6SE568 2007

Troubleshooting Guide

MBE 4000 DDEC® VI

DETROIT DIESEL

Detroit Diesel
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NOTE:
Additional copies of this troubleshooting manual may be purchased from Detroit Diesel Distributors. See your yellow pages - under Engines, Diesel.

CALIFORNIA
Proposition 65 Warning

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

ENGINE EXHAUST

Consider the following before servicing engines:

WARNING:

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

- **Always start and operate an engine in a well ventilated area.**
- **If operating an engine in an enclosed area, vent the exhaust to the outside.**
- **Do not modify or tamper with the exhaust system or emission control system.**

TRADEMARK INFORMATION

MCM/CPC WARNING

WARNING

Unintended engine startup, acceleration, or shutdown could cause personal injury or death.

This MCM and CPC are programmed for specific options. Replacing either with one that has not been programmed with these exact options could have unintended results.

Only replace with an MCM or CPC that has the identical inputs and outputs programmed.

45696

Figure 1 MCM/CPC Replacement Warning

SOFTWARE UPGRADES

NOTE:
These engines are equipped with DaimlerChrysler software. This software generally assures optimal engine performance. The installation of software upgrades may cause minor changes in features and engine performance.

ABSTRACT

This manual provides instruction for troubleshooting the 2007 Electronic Controls engines.

Specifically covered in this manual are troubleshooting and repair steps that apply to DDEC VI.

SAFETY INSTRUCTIONS

To reduce the chance of personal injury and/or property damage, the instructions contained in this Troubleshooting Manual must be carefully observed. Proper service and repair are important to the safety of the service technician and the safe, reliable operation of the engine.

If part replacement is necessary, the part must be replaced with one of the same part number or with an equivalent part number. Do not use a replacement part of lesser quality. The service procedures recommended and described in this manual are effective methods of performing repair. Some of these procedures require the use of specially designed tools. Accordingly, anyone who intends to use a replacement part, procedure or tool which is not recommended, must first determine that neither personal safety nor the safe operation of the engine will be jeopardized by the replacement part, procedure or tool selected.

It is important to note that this manual contains various "Cautions" and "Notices" that must be carefully observed in order to reduce the risk of personal injury during repair, or the possibility that improper repair may damage the engine or render it unsafe. It is also important to understand that these "Cautions" and "Notices" are not exhaustive, because it is impossible to warn personnel of the possible hazardous consequences that might result from failure to follow these instructions.

A LETTER TO THE TECHNICIANS

Technicians today are required to have computer skills, excellent comprehension of the written word and possess an extensive diagnostic understanding of the various technological systems and components. Technicians today must perform at a higher level of efficiency and competency than their predecessors and at the same time furnish professional quality support.

As the leader in engine computer systems and technology, Detroit Diesel Corporation remains focused on providing excellence in products, service support and training. As products become more and more advanced, technicians must become specialized in multiple areas. This manual is designed with that thought in mind. The DDEC VI MBE 4000 Troubleshooting Guide will provide you with concentrated information that will allow you to excel in DDEC VI technology.

REVISION NOTIFICATION

Modifications to this manual are announced in the form of Service Information Bulletins.

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1 INTRODUCTION

Section		Page

1.1 OVERVIEW

Detroit Diesel Corporation is the world leader in diesel engines and diesel engine electronics. DDC has made technological leaps in engine performance and fuel economy. Today, we build the most dependable electronically controlled diesel engine in the industry.

2007 Electronic Controls provides two industry standard serial data links: SAE Standards J1587 and J1939. SAE Standard J1587 provides two way communications for the diagnostic equipment and vehicle displays. SAE Standard J1939 provides control data to other vehicle systems such as transmissions and traction control devices.

As the leader in engine computer systems and technology, Detroit Diesel Corporation remains focused on providing excellence in products, service support and training. As products become more and more advanced, today's technicians must become specialized in multiple areas. This manual is designed with that thought in mind.

Our goal at Detroit Diesel is to be the most customer focused and most responsive engine manufacturer in the world.

1.2 SCOPE AND USE OF THIS GUIDE

The first half of the manual contain mechanical troubleshooting procedures. The second half contains instructions for troubleshooting the electronic controls.

This manual is divided into numbered chapters. Each chapter begins with a table of contents. Pages and illustrations are numbered consecutively within each chapter.

Information can be located by using the table of contents at the front of the manual or the table of contents at the beginning of each chapter.

Instructions to "Contact Detroit Diesel Customer Service Center" indicate that at the time of this publication, all known troubleshooting checks have been included. Review any recent Service Information Bulletins (SIB) or Service Information letters before calling.

It is also suggested that other DDC outlets be contacted. e.g. if you are a dealer or user, contact your closest DDC Distributor.

Ensure you have the engine serial number when you call. The phone number for Detroit Diesel Customer Service Center is 313-592-5800.

Instructions in this manual may suggest replacing a non DDC component. It may be required to contact the supplier of the component, e.g. truck manufacturer for a TPS concern, to obtain approval to replace the component.

Important: To ensure you receive updates to this manual should the need arise, you must fill out the Information Card in the front of this manual. Service Information Bulletins are issued via the DDC extranet. Visit DDCDIRECT at www.accessfreightliner.com.

NOTE:
It is absolutely **critical** that you understand the EGR system to be qualified to offer any type of proper diagnostics. Do not **waste time** trying to troubleshoot a DDC product, you are not qualified to troubleshoot. Your company may incur wasted labor hours. If you are qualified to perform a troubleshooting task and have spent more than one hour on that task, **STOP**, and contact the Detroit Diesel Customer Support Center at (313) 592–5800. Once you have discussed your options with a customer support center person, you can perform the required tests and evaluations. Please keep in contact with your customer support person. Doing so allows you to stay on track.

1.2.1 Mechanical Troubleshooting

Each chapter has a fault as the title (i.e. Excessive White Smoke). The next level within the chapter is the probable cause/symptom of the fault. Following this are the resolution and verification of the resolution. The mechanical troubleshooting should be used before the electronic troubleshooting.

1.2.2 Electronic Troubleshooting

The 2007 Electronic Controls system allows for an increased processor speed and increased memory.

Instructions for repair in this manual are generic. For example, "Repair Open" is used to advise the technician that a particular wire has been determined to be broken. In some cases it may not be best to try and locate the open. It may be that the best repair technique is to replace a complete harness. The technician should make the determination of the proper repair, with the best interest of the customer in mind.

Instructions to check terminals and connectors should include checking for proper contact tension. Using a mating terminal, a modest force should be required to remove a terminal from its mate. Replace terminals with poor tension.

After completing any repair, always clear fault codes that may have been generated during the troubleshooting process.

NOTE:
Be aware that troubleshooting in this manual is mostly concerned with DDEC related codes. Codes associated with other components, e.g. transmissions, ECUs, ABS, etc. can be found in the related publication.

1.3 SAFETY PRECAUTIONS

The following safety precautions must be observed when working on a Detroit Diesel engine:

WARNING:

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

- **Always start and operate an engine in a well ventilated area.**
- **If operating an engine in an enclosed area, vent the exhaust to the outside.**
- **Do not modify or tamper with the exhaust system or emission control system.**

WARNING:

PERSONAL INJURY

To avoid injury from accidental engine startup while servicing the engine, disconnect/disable the starting system.

All engine installations, especially those within enclosed spaces, should be equipped with an exhaust discharge pipe so that exhaust gases are delivered into the outside air.

WARNING:

PERSONAL INJURY

To avoid injury from the sudden release of a high-pressure hose connection, wear a face shield or goggles. Bleed the air from the air starter system before disconnecting the air supply hose.

1.3.1 Exhaust (Start/Run Engine)

Before starting and running an engine, adhere to the following safety precautions:

WARNING:

PERSONAL INJURY

To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

WARNING:

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

- **Always start and operate an engine in a well ventilated area.**
- **If operating an engine in an enclosed area, vent the exhaust to the outside.**
- **Do not modify or tamper with the exhaust system or emission control system.**

1.3.2 Glasses

Select appropriate safety glasses for the job. It is especially important to wear safety glasses when using tools such as hammers, chisels, pullers or punches.

WARNING:

EYE INJURY

To avoid injury from flying debris when using compressed air, wear adequate eye protection (face shield or safety goggles) and do not exceed 276 kPa (40 psi) air pressure.

1.3.3 Welding

Wear welding goggles and gloves when welding or using an acetylene torch. Ensure that a metal shield separates the acetylene and oxygen tanks. These must be securely chained to a cart.

WARNING:

PERSONAL INJURY

To avoid injury from arc welding, gas welding, or cutting, wear required safety equipment such as an arc welder's face plate or gas welder's goggles, welding gloves, protective apron, long sleeve shirt, head protection, and safety shoes. Always perform welding or cutting operations in a well ventilated area. The gas in oxygen/acetylene cylinders used in gas welding and cutting is under high pressure. If a cylinder should fall due to careless handling, the gage end could strike an obstruction and fracture, resulting in a gas leak leading to fire or an explosion. If a cylinder should fall resulting in the gage end breaking off, the sudden release of cylinder pressure will turn the cylinder into a dangerous projectile. Observe the following precautions when using oxygen/acetylene gas cylinders:

- **Always wear required safety shoes.**
- **Do not handle tanks in a careless manner or with greasy gloves or slippery hands.**
- **Use a chain, bracket, or other restraining device at all times to prevent gas cylinders from falling.**
- **Do not place gas cylinders on their sides, but stand them upright when in use.**
- **Do not drop, drag, roll, or strike a cylinder forcefully.**
- **Always close valves completely when finished welding or cutting.**

WARNING:

FIRE

To avoid injury from fire, check for fuel or oil leaks before welding or carrying an open flame near the engine.

1.3.4 Pressurized Fluids

Be extremely careful when dealing with fluids under pressure. Fluids under pressure can have enough force to penetrate the skin. These fluids can infect a minor cut or opening in the skin. If injured by escaping fluid, see a doctor at once. Serious infection or reaction can result without immediate medical treatment.

WARNING:

PERSONAL INJURY

To avoid injury from the sudden release of a high-pressure hose connection, wear a face shield or goggles.

WARNING:

PERSONAL INJURY

To avoid injury from penetrating fluids, do not put your hands in front of fluid under pressure. Fluids under pressure can penetrate skin and clothing.

1.3.5 Fuel

Keep the hose and nozzle or the funnel and container in contact with the metal of the fuel tank when refueling.

WARNING:

FIRE

To avoid injury from fire, keep all potential ignition sources away from diesel fuel, including open flames, sparks, and electrical resistance heating elements. Do not smoke when refueling.

The following cautions should be followed when filling a fuel tank:

WARNING:

FIRE

To avoid injury from fire caused by heated diesel-fuel vapors:

- **Keep those people who are not directly involved in servicing away from the engine.**
- **Stop the engine immediately if a fuel leak is detected.**
- **Do not smoke or allow open flames when working on an operating engine.**
- **Wear adequate protective clothing (face shield, insulated gloves and apron, etc.).**
- **To prevent a buildup of potentially volatile vapors, keep the engine area well ventilated during operation.**

WARNING:

FIRE

To avoid injury from fire, contain and eliminate leaks of flammable fluids as they occur. Failure to eliminate leaks could result in fire.

1.3.6 Batteries

Electrical storage batteries emit highly flammable hydrogen gas when charging and continue to do so for some time after receiving a steady charge.

WARNING:

Battery Explosion and Acid Burn

To avoid injury from battery explosion or contact with battery acid, work in a well ventilated area, wear protective clothing, and avoid sparks or flames near the battery. If you come in contact with battery acid:

- **Flush your skin with water.**
- **Apply baking soda or lime to help neutralize the acid.**
- **Flush your eyes with water.**
- **Get medical attention immediately.**

Always disconnect the battery cable before working on the electrical system.

WARNING:

PERSONAL INJURY

To avoid injury from accidental engine startup while servicing the engine, disconnect/disable the starting system.

1.3.7 Fire

Keep a charged fire extinguisher within reach. Ensure you have the proper type of extinguisher on hand.

WARNING:

FIRE

To avoid injury from fire, keep a fire extinguisher near the grinding machine in case excessive heat should ignite the oil.

1.3.8 Cleaning Agent

Avoid the use of carbon tetrachloride as a cleaning agent because of the harmful vapors that it releases. Ensure the work area is adequately ventilated. Use protective gloves, goggles or face shield, and apron.

WARNING:

PERSONAL INJURY

To avoid injury from harmful vapors or skin contact, do not use carbon tetrachloride as a cleaning agent.

1.3.9 Diagnostic Equipment

For mobile applications, Detroit Diesel Diagnostic Link (DDDL) must be used by personnel other than the vehicle operator. The vehicle operator must maintain control of the vehicle while an assistant performs the diagnostic evaluations.

WARNING:

PERSONAL INJURY

To avoid injury from loss of vehicle/vessel control, the operator of a DDEC equipped engine must not use or read any diagnostic tool while the vehicle/vessel is moving.

1.3.10 Working on a Running Engine

When working on an engine that is running, accidental contact with the hot exhaust manifold can cause severe burns. Remain alert to the location of the rotating fan, pulleys and belts. Avoid making contact across the two terminals of a battery which can result in severe arcing, or battery explosion.

WARNING:
PERSONAL INJURY
To avoid injury from rotating belts and fans, do not remove and discard safety guards.

WARNING:
PERSONAL INJURY
To avoid injury when working near or on an operating engine, remove loose items of clothing and jewelry. Tie back or contain long hair that could be caught in any moving part causing injury.

1.3.11 Optimized Idle

Optimized Idle must be turned on by the factory via order entry or mainframe setup.

CAUTION:

UNEXPECTED ENGINE START

To avoid injury from an unexpected startup of an engine equipped with the Optimized Idle system, remove the starter relay from the relay holder.

WARNING:

PERSONAL INJURY

To avoid injury from accidental engine startup, replace a defective ECM with an ECM programmed with identical inputs and outputs.

1.3.12 Fluoroelastomer

Fluoroelastomer (Viton®) parts such as O-rings and seals are perfectly safe to handle under normal design conditions.

WARNING:

CHEMICAL BURNS

To avoid injury from chemical burns, wear a face shield and neoprene or PVC gloves when handling fluoroelastomer O-rings or seals that have been degraded by excessive heat. Discard gloves after handling degraded fluoroelastomer parts.

A potential hazard may occur if these components are raised to a temperature above 600°F (316°C) (in a fire for example). Fluoroelastomer will decompose (indicated by charring or the appearance of a black, sticky mass) and produce hydrofluoric acid. This acid is extremely corrosive and, if touched by bare skin, may cause severe burns (the symptoms could be delayed for several hours).

2 FUEL INJECTION

Section **Page**

2.1 PERFORMING TROUBLESHOOTING TESTS

To perform fuel troubleshooting tests on the engine:

1. Run the engine for two to three minutes at rated speed, 1800–2100 rpm.

NOTICE:
Correct torque on the high pressure lines is critical. Incorrect torques could result in leaks or lack of power due to restricted fuel flow.

2. Perform a visual inspection of all fuel lines, pressure fittings, and components, including all the fittings that connect the fuel feed and drain hoses to the fuel filter housing. Replace any components found to be damaged or leaking. If necessary, tighten all high-pressure fittings to 25 N·m (18 lb·ft) and all banjo bolts to 40-50 N·m (30-37 lb·ft).
3. Inspect the filter element in the fuel pre-filter. Replace if necessary.
4. Inspect the filter element in the main fuel filter. Replace if necessary.
5. Continue to run the engine until it reaches the operating temperature of approximately 82°C (180°F). When the operating temperature has been reached, shut the engine down and go to the next step.

NOTE:
When doing these tests, be sure the temperature of the fuel in the fuel tank is no higher than 40°C (104°F). Collect any fuel which flows out during the test. The fuel should flow through free of bubbles.

6. Perform the fuel system troubleshooting tests and correct any problems. As indicated by the test results, perform any follow-up tests or check troubleshooting tables, as required. Make the necessary repairs and/or replacements. For troubleshooting tests and tables see the following subjects:
   [a] Test #1: Fuel Pressure Test. Refer to section 2.2.
   [b] Test #2: Percentage of Fuel Delivery for a Smooth Idle, refer to section 2.3.
   [c] Test #3: Impact Delay Time, refer to section .
   [d] Test #4: Fuel Pump Driven Gear Bolt Torque, refer to section 2.4.
   [e] Test #5: Leak Test,. refer to section 2.5.
7. When all the tests are completed, the test equipment removed, and all repairs/replacements have been made, prime the fuel system.
   [a] If equipped with a hand pump on the fuel/water separator, work the hand pump until resistance is felt.

WARNING:

PERSONAL INJURY

To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

[b] Crank the engine for 30 seconds at a time, but no longer. Before cranking the engine again, wait at least two minutes. The engine should start within four 30-second attempts. The fuel system is bled automatically.

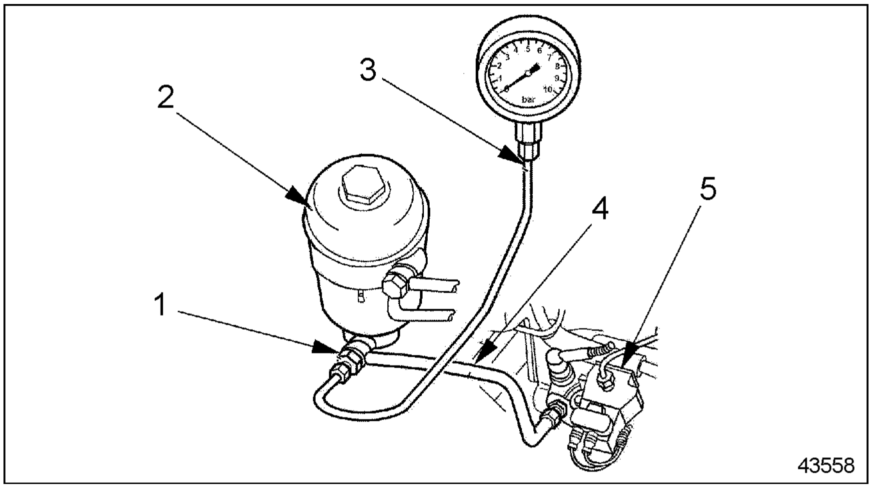
8. If the problem has still not been resolved, test vehicle performance on a chassis dynamometer. If there is no improvement in fuel consumption or performance, connect a fuel consumption measuring system.

2.2 TEST #1: FUEL PRESSURE TEST

The following test set-up and test will determine the fuel pressure.

2.2.1 Test #1 Set-Up

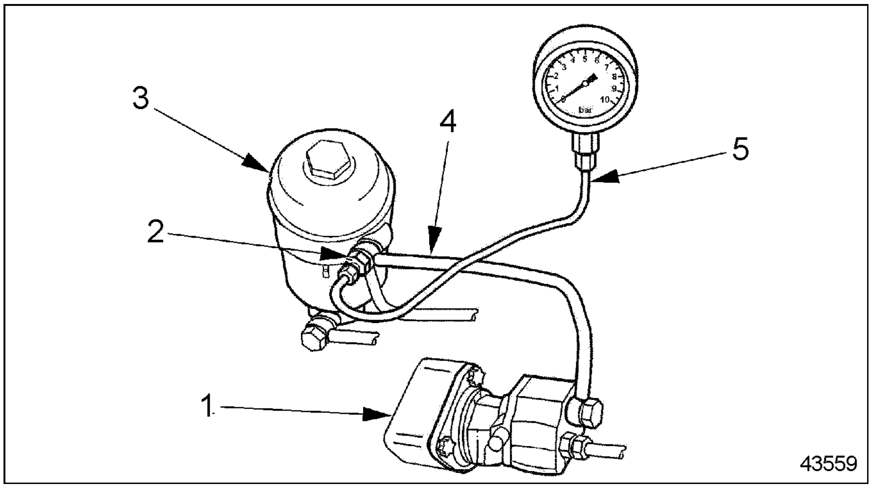
Install the pressure gauge on the fuel system. There are two possible setups for this installation. Setup 1 has the gauge installed *after* the fuel filter. See Figure 2-1.



1. Fitting
2. Fuel Filter Housing
3. Mechanical Gauge
4. Fuel Outlet Line
5. Unit Pump

Figure 2-1 Setup 1 – Gauge Installation After the Fuel Filter

Setup 2 has the gauge installed *before* the fuel filter. See Figure 2-2.



1. Fuel Pump
2. Fitting
3. Fuel Filter Housing
4. Fuel Outlet Line
5. Mechanical Gauge

Figure 2-2 Setup 2 – Gauge Installation Before the Fuel Filter

NOTE:
The fitting applied in both setups is **not** a special tool and it is not included in the Mercedes-Benz kit or SPX kit. This fitting is a component and it can be ordered from Canton PDC under part number 915039012205.

2.2.2 Performing Test #1

Test as follows:

WARNING:

PERSONAL INJURY

To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

WARNING:

PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

- **Always start and operate an engine in a well ventilated area.**
- **If operating an engine in an enclosed area, vent the exhaust to the outside.**
- **Do not modify or tamper with the exhaust system or emission control system.**

1. Start the engine and warm it up to working temperatures: 80°-95°C (176°-203°F).
2. Check the fuel pressure at two points: idle speed and rated speed.
3. Compare the test results with the fuel systems specifications for pressure listed in Table 2-1.

Speed	Pressure
Fuel Pressure Test at idle rpm	2 bar (29 psi) – minimum
Fuel Pressure Test at rated rpm	5.5 – 6.5 bar (80 – 94 psi)
Maximum difference between fuel filter housing inlet and outlet pressure	0.3 bar (4 psi)

Table 2-1 Fuel System Specifications for Pressure

4. If any of the readings are out of spec, follow the procedures listed in Table 2-2.

Reading	Checks
At idle rpm, with fuel pressure lower than 2 bar (29 psi):	Check the pressure valve at the end of the fuel gallery. Look for opening pressure 2 bar (29 psi).
	Check the fuel pump assembly (bearing and/or driven gear).
	Check to see if the fuel system is drawing air.
At rated rpm, for fuel pressure lower than 5.5 bar (80 psi):	Check the water separator filter condition.
	Check for restriction at the check valve on the MCM heat exchange plate.
	Check the main fuel filter condition, looking for saturation or any damaged seal allowing flow of fuel from the pressure side to the return side.
	Check for leaks at the suction lines from the tank.
	Check the fuel pump assembly (bearing and/or driven gear).
	Look for leaks and/or a damaged fuel pump.
	Check for restriction at the check valve on the fuel filter return line to tank.
At rated rpm, for fuel pressure higher than 6.5 bar (94 psi):	Check the return line and injector spill line, looking for restrictions or bent lines.
	Check the fuel pressure valve for a blocked or restricted regulator orifice.

Table 2-2 Checks for Fuel System Specifications

2.3 TEST #2: PERCENTAGE OF FUEL DELIVERY FOR A SMOOTH IDLE

The following test set-up and test will determine the percentage of fuel delivery for each cylinder in order to maintain a smooth operation at idle.

2.3.1 Test #2 Set-up

Operational range for this test: from -3% (negative) to 3% (positive). Identify the cylinder with the biggest absolute value – highest positive (refer to section 2.3.2) or lowest negative (refer to section 2.3.3).

2.3.2 Performing Test #2 for Highest Positive

Test as follows:

1. Check torque at all the thrust bolts (45 N·m [33 lb·ft]). Run the test again. If the results are out of operational range, proceed to next step.
2. Find the cylinder with the result closest to zero. Swap the injector nozzle holder and the transfer tube between this cylinder and the cylinder with the highest result. Run the test again. If the highest result follows the injector nozzle holder, replace the nozzle holder. If not, proceed to the next step.

NOTE:
After removing the injector nozzle holders and transfer tubes, check the coupling area between both components and the seal rings. If any defect or damage is found, replace the damaged parts.

3. Return both injector nozzle holders and transfer tubes to their original positions and run the impact delay time and compression test routines.

2.3.3 Performing Test #2 for Lowest Negative

Test as follows:

1. Check torque at all the thrust bolts (45 N·m [33 lb·ft]). Run the test again. If the results are out of the operational range, proceed to the next step.
2. Find the cylinder with the lowest result, remove the injector nozzle holder and check the opening pressure. If the pressure is lower than the minimum spec (275 bar [3989 psi]), replace the injector nozzle holder. If the pressure is within the spec, proceed to the next step.
3. Run a compression test using DDDL 7.0. The readings must be 75% or higher. For readings lower than 75%, remove the oil pan and cylinder head and check for damaged components.

2.4 TEST #4: FUEL PUMP DRIVEN GEAR BOLT TORQUE

The following describes how to check the fuel pump driven gear bolt torque. Insufficient torque on the bolt will impact engine performance..

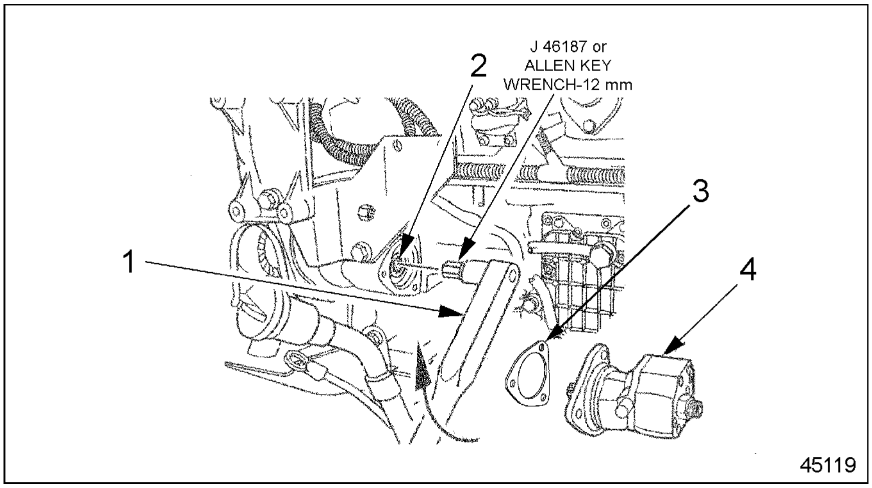
2.4.1 Performing Test #4

Test as follows:

1. Remove the fuel pump.
2. Set a clicker-type torque wrench to 30 N·m (22 lb·ft).

NOTICE:
Do not apply a torque over 30 N·m (22 lb·ft). Excessive torque can cause the bolt/gear failure.

3. Turn the torque wrench as shown by the arrow in until the torque wrench "clicks." This resistance ensures that the fuel pump drive gear bolt is in good condition. In the event of NO resistance found with shaft turning freely, proceed to step 4. See Figure 2-3.

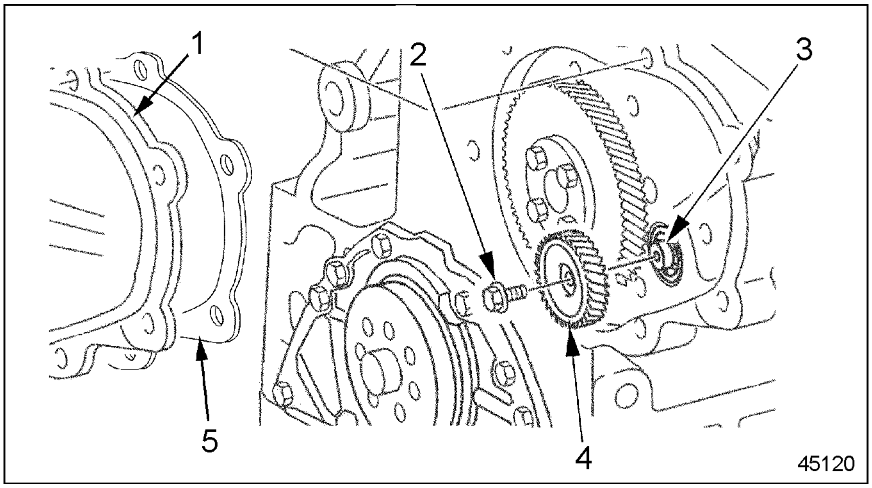


1. Torque Wrench
2. Fuel Pump Drive Gear Splines
3. Fuel Pump
4. Fuel Pump Gasket

Figure 2-3 Checking Fuel Pump Drive Gear

4. Remove the crankshaft vibration damper from the engine through the opening in the bumper.
5. Remove the idler pulley and the air conditioner compressor pad.
6. Remove the camshaft gear cover. See Figure 2-4.

7. Remove the bolt and use a puller to remove the gear. See Figure 2-4.



1. Camshaft Gear Cover
2. Drive Gear Mounting Bolt
3. Fuel Pump Drive Bearing Shaft
4. Fuel Pump Drive Gear
5. Camshaft Gear Cover Gasket

Figure 2-4 Removing/Installing Fuel Pump Drive Gear and Bolt

8. Check the mounting between bolt, gear, and shaft. Look for damaged parts. Replace damaged parts.
9. Install gear and bolt. Apply Loctite® 271 sealant to the bolt threads and install gear and bolt. Install the fuel pump gear locking device (J-46187) into the fuel pump drive splines and secure the shaft from turning while torquing bolt. Torque the bolt to 35 N·m (26 lb·ft). See Figure .
10. Install camshaft front cover and secure with eight bolts. Torque the bolts to 50 N·m (37 lb·ft).
11. Install the air conditioner compressor pad and the idler pulle.
12. Install the alternator and electrical connections.
13. Install the crankshaft vibration damper on the crankshaft. .
14. Install the fuel pump and a new fuel pump gasket. Torque the fuel pump bolts to 25 N·m (18 lb·ft).

2.5 TEST #5: LEAK TEST

The following test set-up and test will determine if and where the fuel system is leaking.

2.5.1 Test #5 Set-up

Set up the test as follows:

1. Remove the engine trim panel.
2. Disconnect the Fuel Temperature Sensor.
3. Plug the disconnected fuel temperature sensor into the engine wiring harness and tie it up out of the way.
4. Install the adaptor and seal from the fuel adaptor parts kit (J-46377).
5. Attach a banjo fitting to the adaptor, and use that to connect the high-pressure fuel line (J-46372) and gauge (J-46378).
6. Disconnect the fuel return line at the main filter housing. Seal the opening with a cap.
7. Disconnect the fuel feed line and feed line fitting at the main filter housing. In their place, attach the hose with a banjo fitting and the shut-off lever from the fuel adaptor parts kit (J-46377).

2.5.2 Performing Test #5

Test as follows:

1. Open the fuel fill cap to release pressure in the fuel tank.
2. Fill the low-pressure fuel circuit with compressed air until the fuel pressure on the high-pressure gauge reads 1,000 kPa (145 psi).
3. Turn the shut-off lever to the OFF position and wait five minutes.
4. At the end of five minutes, read the pressure on the gauge again. The gauge should read at least 975 kPa (141 psi). If the gauge pressure is too low as listed in Table 2-3, correct the problem. Make any necessary repairs and/or replacements.

5. Check the engine oil for presence of fuel. If there is fuel in the engine oil as listed in Table 2-3, correct the problem. Make any necessary repairs and/or replacements.

Possible Cause	Remedy
The engine is leaking at external connections such as the fuel temperature sensor, the fittings at the base of the fuel filter housing, and/or the overflow valve.	Replace seals and/or gaskets as necessary. Tighten all high-pressure lines to 25 N·m (18 lb·ft) and all banjo bolts to 40 - 50 N·m (30 - 37 lb·ft).
The O-ring at one or more unit pumps is leaking, worn, or missing.	Inspect the engine oil at the dipstick for the presence of fuel. Inspect the injector line fittings at the fuel pumps for leaks. Remove the unit pump(s) and replace the O-rings, if necessary.
The O-ring at one or more nozzle holders is leaking, or the nozzle holders themselves are cracked or incorrectly installed.	Inspect the engine oil at the dipstick for the presence of fuel. Inspect all the nozzle holders, and especially their O-rings, for leaks. Remove the nozzle holder(s) and replace the O-rings, if necessary. Replace the nozzle holder(s) if cracked or otherwise broken, and install correctly.
The cylinder head is cracked or there is cavitation in the oil chamber.	Inspect the engine oil at the dipstick for the presence of fuel. Replace the cylinder head if necessary.
There are balls of sealant in the fuel feed line, or the return port is leaking at the cylinder block.	Replace the cylinder block seals.

Table 2-3 Problem — The Low-Pressure Fuel System is Leaking

6. Open the shut-off valve and remove all the test equipment. Connect the fuel feed and return lines, as removed. Reconnect the Fuel Temperature Sensor.
7. Make sure the fuel fill cap is tightly closed and the vehicle has been restored to operating condition.

3 MISFIRING CYLINDER

3.1 POOR VEHICLE GROUND

Check for poor vehicle ground as follows:

1. Remove the alternator drive belt.

WARNING:
PERSONAL INJURY
To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

2. Start the engine.
3. Run the engine through operating range.
4. Listen for engine misfiring.
   [a] If the engine is not misfiring, refer to section 3.1.1. Shut down the engine.
   [b] If the engine is still misfiring, check for aerated fuel. Refer to section 3.2.

3.1.1 Negative Lead Repair

Repair the negative lead as follows:

1. Shut down the engine.
2. Remove negative lead(s) at frame ground stud near battery box.
3. Clean ground stud; refer to OEM guidelines.
4. Clean negative lead(s) terminal lugs with low grit sandpaper.
5. Repair any loose or damaged lead(s), using the splice method or rosin core solder.
6. Install negative lead(s) to frame ground stud; refer to OEM guidelines.
7. Install alternator drive belt.

NOTE:
Drive belts (Vee and poly–vee) should be replaced every 2,000 hours or 160,000 km (100,000 miles).

8. Verify negative lead repair; refer to section 3.1.1.1.

3.1.1.1 Verify Repairs

Verify as follows:

WARNING:

PERSONAL INJURY

To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

1. Start the engine.
2. Run engine speed up to the occurrence of the misfiring.
3. Listen for misfiring cylinder.
   [a] If the engine is not misfiring, no further troubleshooting is required. Shut down the engine.
   [b] If the engine is misfiring, check for aerated fuel. Shut down the engine; refer to section 3.2.

3.2 AERATED FUEL

Check for aerated fuel as follows:

1. Disconnect the fuel line return hose from the fitting located at the fuel tank.
2. Place the opened end of fuel line into a suitable container.

> **WARNING:**
>
> **PERSONAL INJURY**
>
> **To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.**

3. Start the engine.
4. Run the engine at 1000 rpm.
5. Visually check to see if air bubbles are rising to the surface of the fuel within the container.
   [a] If air bubbles are present, refer to section 3.2.1.
   [b] If air bubbles are not present, shut down the engine. Check for improper valve clearance, and worn or damaged camshaft lobes and roller followers; refer to section 3.3.

3.2.1 Aerated Fuel Repair

Repair as follows:

1. Shut down the engine.
2. Tighten all fuel line connections between fuel tank and fuel pump; refer to OEM guidelines.
3. Visually inspect all fuel lines between fuel tank and fuel pump for leaks.
4. Replace any damaged components.
5. Verify repair of fuel lines:
   [a] If no air in the fuel return, refer to section 3.2.1.1.
   [b] If air in the fuel return, locate and repair. Then refer to section 3.2.1.1.

3.2.1.1 Verify Repairs

Verify as follows:

WARNING:

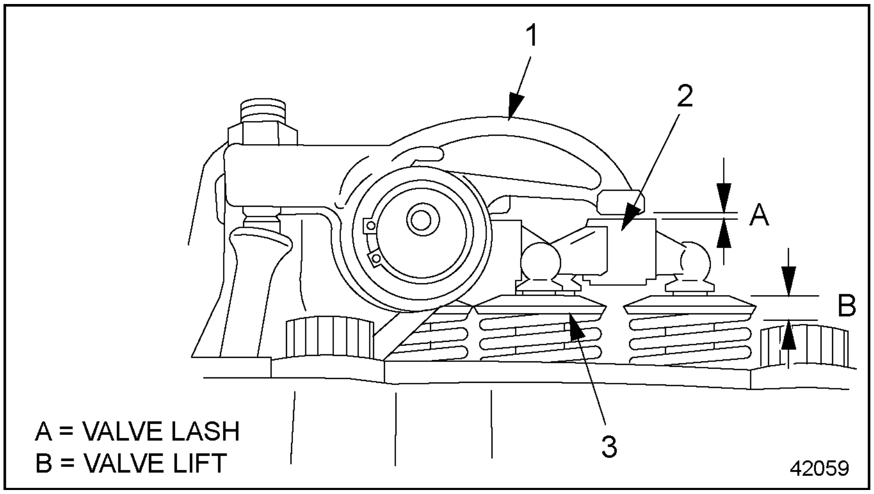
PERSONAL INJURY

To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

1. Start engine.
2. Run the engine at 1000 rpm.
3. Listen for misfiring cylinder.
   [a] If the engine is not misfiring, no further troubleshooting is required. Shut down the engine.
   [b] If the engine is misfiring, check for improper valve clearance, or worn or damaged camshaft lobes or rollers. Shut down the engine; refer to section 3.3.

3.3 IMPROPER VALVE CLEARANCE, WORN OR DAMAGED CAMSHAFT LOBES AND ROLLERS

Intake and exhaust valve clearance are adjusted by means of an adjusting set screw and locknut located at the push rod end of the rocker arm. See Figure 3-1 for intake valves. Exhaust valve is similar.



1. Rocker Arm
2. Valve Bridge
3. Valve Spring Retainer

Figure 3-1 Intake Valves

To determine if improper valve clearance is causing the cylinder to misfire, check if a worn or damaged cam lobe or followers is causing the misfire.

1. Bar the engine over and inspect the camshaft and roller followers for wear or damage.
   [a] If damage is found on the camshaft lobes or roller followers, replace damaged components as necessary.
   [b] If no damage was found to camshaft or roller followers, continue with task. Verify the proper lash setting following the procedure in the “Valve Lash Checking and Adjustment” section of MBE 4000 service manual.

3.3.1 Verify Repairs

Perform the following steps to determine if valve clearance adjustment resolved the misfiring cylinder condition:

WARNING:

PERSONAL INJURY

To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

1. Start the engine.
2. Run the engine at 1000 rpm.
3. Listen for misfiring cylinder.
   - [a] If engine is not misfiring, shut down the engine. No further troubleshooting is required.
   - [b] If engine is misfiring, shut down the engine and check for faulty fuel nozzle; refer to section 3.4.

3.4 FAULTY FUEL NOZZLE/UNIT PUMP

To determine if a faulty fuel nozzle or unit pump is causing the cylinder to misfire, check for the following items:

1. Use the minidiag2 to detect any fault codes.
2. Make sure that the transfer tube thrust bolt is installed at the proper torque of 40 Nm (30 lb ft). A leaking transfer tube may be identified by cylinder cut out evaluation.

3.4.1 Faulty Fuel Nozzle/Unit Pump Repair

Replace the unit pump and nozzle. Refer to the “Injector Unit Pump”section of the *MBE 4000 Service Manual*, Chapter 2 “Fuel System”, for unit pump and nozzle replacement.

3.4.1.1 Verify Repairs

Verify as follows:

WARNING:

PERSONAL INJURY

To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

1. Start the engine.
2. Run the engine speed up to the occurrence of the misfiring.
3. Listen for misfiring cylinder.
   [a] If the engine is not misfiring, shut down the engine. No further troubleshooting is required.
   [b] If the engine is misfiring, shut down the engine and check for a faulty MCM; refer to section 3.5.

3.5 FAULTY MCM

To determine if a faulty MCM is causing the cylinder to misfire, install a test MCM.

NOTE:
Carefully disengage the lock tab on the vehicle wiring harness and engine wiring harness connectors when removing. Follow instructions in the “MCM” section of the *MBE 4000 Service Manual*, Chapter 2 “Fuel System.”

3.5.1 Faulty MCM Repair

There is no authorized repair for the MCM.

3.5.1.1 Verify Repairs

Verify as follows:

WARNING:

PERSONAL INJURY

To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

1. Start the engine.
2. Increase the engine speed up to the occurrence of the misfiring.
3. Listen for misfiring cylinder.
   [a] If the engine is not misfiring, shut down the engine. No further troubleshooting is required. Replace the MCM with a new unit.
   [b] If the engine is misfiring, shut down the engine, install original MCM, and check for worn or damaged valves and cylinder kits; refer to section 3.6.

3.6 WORN OR DAMAGED VALVE OR CYLINDER KIT

Loss of compression in MBE 4000 engines may result from a variety of sources, including worn or broken fire or compression rings, holes in pistons, leaky valves, scored or worn cylinder walls, leaky or broken gaskets and cracked cylinder heads or cylinder liners. The detection and elimination of the cause or causes of cylinder pressure losses is vital to engine life and efficient operation. The following test procedure has been developed to effectively measure the loss of cylinder pressure and locate the source of abnormal leaks in individual cylinders, .

3.6.1 Worn or Damaged Valve or Cylinder Kit Repair

Perform the following steps to determine a worn or damaged valve or cylinder kit:

1. Remove cylinder head. Refer to the MBE 4000 Service Manual (6SE420), Engine Chapter..
2. Inspect the cylinder head for worn or damaged valves. Refer to the MBE 4000 Service Manual (6SE420), Engine Chapter.
3. Inspect the cylinder head components for worn or damaged liners examine the pistons or piston rings.
4. Verify repairs made to cylinder valve(s) or cylinder kit components; refer to section 3.6.1.1.

3.6.1.1 Verification of Repair for Worn or Damaged Valve or Cylinder Kit

Perform the following steps to determine if the repaired valve or cylinder kit resolved the misfiring cylinder condition:

WARNING:

PERSONAL INJURY

To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

1. Start the engine.
2. Run the engine speed up to the occurrence of the misfiring.
3. Listen for misfiring cylinder.
   [a] If the engine is not misfiring, no further troubleshooting is required. Shut down the engine.
   [b] If the engine is misfiring, shut down the engine. Call Detroit Diesel Customer Support Center at 313–592–5800.

4 STARTING DIFFICULTY (ENGINE ROTATES)

4.1 TROUBLESHOOTING PROCEDURE FOR DDEC-CPC WIRING HARNESS

To determine if the DDEC-CPC wire harness is causing starting difficulty, perform the following steps:

1. Turn the ignition switch to the ON position.
2. Install the Diagnostic Data Link (DDL) adaptor to the data cable and plug the adaptor into the DDL connector in the vehicle.
3. Determine if DDEC-CPC data is being received by the DDR. If no data is being received by the DDR, check for intermittent code or a fault and no codes by doing the following:
   - [a] Check for poor mating of the connector halves or terminals not fully seated in the connector body (backed-out terminals).
   - [b] Look for improperly formed or damaged terminals. All connector terminals in the problem circuit should be carefully inspected to determine proper contact tension. Use a mating terminal to test the contact tension.
   - [c] Electrical system interference may be caused by a defective relay, or a switch causing an electrical surge. Look for problems with the charging system (alternator, etc.). In certain cases, the problem can be made to occur when the faulty component is operated as in the case of a relay.
   - [d] Verify alternator grounds are clean and making good contact. Disconnect the alternator belt to test.
   - [e] Wiggle wires and harnesses to try to make the problem active or to occur again.
4. If data is being received by the DDR, check the vehicle circuit breakers or fuses; refer to section 4.2.

4.2 VEHICLE CIRCUIT BREAKERS OR FUSES CHECK

To determine if the vehicle circuit breakers are causing starting difficulty, visually check DDEC-CPC circuit breakers or fuses to determine if circuit breaker(s) or fuse(s) are tripped or blown.

1. If circuit breakers are tripped, determine cause and repair or replace as necessary; refer to OEM guidelines. Perform validation; refer to section 4.4.1.
2. If circuit breakers are not tripped, measure the voltage at the DDEC-ECU power harness. An Electronic Control Troubleshooting Guide is currently under development for this procedure. Contact DDC Customer Support Center at 313-592-5800 in the interim.

4.3 DDEC-ECU POWER HARNESS VOLTAGE TEST

An Electronic Control Troubleshooting Guide is currently under development. Contact DDC Customer Support Center at 313-592-5800 in the interim.

4.4 POWER HARNESS REPAIR

Perform the following steps to repair the power harness:

1. Repair the damage to the power harness.
2. Verify repair of the power harness; refer to section 4.4.1.

4.4.1 Test Engine with Repaired Power Harness

To determine if the repair resolved the starter difficulty, perform the following steps:

WARNING:

PERSONAL INJURY

To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

1. Attempt to start and run the engine, if the engine starts and runs, no further troubleshooting is required. Shut down the engine.
2. If the engine fails to start and run, check for an empty fuel tank; refer to section 4.5.

4.5 TROUBLESHOOTING PROCEDURE FOR AN EMPTY FUEL TANK

To determine if an empty fuel tank is causing starting difficulty, check the amount of fuel in fuel tank; refer to OEM guidelines.

1. If fuel is at recommended level, check for a weak battery; refer to section 4.7.
2. If fuel is below recommended level, refer to section 4.6.

4.6 LOW FUEL LEVEL RESOLUTION

Perform the following steps in order to resolve low fuel level:

1. Fill fuel tank to full; refer to OEM guidelines.
2. Verify fuel tank refill; refer to section 4.6.1.

4.6.1 Test Engine with Filled Tank

To determine if a filled fuel tank resolved starting difficulty, perform the following steps:

WARNING:

PERSONAL INJURY

To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

1. Attempt to start and run the engine, if the engine starts and runs, no further troubleshooting is required. Shut down the engine.
2. If the engine fails to start and run, check the battery; refer to section 4.7.

4.7 TROUBLESHOOTING PROCEDURE FOR LOW BATTERY VOLTAGE

To determine if a weak battery is causing starting difficulty, measure the battery voltage; refer to OEM guidelines.

1. If voltage is between 10.5 - 14 volts (21 - 26 volts for a 24-volt system), check the terminals for corrosion or damage; refer to section 4.10.
2. If voltage is less than 10.5 volts (21 volts for a 24-volt system), battery replacement is necessary; refer to section 4.8.

4.8 BATTERY REPLACEMENT

Perform the following steps for battery repair:

1. Remove and replace the battery; refer to OEM guidelines.
2. Verify battery replacement; refer to section 4.9.

4.9 TEST ENGINE WITH REPLACED BATTERY

To determine if the battery replacement resolved starting difficulty, attempt to start and run the engine.

WARNING:

PERSONAL INJURY

To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

1. If the engine starts and runs, no further troubleshooting is required. Shut down the engine.
2. If the engine fails to start and run, check the terminals; refer to section 4.10.

4.10 TROUBLESHOOTING PROCEDURE FOR CORRODED OR DAMAGED BATTERY TERMINALS

To determine if corroded or damaged terminals are causing starting difficulty, visually inspect terminals for corrosion or damage.

1. If corrosion or damage are not found, check the magnetic switch; refer to section 4.12.
2. If corrosion or damage are found, repair is necessary; refer to section 4.11.

4.11 CORRODED OR DAMAGED BATTERY TERMINAL REPAIR

Perform the following steps to repair corroded or damaged battery terminals:

1. Repair or replace any corroded or damaged terminals; refer to OEM guidelines.
2. Verify repair of corroded or damaged terminals; refer to section 4.11.1.

4.11.1 Test with Repaired Battery Terminals

To determine if the repair resolved starting difficulty, perform the following steps:

WARNING:

PERSONAL INJURY

To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

1. Attempt to start and run the engine, if the engine starts and runs, no further troubleshooting is required. Shut down the engine.
2. If the engine fails to start and run, check the magnetic switch; refer to section 4.12.

4.12 TROUBLESHOOTING PROCEDURE FOR DEFECTIVE MAGNETIC SWITCH

To determine if a defective magnetic switch is causing starting difficulty:

WARNING:

PERSONAL INJURY

To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

1. Start the engine.
2. Clamp a heavy gauge battery jumper cable between the two large studs of the magnetic switch. See Figure 4-1.

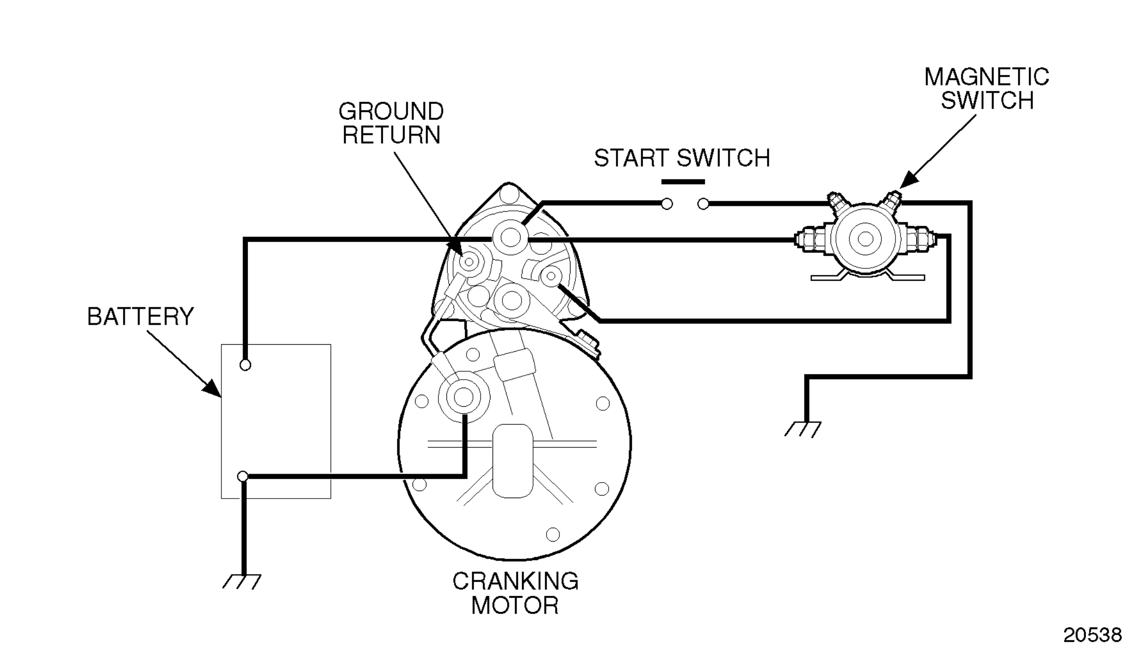


Figure 4-1 Basic Cranking Circuit

[a] If the engine cranked with the jumper cable in place, the magnetic switch must be replaced; refer to section 4.13.

[b] If the engine did not crank with the jumper cable in place, check the starter; refer to section 4.14.

4.13 MAGNETIC SWITCH REPLACEMENT

Perform the following steps for magnetic switch replacement:

1. Replace the magnetic switch; refer to OEM guidelines.
2. Verify magnetic switch replacement; refer to section 4.13.1.

4.13.1 Test Engine with Replaced Magnetic Switch

To determine if the magnetic switch replacement resolved the starting difficulty, perform the following steps:

WARNING:

PERSONAL INJURY

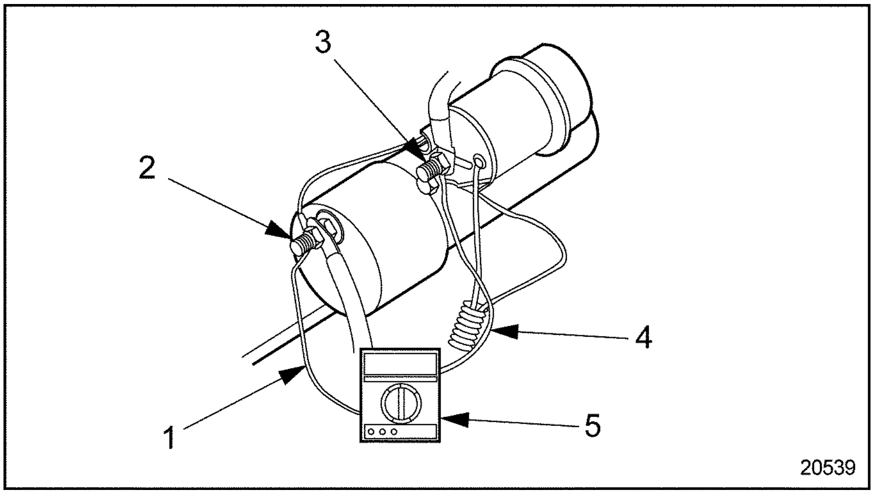
To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

1. Attempt to start and run the engine, if the engine starts and runs, no further troubleshooting is required. Shut down the engine.
2. If the engine fails to start and run, check the starter; refer to section 4.14.

4.14 TROUBLESHOOTING PROCEDURE FOR A DEFECTIVE STARTER

To determine if a defective starter is causing starting difficulty, perform the following steps:

1. Place the red lead of a voltmeter to the solenoid “BAT” terminal; see Figure 4-2.



1. Black Voltmeter Lead
2. Starter Ground Terminal Lug
3. Red Voltmeter Lead
4. Harness Tube
5. Volt Ohm Meter

Figure 4-2 Starting Motor Available Voltage Test

2. Place the black voltmeter lead to the starter ground terminal; see Figure 4-2.
3. Engage the starter switch.
4. View the voltage reading on the meter.
   [a] If the voltage is less than specification while cranking the engine, replacement is necessary; refer to section 4.15.
   [b] If the voltage is to specification while cranking the engine, check the cranking speed; refer to section 4.16.

4.15 STARTER REPLACEMENT

To determine if the replaced starter resolved starting difficulty, perform the following steps:

WARNING:

PERSONAL INJURY

To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

1. Attempt to start and run the engine, if the engine starts and runs, no further troubleshooting is required. Shut down the engine.
2. If the engine fails to start and run, check the cranking speed; refer to section 4.16.

4.16 TROUBLESHOOTING PROCEDURE FOR LOW CRANKING SPEED

To determine if low cranking speed is causing starting difficulty, install a tachometer to the engine and record engine revolution while cranking the engine. Refer to OEM guidelines.

- If the cranking speed is greater than 100 rpm, check the OEM fuel supply valve; refer to section 4.18.
- If the cranking speed is less than 100 rpm; .Refer to section 4.17.

4.17 LOW CRANKING SPEED REPAIR

Perform the following steps for low cranking speed repair:

1. Drain the engine oil. Refer to the MBE 4000 Service Manual (6SE420), Lubrication Chapter.
2. Remove the oil filter(s). Refer to the MBE 4000 Service Manual (6SE420), Lubrication Chapter.
3. Install new oil filter(s). Refer to the MBE 4000 Service Manual (6SE420), Lubrication Chapter.
4. Refill the lubrication system with new oil.
5. Verify low cranking speed repair; refer to section 4.17.1.

4.17.1 Test Engine with Replaced Oil

To determine if the replaced oil resolved starting difficulty, perform the following steps:

WARNING:

PERSONAL INJURY

To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

- □ Attempt to start and run the engine, if the engine starts and runs, no further troubleshooting is required. Shut down the engine.
- □ If the engine fails to start and run, check the fuel supply valve; refer to section 4.18.

4.18 TROUBLESHOOTING PROCEDURE FOR THE FUEL SUPPLY VALVE

To determine if the fuel supply valve is causing starting difficulty, check that the fuel supply valve is open; refer to OEM guidelines.

1. If the fuel supply valve is open, check the fuel filters; refer to section .
2. If the fuel supply valve is closed, repair is necessary; refer to section 4.19.

4.19 FUEL SUPPLY VALVE REPAIR

Perform the following steps for fuel supply valve repair:

1. Correct valve operation or replace valve.
2. Prime the fuel system; Refer to the MBE 4000 Service Manual (6SE420), Operation and Verification Chapter.
3. Verify fuel supply valve repair; refer to section 4.19.1.

4.19.1 Test Engine with Fuel Supply Valve Open

To determine if opening the fuel supply valve resolved starting difficulty, perform the following steps :

WARNING:

PERSONAL INJURY

To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

1. Attempt to start and run the engine, if the engine starts and runs, no further troubleshooting is required. Shut down the engine.
2. If the engine fails to start and run, check the fuel filters; refer to section 4.20.

4.20 PLUGGED FUEL FILTER(S) REPLACEMENT

Perform the following steps to replace the fuel filter(s):

1. Replace the fuel filter; Refer to the MBE 4000 Service Manual (6SE420), Preventive Maintenance Chapter.
2. Test the engine to determine if starting has been improved; refer to section 4.20.1.

4.20.1 Test Engine with Replaced Fuel Filters

To determine if the replaced fuel filters resolved starting difficulty, perform the following steps:

WARNING:

PERSONAL INJURY

To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

1. Attempt to start and run the engine, if the engine starts and runs, no further troubleshooting is required. Shut down the engine.
2. If the engine fails to start and run, check the fuel pump; refer to section 4.21.

4.21 TROUBLESHOOTING PROCEDURE FOR FUEL PUMP

To determine if the fuel pump is causing starting difficulty, perform the following:

WARNING:

PERSONAL INJURY

To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

1. Start and run the engine. If pressure at idle speed (600–650 rpm) is -0.09 to -0.12 bar (-1.3 to -1.7), check for aerated fuel. Refer to section 4.23.
2. If pressure at idle speed (600–650 rpm) is less than -0.09 to -0.12 bar (-1.3 to -1.7), refer to Table .
3. If pressure at idle speed (600–650 rpm) is greater than -0.09 to -0.12 bar (-1.3 to -1.7), refer to Table .
4. If a no pressure reading is observed, replace the fuel pump, refer to section 4.22.

Check fuel intake pressure upstream of fuel pump.

4.22 FUEL PUMP REPLACEMENT

Perform the following steps for fuel pump replacement:

1. Replace the fuel pump: Refer to the MBE 4000 Service Manual (6SE420), Fuel System Chapter.

> **WARNING:**
>
> **PERSONAL INJURY**
>
> **To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.**

2. Test the engine to determine if starting has been improved; refer to section 4.22.1.

4.22.1 Engine Test with Replaced Fuel Pump

To determine if the replaced fuel pump resolved starting difficulty, perform the following steps:

> **WARNING:**
>
> **PERSONAL INJURY**
>
> **To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.**

1. Attempt to start and run the engine, if the engine starts and runs, no further troubleshooting is required. Shut down the engine.
2. If the engine fails to start and run, check for aerated fuel; refer to section 4.23.

□

□

4.23 TROUBLESHOOTING PROCEDURE FOR AERATED FUEL

To determine if aerated fuel is causing starting difficulty, perform the following steps:

1. Disconnect the fuel line return hose from the fitting located at the fuel tank; refer to OEM guidelines.
2. Place the opened end of the fuel line into a suitable container.

> **WARNING:**
>
> **PERSONAL INJURY**
>
> **To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.**

3. Start the engine.
4. Run the engine at 1000 rpm.
5. Visually check to see if air bubbles are rising to the surface of the fuel within the container.

    [a] If air bubbles are present, repair is necessary; refer to section 4.24.

    [b] If air bubbles are not present, check for a restrictive air filter. Shut down the engine; refer to section 4.25.

4.24 AERATED FUEL RESOLUTION

Perform the following steps for aerated fuel resolution:

1. Shut down the engine.
2. Tighten all fuel line connections between fuel tank and fuel pump; refer to OEM guidelines.
3. Visually inspect all fuel lines between fuel tank and fuel pump for leaks.
4. Replace damaged components as required; refer to OEM guidelines.
5. Verify aerated fuel resolution; refer to section 4.24.1.

4.24.1 Test Engine with Aerated Fuel Resolution

To determine if aerated fuel resolution resolved starting difficulty, perform the following steps:

WARNING:

PERSONAL INJURY

To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

1. Attempt to start and run the engine, if the engine starts and runs, no further troubleshooting is required. Shut down the engine.
2. If the engine fails to start and run, check for a restrictive air filter; refer to section 4.25.

4.25 TROUBLESHOOTING PROCEDURE FOR RESTRICTIVE AIR FILTER

To determine if a restrictive air filter is causing starting difficulty, perform the following steps:

1. Remove the air filter element; refer to OEM guidelines.

> **WARNING:**
>
> **PERSONAL INJURY**
>
> **To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.**

2. Attempt to start and run the engine.

   [a] If the engine starts and runs, no further engine troubleshooting is required. Shut down the engine.

   [b] If the engine fails to start and run, refer to section 4.26.

4.26 AIR FILTER REPLACEMENT

Perform the following steps for air filter replacement:

1. Visually inspect the air filter for clogging and replace as necessary; refer to OEM guidelines.
2. Visually inspect gaskets for deterioration and replace as necessary; refer to OEM guidelines.
3. Visually inspect air inlets for restrictions and clean as necessary; refer to OEM guidelines.
4. Verify air filter replacement; refer to section 4.26.1.

4.26.1 Test Engine with Replaced Air Filter

To determine if the replaced air filter resolved starting difficult, perform the following steps:

WARNING:

PERSONAL INJURY

To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

1. Attempt to start the engine, if the engine starts and runs, no further troubleshooting is required. Shut down the engine.
2. If the engine fails to start and run, check compression; refer to section 4.27.

4.27 TROUBLESHOOTING PROCEDURE FOR LOW COMPRESSION

To determine if low compression is causing starting difficulty, perform the following steps:

1. Perform a cylinder compression test. Refer to the MBE 4000 Service Manual (6SE420), Engine Chapter.
2. Compare cylinder compression test results to specifications as listed in Table 4-1.

Description	Pressure in kPa (psi)
Compression Pressure at Starter Speed	2800 (406)
Permissible Difference between Individual Cylinders	400 (58)

Table 4-1 Compression Testing Specifications

[a] If cylinder pressure is below specifications, refer to section 4.28.

[b] If cylinder pressure is within specifications, call Detroit Diesel Customer Support Center at 313-592-5800.

4.28 LOW COMPRESSION REPAIR

Perform the following steps for low compression repair:

1. Remove cylinder head. Refer to the MBE 4000 Service Manual (6SE420), Engine Chapter..
2. Inspect the cylinder head for worn or damaged valves. Refer to the MBE 4000 Service Manual (6SE420), Engine Chapter.
3. Replace damaged valves. Refer to the MBE 4000 Service Manual (6SE420), Engine Chapter.
4. Inspect the cylinder kit components for worn or damaged liners; pistons or piston rings.
5. Verify repairs made to cylinder head valve(s) or cylinder kit components; refer to section 4.28.1.

4.28.1 Test Engine with Repaired Cylinder Head Valve(s), and Cylinder Kit

To determine if the cylinder head valve and cylinder kit repair resolved starting difficulty, perform the following steps:

WARNING:

PERSONAL INJURY

To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

1. Attempt to start and run the engine, if the engine starts and runs, no further troubleshooting is required. Shut down the engine.
2. If the engine fails to start and run, call the Detroit Diesel Customer Support Center at 313-592-5800.

5 NO START (ENGINE WILL NOT ROTATE)

5.1

6 EXCESSIVE OIL CONSUMPTION

6.1 MISCALIBRATED DIPSTICK

To determine if an overfilled crankcase is causing excessive oil consumption, perform the following:

1. Ensure the vehicle is parked on level ground.
2. Drain the oil pan. Refill oil pan to the proper capacity, refer to MBE900 service manual, preventive maintenance.
   [a] If a calibration check indicates that the oil level is off by more than 2.0 mm (0.079 in.), contact Detroit Diesel Customer Support Center at 313-592-5800.
   [b] Check for oil leaks; refer to section 6.2.

6.2 EXTERNAL OIL LEAKS

To determine if oil leaks are causing excessive oil consumption, perform the following:

1. Steam clean the engine.

> **WARNING:**
>
> **PERSONAL INJURY**
>
> **To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.**

2. Start and run the engine to operating temperature: 88° C (190°F).
3. Check for leaks at oil lines, connections, mating joints, seals, and gaskets.
   [a] If no oil leaks are found, shut down the engine and check for a leaking oil cooler core; refer to section 6.4.
   [b] If oil leaks are found, shut down the engine; refer to section 6.3.

6.3 ENGINE OIL LEAK REPAIR

Perform the following steps, as necessary, to resolve engine oil leaks:

1. Repair or replace components leaking oil; refer to MBE900 service manual, lubrication system chapter.
2. Verify repairs made to correct oil leaks; refer to section 6.3.1.

6.3.1 Test Engine with Repairs Made to Correct Oil Leaks

Perform the following steps to determine if the repairs resolved the oil leaks:

WARNING:

PERSONAL INJURY

To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

1. Start and run the engine to operating temperature: 88° C (190° F).
2. Shut down the engine.
3. Check the engine for oil leaks.
   [a] If no oil leaks are observed, check for a leaking oil heat exchanger; refer to section 6.4.
   [b] If external oil leaks are present, refer to section 6.3 and repeat.

6.4 LEAKING OIL HEAT EXCHANGER

To determine if a leaking oil heat exchanger is causing excessive oil consumption, perform the following:

1. Check for oil in the engine coolant or radiator.
   [a] If oil is present in either the engine coolant or radiator; go to step 2.
   [b] If no oil is present in either the engine coolant or radiator, check for a defective air compressor; refer to section 6.6.
2. Remove the oil heat exchanger and housing. Refer to the MBE900 service manual, lubrication system chapter.
3. Clean both the oil side and water side of the oil heat exchanger.
4. Visually inspect the core for cracks.
   [a] If cracks are present, replace oil heat exchanger, refer to MBE900 service manual, lubrication system chapter. Verify the replacement of the oil heat exchanger, refer to section 6.5.
   [b] If no cracks are present, complete a lube oil consumption report; call Detroit Diesel Customer Support Center (313-592-5800) for a form.

6.5 TEST ENGINE WITH NEW OIL HEAT EXCHANGER

Perform the following steps to determine if the replaced oil heat exchanger reduced the oil consumption:

WARNING:

PERSONAL INJURY

To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

1. Start and run the engine to operating temperature: 88°C (190°F)..
2. Shut down the engine.
3. Check the engine coolant for the presence of oil.
   [a] If no oil is present in the coolant, perform a lube oil consumption test report; refer to section 6.5.1.
   [b] If oil is present in the coolant, check for a defective turbocharger. Refer to section 6.8.

6.5.1 Test Engine for Reduced Oil Consumption

Perform a lube oil consumption report; call the Detroit Diesel Customer Support Center at 313-592-5800 for a form.

