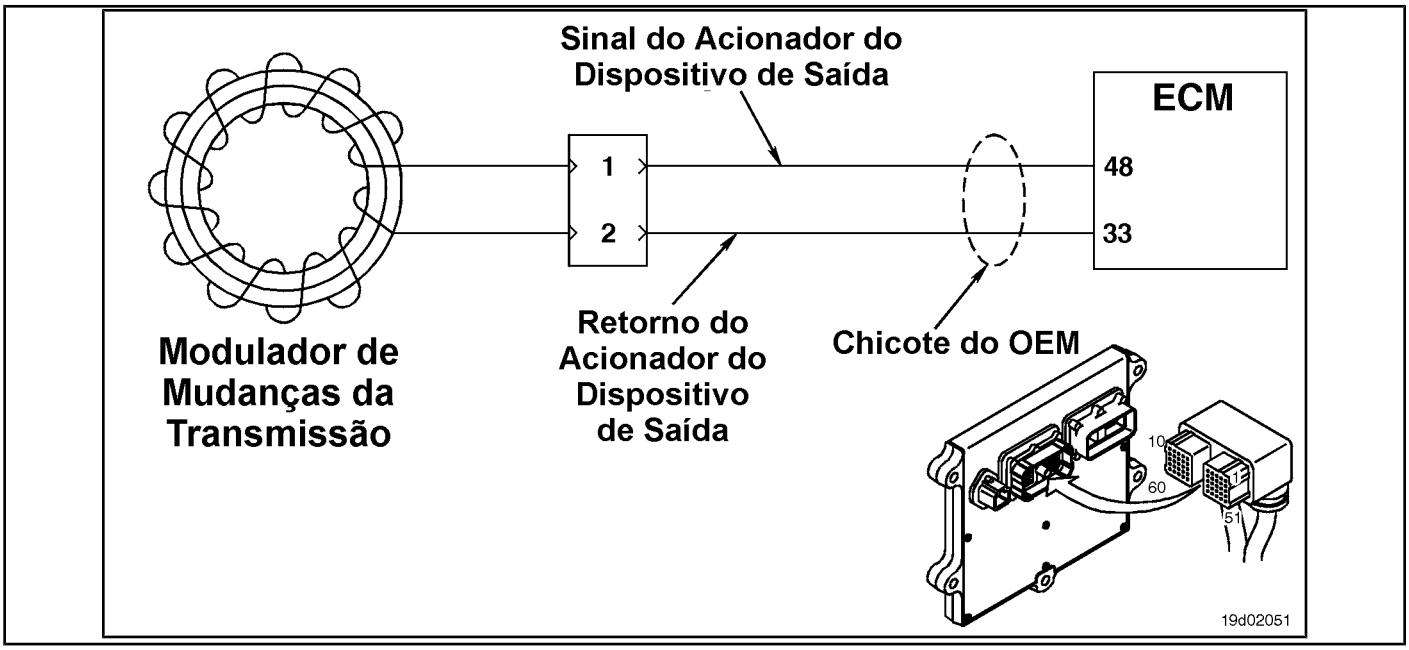
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **NOT**	Proper troubleshooting and repair steps

Fault Code 2557

Auxiliary PWM Trigger No. 1 - Voltage Above Normal or High Voltage

CODES	REASON	IT IS MADE
Fault Code: 2557 PID (P), SID (S): S057 IMF: 3 Lamp: Amber SRT:	Auxiliary PWM Trigger No. 1 - Voltage Above Normal or High Voltage High signal voltage detected in the analog torque circuit.	**Not** it is possible to control the transmission.

Auxiliary PWM Trigger No. 1 Circuit



Circuit Descriptions:

The transmission shift modulator uses this signal from the ECM to determine when to shift the transmission. The return circuit depends on the OEM wiring. It can be connected back to the ECM in some vehicles or connected to the chassis or the ground of the block in others. Refer to the OEM wiring diagram for details on the return circuit.

Component Location:

Refer to the OEM diagram for the location of the transmission shift modulator.

Workshop Tips:

This fault code can be caused by:

- A defective transmission shift modulator
- An open circuit in the output device driver return line
- A short circuit between pins in the driver line of the output device.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch /

AMP / Metri-Pack female test lead. STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check for a passcode failure inactive.	**Fault code 2557 inactive?**	
STEP 2: Check the transmission shifting circuit and modulator.		
STEP 2A: Inspect the transmission shift modulator and connector pins.	**Dirty or damaged pins?**	
STEP 2B: Check the resistance of the transmission shift modulator.	**Less than 2.2k ohms?**	
STEP 2C: Check the voltage diagnostic supply of the transmission shift modulator, the supply line and the return circuit.	**More than 5 VDC?**	
STEP 2D: Check for a circuit open in the output device driver feedback circuit.	**Less than 10 ohms?**	
STEP 3: Check the OEM's ECM and harness.		
STEP 3A: Inspect the ECM and the OEM harness connector pins.	**Dirty or damaged pins?**	
STEP 3B: Check for a circuit open in the OEM harness.	**Less than 10 ohms?**	
STEP 3C: Check for a short circuit between pins in the OEM harness.	**More than 100k ohms?**	
STEP 3D: Check for a passcode failure inactive.	**Fault code 2557 inactive?**	
STEP 4: Clear the fault code.		
STEP 4A: Disable the fault code.	**Fault code 2557 inactive?**	
STEP 4B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

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

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an inactive fault code. • Using INSITE ™, read the fault codes. Fault code 2557 inactive?	**YEA**	Fault Code Inactive or Intermittent, Procedure 019-362 .
	Fault code 2557 inactive? **NOT**	2A

STEP 2: Check the transmission shifting circuit and modulator.

STEP 2A: Inspect the transmission shift modulator and connector pins.

Conditions:

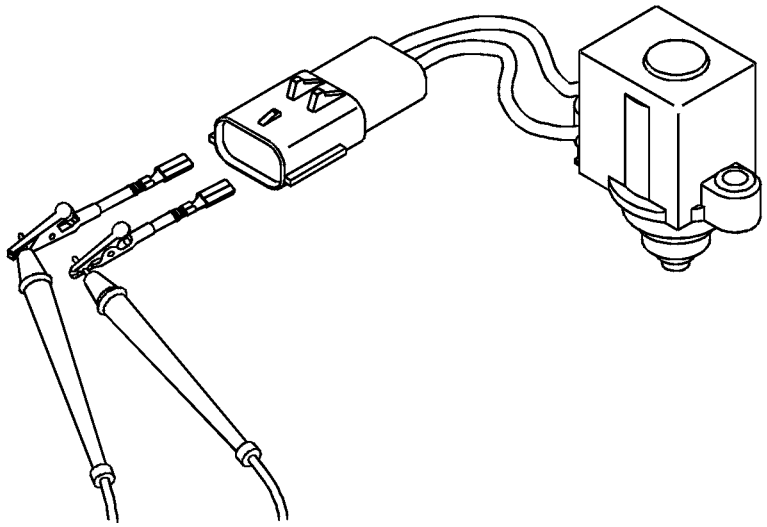
- Turn the ignition key off.
- Disconnect the transmission modulator from the OEM harness transmission.

Action	Specifications / Repair	Next step
Inspect the OEM harness connector pins and the transmission shift modulator for: • Loose connector • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Damage to the wire shield • Moisture inside or over the connector • Damaged or missing connector seals • Broken connector cover • Dirt or debris on the connector pins. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected in the sensor or in the harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-071 .	4A
	Dirty or damaged pins? **NOT**	2B

STEP 2B: Check the resistance of the transmission shift modulator. Conditions:

- Turn the ignition key off.
- Disconnect the transmission modulator from the OEM harness transmission.

Action	Specifications / Repair	Next step
Check the resistance of the transmission shift modulator. • Measure the resistance between the SIGNAL and RETURN pins of the output device driver on the transmission shift modulator connector. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	Less than 2.2k ohms? **YEA**	2C
	Less than 2.2k ohms? **DO NOT** **REPAIR:** Replace the transmission shift modulator. Refer to the OEM fault diagnosis manual.	4A

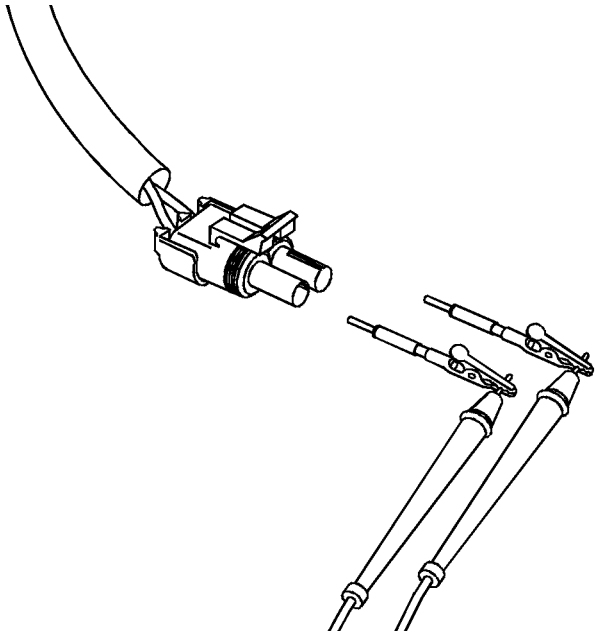


19c01085

STEP 2C: Check the diagnostic supply voltage of the shift modulator transmission, supply line and return circuit.

Conditions:
- Turn the ignition key off.
- Disconnect the transmission modulator from the OEM harness transmission.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check the transmission shift modulator's diagnostic supply voltage and return circuit. • Measure the voltage between the SIGNAL and RETURN pins of the output device driver on the OEM wiring harness modulator connector.	More than 5 VDC? **YEA**	3C
	More than 5 VDC? **NOT**	2D

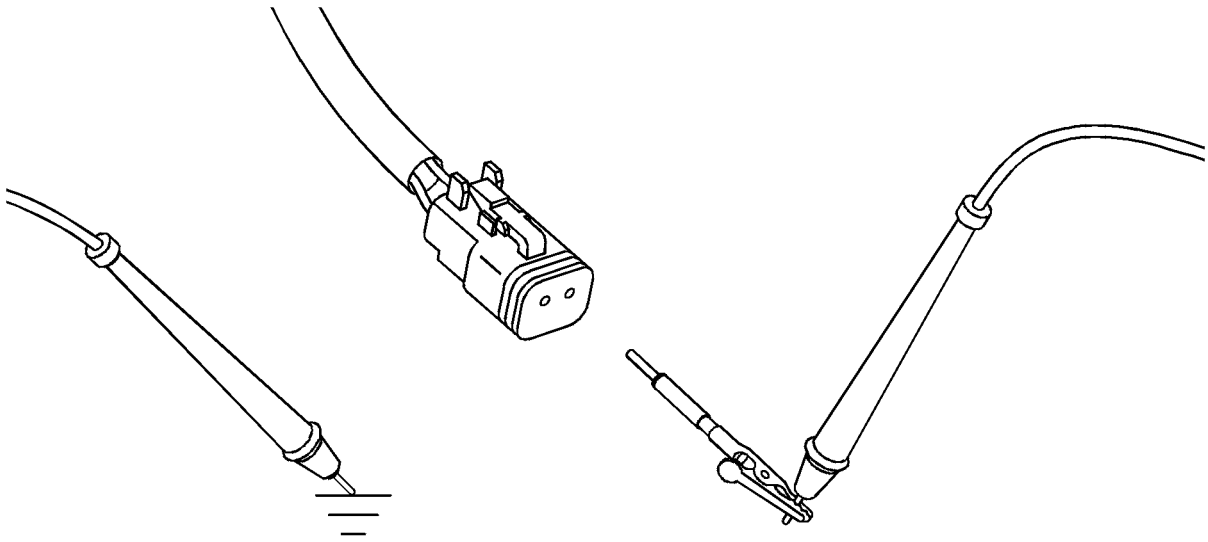


19c01133

STEP 2D: Check for an open circuit in the feedback circuit of the driver of the output.

Conditions:
- Turn the ignition key off.
- Disconnect the transmission modulator from the OEM harness transmission.
- Disconnect the OEM harness from the ECM.

Action	Specifications / Repair	Next step
Check for an open circuit. • Measure the resistance between the RETURN pin of the output device driver on the transmission shift modulator connector and the ground. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	Less than 10 ohms? **YEA**	3A
	Less than 10 ohms? **DO NOT** **REPAIR:** An open circuit was detected on the RETURN wire. Refer to the OEM wiring diagram for the RETURN wire configuration. If the RETURN wire is connected to the ECM, repair or replace the OEM harness. See the Procedure 019-071 . If the RETURN wire is grounded to the chassis or to the engine block ground, repair the source of the defective connection. Clean and repair, or replace the OEM harness. See the Procedure 019-071 .	4A



19c01078

STEP 3: Check the OEM's ECM and harness.