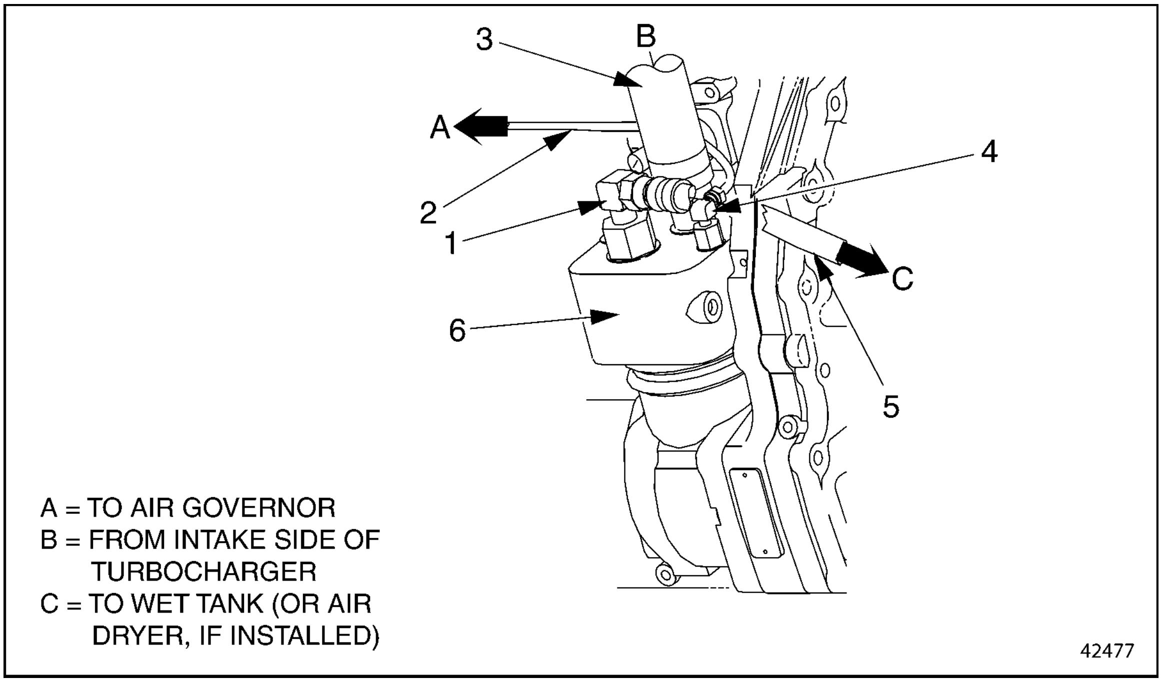
Review the oil consumption report.

1. If the oil consumption report data is within specifications, check for defective air compressor; refer to section 6.6.
2. If the oil consumption report data is not within specifications, call Detroit Diesel Customer Support Center at 313-592-5800.

6.6 DEFECTIVE AIR COMPRESSOR

To determine if a defective air compressor is causing excessive oil consumption, perform the following:

1. Perform a crankcase pressure test and record the test results; refer to section 6.6.1.
2. Disconnect the air discharge line from the air compressor. See Figure 6-1; refer to MBE900 service manual, special equipment chapter.



1. Discharge Port
2. Unloader Air Line
3. Intake Air Line
4. Unloader Port
5. Discharge Air Line
6. Air Compressor

Figure 6-1 Air Line Attachments

3. Repeat step 1 and record the results.
4. Compare the results of test one with test two.
   [a] If the engine crankcase pressure remained the same, check the turbocharger; refer to section 6.8.
   [b] If the engine crankcase pressure decreased, replace the air compressor; refer to MBE900 service manual, special equipment chapter. Verify the replaced (or new) air compressor, refer to section 6.7.

6.6.1 Crankcase Pressure Test

Perform the following steps to check the engine crankcase pressure:

WARNING:

PERSONAL INJURY

To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

1. Start the engine.
2. Run the engine and bring the engine coolant temperature to normal operating range, approximately 88-96°C (190-205°F).
3. Return engine to idle and remove the oil dipstick.
4. Attach a manometer calibrated to read pressure in kPa or inches of (H_2O), to the oil dipstick opening.
5. Run the vehicle to full load and rated speed.
6. Measure and record crankcase pressure.
7. Shut down the engine.
8. Remove the manometer from the oil dipstick opening and install the dipstick.

6.7 TEST ENGINE WITH REPAIRED AIR COMPRESSOR

Perform the following steps to determine if the replaced (or new) air compressor resolved the excessive crankcase pressure:

> **WARNING:**
>
> **PERSONAL INJURY**
>
> **To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.**

1. Start and run the engine.
2. Perform a crankcase pressure test; refer to MBE900 service manual, engine chapter-cylinder head.
   [a] If the engine crankcase pressure exceeds 0.62 kPa (2.5 in. H_2O), shut down the engine. Check for defective turbocharger. Refer to section 6.8.
   [b] If the engine crankcase pressure is within 0.62 kPa (2.5 in. H_2O), shut down the engine; no further troubleshooting is required.

6.8 DEFECTIVE TURBOCHARGER

To determine if a defective turbocharger is causing excessive oil consumption, perform the following:

1. Remove the turbocharger drain line connected to the crankcase and place the drain line into a suitable container.
2. Perform a crankcase pressure test; refer to section 6.6.1
   - [a] If the engine crankcase pressure is less than 0.62 kPa (2.5 in. H_2O), shut down the engine. Replace the turbocharger; refer to MBE900 service manual, air intake system chapter. Verify the replacement of the turbocharger, refer to section 6.8.1.
   - [b] If the engine crankcase pressure indicates no change, shut down the engine. Check for worn or damaged valve or cylinder kit. Refer to section 6.9.

6.8.1 Test Engine with New Turbocharger

Perform the following steps to determine if a new turbocharger resolved the excessive crankcase pressure:

1. Remove the turbocharger drain line connected to the crankcase and place the drain line into a suitable container.
2. Perform a crankcase pressure test. refer to section 6.6.1.
   - [a] If the engine crankcase pressure is greater than 0.62 kPa (2.5 in. H_2O), check for worn or damaged valve or cylinder kit; shut down the engine. Refer to section 6.9.
   - [b] If the engine crankcase pressure is 0.62 kPa (2.5 in. H_2O) or less, no further troubleshooting is required. Shut down the engine.

6.9 WORN OR DAMAGED VALVE OR CYLINDER KIT

A loss of cylinder pressure can cause increased oil consumption. The detection and elimination of cylinder pressure losses is vital to engine life and efficient operation. To assist the mechanic in effectively measuring the loss of cylinder pressure, and locating the source of abnormal leaks in individual cylinders, the following test procedure has been developed.

1. Move the vehicle requiring test to the chassis dynamometer; refer to OEM guidelines.
2. Disconnect the air compressor and remove; refer to MBE900 service manual, special equipment chapter.

> **WARNING:**
>
> **PERSONAL INJURY**
>
> **To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.**

3. Start the engine.
4. Run the engine and bring the engine coolant temperature to normal operating range, approximately 88–96°C (190–205°F).
5. Run the vehicle to full load and rated speed.
6. Perform a crankcase pressure test; refer to section 6.6.1.
7. Shut down the engine.
8. Remove the vehicle from the chassis dynamometer.
9. Review the crankcase pressure test results.
   [a] If the crankcase pressure exceeds 0.62 kPa (2.5 in. H_2O), repair worn or damaged valve(s) or cylinder kit; refer to section .
   [b] IIf the crankcase pressure was less than or equal to 0.62 kPa (2.5 in. H_2O), perform a cylinder compression test;refer to section 6.9.1.
10. Compare the cylinder compression test results to specifications as listed in Table 6-1.
   [a] If the cylinder compression is below specifications, repair worn or damaged valve(s) or cylinder kit; refer to section 6.10.
   [b] If the cylinder compression is within specifications, call Detroit Diesel Customer Support Center (313-592-5800).

Description	Pressure kPa (psi)
Compression Pressure at Starter Speed	2800 (406)
Permissible Difference Between Individual Cylinders	400 (58)

Table 6-1 Compression Testing

6.9.1 Compression Testing

To do compression testing the nozzle holder will need to be removed and the compression tester installed.

1. Set the parking brake and chock the tires.

NOTE:
To do this procedure, coolant temperature must be between 70 - 95°C (158 - 203°F).

WARNING:

PERSONAL INJURY

To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

WARNING:

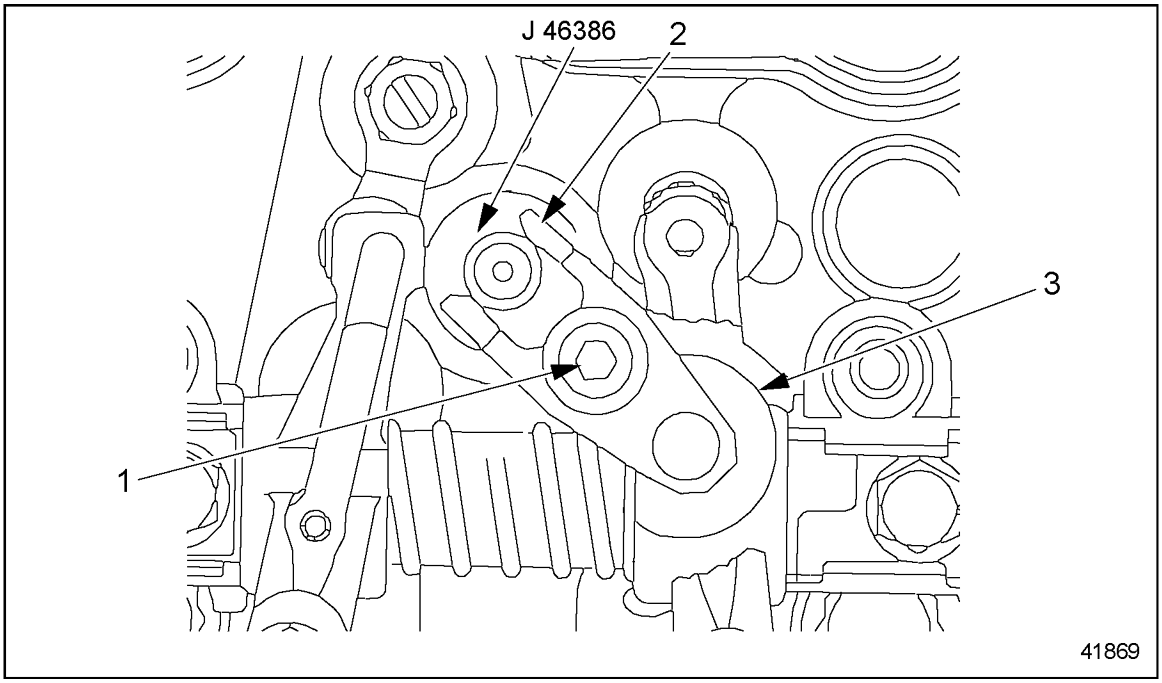
PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

- **Always start and operate an engine in a well ventilated area.**
- **If operating an engine in an enclosed area, vent the exhaust to the outside.**
- **Do not modify or tamper with the exhaust system or emission control system.**

2. Turn on the ignition key switch and run the engine until it reaches operating temperature.
3. Shut down the engine.
4. Remove the nozzle holder. Refer to MBE900 service manual, special equipment chapter.

5. Insert the compression test adaptor J-46386 into the cylinder head. See Figure 6-2. Use the hold-down clamp and bolt included in the kit.



1. Bolt
2. Hold-Down Clamp
3. End Cover (constant throttle)

Figure 6-2 Installing the Connector

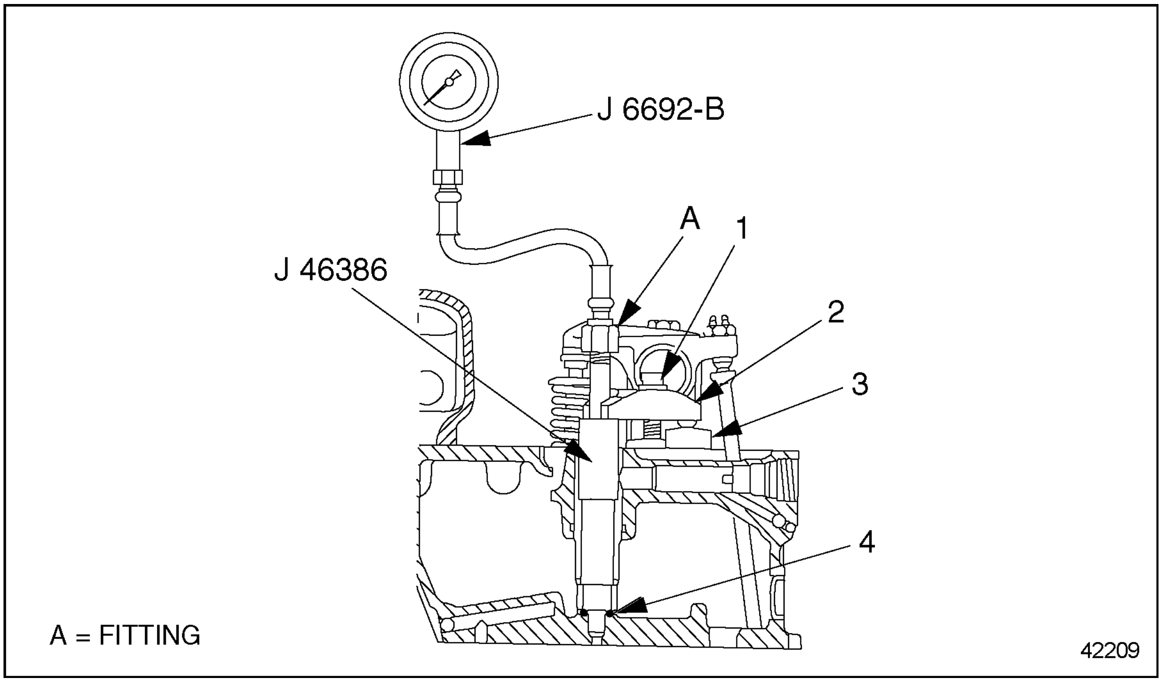
[a] Make sure the smooth surface on the O-ring is pointing toward the test adaptor J-46386.

[b] Install the hold-down clamp with the two prongs around the test adaptor. Turn the hold-down clamp (at the cylinder head) until the button in the base of the hold-down clamp is aligned with the locating element in the end cover of the constant throttle valve end cover.

[c] Tighten the hold-down clamp bolt 30 N·m (22 lb·ft) for a hex-head bolt, or 35 N·m (26 lb·ft) for the 12-point head with the spherical collar.

NOTE:
Follow the equipment manufacturer's operating instructions to connect the compression tester.

6. Attach the compression tester J-6692–B to the test adaptor J-46386. Thread the fitting at the end of the tester to the top of the test adaptor. See Figure 6-3.



1. Hold-Down Bolt
2. Hold-Down Clamp
3. End Cover (constant throttle)
4. O-ring

Figure 6-3 Testing Compression Pressure

Test as follows:

1. Remove either of the electrical connectors from the MCM. When this is done, the engine will not start.
2. For each cylinder, use the starter to crank the engine at least 8 engine revolutions. The results will be recorded on the gauge of the tester.
3. Compare measurements on the gauge with the values listed in Table 6-2.

Description	Pressure
Compression Pressure at Starter Speed	2800 kPa (406 psi)
Permissible Difference Between Individual Cylinders	400 kPa (58 psi)

Table 6-2 Compression Testing

4. If the pressure measured is below the chart compression pressure or above the permissible difference, determine the cause and correct the problem.

Install the nozzle holder as follows:

1. Connect the MCM.
2. Connect DDDL 7.0 version or later to the vehicle and clear all inactive fault codes.

NOTE:
Follow the equipment manufacturer's operating instructions.

3. Disconnect the compression tester from the test adaptor. See Figure 6-3.
4. Remove the compression test adaptor. See Figure 6-3.
5. Install the nozzle holder. See Figure 6-3.
6. Install and adjust the hold-down clamp.
   [a] Position the hold-down clamp on the nozzle holder and install the hold-down clamp bolt.
   [b] Tighten the hold-down bolt 30 N·m (22 lb·ft) for a hex-head bolt, or 35 N·m (26 lb·ft) for the 12-point head with the spherical collar.
7. Repeat this procedure for each cylinder.
8. Remove the chocks from the tires.

6.10 WORN OR DAMAGED VALVE(S) OR CYLINDER KIT(S) REPAIR

Perform the following steps to repair worn or damaged valve(s) and cylinder kit(s):

1. Remove the cylinder head, refer to MBE900 service manual, engine chapter.
2. Inspect the cylinder head for worn or damaged valves, refer to MBE900 service manual, engine chapter.;
3. Inspect the cylinder kit components for worn or damaged liners; pistons or piston rings, refer to MBE900 service manual, engine chapter.
4. Replace damaged cylinder kit components.
5. Verify repairs made to cylinder head valve(s) or cylinder kit components; refer to section 6.10.1.

6.10.1 Test Engine with Repaired Cylinder Head Valve(s), and Cylinder Kit

To determine if the cylinder head valve and cylinder kit repair resolved starting difficulty, perform the following steps:

WARNING:

PERSONAL INJURY

To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

1. Attempt to start and run the engine, if the engine starts and runs, no further troubleshooting in required.
2. If the engine fails to start and run, call the Detroit Diesel Customer Support Center at 313-592-5800.

7 EXCESSIVE CRANKCASE PRESSURE

7.1 OBSTRUCTION OR DAMAGE TO BREATHER SYSTEM

To determine if an obstructed or damaged breather is causing excessive crankcase pressure, perform a crankcase pressure test. Refer to section 7.1.1

7.1.1 Crankcase Pressure Test

Perform the following steps to check the engine crankcase pressure:

WARNING:
PERSONAL INJURY
To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

1. Start the engine.
2. Run the engine and bring the engine coolant temperature to normal operating range, approximately 88-96°C (190-205°F).
3. Return engine to idle and remove the oil dipstick.
4. Attach a manometer calibrated to read pressure in kPa or inches of (H_2O), to the oil dipstick opening.
5. Run the vehicle to rated speed.
6. Measure and record crankcase pressure.
7. Shut down the engine.
8. Remove the manometer from the oil dipstick opening and install the dipstick.
9. If the engine crankcase pressure is greater than 2.0 kPa (8.0 in. H_2O), refer to section 7.1.2
10. If the crankcase pressure remained the same, check the air compressor; refer to section 7.2

7.1.2 Breather System Resolution

Perform the following steps for breather system resolution:

1. Remove the breather from the rear flywheel cover; refer to ???????
2.
3. Verify the crankcase pressure; refer to section 7.1.1.

7.1.2.1 Test Engine with Breather Removed

Perform the following steps to determine if the removed breather element resolved the excessive crankcase pressure.

WARNING:

PERSONAL INJURY

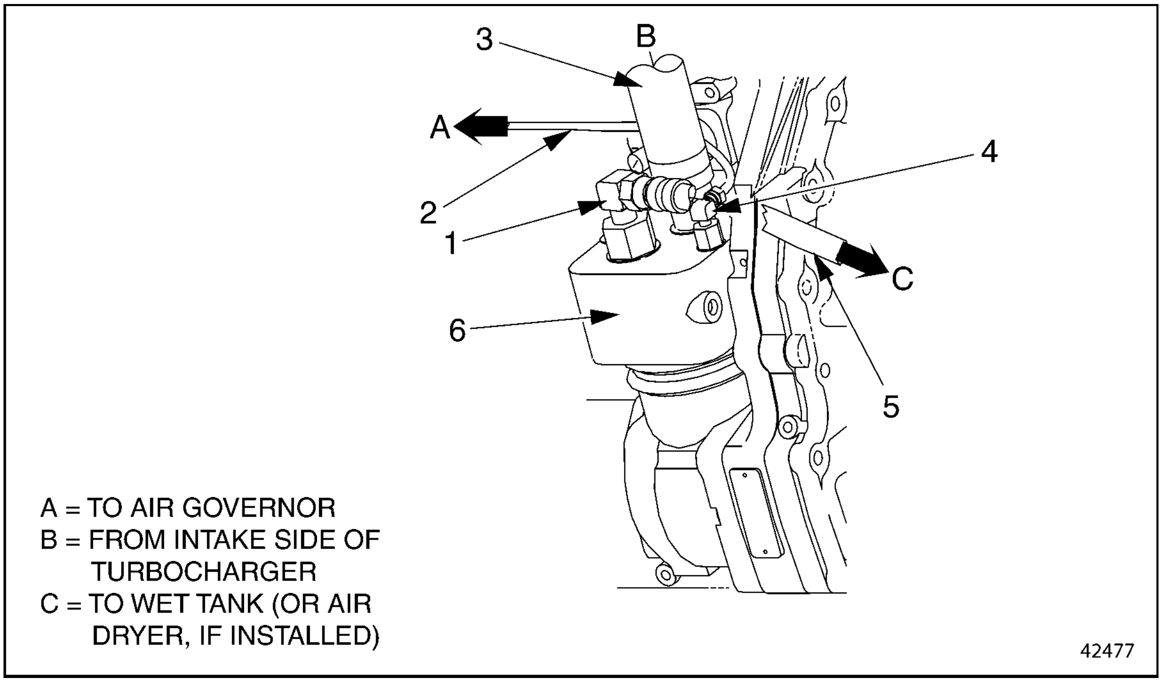
To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

1. Start and run the engine.
2. Perform a crankcase pressure test; refer to section 7.1.1
   [a] If the engine crankcase pressure is less than 2.0 kPa (8.0 in. H_2O), no further troubleshooting is required. Shut down the engine.
   [b] If the engine crankcase pressure is greater than 2.0 kPa (8.0 in. H_2O), check the air compressor;

7.2 DEFECTIVE AIR COMPRESSOR

To determine if a defective air compressor is causing excessive crankcase pressure, perform the following:

1. Perform a crankcase pressure test and record the test results;refer to section 7.1.1
2. Disconnect the air discharge line from the air compressor; see Figure 7-1 for air line attachments. Refer to the *MBE 4000 Service Manual (6SE420*, Special Equipment Chapter.



1. Discharge Port
2. Unloader Air Line
3. Intake Air Line
4. Unloader Port
5. Discharge Air Line
6. Air Compressor

Figure 7-1 Air Line Attachments

3. Repeat step 1 and record test results.
4. Compare the results of test one with test two.
   [a] If the engine crankcase pressure remained the same, check the turbocharger;
   [b] If the engine crankcase pressure decreased, repair or replace the air compressor;refer to section 7.2.1, test engine with repaired air compressor

7.2.1 Test Engine with Repaired Air Compressor

Perform the following steps to determine if a repaired air compressor resolved the excessive crankcase pressure:

WARNING:

PERSONAL INJURY

To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

1. Start and run the engine.
2. Perform a crankcase pressure test; refer to section 7.1.1
   [a] If the engine crankcase pressure is within 2.0 kPa (8.0 in. H_2O), no further troubleshooting is required. Shut down the engine.
   [b] If the engine crankcase pressure is not within 2.0 kPa (8.0 in. H_2O), shutdown the engine. Check the turbocharger; refer to section 7.3

7.3 DEFECTIVE TURBOCHARGER

To determine if a defective turbocharger is causing excessive crankcase pressure, perform the following:

NOTICE:
Ensure that the engine is not allowed to operate longer than necessary to perform the crankcase pressure test. A complete loss of crankcase oil will severely damage the engine.

1. Remove the turbocharger drain line connected to the crankcase and place the drain line into a suitable container; refer to the *MBE 4000 Service Manual (6SE420*, Air Intake System Chapter for turbocharger removal.
2. Perform a crankcase pressure test; refer to section 7.1.1
   [a] If the engine crankcase pressure is less than 2.0 kPa (8.0 in. H_2O), replace the turbocharger; refer to the *MBE 4000 Service Manual (6SE420*, Air Intake System Chapter for turbocharger removal. Shut down the engine.
   [b] If the engine crankcase pressure indicates no change, check for a worn or damaged valve or cylinder kit;

7.3.1 Turbocharger Replacement

Perform the following steps to replace a defective turbocharger:

1. Remove the defective turbocharger from the engine; refer to the *MBE 4000 Service Manual (6SE420*, Air Intake System Chapter for turbocharger removal.
2. Tag the removed turbocharger for remanufacture.
3. Install a replacement turbocharger to the engine; refer to the *MBE 4000 Service Manual (6SE420*, Air Intake System Chapter for turbocharger installation.
4. Verify replacement of new turbocharger; refer to section 7.3.1.1

7.3.1.1 Test Engine with New Turbocharger

To determine if a new turbocharger resolved the excessive crankcase pressure, perform a crankcase pressure test;refer to section 7.1.1

1. If the engine crankcase pressure is 2.0 kPa (8.0 in. H_2O) or less, no further troubleshooting is required. Shut down the engine.
2. If the engine crankcase pressure is greater than 2.0 kPa (8.0 in. H_2O), shut down the engine. Check for a worn or damaged valve or cylinder kit; refer to section 7.4

7.4 WORN OR DAMAGED VALVE OR CYLINDER KIT

To determine if a worn or damaged cylinder kit is causing excessive crankcase pressure, perform the following:

1. Move the vehicle requiring test to the chassis dynamometer; refer to OEM guidelines.
2. Remove air compressor; refer to the *MBE 4000 Service Manual (6SE420*, Air Intake System Chapter.

> **WARNING:**
>
> **PERSONAL INJURY**
>
> **To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.**

3. Start the engine.
4. Run the engine and bring the engine coolant temperature to normal operating range, approximately 88-96°C (190-205°F).
5. Run the vehicle to full load and rated speed.
6. Attach a manometer calibrated to read pressure kPa or inches of H_2O, to the oil dipstick opening.
7. Measure and record crankcase pressure.
8. Shut down the engine.
9. Remove the vehicle from the chassis dynamometer.
10. Review the crankcase pressure test.
    [a] If the crankcase pressure is greater than 2.0 kPa (8.0 in. H_2O), go to step 11.
    [b] If the crankcase pressure is less than 2.0 kPa (8.0 in. H_2O), no further troubleshooting is required.
11. Perform the cylinder compression test, Refer to section 7.4.1
    [a] If cylinder pressure is below specifications, Refer to section 7.4.2.
    [b] If cylinder pressure is within specifications, call Detroit Diesel Customer Support Center at 313-592-5800.

7.4.1 Compression Testing

Perform the following steps to compression test the engine:

Removal

NOTE:
Start this procedure only when the engine is cold. Wait at least 30 minutes after switching off the engine.

1. Set the parking brake and chock the tires.

WARNING:

PERSONAL INJURY

To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

2. Remove the cylinder head cover. Refer to the *MBE 4000 Service Manual (6SE420*, Engine Chapter.
3. Adjust the valve lash. Refer to the *MBE 4000 Service Manual (6SE420*, Engine Tune-up Chapter.

NOTE:
To do this procedure, coolant temperature must be between 70-95°C (158-203°F).

WARNING:

PERSONAL INJURY

To avoid injury when working near or on an operating engine, remove loose items of clothing and jewelry. Tie back or contain long hair that could be caught in any moving part causing injury.

WARNING:

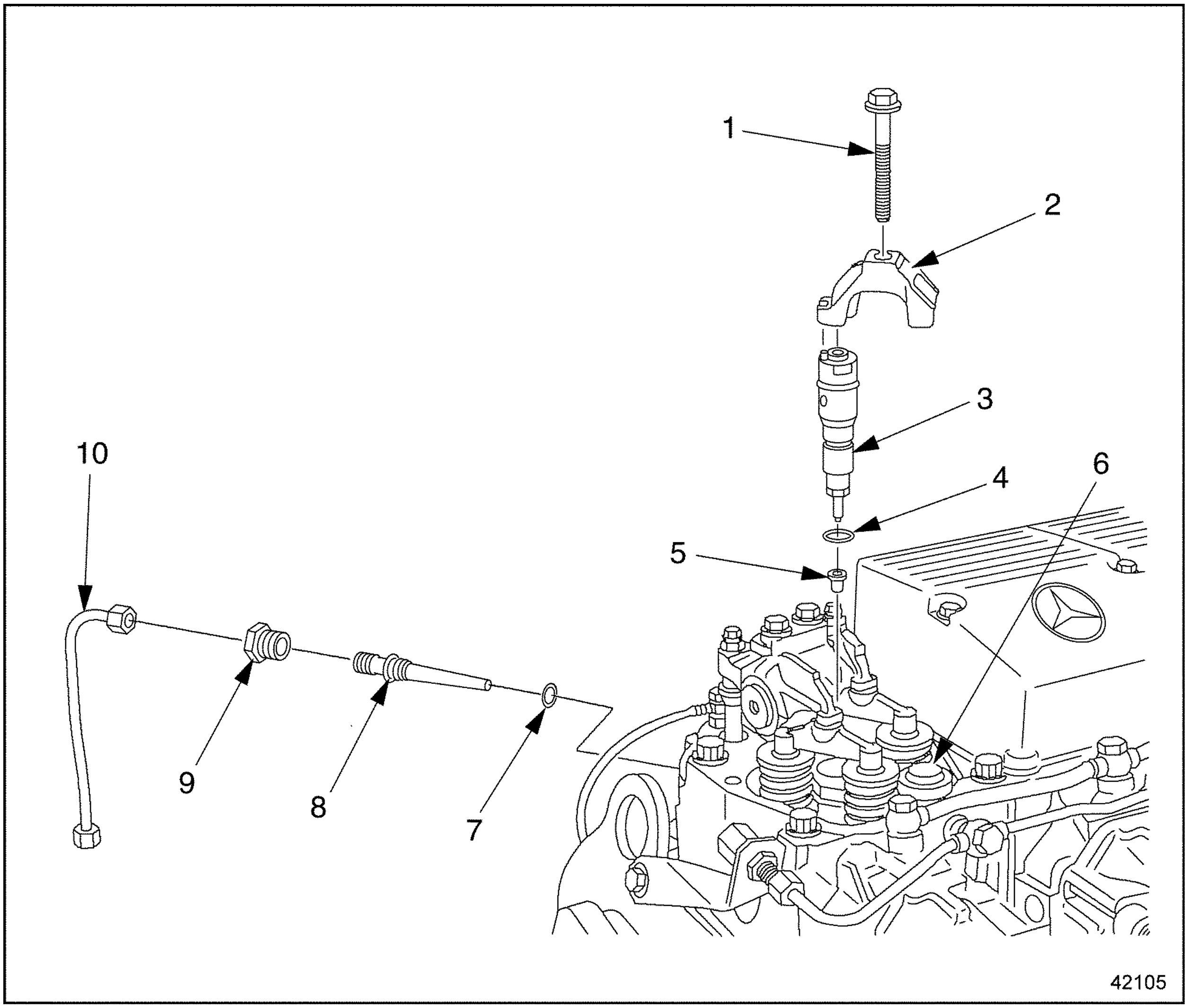
PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

- **Always start and operate an engine in a well ventilated area.**
- **If operating an engine in an enclosed area, vent the exhaust to the outside.**
- **Do not modify or tamper with the exhaust system or emission control system.**

4. Turn on the ignition key switch and run the engine until it reaches operating temperature.
5. Shut down the engine.

6. Remove the fuel injector nozzle. See Figure 7-2. Refer to the *MBE 4000 Service Manual (6SE420*, Fuel System Chapter.



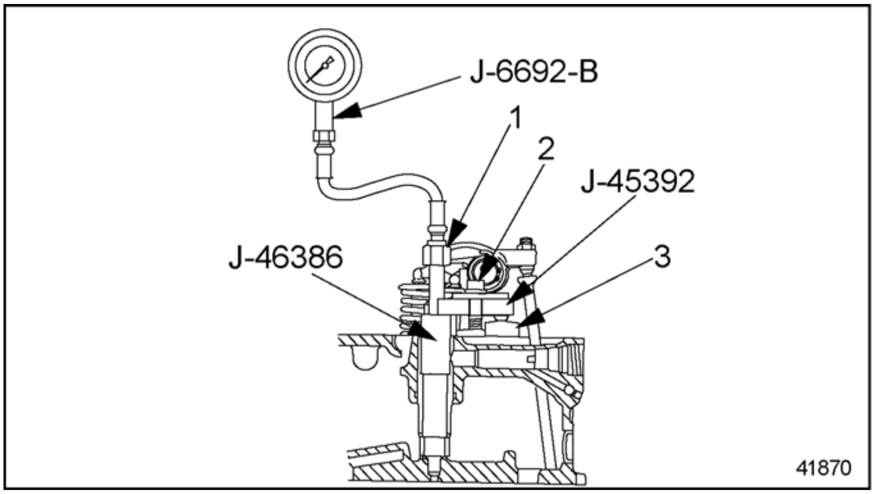
1. Retaining Bolt
2. Tensioning Arm
3. Fuel Injector Nozzle
4. O-ring (nozzle)
5. Heat Isolator
6. Constant-Throttle End Cover
7. O-ring (transfer tube)
8. Transfer Tube
9. Thrust Bolt
10. High Pressure Line

Figure 7-2 Removing the Fuel Injector Nozzle

7. Insert the compression test adaptor (J–46386) into the cylinder head. Use the tensioning adapter (J–45392) and bolt included in the kit to secure test adaptor to the cylinder head. See Figure 7-3.

NOTE:
Follow the equipment manufacturer's operating instructions to connect the compression tester.

8. Attach the compression gage (J–6692–B) to the test adaptor (J–46386). See Figure 7-3.



1. Fitting
2. Bolt from J-45392
3. Constant Throttle Valve Cover

Figure 7-3 Testing Compression Pressure

Testing

1. Remove the electrical connectors from all unit pumps. When this is done, the engine will not start.
2. For each cylinder, use the starter to crank the engine at least 8 engine revolutions. The results will be recorded on the gauge of the tester.
3. Compare measurements on the chart with the values listed in Table 7-1. If the pressure measured is below the minimum compression pressure or above the permissible

difference, determine the cause and correct the problem. To remove the cylinder head, refer to the*MBE 4000 Service Manual (6SE420*, Engine Chapter.

Description	Pressure kPa (psi)
Minimum Compression Pressure Valve	2800 (406)
Permissible Difference Between Individual Cylinders	400 (58)

Table 7-1 Compression Testing

Installation

1. Connect all unit pumps, as removed.
2. Connect minidiag2 to the vehicle and clear all inactive faults.

NOTE:
Follow the equipment manufacturer's operating instructions.

3. Disconnect the compression tester gauge, (J–6692–B) from the test adaptor (J–46383).
4. Remove the compression test adaptor, tensioning arm adaptor and bolt from the cylinder head.
5. Install the fuel injector nozzle, refer to the*MBE 4000 Service Manual (6SE420*, Fuel System Chapter.
6. Install and tighten the tensioning arm.
   [a] Position the tensioning arm on the fuel injector nozzle and install the retaining bolt.
   [b] Tighten the retaining to bolt 50 N·m (37 lb·ft).
7. Install the cylinder head cover, refer to the*MBE 4000 Service Manual (6SE420*, Engine Chapter.
8. Repeat this procedure for each cylinder.
9. Remove the chocks from the tires.

7.4.2 Worn or Damaged Valve or Cylinder Kit Repair

Perform the following steps for a worn or damaged valve or cylinder kit:

1. Remove the cylinder head; refer to the*MBE 4000 Service Manual (6SE420*, Engine Chapter.
2. Inspect the cylinder head for worn or damaged valves; *MBE 4000 Service Manual (6SE420*, Engine Chapter.
3. Inspect the cylinder kit components for worn or damaged liners, piston or piston rings; refer to the *MBE 4000 Service Manual (6SE420*, Engine Chapter.

4. Verify repair to cylinder valve(s) or cylinder kit components; refer to section 7.4.2.1

7.4.2.1 Test Engine with Repairs Made to Correct Worn or Damaged Valve or Cylinder Kit

Perform the following to determine if the repaired valve or cylinder kit resolved the excessive crankcase pressure:

1. Move the vehicle requiring test to the chassis dynamometer; refer to OEM guidelines.
2. Disconnect air compressor; refer to the *MBE 4000 Service Manual (6SE420*, Special Equipment Chapter.

WARNING:

PERSONAL INJURY

To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

3. Start the engine.
4. Run the engine and bring the engine coolant temperature to normal operating range, approximately 88-96°C (190-205°F).
5. Run the vehicle to full load and rated speed.
6. Attach a manometer calibrated to read pressure in kPa or inches of H_2O, to the oil dipstick opening.
7. Measure and record crankcase pressure.
8. Shut down the engine.
9. Remove the vehicle from the chassis dynamometer.
10. Compare the cylinder pressure test results to specifications listed in table7-2
    [a] If cylinder pressure is within specifications, no further troubleshooting is required.
    [b] If cylinder pressure is not within specifications, call Detroit Diesel Customer Support Center at 313-592-5800.

Description	Pressure
Compression Pressure at Starter Speed	2800 kPa (406 psi)
Permissible Difference Between Individual Cylinders	400 kPa (58 psi)

Table 7-2 Compression Pressure Test Data

8 EXCESSIVE EXHAUST SMOKE (BLACK OR GRAY)

Section **Page**

8.1

9 EXCESSIVE BLUE SMOKE

9.1

10 EXCESSIVE WHITE SMOKE

Section **Page**

10.1

11 ROUGH RUNNING OR STALLING

Section **Page**

11.1

12 LACK OF POWER

Section **Page**

12.1

13 HIGH ENGINE COOLANT TEMPERATURE

13.1

14 LOW OIL PRESSURE

Section **Page**

14.1

15 LOW COOLANT TEMPERATURE

15.1

16 POOR FUEL ECONOMY

16.1

17 DDEC VI SYSTEM

17.1 DDEC VI SYSTEM–HOW IT WORKS

DDEC VI is a system that monitors and determines all values required for the operation of the engine. A diagnostic interface is provided to connect to an external diagnosis tester. Besides the engine related sensors and the engine-resident control unit, the Motor Control Module (MCM), this system has a cab-mounted control unit for vehicle engine management, the Common Powertrain Controller (CPC). The connection to the vehicle is made via a CAN interface which digitally transmits the nominal values (e.g. torque, engine speed specification, etc.) and the actual values (e.g. engine speed, oil pressure, etc.).

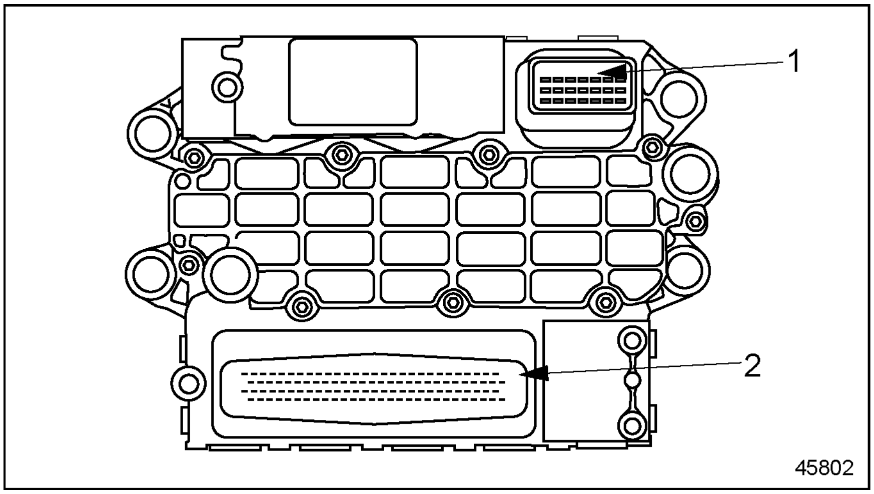
17.1.1 Harnesses

There are two major harness: the Engine Harness (EH) and the Vehicle Interface Harness (VIH). The Engine Harness is installed at the factory and is delivered connected to all engine sensors, the fuel injection system, and the MCM.

The OEM supplied Vehicle Interface Harness connects the ECU to other vehicle systems.

17.2 MOTOR CONTROL MODULE

The engine mounted Motor Control Module (MCM) includes control logic to provide overall engine management. See Figure 17-1.



1. 21–pin Connector (OEM Responsibility)
2. 120–pin Connector (Detroit Diesel Responsibility)

Figure 17-1 Motor Control Module

NOTE:
Do NOT ground the MCM housing. This can result in false codes being logged.

17.2.1 MBE 4000 Engine Harness

The MCM has a 120–pin connector Engine Harness which is factory installed. It also has a 21–pin connector which is the responsibility of the OEM. The pinouts for the 120–pin connector for the MBE 4000 engine are listed in Table 17-1, Table 17-2, Table 17-3, and Table 17-4.

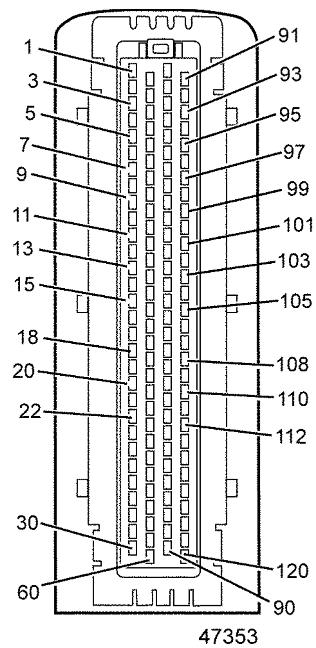
Pin	Function	Connector
1	NC	
2	NC	
3	NC	
4	Electronic Unit Pump (cyl 4) – pin 2	
5	Electronic Unit Pump Common (cyl 4) – pin 1	
6	Electronic Unit Pump (cyl 6) – pin 2	
7	Electronic Unit Pump Common (cyl 6)1 – pin 1	
8	Electronic Unit Pump (cyl 5) – pin 2	
9	Electronic Unit Pump Common (cyl 5) – pin 1	
10	Electronic Unit Pump (cyl 2) – pin 2	
11	Electronic Unit Pump Common (cyl 2) – pin 1	
12	Electronic Unit Pump (cyl 3) – pin 2	
13	Electronic Unit Pump Common (cyl 3) – pin 1	
14	Electronic Unit Pump (cyl 1) – pin 2	
15	Electronic Unit Pump Common (cyl 1) – pin 1	
16	Injector (cyl 4) – pin 2	
17	Injector Common (cyl 4) – pin 1	
18	Injector (cyl 6) – pin 2	
19	Injector Common (cyl 6) – pin 1	
20	Injector (cyl 5) – pin 2	
21	Injector Common (cyl 5) – pin 1	
22	Injector (cyl 2) – pin 2	
23	Injector Common (cyl 2) – pin 1	
24	Injector (cyl 3) – pin 2	
25	Injector Common (cyl 3) – pin 1	
26	Injector (cyl 1) – pin 2	
27	Injector Common (cyl 1) – pin 1	
28	NC	
29	DOC Outlet Temp Sensor	
30	DPF Outlet Pressure Sensor	

Table 17-1 MCM Connector – MBE 4000 (1 of 4) – C Sample

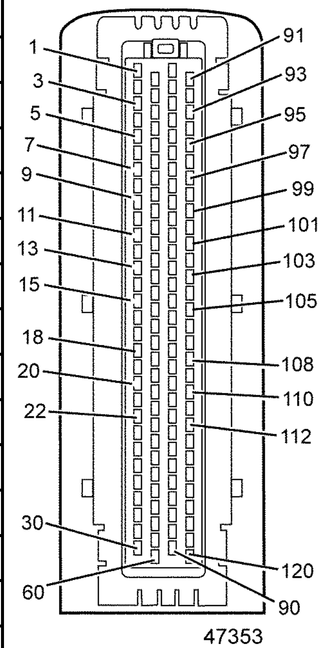
Pin	Function	Connector
31	NC	
32	Constant Throttle Valve	
33	Two-speed Fan or Variable Speed Fan	
34	NC	
35	Wastegate	
36	NC	
37	NC	
38	Ground	
39	Electrostatic Oil Separator	
40	NC	
41	Grid Heater	
42	NC	
43	CKP (+)	
44	NC	
45	CMP (+)	
46	NC	
47	Fan Speed	
48	CMP (-)	
49	NC	
50	Sensor Ground	
51	Turbo Speed Sensor	
52	Sensor Ground	
53	NC	
54	Engine Oil Pressure Sensor	
55	Sensor Ground	
56	NC	
57	NC	
58	Sensor Power Supply	
59	NC	
60	EGR Throttle Position	

Table 17-2 MCM Connector – MBE 4000 (2 of 4) – C Sample

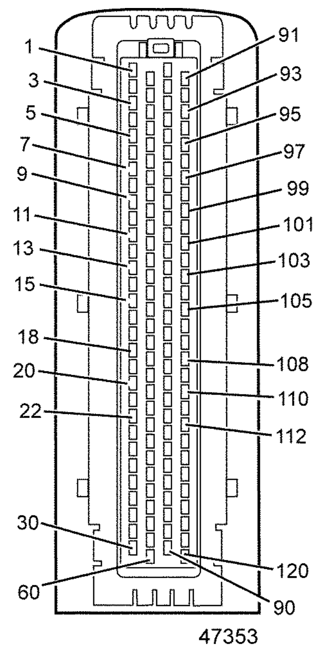
Pin	Function	Connector
61	EGR Valve	
62	Power Supply	
63	NC	
64	Power Supply	
65	Doser	
66	EPV2 (Entry Connecting Flap)	
67	Ground	
68	NC	
69	Fuel Cutoff Valve	
70	NC	
71	NC	
72	NC	
73	CKP (-)	
74	NC	
75	NC	
76	NC	
77	Supply Fuel Temperature Sensor	
78	NC	
79	Grid Heater	
80	NC	
81	NC	
82	Sensor Power Supply	
83	NC	
84	Fuel Compensation Pressure Sensor	
85	Sensor Power Supply	
86	Turbo Compressor Temperature Sensor	
87	Intake Manifold Pressure Sensor	
88	Sensor Ground	
89	DOC Inlet Temp Sensor	
90	Intake Air Throttle Position	

Table 17-3 MCM Connector – MBE 4000 (3 of 4) – C Sample

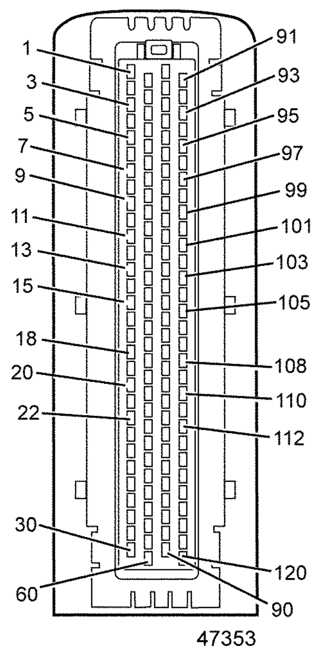
Pin	Function	Connector
91	Power Supply	
92	High Tech Grid Heater	
93	Power Supply	
94	NC	
95	Ground	
96	EPV1 (Entry Shutoff Flap)	
97	NC	
98	Single-speed Fan or Two-speed Fan	
99	NC	
100	Intake Air Throttle Valve 5 kHz (+)	
101	Intake Air Throttle Valve 5 kHz (-)	
102	Sensor Ground	
103	Sensor Ground	
104	Sensor Ground	
105	Sensor Ground	
106	Intake Air Temperature Sensor	
107	Electrostatic Oil Separator	
108	Engine Oil Temperature Sensor	
109	Intake Air Delta P Sensor	
110	Engine Coolant Temp Sensor	
111	Fuel Line Pressure Sensor	
112	NC	
113	NC	
114	Sensor Ground	
115	DPF Outlet Temp Sensor	
116	NC	
117	Sensor Power Supply	
118	DPF Inlet Pressure Sensor	
119	Intake Manifold Pressure Sensor	
120	Turbo Compressor Pressure Sensor	

Table 17-4 MCM Connector – MBE 4000 (4 of 4) – C Sample

17.2.2 Connector Brackets

The harnesses on MCM must be bracketed and held secure. The bracket design will change for different engines as the routing is different. The 120–pin connector and the 21-pin connector must be tie-wrapped to the brackets as shown in the following drawing for the MBE engines (see Figure 17-2).

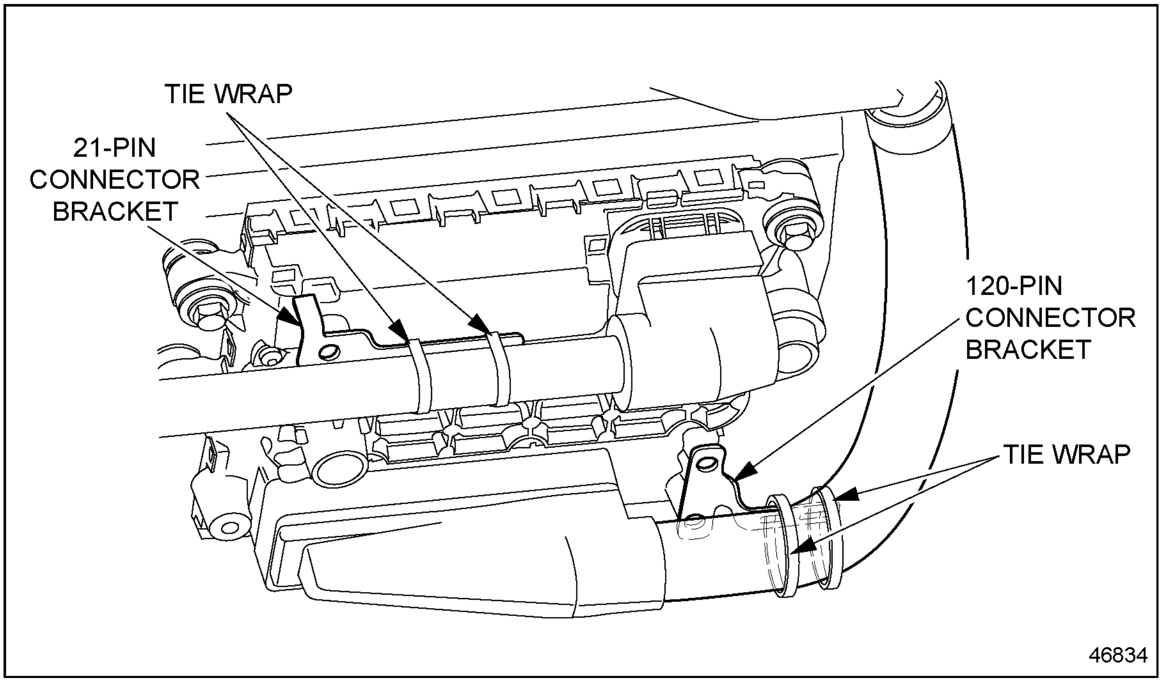


Figure 17-2 MBE 4000 120–pin Connector and 21–pin Connector Tie-wrapped to Brackets

17.2.3 MCM 21–pin and 31–pin Connectors

The wiring for the VIH 21–pin to the MCM is listed in Table 17-5. The side of the connector shown is looking into the pins.

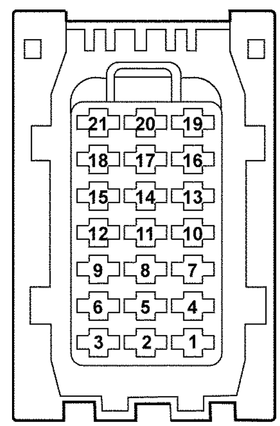
Pin	Signal Type	Function	Connector
21/1	CAN2L	Not Used	 45801 Front Looking into the Pins on the Harness
21/2	CAN2GND	Not Used	
21/3	CAN2H	Not Used	
21/4	CAN2GND	Not Used	
21/5	KL31	Battery (-)	
21/6	KL31	Battery (-)	
21/7	KL15	IGN	
21/8	KL31	Battery (-)	
21/9	KL31	Battery (-)	
21/10	CAN1GND	Engine CAN Shield	
21/11	KL30	Battery (+)	
21/12	KL30	Battery (+)	
21/13	CAN1H	Engine CAN +	
21/14	KL30	Battery (+)	
21/15	KL30	Battery (+)	
21/16	CAN1GND	Not Used	
21/17	BOOT	Not Used	
21/18	KDiag_S	Not Used	
21/19	CAN1L	Engine CAN –	
21/20	KL50	Crank Start Input	
21/21	START_B	Crank Activation Output	

Table 17-5 21–Pin Connector to the MCM

The pinout for the 31–pin pigtail on the Engine Harness is listed in Table 17-6. The OEM is responsible for wiring to this connector.

Pin	Function	Series 60	MBE900	MBE 4000	HDE
31/1	Spare	—	—	—	—
31/2	Power Supply (IGN)	—	—	—	X
31/3	Fuel Heater Supply #1†	—	X	—	X
31/4	Spare	X	X	X	X
31/5	Full Heater Supply #2†	—	X	—	X
31/6	Spare	—	—	—	—

Pin	Function	Series 60	MBE900	MBE 4000	HDE
31/7	Power Supply #2 Ground*	—	—	—	X
31/8	Ether Start	X	—	—	—
31/9	Fan Control #2 – High of Two-speed Fan or Variable Speed Fan	X	X	X	X
31/10	Single Speed Fan or Low for Two-speed Fan	X	X	X	X
31/11	Fuel Heater Ground #1†	—	X	—	X
31/12	AC Compressor Ground (FL)	—	—	—	—
31/13	Spare	—	—	—	—
31/14	Water-in-Fuel Sensor Supply	—	X	—	—
31/15	Water-in-Fuel Sensor Ground	—	X	—	—
31/16	Engine Brake Solenoid Control	—	X	—	—
31/17	DOC Outlet Temp Sensor (Exhaust Gas Temperature in Front of Particulate Trap)	X	X	X	X
31/18	DOC Inlet Temp Sensor	X	X	X	X
31/19	DPF Outlet Temp Sensor(Exhaust Gas Temperature After Particulate Trap)	X	X	X	X
31/20	Full Heater Ground #2†	—	X	—	X
31/21	Spare	—	—	—	—
31/22	Power Supply (Eng Brk, Fan, Ether)	X	X	X	X
31/23	Fan Speed	X	X	X	X
31/24	Sensor Ground	X	X	X	X
31/25	Spare	—	—	—	—
31/26	Water-in-Fuel Sensor	—	X	—	—
31/27	TCI Temp	X	—	—	—
31/28	Sensor Ground	X	X	X	X
31/29	Sensor Supply	X	X	X	X
31/30	DPF Outlet Pressure Sensor (Exhaust Gas Pressure After Particulate Filter)	X	X	X	X
31/31	DPF Inlet Pressure Sensor (Exhaust Gas Pressure Before Particulate Filter)	X	X	X	X

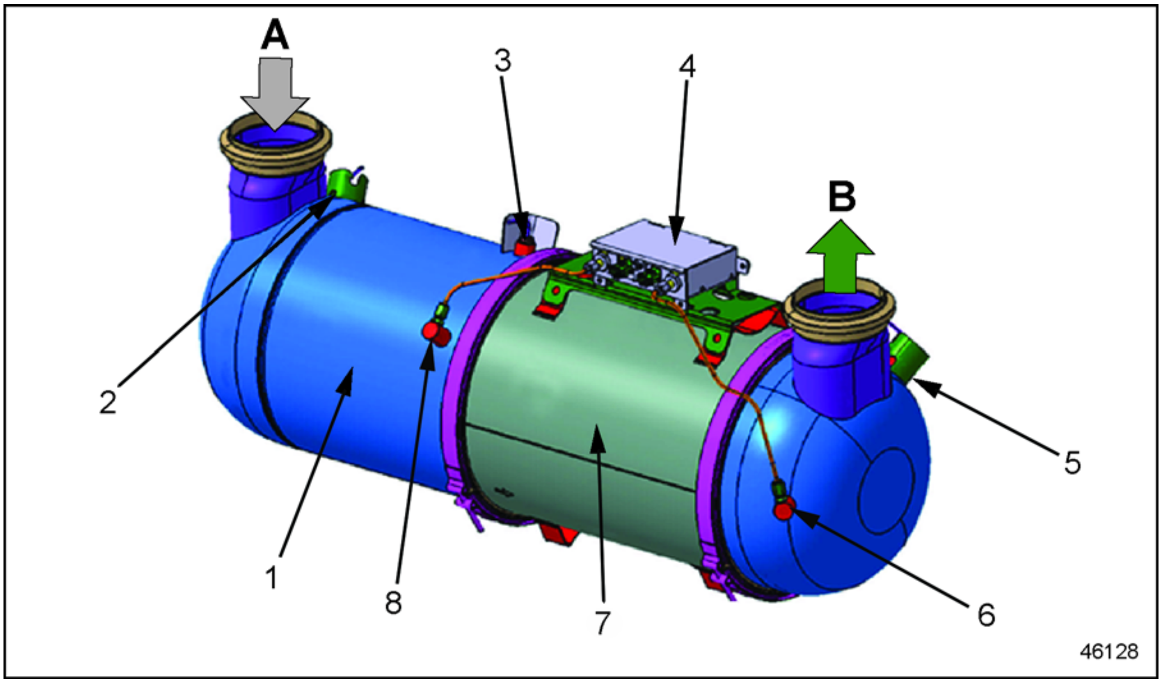
*Fused at 15 amps

† Optional for MBE900 and HDE. Must use 14 AWG wire and fuse at 20A.

Table 17-6 31–pin MCM Pigtail Connector

17.2.4 DPF Harness

The Aftertreatment Device (ATD) configuration includes a Diesel Oxidation Catalyst (DOC) and a Diesel Particulate Filter (DPF). See Figure 17-3.



1. Diesel Oxidation Catalyst
2. DOC Inlet Temperature Sensor
3. DOC Outlet Temperature Sensor
4. Sensor Junction Box
5. DPF Outlet Temperature Sensor
6. Diesel Particulate Filter
7. A= Engine Exhaust Inlet
8. B= Exhaust Outlet

Figure 17-3 Aftertreatment Device

The ATD may be horizontally or vertically mounted depending on the vehicle chassis configuration. See Figure 17-4 for a typical mounting view of the ATD.

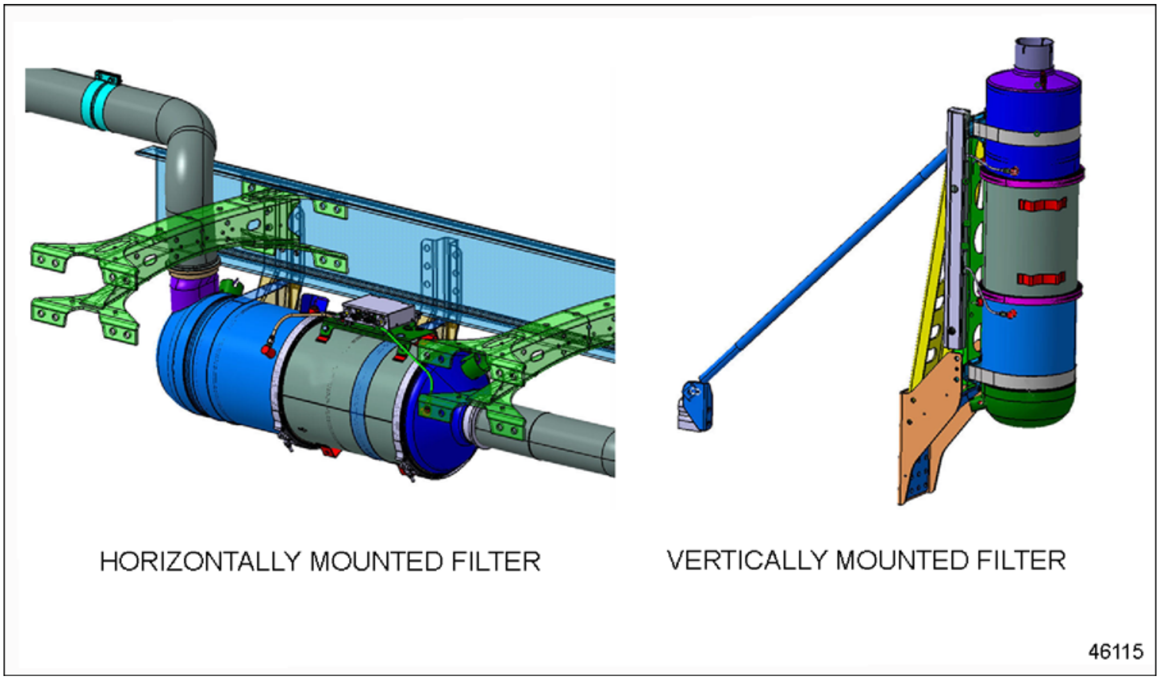


Figure 17-4 Typical Mounting Views of an Aftertreatment Device

The wiring for the DPF Harness is determined by the ATD mount position.

17.2.4.1 DPF Harness – Vertical Mount ATD (31-pin to 10 pin connector)

See Figure 17-5 for the DPF Harness wiring for a vertical mount ATD.

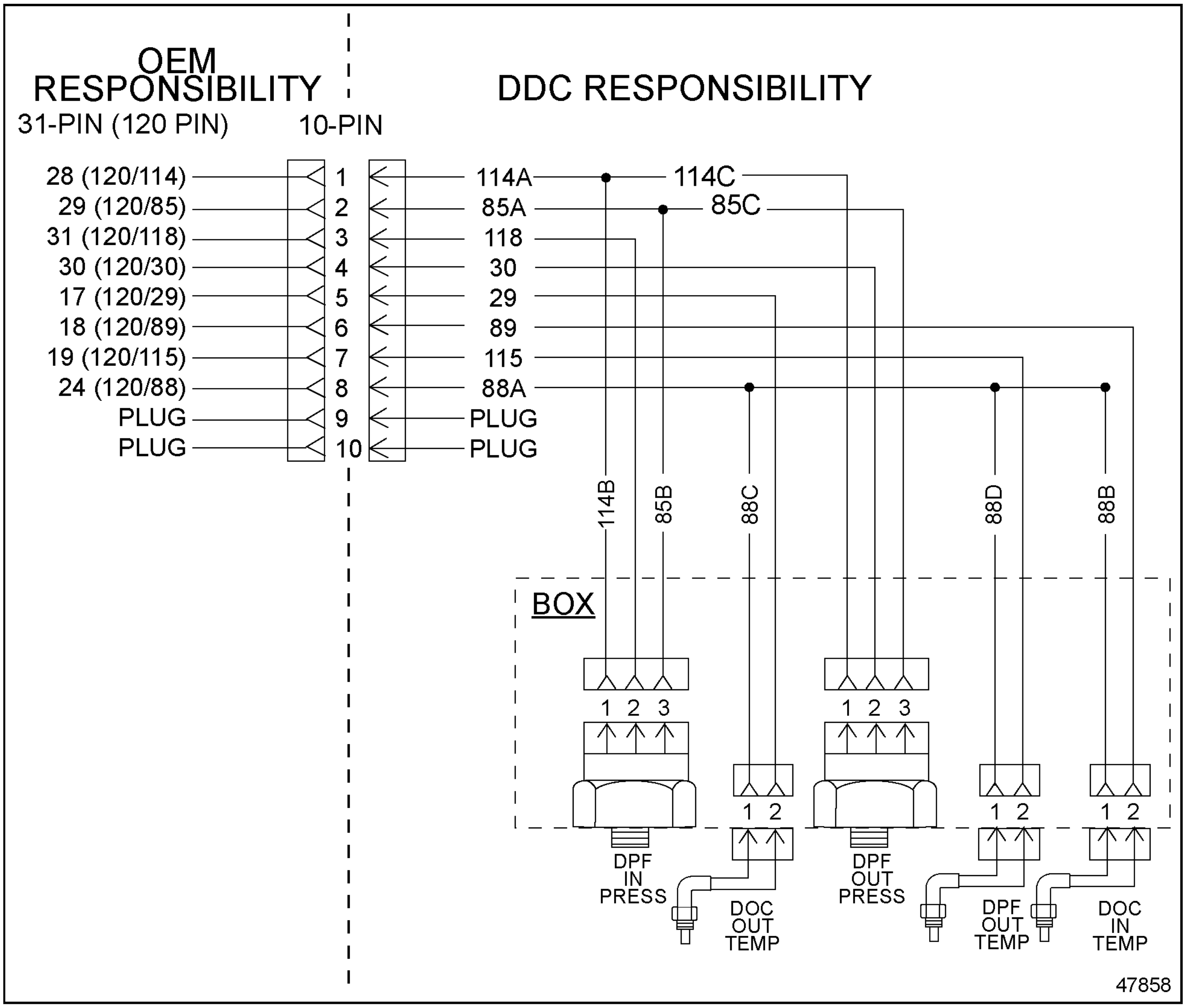
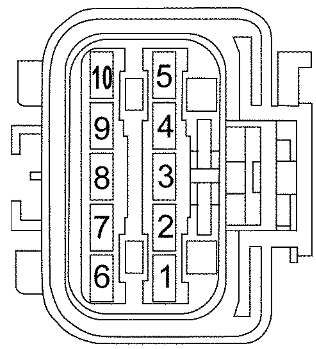


Figure 17-5 Vertical and Under Step Mount ATD Wiring — OEM Responsibility

The wiring for the 10–pin DPF connector is listed in Table 17-7.

<table>
<tr><th>Pin</th><th>Function</th><th>Connector</th></tr>
<tr><td>1</td><td>Sensor Ground</td><td rowspan="10">

45608</td></tr>
<tr><td>2</td><td>Sensor Supply</td></tr>
<tr><td>3</td><td>DPF Inlet Pressure Sensor (Exhaust Gas Pressure Before Particulate Filter)</td></tr>
<tr><td>4</td><td>DPF Outlet Pressure Sensor (Exhaust Gas Pressure After Particulate Filter)</td></tr>
<tr><td>5</td><td>DOC Outlet Temperature Sensor (Exhaust Gas Temp in Front of Particulate Trap)</td></tr>
<tr><td>6</td><td>DOC Inlet Temperature Sensor</td></tr>
<tr><td>7</td><td>DPF Outlet Temperature Sensor(Exhaust Gas Temp After Particulate Trap)</td></tr>
<tr><td>8</td><td>Sensor Ground</td></tr>
<tr><td>9</td><td>Plug</td></tr>
<tr><td>10</td><td>Plug</td></tr>
</table>

Table 17-7 DPF 10–pin Connector

17.2.4.2 DPF Harness – Horizontal Mount ATD (31-pin to 10-pin Connector/2-pin Connector)

See Figure 17-6 for the DPF Harness wiring for a horizontal mount ATD.

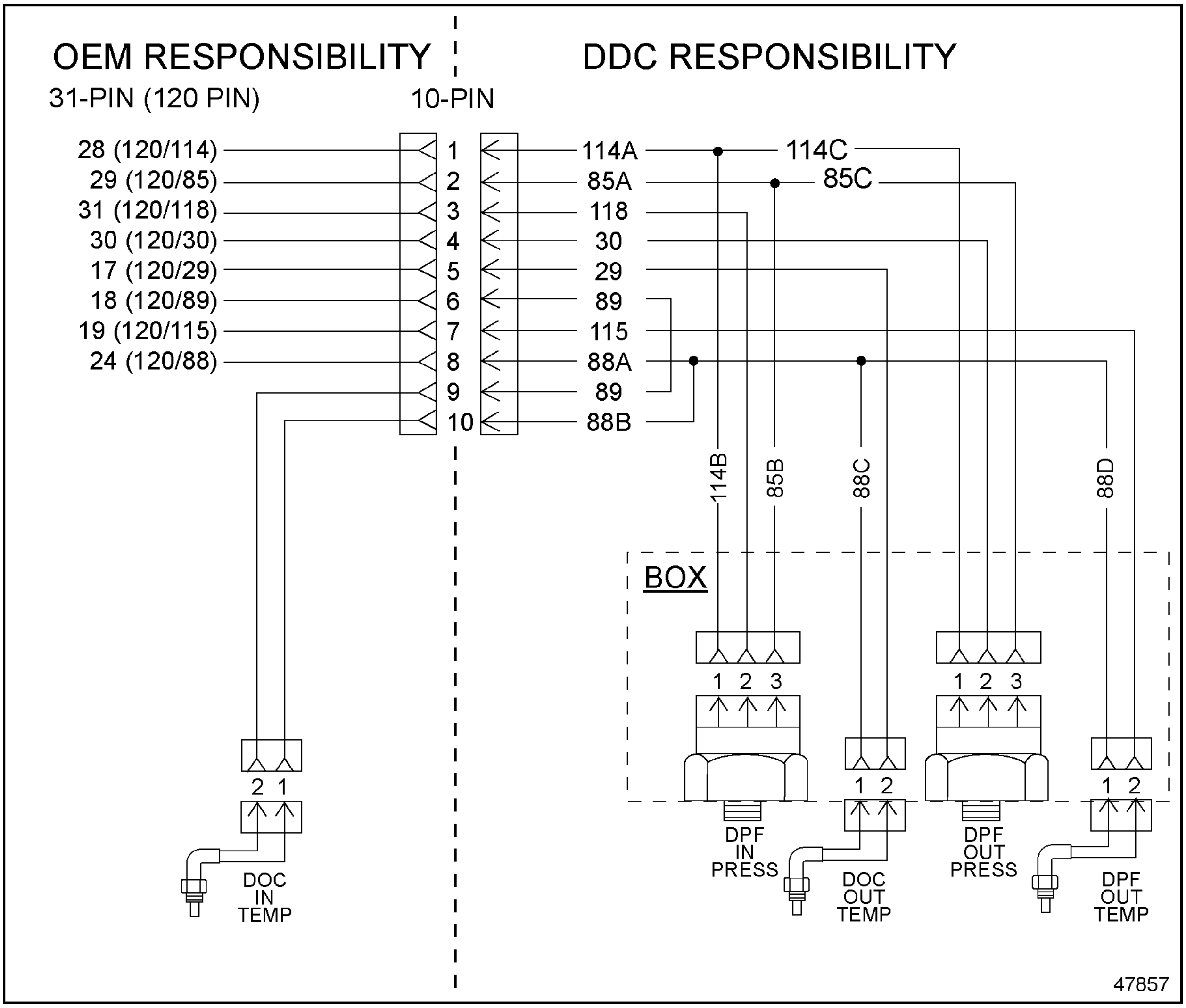


Figure 17-6 Horizontal Mount ATD Wiring — OEM Responsibility

The wiring for the DPF 10–pin connector and 2–pin connector is listed in Table 17-8.

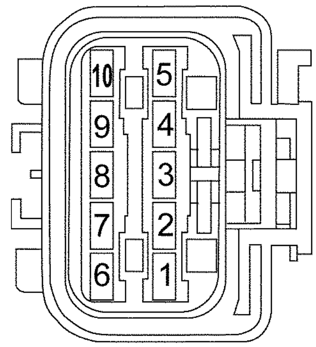
Pin	Function	Connector
1	Sensor Ground	 45608
2	Sensor Supply	
3	DPF Inlet Pressure Sensor (Exhaust Gas Pressure Before Particulate Filter)	
4	DPF Outlet Pressure Sensor (Exhaust Gas Pressure After Particulate Filter)	
5	DOC Outlet Temperature Sensor (Exhaust Gas Temp in Front of Particulate Trap)	
6	DOC Inlet Temperature Sensor	
7	DPF Outlet Temperature Sensor(Exhaust Gas Temp After Particulate Trap)	
8	Sensor Ground	**DPF 2–pin Connector**
9	DOC Inlet Temperature Sensor	2
10	Sensor Ground	1

Table 17-8 DPF 10–pin Connector and 2–pin Connector — Horizontal Mount ATD

17.3 COMMON POWERTRAIN CONTROLLER

The Common Powertrain Controller (CPC) has three 18–pin connectors and one 21–pin connector. The following sections contain the connector pin-outs for truck. vocational, transit bus and crane applications.

The CPC is the interface between the MCM and the vehicle/equipment for engine control and manages other vehicle/equipment functions. See Figure 17-7.

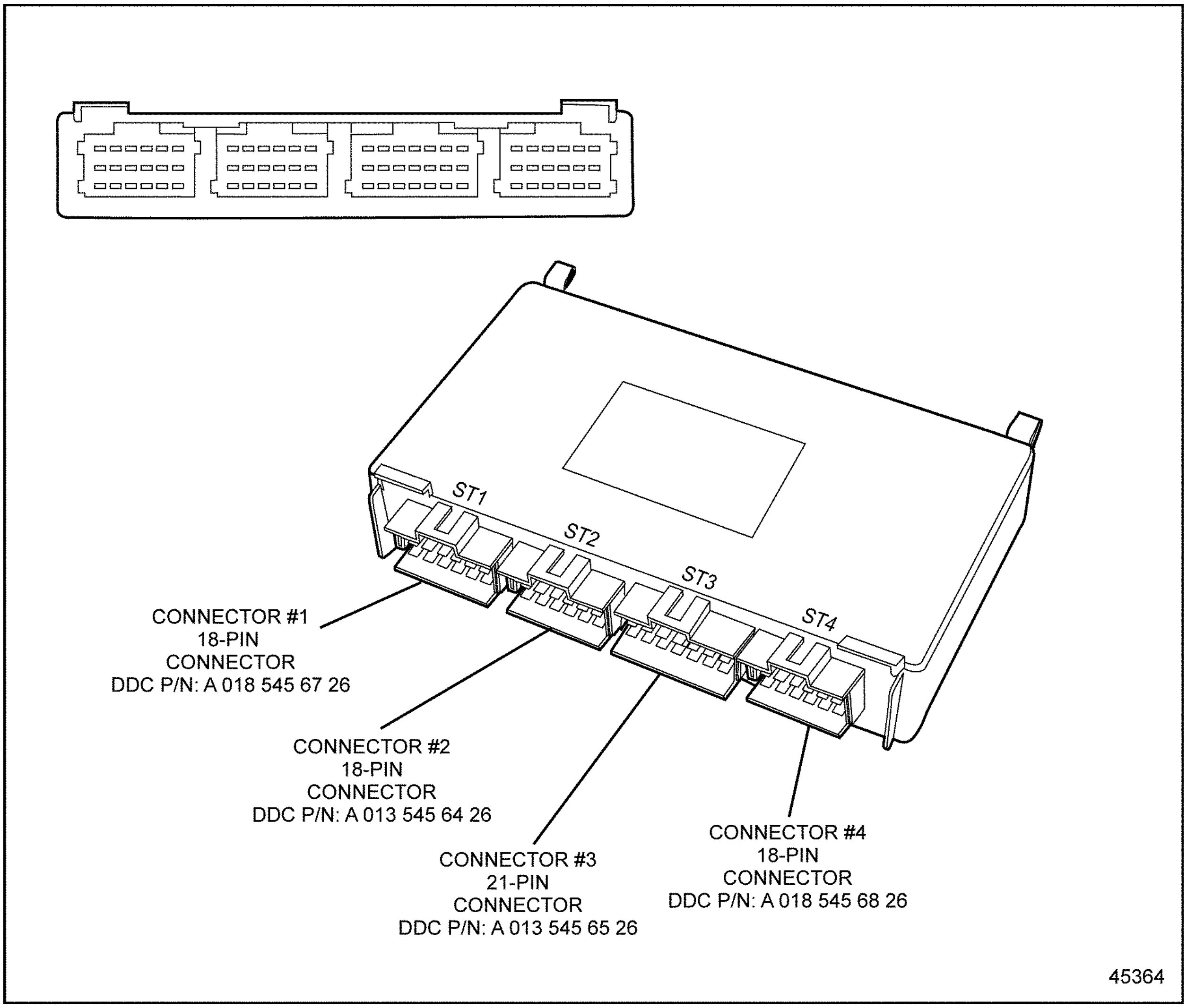


Figure 17-7 The Common Powertrain Controller

The OEM is responsible for mounting this part in an enclosed, protected environment. The mounting bracket is the responsibility of the OEM. There must be maximum physical separation of the VIH from other vehicle/equipment electrical systems. Other electrical system wires should ideally be at least three feet away from the VIH and should not be parallel to the VIH. This will eliminate coupling electromagnetic energy from other systems into the VIH.See Figure 17-8 for the CPC dimensions.

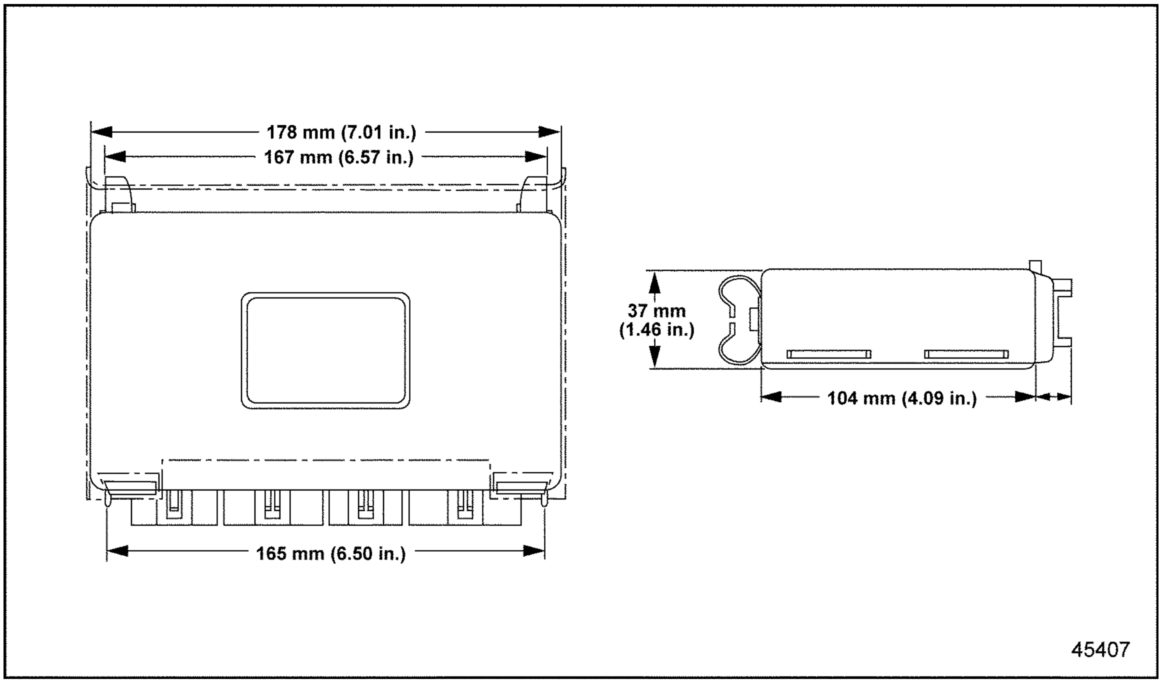


Figure 17-8 CPC Dimensions

NOTE:
The CPC should be mounted with the connectors pointing down.

The CPC communicates over the J1587 and J1939 Data Links to the vehicle (see Figure 17-9).

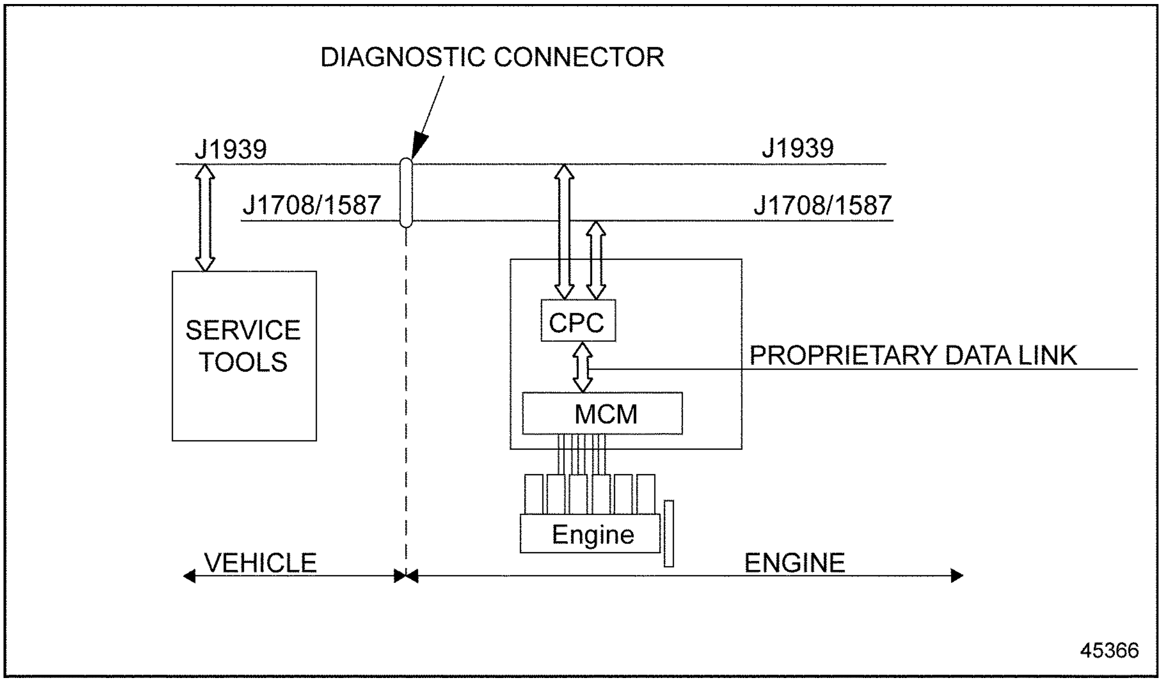


Figure 17-9 NAFTA Architecture On-highway

Within the CPC, sets of data for specific applications are stored. These include idle speed, maximum running speed, and speed limitation. Customer programmable parameters are also stored here.

The CPC receives data from the operator (accelerator pedal position, switches, various sensors) and other electronic control units (for example, synchronization controllers for more than one genset, air compressor controls).

From this data, instructions are computed for controlling the engine and transmitted to the MCM via the proprietary data link.

17.3.1 Environmental Conditions

Temperature, vibration, and water intrusion must be considered.

17.3.1.1 Temperature

The ambient operating temperature range is –40°F to 185°F (-40°C to 85°C).

17.3.1.2 Water Intrusion

The CPC is not water tight and cannot be subject to water spray. It must be mounted in an enclosed, protected environment.

17.3.2 CPC Vehicle Interface Harness

The OEM supplied Vehicle Interface Harness (VIH) connects the CPC to the MCM and other vehicle systems (see Figure 17-10).

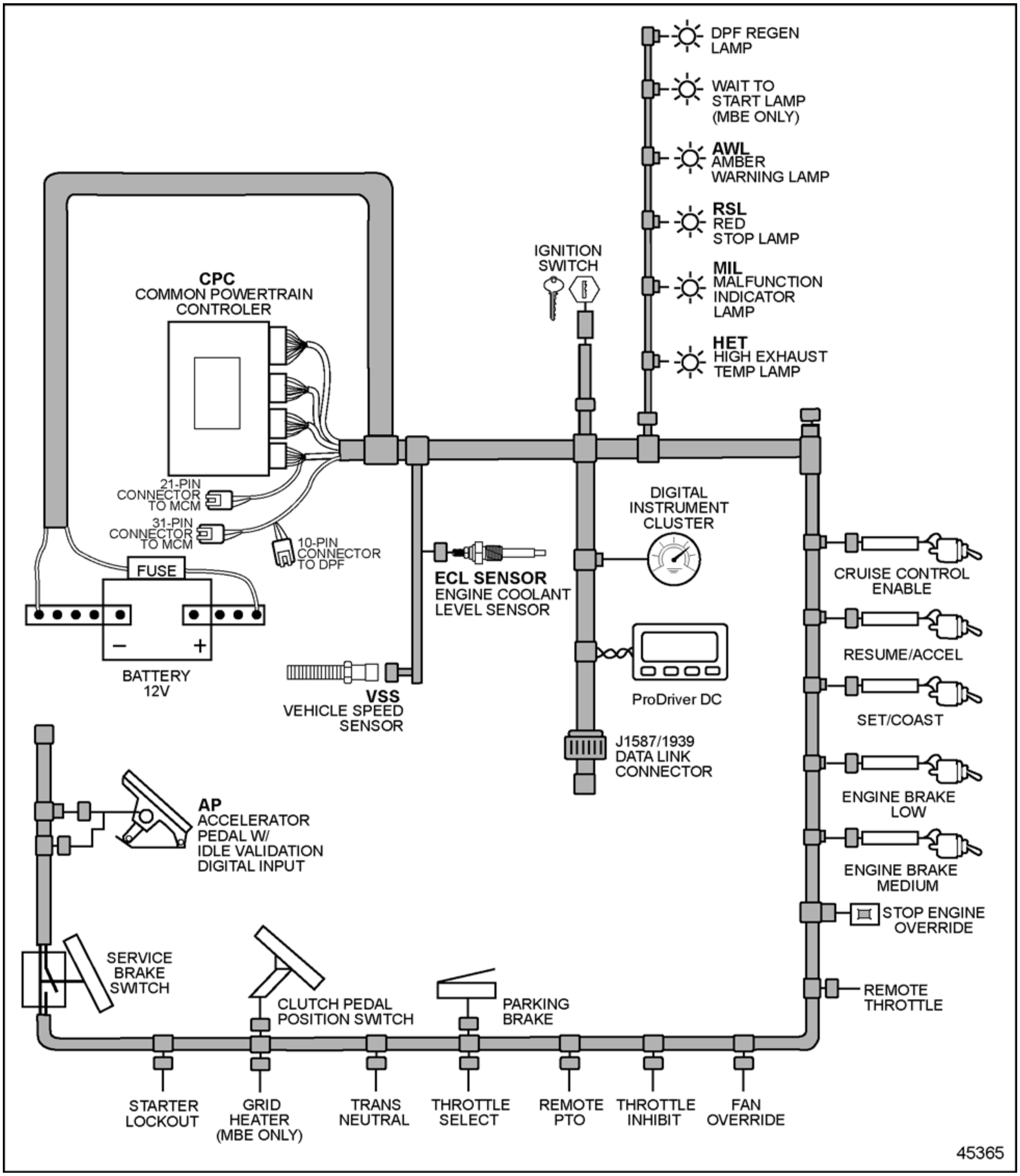


Figure 17-10 Vehicle Interface Harness

The following criteria are to be used when designing the VIH:

- The four vehicle connectors are designed to accept 18 AWG wires for all circuits.
- The conductor must be annealed copper, not aluminum, and must comply with the industry standard SAE J1128 document.
- Color code the wires as shown in the schematics. If the wires used are the same color, hot stamp the cavity number on the wires.

NOTE:
The Vehicle Speed Sensor (VSS) must be a twisted pair. The twists are a minimum of 12 turns per foot (305 mm) and are required to minimize electromagnetic field coupling.

NOTE:
J1939 cable is required for the J1939 datalink wires. Refer to SAE J1939–11 spec for specific requirements.

The low speed propriety Engine-CAN link between the MCM and the CPC must be a twisted shielded cable with 0.75 mm diameter wire (approximately 20 AWG), bundle shielded with drain wire and 30 twists per meter. The insulation is rated to 105°C. Termination resistors for the Engine-CAN link are located in the CPC and MCM.

17.3.2.1 Frequency Input

The CPC has one frequency input on the VIH that can accept a variable reluctance sensor. A typical frequency input functions is the Vehicle Speed Sensor (VSS). Requirements for a variable reluctance signal interface are listed in Table 17-9.

Parameter	Range
Input Amplitude Range	V Peak to Peak
Input Frequency Range	0 to 10,000 Hz

Table 17-9 Variable Reluctance Signal Interface

17.3.3 Power Supply – 12 Volt System

Normal operating voltage on a 12 V system for the CPC and MCM is 11-16 VDC.

NOTICE:
Operating the CPC or MCM over the voltage limits of 16 volts will cause damage to the CPC or MCM.

Operating the CPC and/or MCM between 8 and 11 volts may result in degraded engine operation. (Transient operation in this range during engine starting is considered normal for 12 volt systems.)

NOTICE:
Reversing polarity will cause damage to the CPC and/or MCM if the Power Harness is not properly fused.

NOTE:
All output loads, ignition and CPC power must be powered from the same battery voltage source.

17.3.3.1 Average Current Draw

The maximum average current draw is listed in Table 17-10. This information should be used to size the alternator.

System	Maximum Average Current Draw (12 V Nominal Supply)		
	Crank	Idle	Full Load/Rated Speed
MCM – Engine Loads	1.0 A avg	21.0 A avg	25.0 A avg
CPC – Vehicle Loads*	18.0 A peak	55.0 A peak	55.0 A peak

* Vehicle loads are controlled by the OEMs who can best determine the total maximum current draw for their installation.

Table 17-10 Maximum Average Current Draw

The current draw for a CPC configuration is listed in Table 17-11.

Configuration	Condition	Current
CPC	Ignition Off	<1 mA
	Ignition On and Engine Stopped	120 mA

Table 17-11 Current Draw for CPC Configuration

The current draw for a MCM is listed in Table 17-12.

Configuration	Condition	Current
MCM	Ignition Off	<1 mA
	Ignition On and Engine Stopped	400 mA

Table 17-12 Current Draw for MCM Configuration

17.3.3.2 Battery Isolator

A battery isolator is not required. However, some applications require a battery that is dedicated to the engine and completely isolated from the rest of the vehicle. Commercially available battery isolators can be used.

17.3.3.3 Main Power Shutdown

The main power supply shutdown schematic shows the DDC approved method for main power switch implementation. See Figure 17-11.

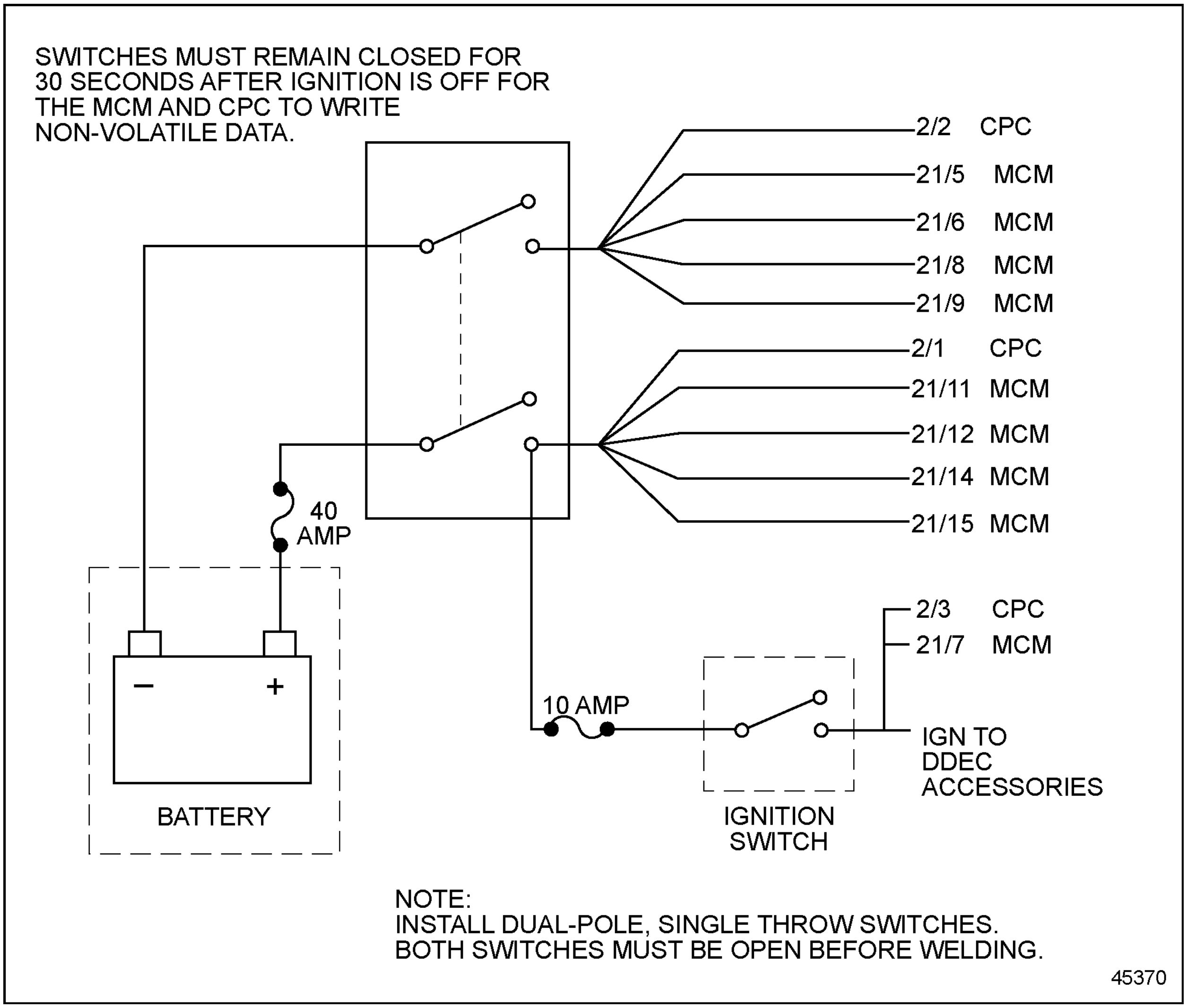


Figure 17-11 Main Power Supply Shutdown

NOTE:
Switches must remain closed for 30 seconds after ignition is off for the MCM and CPC to write non-volatile data.

NOTE:
It is recommended that both the positive (+) and negative (-) battery leads be disconnected.

NOTE:
Disconnecting positive power is not sufficient to isolate the CPC for welding purposes.

NOTICE:
When welding, the following must be done to avoid damage to the electronic controls or the engine: □ Both the positive (+) and negative (-) battery leads must be disconnected before welding. □ The welding ground wire must be in close proximity to welding location - the engine must never be used as a grounding point. □ Welding on the engine or engine mounted components is NEVER recommended.

NOTE:
The alternator should be connected directly to the battery for isolation purposes.

17.3.4 Fuses

A Battery (+) fuse and an ignition circuit fuse must be provided by the vehicle wiring harness. Blade-type automotive fuses are normally utilized; however, manual or automatic reset circuit breakers which meet the following requirements are also acceptable. The fuse voltage rating must be compatible with the CPC – MCM's maximum operating voltage of 16 volts.

CAUTION: **FIRE**
To avoid injury from fire, additional loads should not be placed on existing circuits. Additional loads may blow the fuse (or trip the circuit breaker) and cause the circuit to overheat and burn.

CAUTION:

FIRE

To avoid injury from fire, do not replace an existing fuse with a larger amperage fuse. The increased current may overheat the wiring, causing the insulation and surrounding materials to burn.

The ignition fuse current rating must be sized for the loads utilized in each application; however, a rating of between 5 and 10 amps is usually sufficient.

The Battery (+) fuse current rating must satisfy two criteria:

- Must not open during normal operation
- Must open before the MCM or CPC is damaged during a reverse battery condition

Bussmann ATC-30 and Delphi Packard Electric Systems MaxiFuse 30 amp rated fuses or equivalent will satisfy these requirements. Acceptable blow times versus current and temperature derating characteristics are listed in Table 17-13 and Table 17-14.

% of Rated Fuse Current	Minimum Blow Time	Maximum Blow Time
100%	100 hours	—
135%	1 minutes	30 minute
200%	6 seconds	40 seconds

Table 17-13 Fuse Current and Blow Time

Temperature	% of Rated Fuse Current
-40°C	110% max
+25°C	100%
+120°C	80% min

Table 17-14 Fuse Temperature and Current

17.3.5 Connectors

There are three 18–pin connectors and one 21–pin connector to the CPC. The OEM is responsible for the four connectors at the CPC, the 21–pin connector at the MCM, the 31–pin MCM pigtail connector and the 10–pin DPF connector.

NOTE:
The CPC connectors are not water tight and cannot be subject to water spray.

17.3.5.1 Data Link Connector

The SAE J1708/J1587 nine-pin data link connector is required. DDC recommends that the OEM-supplied Data Link Connector be conveniently positioned in a well protected location facilitating subsequent DDDL 7.0 usage (i.e., reprogramming, diagnostics, etc.).

NOTE:
REQUIRED: The J1939 data link must be wired to this connector.

The following illustration shows the wiring for the nine-pin connector (see see Figure 17-12).

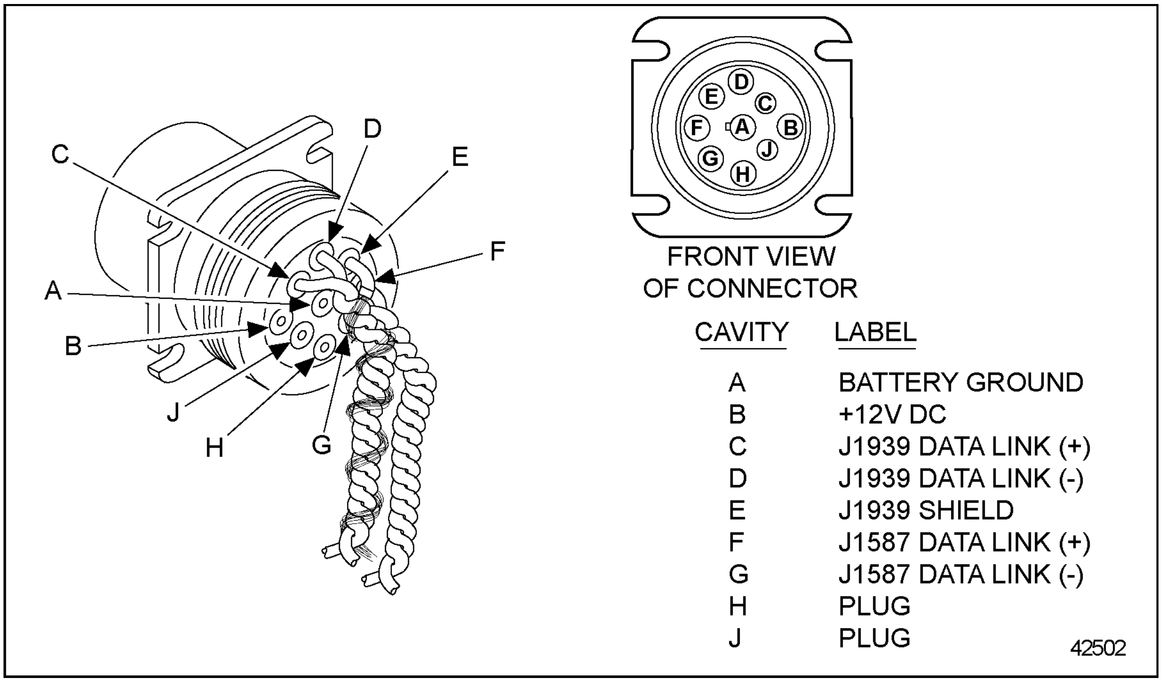


Figure 17-12 Wiring for 9-pin Data Link Connector

The SAE J1587/J1708 Data Link must be twisted pairs. The twists are a minimum of 12 turns per foot (305 mm). The maximum length for the SAE J1587/J1708 Data Link is 130 ft (40 m).

17.4 WIRES AND WIRING

Detroit Diesel Corporation recommends color coding and hot stamping wire numbers in contrasting colors at intervals of four inches or less.

17.4.1 General Requirements

NOTE:
Avoid renumbering DDC circuits since all troubleshooting guides reference the circuit numbers shown in the schematic. DDC suggests including a prefix or suffix with the DDC circuit numbers when conflicts exist.

17.4.2 General Wire

All wires used in conjunction with DDEC VI must meet the following criteria:

NOTICE:
DDC does not recommend using any type of terminal lubricant or grease compounds. These products may cause dirt or other harmful substances to be retained in the connector. DDC has not tested these products and cannot stand behind their use.

NOTICE:
Insulation must be free of nicks.

- Tape, conduit, loom or a combination thereof must be used to protect the wires. Refer to section 17.6 and refer to section 17.5.
- All wires must be annealed copper wire (not aluminum).
- All wires must comply with SAE J1128.
- All wires must be insulated with cross-link polyethylene (XLPE) such as GXL, or any self-extinguishing insulation having a minimum rating of -40°C (-40°F) to 125°C (257°F).

17.4.3 Crimp tools

The part numbers for the crimp tools for working with the MCM and CPC connectors are listed in Table 17-15.

Description	Part Number
Extraction Tool	726503–1
Hand Crimp Tool	169400–0
Crimp Dies for 0.5 mm – 1.0 mm Terminals	734262–0
Crimp Dies for 1.0 mm – 2.5 mm Terminals	169917–0

Table 17-15 Crimp Tools

17.4.4 Deutsch Terminal Installation And Removal

The method of terminal installation and removal varies. The following sections cover Deutsch terminal installation and removal.

17.4.4.1 Deutsch Terminal Installation Guidelines

Deutsch connectors have cable seals molded into the connector. These connectors are push-to-seat connectors with cylindrical terminals. The diagnostic connector terminals are gold plated for clarity.

NOTICE:
Improper selection and use of crimp tools have varying adverse effects on crimp geometry and effectiveness. Proper installation of terminals require specialized tools. Do not attempt to use alternative tools.

The crimp tool to use in Deutsch terminal installation is J–34182 (Kent-Moore part number).

NOTICE:
Terminal crimps must be made with the Deutsch crimp tool P/N: HDT-48-00 to assure gas tight connections.

NOTICE:
If a separate seal is required, be sure to install the seal onto the wire before stripping the insulation.

Use the following instructions for installing Deutsch terminals:

1. Strip approximately .25 inch (6 mm) of insulation from the cable.
2. Remove the lock clip, raise the wire gage selector, and rotate the knob to the number matching the gage wire that is being used.
3. Lower the selector and insert the lock clip.
4. Position the contact so that the crimp barrel is 1/32 of an inch above the four indenters. See Figure 17-13. Crimp the cable.

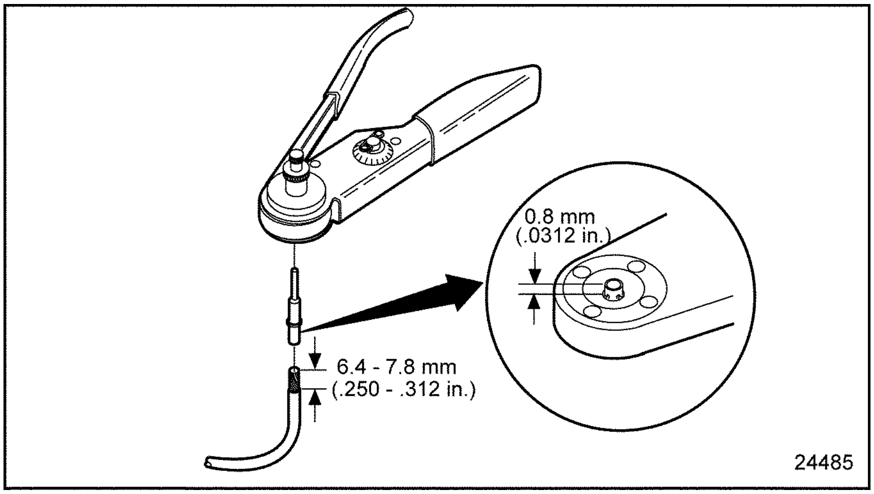


Figure 17-13 Setting Wire Gage Selector and Positioning the Contact

5. Grasp the contact approximately one inch behind the contact crimp barrel. Hold the connector with the rear grommet facing you. See Figure 17-14.

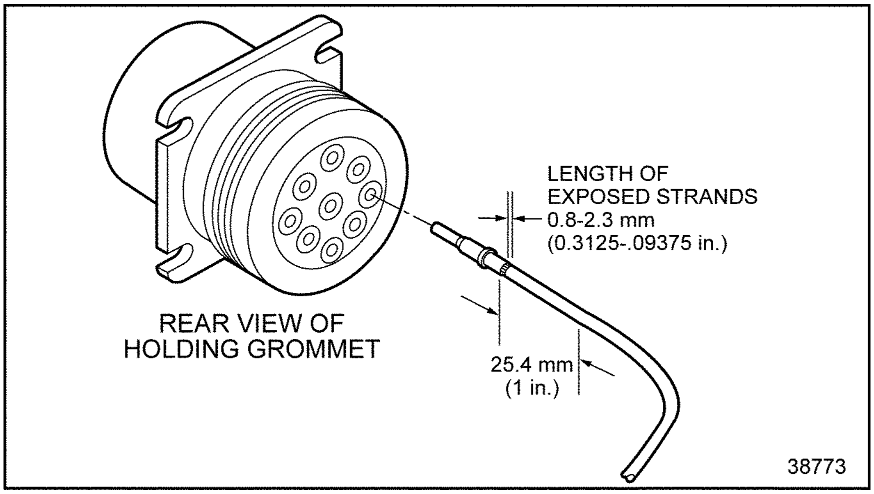


Figure 17-14 Pushing Contact Into Grommet

6. Push the contact into the grommet until a positive stop is felt. See Figure 17-14. A slight tug will confirm that it is properly locked into place. See Figure 17-15.

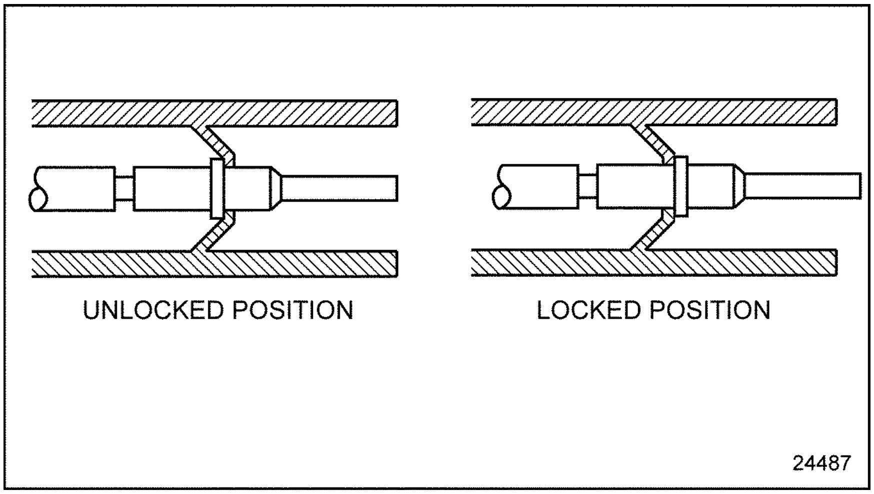


Figure 17-15 Locking Terminal Into Connector

17.4.4.2 Deutsch Terminal Removal

The appropriate size removal tool should be used when removing cables from connectors. The proper removal tools are listed in Table 17-16.

Tool	Kent-Moore Part Number
Removing (12 AWG)	J–37451
Removing (16-18 AWG)	J–34513-1

Table 17-16 Removal Tools for Deutsch Terminals

Remove Deutsch terminals as follows:

1. With the rear insert toward you, snap the appropriate size remover tool over the cable of contact to be removed. See Figure 17-16.

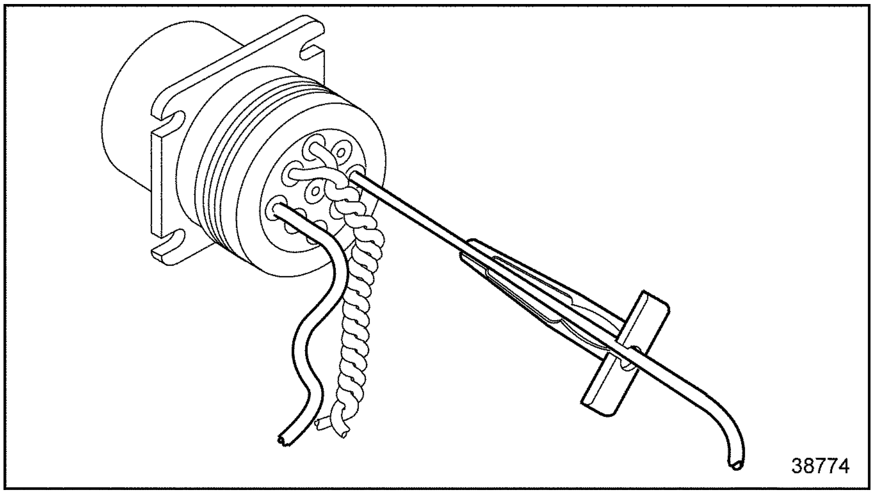


Figure 17-16 Removal Tool Position

2. Slide the tool along the cable into the insert cavity until it engages and resistance is felt. Do not twist or insert tool at an angle. See Figure 17-17.

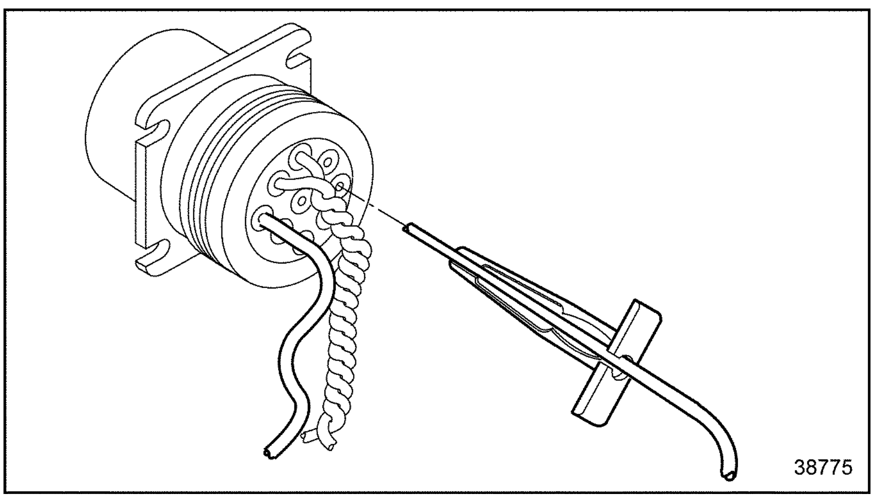


Figure 17-17 Removal Tool Insertion

3. Pull contact cable assembly out of the connector. Keep reverse tension on the cable and forward tension on the tool.

17.4.5 Splicing Guidelines

The following are guidelines which may be used for splices. The selection of crimpers and splice connectors is optional. Select a high quality crimper equivalent to the Kent-Moore tool, J–38706, and commercially available splice clips.

The recommended technique for splicing and repairing circuits (other than power and ignition circuits) is a clipped and soldered splice. Alternatively, any method that produces a high quality, tight (mechanically and electronically sound) splice with durable insulation is considered to be acceptable.

17.4.5.1 Clipped and Soldered Splicing Method

The tools required are listed in Table 17-17.

Tool	Part Number
Heat Gun	--
Sn 60 solder with rosin core flux	--
Wire Stripper	Kent-Moore J–35615 or equivalent
Splice Clips (commercially available)	Wire size dependent
Heat Shrink Tubing	Raychem HTAT or equivalent

Table 17-17 Recommended Splicing Tools

The criteria for splicing straight leads is:

- No more than one strand in a 16 strand wire may be cut or missing.
- Use Sn 60 solder with rosin core flux.
- The exposed wire must be clean before the splice is soldered.

Soldering splice connectors is optional. To solder splice connectors:

1. Position the leads, so one overlaps the other. See Figure 17-18.

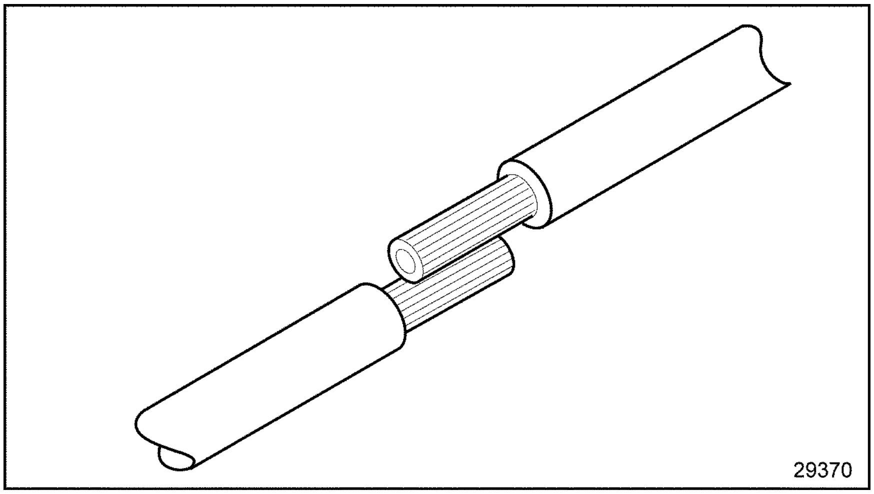


Figure 17-18 Positioning the Leads

2. Secure the leads with a commercially available clip and hand tool. See Figure 17-19.

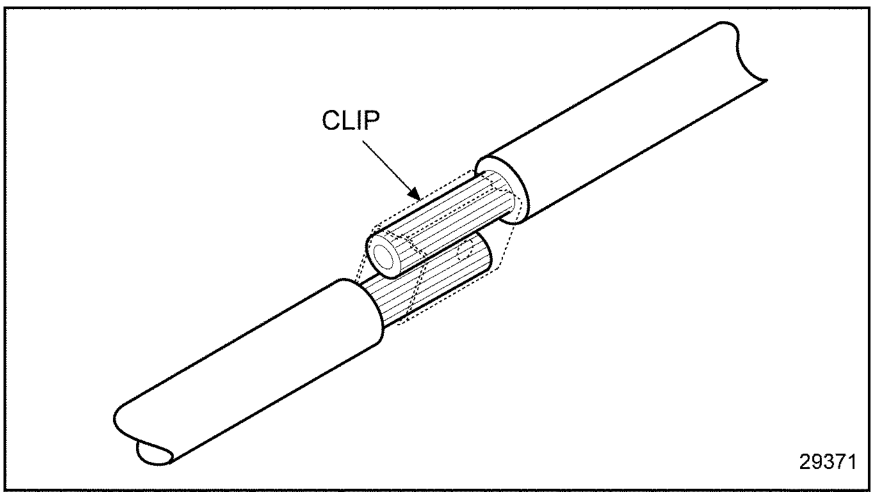


Figure 17-19 Securing the Leads With a Clip

3. Use a suitable electronic soldering iron to heat the wires. Apply the solder to the heated wire and clip (not to the soldering iron) allowing sufficient solder flow into the splice joint.

4. Pull on wire to assure crimping and soldering integrity. The criteria listed in Table 17-18 must be met.

Wire Gage	Must Withstand Applied Load
14 AWG	45 lb (200 N)
16 AWG	27 lb (120 N)
18 AWG	20 lb (90 N)

Table 17-18 Applied Load Criteria for Terminals

5. Loop the lead back over the spliced joint and tape. See Figure 17-20.

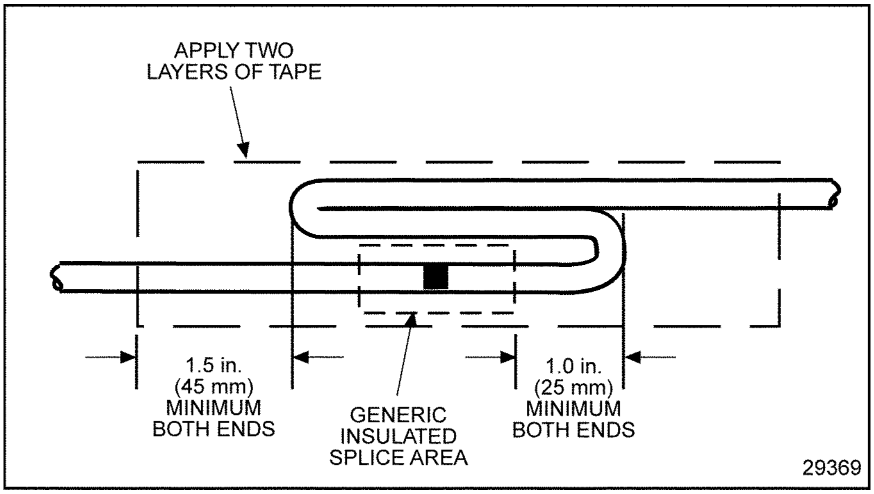


Figure 17-20 Recommended Strain Relief of Spliced Joint

17.4.5.2 Splicing and Repairing Straight Leads-Alternate Method 1

The tools required are listed in Table 17-19.

Tool	Part Number
Heat Gun	--
Wire Stripper	Kent-Moore J–35615 or equivalent
Splice Clips (commercially available)	Wire size dependent
Heat Shrink Tubing	Raychem HTAT or equivalent
Terminal Crimper for Metri-Pack 280 (12 AWG)	Kent-Moore J–38125-6
Terminal Crimper for Metri-Pack 280 (18 AWG)	Kent-Moore J–39848
Terminal Crimper for Weather Pack	Kent-Moore J–35606
Terminal Crimper for Deutsch	Kent-Moore J–34182
Terminal Crimper for Metri-Pack 150	Kent-Moore J–35123

Table 17-19 Recommended Splicing Tools

NOTE:
When splicing straight leads, no more than one strand in a 16 strand wire may be cut or missing.

The recommended method to splice straight leads follows:

1. Locate broken wire.
2. Remove insulation as required; be sure exposed wire is clean and not corroded.
3. Insert one wire into the splice clip until it butts against the clip. Stop and crimp (see Figure 17-21, A).
4. Insert the other wire into the splice clip until it butts against the clip stop (see Figure 17-21, B).

NOTICE:

Any terminal that is cracked or ruptured is unacceptable as malfunctions may occur.

5. Visually inspect the splice clip for cracks, rupture, or other crimping damage. Remove and replace damaged clips before proceeding.
6. Pull on wire to ensure the splice integrity. The criteria listed in Table 17-20 must be met.

Wire Gage	Must Withstand Applied Load
14 AWG	45 lb (200 N)
16 AWG	27 lb (120 N)
18 AWG	20 lb (90 N)

Table 17-20 Applied Load Criteria for Terminals

7. Shrink the splice clip insulative casing with a heat gun to seal the splice (see Figure 17-21, C).

NOTICE:
Splices may not be closer than 12 in. (.3 m) apart to avoid degradation in circuit performance. Replace wire to avoid having splices closer than 12 in. (.3 m) apart.

8. Loop the lead back over the spliced joint and tape. See Figure 17-20.

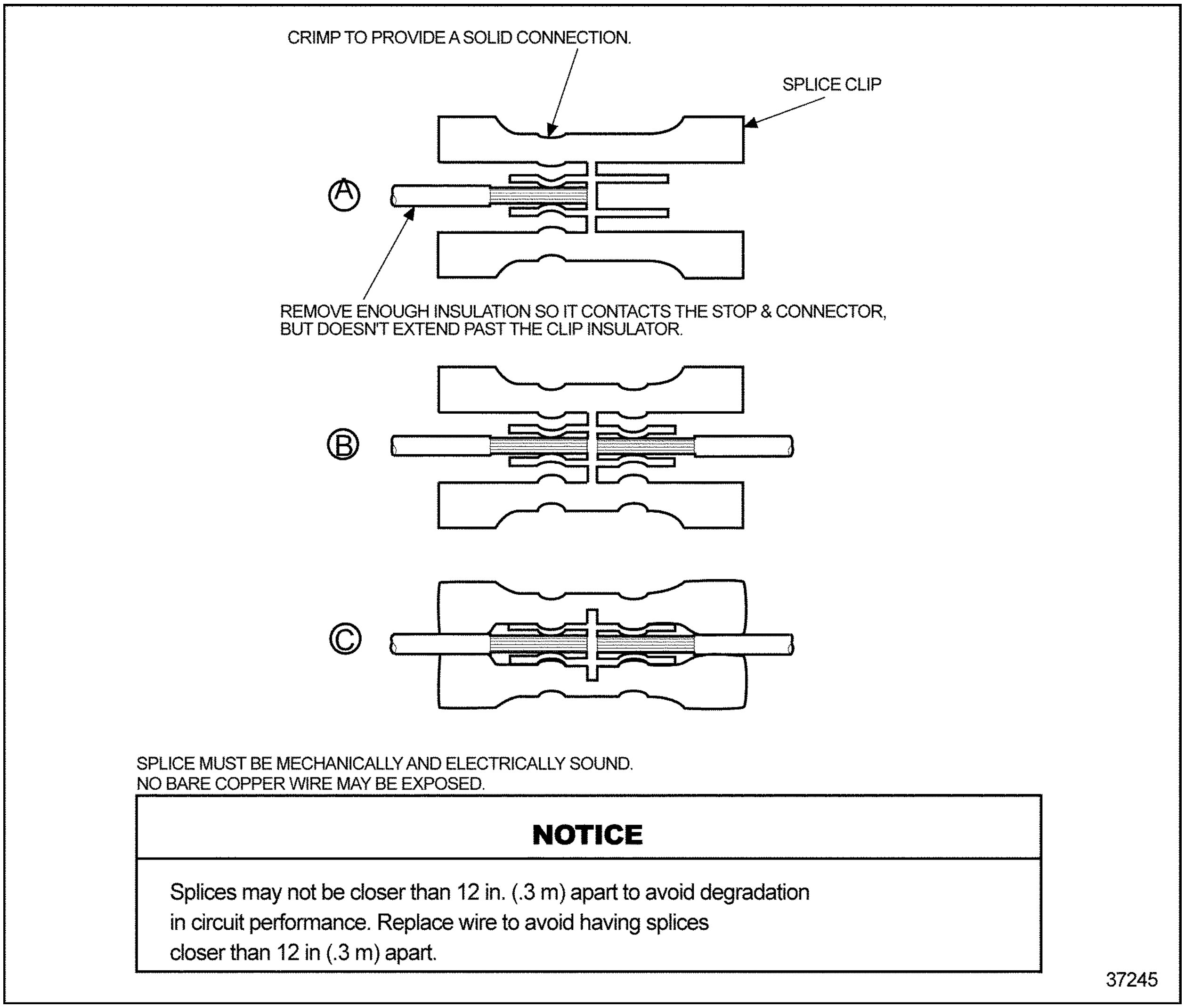


Figure 17-21 Splicing Straight Leads - Alternate Method 1

17.4.5.3 Splicing and Repairing Straight Leads - Alternate Method 2

This method is not allowed or recommended for power or ignition circuits. The tools required are listed in Table 17-21.

Tool	Part Number
Heat Gun	--
Wire Stripper	Kent-Moore J–35615 or equivalent
Splice Clips (commercially available)	Wire size dependent
Heat Shrink Tubing	Raychem HTAT or equivalent
Terminal Crimper for Metri-Pack 280 (12 AWG)	Kent-Moore J–38125-6
Terminal Crimper for Metri-Pack 280 (18 AWG)	Kent-Moore J–39848
Terminal Crimper for Weather Pack	Kent-Moore J–35606
Terminal Crimper for Deutsch	Kent-Moore J–34182
Terminal Crimper for Metri-Pack 150	Kent-Moore J–35123

Table 17-21 Recommended Splicing Tools

NOTE:
When splicing straight leads, no more than one strand in a 16 strand wire may be cut or missing.

An acceptable option for splicing straight leads is:

1. Locate broken wire.
2. Remove insulation as required; be sure exposed wire is clean and not corroded.
3. Slide a sleeve of glue lined, shrink tubing (Raychem HTAT or equivalent) long enough to cover the splice clip on the wire and overlap the wire insulation, about .25 in. (6 mm) on both sides (see Figure 17-22, A).
4. Insert one wire into splice clip until it butts against the splice clip. Stop and crimp (see Figure 17-22, B).
5. Insert the remaining wires into the splice clip one at a time until each butts against the splice clip; stop and crimp (see Figure 17-22, B).

NOTICE:
Any terminal that is cracked or ruptured is unacceptable as malfunctions may occur.

6. Visually inspect the terminal for cracks, rupture, or other crimping damage. Remove and replace damaged terminal before proceeding.
7. Slide the shrink tubing over the crimped splice clip (see Figure 17-22, C).
8. Shrink tubing with a heat gun to seal the splice (see Figure 17-22, D).

NOTICE:
A minimum of two layers of heat shrink tubing must be applied to splices that have more than one lead in or out.

9. Loop the lead back over the spliced joint and tape. See Figure 17-20.

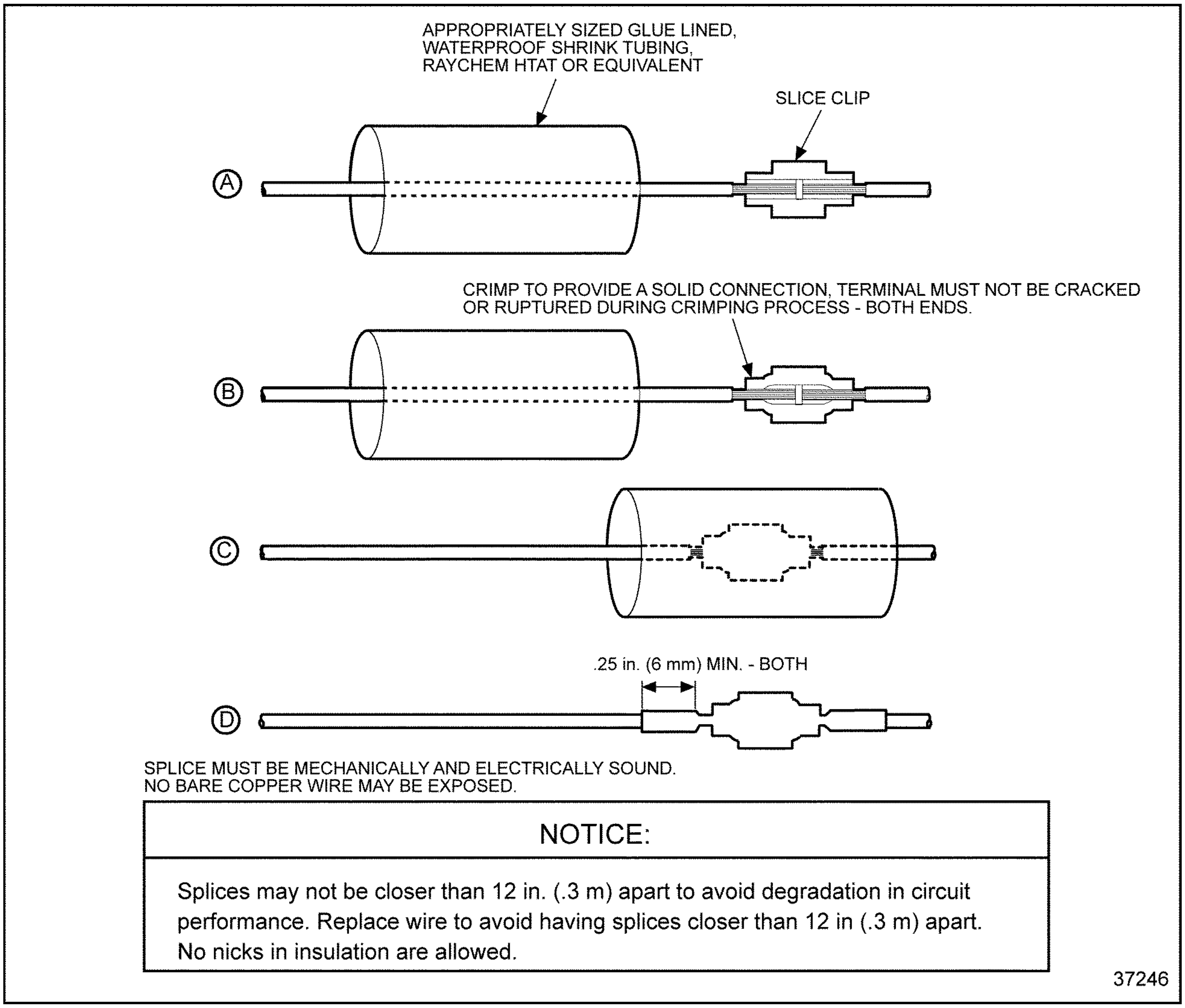


Figure 17-22 Splicing Straight Leads - Alternate Method 2

17.4.5.4 Shrink Wrap

Shrink wrap is required when splicing non insulated connections. Raychem HTAT or any equivalent heat shrink dual wall epoxy encapsulating adhesive polyolefin is required. Shrink wrap must extend at least .25 in. (6 mm) over wire insulation past splice in both directions.

To heat shrink wrap a splice:

NOTICE:
The heat shrink wrap must overlap the wire insulation about .25 in. (6 mm) on both sides of the splice.

1. Select the correct diameter to allow a tight wrap when heated.
2. Heat the shrink wrap with a heat gun; do not concentrate the heat in one location, but apply the heat over the entire length of shrink wrap until the joint is complete.
3. Repeat step 2 to apply a second layer of protection (if required by splicing guidelines).

17.4.5.5 Staggering Wire Splices

Position spliced wires properly as follows:

NOTICE:
You must stagger positions to prevent a large bulge in the harness and to prevent the wires from chafing against each other.

1. Stagger the position of each splice (see Figure 17-23) so there is at least a 2.5 in. (65 mm) separation between splices.

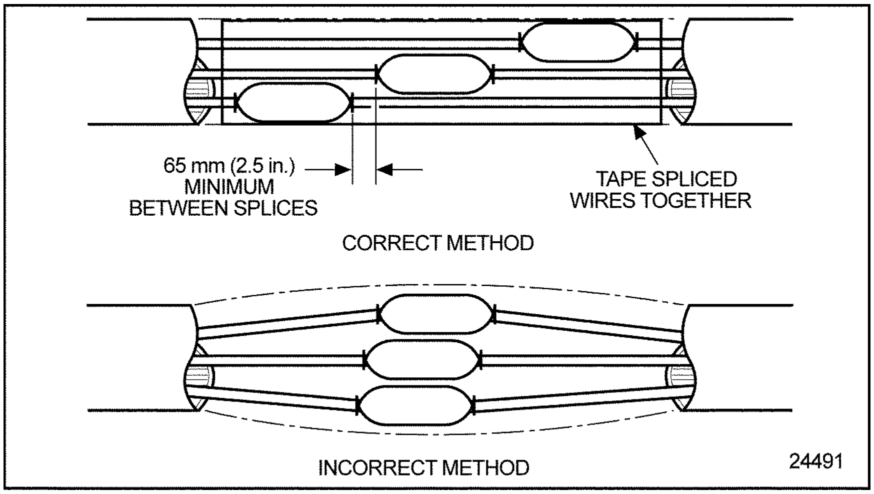


Figure 17-23 The Correct and Incorrect Method of Staggering Multiple Splices

NOTICE:
A minimum of two layers of heat shrink tubing extending .25 in. (6 mm) past the splice must be used to complete the splice.

2. Heat shrink a minimum of two layers of heat shrink tubing.
3. Tape the spliced wires to each other. Refer to section 17.5.

17.5 CONDUIT AND LOOM

Conduit must be used to protect the harness cable and cable splices.

NOTICE:
The conduit must not cover any connectors, switches, relays, fuses, or sensors.

The following guidelines should be used when designing a harness:

NOTICE:
Wires should be sized and cut to near equal length prior to installing conduit.

- The distance between the back of the connector or other listed devices to the end of the conduit should not exceed:
  - 0.5 in. (12.7 mm) for a single connector/device
  - 1.0 in. (25.4 mm) for a double connector/device
  - 1.5 in. (38.1 mm) for multiple (three or more) connectors/devices
- All cable breakouts and conduit ends must be secured in place with conduit outlet rings or tape.

17.5.1 Criteria for Conduit and Loom

Due to the wide variety of operating conditions and environments, it is the responsibility of the OEM to select a conduit that will survive the conditions of the specific applications. Flame retardant convoluted polypropylene conduit or equivalent may be used for most installations. Heat retardant nylon conduit or oil, water, acid, fire, and abrasion resistant non-metallic loom conforming to SAE J562A* is also acceptable. The diameter of conduit should be selected based on the number of wires being protected.

* If non-metallic loom is used, secure the ends with tightly wrapped nylon straps to prevent unraveling.

Conduit should cover the wires without binding and without being excessively large.

17.6 TAPE AND TAPING

Tape must be used when conduit is utilized. Be sure to follow the tape manufacturers' guidelines. The harness manufacturer may use tape under the harness covering (conduit or loom) to facilitate harness building. Tape must be tightly wrapped at all conduit interconnections with a minimum of two layers. Be sure to firmly secure the start and finish ends of tape.

17.6.1 Tape Criteria

In applications where the temperature doesn't exceed 176°F (80°C), black vinyl electrical tape that is flame retardant and weather resistant may be used.

NOTICE:
Black vinyl electrical tape should not be used in applications where the temperature exceeds 176°F (80°C).

In applications where temperature exceeds 176°F (80°C), vinyl electrical tape should not be used. For these applications, adhesive cloth backed, flame retardant polyethylene or fiber glass tape (Delphi #PM-2203, Polikan #165 or equivalent) is recommended.

17.6.2 Taping Criteria

The tape must extend a minimum of 1 in. (25 mm) past the conduit.

The tape must be crossed over butted conduit ends.

The tape must be extended a minimum of 1 in. (25 mm) in each direction at all branches.

17.7 SENSORS

DDEC is designed to operate with several types of sensors as listed in Table 17-22.

Sensor Type	Description
Variable Reluctance/Magnetic Pick-up	Used to monitor the crankshaft position, engine speed, turbo speed, and vehicle speed.
Thermistor	Used to monitor temperatures.
Variable Capacitance	Used to monitor manifold, and oil gallery pressures.
Variable Resistance (Potentiometer)	Used to sense throttle position.
Switch	Used to signal coolant level.

Table 17-22 Sensor Types

The sensors integrated into the Engine Harness are factory-installed (refer to section 17.7.1). The sensors integrated into the Vehicle Interface Harness are installed by the OEM (refer to section 17.7.2).

17.7.1 Factory-installed Sensors

The sensors integrated into the factory-installed Engine Harness are listed in Table 17-23.