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

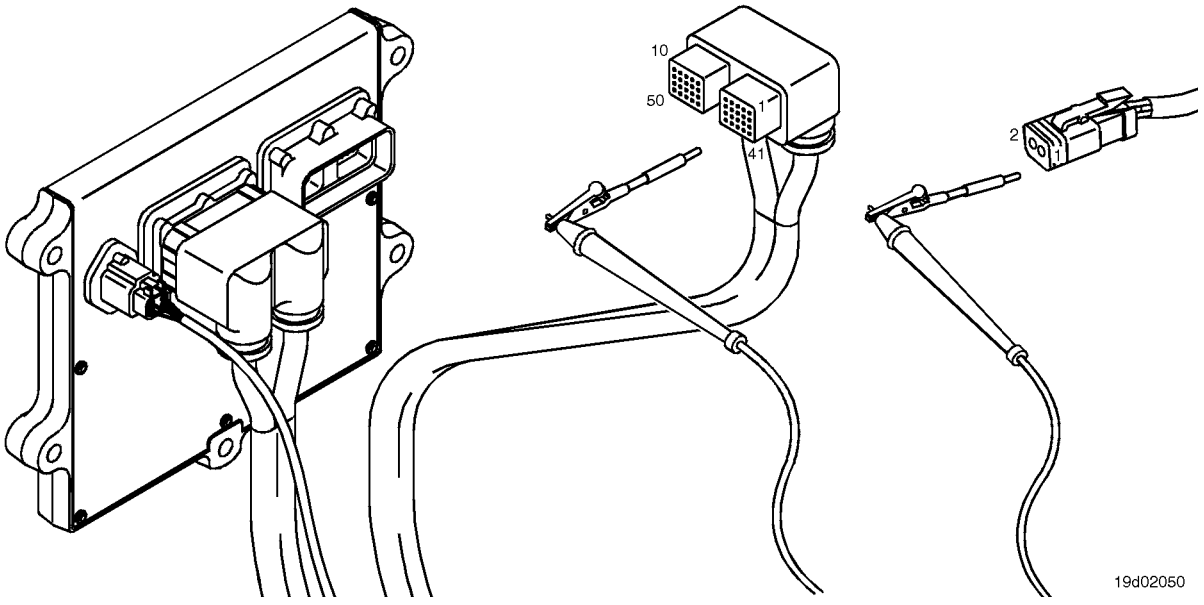
Conditions:
- Turn the ignition key off.
- Disconnect the OEM harness from the ECM.

Action	Specifications / Repair	Next step
Inspect the OEM harness and ECM connector pins for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Damage to the wire shield • Moisture inside or over the connector • Damaged or missing connector seals • Broken connector cover • Dirt or debris on the connector pins. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected at the ECM connector or the OEM harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-071 .	4A
	Dirty or damaged pins? **NOT**	3B

STEP 3B: Check the OEM harness for an open circuit. Conditions:

- Turn the ignition key off.
- Disconnect the OEM harness from the ECM.
- Disconnect the transmission modulator from the OEM harness transmission.

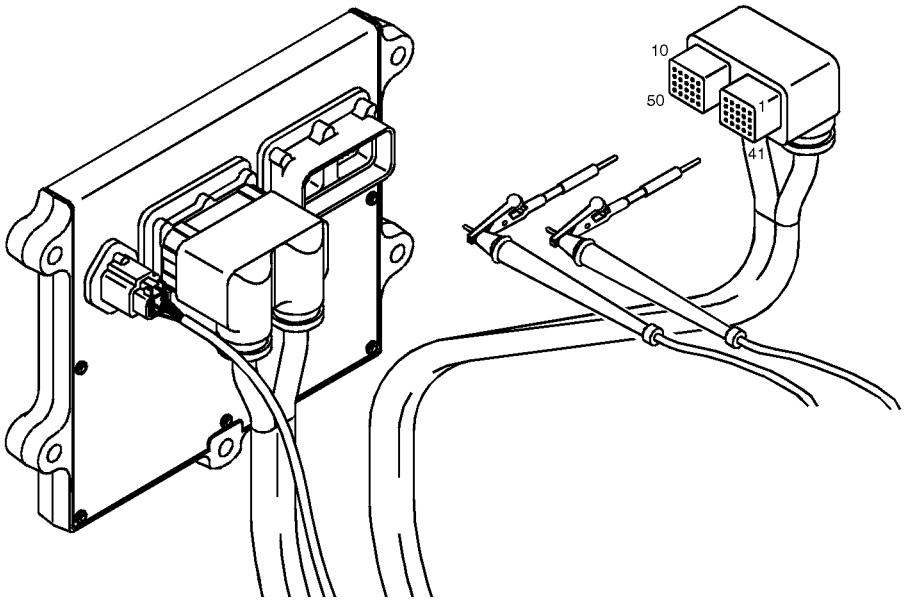
Action	Specifications / Repair	Next step
Check for a short between pins and ground. • Measure the resistance between the output device driver SIGN pin on the transmission shift modulator connector and the output device driver SIGN pin on the engine harness ECM connector. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	Less than 10 ohms? **YEA**	3C
	Less than 10 ohms? **DO NOT** **REPAIR:** An open circuit was detected in the SIGNAL line of the output device driver in the OEM harness. Repair or replace the OEM harness. See the Procedure 019-071 .	4A



STEP 3C: Check the OEM harness for a short circuit between pins. Conditions:

- Turn the ignition key off.
- Disconnect the OEM harness from the ECM.
- Disconnect the transmission modulator from the OEM harness transmission.

Action	Specifications / Repair	Next step
Check for a short circuit between pins. • Measure the resistance between the output device driver SIGN pin, on the OEM harness ECM connector, and all other pins on the OEM connector. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YEA**	3D
	More than 100k ohms? **DO NOT** **REPAIR:** A short circuit was detected between pins in the SIGNAL line of the OEM output device driver in the OEM harness. Repair or replace the OEM harness. See the Procedure 019-071 .	4A



19c01056

STEP 3D: Check for an inactive fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Using INSITE ™, read the fault codes.	Fault code 2557 inactive? **YES** **Repair:** None. Did removing and installing the connector correct the failure?	4A
	Fault code 2557 inactive? **DO NOT** **REPAIR:** Call for pre-authorization. Replace the ECM. See the Procedure 019-031 .	4A

STEP 4: Clear the fault code.

STEP 4A: Disable the fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Using INSITE ™, check that the fault code is inactive.	Fault code 2557 inactive? **YEA**	4B
	Fault code 2557 inactive? **NOT**	1A

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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

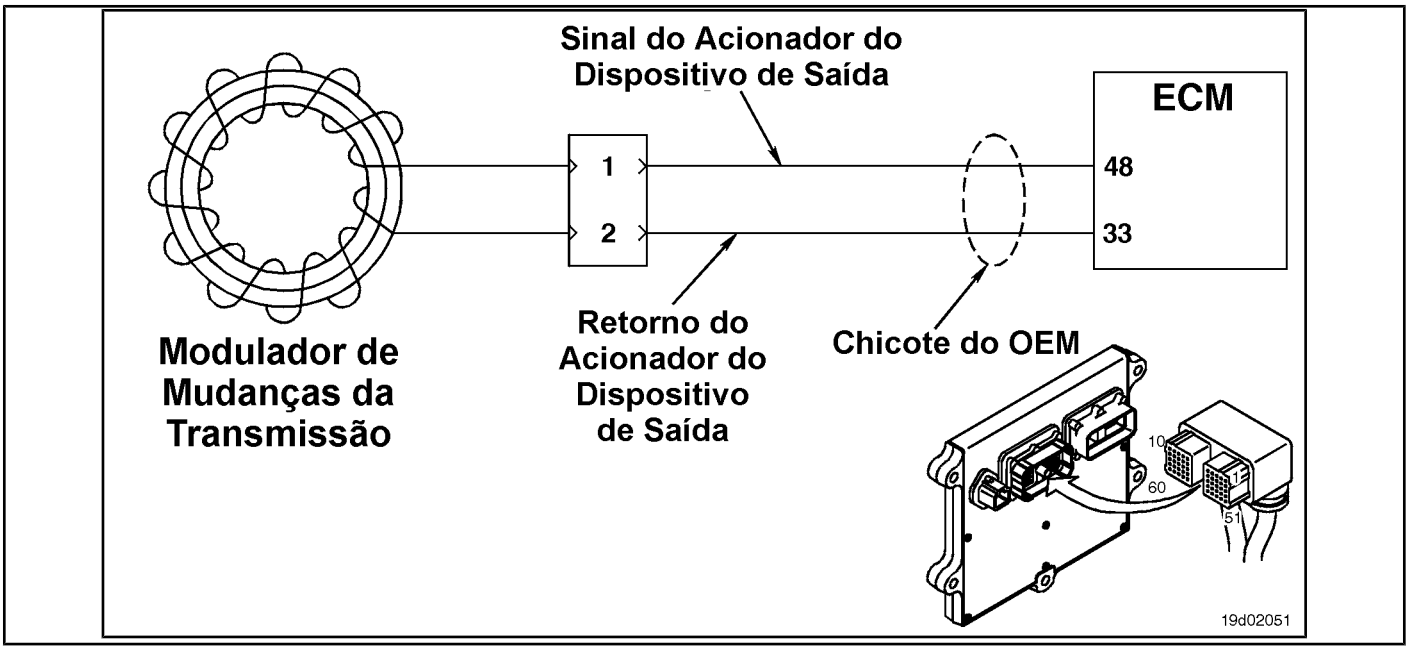
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **NOT**	Proper troubleshooting and repair steps

Fault Code 2558

Auxiliary PWM Actuator No. 1 - Voltage Below Normal or Low Voltage

CODES	REASON	IT IS MADE
Fault Code: 2558 PID (P), SID (S): S057 IMF: 4 Lamp: Amber SRT:	Auxiliary PWM Trigger No. 1 - Voltage Below Normal or Low Voltage Low signal voltage detected in the analog torque circuit.	**Not** it is possible to control the transmission.

Auxiliary PWM Trigger No. 1 Circuit



Circuit Descriptions:

The transmission shift modulator uses this signal from the ECM to determine when to shift the transmission. The return circuit depends on the OEM wiring. It can be connected back to the ECM in some vehicles or connected to the chassis or the ground of the block in others. Refer to the OEM wiring diagram for details on the return circuit.

Component Location:

Refer to the OEM diagram for the location of the transmission shift modulator.

Workshop Tips:

This fault code can be caused by:

- A defective transmission shift modulator
- A short circuit with the ground in the drive line of the output device
- A short circuit between pins in the driver line of the output device.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To prevent damage to a new ECM, investigate all other active fault codes before replacing it.

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch /

AMP / Metri-Pack female test lead. STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check for a passcode failure inactive.	**Fault code 2558 inactive?**	
STEP 2: Check the transmission shifting circuit and modulator.		
STEP 2A: Inspect the transmission shift modulator and connector pins.	**Dirty or damaged pins?**	
STEP 2B: Check the resistance of the transmission shift modulator.	**Less than 2.2k ohms?**	
STEP 2B-1: Check for a short circuit with the ground in the transmission shifting modulator.	**More than 100k ohms?**	
STEP 2C: Check the voltage diagnostic supply of the transmission shift modulator, the supply line and the return circuit.	**More than 5 VDC?**	
STEP 3: Check the OEM's ECM and harness.		
STEP 3A: Inspect the ECM and the OEM harness connector pins.	**Dirty or damaged pins?**	
STEP 3B: Check for a short pin circuit with ground.	**More than 100k ohms?**	
STEP 3C: Check for a short circuit between pins in the OEM harness.	**More than 100k ohms?**	
STEP 3D: Check for a passcode failure inactive.	**Fault code 2558 inactive?**	
STEP 4: Clear the fault code.		
STEP 4A: Disable the fault code.	**Fault code 2558 inactive?**	
STEP 4B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

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

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an inactive fault code. • Using INSITE ™, read the fault codes. Fault code 2558 inactive?	**YEA**	Fault Code Inactive or Intermittent, Procedure 019-362 .
	Fault code 2558 inactive? **NOT**	2A

STEP 2: Check the transmission shifting circuit and modulator.

STEP 2A: Inspect the transmission shift modulator and connector pins.