Sensor	Function
Camshaft Position Sensor (CMP Sensor)	Indicates a specific cylinder in the firing order.
Crankshaft Position Sensor (CKP Sensor)	Senses crankshaft position and engine speed for functions such as fuel control strategy.
DPF Inlet Pressure Sensor	Sensor measures pressure between the Diesel Oxidation Catalyst (DOC) and the Diesel Particulate Filter (DPF) in the aftertreatment assembly located in the exhaust system of the vehicle.
DPF Outlet Pressure Sensor	Sensor measures pressure on the outlet of the after-treatment device in the exhaust system of the vehicle. Located after the DPF that is within the aftertreatment device.
DPF Outlet Temperature Sensor	Temperature measured at the outlet of the after-treatment system that is installed within the exhaust system of the vehicle. It's located after the DPF that is within the aftertreatment unit.
DOC Inlet Temperature	DOC Temperature In - Temperature measured at the inlet of the after-treatment device in the exhaust system of the vehicle. Located before the DOC that is within the after-treatment device.
DOC Outlet Temperature	Temperature measured between the DOC and the DPF in the aftertreatment assembly located in the exhaust system of the vehicle.
Engine Coolant Temperature Sensor (ECT Sensor)	Senses coolant temperature for functions such as engine protection, fan control and engine fueling.
EGR Delta Pressure Sensor EGR Delta P Sensor	Senses EGR pressure for EGR control.
EGR Temperature Sensor	Senses EGR exhaust temperature after EGR cooler. Used for EGR system diagnosis.
Engine Coolant Temperature Sensor (ECT Sensor)	Senses coolant temperature for functions such as engine protection, fan control and engine fueling.
Engine Oil Pressure Sensor (EOP Sensor)	Senses gallery oil pressure for functions such as engine protection.
Engine Oil Pressure Sensor (EOP Sensor)	Senses gallery oil pressure for functions such as engine protection.
Engine Oil Temperature Sensor (EOT Sensor)	Senses oil temperature for functions such as reducing variation in fuel injection and fan control.
Fuel Line Pressure Sensor	Compensates fuel line pressure
Fuel Compensation Pressure Sensor	Senses turbo boost for functions such as smoke control and engine protection.
Intake Manifold Temperature Sensor (IMT Sensor)	Senses boost temperature
Supply Fuel Temperature Sensor (SFT Sensor)	Senses fuel temperature for functions such as engine fueling.
Turbo Compressor Temperature Out Sensor	Senses turbo out air temperature.
Turbo Speed Sensor	Monitors turbo speed.
Water-in-Fuel Sensor (MBE 900 only)	Detects water in the fuel filter that alerts the owner/driver that the fuel filter needs to be dried out.

Table 17-23 Function of Factory-installed Sensors

See Figure 17-24 for the location of the sensors for the DOC and DPF.

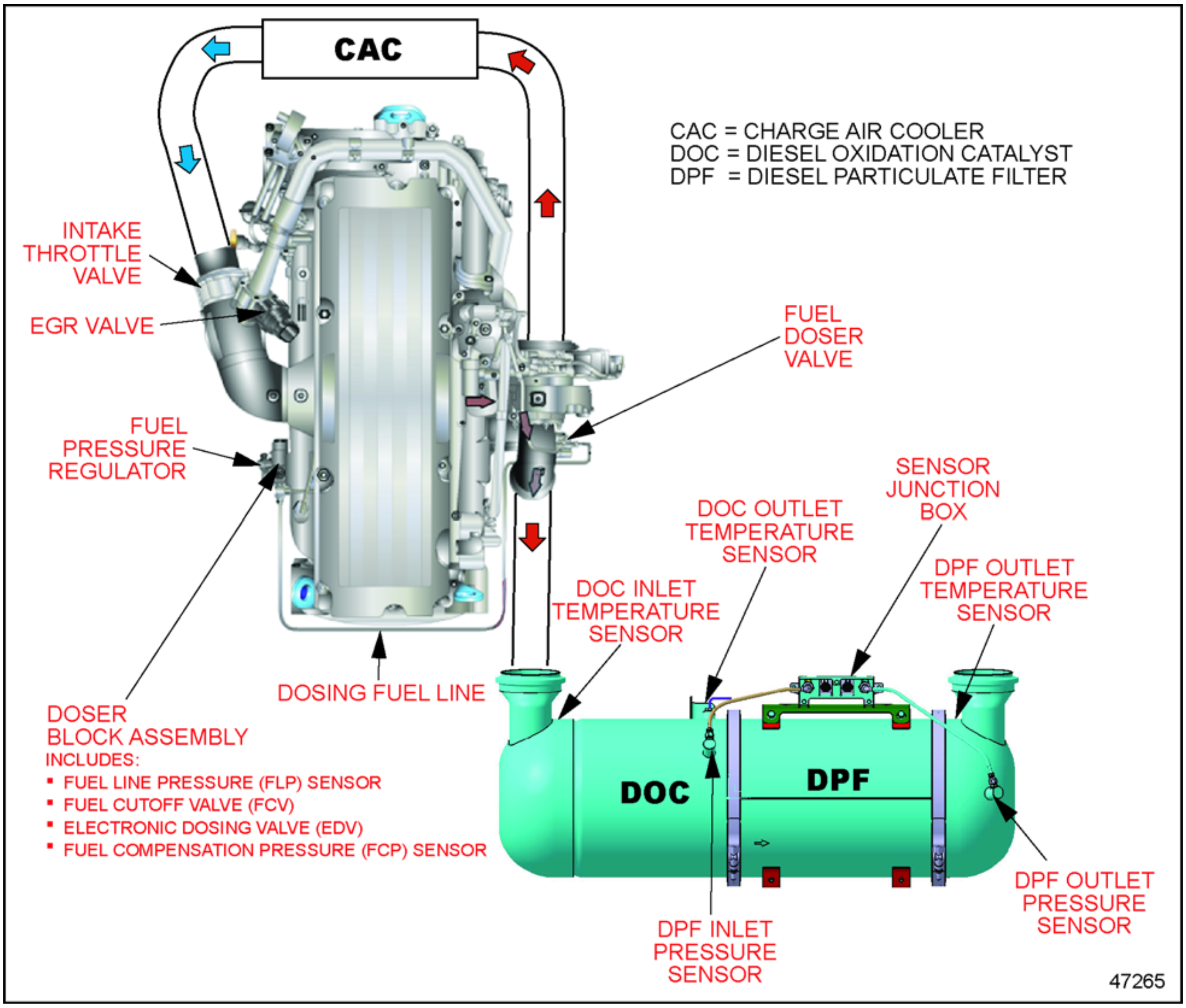


Figure 17-24 Sensor Location for the DOC and DPF

17.7.2 OEM-installed Sensors

All sensors must be of the proper type and continuously monitor vehicular and environmental conditions, so the MCM can react to changing situations.

The OEM is responsible for installing the sensors listed in Table 17-24.

Sensor	Function
Ambient Air Temperature Sensor (AAT Sensor)	Senses ambient air temperature specifically for the Ambient Air Temperature Override Disable feature or for OI. Refer to section 17.7.3.
Engine Coolant Level Sensor (ECL Sensor)	Senses coolant level for engine protection. Refer to section 17.7.4.
Turbo Compressor In Temperature Sensor	Senses the temperature of the turbo compressor inlet. Refer to section 17.7.5.
Vehicle Speed Sensor (VSS)	Senses vehicle speed for Cruise Control and Vehicle Speed Limiting. Refer to section 17.7.6.

* Available in some applications

Table 17-24 Function and Guidelines for OEM-installed Sensors

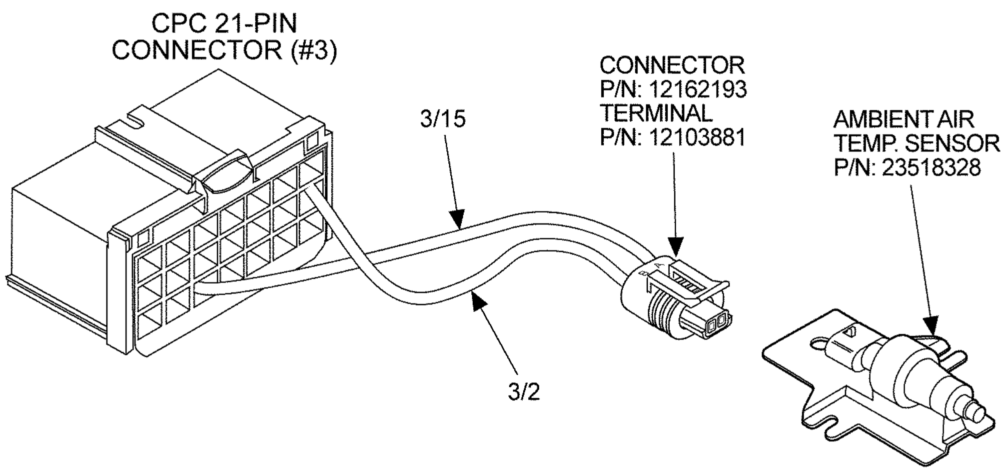
NOTE:
The OEM harness must be securely fastened every six (6) in. It is required that the harness be fastened within six (6) in. of the sensor.

17.7.3 Ambient Air Temperature Sensor

The AAT Sensor is a thermistor type sensor with a variable resistance that produces an analog signal between 0 and 5 V, representing the temperature of the ambient air. The AAT Sensor is used with the Idle Shutdown Timer, specifically for the Ambient Air Temperature Override Disable feature or for Optimized Idle.

17.7.3.1 Ambient Air Temperature Sensor Installation

Install the AAT Senaor where ambient air temperature can be read. A protected location on the frame rails where it will not be splattered with dirt and grime and is removed from any heat source such as exhaust is preferred. See Figure 17-25.



LABEL	CPC CONNECTOR CAVITY	WIRE COLOR	AMBIENT AIR TEMPERATURE CONNECTOR CAVITY
SENSOR RETURN #1	3/15	YEL/BLK	A
AMBIENT AIR TEMP	3/2	TAN/YEL	B

47454

Figure 17-25 Ambient Air Temperature Sensor Installation

17.7.4 Engine Coolant Level Sensor

The ECL Sensor provides an input to the engine protection system and warn the operator if a low coolant level has been reached.

The main component of the ECL Sensor consists of a conductivity probe, which connects to the CPC (see Figure 17-26).

NOTICE:
The probe has an operational temperature range of -40 to 257°F (-40 to 125°C). Exposure to temperatures beyond this range may result in unacceptable component life, or degraded sensor accuracy.

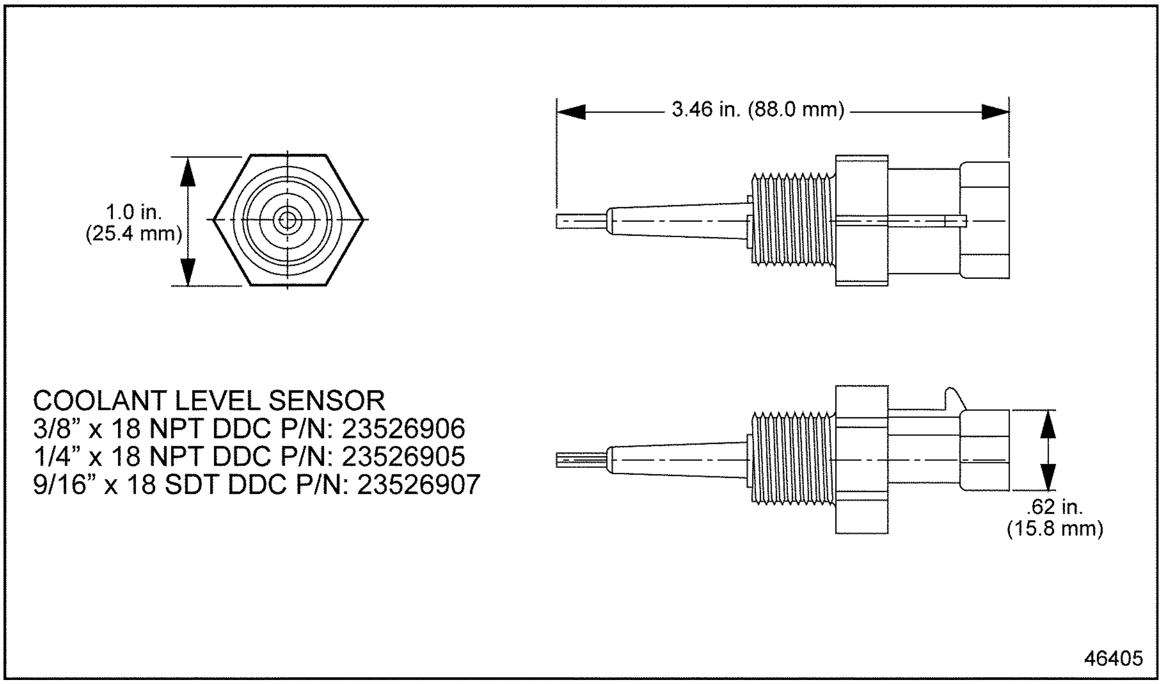


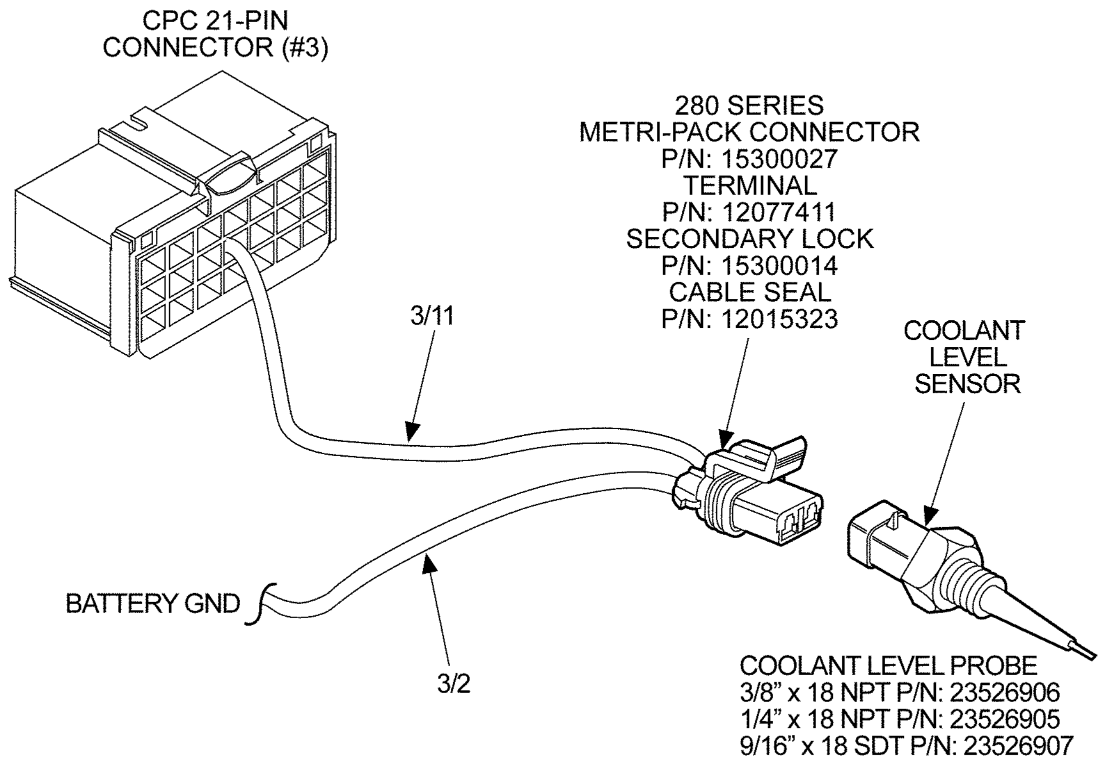
Figure 17-26 Engine Coolant Level Sensor Specifications

The connector listed in Table 17-25 is a Metri-Pack 280 series push-to-seat connector.

Coolant Level Sensor Connector	
Connector	P/N: 15300027
Terminal	P/N: 12077411
Seal	P/N: 12015323
Secondary Lock	P/N: 15300014

Table 17-25 Metri-Pack 280 Connectors and Part Numbers

The OEM must connect the ECL Sensor probe as shown in the next illustration (see Figure 17-27). Polarity of the ground and signal must be correct for proper operation.



LABEL	CPC CONNECTOR CAVITY	WIRE COLOR	CLS CAVITY
COOLANT LEVEL	3/11	ORN	A
GROUND	3/2	BLK	B

45312

Figure 17-27 Engine Coolant Level Sensor Installation for CPC

The probe should be located in either the radiator top tank or a remote mounted surge tank. It should be mounted horizontally in the center of the tank and must be in a position to signal low coolant before aeration occurs. Typically, this is a height representing 98% of the drawdown quantity. The probe should be located so that it is not splashed by deaeration line, stand pipe or coolant return line flows. The insulated portion of the probe should be inserted into the coolant 1/2 in. or more past the inside wall of the tank. See Figure 17-28.

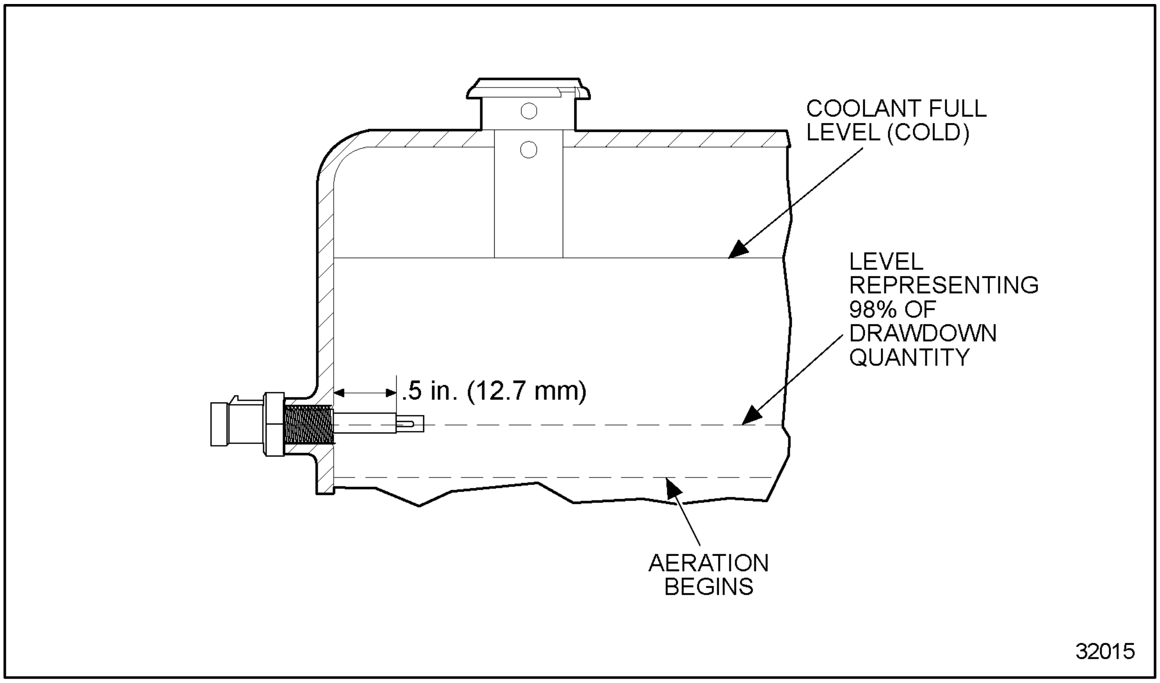


Figure 17-28 Engine Coolant Level Sensor Location - Top of Radiator Tank

Determine proper location for low coolant level sensor while running the drawdown test. It *must* actuate a warning before the satisfactory drawdown level is reached.

The ECL Sensor components are OEM supplied hardware and can be purchased as kits or individual components, depending on OEM requirements.

The following kits listed in Table 17-26 and Table 17-27 provide all the necessary hardware for proper installation of the ECL Sensor. Kits are available through the DDC parts distribution network.

Component	Part Number
ECL Sensor	23526905
Metri-Pack Connector Kit	15300027
Metri-Pack Terminals	12077411
Secondary Lock	15300014
wire Seal	12015323
Terminal	12103881

Table 17-26 ECL Sensor Installation Kit 1/4 in. NPTF P/N: 23515397

Component	Part Number
ECL Sensor	23526906
Metri-Pack Connector Kit	15300027
Metri-Pack Terminals	12077411
Secondary Lock	15300014
Wire Seal	12015323
Terminal	12103881

Table 17-27 ECL Sensor Installation Kit 3/8 in. NPTF P/N: 23515398

The sensor must be enabled with VEPS or the DRS as listed in Table 17-28.

Parameter Group	Parameter	Options	Default
32	Cool Level Sensor Input Enable	0 = Disabled 1 = Dual Level Probe Sensor (IMO), fixed threshold* 2 = Single Level Probe Sensor, temp dependent 3 = Dual Level Float Sensor (FTL), fixed threshold/FTL Gentec 4 = Single Level Probe Sensor, fixed threshold	2

Table 17-28 Enabling the Engine Coolant Level Sensor

17.7.5 Turbo Compressor In Temperature Sensor

The Turbo Compressor In Temperature Sensor (TCI Sensor) produces a signal representing the temperature of the turbo compressor inlet. See Figure 17-29 and Figure 17-30 for installation.

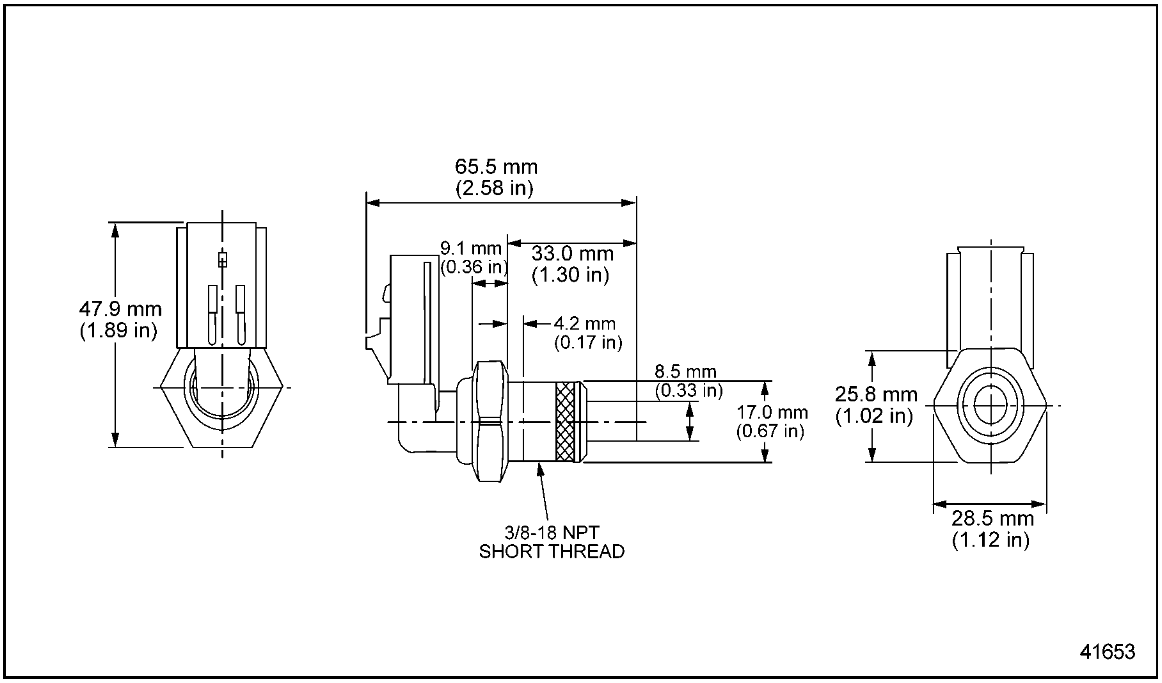


Figure 17-29 Turbo Compressor In Temperature Sensor

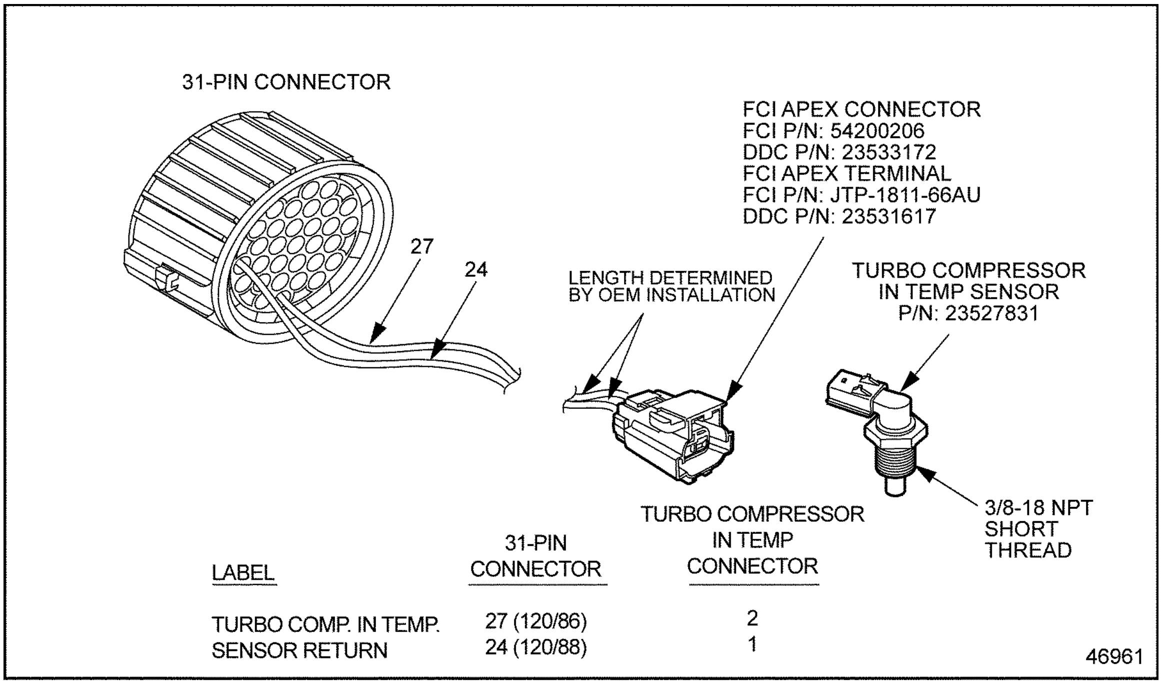


Figure 17-30 Turbo Compressor In Temperature Sensor Installation

17.7.6 Vehicle Speed Sensor

The CPC can calculate vehicle speed providing that it is properly programmed and interfaced with a Vehicle Speed Sensor (VSS) that meets requirements. The VSS (see Figure 17-31) provides a vehicle speed signal for use in Cruise Control and Vehicle Speed Limiting. The VSS signal type can be changed v

NOTE:
DDC does not approve of the use of signal generator sensors.

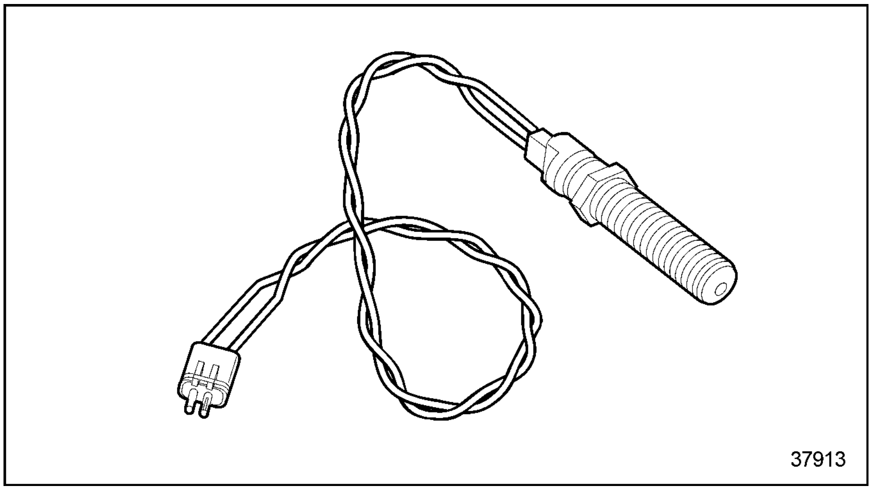


Figure 17-31 Vehicle Speed Sensor

To obtain accurate vehicle mileage, the parameters listed in Table 17-29 must be programmed with VEPS, DRS, or DDDL 7.0.

Parameter Group	Parameter	Range	Default
8	Vehicle Speed Sensor	0 = No Sensor 1 = C3 Sensor 2 = Square Wave (Hall Sensor) 3 = J1939 (ETC1) 4 = Magnetic Pickup 5 = J1939 (TCO1) 6 = J1939 (CCVS Source 1) 7 = J1939 (CCVS Source 2) 8 = J1939 (CCVS Source 3)	4 = Magnetic
8	Axle Ratio	1 – 20.0	5.29
8	Number of Output Shaft Teeth	0 – 250	16
8	Tire Revs per Unit Distance	160 – 1599 l/km	312
8	Top Gear Ratio	0.1 – 2.55	1
8	Second Highest Gear Ratio	0.1 – 5.75	2.54
8	Two Spd Axle Second Axle Ratio	1 – 20.0	5.29
8	Anti Tamper	0 = Disable 1 = Enable VSS Anti Tamper Function via ABS 2 = Enable Anti Tamper Function via Gear Ratio	0 = Disable

Table 17-29 Vehicle Speed Sensor Parameters

17.7.6.1 Magnetic Pickup

The magnetic pickup requirements are listed in Table 17-30. Magnetic Pickup size is determined by installation requirements.

Parameters	Range
Frequency Range	0 - 10 kHz
Low Threshold Voltage	>1.8 Volts Peak to Peak

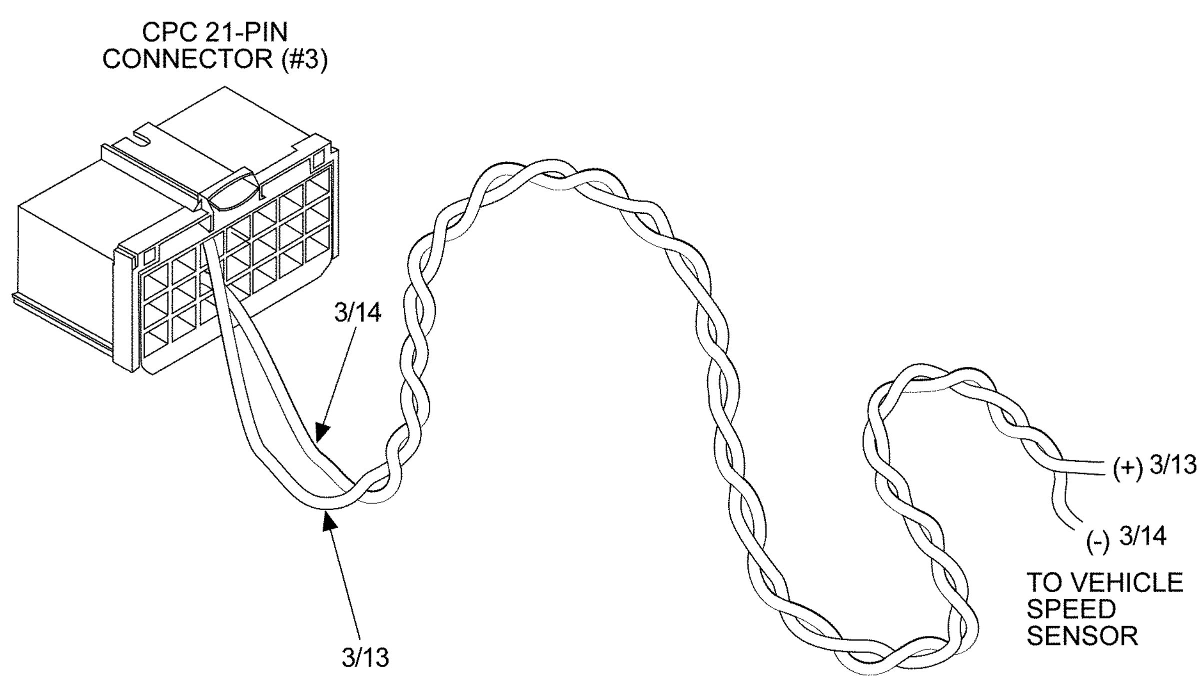
Table 17-30 Magnetic Pickup Vehicle Speed Sensor Requirements

The Vehicle Speed Sensor is wired to the 21–pin #3 connector of the CPC as listed in Table 17-31.

CPC Connector/Pin	Function
3/13	VSS (+)
3/14	VSS (-)

Table 17-31 Vehicle Speed Sensor Wiring

See Figure 17-32 for the installation of the Magnetic VSS.



LABEL	CPC CONNECTOR CAVITY	WIRE COLOR	VSS CONNECTOR CAVITY
VEHICLE SPEED SENSOR (+)	3/13	LT BLU/ORN	SIGNAL
VEHICLE SPEED SENSOR (-)	3/14	LT BLU/BLK	RETURN

Figure 17-32 Magnetic Vehicle Speed Sensor Installation – CPC

17.7.6.2 SAE J1939 Data Link

A VSS wired to the CPC is not required if the transmission output shaft speed message is being transmitted over the SAE J1939 Data Link. To obtain accurate vehicle mileage, the parameters listed in Table 17-32 must be programmed with VEPS.

Parameter Group	Parameter	Range	Default
8	Vehicle Speed Sensor	0 = No Sensor 1 = C3 Sensor 2 = Square Wave (Hall Sensor) 3 = J1939 (ECT1) 4 = Magnetic Pickup 5 = J1939 (TCO1) 6 = J1939 (CCVS Source 1) 7 = J1939 (CCVS Source 2) 8 = J1939 (CCVS Source 3)	4 = Magnetic
8	Axle Ratio	1 – 20.0	5.29
8	Tire Revs per Unit Distance	160 – 1599 l/km	312
8	Top Gear Ratio	0.1 – 2.55	1
8	Second Highest Gear Ratio	0 — 5.75	2.55
8	Two Spd Axle Second Axle Ratio	1 – 20.0	5.29
8	Anti Tamper	0 = Disable 1 = Enable VSS ABS Anti Tampering Function 2 = Enable VSS without ABS Anti Tampering Function	0 = Disable

Table 17-32 Vehicle Speed Sensor Parameters for Transmission Output Shaft Speed

17.7.6.3 VSS Anti-tamper

If the sensor appears to be working improperly, but the vehicle speed is not zero, VSS Anti-Tamper will log a VSS fault.

17.8 INSTRUMENT PANEL LAMPS

The instrument panel lamps are listed in Table 17-33.

Lamp	Lamp Name	Description	Driver Action
	Amber Warning Lamp (AWL)	Indicates a fault with the engine controls.	Truck can be driven to end of shift. Call for service.
	Red Stop Lamp (RSL)	Indicates a major engine fault that may result in engine damage Engine derate and / or shutdown sequence will be initiated.	Move the truck to the nearest safe location and shutdown the engine. Call for service
	DPF Regeneration Lamp	Solid yellow indicates a manual regeneration is required. Blinking yellow and derate or shutdown are possible if back pressure exceeds limits. Blinking yellow during stationary regeneration	Truck may be driven to end of shift. Call for service. Blinking light indicates attention required now.
	High Exhaust Temperature Lamp (HET)	Lamp may be red or yellow. Indicates exhaust temperature is above a preset limit. Illuminates during regeneration process if speed below 30 mph and during stationary regeneration	Truck may be driven. If lamp remains illuminated for an extended period – longer than 40 minutes call for service.
	Malfunction Indicator Lamp (MIL)	Yellow lamp Indicates a failure of an Emission Control device. May illuminate at the same time as the Amber Warning Lamp	Truck may be driven to end of the shift. Call for service

Table 17-33 Instrument Panel Lamps

18 SPN 27 - EGR VALVE POSITION CIRCUIT FAULT

Section **Page**

18.1 SPN 27/FMI 3

This diagnostic condition is typically the EGR valve position circuit failed high.

18.1.1 EGR Valve Position Circuit Check

Check as follows:

1. Disconnect the EGR valve connector.
2. Turn the ignition ON (key ON, engine OFF).
3. Measure the voltage between pin 4 of the EGR connector harness and ground.
   [a] If the voltage is present, repair the short to power between pin 4 of the EGR connector harness and pin 60 of the 120–pin MCM connector. Refer to section 18.1.1.1.
   [b] If there is no voltage present,. go to step 4.
4. Measure the voltage between pin 3 of the EGR connector harness and ground.
   [a] If the voltage is present, repair the short to power between pin 3 of the EGR connector harness and pin 67 of the 120–pin MCM connector. Refer to section 18.1.1.1.
   [b] If there is no voltage present, go to step 5.
5. Turn the ignition OFF.
6. Disconnect the MCM 120–pin connector.
7. Measure the resistance from pin 3 of the EGR connector harness and pin 67 of the 120–pin MCM connector.
   [a] If the resistance is greater than 2 Ω, repair the open between pin 3 of the EGR connector harness and pin 67 of the 120–pin MCM connector. Refer to section 18.1.1.1.
   [b] If the resistance is less than 3 Ω, replace the EGR valve. Refer to section 18.1.1.1.

18.1.1.1 Verify Repairs

Verify repairs as follows:

1. Turn ignition OFF.
2. Reconnect any electrical connections that were disconnected to perform the diagnosis.
3. Clear codes with DDDL 7.0 or latest version.
4. Start and bring engine up to operating temperature (over 140°F/60°C).
5. Verify operation is satisfactory and no warning lamps illuminate. If warning lamps illuminate, troubleshoot the codes. If assistance is required, call the Detroit Diesel Customer Support Center at 313–592–5800.

18.2 SPN 27/FMI 4

This diagnostic condition is typically a circuit failed high.

18.2.1 EGR Valve Position Circuit Check

Check as follows:

1. Check for multiple codes.
   [a] If 27/4, 2791/5 and 1073/4 are present, repair the open between pin 62 of the 120–pin MCM connector, the EGR valve and the Front Jake Brake Solenoid. Refer to section 18.2.1.1.
   [b] If 27/4 and 3471/4 are present, go to step 6.
   [c] If 27/4 and 3482/4 are present, go to step 8.
   [d] If 27/4 and 1073/4 are present, go to step 10.
   [e] If 27/4 and 615/4 are present, go to step 14.
   [f] If only 27/4 is present, go to step 2.
2. Disconnect the EGR valve harness connector.
3. Measure the resistance between pin 4 of the EGR valve harness connector and ground.
   [a] If the resistance is less than 1 kΩ, repair the short to ground between pin 4 of the EGR valve harness connector and pin 60 of the 120–pin MCM connector. Refer to section 18.2.1.1.
   [b] If the resistance is greater than 1 kΩ, go to step 4.
4. Disconnect the MCM 120–pin connector.
5. Measure the resistance between pin 4 of the EGR valve harness connector and pin 60 of the 120–pin MCM connector.
   [a] If the resistance is greater than 3 Ω, repair the open between pin 4 of the EGR valve harness connector and pin 60 of the 120–pin MCM connector. Refer to section 18.2.1.1.
   [b] If the resistance is less than 3 Ω, replace the EGR valve. Refer to section 18.2.1.1.
6. Monitor the active codes; unplug the Electronic Dosing Valve (EDV). Does the code become inactive?
   [a] If yes, replace the EDV. Refer to section 18.2.1.1.
   [b] If no, go to step 7.
7. Unplug the EGR valve. Does the code become inactive?
   [a] If yes, replace the EGR valve. Refer to section 18.2.1.1.
   [b] If no, repair the short to ground on circuit 65 of the 120–pin MCM connector. Refer to section 18.2.1.1.

8. Monitor the active codes; unplug the Fuel Cutoff Valve (FCV). Does the code become inactive?
   [a] If yes, replace the FCV. Refer to section 18.2.1.1.
   [b] If no, go to step 9.
9. Unplug the EGR valve. Does the code become inactive?
   [a] If yes, replace the EGR valve. Refer to section 18.2.1.1.
   [b] If no, repair the short to ground on circuit 69 of the 120–pin MCM connector. Refer to section 18.2.1.1.
10. Monitor the active codes; unplug the EGR valve. Does the code become inactive?
    [a] If yes, replace the EGR valve. Refer to section 18.2.1.1.
    [b] If no, go to step 11.
11. Turn the ignition to the OFF position.
12. Remove the upper valve cover.
13. Disconnect the front Jake Brake solenoid. Does the code become inactive?
    [a] If yes, replace the front Jake Brake solenoid. Refer to section 18.2.1.1.
    [b] If no, repair the short to ground on circuit 32 of the 120–pin MCM connector. Refer to section 18.2.1.1.
14. Monitor the active codes; unplug the Fuel Cutoff Valve (FCV). Does the code become inactive?
    [a] If yes, replace the FCV. Refer to section 18.2.1.1.
    [b] If no, go to step 15.
15. Unplug the EGR valve. Does the code become inactive?
    [a] If yes, replace the EGR valve. Refer to section 18.2.1.1.
    [b] If no, go to step 16.
16. Unplug the Electronic Dosing Valve (EDV). Does the code become inactive?
    [a] If yes, replace the EDV. Refer to section 18.2.1.1.
    [b] If no, repair the short to ground on circuits 62 and/or 64 of the 120–pin MCM connector. Refer to section 18.2.1.1..

18.2.1.1 Verify Repairs

Verify repairs as follows:

1. Turn ignition OFF.
2. Reconnect any electrical connections that were disconnected to perform the diagnosis.
3. Clear codes with DDDL 7.0 or latest version.
4. Start and bring engine up to operating temperature (over 140°F/60°C).
5. Verify operation is satisfactory and no warning lamps illuminate. If warning lamps illuminate, troubleshoot the codes. If assistance is required, call the Detroit Diesel Customer Support Center at 313–592–5800.

18.3 SPN 27/FMI 7

This diagnostic condition is typically the EGR valve stuck open.

18.3.1 Valve Function Check

Check as follows:

1. Turn the ignition ON (key ON, engine OFF).
2. Using DDDL 7.0, monitor the EGR Actual Position while activating PWM1 to 50% for 15 seconds.
3. Is the EGR Actual Position reading between 42 and 48%?
   [a] If yes, go to step 6.
   [b] If no, go to step 4.
4. Remove the EGR valve.
5. Inspect the EGR valve butterfly for signs of excessive soot or white residue.
   [a] If white residue is found, repair the cause of coolant contamination and possible EGR cooler failure. Once the source of coolant contamination is repaired, replace the EGR valve. Refer to section 18.3.1.1.
   [b] If excessive soot residue if found, correct the cause of soot contamination and possible CAC system leaks. Once the source of soot contamination is repaired, replace the EGR valve. Refer to section 18.3.1.1.
   [c] If no contamination is found, replace the EGR valve. Refer to section 18.3.1.1.
6. Disconnect the EGR valve connector.
7. Inspect the connector for bent, spread or corroded pins.
   [a] If damage is found, repair as necessary.
   [b] If no damage is found, contact the Detroit Diesel Customer Support Center at 313–592–5800.

18.3.1.1 Verify Repairs

Verify repairs as follows:

1. Turn ignition OFF.
2. Reconnect any electrical connections that were disconnected to perform the diagnosis.
3. Clear codes with DDDL 7.0 or latest version.
4. Start and bring engine up to operating temperature (over 140°F/60°C).
5. Verify operation is satisfactory and no warning lamps illuminate. If warning lamps illuminate, troubleshoot the codes. If assistance is required, call the Detroit Diesel Customer Support Center at 313–592–5800.

19 SPN 51 - INTAKE THROTTLE VALVE ABOVE OR BELOW NORMAL OPERATING RANGE

Section **Page**

19.1 SPN 51/FMI 2, 3 OR 4

The troubleshooting procedures for this SPN can be found in the *Aftertreatment System Technician's Guide* (7SE63), refer to Chapter 7.

20 SPN 70 (CPC) - J1939 PARK BRAKE SWITCH SIGNAL ERRATIC OR MISSING

Section **Page**

20.1 SPN 70/FMI 13

This fault is typically the J1939 Park Brake Switch signal from Source #1 is missing.

20.1.1 Missing Signal from Source #1, #2, or #3 Check

Check as follows:

1. Check for multiple codes:
   [a] If CPC SPN 168/FMI 0/14/18 (Battery Voltage) are present troubleshoot these first.
   [b] If MCM SPN 625/FMI 9 is present, repair the CAN line faults.
   [c] If only a “J1939 Error” fault is present, go to step 2.
2. Has the CPC been recently reprogrammed?
   [a] If yes, check the proper configuration of the CPC.
   [b] If no, connect ServiceLink to determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

20.2 SPN 70/FMI 19

This fault is typically J1939 Park Brake Switch signal from Source #1 is erratic.

20.2.1 Erratic Signal from Source #1, #2, or #3 Check

Check as follows:

1. Check for multiple codes:
   [a] If CPC SPN 168/FMI 0/14/18 (Battery Voltage) are present troubleshoot and repair these first.
   [b] If MCM SPN 625/FMI 9 is present, troubleshoot and repair the CAN line.
   [c] If only a “J1939 Error” fault is present, go to step 2.
2. Has the CPC been recently reprogrammed?
   [a] If yes, check the proper configuration of the CPC.
   [b] If no, connect ServiceLink to determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

21 SPN 84 (CPC) - J1939 WHEEL-BASED VEHICLE SPEED SIGNAL ERRATIC OR MISSING

Section **Page**

21.1 SPN 84/FMI 13

This fault is typically the J1939 wheel-based vehicle speed signal from Source #1 is missing.

21.1.1 Missing Signal from Source #1, #2, or #3 Check

Check as follows:

1. Check for multiple codes:
   [a] If CPC SPN 168/FMI 0/14/18 (Battery Voltage) are present troubleshoot these first.
   [b] If MCM SPN 625/FMI 9 is present, repair the CAN line faults.
   [c] If only a "J1939 Error" fault is present, go to step 2.
2. Has the CPC been recently reprogrammed?
   [a] If yes, check the proper configuration of the CPC.
   [b] If no, connect ServiceLink to determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

21.2 SPN 84/FMI 19

This fault is typically J1939 wheel-based vehicle speed signal from Source #1, #2, or #3 is erratic.

21.2.1 Erratic Signal from Source #1, #2, or #3 Check

Check as follows:

1. Check for multiple codes:
   [a] If CPC SPN 168/FMI 0/14/18 (Battery Voltage) are present troubleshoot and repair these first.
   [b] If MCM SPN 625/FMI 9 is present, troubleshoot and repair the CAN line.
   [c] If only a "J1939 Error" fault is present, go to step 2.
2. Has the CPC been recently reprogrammed?
   [a] If yes, check the proper configuration of the CPC.
   [b] If no, connect ServiceLink to determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

22 SPN 84 – VEHICLE SPEED SENSOR

Section **Page**

22.1 SPN 84/FMI 2

Contact the Detroit Diesel Support Center at 313–592–5800.

22.2 SPN 84/FMI 3

This diagnostic condition is typically VSS open circuit.

22.2.1 Open Circuit Check

Check as follows:

1. Disconnect the Vehicle Speed Sensor (VSS).
2. Measure the resistance between pin 13 of the CPC connector #3 (21–pin) and pin 1 of the VSS.
   - [a] If the resistance is greater than 3 Ω, repair the open between pin 13 of the CPC connector #3 (21–pin) and pin 1 of the VSS. Refer to section 22.2.1.1.
   - [b] If the resistance is less than 3 Ω, go to step 3.
3. Measure the resistance between pin 14 of the CPC connector #3 (21–pin) and pin 2 of the VSS sensor.
   - [a] If the resistance is greater than 3 Ω, repair the open wire between pin 14 of the CPC #3 connector (21–pin) and pin 2 of the VSS. Refer to section 22.2.1.1.
   - [b] If the resistance is less than 3 Ω, go to step 4.
4. Measure the resistance between pin 13 of the CPC connector #3 (21–pin) and pin 1 of the VSS sensor.
   - [a] If the resistance greater than 3 Ω, replace the VSS. Refer to section 22.2.1.1.
   - [b] If the resistance is less than 3 Ω, repair the short in the harness between pins 13 and 14 of the CPC connector #3 (21–pin). Refer to section 22.2.1.1.

22.2.1.1 Verify Repairs

Verify repairs as follows:

1. Turn ignition OFF.
2. Reconnect any electrical connections that were disconnected to perform the diagnosis.
3. Clear codes with DDDL 7.0 or latest version.
4. Start and bring engine up to operating temperature (over 140°F/60°C).
5. Verify operation is satisfactory and no warning lamps illuminate. If warning lamps illuminate, troubleshoot the codes. If assistance is required, call the Detroit Diesel Customer Support Center at 313–592–5800.

22.3 SPN 84/FMI 4

This diagnostic condition is typically VSS circuit failed low.

22.3.1 Short Circuit Check

Check for a short as follows:

1. Disconnect the VSS connector.
2. Disconnect the CPC #3 connector (21–pin).
3. Measure the resistance between pin 1 and pin 2 of the VSS harness connector.
   - [a] If the resistance measurement is less than 5 Ω, repair the short pin 13 and pin 14 of the CPC #3 connector (21–pin). Refer to section 22.3.1.1.
   - [b] If the resistance measurement is greater than 5 Ω, go to step 4.
4. Measure the resistance between pin 1 of the VSS harness connector and ground.
   - [a] If the resistance measurement is less than 5 Ω, repair the short to ground between pin 13 of the CPC #3 connector (21–pin) and pin 1 of the VSS harness connector. Refer to section 22.3.1.1.
   - [b] If the resistance measurement is greater than 5 Ω, go to step 5.
5. Measure the resistance between pin 2 of the VSS harness connector and ground.
   - [a] If the resistance measurement is less than 5 Ω, repair the short to ground between pin 14 of the CPC #3 connector (21–pin) and pin 2 of the VSS harness connector. Refer to section 22.3.1.1.
   - [b] If the resistance measurement is greater than 5 Ω, replace the VSS. Refer to section 22.3.1.1.

22.3.1.1 Verify Repairs

Verify repairs as follows:

1. Turn ignition OFF.
2. Reconnect any electrical connections that were disconnected to perform the diagnosis.
3. Clear codes with DDDL 7.0 or latest version.
4. Start and bring engine up to operating temperature (over 140°F/60°C).
5. Verify operation is satisfactory and no warning lamps illuminate. If warning lamps illuminate, troubleshoot the codes. If assistance is required, call the Detroit Diesel Customer Support Center at 313–592–5800.

22.4 SPN 84/FMI 6

Contact the Detroit Diesel Support Center at 313–592–5800.

22.5 SPN 84/FMI 8

Contact the Detroit Diesel Support Center at 313–592–5800.

23 SPN 86 – ADAPTIVE CRUISE CONTROL FAULT

Section **Page**

23.1 SPN 86/FMI 14

If Eaton® Smart Cruise® is installed on the vehicle the parameter for Adaptive Cruise Control must be enabled. This code appears if the parameter for Adaptive Cruise Control is enabled and the vehicle is not equipped with Eaton Smart Cruise.

24 SPN 91 – ACCELERATOR PEDAL SENSOR FAULT

24.1 SPN 91/FMI 2

A typical diagnosis for the fault is erratic data.

24.1.1 Erratic Data Check

Check as follows:

1. Disconnect the Accelerator Pedal (AP).
2. Turn the ignition ON (key ON, engine OFF).
3. Measure the voltage between pins 1 and 3 of the AP harness connector.
   [a] If the voltage is between 4.5 and 5.5 volts, go to step 5.
   [b] If the voltage is less than 4.5, go to step 4.
4. Measure the voltage between pins 1 of the AP harness connector and ground.
   [a] If the voltage is between 4.5 and 5.5 volts, repair the open circuit between pin 3 of the AP harness connector and pin 4 of the CPC #1 connector. See Figure 24-1. Refer to section 24.1.1.1.
   [b] If the voltage is less than 4.5, repair the open circuit between pin 1 of the AP harness connector and pin 8 of the CPC #1 connector. See Figure 24-1. Refer to section 24.1.1.1.

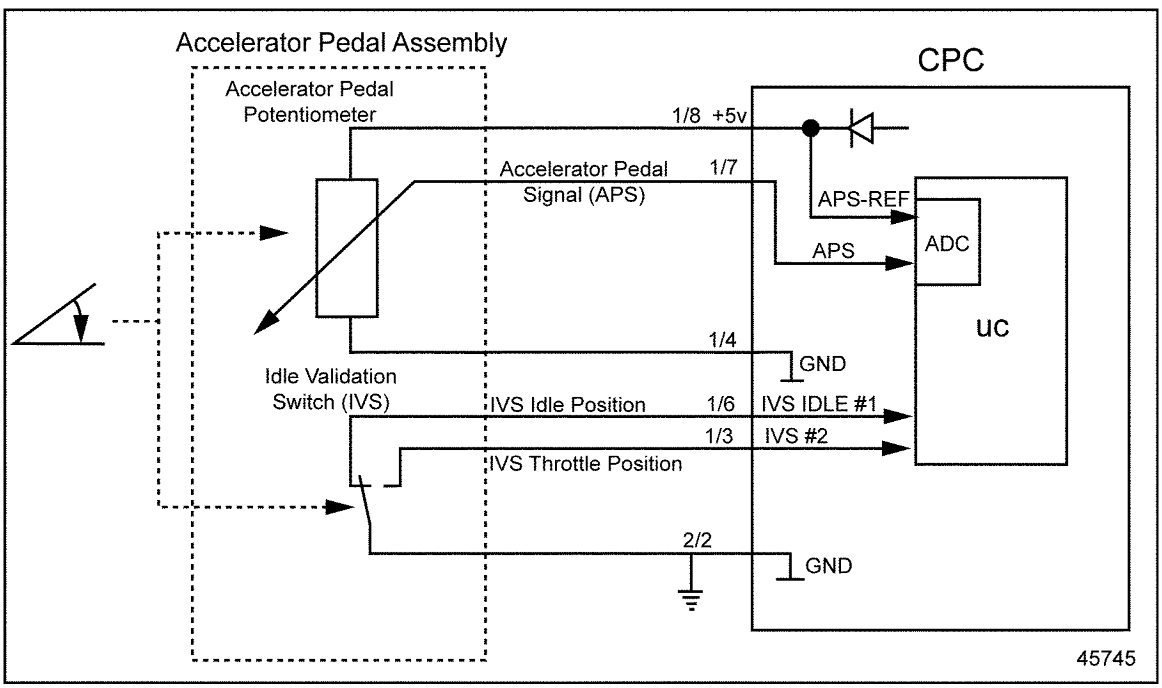


Figure 24-1 Accelerator Pedal Assembly Installation

5. Turn the ignition switch to the OFF position.

6. Disconnect the CPC #1 connector.
7. Measure the resistance between pin 2 of the AP harness connector and pin 7 of the CPC #1 connector.
   [a] Measure the resistance between pin 2 of the AP harness connector and pin 7 of the CPC #1 connector. Refer to section 24.1.1.1.
   [b] If the resistance is less than 3 Ω, replace the Accelerator Pedal. Refer to section 24.1.1.1.

24.1.1.1 Verify Repairs

Verify repairs as follows:

1. Turn ignition OFF.
2. Reconnect any electrical connections that were disconnected to perform the diagnosis.
3. Clear codes with DDDL 7.0 or latest version.
4. Start and bring engine up to operating temperature (over 140°F/60°C).
5. Verify operation is satisfactory and no warning lamps illuminate. If warning lamps illuminate, troubleshoot the codes. If assistance is required, call the Detroit Diesel Customer Support Center at 313–592–5800.

24.2 SPN 91/FMI 3

The typical diagnosis for this fault is circuit failed high.

24.2.1 High Voltage Check

Check as follows:

1. Disconnect the Accelerator Pedal (AP).
2. Turn the ignition ON (key ON, engine OFF).
3. Measure the voltage between pins 1 and 3 of the AP harness connector.
   [a] If the voltage is between 4.5 and 5.5 volts, go to step 5.
   [b] If the voltage is less than 4.5, 4.
4. Measure the voltage between pins 1 of the AP harness connector and ground.
   [a] If the voltage is between 4.5 and 5.5 volts, repair the open circuit between pin 3 of the AP harness connector and pin 4 of the CPC #1 connector. See Figure 24-2. Refer to section 24.2.1.1.

[b] If the voltage is less than 4.5, repair the open circuit between pin 1 of the AP harness connector and pin 8 of the CPC #1 connector. See Figure 24-2. Refer to section 24.2.1.1.

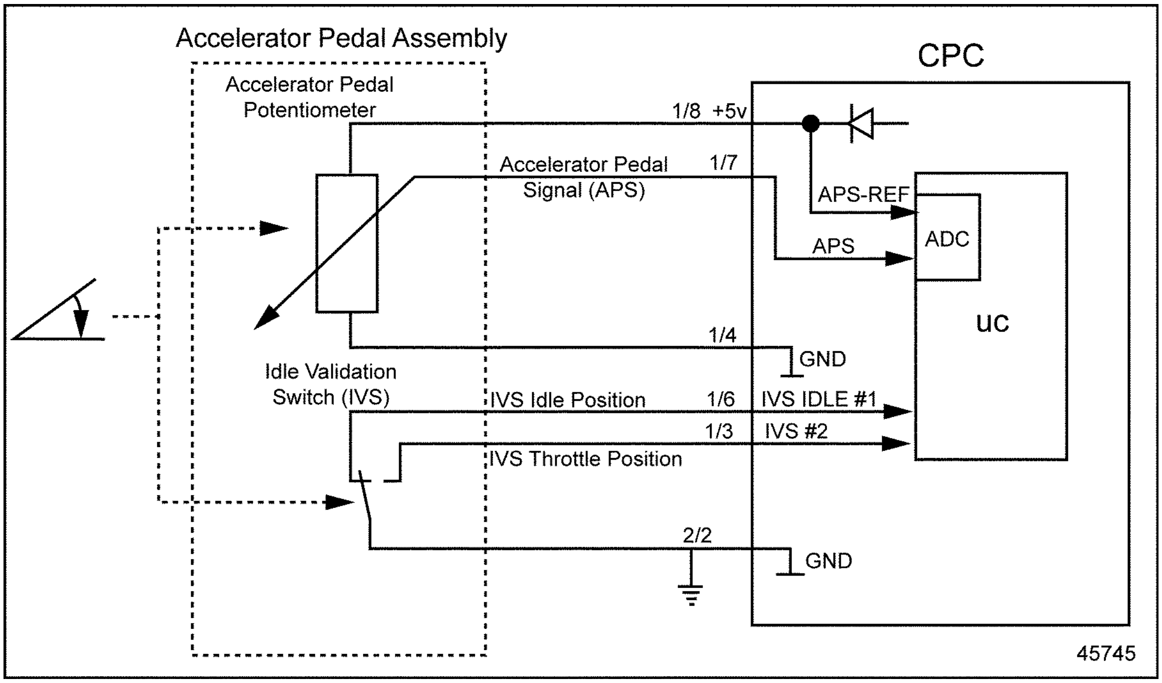


Figure 24-2 Accelerator Pedal Assembly Installation

5. Turn the ignition OFF.
6. Disconnect the CPC #1 connector.
7. Measure the resistance between pin 2 of the AP harness connector and pin 7 of the CPC #1 connector.
   [a] Measure the resistance between pin 2 of the AP harness connector and pin 7 of the CPC #1 connector. Refer to section 24.2.1.1.
   [b] If the resistance is less than 3 Ω, replace the Accelerator Pedal. Refer to section 24.2.1.1.

24.2.1.1 Verify Repairs

Verify repairs as follows:

1. Turn ignition OFF.
2. Reconnect any electrical connections that were disconnected to perform the diagnosis.
3. Clear codes with DDDL 7.0 or latest version.
4. Start and bring engine up to operating temperature (over 140°F/60°C).

5. Verify operation is satisfactory and no warning lamps illuminate. If warning lamps illuminate, troubleshoot the codes. If assistance is required, call the Detroit Diesel Customer Support Center at 313–592–5800.

24.3 SPN 91/FMI 4

The typical diagnosis for this fault is circuit failed low.

24.3.1 Low Voltage Check

Perform the following steps to troubleshoot low voltage.

1. Disconnect the Accelerator Pedal (AP) connector.
2. Disconnect the CPC #1 connector.
3. Measure the resistance between pin 1 and pin 3 of the AP connector.
   [a] If the resistance is less than 5 Ω, repair the short between wires 8 and 4 of the CPC #1 connector. See Figure 24-3. Refer to section 24.3.1.1.
   [b] If the resistance is greater than 5 Ω, go to step 4.

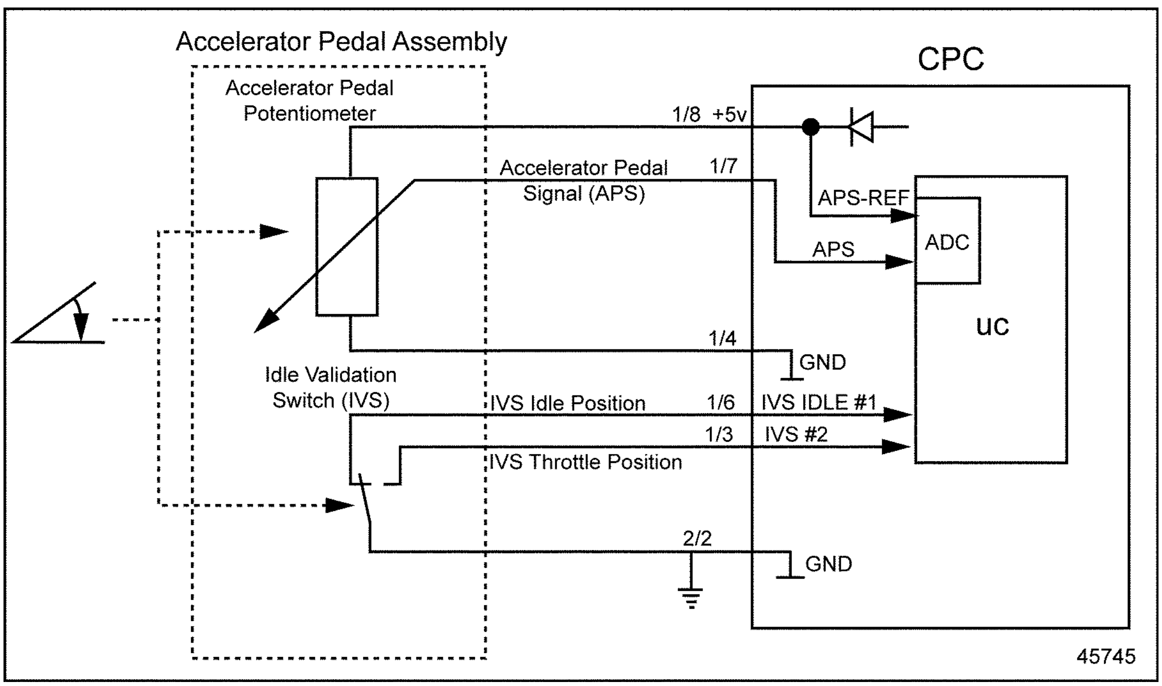


Figure 24-3 Accelerator Pedal Assembly Installation

4. Measure the resistance between pin 2 and 3 of the AP connector.
   [a] If the resistance is less than 5 Ω, repair the short between wires 7 and 14 of the CPC #1 connector. Refer to section 24.3.1.1.
   [b] If the resistance is greater than 5 Ω, go to step 5.

5. Measure the resistance between pin 1 of the AP connector and ground.
   [a] If the resistance is less than 5 Ω, repair the short circuit between pin 1 of the AP connector and ground. Refer to section 24.3.1.1.
   [b] If the resistance is greater than 5 Ω, go to step 6.
6. Measure the resistance between pin 2 of the AP connector and ground.
   [a] If the resistance is less than 5 Ω, repair the short circuit between pin 2 of the AP connector and ground. Refer to section 24.3.1.1.
   [b] If the resistance is greater than 5 Ω, replace the Accelerator Pedal. Refer to section 24.3.1.1.

24.3.1.1 Verify Repairs

Verify repairs as follows:

1. Turn ignition OFF.
2. Reconnect any electrical connections that were disconnected to perform the diagnosis.
3. Clear codes with DDDL 7.0 or latest version.
4. Start and bring engine up to operating temperature (over 140°F/60°C).
5. Verify operation is satisfactory and no warning lamps illuminate. If warning lamps illuminate, troubleshoot the codes. If assistance is required, call the Detroit Diesel Customer Support Center at 313–592–5800.

25 SPN 94 – FUEL COMPENSATION PRESSURE SENSOR CIRCUIT FAULT

Section **Page**

25.1 SPN 94/FMI 3 OR 4

The troubleshooting procedures for this SPN can be found in the *Aftertreatment System Technician's Guide* (7SE63), refer to Chapter 8.

26 SPN 100 — ENGINE OIL PRESSURE OUTSIDE NORMAL OPERATING RANGE

26.1 SPN 100/FMI 1

SPN 100/FMI 1 is typically low engine oil pressure.

The following procedures will troubleshoot SPN 100.

26.1.1 Low Oil Pressure Check

Perform the following steps to troubleshoot a low oil pressure fault code:

1. Turn the ignition ON (key ON, engine OFF).
2. Check for multiple codes.
   - [a] If fault codes 100/1 and 100/3 are both active, refer to section 26.4.2.
   - [b] If fault codes 100/1 and 100/4 are both active, refer to section 26.3.1
   - [c] If only fault code 100/1 is active, go to step 3.
3. Observe the stability of the oil pressure.
   - [a] If the oil pressure is in normal operating range and stable, go to step 4.
   - [b] If the oil pressure is fluctuating, go to step 5.
4. Check the oil level.

NOTE:
An increase in the engine oil level indicates fuel may be leaking into the engine oil.

   - [a] If the oil level is high, check for fuel entering into the engine oil system and repair as required. Change the engine oil. Refer to section 26.1.1.1.
   - [b] If the engine oil level is low, fill oil to proper level. Refer to section 26.1.1.1.
5. Check the operation of the oil gage.
   - [a] If the oil gage readings are erratic, repair or replace the oil gage as required.Refer to section 26.1.1.1.
   - [b] If the oil gage readings are fine, go to step 6.
6. Check the condition of the oil pump suction pipe.
   - [a] If the pipe is loose or cracked, replace a cracked pipe and reinstall a loose pipe. Refer to section 26.1.1.1.
   - [b] If there is no problem with the oil pump suction pipe, go to step 7.
7. Check the condition of the oil pump drive and driven gears.
   - [a] If either gear is loose, repair or replace loose gears as required. Refer to section 26.1.1.1.
   - [b] If neither gear is loose, go to step 8.
8. Check for a faulty oil pressure relief valve.

[a] If the relief valve does not open at the set pressure or sticks open, repair or replace a faulty oil pressure relief valve as required. Refer to section 26.1.1.1.

[b] If the relief valve is fine, refer to section 26.1.1.1.

26.1.1.1 Verify Repairs

Verify repairs as follows:

1. Turn ignition OFF.
2. Reconnect any electrical connections that were disconnected to perform the diagnosis.
3. Clear codes with DDDL 7.0 or latest version.
4. Start and bring engine up to operating temperature (over 140°F/60°C).
5. Verify operation is satisfactory and no warning lamps illuminate. If warning lamps illuminate, troubleshoot the codes. If assistance is required, call the Detroit Diesel Customer Support Center at 313–592–5800.

26.2 SPN 100/FMI 2

The diagnosis for this code is typically erratic data from the Engine Oil Pressure Sensor.

26.2.1 Erratic Data From the Engine Oil Pressure Sensor Check

Check for erratic data from the Engine Oil Pressure Sensor as follows:

1. With the engine shut down, all oil drained into the oil pan, and the vehicle on a level surface, check the oil level.
   - [a] If the oil level is not within the “normal” operating range on the dipstick, add the recommended oil to bring it to the proper level. Refer to section 26.2.1.1.
   - [b] If the oil level is within the “normal” operating range on the dipstick, go to step 2.
2. Check for additional active fault codes.
   - [a] If fault code 100/3 is active in addition to code 100/2, refer to section 26.4.2.
   - [b] If fault code 100/4 is active in addition to code 100/2, refer to section 26.3.1.
   - [c] If only fault code 100/2 is active, check and clean sensor contacts (remove any corrosion). Refer to section 26.2.1.1.

26.2.1.1 Verify Repairs

Perform the following steps to verify repairs.

1. Turn the ignition OFF.
2. Reconnect all connectors.
3. Turn ignition ON.
4. Clear codes with diagnostic tool.
5. Start and run the engine for one minute.
6. Stop engine.
7. Check diagnostic tool for codes.
   - [a] If no codes are displayed, troubleshooting is complete.
   - [b] If code 100/2 is not logged, and other codes are logged, troubleshoot the logged codes.
   - [c] If code 100/2 and other codes are logged, review this section to find the error. If no error is found, call the Detroit Diesel Customer Support Center (313–592–5800).

26.3 SPN 100/FMI 3

This diagnosis is typically an Engine Oil Pressure Sensor short-to-power fault.

26.3.1 Short to Power Check

Check as follows:

1. Turn the ignition ON (key ON, engine OFF).
2. Check for multiple codes.
   - [a] If 100/3, 175/3, 1172/3 and 1176/3 are present, repair the open between pin 105 of the 120–pin connector and the associated sensors. Refer to section 26.3.1.1.
   - [b] If 100/3 and 175/3 are present, go to step 7.
   - [c] If only 100/3 is present, go to step 4.
3. Turn the ignition OFF.
4. Disconnect the Engine Oil Pressure/Temp Sensor.
5. Disconnect the 120–pin MCM connector.
6. Measure the resistance between pins 3 and 4 of the combination sensor harness connector.
   - [a] If resistance is less than 5 Ω, repair short circuit between 120-pin MCM connector wires 54 and 82. Refer to section 26.3.1.1.
   - [b] If resistance is greater than 5 Ω, repair the short to power on the circuit between pin 54 of the 120–pin MCM connector and pin 4 of the Engine Oil Pressure/Temp Sensor harness connector. See Figure 26-1. Refer to section 26.3.1.1.
7. Disconnect the Engine Oil Pressure/Temp Sensor.
8. Measure the resistance between pin 1 and 3 of the Engine Oil Pressure/Temp Sensor.
   - [a] If resistance is less than 140 Ω, go to step 9.
   - [b] If resistance is greater than 140 Ω, replace the sensor. Refer to section 26.3.1.1.
9. Turn the ignition ON (key ON, engine OFF).
10. Measure the voltage between pin 3 of the combination sensor and ground.

[a] If the voltage is less than 2.75 volts, repair the open circuit between pin 82 of the 120–pin MCM connector and pin 3 of the Engine Oil Pressure/Temp Sensor. See Figure 26-1. Refer to section 26.3.1.1.

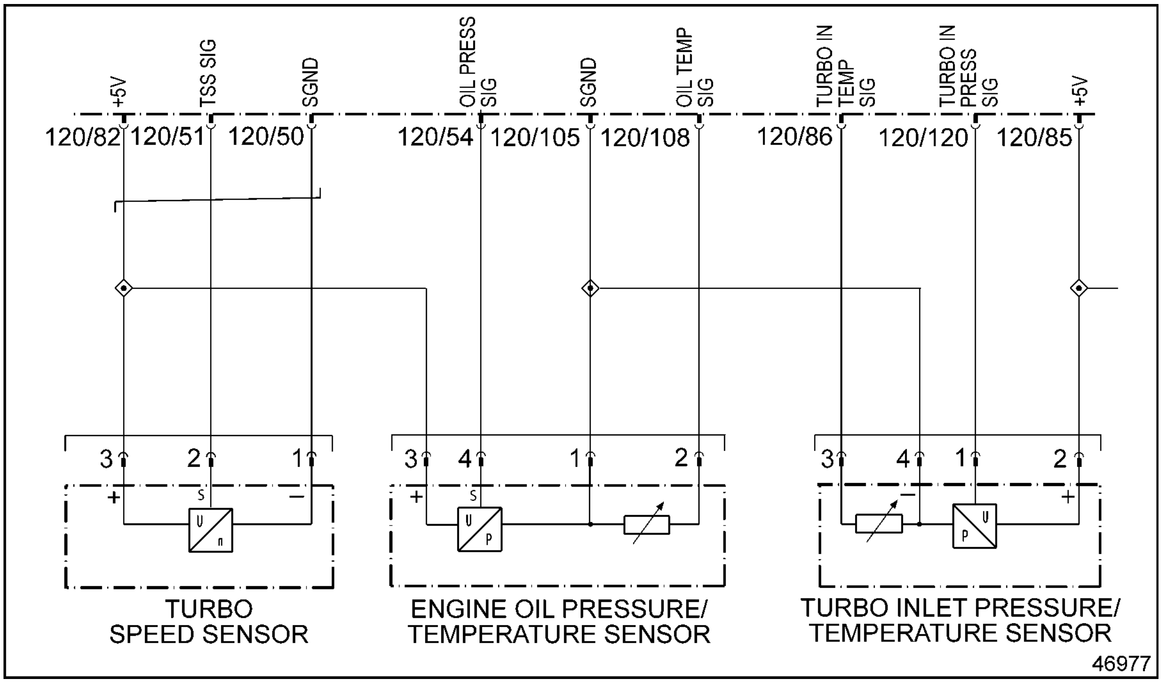


Figure 26-1 Engine Oil Pressure/Temp Sensor

[b] If the voltage is less than 2.75 volts, repair the open circuit between pin 105 of the 120–pin MCM connector and pin 1 of the Engine Oil Pressure/Temp Sensor. See Figure 26-1. Refer to section 26.3.1.1.

26.3.1.1 Verify Repairs

Verify repairs as follows:

1. Turn ignition OFF.
2. Reconnect any electrical connections that were disconnected to perform the diagnosis.
3. Clear codes with DDDL 7.0 or latest version.
4. Start and bring engine up to operating temperature (over 140°F/60°C).
5. Verify operation is satisfactory and no warning lamps illuminate. If warning lamps illuminate, troubleshoot the codes. If assistance is required, call the Detroit Diesel Customer Support Center at 313–592–5800.

26.4 SPN 100/FMI 4

A typical diagnosis is an Engine Oil Pressure Sensor circuit failed low.

26.4.1 Multiple Code Check

Check for multiple codes as follows:

1. Turn the ignition ON (key ON, engine OFF).
2. Plug in diagnostic tool and check for multiple codes.
   [a] If 175/4 and 3480/4 are present with 100/4, repair the open between pin 82 of the MCM 120–pin connector and the associated sensors. Refer to section 26.4.2.1.
   [b] If 175/4 is present with 100/4, repair the open between pin 82 of the MCM 120–pin connector and pin 3 of the Engine Oil Temperature/Pressure Sensor. Refer to section 26.4.2.1.
3. If only 100/4 is present, refer to section 26.4.2.

26.4.2 Open Short to Ground Check

Check for an Engine Oil Temperature/Pressure Sensor open short to ground as follows:

1. Disconnect the Engine Oil Temperature/Pressure Sensor.
2. Measure the resistance between pins 1 and 3 of the Engine Oil Temperature/Pressure Sensor.
   [a] If the resistance is greater than 130k Ω, replace the Engine Oil Temperature/Pressure Sensor. Refer to section 26.4.2.1.
   [b] If the resistance is less than 130k Ω, go to step 3.
3. Measure the resistance between pins 1 and 4 of the combination sensor.
   [a] If the resistance is greater than 130k Ω, replace the sensor. Refer to section 26.4.2.1.
   [b] If the resistance is less than 130k Ω, go to step 4.
4. Disconnect the MCM 120–pin connector.
5. Measure the resistance between pins 1 and 4 of the sensor harness connector.
   [a] If the resistance is greater than 5 Ω, go to step 6.
   [b] If the resistance is less than 5 Ω, repair the short between wires 105 and 54 of the MCM 120–pin connector. Refer to section 26.4.2.1.
6. Measure the resistance between pin 4 of the sensor harness connector and ground.
   [a] If the resistance is greater than 5 Ω, repair the open between pin 4 of the sensor and pin 54 of the MCM 120–pin connector. See Figure 26-2. Refer to section 26.4.2.1.

[b] If the resistance is less than 5 Ω, repair the short to ground circuit between pin 54 of the MCM 120–pin connector and ground. See Figure 26-2. Refer to section 26.4.2.1.

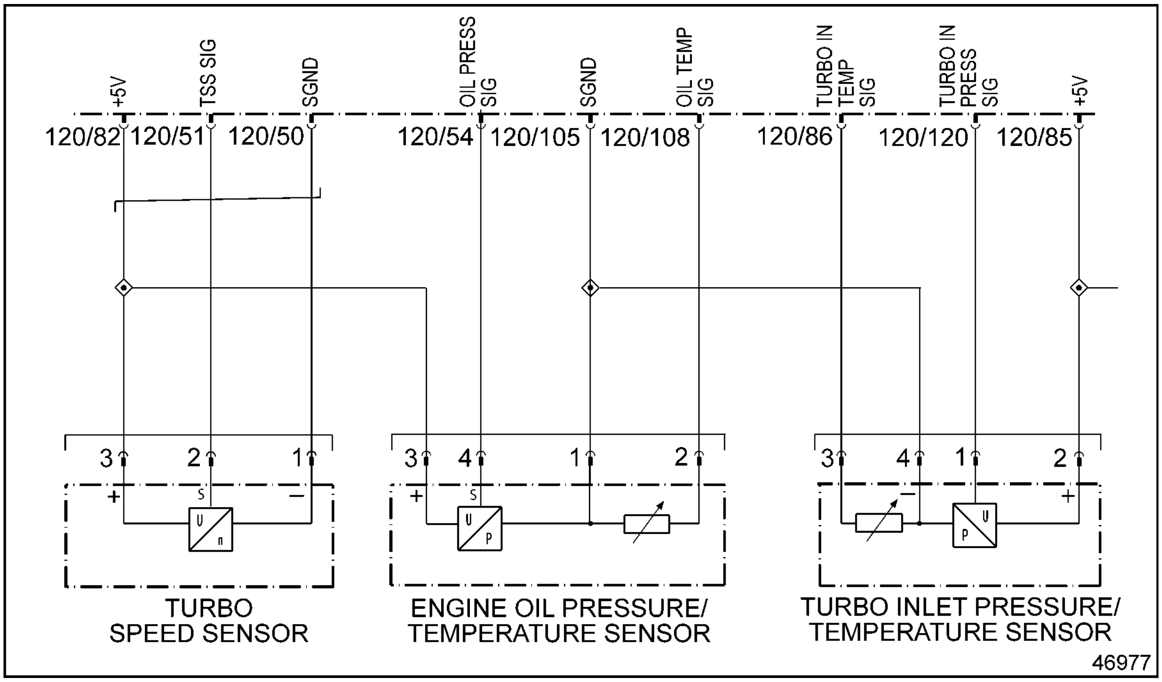


Figure 26-2 Engine Oil Temperature/Pressure Sensor

26.4.2.1 Verify Repairs

Verify repairs as follows:

1. Turn ignition OFF.
2. Reconnect any electrical connections that were disconnected to perform the diagnosis.
3. Clear codes with DDDL 7.0 or latest version.
4. Start and bring engine up to operating temperature (over 140°F/60°C).
5. Verify operation is satisfactory and no warning lamps illuminate. If warning lamps illuminate, troubleshoot the codes. If assistance is required, call the Detroit Diesel Customer Support Center at 313–592–5800.

26.5 SPN 100/FMI 18

This diagnosis is typically oil pressure very low.

26.5.1 Low Oil Pressure Check

Check as follows:

1. Turn the ignition ON (key ON, engine OFF).

2. Check for additional active fault codes.
   [a] If fault code 100/3 is active in addition to code 100/14, refer to section 26.4.2.
   [b] If fault code 100 /4 is active in addition to code 100/14, refer to section 26.3.1.
3. If only fault code 100/14 is active, go to step 4.
4. Start engine and check oil pressure.
   [a] If pressure is fluctuating, go to step 5.
   [b] If pressure is low but stable, go to step 6.
5. Stop the engine and allow sufficient time for the oil to drain into the oil pan. Perform the following steps:
   [a] Check the oil level. Add recommended oil to bring it to the proper level, if required.
   [b] Check for faulty oil gage. Replace, if required.
   [c] Check for loose or cracked oil pump suction pipe. Repair or replace, as required.
   [d] Check for loose drive or driven oil pump gear. Repair or replace, as required.
   [e] Check for faulty oil pressure relief valve. Repair or replace, as required.
   [f] Refer to section 26.5.1.1
6. Stop the engine and allow sufficient time for the oil to drain into the oil pan. Check the oil level.
   [a] If oil is above maximum level with no oil previously added, go to step 7.
   [b] If oil is not above maximum level, contact Detroit Diesel Customer Support Center (313–592–5800).
7. Check for possible fuel in oil.
   [a] If fuel is found, locate and repair source of fuel leak. Change the oil. Refer to section 26.5.1.1.
   [b] If fuel is not found, contact Detroit Diesel Customer Support Center (313–592–5800).

26.5.1.1 Verify Repairs

Verify repairs as follows:

1. Turn ignition OFF.
2. Reconnect any electrical connections that were disconnected to perform the diagnosis.
3. Clear codes with DDDL 7.0 or latest version.
4. Start and bring engine up to operating temperature (over 140°F/60°C).
5. Verify operation is satisfactory and no warning lamps illuminate. If warning lamps illuminate, troubleshoot the codes. If assistance is required, call the Detroit Diesel Customer Support Center at 313–592–5800.

27 SPN 103 – TURBO NO REVOLUTION

Section **Page**

27.1 SPN 103/FMI 0

This diagnosis is typically turbocharger speed above threshold.

27.1.1 Equipment Check

Check equipment as follows:

1. Disconnect the Turbo Speed Sensor.
2. Measure the resistance across pins 1 and 2 of the Turbo Speed Sensor.
   - [a] If the resistance is 0 or greater than 1k Ω, replace the Turbo Speed Sensor. Refer to section 27.1.1.1.
   - [b] If the resistance is less than 1k Ω, go to step 3.
3. Visually inspect the turbocharger for damage.
   - [a] If damage is found, repair as necessary. When the repairs are done, refer to section 27.1.1.1.
   - [b] If no visible damage is found, go to step 4.
4. Using Artisan, perform the turbocharger self test.
   - [a] If the self test fails, repair the turbo/actuator as necessary. When the repairs are done, refer to section 27.1.1.1.
   - [b] If the self test results are satisfactory, go to step 5.
5. Perform the fuel pressure test.
   - [a] If the fuel pressure is not within specifications, repair the fuel system as necessary. When the repairs are done, refer to section 27.1.1.1.
   - [b] If the fuel pressure is within specifications, contact the Detroit Diesel Customer Support Center (313–592–5800).

27.1.1.1 Verify Repairs

Verify repairs as follows:

1. Turn ignition OFF.
2. Reconnect any electrical connections that were disconnected to perform the diagnosis.
3. Clear codes with DDDL 7.0 or latest version.
4. Start and bring engine up to operating temperature (over 140°F/60°C).
5. Verify operation is satisfactory and no warning lamps illuminate. If warning lamps illuminate, troubleshoot the codes. If assistance is required, call the Detroit Diesel Customer Support Center at 313–592–5800.

27.2 SPN 103/FMI 1

This diagnosis is typically turbocharger speed below threshold

27.2.1 Equipment Check

Check equipment as follows:

1. Disconnect the Turbo Speed Sensor.
2. Measure the resistance across pins 1 and 2 of the Turbo Speed Sensor.
   [a] If the resistance is 0 or greater than 1k **Ω**, replace the Turbo Speed Sensor. Refer to section 27.2.1.1.
   [b] If the resistance is less than 1k **Ω**, go to step 3.
3. Visually inspect the turbocharger for damage.
   [a] If damage is found, repair as necessary. When the repairs are done, refer to section 27.2.1.1.
   [b] If no visible damage is found, go to step 4.
4. Using Artisan, perform the turbocharger self test.
   [a] If the self test fails, repair the turbo/actuator as necessary. When the repairs are done, refer to section 27.2.1.1.
   [b] If the self test results are satisfactory, go to step 5.
5. Perform the engine oil pressure.
   [a] If the fuel pressure is not within specifications, repair the lubrication system as necessary. When the repairs are done, refer to section 27.2.1.1.
   [b] If the oil pressure is within specifications, contact the Detroit Diesel Customer Support Center (313–592–5800).

27.2.1.1 Verify Repairs

Verify repairs as follows:

1. Turn ignition OFF.
2. Reconnect any electrical connections that were disconnected to perform the diagnosis.
3. Clear codes with DDDL 7.0 or latest version.
4. Start and bring engine up to operating temperature (over 140°F/60°C).
5. Verify operation is satisfactory and no warning lamps illuminate. If warning lamps illuminate, troubleshoot the codes. If assistance is required, call the Detroit Diesel Customer Support Center at 313–592–5800.

27.3 SPN 103/FMI 3

This diagnosis is typically circuit failed high (open circuit).

27.3.1 Open Circuit Check

Check for an open as follows:

1. Disconnect the Turbo Speed Sensor (TSS).
2. Measure the resistance across pins 1 and 2 of the sensor (see Figure 27-1).
   [a] If the resistance is greater than 1k Ω, replace the sensor. Refer to section 27.3.2.1.
   [b] If the resistance is less than 1k Ω, go to step 3.
3. Turn the ignition switch to the ON position.
4. Measure the voltage between pins 1 and 2 of the TSS harness connector.
   [a] If the voltage is between 4.5 and 5.5 volts, refer to section 27.3.2.
   [b] If the voltage is less than 4.5 volts, go to step 5.
5. Measure the voltage between pin 2 of the TSS harness connector and ground.
   [a] If the voltage is between 4.5 and 5.5 volts, repair the open circuit between pin 1 of the TSS harness connector and pin 50 of the 120–pin MCM connector. See Figure 27-1. Refer to section 27.3.2.1.

[b] If the voltage is less than 4.5 volts, repair the open circuit between pin 2 of the TSS harness connector and pin 51 of the 120–pin MCM connector. See Figure 27-1. Refer to section 27.3.2.1.

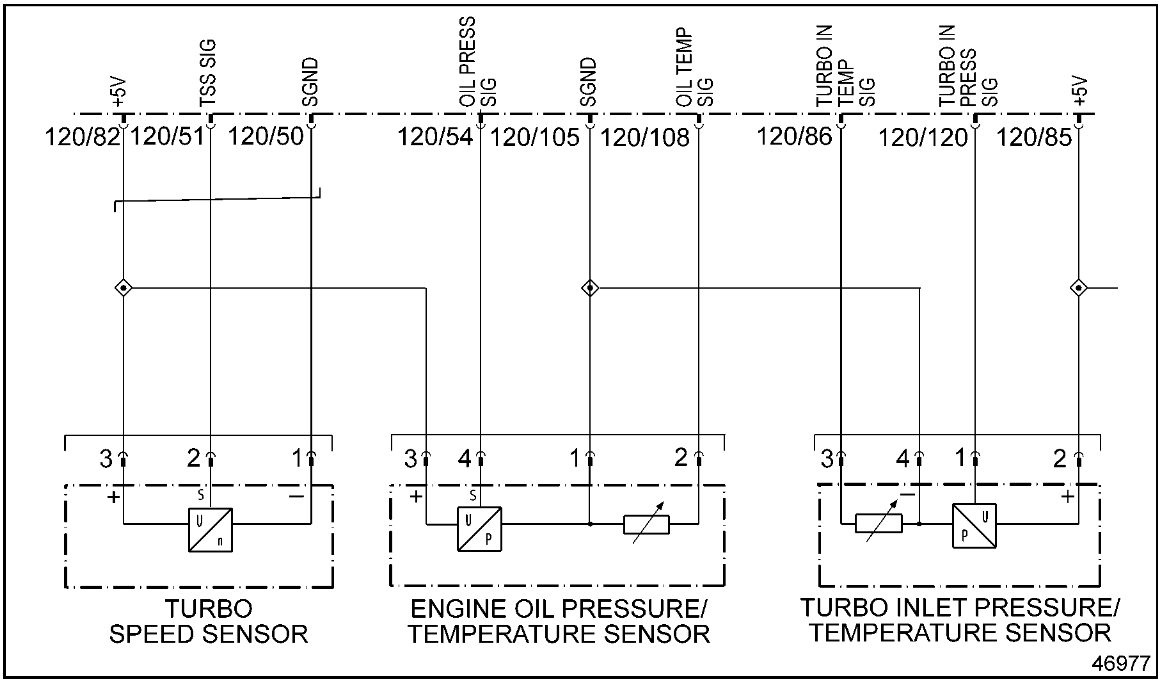


Figure 27-1 Turbo Speed Sensor Terminal and Wire Locations

27.3.2 Resistance and Voltage Check

The resistance and voltage check performed indicate that you should not be getting a code. The following is a recheck before requesting a new MCM.

1. Turn the ignition OFF.
2. Reconnect the TSS.
3. Clear codes. Run engine for one minute. Stop engine.
4. Recheck codes.
   [a] If there are no codes, troubleshooting is finished.
   [b] If code 103/ 3 is logged, go to step 5.
5. Disconnect the Turbo Speed Sensor (TSS).
6. Measure the resistance across pins 1 and 2 of the sensor.
   [a] If the resistance is greater than 1.1k Ω, replace the sensor. Refer to section 27.3.2.1.
   [b] If the resistance is less than 1.1k Ω, go to step 7.
7. Turn the ignition switch to the ON position.
8. Measure the voltage between pins 1 and 2 of the TSS harness connector.

[a] If the voltage is between 4.5 and 5.5 volts, contact the Detroit Diesel Customer Support Center (313–592–5800) for authorization to replace the MCM.

[b] If the voltage is less than 4.5 volts, refer to section 27.3.1, step 5.

27.3.2.1 Verify Repairs

Verify repairs as follows:

1. Turn ignition OFF.
2. Reconnect any electrical connections that were disconnected to perform the diagnosis.
3. Clear codes with DDDL 7.0 or latest version.
4. Start and bring engine up to operating temperature (over 140°F/60°C).
5. Verify operation is satisfactory and no warning lamps illuminate. If warning lamps illuminate, troubleshoot the codes. If assistance is required, call the Detroit Diesel Customer Support Center at 313–592–5800.

27.4 SPN 103/FMI 4

This diagnosis is typically short to ground.

27.4.1 Short Circuit Check

Check for short as follows:

1. Disconnect the Turbo Speed Sensor (TSS).
2. Disconnect the 120–pin MCM connector.
3. Measure the resistance across pins 1 and 2 of the TSS connector.
   [a] If the resistance is less than 5 Ω, repair the short between the 120–pin MCM connector wires 50 and 51. Refer to section 27.4.2.1.
   [b] If the resistance is greater than 5 Ω, go to step 4.
4. Measure the resistance between pin 1 of the TSS harness connector and ground.
   [a] If the resistance is less than 5 Ω, repair the short between pin 1 of the TSS harness connector and ground. Refer to section 27.4.2.1.
   [b] If the resistance is greater than 5 Ω, go to step 5.
5. Measure the resistance between pin 2 of the TSS harness connector and ground.
   [a] If the resistance is less than 5 Ω, repair the short between pin 2 of the TSS harness connector and ground. Refer to section 27.4.2.1.
   [b] If the resistance is greater than 5 Ω, refer to section 27.4.2.1.

27.4.2 Resistance Check

The resistance checks performed in the previous section indicated that you should not be getting a code. The following is a recheck before requesting a new MCM.

1. Reconnect all connectors. Turn ignition ON.
2. Clear codes with diagnostic tool.
3. Start and run the engine for one minute. Stop engine.
4. Recheck codes.
   [a] If there are no codes, troubleshooting is finished.
   [b] If code 103/4 is logged, go to step 5.
5. Disconnect the TSS and the 120–pin MCM connector.
6. Measure the resistance across pins 1 and 2 of the TSS connector.
   [a] If the resistance is less than 5 Ω, repair the short between the 120–pin MCM connector wires 50 and 51. Refer to section 27.4.2.1.
   [b] If the resistance is greater than 5 Ω, go to step 7.
7. Measure the resistance between pin 1 of the TSS harness connector and ground.
   [a] If the resistance is less than 5 Ω, repair the short between pin 1 of the TSS harness connector and ground. Refer to section 27.4.2.1.
   [b] If the resistance is greater than 5 Ω, go to step 8.
8. Measure the resistance between pin 2 of the TSS harness connector and ground.
   [a] If the resistance is less than 5 Ω, repair the short between pin 2 of the TSS harness connector and ground. Refer to section 27.4.2.1.
   [b] If the resistance is greater than 5 Ω, contact the Detroit Diesel Customer Support Center (313–592–5800) for authorization to replace the MCM.

27.4.2.1 Verify Repairs

Verify repairs as follows:

1. Turn ignition OFF.
2. Reconnect any electrical connections that were disconnected to perform the diagnosis.
3. Clear codes with DDDL 7.0 or latest version.
4. Start and bring engine up to operating temperature (over 140°F/60°C).
5. Verify operation is satisfactory and no warning lamps illuminate. If warning lamps illuminate, troubleshoot the codes. If assistance is required, call the Detroit Diesel Customer Support Center at 313–592–5800.

27.5 SPN 103/FMI 7

Certain engines equipped with a turbo brake require turbo speed monitoring during the braking mode in order to control engine brake power. The speed is controlled through the TSS installed on the turbo shaft housing. SPN 103 (SPN 103/FMI 7) is logged when the MCM on the engine fails to receive the monitoring signal from the sensor.

There are two possible causes for this fault code:

- Failed sensor.
- Sensor too close to the turbo shaft (not enough air gap).

27.5.1 Turbo Speed Sensor Check

Troubleshoot a Turbo No Revolution fault as follows:

1. With the engine stopped and at ambient temperature, unplug the TSS from the TSS connector.
2. Measure the resistance between the sensor terminals.
   [a] If resistance is approximately 900 Ω, refer to section 27.5.2.
   [b] If resistance is zero or higher than 950 Ω, replace the sensor. Refer to section 27.5.2.1.

27.5.2 Adjust the Turbo Speed Sensor Air Gap

Adjust the TSS air gap a follows:

1. Remove the TSS from the turbo shaft housing.
2. Adjust the air gap by adding a 0.020 in. washer between the sensor body and the housing.
3. Install the sensor into the turbo shaft housing. Refer to section 27.5.2.1.

27.5.2.1 Verify Repairs

Verify repairs as follows:

1. Turn ignition OFF.
2. Reconnect any electrical connections that were disconnected to perform the diagnosis.
3. Clear codes with DDDL 7.0 or latest version.
4. Start and bring engine up to operating temperature (over 140°F/60°C).
5. Verify operation is satisfactory and no warning lamps illuminate. If warning lamps illuminate, troubleshoot the codes. If assistance is required, call the Detroit Diesel Customer Support Center at 313–592–5800.

28 SPN 110 — COOLANT TEMPERATURE ABOVE OR BELOW NORMAL OPERATING RANGE

Section **Page**

28.1 SPN 110/FMI 0

The diagnostic condition is typically engine coolant temperature high.

28.1.1 Multiple Code Check

Perform the following steps to check for multiple codes

1. Turn the ignition ON (key ON, engine OFF).
2. Plug in the diagnostic tool.
3. Read active codes.
   [a] If fault 110/3 is active in addition to 110/0, refer to section 28.3.
   [b] If fault 110/4 is active in addition to 110/0, refer to section 28.4.
   [c] If fault 111/1 is active in addition to 110/0, refer to section 29.1.
   [d] If only fault code 110/0 is active, refer to section 28.1.2.

28.1.2 System Checks to Resolve Fault

Perform the following steps to resolve a coolant temperature high fault. Repair or replace, as required.

1. Check for coolant loss.
2. Check for blockage in radiator and charge air cooler.
3. Check fan belt condition (slippage).
4. Check for proper location of fan shroud.
5. Check for proper radiator hose condition (no collapsed hoses).
6. Check for proper viscous fan operation.
7. Once checks and repairs are finished, refer to section 28.1.2.1.

28.1.2.1 Verify Repairs

Verify repairs as follows:

1. Turn ignition OFF.
2. Reconnect any electrical connections that were disconnected to perform the diagnosis.
3. Clear codes with DDDL 7.0 or latest version.
4. Start and bring engine up to operating temperature (over 140°F/60°C).
5. Verify operation is satisfactory and no warning lamps illuminate. If warning lamps illuminate, troubleshoot the codes. If assistance is required, call the Detroit Diesel Customer Support Center at 313–592–5800.

28.2 SPN 110/FMI 2

This condition is typically coolant temperature out of range (drifted low/high).

NOTE:
When diagnosing rationality erratic data faults (FMI 2) always refer to SILs or SIBs for any known issues first.

28.2.1 Rationality Check for Temperature Drift

Troubleshoot SPN 110/2 as follows:

1. Check cooling system integrity (lack of heat complaints).
2. Connect the diagnostic tool and monitor the engine oil temperature and the engine coolant temperature.
3. With the engine running at idle and the engine oil temperature above 160°, is the coolant temperature within X degrees of the oil temperature?
   [a] If yes, go to step 4.
   [b] If no, disconnect the ECT Sensor and the MCM connector. Bridge pins X and X of the sensor, measure the resistance at the MCM between pins X and X. If the resistance is greater than 3 **Ω**, repair the harness. If the resistance is less than 3 **Ω**, replace the sensor. Refer to section 28.2.1.1.
4. With the engine running at 1500 rpm and oil temperature above 160°, check the coolant temperature. Is it within X degrees of the oil temperature?
   [a] If yes, contact the Detroit Diesel Customer Support Center (313–592–5800).
   [b] If no, disconnect the ECT Sensor and the MCM connector. Bridge pins X and X of the sensor and measure resistance at the MCM between pins X and X. If the resistance is greater than 3 **Ω** repair the harness. If the resistance is less than 3 **Ω**, replace the sensor. Refer to section 28.2.1.1.

28.2.1.1 Verify Repairs

Verify repairs as follows:

1. Turn ignition OFF.
2. Reconnect any electrical connections that were disconnected to perform the diagnosis.
3. Clear codes with DDDL 7.0 or latest version.
4. Start and bring engine up to operating temperature (over 140°F/60°C).
5. Verify operation is satisfactory and no warning lamps illuminate. If warning lamps illuminate, troubleshoot the codes. If assistance is required, call the Detroit Diesel Customer Support Center at 313–592–5800.

28.3 SPN 110/FMI 3

SPN 110/FMI 3 indicates that the Engine Coolant Temperature Sensor (ECT Sensor) input to the MCM has exceeded 95% of the sensor supply voltage. The diagnostic condition is typically engine coolant temperature open circuit (110/3).

28.3.1 Multiple Code Check

Check for multiple codes as follows:

1. Turn the ignition ON (key ON, engine OFF).
2. Plug in the diagnostic tool.
3. Read the active codes.
   [a] If codes 110/3, 174/3 and 175/3 are active at the same time, repair the open circuit between pin 73 of the 120–pin MCM connector and pin 1 of the ECT Sensor, the EOT Sensor and the Supply Fuel Temperature Sensor. Refer to section 28.3.2.1.
   [b] If only fault 110/3 is active, refer to section 28.3.2.

28.3.2 Open Circuit Check

Perform the following steps to troubleshoot an ECT Sensor open circuit fault:

1. Disconnect the ECT Sensor.
2. Measure the resistance across pins 1 and 2 of the ECT Sesnor.
   [a] If the resistance is greater than 4 kΩ, replace the sensor. Refer to section 28.3.2.1.
   [b] If the resistance is less than 4 kΩ, go to step 3.
3. Turn the ignition ON (key ON, engine OFF).
4. Measure the voltage between pins 1 and 2 of the ECT Sensor harness connector.
   [a] If the voltage is between 2.75 and 3.25 volts, go to step 6.
   [b] If the voltage is less than 2.75 volts, go to step 5.
5. Measure the voltage between pin 2 of the ECT Sensor harness connector and ground.
   [a] If the voltage is between 2.75 and 3.25 volts, repair the open circuit between pin 1 of the ECT Sensor harness connector and pin 73 of the 120–pin MCM connector (see Figure 28-1). Refer to section 28.3.2.1.

[b] If the voltage is less than 2.75 volts, repair the open circuit between pin 2 of the ECT Sensor harness connector and pin 110 of the 120–pin MCM connector (see Figure 28-1). Refer to section 28.3.2.1.

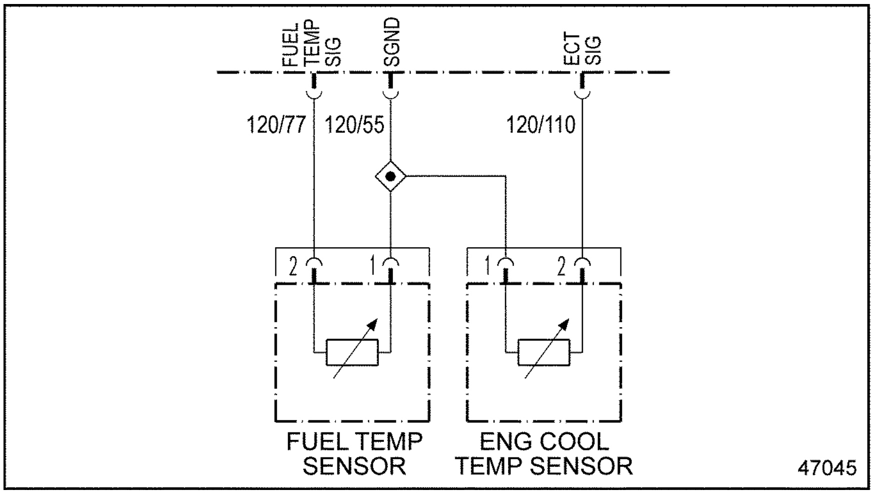


Figure 28-1 Engine Coolant Temperature Sensor

6. Disconnect the 120–pin MCM connector. Measure the resistance between pins 1 and 2 of the ECT Sensor harness connector.

   [a] If the resistance is greater than 5 Ω, replace the ECT Sensor. Refer to section 28.3.2.1.

   [b] If the resistance is less than 5 Ω, repair the short between pins 73 and 110 of the 120–pin MCM connector. Refer to section 28.3.2.1.

28.3.2.1 Verify Repairs

Verify repairs as follows:

1. Turn ignition OFF.
2. Reconnect any electrical connections that were disconnected to perform the diagnosis.
3. Clear codes with DDDL 7.0 or latest version.
4. Start and bring engine up to operating temperature (over 140°F/60°C).
5. Verify operation is satisfactory and no warning lamps illuminate. If warning lamps illuminate, troubleshoot the codes. If assistance is required, call the Detroit Diesel Customer Support Center at 313–592–5800.

28.4 SPN 110/FMI 4

The diagnostic condition is typically engine coolant temperature short to ground.

28.4.1 Short to Ground Check

Perform the following steps to troubleshoot an ECT Sensor short-to-ground fault.

1. Disconnect the ECT Sensor.
2. Disconnect the 120–pin MCM connector.
3. Measure the resistance across pins 1 and 2 of the ECT Sensor connector. See Figure 28-2.

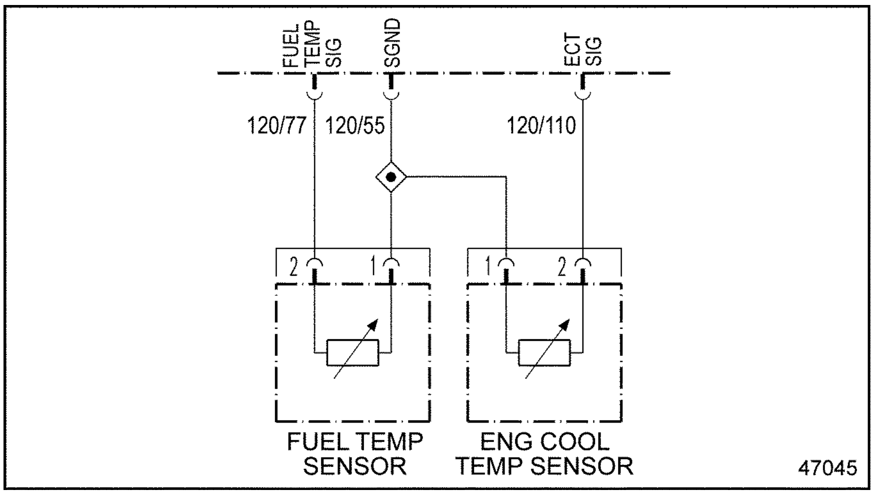


Figure 28-2 Engine Coolant Temperature Sensor

   [a] If resistance is greater than 5 Ω, go to step 4.

   [b] If resistance is less than 5 Ω, repair short to ground between pins 73 and 110 of the 120-pin MCM connector. Refer to section 28.4.1.1.

4. Measure the resistance between pin 1 of the ECT Sensor harness connector and ground.

   [a] If resistance is greater than 5 Ω, go to step 5.

   [b] If resistance is less than 5 Ω, repair the short circuit pin 1 of the ECT Sensor harness connector and ground. Refer to section 28.4.1.1.

5. Measure the resistance between pin 2 of the ECT Sensor harness connector and ground.

   [a] If resistance is greater than 5 Ω, repeat steps 3 through 5. If the results are the same, call the Detroit Diesel Customer Support Center (313–592–5800).

   [b] If resistance is less than 5 Ω, repair the short circuit between pin 2 of the ECT Sensor harness connector and ground. Refer to section 28.4.1.1.

28.4.1.1 Verify Repairs

Verify repairs as follows:

1. Turn ignition OFF.
2. Reconnect any electrical connections that were disconnected to perform the diagnosis.
3. Clear codes with DDDL 7.0 or latest version.
4. Start and bring engine up to operating temperature (over 140°F/60°C).
5. Verify operation is satisfactory and no warning lamps illuminate. If warning lamps illuminate, troubleshoot the codes. If assistance is required, call the Detroit Diesel Customer Support Center at 313–592–5800.

28.5 SPN 110/FMI 14

The diagnostic condition is typically engine coolant temperature very high.

28.5.1 System Checks to Resolve Fault

Check as follows:

1. Turn the ignition ON (key ON, engine OFF).
2. Plug in DDDL 7.0.
3. Read active codes:
   [a] If only fault code 110/14 is active, go to step 4.
   [b] If fault code 110/3 is active in addition to fault code 110/14, refer to section 28.3.2.
   [c] If fault code 110/4 is active in addition to fault code 110/14, refer to section 28.4.1.
4. Check for coolant loss.
5. Check for blockage in radiator and charge air cooler.
6. Check fan belt condition (slippage).
7. Check for proper location of fan shroud.
8. Check for proper radiator hose condition (no collapsed hoses).
9. Check for proper viscous fan operation.
10. Once checks and repairs are finished, refer to section 28.5.1.1.

28.5.1.1 Verify Repairs

Verify repairs as follows:

1. Turn ignition OFF.
2. Reconnect any electrical connections that were disconnected to perform the diagnosis.
3. Clear codes with DDDL 7.0 or latest version.
4. Start and bring engine up to operating temperature (over 140°F/60°C).
5. Verify operation is satisfactory and no warning lamps illuminate. If warning lamps illuminate, troubleshoot the codes. If assistance is required, call the Detroit Diesel Customer Support Center at 313–592–5800.

29 SPN 111 – COOLANT LEVEL OUTSIDE NORMAL OPERATING RANGE

Section **Page**

29.1 SPN 111/FMI 1

Perform the following steps to troubleshoot 111/1:

29.1.1 Coolant Level Check

1. Turn the ignition ON (key ON, engine OFF).
2. Check for multiple codes.
   [a] If other faults are active in addition to fault 111/1, troubleshoot the other faults first.
   [b] If only fault 111/1 is active, go to step 3.
3. Check the coolant level in the reservoir. See Figure 29-1.

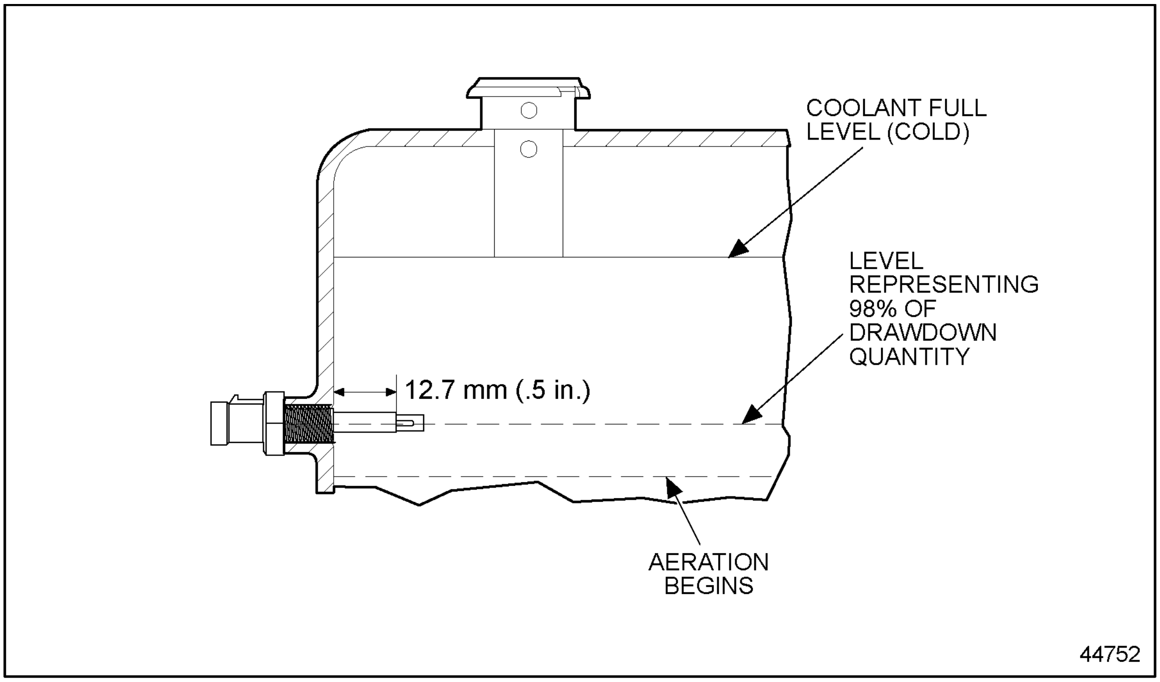
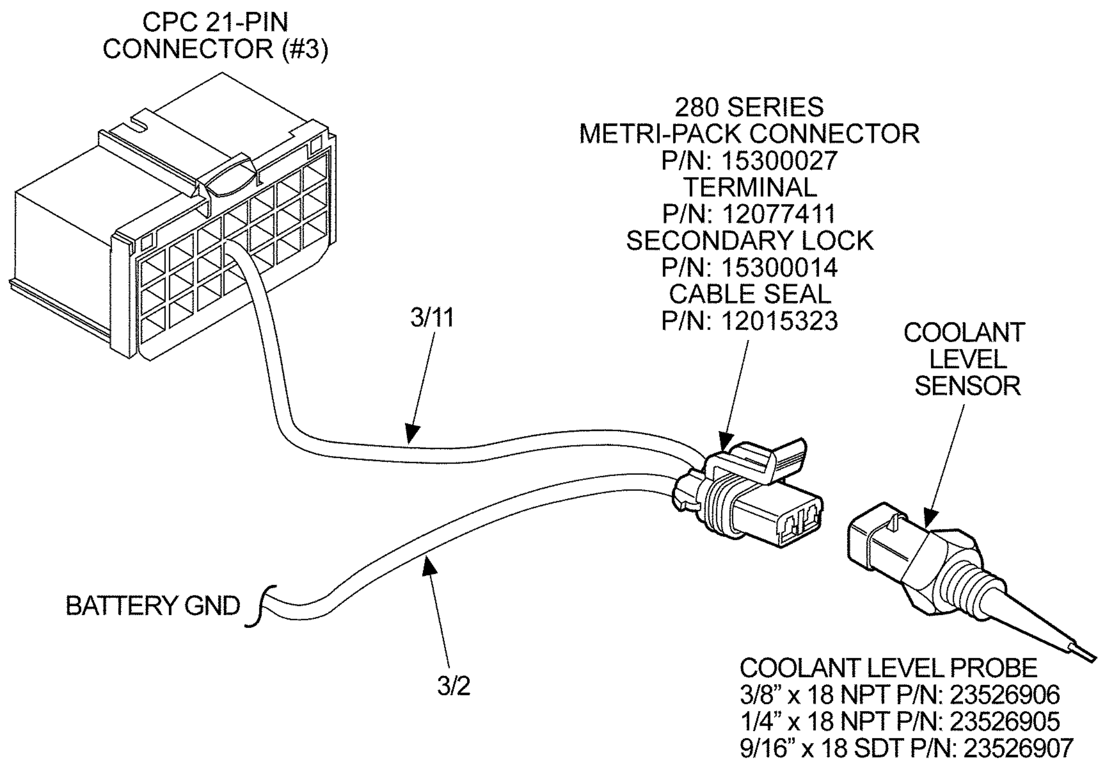


Figure 29-1 Engine Coolant Level Sensor Mounted in Radiator Top Tank

[a] If the coolant level in the reservoir is not within limit, refer to section 29.1.2.

[b] If the coolant level in the reservoir is within limit, replace the sensor (see Figure 29-2). Refer to section 29.1.2.1.



LABEL	CPC CONNECTOR CAVITY	WIRE COLOR	CLS CAVITY
COOLANT LEVEL	3/11	ORN	A
GROUND	3/2	BLK	B

45312

Figure 29-2 Engine Coolant Level Sensor Installation for CPC

29.1.2 Coolant Leak or Faulty Radiator Cap Check

Perform the following steps to resolve a coolant level low fault. Repair as required.

1. Check for coolant leak at cylinder head gasket.
2. Check for coolant leak at air compressor head gasket.
3. Check for external coolant leak at hose connections.
4. Check for coolant in oil.
5. Check for loose or faulty radiator cap.
6. When these checks and subsequent repairs are finished, Refer to section 29.1.2.1.

29.1.2.1 Verify Repairs

Perform the following steps to test the repair:

1. Connect all the removed connectors.
2. Start and run the engine for 5 minutes.
3. Plug in the diagnostic tool.
4. Read the active codes.
   [a] If no codes display, the repairs are complete.
   [b] If code 111/1 displays, review these steps to find the error. If you cannot find the error, call the Detroit Diesel Customer Support Center (313–592–5800).
   [c] If any codes other than code 111/1 display, troubleshoot those codes.

29.2 SPN 111/FMI 3

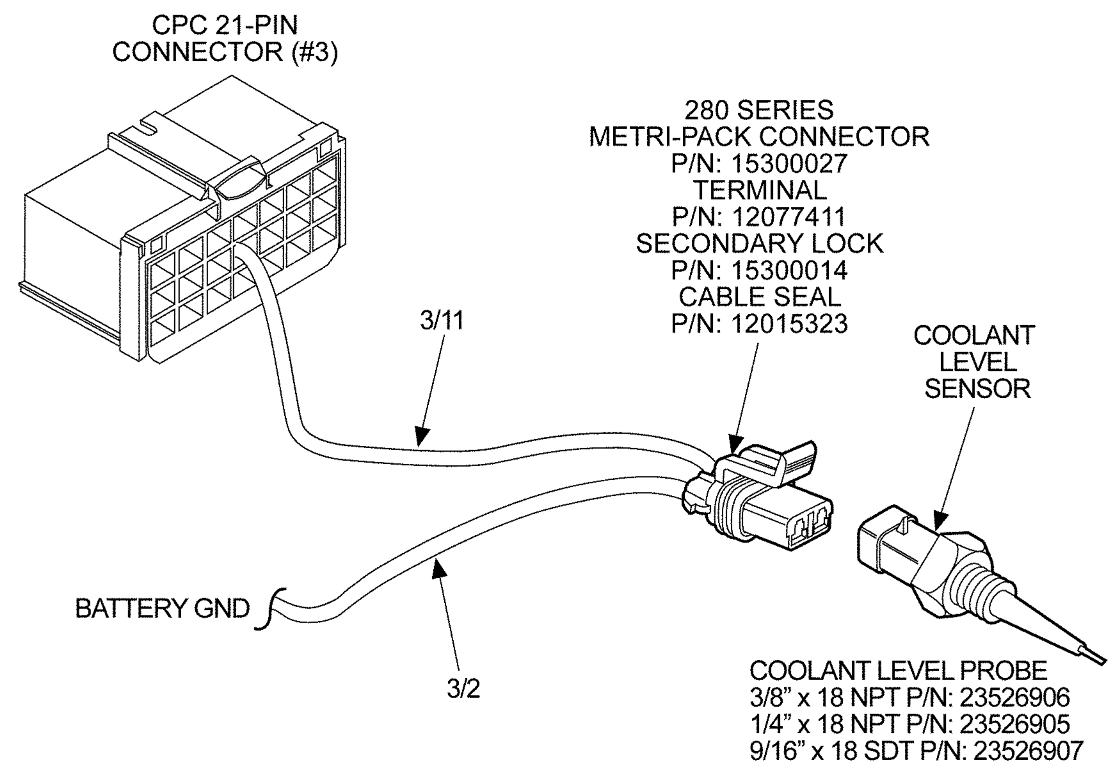
This condition is typically an open circuit fault.

29.2.1 Open Circuit Check

Perform the following steps to troubleshoot an ECL Sensor open circuit fault:

1. Check for multiple codes.
   [a] If other faults are active in addition to fault 111/3, troubleshoot the other faults first.
   [b] If only fault 111/3 is active, go to step 2.

2. Check the voltage between the CPC #3 connector (21-pin) wire 3/11 on the ECL Sensor. See Figure 29-3.



LABEL	CPC CONNECTOR CAVITY	WIRE COLOR	CLS CAVITY
COOLANT LEVEL	3/11	ORN	A
GROUND	3/2	BLK	B

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Figure 29-3 Engine Coolant Level Sensor Installation for CPC

[a] If voltage is about 5 volts, replace ECL sensor. Refer to section 29.2.1.1.

[b] If voltage is the same as battery voltage, repair short to wire in ECL Sensor wire 3/11. Refer to section 29.2.1.1.

[c] If voltage is 0 volts, go to step 3.

3. Bridge wire 3/11 to battery ground.

[a] If fault 111/3 is active, repair open circuit in ECL Sensor wire 3/11. Refer to section 29.2.1.1.

[b] If fault 111/4 is active, repair open circuit in ECL Sensor wire 3/2. Refer to section 29.2.1.1.

29.2.1.1 Verify Repairs

Perform the following steps to test the repair:

1. Connect all the removed connectors.
2. Start and run the engine for 5 minutes.
3. Plug in the diagnostic tool.
4. Read the active codes.
   [a] If no codes display, the repairs are complete.
   [b] If code 111/3 displays, review these steps to find the error. If you cannot find the error, call the Detroit Diesel Customer Support Center (313–592–5800).
   [c] If any codes other than code 111/3 display, troubleshoot those codes.

29.3 SPN 111/FMI 4

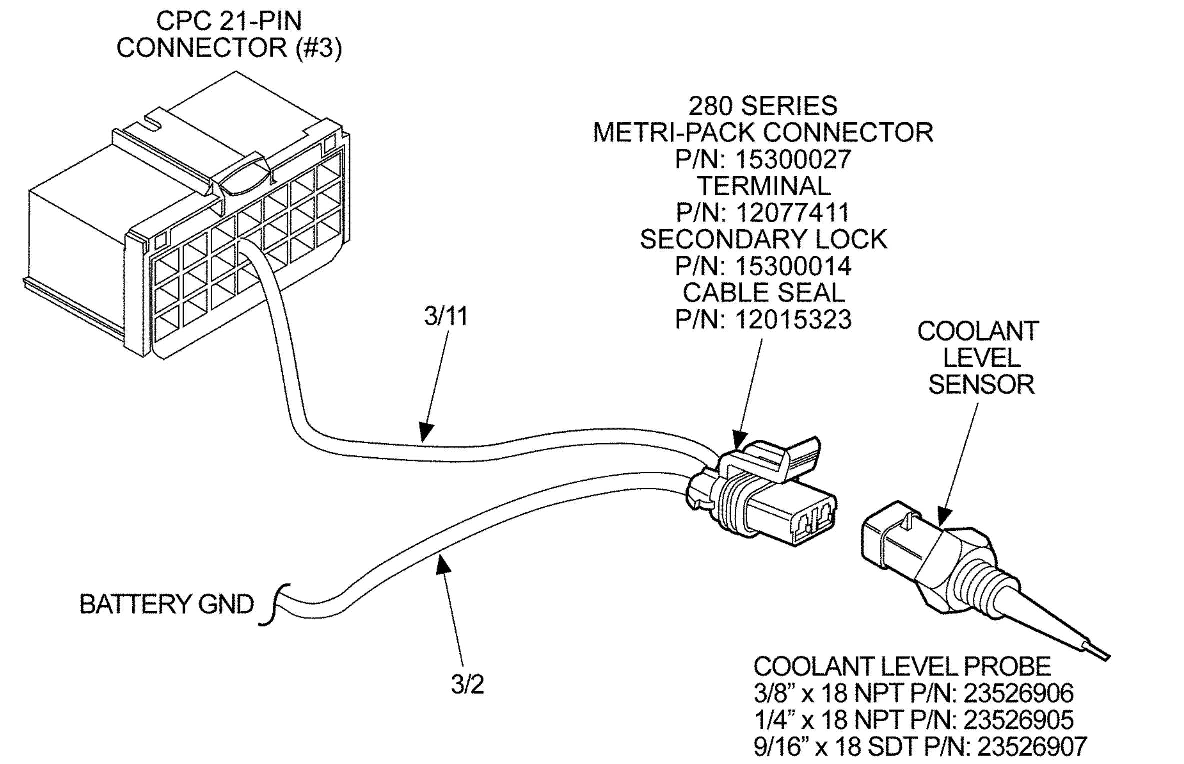
This fault is typically a short to ground. Perform the following steps to troubleshoot.

29.3.1 Short to Ground Check

Check for a short to ground as follows:

1. Check for multiple codes.
   [a] If other faults are active in addition to fault 111/4, troubleshoot the other faults first.
   [b] If only fault 111/4 is active, go to step 2.

2. Disconnect the ECL Sensor. See Figure 29-4.



LABEL	CPC CONNECTOR CAVITY	WIRE COLOR	CLS CAVITY
COOLANT LEVEL	3/11	ORN	A
GROUND	3/2	BLK	B

Figure 29-4 Engine Coolant Level Sensor Installation for CPC

[a] If fault 111/4 is not active after disconnecting the sensor, replace the ECL Sensor.

[b] If fault 111/4 is active after disconnecting the sensor, go to step 3.

3. Disconnect the #3 connector (21-pin).

4. Measure the resistance across pins 1 and 2 of the ECL Sensor connector.

[a] If the resistance is less than 5 Ω, repair the short between the wires 2 and 11 of the CPC #3 connector. Refer to section 29.3.1.1.

[b] If the resistance is greater than 5 Ω, go to step 5.

5. Measure the resistance between pin 1 of the ECL Sensor harness connector and ground.

[a] If the resistance is less than 5 Ω, repair the short circuit between pin 1 of the ECL Sensor harness connector and ground. Refer to section 29.3.1.1.

[b] If the resistance is greater than 5 Ω, go to step 6.

6. Measure the resistance between pin 2 of the ECL Sensor harness connector and ground.

   [a] If the resistance is less than 5 Ω, repair the short circuit between pin 2 of the ECL Sensor harness connector and ground. Refer to section 29.3.1.1.

   [b] If the resistance is greater than 5 Ω, review steps 29.3.1.1 through 6. If the results are the same, call the Detroit Diesel Customer Support Center (313–592–5800).

29.3.1.1 Verify Repairs

Perform the following steps to test the repair:

1. Connect all the removed connectors.
2. Start and run the engine for 5 minutes.
3. Plug in the diagnostic tool.
4. Read the active codes.

   [a] If no codes display, the repairs are complete.

   [b] If code 111/4 displays, review these steps to find the error. If you cannot find the error, call the Detroit Diesel Customer Support Center (313–592–5800).

   [c] If any codes other than code 111/4 display, troubleshoot those codes.

30 SPN 158 — BATTERY CHARGING FAULT

Section **Page**

30.1 SPN 158/FMI 0

The diagnostic condition is typically high system voltage.

30.1.1 Battery High Voltage Check

Check for high voltage as follows:

1. Start the engine and rev at rated speed.
2. Measure the voltage across the battery terminals. .
   [a] If the voltage is greater than 16 V, troubleshoot the charging system for an overvoltage condition. Refer to the OEM Vehicle Manual.
   [b] If the voltage is between 16 and 11.0 V and fault code 158/0 is still active, replace the MCM. Refer to section 30.1.1.1.

30.1.1.1 Verify Repairs

Perform the following steps to verify repairs.

1. Turn the ignition OFF.
2. Reconnect all connectors. Turn ignition ON.
3. Clear codes with diagnostic tool.
4. Start and run the engine for one minute. Stop engine.
5. Check diagnostic tool for codes.
   [a] If no codes are displayed, troubleshooting is complete.
   [b] If code 158/0 is not logged, and other codes are logged, troubleshoot the logged codes.
   [c] If code 158/0 and other codes are logged, review this section to find the error. If no error is found, call the Detroit Diesel Customer Support Center (313–592–5800).

30.2 SPN 158/FMI 1

The diagnostic condition is typically low system voltage.

30.2.1 Battery Voltage Switched – Low

Check for low voltage as follows:

1. Turn the ignition ON (key ON, engine OFF).
2. Measure the voltage across the battery terminals. See Figure 30-1.

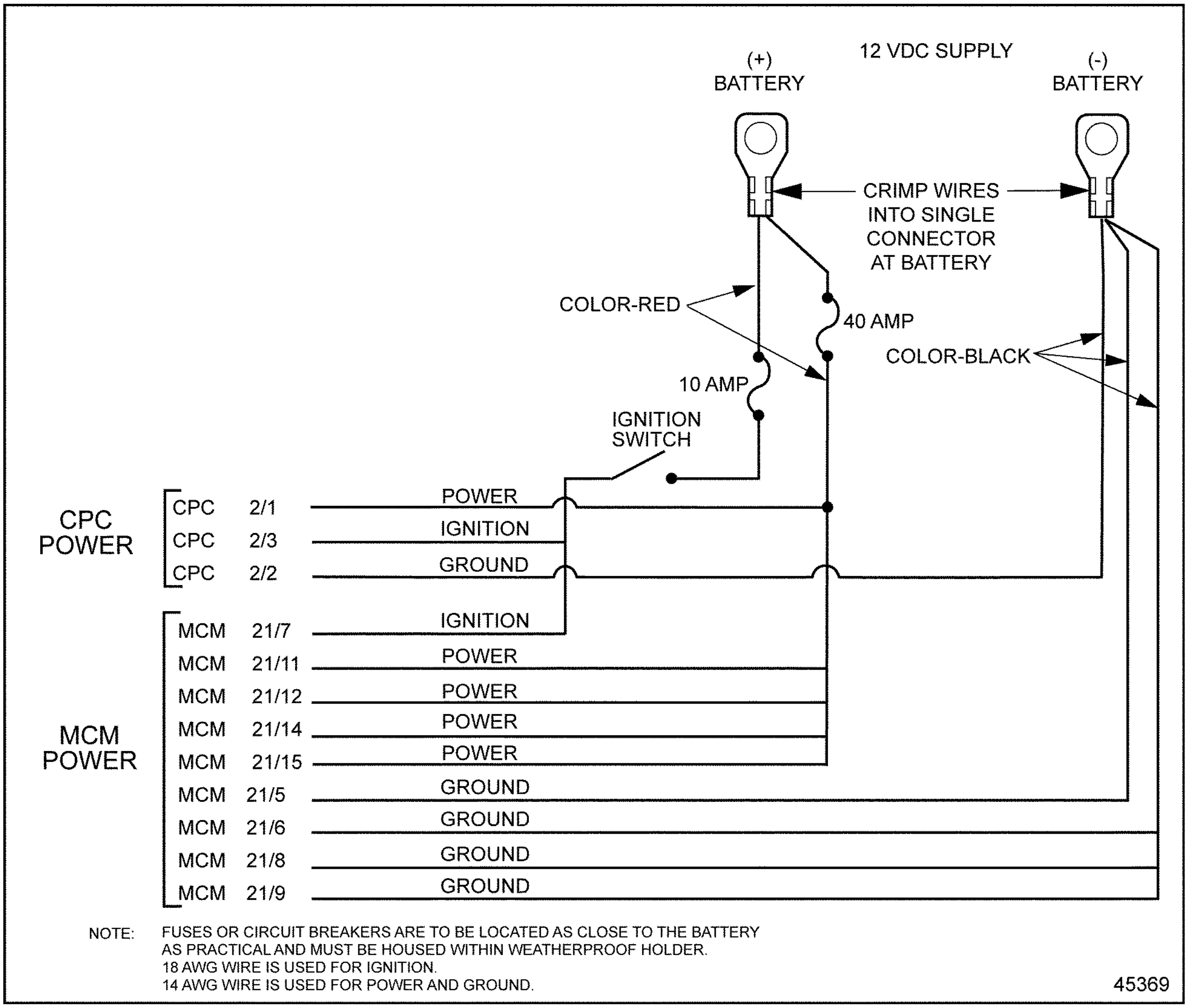


Figure 30-1 Power Wiring

[a] If the voltage is less than 11.0 V, troubleshoot the battery, starting, and charging system for an under voltage condition. Refer to the OEM Vehicle Manual.

[b] If the voltage is not less than 11.0 V, go to step 3.

3. Measure the voltage between pins 2/2 and 2/3 of the CPC #2 connector (18-pin). See Figure 30-1.
   - [a] If the voltage is between 11.0 and 16 V, replace the CPC. Refer to section 30.2.1.1.
   - [b] If the voltage is 16 V, go to step 4.
4. Start and run the engine. Measure the voltage drop between pin 2/3 of the CPC #2 connector and the positive battery terminal.
   - [a] If the voltage was less than 11.0 V (ignition on and engine not running) and voltage drop between pin 2/3 of the CPC #2 connector and the positive battery terminal is greater than 0.5 V (engine running), replace or repair the supply side wires and connectors between pin 2/3 of the CPC #2 connector and battery. Refer to section 30.2.1.1.
   - [b] If the voltage was not less than 11.0 V (ignition on and engine not running) and the voltage drop was not greater than 0.5 V, go to step 5.
5. With the engine still running, measure the voltage drop between pin 2/3 of the CPC #2 connector and the negative battery terminal.
   - [a] If the voltage is less than 11.0 V and voltage drop between pin 2/3 of the CPC #2 connector and the negative battery terminal is greater than 0.5 V, replace or repair the ground side wires and connectors between pin 2/3 of the CPC #2 connector and battery ground. Refer to section 30.2.1.1.
   - [b] If the voltage is less than 11.0 V and voltage drop between pin 2/3 of the CPC #2 connector and the negative battery terminal is less than 0.5 V, contact the Detroit Diesel Customer Support Center (313–592–5800).

30.2.1.1 Verify Repairs

Perform the following steps to verify repairs.

1. Turn the ignition OFF.
2. Reconnect all connectors. Turn ignition ON.
3. Clear codes with diagnostic tool.
4. Start and run the engine for one minute. Stop engine.
5. Check diagnostic tool for codes.
   - [a] If no codes are displayed, troubleshooting is complete.
   - [b] If code 158/1 is not logged, and other codes are logged, troubleshoot the logged codes.
   - [c] If code 158/1 and other codes are logged, review this section to find the error. If no error is found, call the Detroit Diesel Customer Support Center (313–592–5800).

30.3 SPN 158/FMI 2

This diagnostic is typically unmatched MCM and CPC signals.

30.3.1 MCM and CPC Signals Check

Check MCM and CPC signals as follows:

1. Check for multiple codes.
   [a] If fault codes 158/2 and 168/0 are both still active, refer to section 31.1.
   [b] If fault codes 158/2 and 158/1 are both still active, refer to section 30.2.1
   [c] If fault codes 158/2 and 158/0 are both still active, refer to section 30.1.1.
   [d] If fault codes 158/2 and 168/1 are both still active, refer to section 31.2.
   [e] If only fault code 158/2 is active, go to step 2.
2. Measure the difference in voltage inputs between the CPC and the MCM. See Figure 30-2.
   [a] If the voltage difference is less than 1.0 V, contact the Detroit Diesel Customer Support Center (313–592–5800).
   [b] If the voltage difference is greater than 1.0 V with the CPC indicating the low voltage, go to step 3.

[c] If the voltage difference is greater than 1.0 V with the MCM indicating the low voltage, go to step 4.