Conditions:

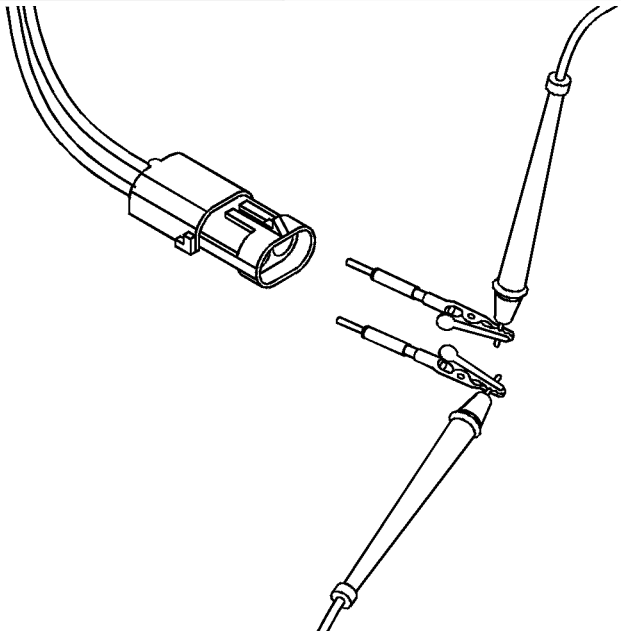
- Turn the ignition key off.
- Disconnect the transmission modulator from the OEM harness transmission.

Action	Specifications / Repair	Next step
Inspect the OEM harness connector pins and the transmission shift modulator for: • Loose connector • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Damage to the wire shield • Moisture inside or over the connector • Damaged or missing connector seals • Broken connector cover • Dirt or debris on the connector pins. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected in the sensor or in the harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-071 .	4A
	Dirty or damaged pins? **NOT**	2B

STEP 2B: Check the resistance of the transmission shift modulator. Conditions:

- Turn the ignition key off.
- Disconnect the transmission modulator from the OEM harness transmission.

Action	Specifications / Repair	Next step
Check the resistance of the transmission shift modulator. • Measure the resistance between the SIGNAL and RETURN pins of the output device driver on the transmission shift modulator connector. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	Less than 2.2k ohms? **YEA**	2B-1
	Less than 2.2k ohms? **DO NOT** **REPAIR:** Replace the transmission shift modulator. Refer to the OEM fault diagnosis manual.	4A

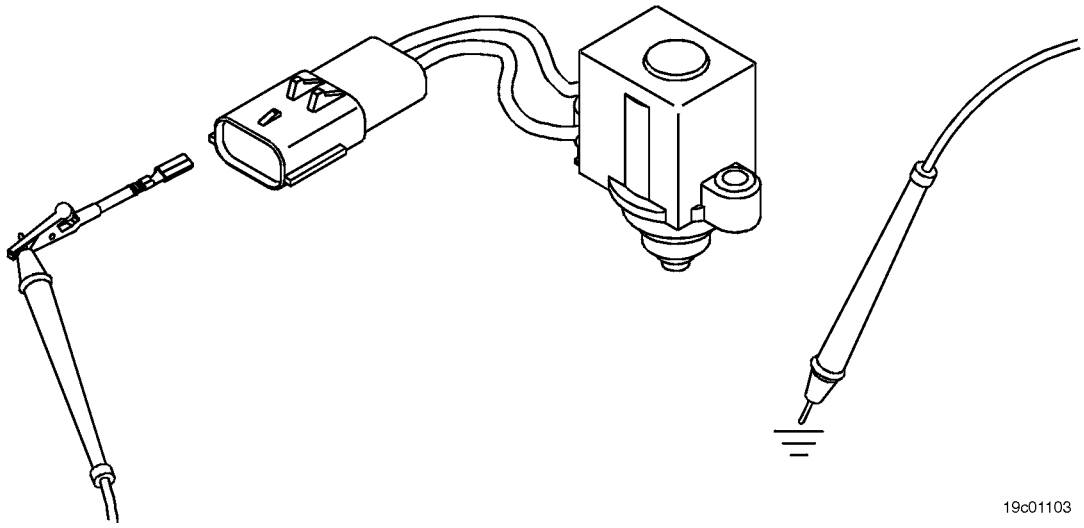


19c01114

STEP 2B-1: Check for a short circuit with the ground in the gearshift modulator of the streaming.

Conditions:
- Turn the ignition key off.
- Disconnect the transmission modulator from the OEM harness transmission.

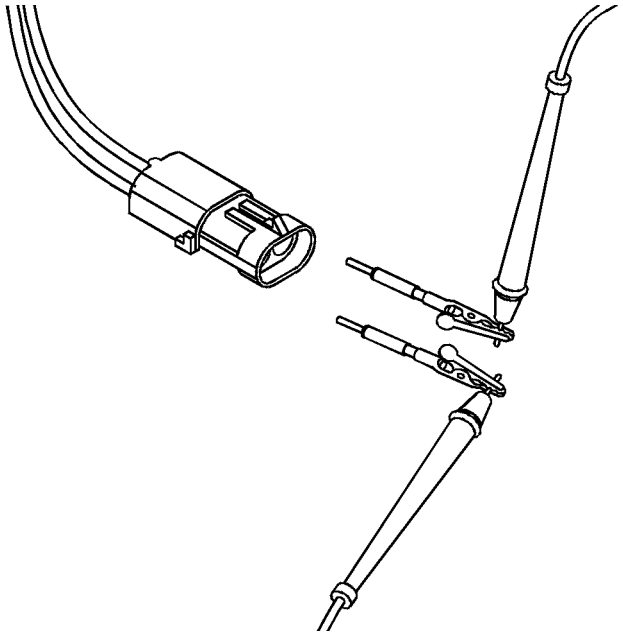
Action	Specifications / Repair	Next step
Check for a short with the ground of the transmission shift modulator output. • Measure the resistance between the output device driver SIGN pin and ground on the transmission shift modulator connector. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YEA**	2C
	More than 100k ohms? **DO NOT** **REPAIR:** Replace the transmission shift modulator. Refer to the OEM fault diagnosis manual.	4A



STEP 2C: Check the diagnostic supply voltage of the shift modulator transmission, supply line and return circuit.

Conditions:
- Turn the ignition key off.
- Disconnect the transmission modulator from the OEM harness transmission.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check the transmission shift modulator's diagnostic supply voltage and return circuit. • Measure the voltage between the SIGNAL and RETURN pins of the output device driver on the OEM wiring harness modulator connector.	More than 5 VDC? **YEA**	3C
	More than 5 VDC? **NOT**	3A



19c01114

STEP 3: Check the OEM's ECM and harness.

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

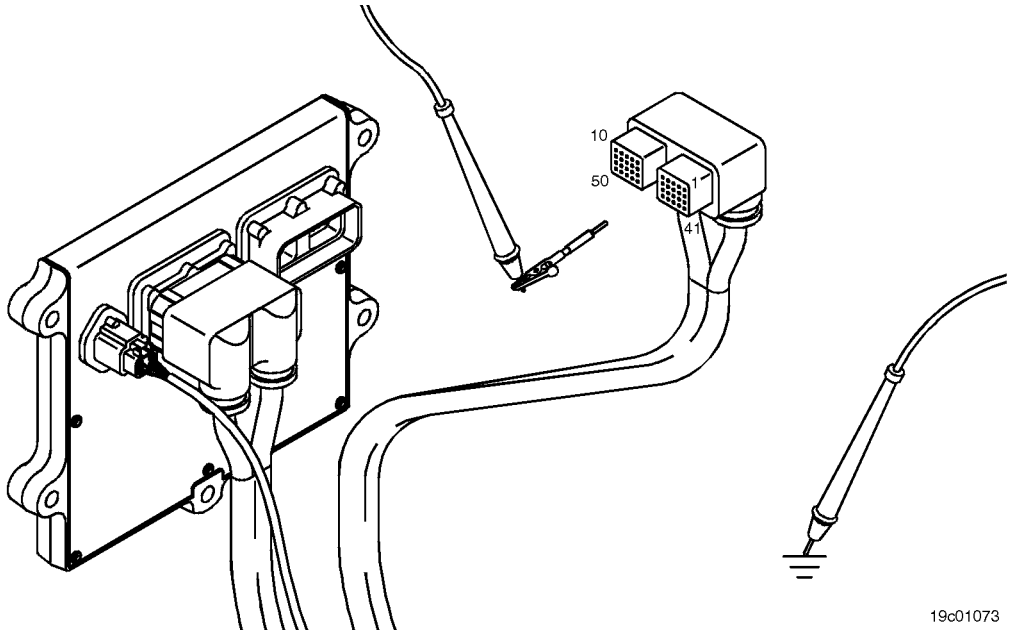
Conditions:
- Turn the ignition key off.
- Disconnect the OEM harness from the ECM.

Action	Specifications / Repair	Next step
Inspect the OEM harness and ECM connector pins for: • Loose connector • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Damage to the wire shield • Moisture inside or over the connector • Damaged or missing connector seals • Broken connector cover • Dirt or debris on the connector pins. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected in the sensor or in the harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-071 .	4A
	Dirty or damaged pins? **NOT**	3B

STEP 3B: Check if there is a pin short with the ground. Conditions:

- Turn the ignition key off.
- Disconnect the OEM harness from the ECM.
- Disconnect the transmission modulator from the OEM harness transmission.

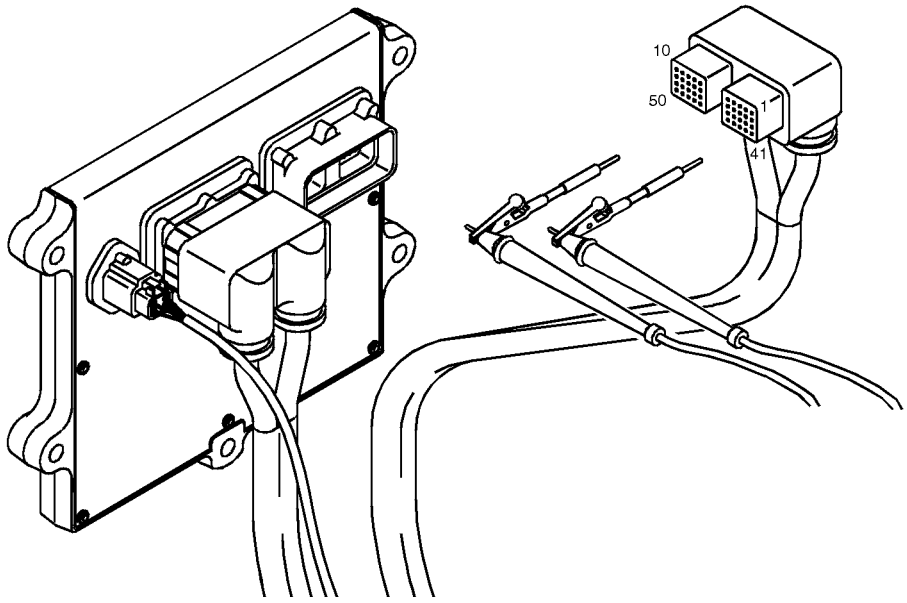
Action	Specifications / Repair	Next step
Check for a short between pins and ground. • Measure the resistance between the OEM output device driver SIGN pin, the OEM harness ECM connector, and the ground. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YEA**	3C
	More than 100k ohms? **DO NOT** **REPAIR:** A short circuit was detected between the pins and ground in the SIGNAL line of the OEM output device driver in the OEM harness. Repair or replace the OEM harness. See the Procedure 019-071 .	4A



STEP 3C: Check the OEM harness for a short circuit between pins. Conditions:

- Turn the ignition key off.
- Disconnect the OEM harness from the ECM.
- Disconnect the transmission modulator from the OEM harness transmission.

Action	Specifications / Repair	Next step
Check for a short circuit between pins. • Measure the resistance between the output device driver SIGN pin, on the OEM harness ECM connector, and all other pins on the OEM connector. Refer to the electrical diagram for identification of the connector pins. For general resistance measurement techniques, see Resistance Measurements with a Multimeter and Electrical Diagram, Procedure 019-360 .	More than 100k ohms? **YEA**	3D
	More than 100k ohms? **DO NOT** **REPAIR:** A short circuit was detected between pins in the SIGNAL line of the OEM output device driver in the OEM harness. Repair or replace the OEM harness. See the Procedure 019-071 .	4A



STEP 3D: Check for an inactive fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for proper circuit response after 30 seconds. • Using INSITE ™, read the fault codes.	Fault code 2558 inactive? **YES** **Repair:** None. Did removing and installing the connector correct the failure?	4A
	Fault code 2558 inactive? **DO NOT** **REPAIR:** Call for pre-authorization. Replace the ECM. See the Procedure 019-031 .	4A

STEP 4: Clear the fault code.

STEP 4A: Disable the fault code. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Using INSITE ™, check that the fault code is inactive.	Fault code 2558 inactive? **YEA**	4B
	Fault code 2558 inactive? **NOT**	1A

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

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

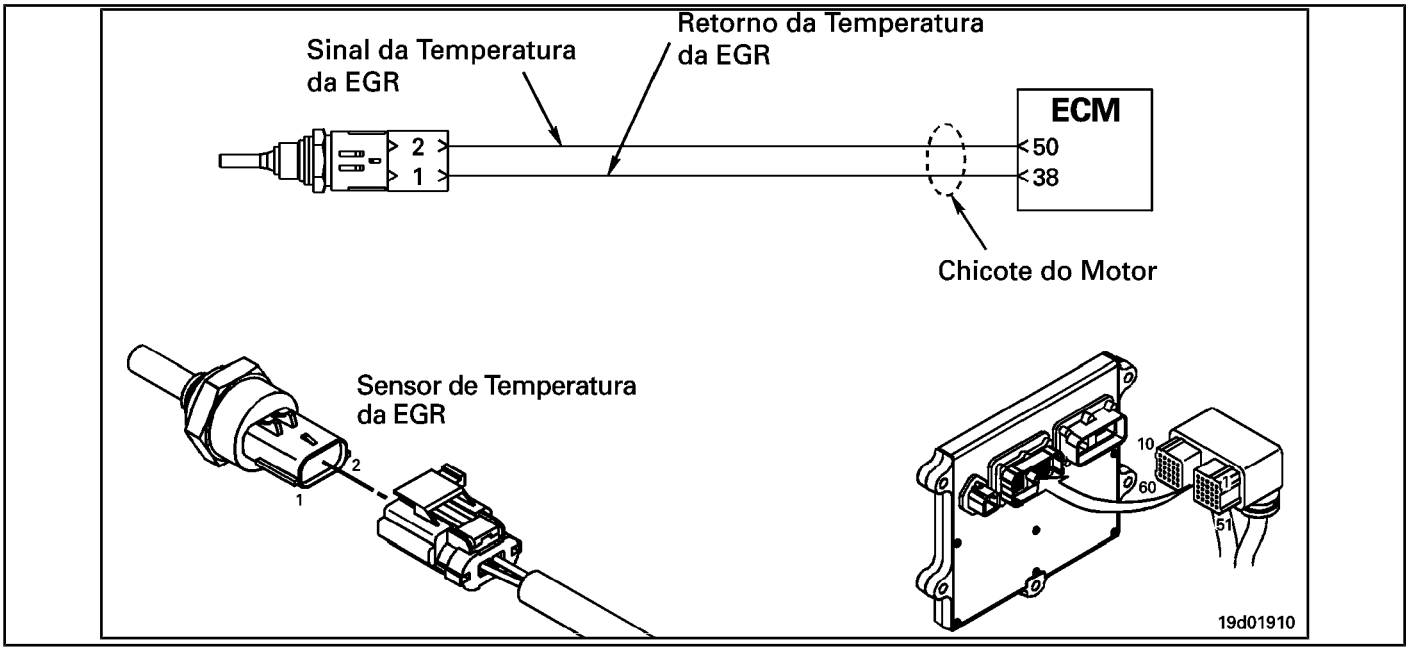
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **NOT**	Proper troubleshooting and repair steps

Fault Code 2961

EGR Temperature - Valid Data but Above Normal Operating Range - Level Less Severe

CODES	REASON	IT IS MADE
Fault Code: 2961 PID (P), SID (S): P412 IMF: 0/15 Lamp: No SRT:	Exhaust Gas Recirculation Valve (EGR) Temperature - valid data but above the normal operating range - less severe level.	De-powering the engine until the EGR temperature is below the maximum limit.

EGR Valve Temperature Sensor Circuit



Circuit Descriptions:

The EGR valve temperature sensor is used to measure the temperature of the exhaust gases leaving the EGR cooler. This temperature is monitored to protect the engine from the extremely high temperatures associated with the EGR system.

Component Location:

The temperature sensor of the EGR valve is located on the air inlet connection on the intake side of the engine. See the Procedure 100-002 for the detailed location of each component.

Workshop Tips:

This failure can be caused by:

- An EGR clogged cooler
- High coolant temperature
- Low coolant level
- EGR valve failure
- EGR valve position sensor failure
- High exhaust temperatures
- Water-coolant mix
- Stuck variable geometry turbocharger.

NOTE: This fault code is likely **not** will be activated with the engine unloaded in the workshop. The engine **must** be under load for this fault code to be triggered and to determine whether the fault has been found and repaired.

SUMMARY OF FAULT DIAGNOSTICS

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check for fault codes active.	Are there any fault codes active?	
STEP 1B: Check for fault codes inactive.	Fault Codes 151, 235, 245, 595, 2277, 2346, 2348, 2357, 2359 or 2963 inactive?	
STEP 2: Check the air intake system for leaks.		
STEP 2A: Check for leaks in the air-to-air cooler.	Is there an air leak?	
STEP 2B: Check for leaks in the air inlet and inlet manifold connections.	Is there an air leak?	
STEP 3: Check the cooling system.		
STEP 3A: Check the liquid mixture engine cooling.	Is the engine coolant mixture correct?	
STEP 3B: Check the liquid level engine cooling.	Is the coolant at the correct level or at an acceptable level?	
STEP 4: Check the EGR cooler.		
STEP 4A: Check for obstructions in the EGR valve cooler.	Was the INSITE ™ EGR valve cooler efficiency test successful?	
STEP 5: Check the turbocharger.		
STEP 5A: Perform the operational test of the turbocharger of the INSITE ™ electronic service tool.	The Tu Operational Test rbocompres sor da tool service electronics was successful?	
STEP 6: Check the EGR differential pressure sensor.		
STEP 6A: Check that the pressure sensor EGR differential works correctly.	Is the EGR differential pressure greater than 6 mm Hg [0.236 in- Hg] when the EGR valve is open?	
STEP 7: Clear the fault codes.		
STEP 7A: Disable the fault code.	Fault code 2961 inactive?	
STEP 7B: Clear the fault codes inactive.	All codes cleared?	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Check for active fault codes. Conditions:

- Connect the electronic service tool INSITE ™.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check for active fault codes. • Use the electronic service tool INSITE ™ to read fault codes.	Are there any fault codes active? **YEA**	Appropriate fault diagnosis diagram
	Are there any fault codes active? **NOT**	1B

STEP 1B: Check for inactive fault codes. Conditions:

- Connect the electronic service tool INSITE ™.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check for inactive fault codes. • Use the electronic service tool INSITE ™ to read fault codes.	Fault Codes 151, 235, 245, 595, 2277, 2346, 2348, 2357, 2359 or 2963 inactive? **YEA**	7A; Diagnose inactive fault codes starting with the fault code that contains the most counts
	Fault Codes 151, 235, 245, 595, 2277, 2346, 2348, 2357, 2359 or 2963 inactive? **NOT**	2A

STEP 2: Check the air intake system for leaks.

STEP 2A: Check the air-to-air cooler for leaks. Conditions:

- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check for leaks in the air-to-air cooler. • Start the engine and check for air leaks in the air-to-air cooler and connections.	Is there an air leak? **YES** **Repair:** Repair or replace the leaking component.	7A
	Is there an air leak? **NOT**	2B

STEP 2B: Check for leaks in the air intake and inlet manifold connections. Conditions:

- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check for air leaks in the connections and hoses between the turbocharger and the intake manifold air intake.	Is there an air leak? **YES** **Repair:** Repair or replace the leaking component.	7A
	Is there an air leak? **NOT**	3A

STEP 3: Check the cooling system.

STEP 3A: Check the engine coolant mixture. Conditions:

- Turn the ignition key off.

Action	Specifications / Repair	Next step
Incorrect mixing of the coolant will cause high temperatures in the EGR valve due to inefficient cooling. • Check the engine coolant freezing point to make sure the mixture is correct.	Is the engine coolant mixture correct? **YEA**	3B
	Is the engine coolant mixture correct? **DO NOT** **REPAIR:** Drain and fill the cooling system with the correct mixture. Refer to Procedure 008-018 in the ISB Series Engine Troubleshooting and Repair Manual and, ISB and QSB5.9, Bulletin 3653336.	7A

STEP 3B: Check the engine coolant level. Conditions:

- Turn the ignition key off.
- The engine coolant temperature must be less than 180 ° F.

Action	Specifications / Repair	Next step
Check the engine coolant level. • The low level of the engine coolant can cause an incorrect flow of liquid through the EGR cooler, which in turn will raise the EGR temperature. • Check that the engine coolant level is correct.	Is the coolant at the correct level or at an acceptable level? **YEA**	4A
	Is the coolant at the correct level or at an acceptable level? **DO NOT** **REPAIR:** Refill the cooling system and check for liquid loss, if necessary.	7A

STEP 4: Check the EGR cooler.

STEP 4A: Check the EGR valve cooler for obstructions. Conditions:

-
- Fan control switch in the OFF position.
- Air conditioning off (OFF).
- Connect the electronic service tool INSITE ™.
- Turn the ignition key ON.
- Coolant temperature above 79 ° C [174 ° F].

Action	Specifications / Repair	Next step
If the efficiency of the cooler is reduced, the cooler will not efficiently cool the exhaust gas and cause the temperature of the EGR to rise. • Start the engine and adjust the PTO speed to 2000 rpm. • Test the EGR Valve with INSITE ™ and give a command for the EGR valve to open 100 Percent. • Start INSITE ™, open the monitoring screen and check the EGR Valve Cooler Efficiency. • Perform the EGR Valve Cooler Efficiency Test with INSITE ™. • Start the engine and let it run in this condition for 4 minutes. • After 4 minutes, record the EGR Cooler Efficiency value.	Was the INSITE ™ EGR valve cooler efficiency test successful? **YEA**	5A
	Was the INSITE ™ EGR valve cooler efficiency test successful? **DO NOT** **REPAIR:** Clean or replace the EGR valve cooler. Refer to Procedure 011-019 in the ISB Series Engine Troubleshooting and Repair Manual and, ISB and QSB5.9, Bulletin 3653336.	7A

STEP 5: Check the turbocharger.

STEP 5A: Perform the Turbocharger Operational Test of the INSITE ™ electronic service tool. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.
- Start the engine and let it run at idle.

Action	Specifications / Repair	Next step
Select EGR Operational Test / Variable Geometry Turbocharger with INSITE ™ electronic service tool. • Perform the Turbocharger Operational Test.	The Turbocharger Operational Test of tool service electronics was successful? **YEA**	6A
	The Turbocharger Operational Test of tool service electronics was successful? **DO NOT** **REPAIR:** Replace the variable geometry turbocharger. Refer to Procedure 010-033 in the ISB Series Engine Troubleshooting and Repair Manual and, ISB and QSB5.9, Bulletin 3653336.	7A

STEP 6: Check the EGR differential pressure sensor.

STEP 6A: Check that the EGR differential pressure sensor works correctly. Conditions:

- Turn the ignition key ON.
- Engine running.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Start the engine and let it run until the EGR valve opens. • Using INSITE ™, monitor the position and differential pressure of the EGR valve. • When the position of the EGR valve is greater than 0 Percent, make sure the EGR differential pressure is greater than 6 mm Hg [0.236 in-Hg].	Is the EGR differential pressure greater than 6 mm Hg [0.236 in-Hg] when the EGR valve is open? **YEA**	7A
	Is the EGR differential pressure greater than 6 mm Hg [0.236 in-Hg] when the EGR valve is open? **DO NOT** **REPAIR:** Replace the EGR differential pressure sensor. See the Procedure 019-370 .	7A

STEP 7: Clear the fault codes.

STEP 7A: Disable the fault code. Conditions:

- Connect all components.
- Connect the electronic service tool INSITE ™.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Using the electronic service tool INSITE ™, make sure that the fault code is inactive.	Fault code 2961 inactive? **YEA**	7B
	Fault code 2961 inactive? **NOT**	1A

STEP 7B: Clear the inactive fault codes. Conditions:

- Connect all components.
- Turn the ignition key ON.