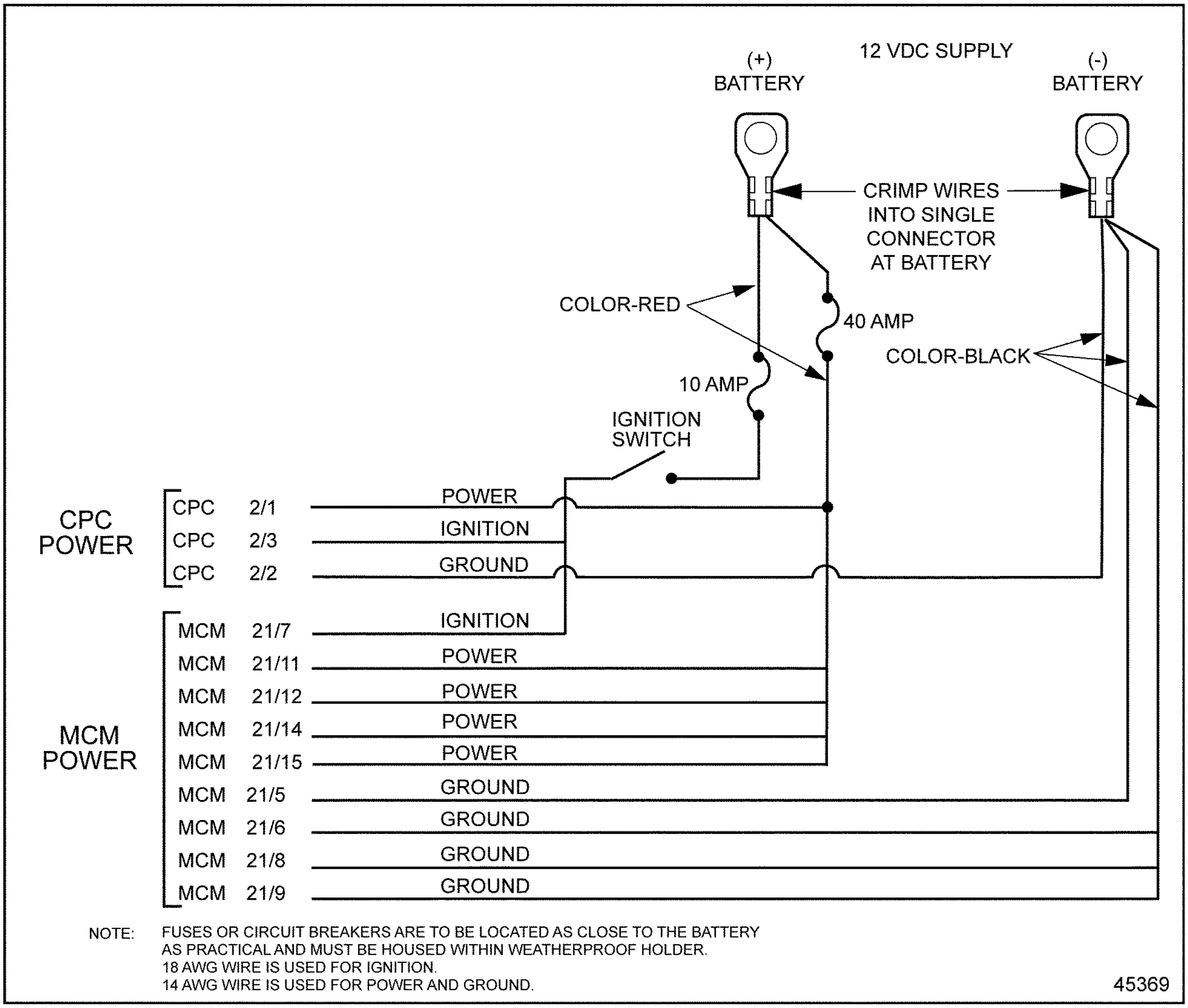


Figure 30-2 Power Wiring

3. Replace or repair the bad contacts and/or voltage supply for pins 2/3 (ignition) and 2/2 (ground) of the CPC #2 connector. Refer to section 30.3.1.1.
4. Replace or repair the bad contacts and/or voltage supply for pin M21/7 (power) and pins M21/5, M21/6, M21/8, and M21/9 (ground) on the MCM 21-pin connector. Refer to section 30.3.1.1.

30.3.1.1 Verify Repairs

Perform the following steps to verify repairs.

1. Turn the ignition OFF.
2. Reconnect all connectors. Turn ignition ON.
3. Clear codes with diagnostic tool.
4. Start and run the engine for one minute. Stop engine.
5. Check diagnostic tool for codes.
   [a] If no codes are displayed, troubleshooting is complete.
   [b] If code 158/2 is not logged, and other codes are logged, troubleshoot the logged codes.
   [c] If code 158/2 and other codes are logged, review this section to find the error. If no error is found, call the Detroit Diesel Customer Support Center (313–592–5800).

31 SPN 168 – BATTERY VOLTAGE OUTSIDE NORMAL OPERATING RANGE

Section **Page**

31.1 SPN 168/FMI 0

SPN 168/FMI 0 is a battery voltage high fault.

31.1.1 Measure Battery Voltage

Measure the battery voltage as follows:

1. Measure battery voltage with the engine running at maximum rpm.
2. If greater than 16 volts, check for proper alternator operation and repair or replace, as required. Refer to section 31.1.1.1.

31.1.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF and reconnect all connectors.
2. Turn the ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
   - [a] If no codes are present, troubleshooting is complete.
   - [b] If code 168/0 is not logged but other codes are logged, troubleshoot the other codes.
   - [c] If code 168/0 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313–592–5800).

31.2 SPN 168/FMI 1

SPN 168/FMI 1 is a battery voltage low fault.

31.2.1 Check the Alternator and the Battery

Check the alternator and battery as follows:

1. Check the condition of the alternator drive belt and replace, if required.
   - [a] If fault is no longer active, refer to section 31.2.2.1.
   - [b] If fault is still active, go to step 2.
2. Check for loose alternator mounting and retighten or repair, as required.
   - [a] If fault is no longer active, refer to section 31.2.2.1.
   - [b] If fault is still active, go to step 3.
3. Check for proper alternator operation and repair or replace, as required.
   - [a] If fault is no longer active, erase fault code memory.
   - [b] If fault is still active, go to step 4.
4. Check the condition of the battery (does it hold the charge?) and replace, if required.
   - [a] If fault is no longer active, refer to section 31.2.2.1.
   - [b] If fault is still active, go to step 1.

31.2.2 Measure the Resistance

Measure the resistance as follows:

1. Measure the resistance of the individual wires in the ground circuit (MCM 21/5, 21/6, 21/8, 21/9 and CPC 2/2). See Figure 31-1.
   - [a] If resistance is greater than 0.5 Ω in any wire, repair or replace the wire and connector.Refer to section 31.2.2.1.

[b] If resistance is less than 0.5 Ω in all wires, go to step 2.

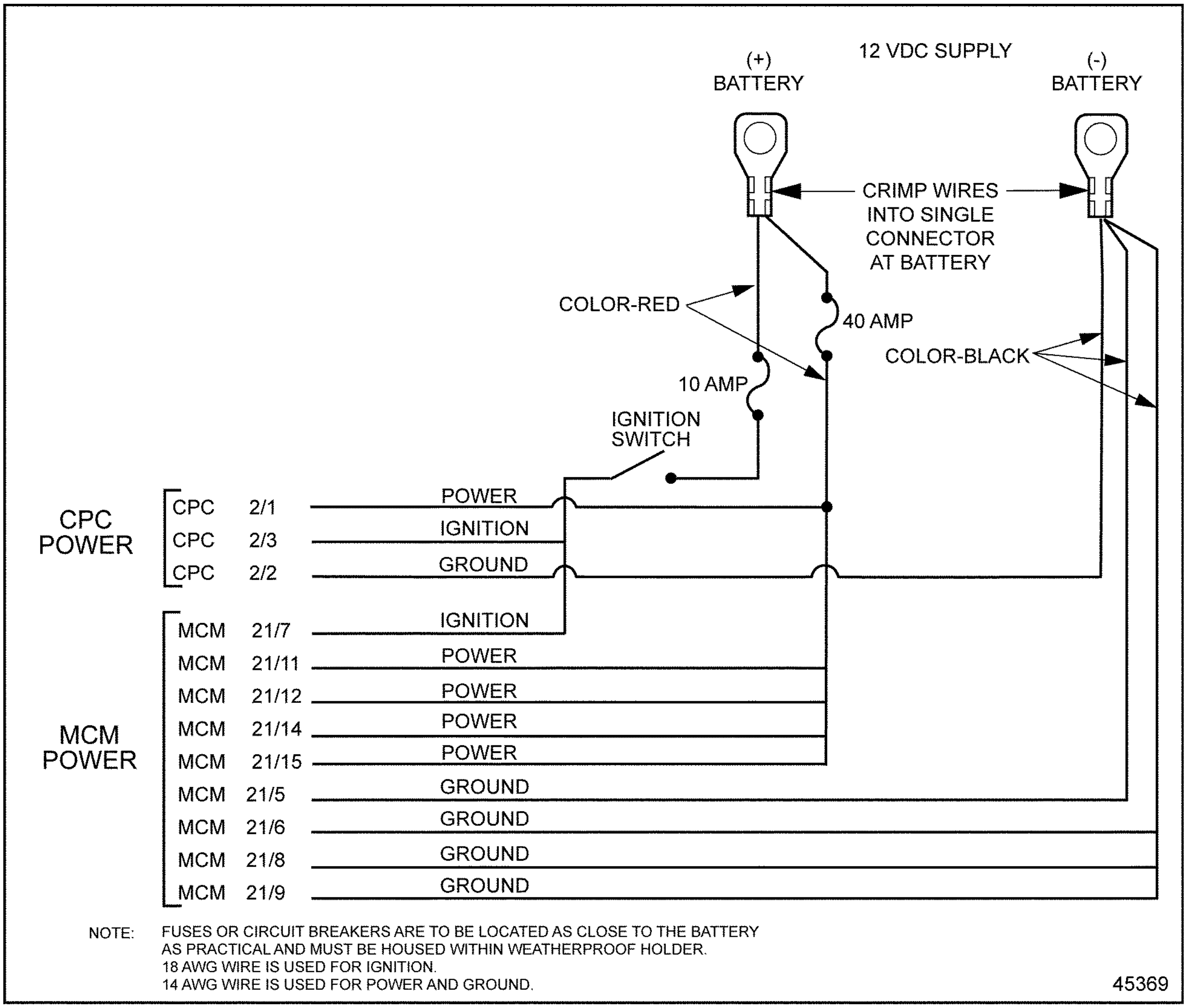


Figure 31-1 Power Wiring

2. Measure the resistance of the individual wires in the power circuit (MCM 21/11, 21/12, 21/14, 21/15 and CPC 2/1) with the engine running and battery voltage greater than 12.5 V. See Figure 31-1.

   [a] If resistance is greater than 0.5 Ω in any wire, repair or replace the power circuit wires and connector. Refer to section 31.2.2.1.

   [b] If resistance is less than 0.5 Ω in any wire, go to step 3.

3. Measure the current drop of the individual wires in the ground circuit (MCM 21/5, 21/6, 21/8, 21/9 and CPC 2/2). See Figure 31-1.

   [a] If the current drop is more than 0.2 volts in any wire, repair or replace the ground circuit wires and connector. Refer to section 31.2.2.1.

   [b] If the current drop is less than 0.2 volts in any wire, go to step 4.

4. Measure the current drop of the individual wires in the power circuit (MCM 21/11, 21/12, 21/14, 21/15 and CPC 2/1).See Figure 31-1
   [a] If the current drop is more than 0.2 volts in any wire, repair or replace the power circuit wires and connector. Refer to section 31.2.2.1.
   [b] If the current drop is more than 0.2 volts in any wire, refer to section 31.2.2.1.

31.2.2.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF and reconnect all connectors.
2. Turn the ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
   [a] If no codes are present, troubleshooting is complete.
   [b] If code 168/1 is not logged but other codes are logged, troubleshoot the other codes.
   [c] If code 168/1 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313–592–5800).

32 SPN 174 – SUPPLY FUEL TEMPERATURE FAULT

Section **Page**

32.1 SPN 174/FMI 3

SPN 174/FMI 3 indicates an Supply Fuel Temperature Sensor (SFT Sensor) open circuit.

32.1.1 Open Circuit Check

Check for an open circuit fault as follows:

1. Check for multiple codes.
   [a] If faults 174/3 and 110/3 are active at the same time, repair the open circuit between pin 55 of the 120–pin MCM Connector and pin 1 of the Engine Oil Temperature (EOT) Sensor and the Supply Fuel Temperature (SFT) Sensor. Refer to section 32.1.1.1.
   [b] If only fault 174/3 is active, go to step 2.
2. Disconnect the Supply Fuel Temperature Sensor.
3. Measure the resistance across pins 1 and 2 of the SFT Sensor. See Figure 32-1.

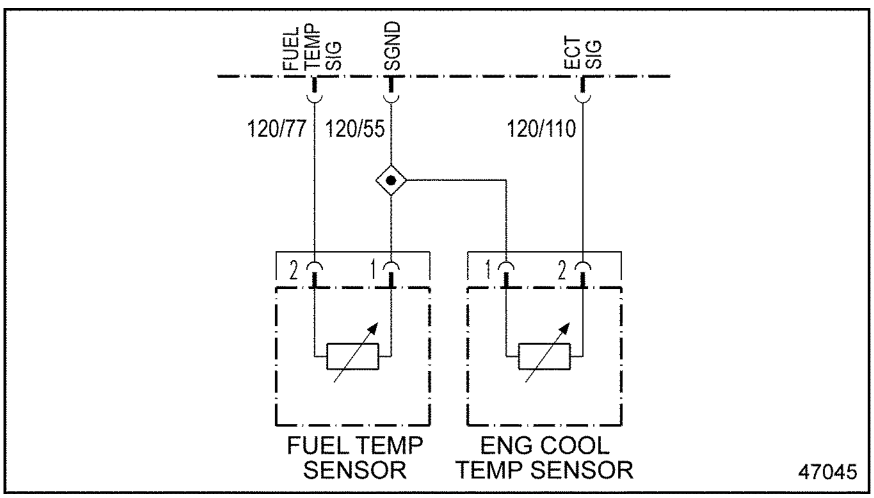


Figure 32-1 Supply Fuel Temperature Sensor

   [a] If the resistance is greater than 4k Ω, replace SFT Sensor. Refer to section 32.1.1.1.
   [b] If the resistance is less than 4k Ω, go to step 4.
4. Turn the ignition ON (key ON, engine OFF).
5. Measure the voltage between pins 1 and 2 of the SFT Sensor harness connector.
   [a] If the voltage is between 2.75 and 3.25 volts, go to step 7.
   [b] If the voltage is less than 2.75 volts, go to step 6.
6. Measure the voltage between pin 2 of the SFT Sensor harness connector and ground.

[a] If the voltage is between 2.75 and 3.25 volts, repair the open circuit between pin 1 of the SFT Sensor harness connector and pin 55 of the 120–pin MCM connector.See Figure 32-2. Refer to section 32.1.1.1.

[b] If the voltage is less than 2.75 volts, repair the open circuit between pin 2 of the SFT Sensor harness connector and pin 77 of the 120–pin MCM connector. See Figure 32-2. Refer to section 32.1.1.1.

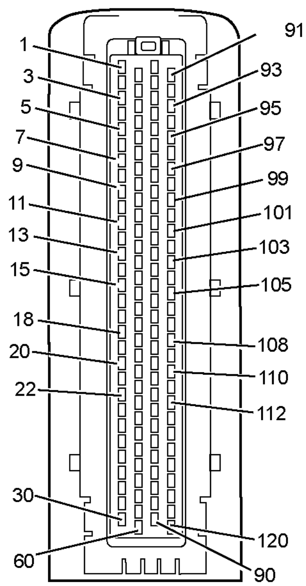


Figure 32-2 MCM 120–pin Connector

7. Disconnect the 120–pin MCM connector and measure the resistance between pins 1 and 2 of the SFT Sensor harness connector.

[a] If the resistance is less than 5 Ω, repair the short between pins 55 and 77 of the 120–pin MCM connector. Refer to section 32.1.1.1.

[b] If the resistance is greater than 5 Ω, replace the sensor. Refer to section 32.1.1.1.

32.1.1.1 Verify Repairs

Perform the following steps to verify repairs.

1. Turn the ignition OFF and reconnect all connectors.
2. Turn ignition ON. Clear codes.
3. Start and run the engine for eight minutes. Stop engine.
4. Check diagnostic tool for codes.

[a] If no codes are logged, no further troubleshooting is required.

[b] If code 174/3 and any other codes are logged, review this section from the first step to find the error. If not error is found, call the Detroit Diesel Customer Support Center (313–592–5800).

[c] If code 174/3 is not logged but other codes are logged, troubleshoot the other codes.

32.2 SPN 174/FMI 4

SPN 174/FMI 4 indicates a SFT Sensor short to ground.

32.2.1 Short to Ground Check

Perform the following steps to troubleshoot an SFT Sensor short-to-ground fault.

1. Disconnect the SFT Sensor.
2. Disconnect the 120-pin MCM connector.
3. Measure the resistance across pins 1 and 2 of the SFT Sensor connector.

   [a] If resistance is less than 5 Ω, repair short between wires 55 and 77 of the 120-pin MCM connector. Refer to section 32.2.1.1.

   [b] If resistance is greater than 5 Ω, go to step 4.
4. Measure the resistance between pin 1 of the SFT Sensor harness connector and ground. See Figure 32-3.

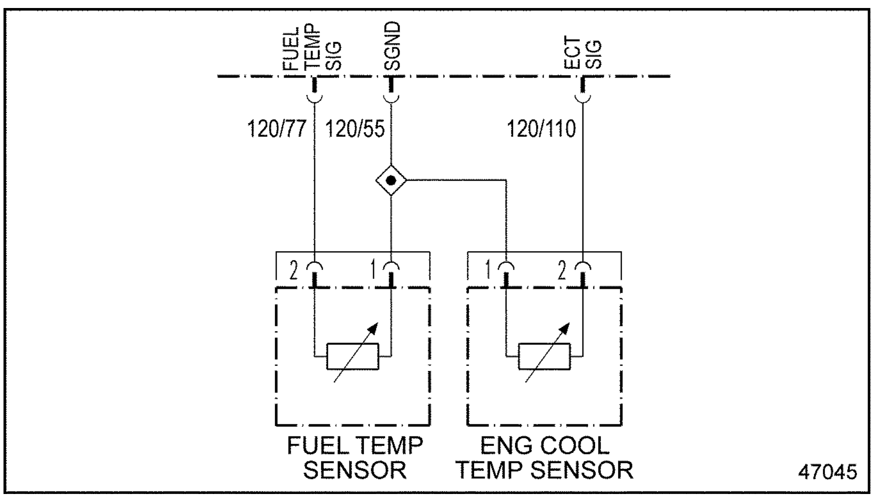


Figure 32-3 Supply Fuel Temperature Sensor

   [a] If resistance is less than 5 Ω, repair the short circuit between pin 1 of the SFT Sensor harness connector and ground. Refer to section 32.2.1.1.

   [b] If resistance is greater than 5 Ω, go to step 5.

5. Measure the resistance between pin 2 of the SFT Sensor harness connector and ground.

[a] If resistance is less than 5 Ω, repair the short circuit between pin 2 of the SFT Sensor harness connector and ground. Refer to section 32.2.1.1.

[b] If resistance is greater than 5 Ω, review steps 3 through 5. If the results are the same, contact Detroit Diesel Customer Support Center (313–592–5800).

32.2.1.1 Verify Repairs

Perform the following steps to verify repairs.

1. Turn the ignition OFF and reconnect all connectors.
2. Turn ignition ON. Clear codes.
3. Start and run the engine for eight minutes. Stop engine.
4. Check diagnostic tool for codes.

[a] If no codes are logged, no further troubleshooting is required.

[b] If code 174/4 and any other codes are logged, review this section from the first step to find the error. If not error is found, call the Detroit Diesel Customer Support Center (313–592–5800).

[c] If code 174/4 is not logged but other codes are logged, troubleshoot the other codes.

33 SPN 175 – ENGINE OIL TEMPERATURE OUTSIDE NORMAL RANGE

Section **Page**

33.1 SPN 175/FMI 2

This diagnosis is typically engine oil temperature out of range (drifted low/high).

NOTE:
When diagnosing rationality erratic data faults (FMI 2) always refer to SILs or SIBs or any known issues first.

33.1.1 Rationality Check for Temperature Drift

Check for temperature drift as follows:

1. Check engine oil level. Add oil if needed and recheck for fault codes. If SPN 175/FMI 2 is still active, go to step 2.
2. Connect the diagnostic tool. Monitor the engine oil temperature and engine coolant temperature.
3. With the engine running at idle and coolant temperature above 160°, is the oil temperature within X degrees of the coolant temperature?
   [a] If yes, go to step 4.
   [b] If no, disconnect the Engine Oil Pressure/Temp Sensor and the MCM connector. Bridge pins 1 and 2 of the sensor harness. Measure the resistance at the MCM

between pins 55 and 108. If the resistance is greater than 3 Ω, repair the harness. If the resistance is less than 3 Ω, replace the sensor. Refer to section 33.1.1.1.

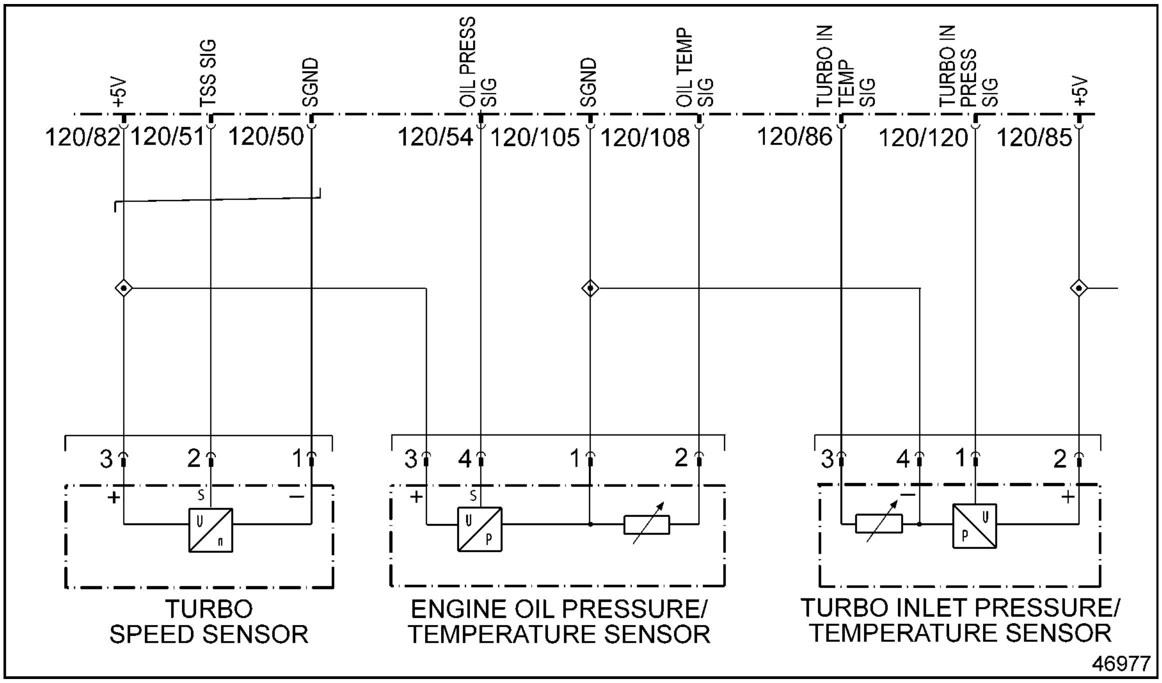


Figure 33-1 Engine Oil Pressure/Temp Sensor Wiring

NOTE:
Steps 4 and 5 are for cold start applications only.

4. Using the diagnostic tool, monitor the engine oil temperature and the fuel consumed.
5. With the engine running at idle, when the fuel consumed is greater than 0.X gallons is the oil temperature greater than 140°?
   [a] If yes, contact the Detroit Diesel Customer Support Center (313–592–5800).
   [b] If no, disconnect the Engine Oil Pressure/Temp Sensor and the 120–pin MCM connector. Bridge pins 1 and 2 of the sensor harness. Measure the resistance at the MCM between pins 55 and 108. If the resistance is greater than 3 Ω, repair the harness. If the resistance is less than 3 Ω, replace the sensor. Refer to section 33.1.1.1.

33.1.1.1 Verify Repairs

Perform the following steps to verify repairs.

1. Turn the ignition OFF and reconnect all connectors.
2. Turn the ignition ON. Clear the codes.
3. Start and run the engine for eight minutes. Stop the engine.
4. Check for codes.

[a] If no codes are logged, troubleshooting is complete.

[b] If other codes are logged, review this section to find the error. If no error is found, contact Detroit Diesel Customer Support Center (313–592–5800).

33.2 SPN 175/FMI 3

This diagnosis is typically engine oil temperature short to power.

33.2.1 Check for Short to Power

Check for a short to power as follows:

1. Check for multiple codes..
   [a] If codes 100/3, 175/3 and 3480/3 are active at the same time, repair the open between pin 82 of the 120–pin MCM connector and associated sensors. Refer to section 33.2.1.1.
   [b] If 100/3 and 175/3 are active, repair the open between pin 82 of the 120–pin MCM connector and pin 3 of the Engine Oil Temperature Sensor. Refer to section 33.2.1.1.
   [c] If only fault 175/3 is active, go to step 2.
2. Disconnect the Engine Oil Pressure/Temp Sensor.
3. Disconnect the 120–pin MCM connector.
4. Measure the resistance between pins 1 and 2 of the Engine Oil Pressure/Temp Sensor.
   [a] If the resistance is greater than 130k Ω, replace the Engine Oil Pressure/Temp Sensor. Refer to section 33.2.1.1.
   [b] If he resistance is less than 130k Ω, go to step 5.
5. Turn the ignition ON (key ON, engine OFF).
6. Measure the voltage between pins 2 of the Engine Oil Pressure/Temp Sensor harness and ground.
   [a] If the voltage is greater than 2.75 volts, go to step 7.

[b] If the voltage is less than 2.75 volts, repair the open circuit between pin 108 of the 120–pin MCM connector and pin 2 of the Engine Oil Pressure/Temp Sensor. See Figure 33-2. Refer to section 33.2.1.1.

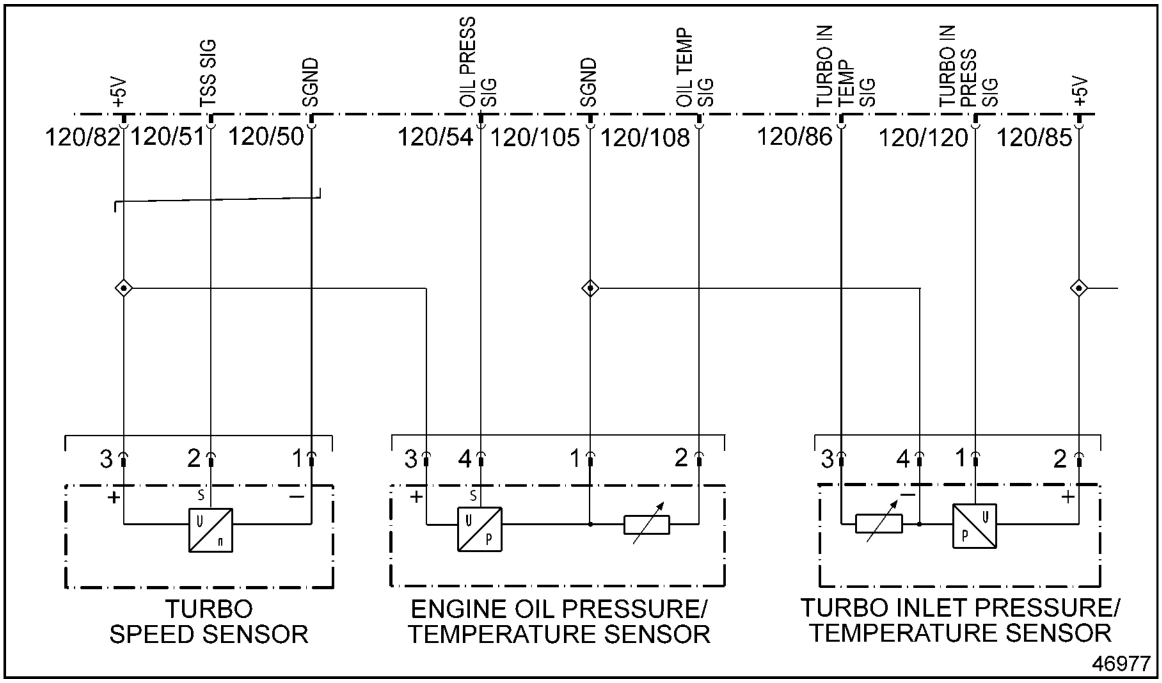


Figure 33-2 Engine Oil Pressure/Temp Sensor Wiring

7. Turn the ignition OFF.
8. Disconnect the 120–pin MCM connector.
9. Measure the resistance between pins 1 and 2 of the Engine Oil Pressure/Temp Sensor harness connector.

   [a] If the resistance is greater than 5Ω, repapir the short to power on the circuit between pin 108 of the 120–pin MCM connector and pin 2 of the Engine Oil Pressure/Temp Sensor harness connector. Refer to section 33.2.1.1.

   [b] If he resistance is less than 5Ω, repair the short between wires 105 and 108 of the 120–pin MCM connector. Refer to section 33.2.1.1.

33.2.1.1 Verify Repairs

Perform the following steps to verify repairs.

1. Turn the ignition OFF and reconnect all connectors.
2. Turn the ignition ON. Clear the codes.
3. Start and run the engine for eight minutes. Stop the engine.
4. Check for codes.

[a] If no codes are logged, troubleshooting is complete.

[b] If other codes are logged, review this section to find the error. If no error is found, contact Detroit Diesel Customer Support Center (313–592–5800).

33.3 SPN 175/FMI 4

This diagnosis is typically oil temperature sensor open short to ground.

33.3.1 Check for Short to Ground

Check for a short to ground as follows:

1. Disconnect the Engine Oil Pressure/Temp Sensor.
2. Disconnect the 120–pin MCM connector.
3. Measure the resistance between pins 1 and 2 of the Engine Oil Pressure/Temp Sensor.

   [a] If the resistance is greater than 5Ω, repair the short to ground on the circuit between pin 108 of the 120–pin MCM connector and pin 2 of the Engine Oil Pressure/Temp Sensor harness connector.Refer to section 33.3.1.1.

   [b] If the resistance is less than 5Ω, repair the short between pins 105 and 108 of 120–pin MCM connector. Refer to section 33.3.1.1.

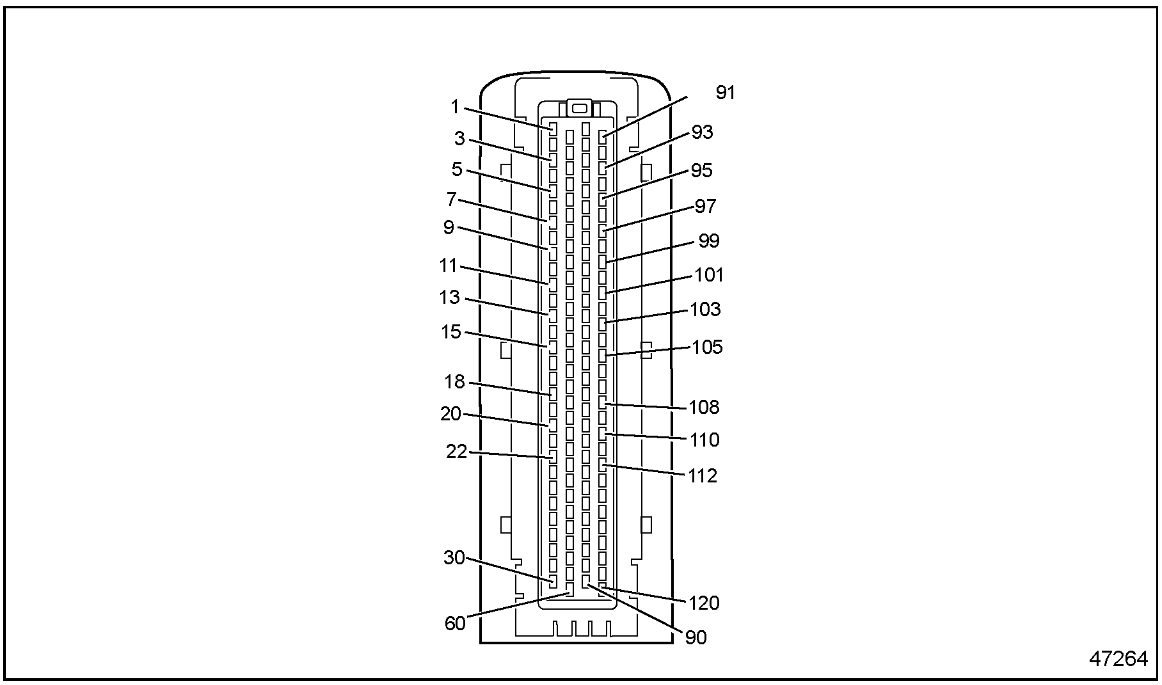


Figure 33-3 120–pin MCM Connector

33.3.1.1 Verify Repairs

Perform the following steps to verify repairs.

1. Turn vehicle ignition OFF and reconnect all connectors.
2. Turn vehicle ignition ON. Clear the codes.
3. Start and run the engine for eight minutes. Stop the engine.
4. Check for codes.
   [a] If no codes are logged, troubleshooting is complete.
   [b] If other codes are logged, review this section to find the error. If no error is found, contact Detroit Diesel Customer Support Center (313–592–5800).

34 SPN 190 - ENGINE SPEED HIGH

Section **Page**

34.1 SPN 190/FMI 2

This is an information code only. SPN 190/FMI 2 is active when the MCM detects an engine speed greater than 2,500 rpm for a specific amount of time. The driver should be questioned about vehicle driving conditions.

35 SPN 191 (CPC) - J1939 ETC1 MESSAGE MISSING AND TRANSMISSION OUTPUT SHAFT SPEED SIGNAL ERRATIC OR MISSING

Section **Page**

35.1 SPN 191/FMI 9

This fault is typically the J1939 ETC1 message is missing.

35.1.1 Missing ETC1 Message Check

Check as follows:

1. Check for multiple codes:
   [a] If CPC SPN 168/FMI 0/14/18 (Battery Voltage) are present troubleshoot these first.
   [b] If MCM SPN 625/FMI 9 is present, troubleshoot and repair the CAN line.
   [c] If only a “J1939 Error” fault is present, go to step 2.
2. Has the CPC been recently reprogrammed?
   [a] If yes, check the proper configuration of the CPC.
   [b] If no, connect ServiceLink to determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

35.2 SPN 191/FMI 13

This fault is typically the transmission output speed shaft signal is missing.

35.2.1 Missing Transmission Output Speed Shaft Signal Check

Check as follows:

1. Check for multiple codes:
   [a] If CPC SPN 168/FMI 0/14/18 (Battery Voltage) are present troubleshoot these first.
   [b] If MCM SPN 625/FMI 9 is present, troubleshoot and repair the CAN line.
   [c] If only a “J1939 Error” fault is present, go to step 2.
2. Has the CPC been recently reprogrammed?
   [a] If yes, check the proper configuration of the CPC.
   [b] If no, connect ServiceLink to determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

35.3 SPN 191/FMI 19

This fault is typically the transmission output speed shaft signal is erratic.

35.3.1 Erratic Transmission Output Speed Shaft Signal Check

Check as follows:

1. Check for multiple codes:
   [a] If CPC SPN 168/FMI 0/14/18 (Battery Voltage) are present troubleshoot these first.
   [b] If MCM SPN 625/FMI 9 is present, troubleshoot and repair the CAN line.
   [c] If only a "J1939 Error" fault is present, go to step 2.
2. Has the CPC been recently reprogrammed?
   [a] If yes, check the proper configuration of the CPC.
   [b] If no, connect ServiceLink to determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

36 SPN 274 (CPC) – MCM ENGINE HOURS DATA HIGHER OR LOWER THAN EXPECTED

Section **Page**

36.1 SPN 274/FMI 0

MCM engine hours data higher than expected – This fault usually occurs after reprogramming the CPC or MCM. The internal clocks of the CPC or MCM do not match. After reprogramming either module, all fault codes *must* be cleared.

NOTE:
The CPC digital outputs have the same SPN as some MCM faults. DDDL 7.0 makes the distinction between the MCM and CPC when diagnosing a fault.

36.2 SPN 274/FMI 1

MCM engine hours data lower than expected – This fault usually occurs after reprogramming the CPC or MCM. The internal clocks of the CPC or MCM do not match. After reprogramming either module, all fault codes *must* be cleared.

NOTE:
The CPC digital outputs have the same SPN as some MCM faults. DDDL 7.0 makes the distinction between the MCM and CPC when diagnosing a fault.

37 SPN 411 — EGR DIFFERENTIAL PRESSURE OR DELTA P SENSOR CIRCUIT OUTSIDE OF NORMAL OPERATING RANGE

Section **Page**

37.1 SPN 411/FMI 0

This diagnosis is typically EGR differential pressure failed high.

37.1.1 Check for Coolant Loss and Multiple Codes

Begin by checking for coolant loss as follows:

1. Inspect to see of the coolant level is low.
   [a] If the coolant level is low, inspect the EGR cooler.
   [b] If the coolant level is OK, go to step 2.
2. Check for multiple diagnostic trouble codes.
   [a] If codes other than 411/0 are present, service them first.
   [b] If only 411/0 is present, refer to section 37.1.2.

37.1.2 Check EGR Components

Check the EGR components as follows:

1. Connect DDDL 7.0 and monitor the coolant temperature, EGR Delta P, EGR PW, EGR valve position and EGR temperature.
2. Start the engine and increase the RPM to 1200.
3. Activate EGR PW to 60%.

NOTE:
Do not exceed three minutes.

4. Is the EGR Delta P count greater than 170 and the EGR temperature greater than 90° above coolant temperature?
   [a] If yes, repeat all the steps in section 37.1.1 and steps 1 through 4 in this section. If the same results occur, contact the Detroit Diesel Customer Support Center (313–592–5800).
   [b] If no, go to step 5.
5. Turn the engine OFF.
6. Inspect the EGR delivery pipes for damage and proper assembly.
   [a] If damaged, repair as necessary. Refer to section 37.1.2.1.
   [b] If OK, go to step 7.
7. Disconnect the EGR Delta P Sensor and inspect the EGR venturi tubes for blockage.
   [a] If the tubes are blocked, clean them. Refer to section 37.1.2.1.
   [b] If the tubes are not blocked, replace the EGR Delta P Sensor. Refer to section 37.1.2.1.

37.1.2.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF. Reconnect all connectors.
2. Turn the ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
   [a] If no codes are present, troubleshooting is complete.
   [b] If code 411/0 is not logged but other codes are logged, troubleshoot the other codes.
   [c] If code 411/0 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313–592–5800).

37.2 SPN 411/FMI 1

This diagnosis is typically EGR differential pressure failed low.

37.2.1 Check EGR Components

Check the EGR components as follows:

1. Connect DDDL 7.0 to check for codes.
2. Are codes other than 411/1 present?
   [a] If codes other than 411/1 are present, service them first.
   [b] If only 411/1 is present, go to step 3.
3. Using DDDL 7.0, monitor the coolant temperature, EGR Delta P, EGR PW, EGR valve position and EGR temperature.
4. Idle the engine with the EGR PW less than 3% and the EGR position less than 5% (NO EGR FLOW COMMANDED).
5. Is the EGR Delta P greater than 130 counts and the EGR temperature greater than 40° above the coolant temperature?
   [a] If yes, replace the EGR valve. Refer to section 37.2.1.1.
   [b] If no, go to step 6.
6. Turn the engine OFF.
7. Disconnect the EGR Delta P Sensor and inspect the EGR tubes for blockage.
   [a] If the tubes are blocked, clean them. Refer to section 37.2.1.1.
   [b] If the tubes are not blocked, replace the EGR Delta P Sensor. Refer to section 37.2.1.1

37.2.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF. Reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
   [a] If no codes are present, troubleshooting is complete.
   [b] If code 411/1 is not logged but other codes are logged, troubleshoot the other codes.
   [c] If code 411/1 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313–592–5800).

37.3 SPN 411/FMI 3

This diagnosis is typically EGR Delta P Sensor short circuit.

37.3.1 Check for Short

Check the circuit for the EGR Delta P Sensor as follows:

1. Disconnect the EGR Delta P Sensor.
2. Disconnect the 120–pin MCM connector.
3. Measure the resistance across pins 1 and 3of the EGR Delta P Sensor. See Figure 37-1.

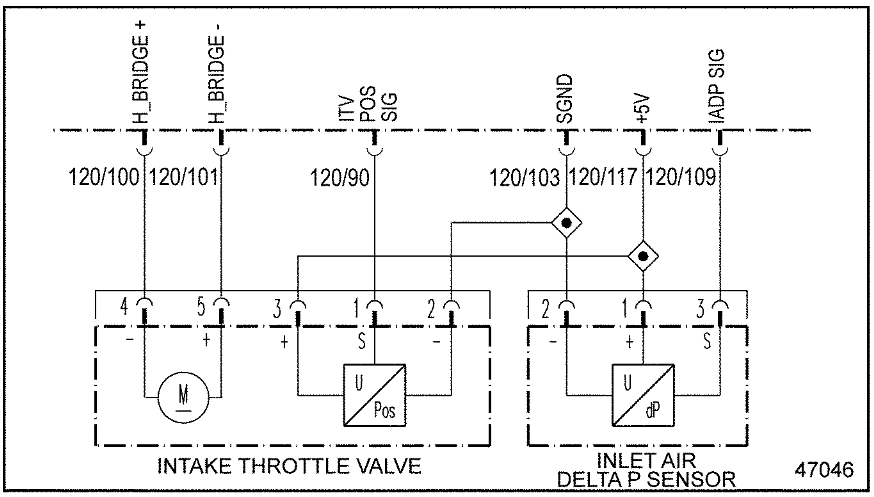


Figure 37-1 EGR Delta P Sensor

[a] If the resistance is greater than 5Ω, repair the short to power on wire 109 of the 120–pin MCM connector . Refer to section 37.3.1.1.

[b] If the resistance is less than 5Ω, repair the short between pins 109 and 117 of the 120–pin MCM connector. Refer to section 37.3.1.1.

37.3.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF. Reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes

   [a] If no codes are present, troubleshooting is complete.

   [b] If code 411/3 is not logged but other codes are logged, troubleshoot the other codes.

[c] If code 411/3 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313–592–5800).

37.4 SPN 411/FMI 4

This diagnosis is typically EGR Delta P Sensor open circuit.

37.4.1 Check for Open Circuit

Check for a short as follows:

1. Disconnect the EGR Delta P Sensor.
2. Measure the resistance across pins 1 and 3 of the EGR Delta P Sensor. See Figure 37-2.

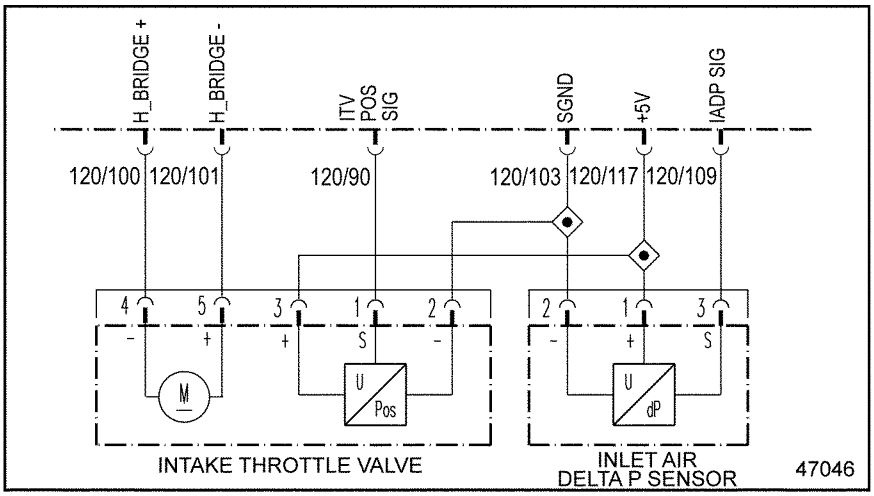


Figure 37-2

[a] If the resistance is greater than 130 kΩ, replace the EGR Delta P Sensor. Refer to section 37.4.1.1.

[b] If the resistance is less than 130 kΩ, go to step 3.

3. Measure the resistance between pins 1 and 2 of the EGR Delta P Sensor.

[a] If the resistance is greater than 130 kΩ, replace the EGR Delta P Sensor. Refer to section 37.4.1.1.

[b] If the resistance is less than 130 kΩ,, go to step 4.

4. Turn the ignition switch to the ON position.
5. Measure the voltage between pins 1 and 3 of the EGR Delta P Sensor harness connector.

[a] If the voltage is between 4.5 and 5.5 volts, go to step 7.

[b] If the voltage is less than 4.5 volts, go to step 6.

6. Measure the voltage between pin 1 of the EGR Delta P Sensor harness connector and ground.
   [a] If the voltage is between 4.5 and 5.5 volts, repair the open circuit between pin 3 of the EGR Delta P Sensor harness connector and pin 109 of the 120–pin MCM connector. Refer to section 37.4.1.1.
   [b] If the voltage is less than 4.5 volts, repair the open circuit between pin 1 of the EGR Delta P Sensor harness connector and pin 117 of the 120–pin MCM connector. Refer to section 37.4.1.1.
7. Turn the ignition switch to the OFF position.
8. Disconnect the 120–pin MCM connector.
9. Measure the resistance between pins 1 and 3 of the EGR Delta P Sensor harness connector.
   [a] If the resistance is less than 5 Ω, repair the short in wires between pins 1 and 3 of the EGR Delta P Sensor harness connector and pins 117 and 109 of the 120–pin MCM connector. Refer to section 37.3.1.1.
   [b] If the resistance is greater than 5 Ω, go to step 10.
10. Measure the resistance across pins 2 and 3 of the EGR Delta P Sensor harness connector.
   [a] If the resistance is less than 5 Ω, repair the short in wires between pins 109 and 103 of the 120–pin MCM connector. Refer to section 37.3.1.1
   [b] If the resistance is greater than 5 Ω, go to step 11.
11. Measure the resistance between pin 1of the EGR Delta P Sensor harness connector and ground.
   [a] If the resistance is less than 5 Ω, repair the short circuit between pin 117 of the 120–pin MCM connector and ground. Refer to section 37.3.1.1.
   [b] If the resistance is greater than 5 Ω, go to step 12.
12. Measure the resistance between pin 3 of the EGR Delta P Sensor harness connector and ground..
   [a] If the resistance is less than 5 Ω, repair the short between pin 109 of the 120–pin MCM connector and ground. Refer to section 37.4.1.1.
   [b] If the resistance is greater than 5 Ω, repair the open circuit between pin 3 of the EGR Delta P Sensor harness connector and pin 109 of the 120–pin MCM connector. Refer to section 37.4.1.1.

37.4.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF. Reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
   [a] If no codes are present, troubleshooting is complete.
   [b] If code 411/4 is not logged but other codes are logged, troubleshoot the other codes.
   [c] If code 411/4 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313–592–5800).

38 SPN 523 (CPC) - TRANSMISSION CURRENT GEAR SIGNAL ERRATIC OR MISSING

Section **Page**

38.1 SPN 523/FMI 19

This fault is typically the transmission current gear signal is erratic.

38.1.1 Erratic Transmission Current Gear Signal Check

Check as follows:

1. Check for multiple codes:
   [a] If CPC SPN 168/FMI 0/14/18 (Battery Voltage) are present troubleshoot these first.
   [b] If MCM SPN 625/FMI 9 is present, troubleshoot and repair the CAN line.
   [c] If only a “J1939 Error” fault is present, go to step 2.
2. Has the CPC been recently reprogrammed?
   [a] If yes, check the proper configuration of the CPC.
   [b] If no, connect ServiceLink to determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

38.2 SPN 523/FMI 13

This fault is typically the transmission current gear signal is missing.

38.2.1 Missing Transmission Current Gear Signal Check

Check as follows:

1. Check for multiple codes:
   [a] If CPC SPN 168/FMI 0/14/18 (Battery Voltage) are present troubleshoot these first.
   [b] If MCM SPN 625/FMI 9 is present, troubleshoot and repair the CAN line.
   [c] If only a “J1939 Error” fault is present, go to step 2.
2. Has the CPC been recently reprogrammed?
   [a] If yes, check the proper configuration of the CPC.
   [b] If no, connect ServiceLink to determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

39 SPN 524 (CPC) - J1939 ETC2 MESSAGE IS MISSING

Section **Page**

39.1 SPN 523/FMI 9

This fault is typically the J1939 ETC2 message is missing.

39.1.1 Missing J1939 ETC2 Message Check

Check as follows:

1. Check for multiple codes:
   - [a] If CPC SPN 168/FMI 0/14/18 (Battery Voltage) are present troubleshoot these first.
   - [b] If MCM SPN 625/FMI 9 is present, troubleshoot and repair the CAN line.
   - [c] If only a “J1939 Error” fault is present, go to step 2.
2. Has the CPC been recently reprogrammed?
   - [a] If yes, check the proper configuration of the CPC.
   - [b] If no, connect ServiceLink to determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

40 SPN 527 (CPC) - J1939 CCVS MESSAGE MISSING

Section **Page**

40.1 SPN 527/FMI 9

This fault is typically the J1939 CCVS message from Source #1, #2, or #3 is missing.

40.1.1 Missing J1939 CCVS Message from Source #1, #2, or #3 Check

Check as follows:

1. Check for multiple codes:
   - [a] If CPC SPN 168/FMI 0/14/18 (Battery Voltage) are present troubleshoot these first.
   - [b] If MCM SPN 625/FMI 9 is present, troubleshoot and repair the CAN line.
   - [c] If only a "J1939 Error" fault is present, go to step 2.
2. Has the CPC been recently reprogrammed?
   - [a] If yes, check the proper configuration of the CPC.
   - [b] If no, connect ServiceLink to determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

41 SPN 558 - IDLE VALIDATION SWITCH

Section **Page**

41.1 SPN 558/FMI 1

This fault is a typically incorrect wiring of the Idle Validation Switch (IVS).

41.1.1 Idle Validation Switch Wiring Check

Check Idle Validation Switch (IVS) wiring as follows:

1. Connect DDDL 7.0.
2. Turn ignition ON.
3. Monitor IVS #1 and IVS #2 with the throttle pedal in the idle position.
4. If IVS #1 reads OFF and IVS #2 reads ON, verify the proper wire pin outs.
   - IVS #1 should be routed from Idle Validation Switch pin 5 to pin 6 of the CPC #1 connector.
   - IVS #2 should be routed from Validation Switch pin 6 to pin 3 of the CPC #1 connector.
5. If wiring checks OK, contact the Detroit Diesel Customer Support Center (313–592–5800).

41.2 SPN 558/FMI 3

This diagnostic condition is typically an open circuit.

41.2.1 Open Circuit Check

Check for open as follows:

1. Disconnect the Idle Validation Switch.
2. Turn the ignition ON (key ON, engine OFF).
3. Measure the voltage between the Idle Validation Switch pins 4 and 6.
   [a] If the voltage is greater than 11.5 volts, go to step 7.
   [b] If the voltage is less than 11.5 volts, go to step 4.
4. Measure the voltage between the Idle Validation Switch pin 4 and ground.
   [a] If the voltage is greater than 11.5 volts, go to step 5.
   [b] If the voltage is less than 11.5 volts, repair the open wire between pin 6 of the CPC #1 connector and pin 4 of the Idle Validation Switch. Refer to section 41.2.1.1.
5. Disconnect the CPC #2 connector.
6. Measure the resistance between pin 2 of the CPC #2 connector and pin 6 of the Idle Validation Switch.
   [a] If the resistance is greater than 5Ω, repair the open the wire between pin 2 of the CPC #2 connector and pin 6 of the Idle Validation Switch. Refer to section 41.2.1.1.
   [b] If the resistance is less than 5Ω, replace the Idle Validation Switch. Refer to section 41.2.1.1.

7. Measure the voltage between the Idle Validation Switch pins 5 and 6.
   - [a] If the voltage is greater than 11.5 volts, replace the Idle Validation Switch. Refer to section 41.2.1.1.
   - [b] If the voltage is less than 11.5 volts, repair the open the wire between pin 3 of the CPC #1 connector and pin 5 of the Idle Validation Switch. Refer to section 41.2.1.1.

41.2.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF. Reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
   - [a] If no codes are present, troubleshooting is complete.
   - [b] If code 558/3 is not logged but other codes are logged, troubleshoot the other codes.
   - [c] If code 558/3 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313–592–5800).

41.3 SPN 558/FMI 4

This diagnostic condition is typically a short to ground.

41.3.1 Short to Ground Check

Check for short to ground as follows:

1. Disconnect the Idle Validation Switch. See Figure 41-1.

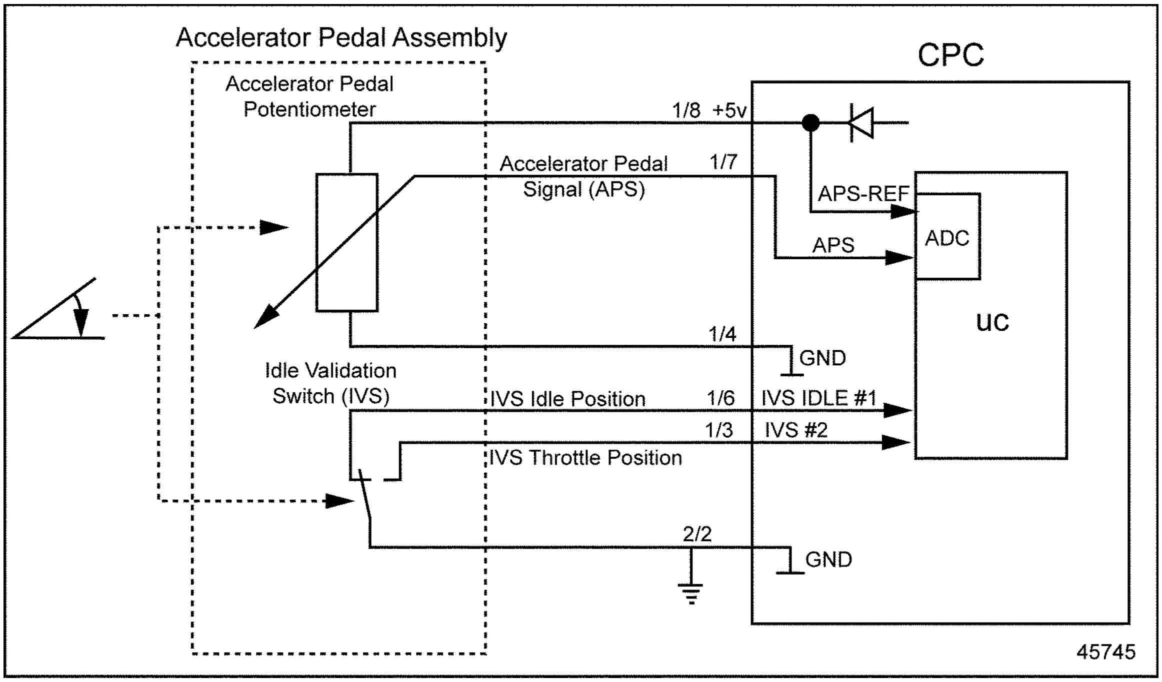


Figure 41-1 Idle Validation Switch, Part of the Accelerator Pedal Assembly

2. Disconnect the CPC #1 connector.
3. Measure the resistance between pin 4 of the Idle Validation Switch connector and ground.
   [a] If the resistance is less than 5 Ω, repair the short to ground between pin 6 of the CPC #1 connector and pin 4 of the Idle Validation Switch connector. Refer to section 41.3.1.1.
   [b] If the resistance is greater than 5 Ω, go to step 4.
4. Measure the resistance between pin 5 of the Idle Validation Switch connector and ground.
   [a] If the resistance is less than 5 Ω, repair the short to ground between pin 3 of the CPC #1 connector and pin 5 of the Idle Validation Switch connector. Refer to section 41.3.1.1.
   [b] If the resistance is greater than 5 Ω, replace the Idle Validation Switch.

41.3.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF. Reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
   [a] If no codes are present, troubleshooting is complete.
   [b] If code 558/4 is not logged but other codes are logged, troubleshoot the other codes.
   [c] If code 558/4 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313–592–5800).

42 SPN 596 (CPC) - CRUISE CONTROL ENABLE SWITCH SIGNAL ERRATIC OR MISSING

42.1 SPN 596/FMI 13

This fault is typically the J1939 Cruise Control Enable Switch signal from Source #1, #2, or #3 is missing.

42.1.1 Missing Cruise Control Enable Switch Signal from Source #1, #2, or #3 Check

Check as follows:

1. Check for multiple codes:
   - [a] If CPC SPN 168/FMI 0/14/18 (Battery Voltage) are present troubleshoot these first.
   - [b] If MCM SPN 625/FMI 9 is present, repair the CAN line faults.
   - [c] If only a “J1939 Error” fault is present, go to step 2.
2. Has the CPC been recently reprogrammed?
   - [a] If yes, check the proper configuration of the CPC.
   - [b] If no, connect ServiceLink to determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

42.2 SPN 596/FMI 19

This fault is typically J1939 Cruise Control Enable Switch signal from Source #1, #2, or #3 is erratic.

42.2.1 Erratic Cruise Control Enable Switch Signal from Source #1, #2, or #3 Check

Check as follows:

1. Check for multiple codes:
   - [a] If CPC SPN 168/FMI 0/14/18 (Battery Voltage) are present troubleshoot and repair these first.
   - [b] If MCM SPN 625/FMI 9 is present, troubleshoot and repair the CAN line.
   - [c] If only a “J1939 Error” fault is present, go to step 2.
2. Has the CPC been recently reprogrammed?
   - [a] If yes, check the proper configuration of the CPC.
   - [b] If no, connect ServiceLink to determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

43 SPN 597 (CPC) - SERVICE BRAKE SWITCH SIGNAL ERRATIC OR MISSING

Section **Page**

43.1 SPN 597/FMI 13

This fault is typically the J1939 Service Brake Switch signal from Source #1, #2, or #3 is missing.

43.1.1 Missing Service Brake Switch Signal from Source #1, #2, or #3 Check

Check as follows:

1. Check for multiple codes:
   [a] If CPC SPN 168/FMI 0/14/18 (Battery Voltage) are present troubleshoot these first.
   [b] If MCM SPN 625/FMI 9 is present, repair the CAN line faults.
   [c] If only a “J1939 Error” fault is present, go to step 2.
2. Has the CPC been recently reprogrammed?
   [a] If yes, check the proper configuration of the CPC.
   [b] If no, connect ServiceLink to determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

43.2 SPN 597/FMI 19

This fault is typically J1939 Service Brake Switch signal from Source #1, #2, or #3 is erratic.

43.2.1 Erratic Service Brake Switch Signal from Source #1, #2, or #3 Check

Check as follows:

1. Check for multiple codes:
   [a] If CPC SPN 168/FMI 0/14/18 (Battery Voltage) are present troubleshoot and repair these first.
   [b] If MCM SPN 625/FMI 9 is present, troubleshoot and repair the CAN line.
   [c] If only a “J1939 Error” fault is present, go to step 2.
2. Has the CPC been recently reprogrammed?
   [a] If yes, check the proper configuration of the CPC.
   [b] If no, connect ServiceLink to determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

44 SPN 599 - CRUISE CONTROL SWITCHES NOT FUNCTIONING PROPERLY

Section **Page**

44.1 SPN 599/FMI 4

This diagnosis is typically both Cruise Control switches, SET and RES, are shorted to ground.

44.1.1 Short to Ground Check

Check for a short to ground as follows:

1. Turn the ignition ON (key ON, engine OFF) and place the Cruise Control Switch in the OFF position. DO NOT start the engine.
2. Check the driver console display.
   [a] If Cruise Control switch status RES is displayed, go to step 3.
   [b] If Cruise Control switch status SET is displayed, go to step 4.
3. Unplug the RES Cruise Control Switch.
   [a] If RES status is no longer displayed, replace the Cruise Control RES Switch. Refer to section 44.1.1.1.
   [b] If RES status is still displayed, repair the short to ground in the wire from the RES switch to pin 16 of the CPC #1 connector. Refer to section 44.1.1.1.
4. Unplug the SET Cruise Control Switch.
   [a] If SET status is no longer displayed, replace the Cruise Control SET Switch. Refer to section 44.1.1.1.
   [b] If SET status is still displayed, repair the short to ground in the wire from the SET switch to pin 12 of the CPC #1 connector. Refer to section 44.1.1.1.

44.1.1.1 Verify Repairs

Verify repairs as follows:

1. Turn ignition OFF.
2. Reconnect any electrical connections that were disconnected to perform the diagnosis.
3. Clear codes with DDDL 7.0 or latest version.
4. Start and bring engine up to operating temperature (over 140°F/60°C).
5. Verify operation is satisfactory and no warning lamps illuminate. If warning lamps illuminate, troubleshoot the codes. If assistance is required, call the Detroit Diesel Customer Support Center at 313–592–5800.

45 SPN 600 (CPC) - CRUISE CONTROL COAST SWITCH SIGNAL ERRATIC OR MISSING

Section **Page**

45.1 SPN 600/FMI 13

This fault is typically the J1939 Cruise Control Coast Switch signal from Source #1, #2, or #3 is missing.

45.1.1 Missing Cruise Control Coast Switch Signal from Source #1, #2, or #3 Check

Check as follows:

1. Check for multiple codes:
   [a] If CPC SPN 168/FMI 0/14/18 (Battery Voltage) are present troubleshoot these first.
   [b] If MCM SPN 625/FMI 9 is present, repair the CAN line faults.
   [c] If only a “J1939 Error” fault is present, go to step 2.
2. Has the CPC been recently reprogrammed?
   [a] If yes, check the proper configuration of the CPC.
   [b] If no, connect ServiceLink to determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

45.2 SPN 600/FMI 19

This fault is typically J1939 Cruise Control Coast Switch signal from Source #1, #2, or #3 is erratic.

45.2.1 Erratic Cruise Control Coast Switch Signal from Source #1 Check

Check as follows:

1. Check for multiple codes:
   [a] If CPC SPN 168/FMI 0/14/18 (Battery Voltage) are present troubleshoot and repair these first.
   [b] If MCM SPN 625/FMI 9 is present, troubleshoot and repair the CAN line.
   [c] If only a “J1939 Error” fault is present, go to step 2.
2. Has the CPC been recently reprogrammed?
   [a] If yes, check the proper configuration of the CPC.
   [b] If no, connect ServiceLink to determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

46 SPN 602 (CPC) - CRUISE CONTROL ACCELERATE SWITCH SIGNAL ERRATIC OR MISSING

46.1 SPN 602/FMI 13

This fault is typically the J1939 Cruise Control Accelerate Switch signal from Source #1, #2, or #3 is missing.

46.1.1 Missing Cruise Control Accelerate Switch Signal from Source #1, #2, or #3 Check

Check as follows:

1. Check for multiple codes:
   [a] If CPC SPN 168/FMI 0/14/18 (Battery Voltage) are present troubleshoot these first.
   [b] If MCM SPN 625/FMI 9 is present, repair the CAN line faults.
   [c] If only a “J1939 Error” fault is present, go to step 2.
2. Has the CPC been recently reprogrammed?
   [a] If yes, check the proper configuration of the CPC.
   [b] If no, connect ServiceLink to determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

46.2 SPN 602/FMI 19

This fault is typically J1939 Cruise Control Accelerate Switch signal from Source #1, #2, or #3 is erratic.

46.2.1 Erratic Cruise Control Accelerate Switch Signal from Source #1, #2, or #3 Check

Check as follows:

1. Check for multiple codes:
   [a] If CPC SPN 168/FMI 0/14/18 (Battery Voltage) are present troubleshoot and repair these first.
   [b] If MCM SPN 625/FMI 9 is present, troubleshoot and repair the CAN line.
   [c] If only a “J1939 Error” fault is present, go to step 2.
2. Has the CPC been recently reprogrammed?
   [a] If yes, check the proper configuration of the CPC.
   [b] If no, connect ServiceLink to determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

47 SPN 609 - MCM FAULT (ERRONEOUS DATA)

Section **Page**

47.1 SPN 609/FMI 12

This diagnostic condition is typically MCM failed or programmed incorrectly.

47.1.1 MCM Parameter Check

Check the parameters as follows:

1. Using your diagnostic tool, reset the parameters on the MCM.
   [a] If fault code 233/12 is not active after resetting parameters, troubleshooting is finished.
   [b] If fault code 233/12 is still active after resetting parameters, go to step 2.
2. Check the MCM parameters to ensure they are correct for the vehicle configuration.
   [a] If parameters are not correct, reset parameters on the MCM.
   [b] If parameters are correct, contact Detroit Diesel Customer Support Center (313–592–5800) for authorization to replace the MCM. Set parameters on the new MCM.

47.2 SPN 609/FMI 14

This diagnostic condition is typically MCM incorrectly programmed.

47.2.1 MCM Check

Check the MCM as follows:

1. Check to ensure the MCM is correct for the engine.
   [a] If MCM is correct for the engine, go to step 2.
   [b] If MCM is not correct for the engine, contact Detroit Diesel Customer Support Center (313–592–5800) for authorization to replace the MCM. Set parameters on the new MCM.
2. Reset the MCM parameters.
   [a] If fault code 233/14 is not active after the MCM parameters are reset, troubleshooting is complete.
   [b] If fault code 233/14 is still active after the MCM parameters are reset, go to step 3.
3. Check the MCM parameters to ensure they are correct for the vehicle configuration.
   [a] If the MCM parameters are not correct, reset the parameters.
   [b] If the MCM parameters are correct, contact Detroit Diesel Customer Support Center (313–592–5800) for authorization to replace the MCM. Set the parameters on the new MCM.

48 SPN 615 - INTAKE AIR DELTA PRESSURE OUTSIDE OF NORMAL OPERATING RANGE

Section **Page**

48.1 SPN 615/FMI 3

This diagnosis is typically an open circuit.

48.1.1 Open Circuit Check

Check as follows:

1. Check for multiple codes.
   [a] If 51/3 and 615/3 are present, repair the open between pin 103 of the 120–pin MCM connector and pin 2 of the Intake Air Delta P Sensor and the Intake Throttle Valve. See Figure 48-1. Refer to section 48.1.1.1.