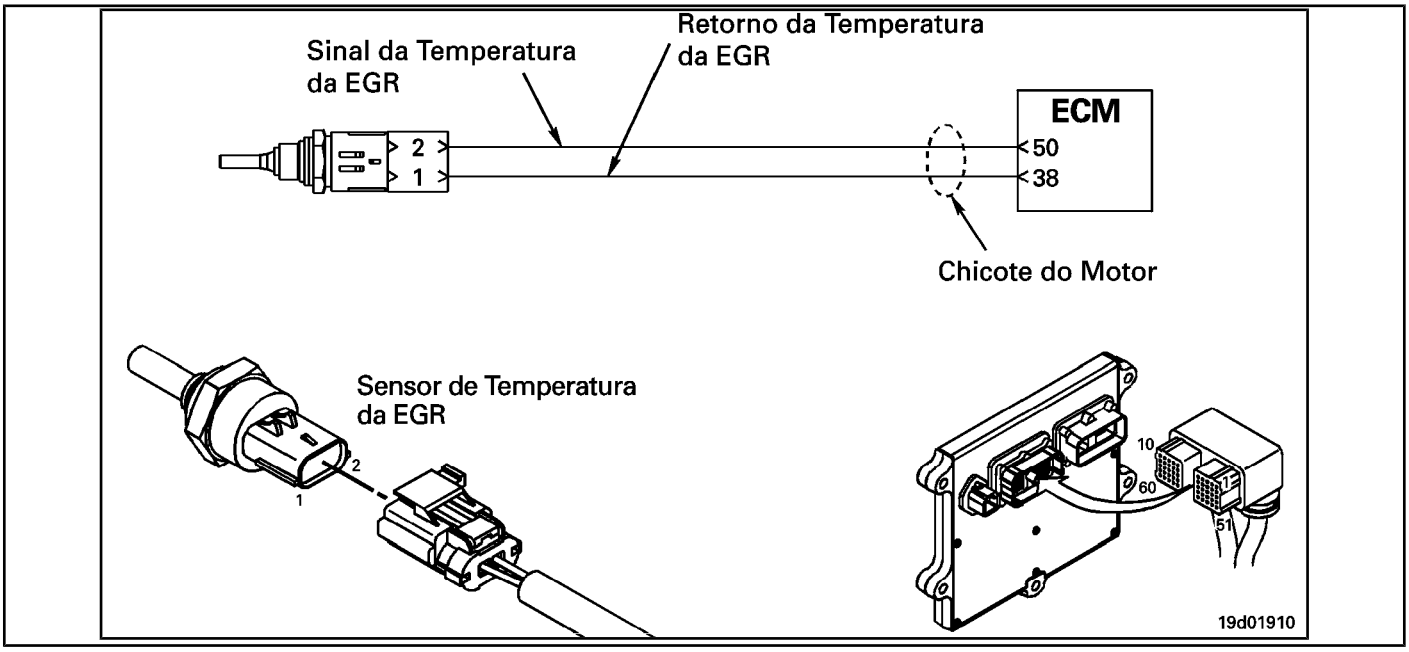
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **NOT**	Proper troubleshooting and repair steps

Fault Code 2962

EGR Temperature - Valid Data but Above Normal Operating Range - Level Moderately severe

CODES	REASON	IT IS MADE
Fault Code: 2962 PID (P), SID (S): P412 IMF: 0/16 Lamp: Amber SRT:	Exhaust Gas Recirculation Valve (EGR) Temperature - valid data but above normal operating range - level moderately severe.	Severe reduction of fuel supply to lower the EGR temperature below the maximum limit.

EGR Valve Temperature Sensor Circuit



Circuit Descriptions:

The EGR valve temperature sensor is used to measure the temperature of the exhaust gases leaving the EGR cooler. This temperature is monitored to protect the engine from the extremely high temperatures associated with the EGR system.

Component Location:

The temperature sensor of the EGR valve is located on the air inlet connection on the intake side of the engine. See the Procedure 100-002 for the detailed location of each component.

Workshop Tips:

This failure can be caused by:

- An EGR clogged cooler
- High coolant temperature
- Low coolant level
- EGR valve failure
- EGR valve position sensor failure
- High exhaust temperatures
- Water-coolant mix

- Stuck variable geometry turbocharger. NOTE: This fault code is likely **not** will be activated with the engine unloaded in the workshop. The engine **must** be under load for this fault code to be triggered and to determine whether the fault has been found and repaired.

SUMMARY OF FAULT DIAGNOSTICS

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check for fault codes active.	Are there any fault codes active?	
STEP 1B: Check for fault codes inactive.	Fault Codes 151, 235, 245, 595, 2277, 2346, 2348, 2357, 2359 or 2963 inactive?	
STEP 2: Check the air intake system for leaks.		
STEP 2A: Check for leaks in the air-to-air cooler.	Is there an air leak?	
STEP 2B: Check for leaks in the air inlet and inlet manifold connections.	Is there an air leak?	
STEP 3: Check the cooling system.		
STEP 3A: Check the liquid mixture engine cooling.	Is the engine coolant mixture correct?	
STEP 3B: Check the liquid level engine cooling.	Is the coolant at the correct level or at an acceptable level?	
STEP 4: Check the EGR cooler.		
STEP 4A: Check for obstructions in the EGR valve cooler.	Was the INSITE ™ EGR valve cooler efficiency test successful?	
STEP 5: Check the turbocharger.		
STEP 5A: Perform the operational test of the turbocharger with INSITE ™.	The Turbocharger Operational Test of tool service electronics was successful?	
STEP 6: Check the EGR differential pressure sensor.		
STEP 6A: Check that the pressure sensor EGR differential works correctly.	Is the EGR differential pressure greater than 6 mm Hg [0.236 in- Hg] when the EGR valve is open?	
STEP 7: Clear the fault codes.		
STEP 7A: Disable the fault code.	Fault code 2962 inactive?	
STEP 7B: Clear the fault codes inactive.	All codes cleared?	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Check for active fault codes. Conditions:

- Connect the electronic service tool INSITE ™.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check for active fault codes. • Use the electronic service tool INSITE ™ to read fault codes.	Are there any fault codes active? **YEA**	Appropriate fault diagnosis diagram
	Are there any fault codes active? **NOT**	1B

STEP 1B: Check for inactive fault codes. Conditions:

- Connect the electronic service tool INSITE ™.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check for inactive fault codes. • Use the electronic service tool INSITE ™ to read fault codes.	Fault Codes 151, 235, 245, 595, 2277, 2346, 2348, 2357, 2359 or 2963 inactive? **YEA**	6A
	Fault Codes 151, 235, 245, 595, 2277, 2346, 2348, 2357, 2359 or 2963 inactive? **NOT**	2A

STEP 2: Check the air intake system for leaks.

STEP 2A: Check the air-to-air cooler for leaks. Conditions:

- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check for leaks in the air-to-air cooler. • Start the engine and check for air leaks in the air-to-air cooler and connections.	Is there an air leak? **YES** **Repair:** Repair or replace the leaking component.	7A; Diagnose inactive fault codes starting with the fault code that contains the most counts
	Is there an air leak? **NOT**	2B

STEP 2B: Check for leaks in the air intake and inlet manifold connections. Conditions:

- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Check for air leaks in the connections and hoses between the turbocharger and the intake manifold air intake.	Is there an air leak? **YES** **Repair:** Repair or replace the leaking component.	7A
	Is there an air leak? **NOT**	3A

STEP 3: Check the cooling system.

STEP 3A: Check the engine coolant mixture. Conditions:

- Turn the ignition key off.

Action	Specifications / Repair	Next step
Incorrect mixing of the coolant will cause high temperatures in the EGR valve due to inefficient cooling. • Check the engine coolant freezing point to make sure the mixture is correct.	Is the engine coolant mixture correct? **YEA**	3B
	Is the engine coolant mixture correct? **DO NOT** **REPAIR:** Drain and fill the cooling system with the correct mixture. Refer to Procedure 008-018 in the ISB Series Engine Troubleshooting and Repair Manual and, ISB and QSB5.9 ((Common Rail Fuel System), Bulletin 3653336.	7A

STEP 3B: Check the engine coolant level. Conditions:

- Turn the ignition key off.
- The engine coolant temperature must be less than 180 ° F.

Action	Specifications / Repair	Next step
Check the engine coolant level. • The low level of the engine coolant can cause an incorrect flow of liquid through the EGR cooler, which in turn will raise the EGR temperature. • Check that the engine coolant level is correct.	Is the coolant at the correct level or at an acceptable level? **YEA**	4A
	Is the coolant at the correct level or at an acceptable level? **DO NOT** **REPAIR:** Refill the cooling system and check for liquid loss, if necessary.	7A

STEP 4: Check the EGR cooler.

STEP 4A: Check the EGR valve cooler for obstructions. Conditions:

-
- Fan control switch in the OFF position.
- Air conditioning off (OFF).
- Connect the electronic service tool INSITE ™.
- Turn the ignition key ON.
- Coolant temperature above 79 ° C [174 ° F].

Action	Specifications / Repair	Next step
If the efficiency of the cooler is reduced, the cooler will not efficiently cool the exhaust gas and cause the temperature of the EGR to rise. • Start the engine and adjust the PTO speed to 2000 rpm. • Test the EGR Valve with INSITE ™ and give a command for the EGR valve to open 100 Percent. • Start INSITE ™, open the monitoring screen and check the EGR Valve Cooler Efficiency. • Perform the EGR Valve Cooler Efficiency Test with INSITE ™. • Start the engine and let it run in this condition for 4 minutes. • After 4 minutes, record the EGR Cooler Efficiency value.	Was the INSITE ™ EGR valve cooler efficiency test successful? **YEA**	5A
	Was the INSITE ™ EGR valve cooler efficiency test successful? **DO NOT** **REPAIR:** Clean or replace the EGR valve cooler. Refer to Procedure 011-019 in the ISB Series Engine Troubleshooting and Repair Manual and, ISB and QSB5.9 ((Common Rail Fuel System), Bulletin 3653336.	7A

STEP 5: Check the turbocharger.

STEP 5A: Perform the turbocharger operational test of the INSITE ™ electronic service tool. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.
- Start the engine and let it run at idle.

Action	Specifications / Repair	Next step
Select EGR Operational Test / Variable Geometry Turbocharger with INSITE ™ electronic service tool. • Perform the Turbocharger Operational Test.	The Turbocharger Operational Test of tool service electronics was successful? **YEA**	6A
	The Turbocharger Operational Test of tool service electronics was successful? **DO NOT** **REPAIR:** Replace the variable geometry turbocharger. Refer to Procedure 010-033 in the ISB Series Engine Troubleshooting and Repair Manual and, ISB and QSB5.9 ((Common Rail Fuel System), Bulletin 3653336.	7A

STEP 6: Check the EGR differential pressure sensor.

STEP 6A: Check that the EGR differential pressure sensor works correctly. Conditions:

- Turn the ignition key ON.
- Engine running.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Start the engine and let it run until the EGR valve opens. • Using INSITE ™, monitor the position and differential pressure of the EGR valve. • When the position of the EGR valve is greater than 0 Percent, make sure the EGR differential pressure is greater than 6 mm Hg [0.236 in-Hg].	Is the EGR differential pressure greater than 6 mm Hg [0.236 in-Hg] when the EGR valve is open? **YEA**	7A
	Is the EGR differential pressure greater than 6 mm Hg [0.236 in-Hg] when the EGR valve is open? **DO NOT** **REPAIR:** Replace the EGR differential pressure sensor. See the Procedure 019-370 .	7A

STEP 7: Clear the fault codes.

STEP 7A: Disable the fault code. Conditions:

- Connect all components.
- Connect the electronic service tool INSITE ™.
- Turn the ignition key ON.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine and let it run at idle for 1 minute. • Using the electronic service tool INSITE ™, make sure that the fault code is inactive.	Fault code 2962 inactive? **YEA**	7B
	Fault code 2962 inactive? **NOT**	1A

STEP 7B: Clear the inactive fault codes. Conditions:

- Connect all components.
- Turn the ignition key ON.