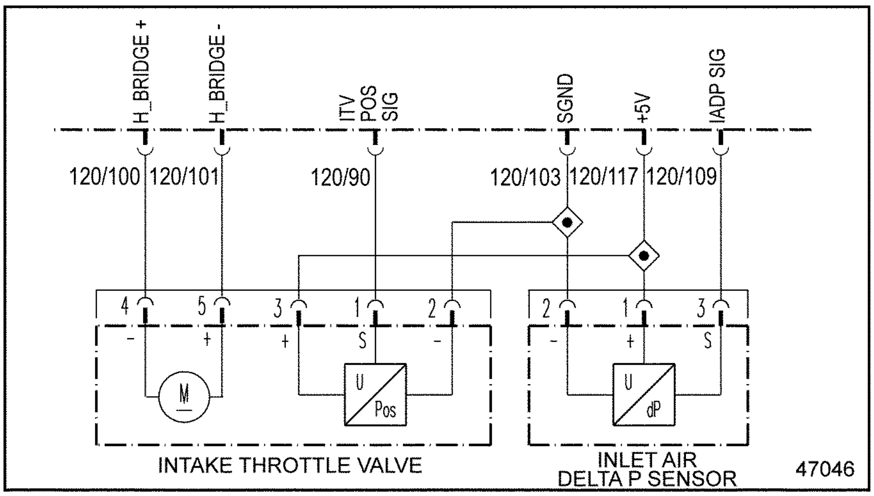


Figure 48-1 Intake Air Delta P Sensor

   [b] If only 615/3 is present, go to step 2.
2. Disconnect the Intake Air Delta P Sensor.
3. Measure the resistance across pins 1 and 2 of the Intake Air Delta P Sensor.
   [a] If the resistance is greater than 200k Ω, replace the Intake Air Delta P Sensor.
   [b] If the resistance is less than 200k Ω, go to step 4.
4. Measure the resistance across pins 1 and 3 of the Intake Air Delta P Sensor.
   [a] If the resistance is greater than 50k Ω, replace the Intake Air Delta P Sensor.
   [b] If the resistance is less than 50k Ω, go to step 5.
5. Turn the ignition ON (key ON, engine OFF).
6. Measure the voltage between pins 1 and 2 of the Intake Air Delta P Sensor harness connector.
   [a] If the voltage is between 4.5 and 5.5 volts, go to step 8.
   [b] If the voltage is less than 4.5 volts, go to step 7.

7. Measure the voltage between pin 1 of the Intake Air Delta P Sensor harness connector and ground.

   [a] If the voltage is between 4.5 and 5.5 volts, repair the open circuit between pin 2 of the Intake Air Delta P Sensor harness connector and pin 103 of the 120–pin MCM connector. See Figure 48-2. Refer to section 48.1.1.1.

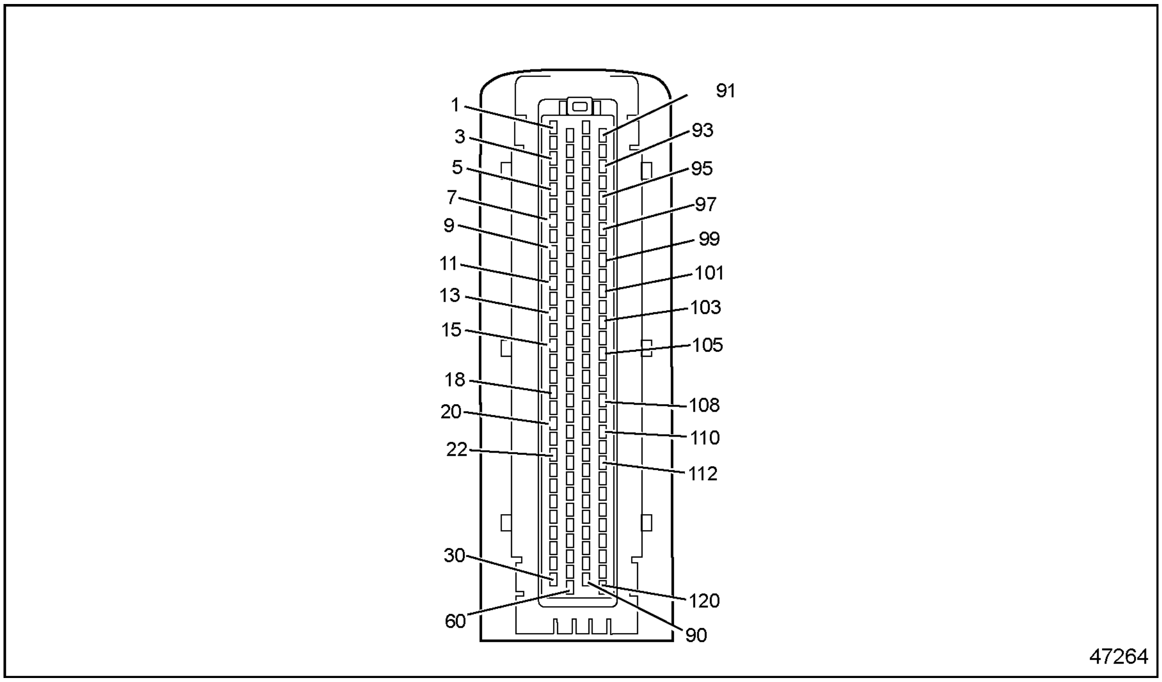


Figure 48-2 120–pin MCM Connector

   [b] If the voltage is less than 4.5 volts, repair the open circuit between pin 1 of the Intake Air Delta P Sensor harness connector and pin 117 of the 120–pin MCM connector. Refer to section 48.1.1.1.

8. Turn the ignition OFF.
9. Disconnect the 120–pin MCM connector.
10. Measure the resistance between pins 1 and 3 of the Intake Air Delta P Sensor harness connector.

    [a] If the resistance is greater than 5 Ω, go to step 11.

    [b] If the resistance is less than 5 Ω, repair the short in wires between pins 1 and 3 of the Intake Air Delta P Sensor harness connector and pin 109 of the 120–pin MCM connector. Refer to section 48.1.1.1.

11. Measure the resistance between pin 3 of the Intake Air Delta P Sensor harness connector and pin 109 of the 120–pin MCM connector.

    [a] If the resistance is greater than 3 Ω, repair the open between pin 3 of the Intake Air Delta P Sensor harness connector and pin 109 of the 120–pin MCM connector. Refer to section 48.1.1.1.

[b] If the resistance is less than 3 Ω, repeat steps 2 through 11. If the results are the same, contact the Detroit Diesel Customer Support Center (313–592–5800).

48.1.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF. Reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
   [a] If no codes are present, troubleshooting is complete.
   [b] If code 615/3 is not logged but other codes are logged, troubleshoot the other codes.
   [c] If code 615/3 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313–592–5800).

48.2 SPN 615/FMI 4

This diagnosis is typically a short to ground.

48.2.1 Short to Ground Check

Check as follows:

1. Disconnect the Intake Air Delta P Sensor.
2. Disconnect the 120–pin MCM connector.
3. Measure the resistance between pins 1 and 2 of the Intake Air Delta P Sensor. See Figure 48-3.

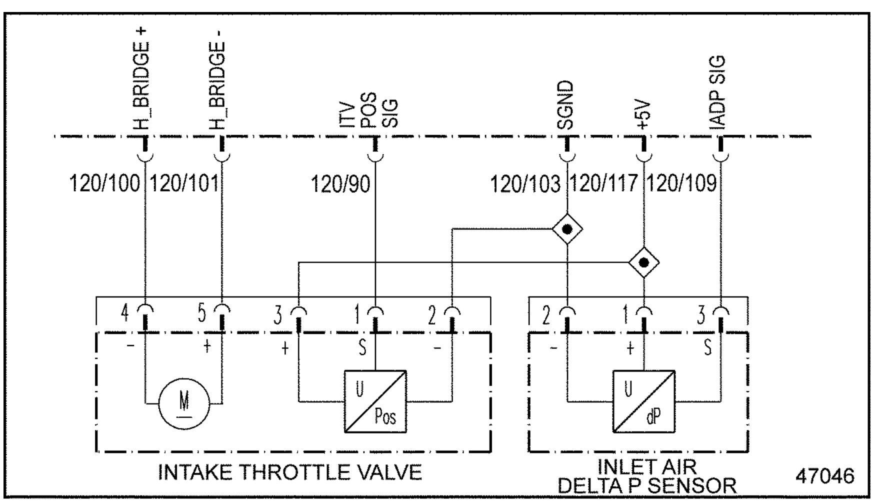


Figure 48-3 Intake Air Delta P Sensor

[a] If the resistance is less than 5Ω, repair the short between pins 117 and 103 of the 120–pin MCM connector. See Figure 48-4. Refer to section 48.2.1.1.

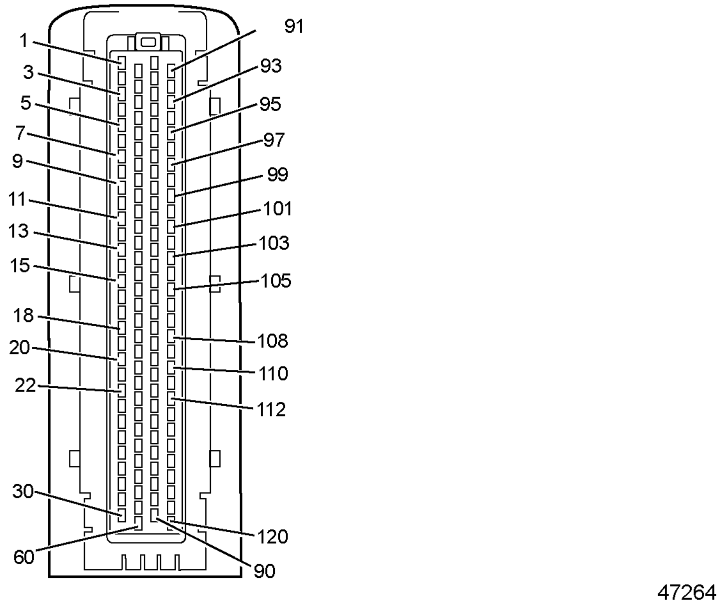


Figure 48-4 120–pin MCM Connector

[b] If the resistance is greater than 5Ω, go to step 4.

4. Measure the resistance between pins 2 and 3 of the Intake Air Delta P Sensor.

   [a] If the resistance is less than 5Ω, repair the short between pins 109 and 103 of the 120–pin MCM connector. Refer to section 48.2.1.1.

   [b] If the resistance is greater than 5Ω, go to step 5.

5. Measure the resistance between pin 1 of the Intake Air Delta P Sensor harness connector and ground.

   [a] If the resistance is less than 3Ω, repair the short circuit between pin 1 of the Intake Air Delta P Sensor harness connector and ground. Refer to section 48.2.1.1.

   [b] If the resistance is greater than 3Ω, go to step 6.

6. Measure the resistance between pin 3 of the Intake Air Delta P Sensor harness connector and ground.

   [a] If the resistance is less than 3Ω, repair the short circuit between pin 3 of the Intake Air Delta P Sensor harness connector and ground. Refer to section 48.2.1.1.

   [b] If the resistance is greater than 3Ω, repeat steps 3 through 6. If the results are the same, contact the Detroit Diesel Customer Support Center (313–592–5800).

48.2.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF. Reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
   [a] If no codes are present, troubleshooting is complete.
   [b] If code 615/3 is not logged but other codes are logged, troubleshoot the other codes.
   [c] If code 615/3 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313–592–5800).

49 SPN 615 (CPC) - J1939 DM1 MESSAGE FROM TRANSMISSION MISSING

49.1 SPN 615/FMI 9

This fault is typically the J1939 DM1 message from the transmission is missing.

49.1.1 Missing J1939 DM1 Message Check

Check as follows:

1. Check for multiple codes:
   [a] If CPC SPN 168/FMI 0/14/18 (Battery Voltage) are present troubleshoot these first.
   [b] If MCM SPN 625/FMI 9 is present, troubleshoot and repair the CAN line.
   [c] If only a “J1939 Error” fault is present, go to step 2.
2. Has the CPC been recently reprogrammed?
   [a] If yes, check the proper configuration of the CPC.
   [b] If no, connect ServiceLink to determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

50 SPN 625 - CAN FAULT

Section **Page**

50.1 SPN 625/FMI 2

This fault is typically erratic data or the CAN propriety data link has failed due to no communication between the MCM and the CPC.

NOTE:
The following diagnostics pertain to faults received from the MCM and /or the CPC.

50.1.1 Data Link Check

Check as follows:

1. Have the MCM and/or the CPC been recently changed or reprogrammed?
   [a] If yes, verify the that the correct MCM calibration and/or the correct CPC parameter list has been installed. If the correct calibration and correct parameter list have been installed, go to step 2.
   [b] If no, go to step 2.
2. Disconnect the MCM 21–pin connector.
3. Turn the ignition ON (key ON, engine OFF).
4. Measure the battery voltage at pin 7 on the MCM 21–pin connector.
   [a] If the battery voltage is less than 10.5 volts, restore the battery voltage at pin 7 on the MCM 21–pin connector.

NOTE:
Poor battery grounds can be a possible cause of low battery voltage.

   [b] If the battery voltage is greater than 10.5 volts, go to step 5.
5. Turn ignition OFF, leave the 21–pin MCM connector disconnected.
6. Disconnect the CPC #4 connector.
7. Measure the resistance between pins 1 and 3 of the CPC #4 connector.
   [a] If the resistance is greater than 5 Ω, go to step 8.
   [b] If the resistance is less than 5 Ω, repair the short in the wires between pins 1 and 3 of the CPC #4 connector and pins 13 and 19 of the 21–pin MCM connector. Refer to section 50.1.1.1.
8. Measure the resistance between pin 1 of the CPC #4 connector and ground.
   [a] If the resistance is greater than 5 Ω, go to step 9.
   [b] If the resistance is less than 5 Ω, repair the short to ground between pin 1 of the CPC #4 connector and ground. Refer to section 50.1.1.1.
9. Measure the resistance between pin 3 of the CPC #4 connector and ground.
   [a] If the resistance is greater than 5 Ω, go to step 10.

[b] If the resistance is less than 5 Ω, repair the short to ground between pin 3 of the CPC #4 connector and ground. Refer to section 50.1.1.1.

10. Measure the resistance between pin 1 of the CPC #4 connector and pin 19 of the 21–pin MCM connector.

    [a] If the resistance is greater than 5 Ω, repair the open between pin 1 of the CPC #4 connector and pin 19 of the 21–pin MCM connector. Refer to section 50.1.1.1.

    [b] If the resistance is less than 5 Ω, go to step 11.

11. Measure the resistance between pin 3 of the CPC #4 connector and pin 13 of the 21–pin MCM connector.

    [a] If the resistance is greater than 5 Ω, repair the open between pin 3 of the CPC #4 connector and pin 13 of the 21–pin MCM connector. Refer to section 50.1.1.1.

    [b] If the resistance is less than 5 Ω, call the DDC Customer Support Center (313–592–5800).

50.1.1.1 Verify Repairs

Verify repairs as follows:

1. Turn ignition OFF.
2. Reconnect any electrical connections that were disconnected to perform the diagnosis.
3. Clear codes with DDDL 7.0 or latest version.
4. Start and bring engine up to operating temperature (over 140°F/60°C).
5. Verify operation is satisfactory and no warning lamps illuminate. If warning lamps illuminate, troubleshoot the codes. If assistance is required, call the Detroit Diesel Customer Support Center at 313–592–5800.

50.2 SPN 625/FMI 4

This fault indicates that the CAN propriety data link to the CPC has shorted.

NOTE:
The following diagnostic pertains to a fault reported from the CPC.

50.2.1 Check for Short Circuit

Check as follows:

1. Turn ignition OFF, disconnect the 21–pin MCM connector.
2. Disconnect the CPC #4 connector.
3. Measure the resistance between pins 1 and 3 of the CPC #4 connector.
   [a] If the resistance is greater than 5 Ω, go to step 4.
   [b] If the resistance is less than 5 Ω, repair the short in the wires between pins 1 and 3 of the CPC #4 connector and pins 13 and 19 of the 21–pin MCM connector. Refer to section 50.2.1.1.
4. Measure the resistance between pin 1 of the CPC #4 connector and ground.
   [a] If the resistance is greater than 5 Ω, go to step 5.
   [b] If the resistance is less than 5 Ω, repair the short to ground between pin 1 of the CPC #4 connector and ground. Refer to section 50.2.1.1.
5. Measure the resistance between pin 3 of the CPC #4 connector and ground.
   [a] If the resistance is greater than 5 Ω, go to step 6.
   [b] If the resistance is less than 5 Ω, repair the short to ground between pin 3 of the CPC #4 connector and ground. Refer to section 50.2.1.1.
6. Measure the resistance between pin 1 of the CPC #4 connector and pin 19 of the 21–pin MCM connector.
   [a] If the resistance is greater than 5 Ω, repair the open between pin 1 of the CPC #4 connector and pin 19 of the 21–pin MCM connector. Refer to section 50.2.1.1.
   [b] If the resistance is less than 5 Ω, go to step 7.
7. Measure the resistance between pin 3 of the CPC #4 connector and pin 13 of the 21–pin MCM connector.
   [a] If the resistance is greater than 5 Ω, repair the open between pin 3 of the CPC #4 connector and pin 13 of the 21–pin MCM connector. Refer to section 50.2.1.1.
   [b] If the resistance is less than 5 Ω, call the DDC Customer Support Center (313–592–5800).

50.2.1.1 Verify Repairs

Verify repairs as follows:

1. Turn ignition OFF.
2. Reconnect any electrical connections that were disconnected to perform the diagnosis.
3. Clear codes with DDDL 7.0 or latest version.
4. Start and bring engine up to operating temperature (over 140°F/60°C).
5. Verify operation is satisfactory and no warning lamps illuminate. If warning lamps illuminate, troubleshoot the codes. If assistance is required, call the Detroit Diesel Customer Support Center at 313–592–5800.

51 SPN 628 (CPC) - MULTIPLE FAULTS

Section **Page**

51.1 SPN 628/FMI 13 (ALL FAULT DESCRIPTIONS)

There are multiple fault descriptions for SPN 628/FMI 13. The troubleshooting solution is the same for any and all fault descriptions: reprogram the CPC with the latest software release.

51.2 SPN 628/FMI 14

SPN 628/FMI 14 indicates an XFLASH failure. Replace the CPC and reprogram with the latest software release.

52 SPN 629 (CPC) - MULTIPLE FAULTS

52.1 SPN 629/FMI 2

There are multiple fault descriptions for SPN 629/FMI 2. The troubleshooting solution is the same for any and all fault descriptions: Replace the CPC and reprogram with the latest software release.

52.2 SPN 629/FMI 12

There are multiple fault descriptions for SPN 629/FMI 12. The troubleshooting solution is the same for any and all fault descriptions: Replace the CPC and reprogram with the latest software release.

53 SPN 630 (CPC) - MULTIPLE FAULTS

53.1 SPN 630/FMI 14

There are multiple fault descriptions for SPN 630/FMI 14. They are listed with the troubleshooting solution:

- CPC failed to download MCM static fault data. Reprogram the CPC with the latest software release.
- MCM reporting inconsistent static fault code data. Reprogram the MCM with the latest software release
- MCM contains more MUs than the current CPC2 software version is able to store. Reprogram the CPC with the latest software release.
- MCM is reporting inconsistent static fault code data. Reprogram the MCM with the latest software release.

54 SPN 636 — CRANKSHAFT POSITION SENSOR OUTSIDE OF NORMAL OPERATING CONDITIONS

Section **Page**

54.1 SPN 636/FMI 1

The diagnostic condition is typically CKP Sensor Signal Voltage Too Low.

54.1.1 Low Signal Voltage Check

Check low signal voltage as follows:

1. If fault occurs only when cranking the engine (and engine will not start), check that the CKP and Camshaft Position (CMP) sensors are correctly wired to the MCM. See Figure 54-1.

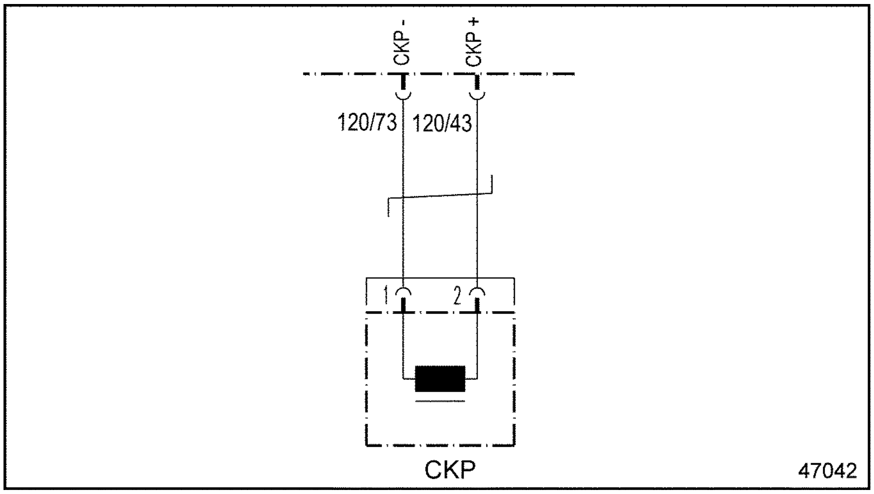


Figure 54-1 Crankshaft Position Sensor Wiring

   [a] If wires are not correctly wired, repair or replace wires as required. Refer to section 54.1.1.1.

   [b] If wires are correctly wired, go to step 2.

2. If fault occurs at other times then when cranking the engine, check that the CKP Sensor position is correct (the sensor is seated in all the way).

   [a] If fault is not active after checking CKP Sensor position, repair the CKP Sensor clamping sleeve. Refer to section 54.1.1.1.

   [b] If fault is still active after checking the CKP Sensor position, go to step 3.

3. Check the flywheel position through the inspection window of the timing case using turning tool. Look for timing marks and damage.

   [a] If the flywheel is out of position, repair or replace, as required. Refer to section 54.1.1.1.

   [b] If sthe flywheel is not out of position, go to step 4.

4. Check crankshaft axial play.

[a] If axial play is not within specifications, repair or replace crankshaft thrust bearings, as required. Refer to section 54.1.1.1.

[b] If axial play is within specifications, replace the MCM. Refer to section 54.1.1.1.

54.1.1.1 Verify Repairs

Verify repairs as follows:

1. Turn ignition OFF.
2. Reconnect any electrical connections that were disconnected to perform the diagnosis.
3. Clear codes with DDDL 7.0 or latest version.
4. Start and bring engine up to operating temperature (over 140°F/60°C).
5. Verify operation is satisfactory and no warning lamps illuminate. If warning lamps illuminate, troubleshoot the codes. If assistance is required, call the Detroit Diesel Customer Support Center at 313–592–5800.

54.2 SPN 636/FMI 3

The diagnostic condition is typically CKP Sensor has an open circuit.

54.2.1 Open Circuit Check

Check for a CKP Sensor open circuit as follows:

1. Disconnect the CKP Sensor.
2. Measure the resistance across pins 1 and 2 of the CKP Sensor. See Figure 54-2.

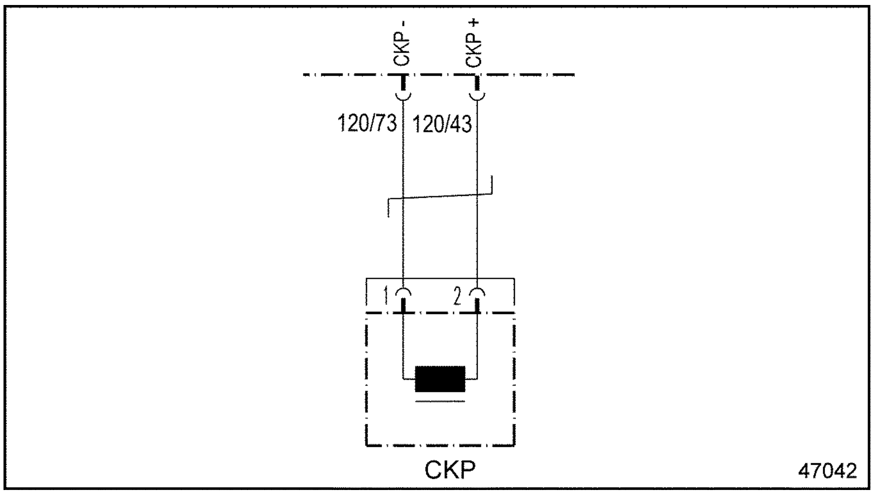


Figure 54-2 Crankshaft Position Sensor Wiring

   [a] If the resistance is greater than 140 Ω, replace CKP Sensor. Refer to section 54.2.2.1.

   [b] If the resistance is less than 140 Ω, go to step 3.

3. Disconnect the 120–pin MCM connector.
4. Measure the resistance across pins 1 and 2 of the CKP Sensor harness connector.

   [a] If the resistance is greater than 5 Ω, go to step 5.

   [b] If the resistance is less than 5 Ω, repair the short between pins 1 and 2 of the CKP Sensor harness connector and pins 42 and 43 of the 120–pin MCM connector. Refer to section 54.2.2.1.

5. Measure the resistance between pin 1 of the CKP Sensor harness connector and pin 42 of the 120–pin MCM connector.

   [a] If the resistance is greater than 5 Ω, repair the open between pin 1 of the CKP Sensor harness connector and pin 42 of the 120–pin MCM connector. Refer to section 54.2.2.1.

   [b] If the resistance is less than 5 Ω, go to step 6.

6. Measure the resistance between pin 2 of the CKP Sensor harness connector and pin 43 of the 120–pin MCM connector.
   - [a] If the resistance is greater than 5 Ω, repair the open between pin 2 of the CKP Sensor harness connector and pin 43 of the 120–pin MCM connector. Refer to section 54.2.2.1.
   - [b] If the resistance is less than 5 Ω, refer to section 54.2.2.

54.2.2 Crankshaft Position Sensor Gap Check

Check the crankshaft position sensor gap as follows:

1. Bar the engine until the CKP Sensor is over a CKP tooth of the pulse wheel.
2. Check the gap between the CKP Sensor and the tooth of the pulse wheel (0.020 to 0.040 in.). A depth micrometer can be used.
   - [a] If the gap setting is correct, repeat steps 1 and 2. If the results are the same, call the Detroit Diesel Customer Support Center (313–592–5800).
   - [b] If the gap setting is not correct, adjust the CKP Sensor until the gap setting is correct and refer to section 54.2.2.1. If the problem returns, the pulse wheel may be loose or bad or damaged.

54.2.2.1 Verify Repairs

Verify repairs as follows:

1. Turn ignition OFF.
2. Reconnect any electrical connections that were disconnected to perform the diagnosis.
3. Clear codes with DDDL 7.0 or latest version.
4. Start and bring engine up to operating temperature (over 140°F/60°C).
5. Verify operation is satisfactory and no warning lamps illuminate. If warning lamps illuminate, troubleshoot the codes. If assistance is required, call the Detroit Diesel Customer Support Center at 313–592–5800.

54.3 SPN 636/FMI 4

This diagnostic condition is typically the CKP Sensor shorted to ground.

54.3.1 Short to Ground Check

Troubleshoot a CKP Sensor short to ground fault as follows:

1. Disconnect the CKP Sensor.
2. Measure the resistance between pin 1 of the CKP Sensor and ground.
   - [a] If the resistance is greater than 5 Ω, go to step 3.
   - [b] If the resistance is less than 5 Ω, replace the sensor. Refer to section 54.3.1.1.
3. Measure the resistance between pin 2 of the CKP Sensor and ground.
   - [a] If the resistance is greater than 5 Ω, go to step 4.
   - [b] If the resistance is less than 5 Ω, replace the sensor. Refer to section 54.3.1.1.
4. Disconnect the 120–pin MCM connector.
5. Measure the resistance across pins 1 and 2 of the CKP Sensor harness connector. See Figure 54-3.

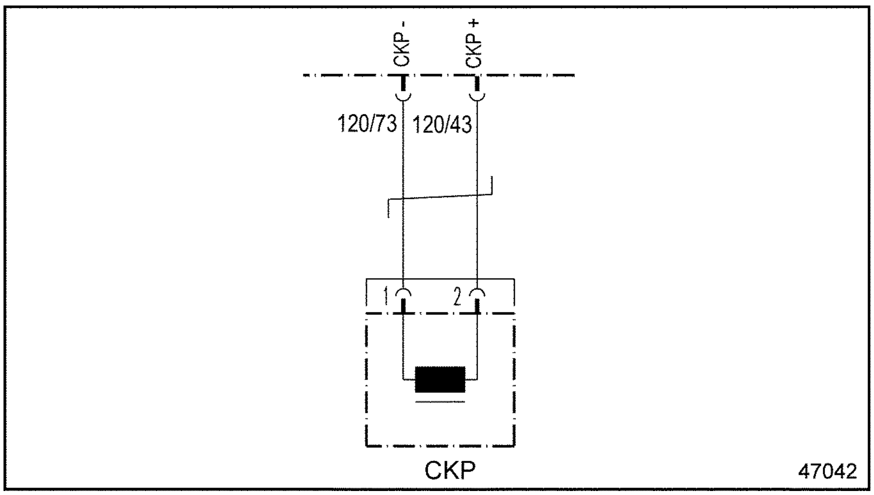


Figure 54-3 Crankshaft Position Sensor Wiring

   - [a] If the resistance is greater than 5 Ω, go to step 6.
   - [b] If the resistance is less than 5 Ω, repair the short between the CKP Sensor harness connector pins 1 and 2 and pins 42 and 43 of the 120–pin MCM connector. Refer to section 54.3.1.1.
6. Measure the resistance between pin 1 of the CKP Sensor harness connector and ground.
   - [a] If the resistance is greater than 5 Ω, go to step 7.

[b] If the resistance is less than 5 Ω, repair the short to ground between pin 1 of the CKP Sensor harness connector and pin 42 of the 120–pin MCM connector. Refer to section 54.3.1.1.

7. Measure the resistance between pin 2 of the CKP Sensor harness connector and pin 43 of the 120–pin MCM connector.

   [a] If the resistance is greater than 5 Ω, reconnect the 120–pin MCM connector and review steps 2 through 7. If the results are the same, call the Detroit Diesel Customer Support Center (313–592–5800).

   [b] If the resistance is less than 5 Ω, repair the short to ground between pin 2 of the CKP Sensor harness connector and pin 43 of the 120–pin MCM connector. Refer to section 54.3.1.1.

54.3.1.1 Verify Repairs

Verify repairs as follows:

1. Turn ignition OFF.
2. Reconnect any electrical connections that were disconnected to perform the diagnosis.
3. Clear codes with DDDL 7.0 or latest version.
4. Start and bring engine up to operating temperature (over 140°F/60°C).
5. Verify operation is satisfactory and no warning lamps illuminate. If warning lamps illuminate, troubleshoot the codes. If assistance is required, call the Detroit Diesel Customer Support Center at 313–592–5800.

54.4 SPN 636/FMI 7

This diagnostic condition is typically camshaft and crankshaft signals not matching.

54.4.1 Camshaft and Crankshaft Signals Not Matching Check

Troubleshoot a no match of camshaft and crankshaft signals fault as follows:

1. Remove CKP and CMP sensors.
2. Reseat the CKP Sensor until it touches the flywheel and reseat the CMP Sensor until it touches the cam gear. Check codes.
   [a] If 636/7 is not active, refer to section 54.4.1.1.
   [b] If 636/7 is active, go to step 3.
3. Remove CKP and CMP sensors.
4. Remove O-ring in CMP Sensor opening.
5. Reseat CKP Sensor until it touches the flywheel and reseat the CMP Sensor without the O-ring until the sensor touches the cam gear.
   [a] If 636/7 is not active, replace the O-ring with a smaller O-ring. Refer to section 54.4.1.1.
   [b] If 636/7 is active, go to step 6.
6. Disconnect the CKP Sensor connector and measure the sensor reisitance.
   [a] If the sensor resistance is not between 1000 Ω and 1385 Ω, replace the sensor. refer to section 54.4.1.1.
   [b] If the sensor resistance is between 1000 Ω and 1385 Ω, go to step 7.
7. Verify that all flywheel holes or slots are present by viewing through the access hole on the flywheel housing.
   [a] If the flywheel holes or slots are missing or damaged, replace the flywheel as needed. refer to section 54.4.1.1.

[b] If the flywheel holes or slots are all present, go to step 8.

8. Replace the MCM. Refer to section 54.4.1.1.

54.4.1.1 Verify Repairs

Verify repairs as follows:

1. Turn ignition OFF.
2. Reconnect any electrical connections that were disconnected to perform the diagnosis.
3. Clear codes with DDDL 7.0 or latest version.
4. Start and bring engine up to operating temperature (over 140°F/60°C).
5. Verify operation is satisfactory and no warning lamps illuminate. If warning lamps illuminate, troubleshoot the codes. If assistance is required, call the Detroit Diesel Customer Support Center at 313–592–5800.

54.5 SPN 636/FMI 8

The diagnostic condition is typically CKP Sensor Time Out.

54.5.1 Check for Multiple Codes

Check for multiple codes as follows:

1. Plug in your diagnostic tool.
2. Turn ON ignition and start the engine.
3. Read active codes.
   [a] If fault 636/3 is active in addition to fault 636/8 with the engine running, refer to section 54.2.1.
   [b] If fault 636/4 is active in addition to fault s 636/8 with the engine running, refer to section 54.3.1.
   [c] If only fault s 636/8 is active with the engine running, refer to section 54.5.2.

54.5.2 Sensor Time Out Check

Check for a sensor time out as follows:

1. Check the CKP Sensor position.
   [a] If fault 636/8 is not active after checking position, replace CKP Sensor clamping sleeve. Refer to section 54.5.2.1.
   [b] If fault 636/8 is active after checking position, go to step 2.
2. Replace the Vehicle Speed Sensor.
   [a] If fault s 636/8 is not active, refer to section 54.5.2.1.
   [b] If fault s 636/8 is still active, go to step 3.
3. Check the flywheel position in the timing case through the inspection window using the turning tool.
   [a] If sensors are out of position, repair or replace the spring bushing, as required. Erase fault code memory. See Figure 54-4.

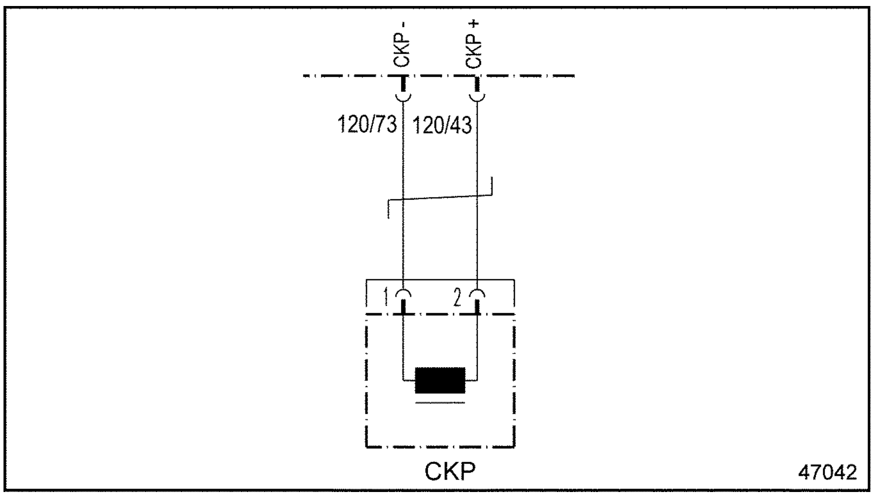


Figure 54-4 Crankshaft Position Sensor

   [b] If sensors are not out of position, go to step 4.
4. Check crankshaft axial play.
   [a] If axial play is not within specifications, repair or replace crankshaft thrust bearings, as required. Refer to section 54.5.2.1.
   [b] If axial play is within specifications, contact the Detroit Diesel Customer Support Center (313-592-5800).

54.5.2.1 Verify Repairs

Verify repairs as follows:

1. Turn ignition OFF.
2. Reconnect any electrical connections that were disconnected to perform the diagnosis.
3. Clear codes with DDDL 7.0 or latest version.
4. Start and bring engine up to operating temperature (over 140°F/60°C).
5. Verify operation is satisfactory and no warning lamps illuminate. If warning lamps illuminate, troubleshoot the codes. If assistance is required, call the Detroit Diesel Customer Support Center at 313–592–5800.

55 SPN 651 – INJECTOR #1 NOT OPERATING NORMALLY

55.1 SPN 651/FMI 5

This diagnosis is typically the injector current is below normal or an open circuit fault.

55.1.1 Open Circuit Check

Check as follows:

1. Check for multiple codes.
   [a] If fault code 168/0 is active in addition to 651/5, service 168/0 first. Refer to section 31.1.
   [b] If fault 652/5 and 653/5 are active in addition to 651/5, call the Detroit Diesel Customer Support Center (313–592–5800) for MCM replacement.
   [c] If only fault code 651/5 is active, go to step 2.
2. Turn the ignition OFF.
3. Remove valve cover.
4. Turn the ignition ON (key ON, engine OFF).
5. Measure the voltage between pins 1 and 2 of injector #1. See Figure 55-1.

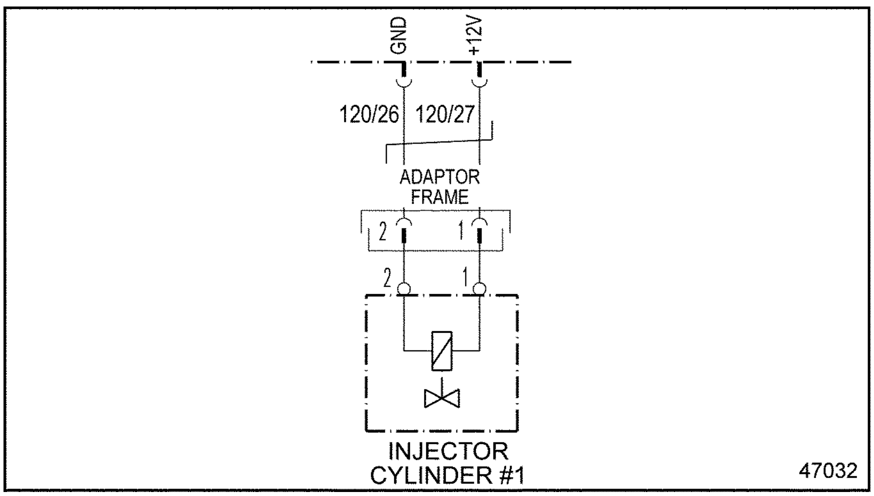


Figure 55-1 Injector #1

   [a] If the voltage is less than 11.5 volts, go to step 6.
   [b] If the voltage is greater than 11.5 volts, replace injector #1. After the replacing the injector,refer to section 55.1.1.1.
6. Measure the voltage between pin 1 of injector #1 and ground.
   [a] If the voltage is less than 11.5 volts, repair the open between pin 27 of the 120–pin MCM connector and pin 1 of injector #1. Refer to section 55.1.1.1.

[b] If the voltage is greater than 11.5 volts, repair the open between pin 26 of the 120–pin MCM connector and pin 2 of injector #1. Refer to section 55.1.1.1.

55.1.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF and reconnect all connectors.
2. Turn the ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes

   [a] If no codes are present, troubleshooting is complete.

   [b] If code 651/5 is not logged but other codes are logged, troubleshoot the other codes.

   [c] If code 651/5 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313–592–5800).

55.2 SPN 651/FMI 10

This diagnostic condition is typically a short to ground.

55.2.1 Short to Ground Check

Check as follows:

1. Turn the ignition OFF.
2. Disconnect the 120–pin MCM connector.
3. Remove the valve cover.
4. Disconnect pins 1 and 2 of injector #1.
5. Measure the resistance between pin 1 of injector #1 and ground. See Figure 55-2.

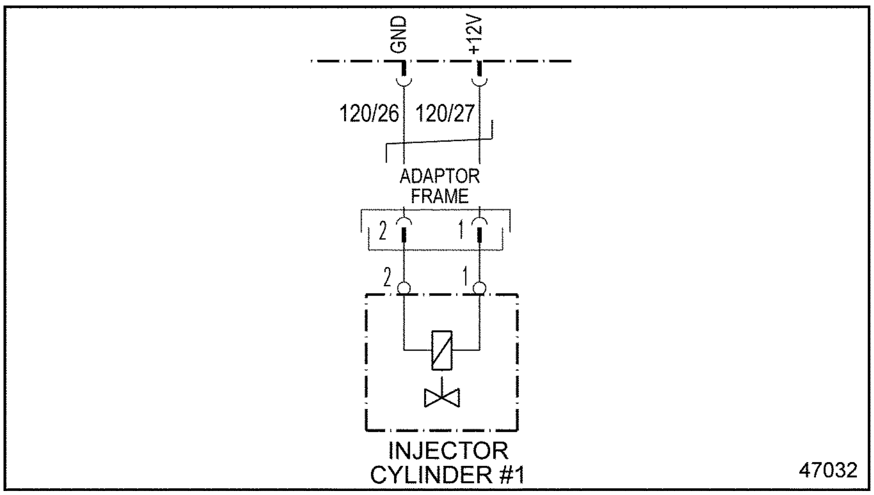


Figure 55-2 Injector #1

   [a] If the resistance is less than 5 Ω, replace injector #1. After the replacing the injector,refer to section 55.2.1.1.

   [b] If the resistance is greater than 5 Ω, go to step 6.

6. Measure the resistance between pins 1 and 2 of the injector #1 harness.

   [a] If the resistance is less than 5 Ω, repair the short between pin 1 and pin 2 of injector #1 and pins 27 and 26 of the 120–pin MCM connector. Refer to section 55.2.1.1.

   [b] If the resistance is greater than 5 Ω, go to step 7.

7. Measure the resistance between pin 1 of the injector #1 harness and ground.

   [a] If the resistance is less than 5 Ω, repair the short to ground between pin 1 of the injector #1 harness and pin 27 of the MCM 120–pin connector. Refer to section 55.2.1.1.

[b] If the resistance is greater than 5 Ω, repair the short to ground between pin 2 of the injector #1 harness and pin 26 of the MCM 120–pin connector. Refer to section 55.2.1.1.

55.2.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF and reconnect all connectors.
2. Turn the ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
   [a] If no codes are present, troubleshooting is complete.
   [b] If code 651/10 is not logged but other codes are logged, troubleshoot the other codes.
   [c] If code 651/10 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313–592–5800).

56 SPN 652 – INJECTOR #2 NOT OPERATING NORMALLY

Section **Page**

56.1 SPN 652/FMI 5

This diagnosis is typically the injector current is below normal or an open circuit fault.

56.1.1 Open Circuit Check

Check as follows:

1. Check for multiple codes.
   - [a] If fault code 168/0 is active in addition to 652/5, service 168/0 first. Refer to section 31.1.
   - [b] If fault 651/5 and 653/5 are active in addition to 652/5, call the Detroit Diesel Customer Support Center (313–592–5800) for MCM replacement.
   - [c] If only fault code 652/5 is active, go to step 2.
2. Turn the ignition OFF.
3. Remove valve cover.
4. Turn the ignition ON (key ON, engine OFF).
5. Measure the voltage between pins 1 and 2 of injector #2. See Figure 56-1.

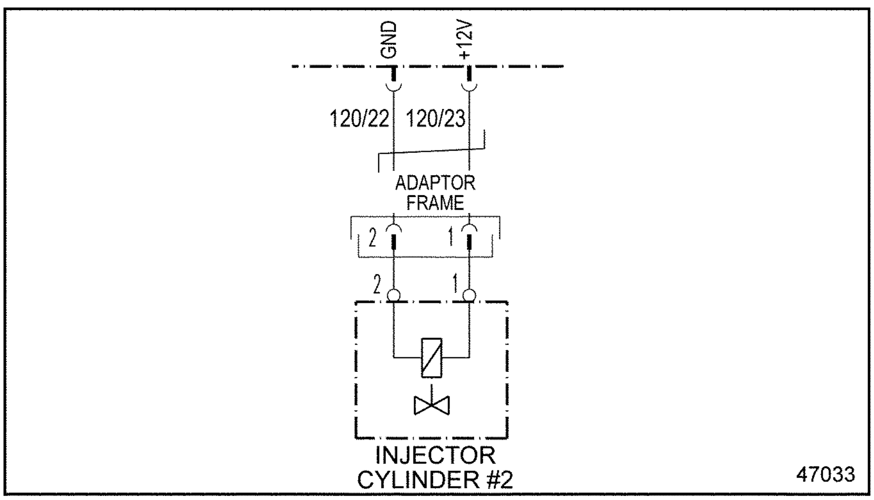


Figure 56-1 Injector #2

   - [a] If the voltage is less than 11.5 volts, go to step 6.
   - [b] If the voltage is greater than 11.5 volts, replace injector #2. After the replacing the injector,refer to section 56.1.1.1.
6. Measure the voltage between pin 1 of injector #2 and ground.
   - [a] If the voltage is less than 11.5 volts, repair the open between pin 23 of the 120–pin MCM connector and pin 1 of injector #2. Refer to section 56.1.1.1.

[b] If the voltage is greater than 11.5 volts, repair the open between pin 22 of the 120–pin MCM connector and pin 2 of injector #2. Refer to section 56.1.1.1.

56.1.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF and reconnect all connectors.
2. Turn the ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
   [a] If no codes are present, troubleshooting is complete.
   [b] If code 652/5 is not logged but other codes are logged, troubleshoot the other codes.
   [c] If code 652/5 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313–592–5800).

56.2 SPN 652/FMI 10

This diagnostic condition is typically a short to ground.

56.2.1 Short to Ground Check

Check as follows:

1. Turn the ignition OFF.
2. Disconnect the 120–pin MCM connector.
3. Remove the valve cover.
4. Disconnect pins 1 and 2 of injector #2.
5. Measure the resistance between pin 1 of injector #2 and ground. See Figure 56-2.

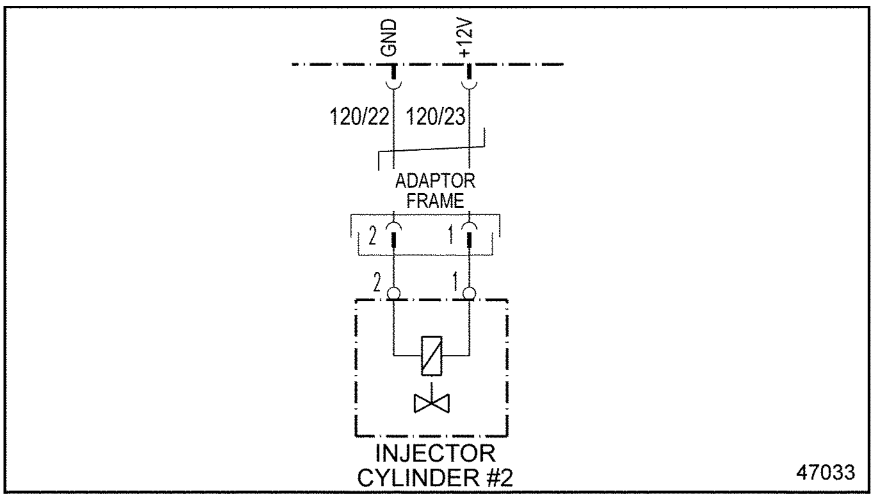


Figure 56-2 Injector #2

   [a] If the resistance is less than 5 Ω, replace injector #2. After the replacing the injector,refer to section 56.2.1.1.

   [b] If the resistance is greater than 5 Ω, go to step 6.

6. Measure the resistance between pins 1 and 2 of the injector #2 harness.

   [a] If the resistance is less than 5 Ω, repair the short between pin 1 and pin 2 of injector #2 and pins 23 and 22 of the 120–pin MCM connector. Refer to section 56.2.1.1.

   [b] If the resistance is greater than 5 Ω, go to step 7.

7. Measure the resistance between pin 1 of the injector #2 harness and ground.

   [a] If the resistance is less than 5 Ω, repair the short to ground between pin 1 of the injector #2 harness and pin 23 of the MCM 120–pin connector. Refer to section 56.2.1.1.

[b] If the resistance is greater than 5 Ω, repair the short to ground between pin 2 of the injector #2 harness and pin 22 of the MCM 120–pin connector. Refer to section 56.2.1.1.

56.2.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF and reconnect all connectors.
2. Turn the ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
   [a] If no codes are present, troubleshooting is complete.
   [b] If code 652/10 is not logged but other codes are logged, troubleshoot the other codes.
   [c] If code 652/10 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313–592–5800).

57 SPN 653 – INJECTOR #3 NOT OPERATING NORMALLY

Section **Page**

57.1 TROUBLESHOOTING SPN 653/FMI 5

This diagnosis is typically the injector current is below normal or an open circuit fault.

57.1.1 Open Circuit Check

Check as follows:

1. Check for multiple codes.
   [a] If fault code 168/0 is active in addition to 653/5, service 168/0 first. Refer to section 31.1.
   [b] If fault 652/5 and 651/5 are active in addition to 653/5, call the Detroit Diesel Customer Support Center (313–592–5800) for MCM replacement.
   [c] If only fault code 653/5 is active, go to step 2.
2. Turn the ignition OFF.
3. Remove valve cover.
4. Turn the ignition ON (key ON, engine OFF).
5. Measure the voltage between pins 1 and 2 of injector #3. See Figure 57-1.

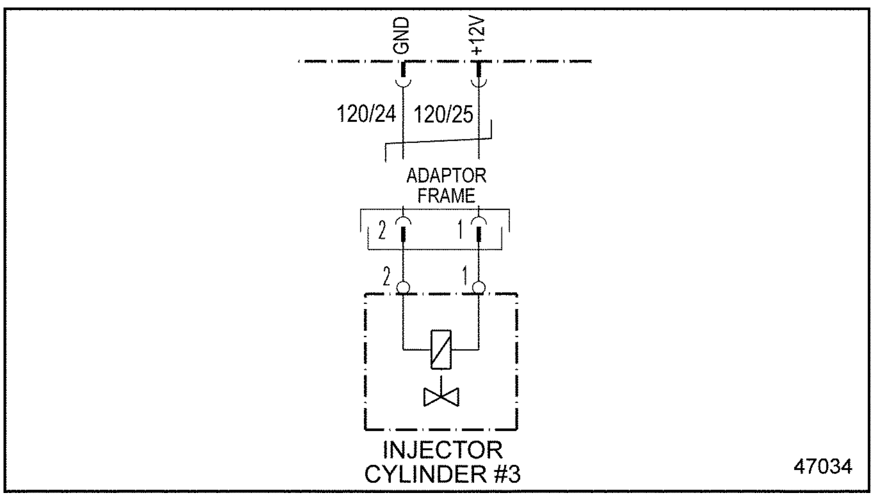


Figure 57-1 Injector #3

   [a] If the voltage is less than 11.5 volts, go to step 6.
   [b] If the voltage is greater than 11.5 volts, replace injector #3. After the replacing the injector,refer to section 57.1.1.1.
6. Measure the voltage between pin 1 of injector #3 and ground.
   [a] If the voltage is less than 11.5 volts, repair the open between pin 25 of the 120–pin MCM connector and pin 1 of injector #3. Refer to section 57.1.1.1.

[b] If the voltage is greater than 11.5 volts, repair the open between pin 24 of the 120–pin MCM connector and pin 2 of injector #3. Refer to section 57.1.1.1.

57.1.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF and reconnect all connectors.
2. Turn the ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
   [a] If no codes are present, troubleshooting is complete.
   [b] If code 653/5 is not logged but other codes are logged, troubleshoot the other codes.
   [c] If code 653/5 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313–592–5800).

57.2 TROUBLESHOOTING SPN 653/FMI 10

This diagnostic condition is typically a short to ground.

57.2.1 Short to Ground Check

Check as follows:

1. Turn the ignition OFF.
2. Disconnect the 120–pin MCM connector.
3. Remove the valve cover.
4. Disconnect pins 1 and 2 of injector #3.
5. Measure the resistance between pin 1 of injector #3 and ground. See Figure 57-2.

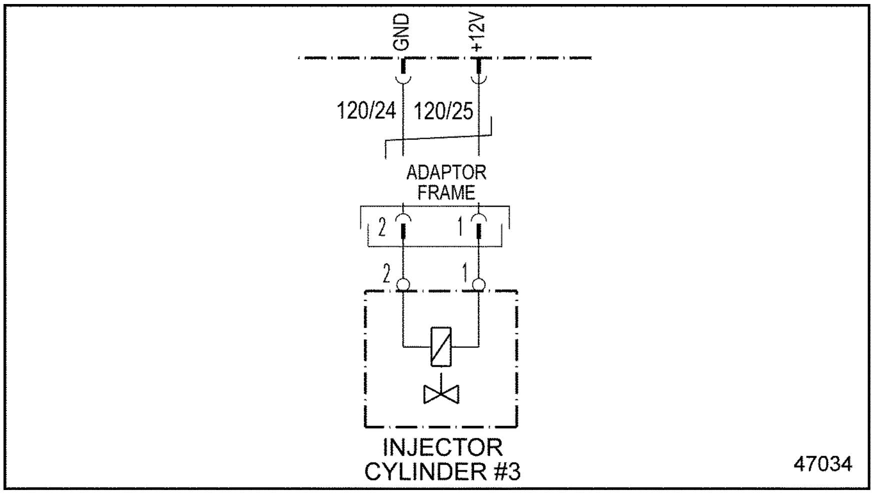


Figure 57-2 Injector #3

   [a] If the resistance is less than 5 Ω, replace injector #3. After the replacing the injector,refer to section 57.2.1.1.

   [b] If the resistance is greater than 5 Ω, go to step 6.

6. Measure the resistance between pins 1 and 2 of the injector #3 harness.

   [a] If the resistance is less than 5 Ω, repair the short between pin 1 and pin 2 of injector #3 and pins 25 and 24 of the 120–pin MCM connector. Refer to section 57.2.1.1.

   [b] If the resistance is greater than 5 Ω, go to step 7.

7. Measure the resistance between pin 1 of the injector #3 harness and ground.

   [a] If the resistance is less than 5 Ω, repair the short to ground between pin 1 of the injector #3 harness and pin 25 of the MCM 120–pin connector. Refer to section 57.2.1.1.

[b] If the resistance is greater than 5 Ω, repair the short to ground between pin 2 of the injector #3 harness and pin 24 of the MCM 120–pin connector. Refer to section 57.2.1.1.

57.2.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF and reconnect all connectors.
2. Turn the ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
   [a] If no codes are present, troubleshooting is complete.
   [b] If code 653/10 is not logged but other codes are logged, troubleshoot the other codes.
   [c] If code 653/10 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313–592–5800).

58 SPN 654 – INJECTOR #4 NOT OPERATING NORMALLY

Section **Page**

58.1 TROUBLESHOOTING SPN 654/FMI 5

This diagnosis is typically the injector current is below normal or an open circuit fault.

58.1.1 Open Circuit Check

Check as follows:

1. Check for multiple codes.
   [a] If fault code 168/0 is active in addition to 654/5, service 168/0 first. Refer to section 31.1.
   [b] If fault 655/5 and 656/5 are active in addition to 654/5, call the Detroit Diesel Customer Support Center (313–592–5800) for MCM replacement.
   [c] If only fault code 654/5 is active, go to step 2.
2. Turn the ignition OFF.
3. Remove valve cover.
4. Turn the ignition ON (key ON, engine OFF).
5. Measure the voltage between pins 1 and 2 of injector #4. See Figure 58-1.

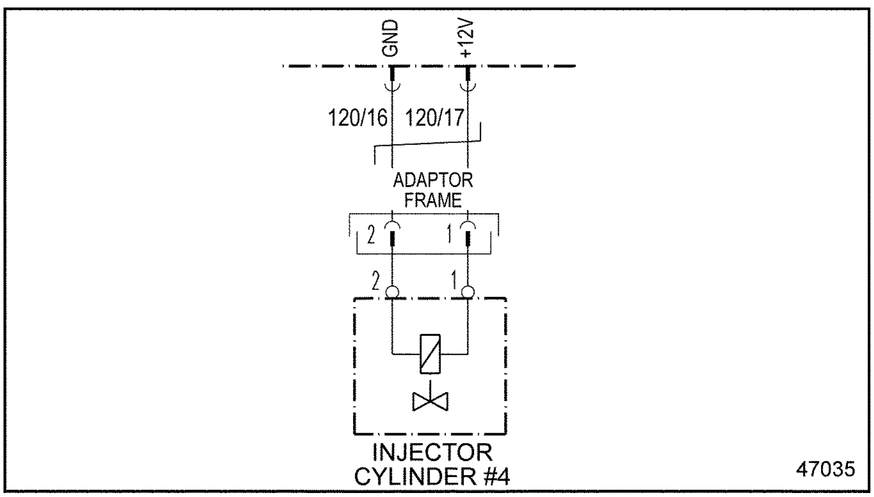


Figure 58-1 Injector #4

   [a] If the voltage is less than 11.5 volts, go to step 6.
   [b] If the voltage is greater than 11.5 volts, replace injector #4. After the replacing the injector, refer to section 58.1.1.1.
6. Measure the voltage between pin 1 of injector #4 and ground.
   [a] If the voltage is less than 11.5 volts, repair the open between pin 17 of the 120–pin MCM connector and pin 1 of injector #4. Refer to section 58.1.1.1.

[b] If the voltage is greater than 11.5 volts, repair the open between pin 16 of the 120–pin MCM connector and pin 2 of injector #4. Refer to section 58.1.1.1.

58.1.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the vehicle ignition OFF and reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
   [a] If no codes are present, troubleshooting is complete.
   [b] If code 654/5 is not logged but other codes are logged, troubleshoot the other codes.
   [c] If code 654/5 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313–592–5800).

58.2 TROUBLESHOOTING SPN 654/FMI 10

This diagnostic condition is typically a short to ground.

58.2.1 Check for Short to Ground

Check as follows:

1. Turn the ignition OFF.
2. Disconnect the 120–pin MCM connector.
3. Remove the valve cover.
4. Disconnect pins 1 and 2 of injector #4.
5. Measure the resistance between pin 1 of injector #4 and ground. See Figure 58-2.

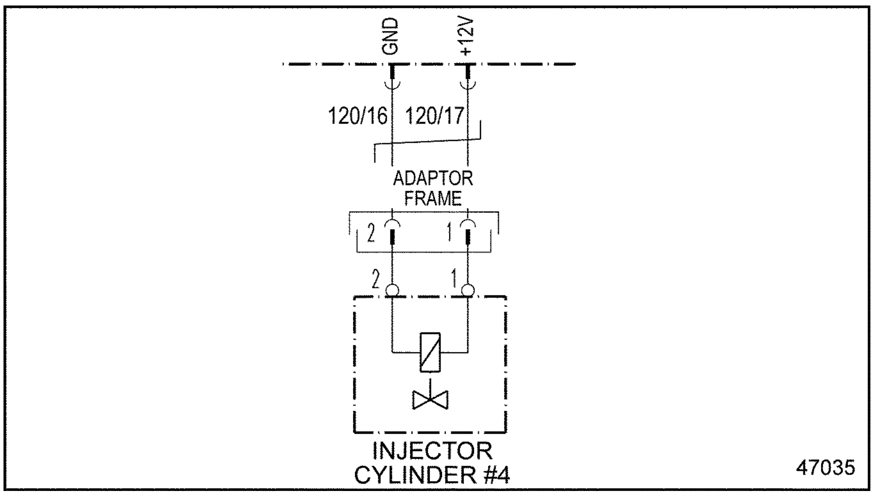


Figure 58-2 Injector #4

   [a] If the resistance is less than 5 Ω, replace injector #4. After the replacing the injector,refer to section 58.2.1.1.

   [b] If the resistance is greater than 5 Ω, go to step 6.

6. Measure the resistance between pins 1 and 2 of the injector #4 harness.

   [a] If the resistance is less than 5 Ω, repair the short between pin 1 and pin 2 of injector #4 and pins 17 and 16 of the 120–pin MCM connector. Refer to section 58.2.1.1.

   [b] If the resistance is greater than 5 Ω, go to step 7.

7. Measure the resistance between pin 1 of the injector #4 harness and ground.

   [a] If the resistance is less than 5 Ω, repair the short to ground between pin 1 of the injector #4 harness and pin 17 of the MCM 120–pin connector. Refer to section 58.2.1.1.

[b] If the resistance is greater than 5 Ω, repair the short to ground between pin 2 of the injector #4 harness and pin 16 of the MCM 120–pin connector. Refer to section 58.2.1.1.

58.2.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the vehicle ignition OFF and reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
   [a] If no codes are present, troubleshooting is complete.
   [b] If code 654/10 is not logged but other codes are logged, troubleshoot the other codes.
   [c] If code 654/10 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313–592–5800).

59 SPN 655 – INJECTOR #5 NOT OPERATING NORMALLY

Section **Page**

59.1 SPN 655/FMI 5

This diagnosis is typically the injector current is below normal or an open circuit fault.

59.1.1 Open Circuit Check

Check as follows:

1. Check for multiple codes.
   - [a] If fault code 168/0 is active in addition to 655/5, service 168/0 first. Refer to section 31.1.
   - [b] If fault 654/5 and 656/5 are active in addition to 655/5, call the Detroit Diesel Customer Support Center (313–592–5800) for MCM replacement.
   - [c] If only fault code 655/5 is active, go to step 2.
2. Turn the ignition OFF.
3. Remove valve cover.
4. Turn the ignition ON (key ON, engine OFF).
5. Measure the voltage between pins 1 and 2 of injector #5. See Figure 59-1.

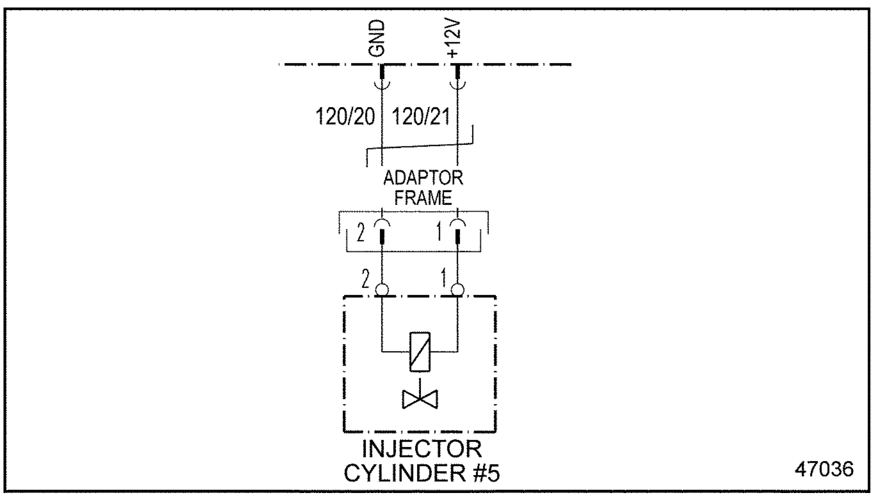


Figure 59-1 Injector #5

   - [a] If the voltage is less than 11.5 volts, go to step 6.
   - [b] If the voltage is greater than 11.5 volts, replace injector #5. After the replacing the injector,refer to section 59.1.1.1.

6. Measure the voltage between pin 1 of injector #5 and ground.
   - [a] If the voltage is less than 11.5 volts, repair the open between pin 21 of the 120–pin MCM connector and pin 1 of injector #5. Refer to section 59.1.1.1.

[b] If the voltage is greater than 11.5 volts, repair the open between pin 20 of the 120–pin MCM connector and pin 2 of injector #5. Refer to section 59.1.1.1.

59.1.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the vehicle ignition OFF and reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
   [a] If no codes are present, troubleshooting is complete.
   [b] If code 655/5 is not logged but other codes are logged, troubleshoot the other codes.
   [c] If code 655/5 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313–592–5800).

59.2 SPN 655/FMI 10

This diagnostic condition is typically a short to ground.

59.2.1 Short to Ground Check

Check as follows:

1. Turn the ignition OFF.
2. Disconnect the 120–pin MCM connector.
3. Remove the valve cover.
4. Disconnect pins 1 and 2 of injector #5.
5. Measure the resistance between pin 1 of injector #5 and ground. See Figure 59-2.

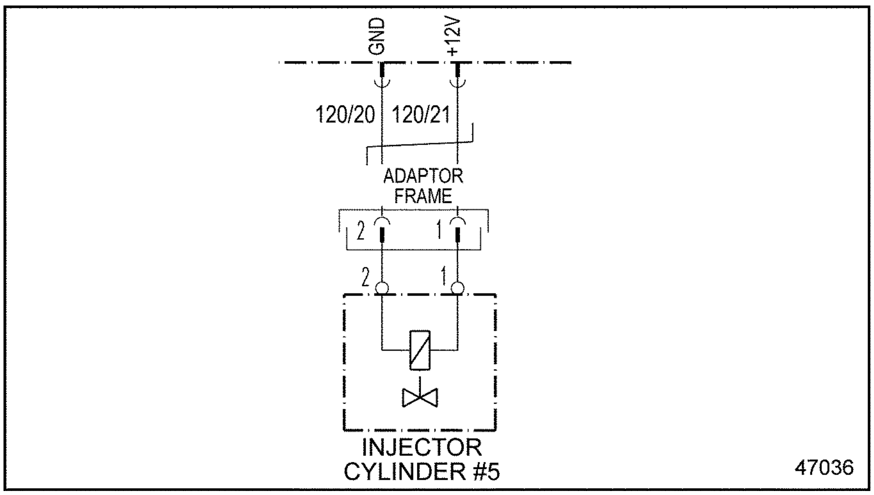


Figure 59-2 Injector #5

   [a] If the resistance is less than 5 Ω, replace injector #5. After the replacing the injector,refer to section 59.2.1.1.

   [b] If the resistance is greater than 5 Ω, go to step 6.

6. Measure the resistance between pins 1 and 2 of the injector #5 harness.

   [a] If the resistance is less than 5 Ω, repair the short between pin 1 and pin 2 of injector #5 and pins 21 and 20 of the 120–pin MCM connector. Refer to section 59.2.1.1.

   [b] If the resistance is greater than 5 Ω, go to step 7.

7. Measure the resistance between pin 1 of the injector #5 harness and ground.

   [a] If the resistance is less than 5 Ω, repair the short to ground between pin 1 of the injector #5 harness and pin 21 of the MCM 120–pin connector. Refer to section 59.2.1.1.

[b] If the resistance is greater than 5 Ω, repair the short to ground between pin 2 of the injector #5 harness and pin 20 of the MCM 120–pin connector. Refer to section 59.2.1.1.

59.2.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the vehicle ignition OFF and reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
   [a] If no codes are present, troubleshooting is complete.
   [b] If code 655/10 is not logged but other codes are logged, troubleshoot the other codes.
   [c] If code 655/10 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313–592–5800).

60 SPN 656 – INJECTOR #6 NOT OPERATING NORMALLY

Section **Page**

60.1 SPN 656/FMI 5

This diagnosis is typically the injector current is below normal or an open circuit fault.

60.1.1 Open Circuit Check

Check as follows:

1. Check for multiple codes.
   [a] If fault code 168/0 is active in addition to 656/5, service 168/0 first. Refer to section 31.1.
   [b] If fault 654/5 and 655/5 are active in addition to 656/5, call the Detroit Diesel Customer Support Center (313–592–5800) for MCM replacement.
   [c] If only fault code 656/5 is active, go to step 2.
2. Turn the ignition OFF.
3. Remove valve cover.
4. Turn the ignition ON (key ON, engine OFF).
5. Measure the voltage between pins 1 and 2 of injector #6. See Figure 60-1.