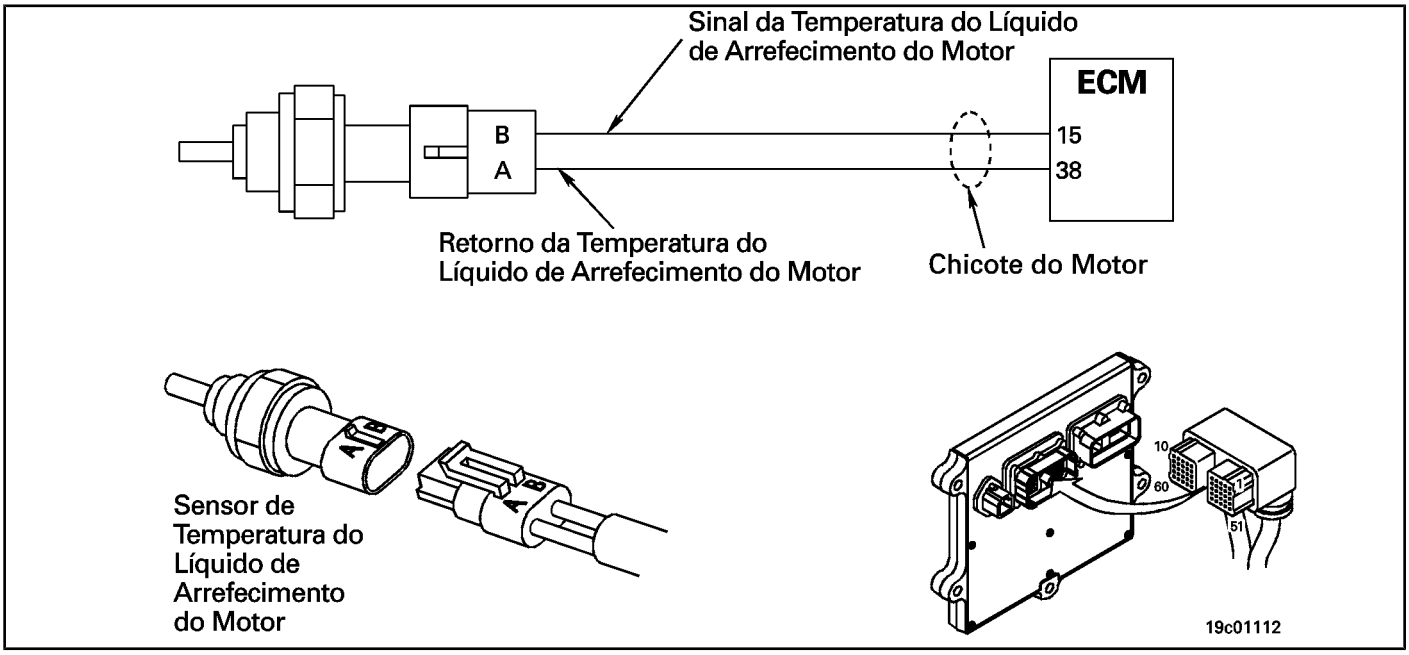
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **NOT**	Proper troubleshooting and repair steps

Fault Code 2963

High Engine Coolant Temperature - Valid Data but Above Normal Operating Range - Less Severe Level

CODES	REASON	IT IS MADE
Fault Code: 2963 PID (P), SID (S): P110 IMF: 0/15 Lamp: No SRT:	High Engine Coolant Temperature - Valid Data but Above Normal Operating Range - Less Severe Level. The engine coolant temperature signal indicates that the coolant temperature is above the engine protection warning limit by coolant temperature.	Progressive de-powering of the motor increasing in severity due to the increased alert time.

Engine Coolant Temperature Sensor Circuit



Circuit Descriptions:

The engine coolant temperature sensor is used by the ECM to monitor the coolant temperature. The ECM monitors the voltage at the signal pin and converts it to a temperature value. The engine coolant temperature value is used by the ECM for the engine's emission protection and control system.

Component Location:

The engine coolant temperature sensor is located on the exhaust side of the engine, close to the thermostat housing. See the Procedure 100-002 for the detailed location of each component.

Workshop Tips:

This fault code indicates that the coolant temperature has exceeded the engine protection limits due to high coolant temperature. Refer to the Engine Coolant Temperature above Normal fault diagnosis diagram.

SUMMARY OF FAULT DIAGNOSTICS

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check the Fault Code 2963 is registered.	**Fault Code 2963 active or inactive counts?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Check if Fault Code 2963 is registered. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

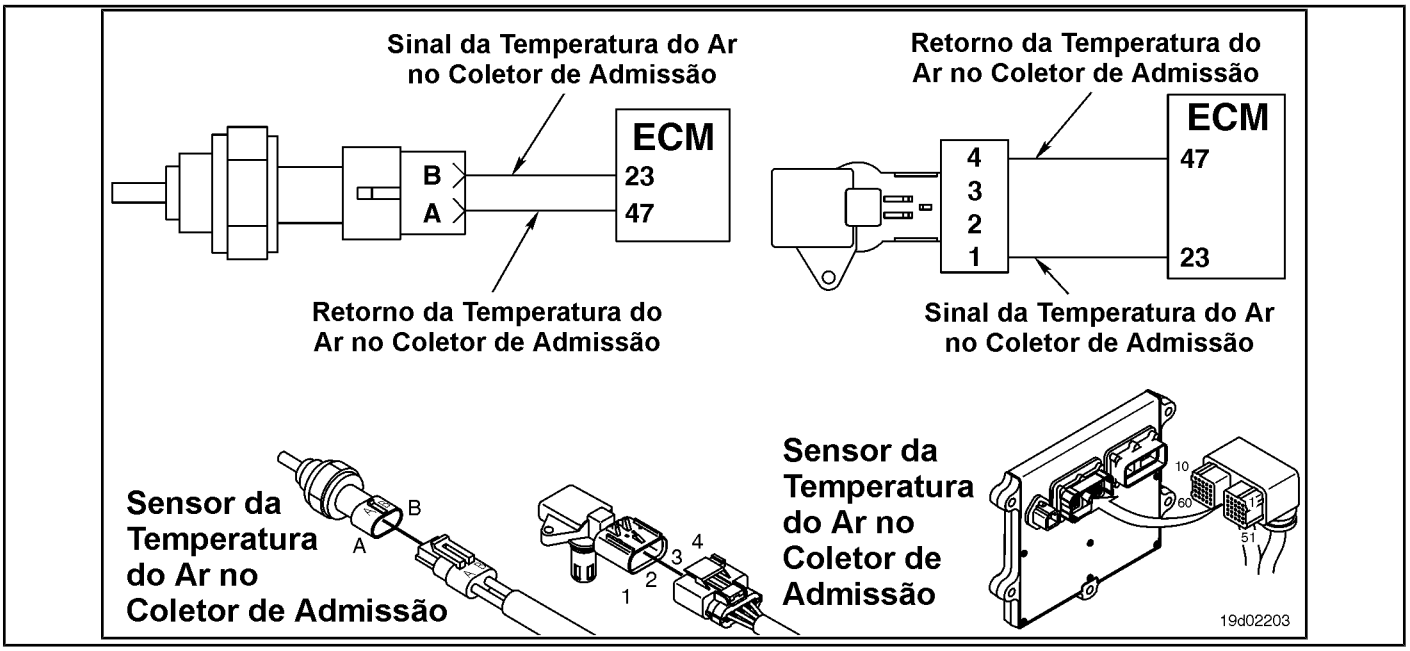
Action	Specifications / Repair	Next step
Check that Fault Code 2963 is registered. • Using INSITE ™, read the fault codes.	Fault Code 2963 active or inactive counts? **YES** **Repair:** Refer to the diagram of fault symptoms Above Engine Coolant Temperature in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266.	Appropriate fault diagnosis diagram
	Fault Code 2963 active or inactive counts? **NOT**	Complete repair

Fault Code 2964

High Intake Manifold Temperature - Valid Data but Above Normal Range Operation - Less Severe Level

CODES	REASON	IT IS MADE
Fault Code: 2964 PID (P), SID (S): P105 IMF: 0/15 Lamp: No SRT:	High Temperature in the Intake Manifold - Valid Data but Above the Normal Operating Range - Less Severe Level. The air temperature signal at the intake manifold indicates that the air temperature at the intake manifold is above the engine protection warning limit.	Automotive application: Progressive engine de-powering increasing in severity due to increased alert time. Marine application: None.

Air Temperature in the Intake Manifold



Circuit Descriptions:

The air temperature sensor in the intake manifold monitors the air temperature in the intake manifold and passes the information to the electronic control module (ECM) through the engine harness. If the air temperature in the intake manifold becomes too high, a de-powering condition will occur.

Component Location:

The air temperature sensor on the intake manifold is located on the intake manifold. See the Procedure 100-002 for the detailed location of each component.

Workshop Tips:

The air temperature sensor in the intake manifold measures the cooler air temperature as it passes through the manifold. Possible causes of this fault code:

- Air-to-air cooler fins blocked
- Airflow restriction through air-to-air cooler

- Undersized air-to-air cooler
- High outlet temperature of the turbocharger compressor.

SUMMARY OF FAULT DIAGNOSTICS

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check the Fault Code 2964 is registered.	**Fault Code 2964 active or inactive counts?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Check if Fault Code 2964 is registered. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

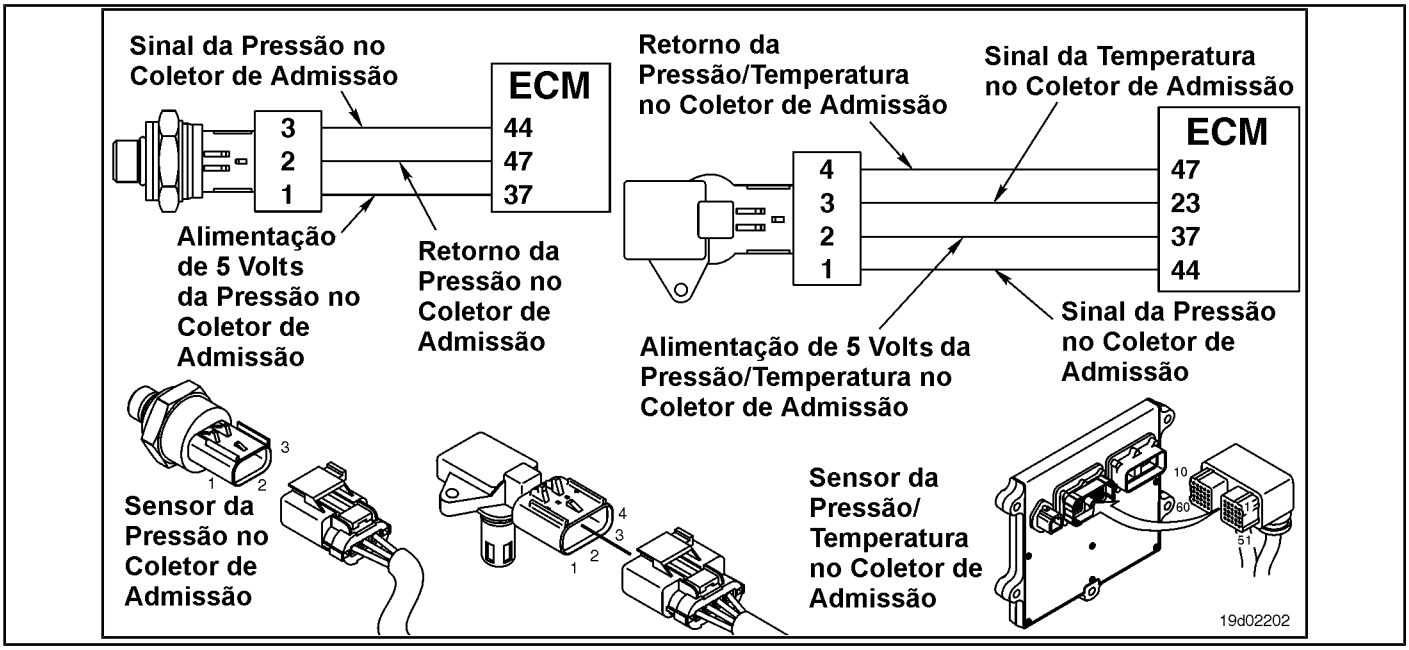
Action	Specifications / Repair	Next step
Check for active fault codes. • Use the electronic service tool INSITE ™ to read fault codes.	Fault Code 2964 active or inactive counts? **YES** **Repair:** Refer to the above-specification Intake Manifold Air Temperature fault diagnosis diagram in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266.	Appropriate fault diagnosis diagram
	Fault Code 2964 active or inactive counts? **NOT**	Complete repair

Fault Code 2973

Pressure Sensor Circuit in the Intake Manifold - Invalid, Intermittent or Incorrect

CODES	REASON	IT IS MADE
Fault Code: 2973 PID (P), SID (S): P102 IMF: 2/2 Lamp: Amber SRT:	Pressure Sensor Circuit in the Intake Manifold - Invalid, Intermittent or Incorrect Data The ECM has detected an inlet manifold pressure signal that is too high or too low for the current engine operating conditions.	Engine de-powering. Seafarers - none.

Pressure Sensor Circuit in the Intake Manifold



Circuit Descriptions:

The pressure sensor in the intake manifold monitors the pressure in the intake manifold and passes the information to the electronic control module (ECM) through the engine harness. If the intake manifold pressure becomes too low or too high, it will cause a de-powering condition.

Component Location:

The pressure sensor on the intake manifold is located on the air intake manifold. See the Procedure 100-002 to identify the location of each component.

Workshop Tips:

The pressure sensor in the intake manifold monitors the pressure in the intake manifold. This fault becomes active when the pressure in the intake manifold is too high or too low for the current engine operating conditions. The ECM compares the pressure reading on the intake manifold for the turbocharger rotation to determine if the pressure reading is valid. Possible causes of this failure:

- Inlet manifold pressure sensor failure

- Barometric pressure sensor failure
- Leaks in the air intake system between the turbocharger and the intake manifold
- Air-to-air cooler restriction
- An obstructed or restricted air filter
- Turbocharger rotation sensor failure.

SUMMARY OF FAULT DIAGNOSTICS

PRECAUTION

To reduce the possibility of damage to the pins and the harness, use the following probes when making a measurement:

Part No. 3822758 - Deutsch / AMP / Metri-Pack male test lead Part No. 3822917 - Deutsch /

AMP / Metri-Pack female test lead. STEPS

	SPECIFICATIONS	SRT CODE
STEP 1: Check the fault codes.		
STEP 1A: Check for fault codes active or inactive.	**High active or inactive Fault Code counts 122, 123, 221, 222, 595, 687 or 2345?**	
STEP 2: Check the air intake system for leaks.		
STEP 2A: Check for leaks in the air-to-air cooler.	**Is there an air leak?**	
STEP 2B: Check for leaks in the air inlet and inlet manifold connections.	**Is there an air leak?**	
STEP 2C: Check for restriction in air-to-air cooler.	**Within specifications?**	
STEP 3: Check the circuit and temperature / pressure sensor on the intake manifold the engine.		
STEP 3A: Check the pressure sensor / engine intake manifold temperature and connector pins.	**Dirty or damaged pins?**	
STEP 3B: Check the circuit response.	**Fault code 123 active?**	
STEP 3C: Check the circuit response.	**Fault code 124 active?**	
STEP 4: Check the ECM and the engine harness.		
STEP 4A: Inspect the engine harness and ECM connector pins.	**Dirty or damaged pins?**	
STEP 4B: Check the circuit response.	**Fault code 123 active?**	
STEP 4C: Check the circuit response.	**Fault code 124 active?**	
STEP 5: Check the barometric pressure sensor.		
STEP 5A: Check the accuracy of the sensor.	**Is the INSITE ™ electronic service tool reading within the 102 mm-Hg [4 in-Hg] range of the local barometric pressure?**	
STEP 6: Clear the fault codes.		
STEP 6A: Disable the fault code.	**Fault code 2973 inactive?**	
STEP 6B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Check the fault codes.

STEP 1A: Check for active or inactive fault codes. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for other fault codes. • Use the electronic service tool INSITE ™ to read fault codes.	High active or inactive Fault Code counts 122, 123, 221, 222, 595, 687 or 2345? **YEA**	Diagnostic and repair diagram of the appropriate fault code.
	High active or inactive Fault Code counts 122, 123, 221, 222, 595, 687 or 2345? **NOT**	2A

STEP 2: Check the air intake system for leaks.

STEP 2A: Check the air-to-air cooler for leaks. Conditions:

- Engine running.

Action	Specifications / Repair	Next step
Check the air-to-air cooler and connections for leaks.	Is there an air leak? **YES** **Repair:** Repair or replace the leaking component.	6A
	Is there an air leak? **NOT**	2B

STEP 2B: Check for leaks in the air intake and inlet manifold connections. Conditions:

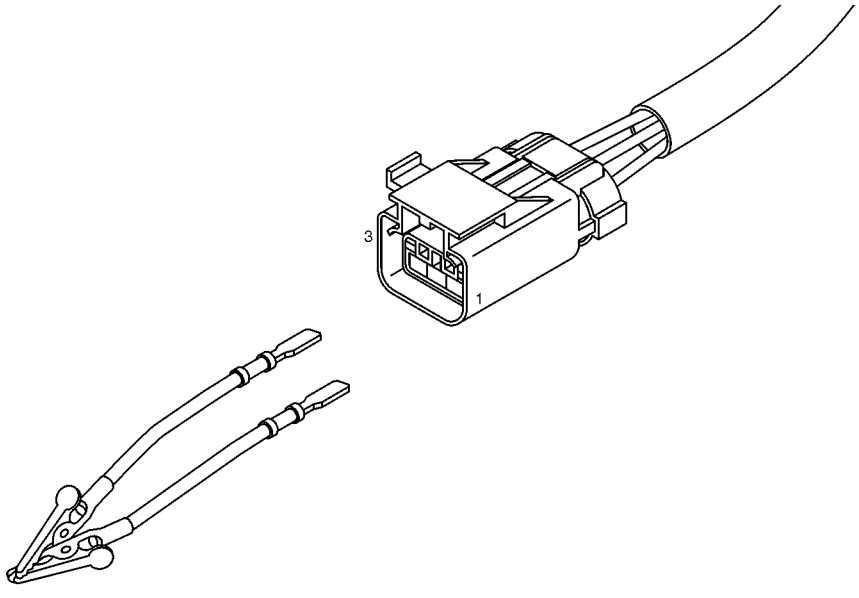
- Engine running.

Action	Specifications / Repair	Next step
Check for air leaks in the connections and hoses between the turbocharger and the intake manifold air intake. Refer to Procedure 010-024 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266.	Is there an air leak? **YES** **Repair:** Repair or replace the leaking component.	6A
	Is there an air leak? **NOT**	2C

STEP 2C: Check for restriction in the air-to-air cooler. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Engine running.

Action	Specifications / Repair	Next step
Check the pressure differential in the air-to-air cooler. • Refer to Procedure 010-027 in the ISC, QSC8.3, ISL and QSL9 Engine Troubleshooting and Repair Manual, Bulletin 3653266.	Within specifications? **YEA**	3A
	Within specifications? **DO NOT** **REPAIR:** Clean or replace the air-to-air cooler, if necessary.	6A



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STEP 3: Check the circuit and temperature / pressure sensor on the intake manifold the engine.

STEP 3A: Check the engine intake manifold pressure / temperature sensor and the engine pins connector.

Conditions:
- Turn the ignition key off.
- Disconnect the air temperature sensor on the engine intake manifold from the engine harness.

Action	Specifications / Repair	Next step
Inspect the turbocharger rotation sensor connector, the engine harness connector and the turbocharger rotation sensor pigtail connector for: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Damage to the wire shield • Moisture inside or over the connector • Damaged or missing connector seals • Broken connector cover • Dirt or debris on the connector pins. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection was detected in the sensor or in the engine harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-071 .	6A
	Dirty or damaged pins? **NOT**	3B

STEP 3B: Check the circuit response. Conditions:

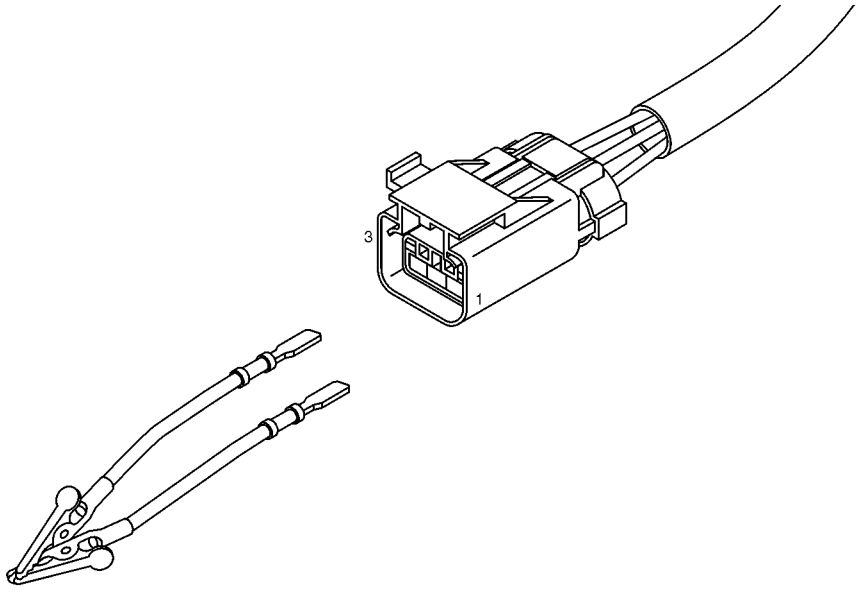
- Turn the ignition key off.
- Disconnect the air pressure sensor on the engine intake manifold from the engine harness.

Action	Specifications / Repair	Next step
Check for an appropriate ECM response after 30 seconds. Use the electronic service tool INSITE ™ to read fault codes.	Fault code 123 active? **YEA**	3C
	Fault code 123 active? **NOT**	4A

STEP 3C: Check the circuit response. Conditions:

- Turn the ignition key off.
- Disconnect the air pressure sensor on the engine intake manifold from the engine harness.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Install a jumper wire between the +5 volt POWER and SIGNAL pins on the pressure sensor on the intake manifold and the SIGNAL pin on the pressure sensor connector on the engine harness intake manifold. Refer to the circuit diagram or electrical diagram for the identification of the connector pins. Check for proper circuit response after 30 seconds. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 124 active? **YES** **Repair:** An out of range fault was detected in the pressure sensor in the intake manifold. Replace the pressure sensor on the engine intake manifold. See the Procedure 019-061 .	6A
	Fault code 124 active? **NOT**	4A



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STEP 4: Check the ECM and the engine harness.

STEP 4A: Inspect the engine harness and ECM connector pins.

Conditions:
- Turn the ignition key off.
- Disconnect the engine harness from the ECM connector.

Action	Specifications / Repair	Next step
Check that the pins on the engine harness and ECM connectors have: • Corroded pins • Bent or broken pins • Pins twisted back or expanded • Damage to the wire shield • Moisture inside or over the connector. • Damaged or missing connector seals • Broken connector cover • Dirt or debris on the connector pins. For general inspection techniques, see Component Pin and Connector Inspection, Procedure 019-361 .	Dirty or damaged pins? **YES** **Repair:** A faulty connection has been detected in the ECM connector or the motor harness connector. Clean the connector and pins. If damaged, repair the harness, connector or pins, if possible. See the Procedure 019-043 .	6A
	Dirty or damaged pins? **NOT**	4B

STEP 4B: Check the circuit response. Conditions:

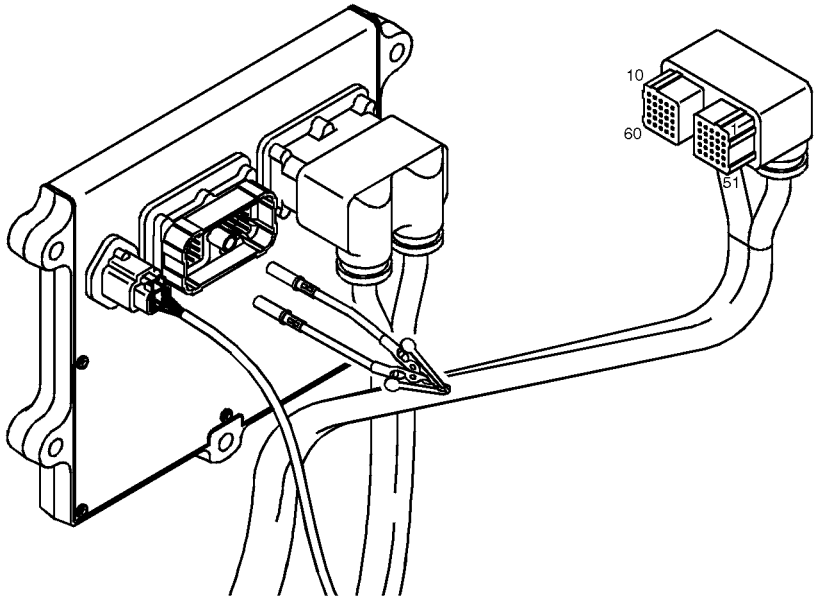
- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Check for an appropriate ECM response after 30 seconds. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 123 active? **YEA**	4C
	Fault code 123 active? **DO NOT** **REPAIR:** Call for pre-authorization. Replace the ECM. See the Procedure 019-031 .	6A

STEP 4C: Check the circuit response. Conditions:

- Turn the ignition key off.
- Disconnect the engine harness from the ECM.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Install a bridge wire between the +5 volt POWER pin and the pressure sensor SIGN pin on the engine intake manifold on the engine harness ECM connector. Check for an appropriate ECM response after 30 seconds. • Use the electronic service tool INSITE ™ to read fault codes.	Fault code 124 active? **YES** **Repair:** High resistance or a short circuit was detected in the engine harness. Repair or replace the engine harness. See the Procedure 019-043 .	6A
	Fault code 124 active? **DO NOT** **REPAIR:** Call for pre-authorization. Replace the ECM. See the Procedure 019-031 .	6A



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STEP 5: Check the barometric pressure sensor.

STEP 5A: Check the accuracy of the sensor. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Start the INSITE ™ Data Logger / Monitor and compare the INSITE ™ barometric pressure reading with the local barometric pressure using the table below. Altitude (m) Altitude [feet] Pressure [in Hg] 0 (sea level) 0 29.9 915 3000 26.9 1830 6000 24.0 2744 9000 21.4 3659 12,000 19.0	Is the reading of the electronic service tool INSITE ™ within the range of 102 mm-Hg [4 in-Hg] of the local barometric pressure? **YEA**	6A
	Is the reading of the electronic service tool INSITE ™ within the range of 102 mm-Hg [4 in-Hg] of the local barometric pressure? **DO NOT** **REPAIR:** Replace the barometric pressure sensor. See the Procedure 019-004 .	6A

STEP 6: Clear the fault codes.

STEP 6A: Disable the fault code. Conditions:

- Connect all components.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Disable the fault code. • Start the engine. • Increase the engine speed to 1500 rpm and hold it for 30 seconds. • Using the electronic service tool INSITE ™, make sure that the fault code is inactive.	Fault code 2973 inactive? **YEA**	6B
	Fault code 2973 inactive? **DO NOT** **REPAIR:** Return to the troubleshooting steps.	1A

STEP 6B: Clear the inactive fault codes. Conditions:

- Connect all components.
- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

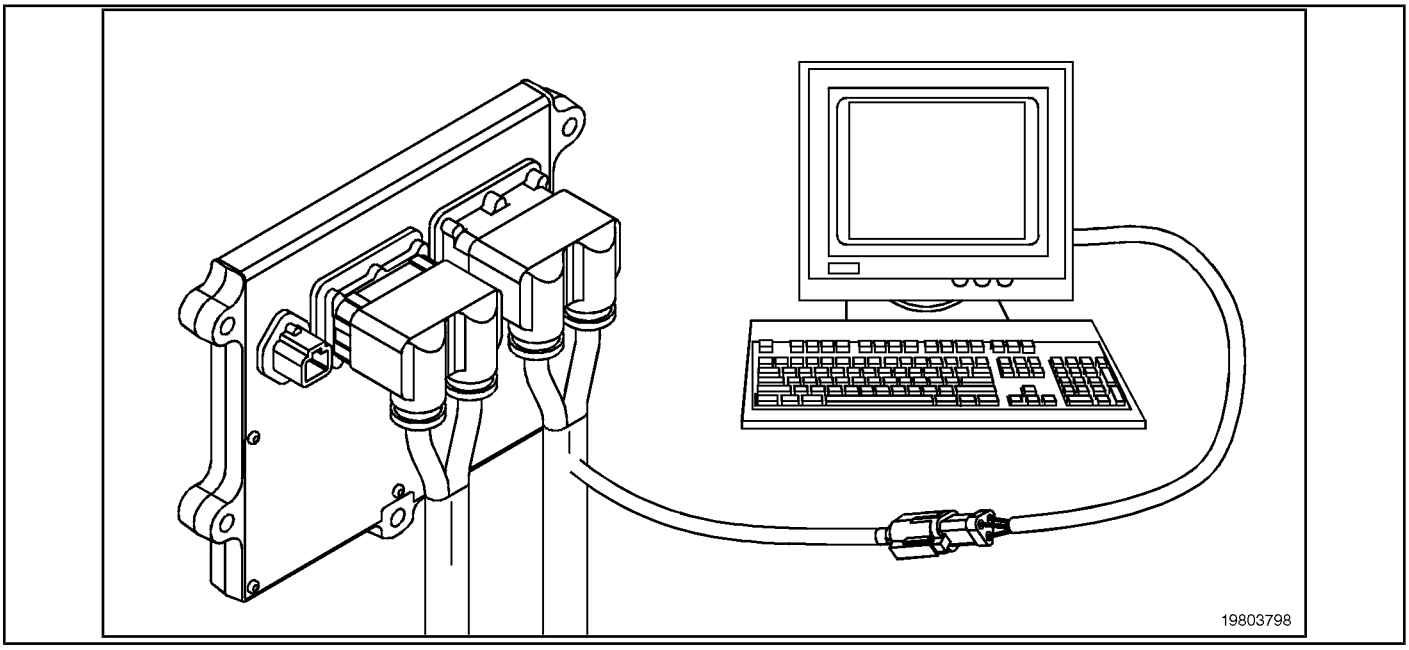
Action	Specifications / Repair	Next step
Clear the inactive fault codes. • Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **NOT**	Proper troubleshooting and repair steps

Fault Code 9121

Excess Temperature (Calculated) of EGR Valve Actuator - Above Range Data Normal

CODES	REASON	IT IS MADE
Fault Code: 9121 PID (P), SID (S): S146 IMF: 0/15 Lamp: No SRT:	Excess Temperature (Calculated) of the Exhaust Gas Recirculation Valve (EGR) Actuator - Data Above the Normal Range - Less Severe Level.	The EGR valve will be closed.

electronic service tool INSITE ™



Circuit Descriptions:

The electronic control module (ECM) controls the exhaust gas recirculation valve (EGR), opening and closing it based on the various operating conditions of the engine. The EGR valve is opened and closed by a VCC motor that receives voltage from the ECM in the (+) and (-) signal circuits of the EGR valve motor. To open the valve, the motor receives voltage in the (+) signal circuit of the EGR valve motor. To close the valve, the motor receives voltage in the signal circuit (-) of the EGR valve motor.

Component Location:

The EGR valve engine is located on the exhaust side of the engine and is coupled to the EGR valve assembly, which is mounted on the exhaust manifold. See the Procedure 100-002 for a detailed view of each component.

Workshop Tips:

The ECM calculates the engine temperature of the EGR valve. If the ECM detects excessive temperatures during a calibrated period, this failure will be recorded and the valve will be closed. This action aims to only the protection of the valve; this fault code not indicates the failure of any component. When the ECM detects normal EGR valve temperatures, the fault code becomes inactive and operation of the EGR valve is resumed.

NOTE: During this event, there will be no noticeable symptoms. This fault diagnosis diagram **not** should be considered if there is a performance claim.

A combination of frequent valve movements and high coolant temperatures can result in this fault code.

SUMMARY OF FAULT DIAGNOSTICS

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Read the fault codes.		
STEP 1A: Check for fault codes.	**Fault codes active or inactive?**	
STEP 2: Clear the fault codes.		
STEP 2A: Disable the fault codes.	**Fault code 9121 inactive?**	
STEP 2B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Read the fault codes.

STEP 1A: Check for fault codes. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Use the electronic service tool INSITE ™ to read fault codes.	Fault codes active or inactive? **YEA**	Diagnose other active fault codes.
	Fault codes active or inactive? **NOT**	2A

STEP 2: Clear the fault codes.

STEP 2A: Disable the fault codes. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Start the engine and let it run at idle for 1 minute. Using the electronic service tool INSITE ™, make sure that the fault code is inactive.	Fault code 9121 inactive? **YEA**	2B
	Fault code 9121 inactive? **NOT**	1A

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

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

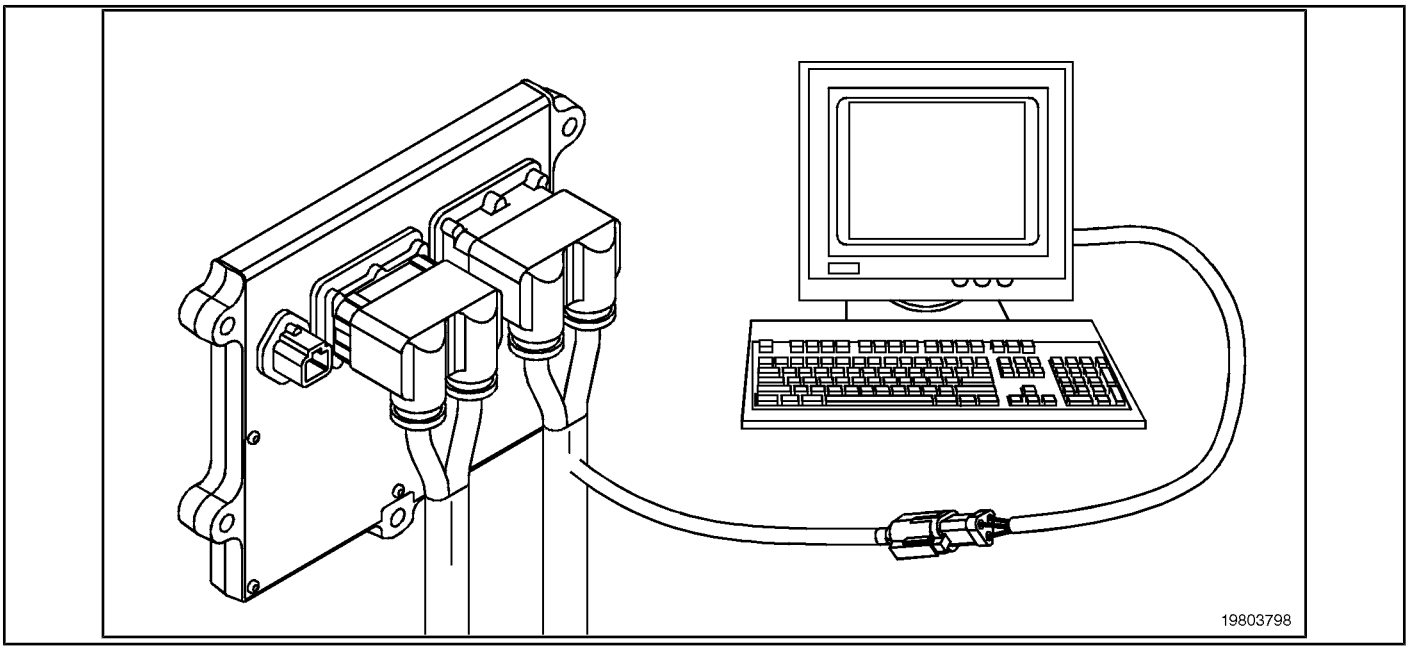
Action	Specifications / Repair	Next step
Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **NOT**	Proper troubleshooting and repair steps

Fault Code 9122

Excessive Temperature of Variable Geometry Turbocharger Actuator

CODES	REASON	IT IS MADE
Fault Code: 9122 PID (P), SID (S): S27 IMF: 0/15 Lamp: No SRT:	Excess Temperature (Calculated) of Variable Geometry Turbocharger Actuator - Data Above Normal Range - Less Severe Level.	Possible loss of power. The power to the turbocharger actuator will be limited.

electronic service tool INSITE ™



Circuit Descriptions:

The electronic control module (ECM) controls the engine of the turbocharger actuator, which changes the airflow of the turbocharger based on various engine operating conditions. The sliding spray nozzle of the turbocharger is driven by the engine of the turbocharger actuator. The turbocharger actuator motor is a DC motor that receives voltage from the ECM in the positive (+) and negative (-) signal circuits of the turbocharger actuator motor. To open the sliding spray nozzle, the motor receives voltage in the (+) signal circuit of the turbocharger actuator motor. To close the sliding spray nozzle, the motor receives voltage in the (-) signal circuit of the turbocharger actuator motor.

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 on the turbocharger bearing housing. See the Procedure
100-002 for the detailed location of each component.

Workshop Tips:

The electronic control module (ECM) calculates the engine temperature of the turbocharger actuator. If the ECM detects excessive temperatures during a calibrated period, this failure will be logged and power to the turbocharger actuator motor will be limited. This action aims to **only** the engine protection of the turbocharger actuator; this fault code **not** indicates the failure of any component. When the ECM detects normal engine temperatures from the turbocharger actuator, the fault code becomes inactive and the turbocharger operation returns to normal.

A combination of frequent movements of the turbocharger actuator and elevated coolant temperatures can result in this fault code.

SUMMARY OF FAULT DIAGNOSTICS

STEPS	SPECIFICATIONS	SRT CODE
STEP 1: Read the fault codes.		
STEP 1A: Check for fault codes.	**Other active or inactive fault codes?**	
STEP 2: Clear the fault codes.		
STEP 2A: Disable the fault codes.	**Fault code 9122 inactive?**	
STEP 2B: Clear the fault codes inactive.	**All codes cleared?**	

FAULT DIAGNOSTIC STEP

STEP 1: Read the fault codes.

STEP 1A: Check for fault codes. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Use the electronic service tool INSITE ™ to read fault codes.	Other active or inactive fault codes? **YEA**	Diagnose other fault codes
	Other active or inactive fault codes? **NOT**	2A

STEP 2: Clear the fault codes.

STEP 2A: Disable the fault codes. Conditions:

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Start the engine and let it run at idle for 1 minute. • Using the electronic service tool INSITE ™, make sure that the fault code is inactive.	Fault code 9122 inactive? **YEA**	2B
	Fault code 9122 inactive? **NOT**	1A

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

- Turn the ignition key ON.
- Connect the electronic service tool INSITE ™.

Action	Specifications / Repair	Next step
Use the electronic service tool INSITE ™ to clear inactive fault codes.	All codes cleared? **YEA**	Complete repair
	All codes cleared? **NOT**	Proper troubleshooting and repair steps

Notes

Fault Codes

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