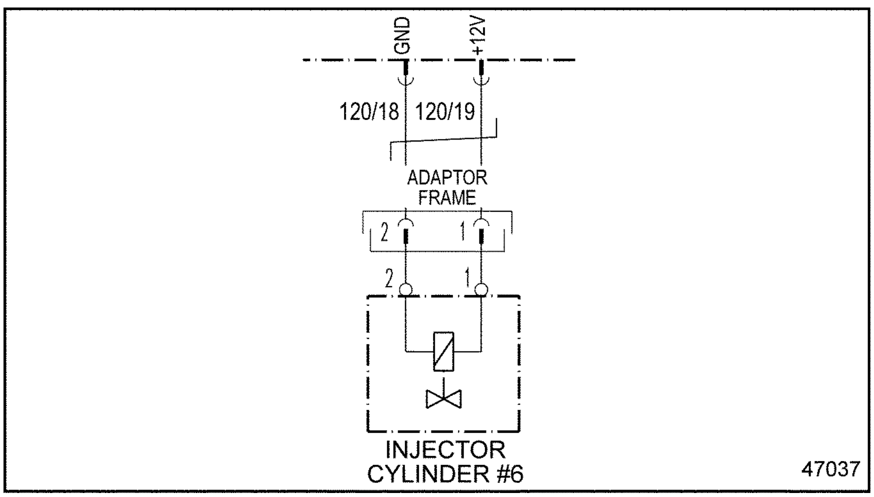


Figure 60-1 Injector #6

   [a] If the voltage is less than 11.5 volts, go to step 6.
   [b] If the voltage is greater than 11.5 volts, replace injector #6. After the replacing the injector,refer to section 60.1.1.1.
6. Measure the voltage between pin 1 of injector #6 and ground.
   [a] If the voltage is less than 11.5 volts, repair the open between pin 19 of the 120–pin MCM connector and pin 1 of injector #6. Refer to section 60.1.1.1.

[b] If the voltage is greater than 11.5 volts, repair the open between pin 18 of the 120–pin MCM connector and pin 2 of injector #6. Refer to section 60.1.1.1.

60.1.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the vehicle ignition OFF and reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
   [a] If no codes are present, troubleshooting is complete.
   [b] If code 656/5 is not logged but other codes are logged, troubleshoot the other codes.
   [c] If code 656/5 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313–592–5800).

60.2 SPN 656/FMI 10

This diagnostic condition is typically a short to ground.

60.2.1 Short to Ground Check

Check as follows:

1. Turn the ignition OFF.
2. Disconnect the 120–pin MCM connector.
3. Remove the valve cover.
4. Disconnect pins 1 and 2 of injector #6.
5. Measure the resistance between pin 1 of injector #6 and ground. See Figure 60-2.

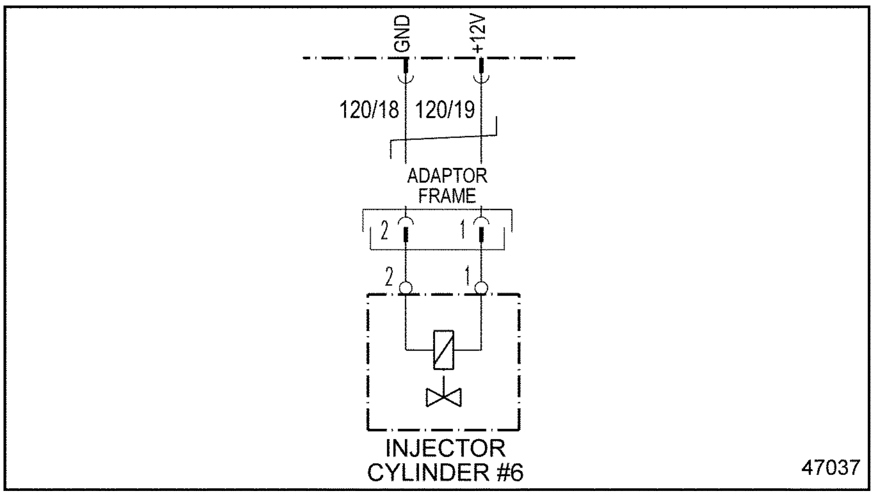


Figure 60-2 Injector #6

   [a] If the resistance is less than 5 Ω, replace injector #6. After the replacing the injector,refer to section 60.2.1.1.

   [b] If the resistance is greater than 5 Ω, go to step 6.

6. Measure the resistance between pins 1 and 2 of the injector #6 harness.

   [a] If the resistance is less than 5 Ω, repair the short between pin 1 and pin 2 of injector #6 and pins 19 and 18 of the 120–pin MCM connector. Refer to section 60.2.1.1.

   [b] If the resistance is greater than 5 Ω, go to step 7.

7. Measure the resistance between pin 1 of the injector #6 harness and ground.

   [a] If the resistance is less than 5 Ω, repair the short to ground between pin 1 of the injector #6 harness and pin 19 of the MCM 120–pin connector. Refer to section 60.2.1.1.

[b] If the resistance is greater than 5 Ω, repair the short to ground between pin 2 of the injector #6 harness and pin 18 of the MCM 120–pin connector. Refer to section 60.2.1.1.

60.2.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the vehicle ignition OFF and reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
   [a] If no codes are present, troubleshooting is complete.
   [b] If code 656/10 is not logged but other codes are logged, troubleshoot the other codes.
   [c] If code 656/10 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313–592–5800).

61 SPN 701 - CONSTANT THROTTLE VALVE (AUX PWM #7) NOT OPERATING NORMALLY

61.1 SPN 701/FMI 3

This diagnosis is typically a short to power.

61.1.1 Short to Power Check

Check as follows:

1. Disconnect the Constant Throttle Valve connector.
2. Turn the ignition ON.
3. Measure the voltage between pin 1 of the Constant Throttle Valve connector and ground.
   [a] If the voltage is greater than 11.5 volts, repair the short to power between pin 1 of the Constant Throttle Valve connector and pin 32 of the 120–pin MCM connector. See Figure 61-1. Refer to section 61.1.1.1.

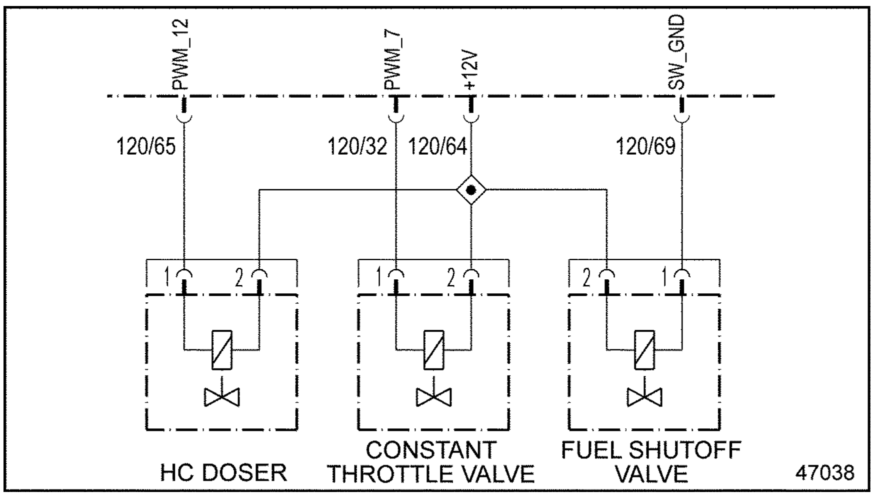


Figure 61-1 Constant Throttle Valve

   [b] If the voltage is less than 11.5 volts, go to step 4.
4. Turn the ignition OFF.
5. Disconnect the 120–pin MCM connector.
6. Measure the resistance between pins 1 and 2 of the Constant Throttle Valve connector.
   [a] If the resistance is greater than 5Ω, repeat steps 2 through 6. If the results are the same, contact the Detroit Diesel Customer Support Center (313–592–5800).
   [b] If the resistance is less than 5Ω, repair the short between pins 1 and 2 of the Constant Throttle Valve and pins 32 and 64 of the 120–pin MCM connector. Refer to section 61.1.1.1.

61.1.1.1 Verify Repairs

Perform the following steps to verify repairs.

1. Turn vehicle ignition OFF.
2. Reconnect all connectors. Turn ignition ON.
3. Clear codes with diagnostic tool.
4. Start and run the engine for one minute. Stop engine.
5. Check diagnostic tool for codes.
   [a] If no codes are displayed, troubleshooting is complete.
   [b] If code 701/3 is not logged and other codes are logged, troubleshoot the logged codes.
   [c] If code 701/3 and other codes are logged, review this section to find the error. If no error is found, call the Detroit Diesel Customer Support Center (313–592–5800).

61.2 SPN 701/FMI 4

This diagnosis is typically a short to ground.

61.2.1 Short to Ground Check

Check as follows:

1. Check for multiple codes.
   [a] If 3471/4 and 3482/4 are active with 701/4, repair the short to ground on pin 64 of the 120–pin MCM connector and pin 2 of the Constant Throttle Valve and pin 2 of the Electronic Dosing Valve connector and pin 2 of the Fuel Shutoff Valve. See Figure 61-2. Refer to section 61.2.1.1.
   [b] If only 701/4 is active, go to step 2.
2. Disconnect the Constant Throttle Valve connector.
3. Disconnect the 120–pin MCM connector.
4. Measure the resistance between pins 1 and 2 of the Constant Throttle Valve connector.
   [a] If the resistance is greater than 5Ω, go to step 5.

[b] If the resistance is less than 5Ω, repair the short between wires 32 and 64 of the 120–pin MCM connector. See Figure 61-2. Refer to section 61.2.1.1.

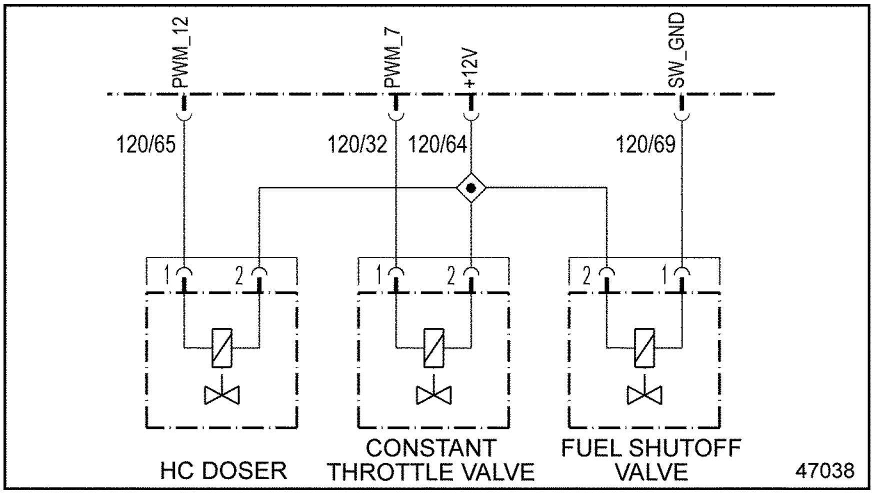


Figure 61-2 Constant Throttle Valve

5. Measure the resistance between pin 1 of the Constant Throttle Valve connector and ground.
   [a] If the resistance is greater than 5Ω, repeat steps 4 and 5. If the results are the same, contact the Detroit Diesel Customer Support Center (313–592–5800).
   [b] If the resistance is less than 5Ω, repair the short between pin 1 of the Constant Throttle Valve connector and ground. Refer to section 61.2.1.1.

61.2.1.1 Verify Repairs

Perform the following steps to verify repairs.

1. Turn vehicle ignition OFF.
2. Reconnect all connectors. Turn ignition ON.
3. Clear codes with diagnostic tool.
4. Start and run the engine for one minute. Stop engine.
5. Check diagnostic tool for codes.
   [a] If no codes are displayed, troubleshooting is complete.
   [b] If code 701/4 is not logged and other codes are logged, troubleshoot the logged codes.
   [c] If code 701/4 and other codes are logged, review this section to find the error. If no error is found, call the Detroit Diesel Customer Support Center (313–592–5800).

61.3 SPN 701/FMI 5

This diagnosis is typically an open circuit

61.3.1 Open Circuit Check

Check as follows:

1. Check for multiple codes.
   - [a] If 3471/5 and 3482/5 are active with 701/5, repair the open between pin 64 of the 120–pin MCM connector and pin 2 of the Constant Throttle Valve and pin 2 of the Electronic Dosing Valve connector and pin 2 of the Fuel Shutoff Valve. See Figure 61-3. Refer to section 61.2.1.1.

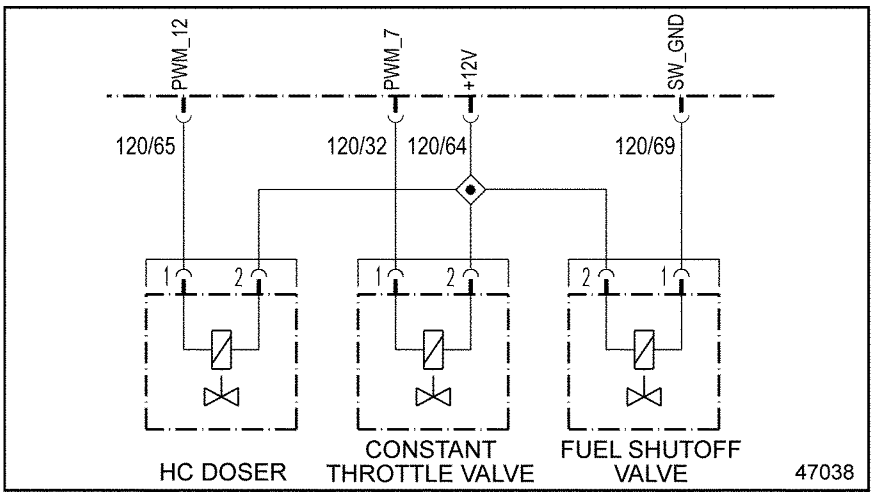


Figure 61-3 Constant Throttle Valve

   - [b] If only 701/4 is active, go to step 2.
2. Disconnect the Constant Throttle Valve connector.
3. Turn the ignition ON.
4. Measure the voltage between pins 1 and 2 of the Constant Throttle Valve connector.
   - [a] If the voltage is between 11 and 13 volts, replace the Constant Throttle Valve.
   - [b] If the voltage is less than 11 volts, go to step 5.
5. Measure the voltage between pin 2 of the Constant Throttle Valve connector and ground.
   - [a] If the voltage is between 11 and 13 volts, repair the open in the wire between pin 32 of the 120–pin MCM connector and pin 1 of the Constant Throttle Valve connector. See Figure 61-3. Refer to section 61.3.1.1.
   - [b] If the voltage is less than 11 volts, repair the open in the wire between pin 64 of the 120–pin MCM connector and pin 2 of the Constant Throttle Valve connector. See Figure 61-3. Refer to section 61.3.1.1.

61.3.1.1 Verify Repairs

Perform the following steps to verify repairs.

1. Turn vehicle ignition OFF.
2. Reconnect all connectors. Turn ignition ON.
3. Clear codes with diagnostic tool.
4. Start and run the engine for one minute. Stop engine.
5. Check diagnostic tool for codes.
   [a] If no codes are displayed, troubleshooting is complete.
   [b] If code 701/5 is not logged and other codes are logged, troubleshoot the logged codes.
   [c] If code 701/5 and other codes are logged, review this section to find the error. If no error is found, call the Detroit Diesel Customer Support Center (313–592–5800).

62 SPN 703 (CPC) - ASG2 BACKUP LAMP

Section **Page**

62.1 SPN 703/FMI 3

ASG2 backup lamp - indicates a short to power/open circuit on pin 9 of the CPC #3 connector. For wiring schematic information refer to OEM literature.

NOTE:
The CPC digital outputs have the same SPN as some MCM faults. DDDL 7.0 makes the distinction between the MCM and CPC when diagnosing a fault.

62.2 SPN 703/FMI 4

ASG2 backup lamp - indicates a short to ground on the pin 9 circuit of the CPC #3 connector. For wiring schematic information refer to OEM literature.

NOTE:
The CPC digital outputs have the same SPN as some MCM faults. DDDL 7.0 makes the distinction between the MCM and CPC when diagnosing a fault.

63 SPN 704 (CPC) - HIGH EXHAUST SYSTEM TEMPERATURE LAMP

Section **Page**

63.1 SPN 704/FMI 3

High Exhaust System Temperature Lamp - indicates a short to power/open circuit on pin 7 of the CPC #4 connector. For wiring schematic information refer to OEM literature.

NOTE:
The CPC digital outputs have the same SPN as some MCM faults. DDDL 7.0 makes the distinction between the MCM and CPC when diagnosing a fault.

63.2 SPN 704/FMI 4

High Exhaust System Temperature Lamp - indicates a short to ground on the pin 7 circuit of the CPC #4 connector. For wiring schematic information refer to OEM literature.

NOTE:
The CPC digital outputs have the same SPN as some MCM faults. DDDL 7.0 makes the distinction between the MCM and CPC when diagnosing a fault.

64 SPN 705 (CPC) - MALFUNCTION INDICATOR LAMP

Section **Page**

64.1 SPN 705/FMI 3

Malfunction Indicator Lamp (MIL)- indicates a short to power/open circuit on pin 13of the CPC #1 connector. For wiring schematic information refer to OEM literature.

NOTE:
The CPC digital outputs have the same SPN as some MCM faults. DDDL 7.0 makes the distinction between the MCM and CPC when diagnosing a fault.

64.2 SPN 705/FMI 4

Malfunction Indicator Lamp (MIL) - indicates a short to ground on the pin 13 circuit of the CPC #1 connector. For wiring schematic information refer to OEM literature.

NOTE:
The CPC digital outputs have the same SPN as some MCM faults. DDDL 7.0 makes the distinction between the MCM and CPC when diagnosing a fault.

65 SPN 706 (CPC) - ASG2 CHECK TRANS TEMP LAMP

65.1 SPN 706/FMI 3

ASG2 Check Trans Temp Lamp - indicates a short to power/open circuit on pin 10 of the CPC #3 connector. For wiring schematic information refer to OEM literature.

NOTE:
The CPC digital outputs have the same SPN as some MCM faults. DDDL 7.0 makes the distinction between the MCM and CPC when diagnosing a fault.

65.2 SPN 706/FMI 4

ASG2 Check Trans Temp Lamp - indicates a short to ground on the pin 10 circuit of the CPC #3 connector. For wiring schematic information refer to OEM literature.

NOTE:
The CPC digital outputs have the same SPN as some MCM faults. DDDL 7.0 makes the distinction between the MCM and CPC when diagnosing a fault.

66 SPN 706 - ELECTRONIC PROPORTIONING VALVE CONTROL #2 NOT OPERATING NORMALLY

Section **Page**

66.1 SPN 706/FMI 3

This diagnosis is typically a short to power.

66.1.1 Short to Power Check

Check as follows:

1. Disconnect the Electronic Proportioning Valve #2 (EPV2) connector.
2. Turn the ignition ON (key ON, engine OFF).
3. Measure the voltage between pin 1 of the EPV2 connector for the volute valve and ground. See Figure 66-1.

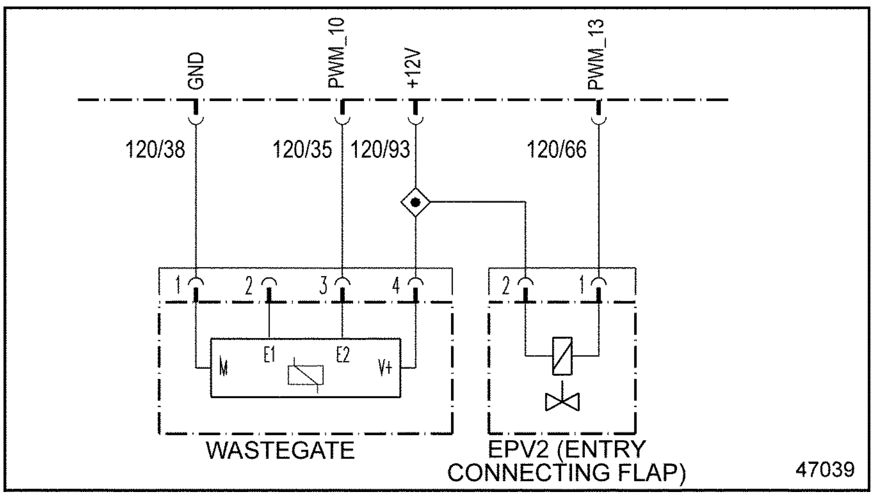


Figure 66-1 EPV2 (Entry Connecting Flap) and Wastegate

[a] If the voltage is greater than 11.5 volts, repair the short to power between pin 1 of the EPV2 connector and pin 66 of the 120–pin MCM connector. Refer to section 66.1.1.1.

[b] If the voltage is less than 11.5 volts, go to step 4.

4. Turn the ignition OFF.
5. Disconnect the 120–pin MCM connector.
6. Measure the resistance between pins 1 and 2 of the EPV2 connector.

[a] If the resistance is greater than 5 Ω, refer to section 66.1.1.1.

[b] If the resistance is less than 5 Ω, repair the short between pins 1 and 2 of the EPV2 connector and pins 66 and 93 of the 120–pin MCM connector. Refer to section 66.1.1.1.

66.1.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the vehicle ignition OFF and reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
   [a] If no codes are present, troubleshooting is complete.
   [b] If code 706/3 is not logged but other codes are logged, troubleshoot the other codes.
   [c] If code 706/3 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313–592–5800).

66.2 SPN 706/FMI 4

This diagnosis is typically a short to ground.

66.2.1 Short to Ground Check

Check as follows:

1. Check for multiple codes.
   [a] If 704/4 is active with 706/4, repair the short to ground between pin 93 of the 120–pin MCM connector and pin 2 of the EPV2 connector and pin 4 of the wastegate connector. See Figure 66-2. Refer to section 66.2.1.1.

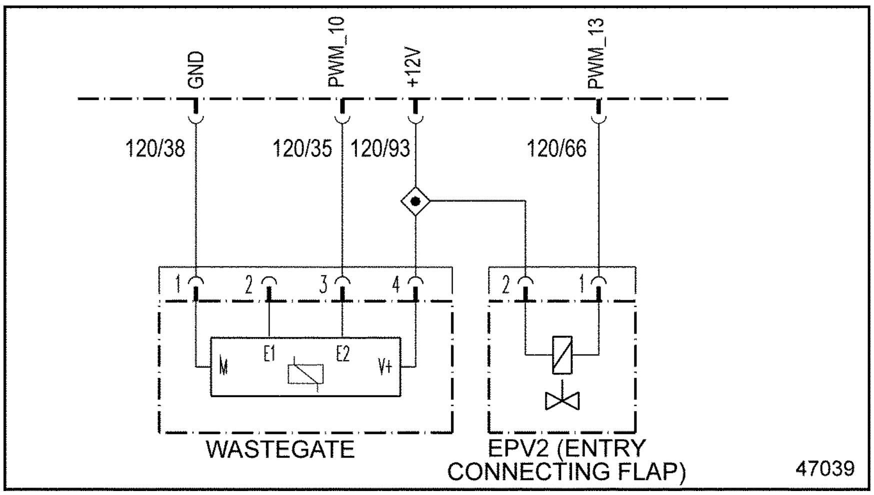


Figure 66-2 EPV2 (Entry Connecting Flap) and Wastegate

   [b] If only 706/4 is active, go to step 2.
2. Disconnect the EPV2 connector.
3. Disconnect the 120–pin MCM connector.
4. Measure the resistance between pins 1 and 2 of the EPV2 connector.
   [a] If the resistance is less than 5 Ω, repair the short between wires 66 and 93 of the 120–pin MCM connector. Refer to section 66.2.1.1.
   [b] If the resistance is greater than 5 Ω, go to step 5.
5. Measure the resistance between pin 1 of the EPV2 connector and ground.
   [a] If the resistance is less than 5 Ω, repair the short circuit between pin 1 of the EPV2 connector and ground. Refer to section 66.2.1.1.
   [b] If the resistance is greater than 5 Ω, refer to section 66.2.1.1.

66.2.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the vehicle ignition OFF and reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
   [a] If no codes are present, troubleshooting is complete.
   [b] If code 706/4 is not logged but other codes are logged, troubleshoot the other codes.
   [c] If code 706/4 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313–592–5800).

66.3 SPN 706/FMI 5

This diagnosis is typically an open circuit.

66.3.1 Open Circuit Check

Check as follows:

1. Disconnect the EPV2 connector.
2. Turn the ignition ON (key ON, engine OFF).
3. Measure the voltage between pins 1 and 2 of the EPV2 connector.
   [a] If the voltage is between 11 and 13 volts, replace the EPV2. Refer to section 66.3.1.1.
   [b] If the voltage is less than 11 volts, go to step 4.
4. Measure the voltage between pin two of the EPV2 connector and ground.
   [a] If the voltage is between 11 and 13 volts, repair the open in the wire between pin 66 of the 120–pin MCM connector and pin 1 of the EPV2 connector. See Figure 66-3. Refer to section 66.3.1.1.

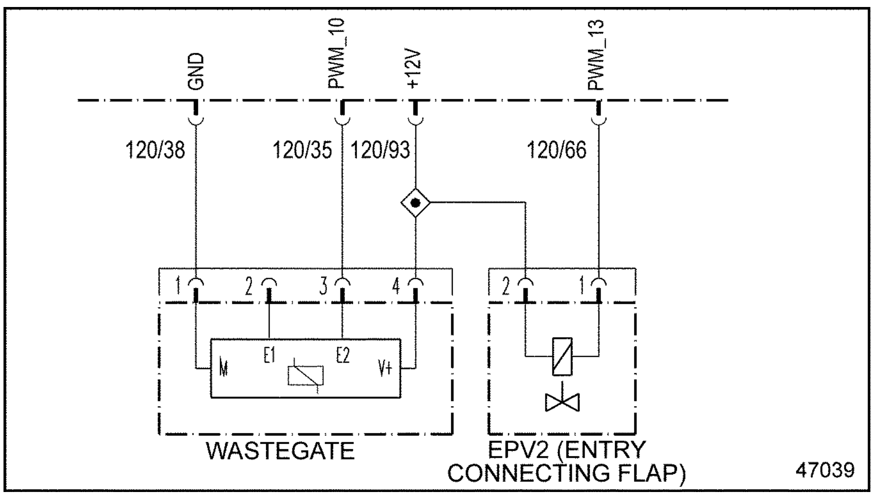


Figure 66-3 EPV2 (Entry Connecting Flap) and Wastegate

   [b] If the voltage is less than 11 volts, repair the open in the wire between pin 93 of the 120–pin MCM connector and pin 1 of EPV2 connector. Refer to section 66.3.1.1.

66.3.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the vehicle ignition OFF and reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
   [a] If no codes are present, troubleshooting is complete.
   [b] If code 706/5 is not logged but other codes are logged, troubleshoot the other codes.
   [c] If code 706/5 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313–592–5800).

67 SPN 707 (CPC) - AMBER WARNING LAMP

Section **Page**

67.1 SPN 707/FMI 3

Amber Warning Lamp (AWL)- indicates a short to power/open circuit on pin 10 of the CPC #2 connector. For wiring schematic information refer to OEM literature.

NOTE:
The CPC digital outputs have the same SPN as some MCM faults. DDDL 7.0 makes the distinction between the MCM and CPC when diagnosing a fault.

67.2 SPN 707/FMI 4

Amber Warning Lamp (AWL) - indicates a short to ground on the pin 10 circuit of the CPC #2 connector. For wiring schematic information refer to OEM literature.

NOTE:
The CPC digital outputs have the same SPN as some MCM faults. DDDL 7.0 makes the distinction between the MCM and CPC when diagnosing a fault.

68 SPN 708 (CPC) - ASG2 CHECK TRANS LAMP

68.1 SPN 708/FMI 3

ASG2 Check Trans Lamp - indicates a short to power/open circuit on pin 12 of the CPC #3 connector. For wiring schematic information refer to OEM literature.

NOTE:
The CPC digital outputs have the same SPN as some MCM faults. DDDL 7.0 makes the distinction between the MCM and CPC when diagnosing a fault.

68.2 SPN 708/FMI 4

ASG2 Check Trans Lamp - indicates a short to ground on the pin 12 circuit of the CPC #3 connector. For wiring schematic information refer to OEM literature.

NOTE:
The CPC digital outputs have the same SPN as some MCM faults. DDDL 7.0 makes the distinction between the MCM and CPC when diagnosing a fault.

69 SPN 709 - SINGLE-SPEED FAN (LOW-SIDE DIGITAL OUTPUT #3) FAULT

Section **Page**

69.1 SPN 709/FMI 3

This fault code indicates that there is a short to power.

69.1.1 Short to Power Check

Check for short to power as follows:

1. Turn the ignition OFF.
2. Disconnect the fan control solenoid connector.
3. Turn the ignition ON (key ON, engine OFF).
4. Measure the voltage between pin 1 of the fan control solenoid connector and ground.
   [a] If the voltage is greater than 11.5 volts, repair the short to power between pin 1 of the fan control solenoid connector and pin 98 of the 120–pin MCM connector. Refer to section 69.1.2.1.
   [b] If the voltage is less than 11.5 volts, refer to section 69.1.2.

69.1.2 Voltage Check

The voltage check performed indicate that you should not be getting a code. The following is a recheck before requesting a new MCM.

1. Turn vehicle ignition OFF. Reconnect all connectors.
2. Turn ignition ON. Clear codes with diagnostic tool.
3. Start and run the engine for one minute. Stop engine.
4. Put the ignition switch in the OFF position
5. Disconnect the fan control solenoid connector.
6. Turn the ignition ON (key ON, engine OFF).
7. Measure the voltage between pin 1 of the fan control solenoid connector and ground.
   [a] If the voltage is greater than 11.5 volts, repair the short to power between pin 1 of the fan control solenoid connector and pin 98 of the 120–pin MCM connector. Refer to section 69.1.2.1.
   [b] Of the voltage is less than 11.5 volts, contact the Detroit Diesel Customer Support Center (313–592–5800) for authorization to replace the MCM.

69.1.2.1 Verify Repairs

Verify repairs as follows:

1. Turn the vehicle ignition OFF and reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.

3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
   [a] If no codes are present, troubleshooting is complete.
   [b] If code 709/3 is not logged but other codes are logged, troubleshoot the other codes.
   [c] If code 709/3 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313–592–5800).

69.2 SPN 709/FMI 4

This fault code indicates that there is a short to ground.

69.2.1 Short to Ground Check

Check for short to ground as follows:

1. Turn the ignition OFF.
2. Disconnect the fan control solenoid connector.
3. Disconnect the 120–pin MCM connector.
4. Measure the resistance between pin 1 of the fan control solenoid connector and ground.
   - [a] If the resistance is less than 5 Ω, repair the short to ground between pin 1 of the fan control solenoid connector and pin 98 of the 120–pin MCM connector. Refer to section 69.2.1.1.
   - [b] If the resistance is greater than 5 Ω, repair the short to ground between pin 2 of the fan control solenoid connector and pin 91 of the 120–pin MCM connector. Refer to section 69.2.1.1.

69.2.1.1 Verify Repairs

Verify repairs as follows:

1. Reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
   - [a] If no codes are present, troubleshooting is complete.
   - [b] If code 709/4 is not logged but other codes are logged, troubleshoot the other codes.
   - [c] If code 709/4 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313–592–5800).

69.3 SPN 709/FMI 5

This fault code indicates that there is an open circuit.

69.3.1 Open Circuit Check

Check for open as follows:

1. Check for multiple codes.
   - [a] If SPN 704/5, SPN 708/5, and SPN 709/5 are active, repair the open in between pin 91 of the 120–pin MCM connector and the fan and the Jake Brake solenoids. Refer to section 69.3.1.1.
   - [b] If only SPN 709/5 is active, go to step 2.
2. Disconnect the fan control solenoid connector.
3. Turn the ignition ON (key ON, engine OFF).
4. Measure the voltage between pin 1 and 2 of the fan control solenoid connector.
   - [a] If the voltage is less than 11.5 volts, go to step 5.
   - [b] If the voltage is between 11.5 and 13.5 volts, replace the fan control solenoid. Refer to section 69.3.1.1.
5. Measure the voltage between pin 2 of the fan control solenoid connector and pin 91 of the 120–pin MCM connector. Refer to section 69.3.1.1.
   - [a] If the voltage is less than 11.5 volts, repair the open between pin 2 of the fan control solenoid connector and ground. Refer to section 69.3.1.1.
   - [b] If the voltage is greater than 11.5, repair the open between pin 1 of the fan control solenoid connector and pin 98 of the 120–pin MCM connector. Refer to section 69.3.1.1.

69.3.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF. Reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
   - [a] If no codes are present, troubleshooting is complete.
   - [b] If code 709/5 is not logged but other codes are logged, troubleshoot the other codes.
   - [c] If code 709/5 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313–592–5800).

70 SPN 710 - ELECTRONIC PROPORTIONING VALVE 1 (ENTRY SHUTOFF FLAP) NOT OPERATING NORMALLY

Section **Page**

70.1 SPN 710/FMI 3

This diagnosis is typically a short to power.

70.1.1 Short to Power Check

Check as follows:

1. Disconnect the EPV1 connector for the Entry Shutoff Flap.
2. Turn the ignition ON (key ON, engine OFF).
3. Measure the voltage between pin 1 of the EPV1 connector for the Entry Shutoff Flap and ground.
   [a] If the voltage is greater than 11.5 volts, repair the short to power between pin 1 of the EPV1 connector for the Entry Shutoff Flap and pin 96 of the 120–pin MCM connector. See Figure 70-1. Refer to section 70.1.1.1.

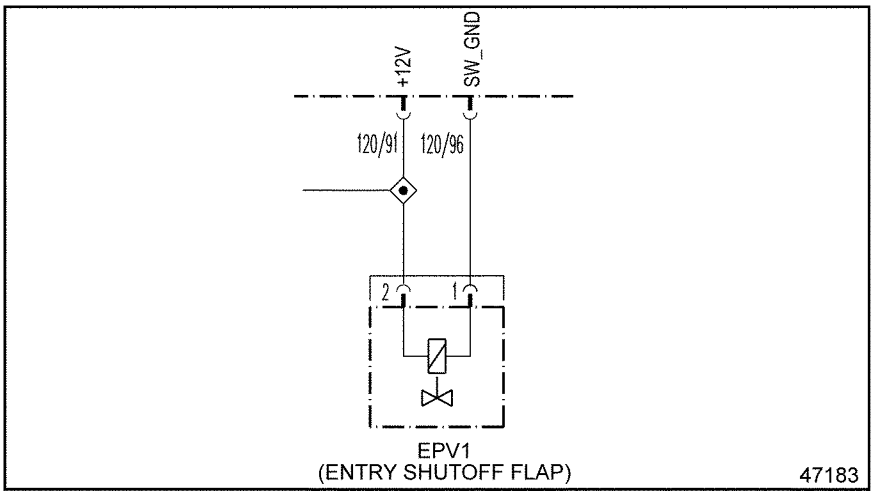


Figure 70-1 EPV1 (Entry Shutoff Flap)

   [b] If the voltage is less than 11.5 volts, go to step 4.
4. Turn the ignition OFF.
5. Disconnect the 120–pin MCM connector.
6. Measure the resistance between pins 1 and 2 of the EPV1 connector for the Entry Shutoff Flap.
   [a] If the resistance is greater than 5Ω, reconnect the 120–pin MCM connector and repeat steps 2 through 6. If the results are the same, contact the Detroit Diesel Customer Support Center (313–592–5800).
   [b] If the resistance is less than 5Ω, repair the short between pins 1 and 2 of the EPV1 connector for the Entry Shutoff Flap and pins 91 and 96 of the 120–pin MCM connector. Refer to section 70.1.1.1.

70.1.1.1 Verify Repairs

Verify repairs as follows:

1. Turn vehicle ignition OFF.
2. Reconnect all connectors. Turn ignition ON.
3. Clear codes with diagnostic tool.
4. Start and run the engine for one minute. Stop engine.
5. Check diagnostic tool for codes.
   [a] If no codes are displayed, troubleshooting is complete.
   [b] If code 710/3 is not logged and other codes are logged, troubleshoot the logged codes.
   [c] If code 710/3 and other codes are logged, review this section to find the error. If no error is found, call the Detroit Diesel Customer Support Center (313–592–5800).

70.2 SPN 710/FMI 4

This diagnosis is typically a short to ground.

70.2.1 Check for Short to Ground

Check as follows:

1. Check for multiple codes.
   [a] If 716/4 is active with 716/4, repair the short to ground between pin 91 of the 120–pin MCM connector and pin 2 of the EPV1 connector for the Entry Shutoff Flap and pin 21 of the 31–pin connector. See Figure 70-2. Refer to section 70.2.1.1.

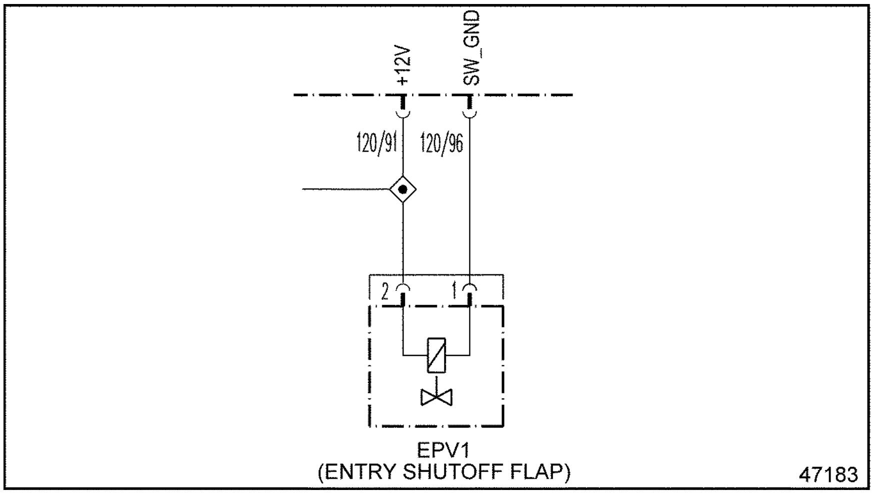


Figure 70-2 EPV1 (Entry Shutoff Flap)

   [b] If only 710/4 is active, go to step 2.

2. Disconnect the EPV1 connector for the Entry Shutoff Flap.
3. Disconnect the 120–pin MCM connector.
4. Measure the resistance between pins 1 and 2 of the EPV1 connector for the Entry Shutoff Flap.
   [a] If the resistance is less than 5 Ω, repair the short between wires 91 and 96 of the 120–pin connector. Refer to section 70.2.1.1.
   [b] If the resistance is greater than 5 Ω, go to step 5.
5. Measure the resistance between pin 1 of the EPV1 connector for the Entry Shutoff Flap and ground.
   [a] If the resistance is less than 5 Ω, repair the short between pin 1 of the EPV1 connector for the Entry Shutoff Flap and ground. Refer to section 70.2.1.1.
   [b] If the resistance is greater than 5 Ω, repeat steps 4 and 5. If the results are the same, contact the Detroit Diesel Customer Support Center (313–592–5800).

70.2.1.1 Verify Repairs

Verify repairs as follows:

1. Turn vehicle ignition OFF.
2. Reconnect all connectors. Turn ignition ON.
3. Clear codes with diagnostic tool.
4. Start and run the engine for one minute. Stop engine.
5. Check diagnostic tool for codes.
   [a] If no codes are displayed, troubleshooting is complete.
   [b] If code 710/4 is not logged and other codes are logged, troubleshoot the logged codes.
   [c] If code 710/4 and other codes are logged, review this section to find the error. If no error is found, call the Detroit Diesel Customer Support Center (313–592–5800).

70.3 SPN 710/FMI 5

This diagnosis is typically an open circuit.

70.3.1 Open Circuit Check

Check as follows:

1. Check for multiple codes.
   [a] If 716/3 is active with 716/3, repair the short to ground between pin 91 of the 120–pin MCM connector and pin 2 of the EPV1 connector for the Entry Shutoff Flap and pin 22 of the 31–pin connector. Refer to section 70.3.1.1.
   [b] If only code 710/5 is present, go to step 2.
2. Disconnect the EPV1 connector for the Entry Shutoff Flap.
3. Measure the resistance across pins 1 and 2 of the EPV1 connector for the Entry Shutoff Flap.
   [a] If the resistance is greater than 5Ω, replace the EPV1 for the Entry Shutoff Flap. See Figure 70-3. Refer to section 70.3.1.1.

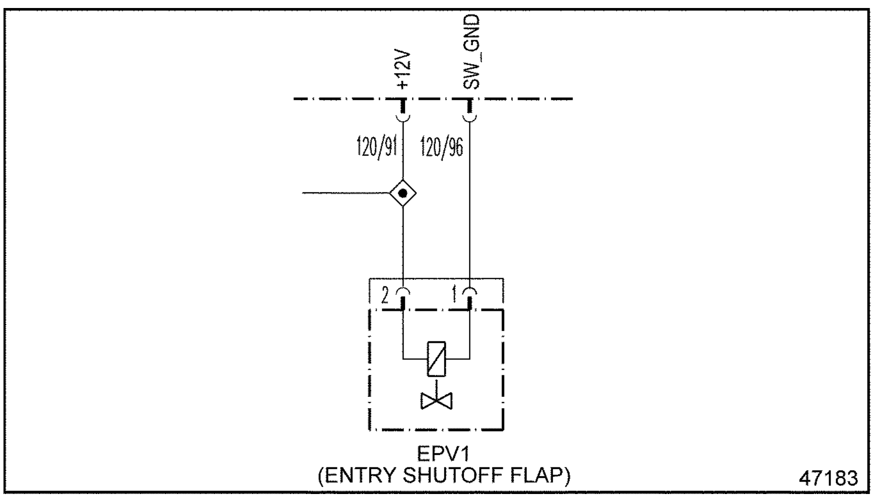


Figure 70-3 EPV1 (Entry Shutoff Flap)

   [b] If the resistance is greater than 5Ω, go to step 4.
4. Turn the ignition ON (key ON, engine OFF).
5. Measure the voltage between pins 1 and 2 of the EPV1 connector for the Entry Shutoff Flap.
   [a] If the voltage is between 11.5 and 12.5, check the resistance again and then verify the results. Refer to section 70.3.1.1.
   [b] the EPV1 connector for the Entry Shutoff Fla go to step 6.

6. Measure the voltage between pin 2 of the EPV1 connector for the Entry Shutoff Flap and ground.
   [a] If the voltage is between 11.5 and 12.5, repair the open circuit between pin 1 of the EPV1 connector for the Entry Shutoff Flap and pin 96 of the 120–pin MCM connector. Refer to section 70.3.1.1.
   [b] If the voltage is less than 11.5 volts, repair the open circuit between pin 2 of the EPV1 connector for the Entry Shutoff Flap and pin 91 of the 120–pin MCM connector. Refer to section 70.3.1.1.

70.3.1.1 Verify Repairs

Verify repairs as follows:

1. Turn vehicle ignition OFF.
2. Reconnect all connectors. Turn ignition ON.
3. Clear codes with diagnostic tool.
4. Start and run the engine for one minute. Stop engine.
5. Check diagnostic tool for codes.
   [a] If no codes are displayed, troubleshooting is complete.
   [b] If code 710/5 is not logged and other codes are logged, troubleshoot the logged codes.
   [c] If code 710/5 and other codes are logged, review this section to find the error. If no error is found, call the Detroit Diesel Customer Support Center (313–592–5800).

71 SPN 711 (CPC) - DPF REGEN LAMP

Section **Page**

71.1 SPN 711/FMI 3

DPF Regen Lamp - indicates a short to power/open circuit on pin 5 of the CPC #1 connector. For wiring schematic information refer to OEM literature.

NOTE:
The CPC digital outputs have the same SPN as some MCM faults. DDDL 7.0 makes the distinction between the MCM and CPC when diagnosing a fault.

71.2 SPN 711/FMI 4

DPF Regen Lamp - indicates a short to ground on the pin 5 circuit of the CPC #1 connector. For wiring schematic information refer to OEM literature.

NOTE:
The CPC digital outputs have the same SPN as some MCM faults. DDDL 7.0 makes the distinction between the MCM and CPC when diagnosing a fault.

72 SPN 713 (CPC) - TOP2 LOCKOUT SOLENOID

Section **Page**

72.1 SPN 713/FMI 3

TOP2 Lockout Solenoid - indicates a short to power on the pin 7 circuit of the CPC #3 connector. For wiring schematic information refer to OEM literature.

NOTE:
The CPC digital outputs have the same SPN as some MCM faults. DDDL 7.0 makes the distinction between the MCM and CPC when diagnosing a fault.

72.2 SPN 713/FMI 4

TOP2 Lockout Solenoid - indicates a short to ground circuit on pin 7 of the CPC #3 connector. For wiring schematic information refer to OEM literature.

NOTE:
The CPC digital outputs have the same SPN as some MCM faults. DDDL 7.0 makes the distinction between the MCM and CPC when diagnosing a fault.

72.3 SPN 713/FMI 5

TOP2 Lockout Solenoid - indicates an open circuit on the pin 7 circuit of the CPC #3 connector. For wiring schematic information refer to OEM literature.

NOTE:
The CPC digital outputs have the same SPN as some MCM faults. DDDL 7.0 makes the distinction between the MCM and CPC when diagnosing a fault.

72.4 SPN 713/FMI 7

TOP2 Shift Failure – indicates an open, ground or shot to power on the pin 7 of the CPC #3 connector. For wiring schematic information refer to OEM literature.

NOTE:
The CPC digital outputs have the same SPN as some MCM faults. DDDL 7.0 makes the distinction between the MCM and CPC when diagnosing a fault.

73 SPN 714 (CPC) - TOP2 SHIFT SOLENOID

Section **Page**

73.1 SPN 714/FMI 3

TOP2 Shift Solenoid - indicates a short to power on the pin 8 circuit CPC #3 connector. For wiring schematic information refer to OEM literature.

NOTE:
The CPC digital outputs have the same SPN as some MCM faults. DDDL 7.0 makes the distinction between the MCM and CPC when diagnosing a fault.

73.2 SPN 714/FMI 4

TOP2 Shift Solenoid - indicates a short to ground circuit on pin 8 of the CPC #3 connector. For wiring schematic information refer to OEM literature.

NOTE:
The CPC digital outputs have the same SPN as some MCM faults. DDDL 7.0 makes the distinction between the MCM and CPC when diagnosing a fault.

73.3 SPN 714/FMI 5

TOP2 Shift Solenoid - indicates a open circuit on the pin 8 circuit of the CPC #3 connector. For wiring schematic information refer to OEM literature.

NOTE:
The CPC digital outputs have the same SPN as some MCM faults. DDDL 7.0 makes the distinction between the MCM and CPC when diagnosing a fault.

74 SPN 715 (CPC) - VEHICLE POWER SHUTDOWN

74.1 SPN 715/FMI 3

Vehicle Power Shutdown - indicates a short to power on the pin 10 circuit of the CPC #4 connector. For wiring schematic information refer to OEM literature.

NOTE:
The CPC digital outputs have the same SPN as some MCM faults. DDDL 7.0 makes the distinction between the MCM and CPC when diagnosing a fault.

74.2 SPN 715/FMI 4

Vehicle Power Shutdown - indicates a short to ground circuit on pin 10 of the CPC #4 connector. For wiring schematic information refer to OEM literature.

NOTE:
The CPC digital outputs have the same SPN as some MCM faults. DDDL 7.0 makes the distinction between the MCM and CPC when diagnosing a fault.

74.3 SPN 715/FMI 5

Vehicle Power Shutdown - indicates a open circuit on the pin 10 circuit of the CPC #4 connector. For wiring schematic information refer to OEM literature.

NOTE:
The CPC digital outputs have the same SPN as some MCM faults. DDDL 7.0 makes the distinction between the MCM and CPC when diagnosing a fault.

75 SPN 729 - GRID HEATER NOT OPERATING NORMALLY

Section **Page**

75.1 SPN 729/FMI 3

This diagnosis is typically a short to power/open.

75.1.1 Short to Power/Open Check

Check as follows:

1. Disconnect the Grid Heater connector.
2. Turn the ignition ON (key ON, engine OFF).
3. Measure the voltage between pins 2 and 4 of the Grid Heater connector. See Figure 75-1.

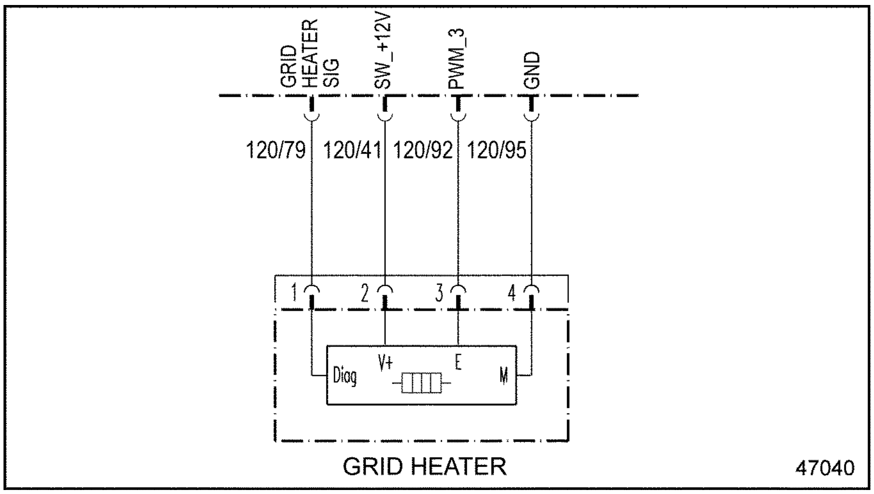


Figure 75-1 Grid Heater Wiring

   [a] If the voltage is greater than 11.5 volts, go to step 5.

   [b] If the voltage is less than 11.5 volts, go to step 4.

4. Measure the voltage between pin 2 of the Grid Heater connector and ground.

   [a] If the voltage is greater than 11.5 volts, repair the open between pin 4 of the Grid Heater connector and pin 95 of the 120–pin MCM connector. Refer to section 75.1.1.1.

   [b] If the voltage is less than 11.5 volts, repair the open between pin 2 of the Grid Heater connector and pin 41 of the 120–pin MCM connector. Refer to section 75.1.1.1.

5. Turn the ignition OFF.
6. Disconnect the 120–pin MCM connector.
7. Measure the resistance between pins 2 and 3 of the Grid Heater connector.

   [a] If the resistance is greater than 5 Ω, go to step 8.

   [b] If the resistance is less than 5 Ω, repair the short between Grid Heater pins 2 and 3 and pins 41 and 92 of the 120–pin MCM connector. Refer to section 75.1.1.1.

8. Measure the resistance between pin 3 of the Grid Heater connector and pin 92 of the 120–pin MCM connector.
   [a] If the resistance is greater than 5 Ω, repair the open between pin 3 of the Grid Heater connector and pin 92 of the 120–pin MCM connector. Refer to section 75.1.1.1.
   [b] If the resistance is less than 5 Ω, replace the Grid Heater.

75.1.1.1 Verify Repairs

Perform the following steps to verify repairs.

1. Turn vehicle ignition OFF. Reconnect all connectors.
2. Turn ignition ON. Clear codes with diagnostic tool.
3. Start and run the engine for one minute. Stop the engine.
4. Check diagnostic tool for codes.
   [a] If no codes are displayed, troubleshooting is complete.
   [b] If code 729/3 is not logged, and other codes are logged, troubleshoot the logged codes.
   [c] If code 729/3 and other codes are logged, review this section to find the error. If no error is found, call the Detroit Diesel Customer Support Center (313–592–5800).

75.2 SPN 729/FMI 4

This diagnosis is typically a short to ground.

75.2.1 Short to Ground Check

Check as follows:

1. Disconnect the Grid Heater connector.
2. Disconnect the 120–pin MCM connector.
3. Measure the resistance between pins 3 and 4 of the Grid Heater connector.
   [a] If the resistance is less than 5 Ω, repair the short between pins 3 and 4 of the Grid Heater connector and pins 92 and 95 of the 120–pin MCM connector. Refer to section 75.2.1.1.
   [b] If the resistance is greater than 5 Ω, go to step 4.
4. Measure the resistance between pin 3 of the Grid Heater connector and ground.
   [a] If the resistance is less than 5 Ω, repair the short between pin 3 of the Grid Heater connector and ground. Refer to section 75.2.1.1.
   [b] If the resistance is greater than 5 Ω, replace the Grid Heater.

75.2.1.1 Verify Repairs

Perform the following steps to verify repairs.

1. Turn the ignition OFF. Reconnect all connectors.
2. Turn ignition ON. Clear codes with diagnostic tool.
3. Start and run the engine for one minute. Stop the engine.
4. Check diagnostic tool for codes.
   [a] If no codes are displayed, troubleshooting is complete.
   [b] If code 729/4 is not logged, and other codes are logged, troubleshoot the logged codes.
   [c] If code 729/4 and other codes are logged, review this section to find the error. If no error is found, call the Detroit Diesel Customer Support Center (313–592–5800).

76 SPN 723 — CAMSHAFT POSITION SENSOR FAULT

Section **Page**

76.1 SPN 723/FMI 3

The diagnostic condition is typically an open circuit.

76.1.1 Open Circuit Check

Perform the following steps to troubleshoot an open circuit.

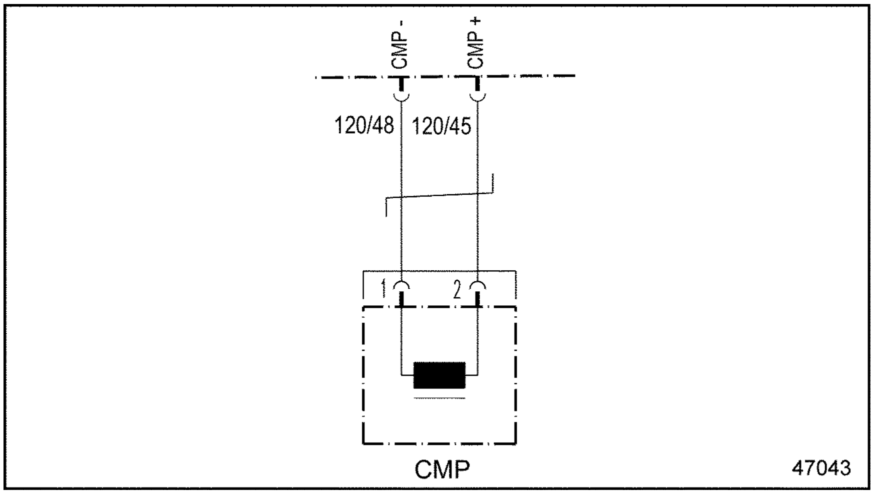


Figure 76-1 MCM — Camshaft Position Sensor Schematic

1. Disconnect CMP Sensor
2. Measure the resistance across pins 1 and 2 of the CMP Sensor.See Figure 76-1.
   [a] If the resistance is less than 140 Ω, go to step 3.
   [b] If the resistance is greater than 140 Ω, replace the CMP Sensor. Refer to section 76.1.1.1.
3. Disconnect the 120–pin MCM connector.
4. Measure the resistance across pins 1 and 2 of the CMP harness connector.
   [a] If the resistance is less than 5 Ω, repair short between pins 1 and 2 of the CMP harness connector and the pins 44 and 45 of the MCM 120 pin connector. Refer to section 76.1.1.1.
   [b] If the resistance is greater than 5 Ω, go to step 5.
5. Measure the resistance between pin 1 of the CMP harness connector and pin 44 of the MCM 120 pin connector
   [a] If the resistance is greater then 5 Ω, repair open between pin 1 of the CMP harness connector and pin 44 of the MCM 120 pin connector. Refer to section 76.1.1.1.
   [b] If the resistance is less than 5 Ω, go to step 6.

6. Measure the resistance between pin 2 of the CMP harness connector and pin 45 of the MCM 120 pin connector.
   [a] If the resistance is greater then 5 ohms, repair open between pin 2 of the CMP harness connector and pin 45 of the MCM 120–pin connector. Refer to section 76.1.1.1.
   [b] If the resistance is less than 5 Ω, review steps 2 through 6. If the results are the same, contact the Detroit Diesel Customer Support Center (313–592–5800).

76.1.1.1 Verify Repairs

Verify repairs as follows:

1. Turn vehicle ignition OFF and reconnect all connectors.
2. Turn vehicle ignition ON.
3. Start and run the engine for one minute. Stop engine.
4. Check the diagnostic tool for codes.
   [a] If no codes are logged, troubleshooting is complete.
   [b] If code 723/3 and any other codes are logged, and the CMP was not replaced, replace the sensor and retest.
   [c] If code 723/3 and any other codes are logged and the CMP was replaced, review this section to find the error or contact Detroit Diesel Customer Support Center (313–592–5800) for authorization to replace the MCM.
   [d] If any codes except code 723/3 are logged, troubleshoot those codes.

76.2 SPN 723/FMI 4

A typical diagnosis is a short to ground.

76.2.1 Short to Ground Check

Perform the following step to troubleshoot a short to ground.

1. Disconnect the CMP Sensor.
2. Measure the resistance between pin 1 of the CMP Sensor and ground. See Figure 76-2.

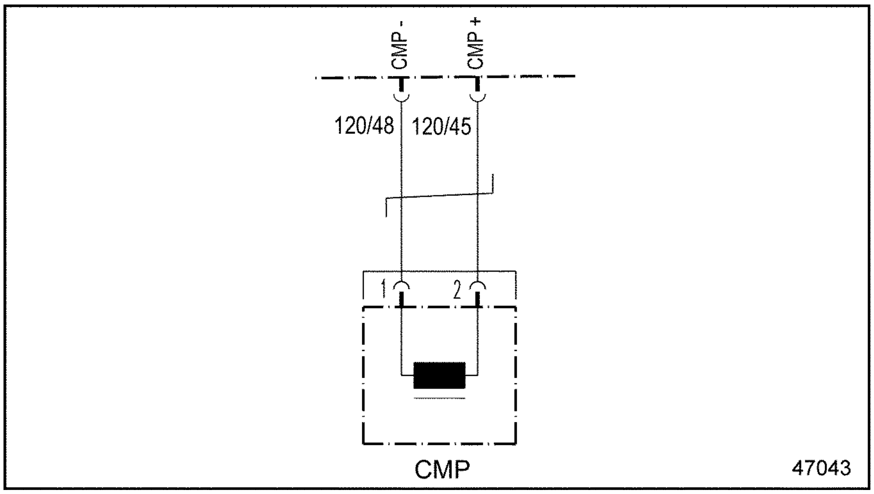


Figure 76-2 MCM — Camshaft Position Sensor Schematic

   [a] If the resistance is greater than 5 Ω, go to step 3.

   [b] If the resistance is less than 5 Ω, replace the CMP Sensor.Refer to section 76.2.1.1.

3. Measure the resistance between pin 2 of the CMP Sensor and ground.

   [a] If the resistance is greater than 5 Ω, go to step 4.

   [b] If the resistance is less than 5 Ω, replace the CMP Sensor.Refer to section 76.2.1.1.

4. Disconnect 120-pin MCM connector.
5. Measure the resistance across pins 1 and 2 of the CMP harness connector.

   [a] If the resistance is greater than 5 Ω, go to step 6.

   [b] If the resistance is less than 5 Ω, repair the short between pins 1 and 2 of the CMP harness connector and pins 44 and 45 of the 120–pin MCM connector. Refer to section 76.2.1.1.

6. Measure the resistance between pin 1 of the CMP harness connector and ground.

   [a] If the resistance is greater than 5 Ω, go to step 7.

[b] If the resistance is less than 5 Ω, repair the short to ground between pin 1 of the CMP harness connector and pin 44 of the 120–pin MCM connector. Refer to section 76.2.1.1.

7. Measure the resistance between pin 2 of the CMP harness connector and pin 45 of the 120–pin MCM connector.
   [a] If the resistance is greater than 5 Ω, review steps 2 through 7. If the results are the same, contact Detroit Diesel Customer Support Center (313–592–5800).
   [b] If the resistance is less than 5 Ω, repair the short to ground between pin 2 of the CMP harness connector and pin 45 of the 120–pin MCM connector. Refer to section 76.2.1.1.

76.2.1.1 Verify Repairs

Verify repairs as follows:

1. Turn vehicle ignition OFF and reconnect all connectors.
2. Turn vehicle ignition ON.
3. Start and run the engine for one minute. Stop engine.
4. Check the diagnostic tool for codes.
   [a] If no codes are logged, troubleshooting is complete.
   [b] If code 723/4 and any other codes are logged, and the Engine Oil Pressure Sensor was not replaced, replace the sensor and retest.
   [c] If any codes except code 723/4 are logged, troubleshoot those codes.

76.3 SPN 723/FMI 8

A typical diagnosis is time out.

76.3.1 Time Out Check

Perform the following steps to troubleshoot a time out.

1. Start and run the engine.
2. Check for active fault codes.
   [a] If fault codes 723/3 and 723/8 are active, troubleshoot active fault code 723/3. Refer to section 76.1.
   [b] If fault codes 723/4 and 723/8 are not active, go to step 3.
   [c] If fault codes 723/4 and 723/8 are active, refer to section 76.3.2.
3. Shutdown the engine.
4. Ensure that the sensor is correctly positioned and check for active codes.

[a] If the sensor position is correct and fault code 723/8 is active, refer to section 76.3.2.

[b] If the sensor position is incorrect and fault code 723/8 is not active, remove and replace the camshaft sensor sleeve. Refer to section 76.3.2.1.

76.3.2 Camshaft Position Sensor Check

Perform the following steps to check the sensor.

1. Remove the Camshaft Position Sensor and ensure that the sensor bores are not damaged. If damaged is present, repair as necessary. Refer to section 76.3.2.1.
2. Check the Camshaft Position Sensor for proper axial play. Repair as necessary if the axial play is incorrect. Refer to section 76.3.2.1.

76.3.2.1 Verify Repairs

Verify repairs as follows:

1. Turn vehicle ignition OFF and reconnect all connectors.
2. Turn vehicle ignition ON.
3. Start and run the engine for one minute. Stop engine.
4. Check the diagnostic tool for codes.
   [a] If no codes are logged, troubleshooting is complete.
   [b] If any codes except code s 723/8 are logged, troubleshoot those codes.

76.4 SPN 723/FMI 14

A typical diagnosis is swapped pins.

76.4.1 Swapped Pins Check

Perform the following step to troubleshoot pins swapped.

1. If fault code 723/14 is active, check the engine speed sensor for reversed polarity.
2. Reseat the camshaft and crankshaft sensors.

3. Ensure that the 120-pin connector wires are not crossed. If crossed, repair as necessary. See Figure 76-3. Refer to section 76.4.1.1.

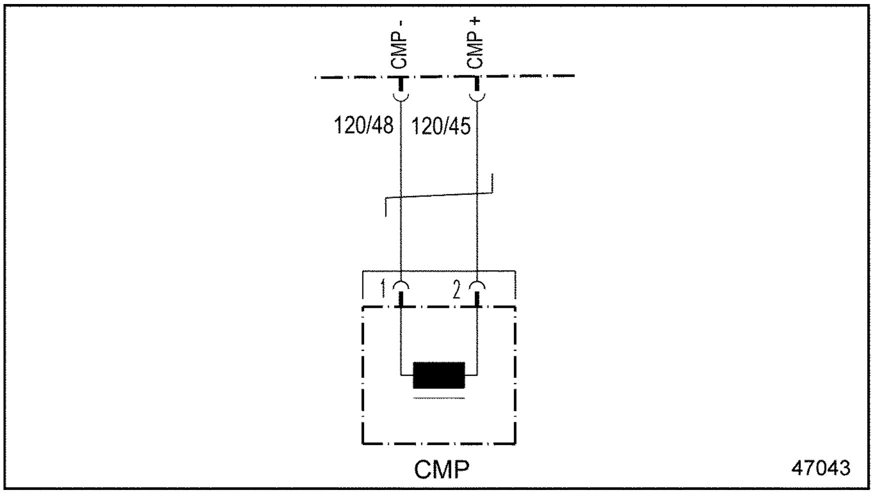


Figure 76-3 Camshaft Position Sensor

76.4.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF and reconnect all connectors.
2. Turn the ignition ON.
3. Start and run the engine for one minute. Stop engine.
4. Check the diagnostic tool for codes.
   [a] If no codes are logged, troubleshooting is complete.
   [b] If any codes except code s 723/14 are logged, troubleshoot those codes.

77 SPN 904 (CPC) - J1939 EBC2 MESSAGE MISSING AND FRONT AXLE SPEED SIGNAL ERRATIC OR MISSING

Section **Page**

77.1 SPN 904/FMI 9

This fault is typically the J1939 EBC2 message from the ABS is missing.

77.1.1 Missing EBC2 Message from ABS Check

Check as follows:

1. Check for multiple codes:
   [a] If CPC SPN 168/FMI 0/14/18 (Battery Voltage) are present troubleshoot these first.
   [b] If MCM SPN 625/FMI 9 is present, troubleshoot and repair the CAN line.
   [c] If only a “J1939 Error” fault is present, go to step 2.
2. Has the CPC been recently reprogrammed?
   [a] If yes, check the proper configuration of the CPC.
   [b] If no, connect ServiceLink to determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

77.2 SPN 904/FMI 13

This fault is typically the front axle speed signal is missing.

77.2.1 Missing Front Axle Speed Signal Check

Check as follows:

1. Check for multiple codes:
   [a] If CPC SPN 168/FMI 0/14/18 (Battery Voltage) are present troubleshoot these first.
   [b] If MCM SPN 625/FMI 9 is present, troubleshoot and repair the CAN line.
   [c] If only a “J1939 Error” fault is present, go to step 2.
2. Has the CPC been recently reprogrammed?
   [a] If yes, check the proper configuration of the CPC.
   [b] If no, connect ServiceLink to determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

77.3 SPN 904/FMI 19

This fault is typically the front axle speed signal is erratic.

77.3.1 Erratic Front Axle Speed Signal Check

Check as follows:

1. Check for multiple codes:
   [a] If CPC SPN 168/FMI 0/14/18 (Battery Voltage) are present troubleshoot these first.
   [b] If MCM SPN 625/FMI 9 is present, troubleshoot and repair the CAN line.
   [c] If only a “J1939 Error” fault is present, go to step 2.
2. Has the CPC been recently reprogrammed?
   [a] If yes, check the proper configuration of the CPC.
   [b] If no, connect ServiceLink to determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

78 SPN 973 (CPC) - J1939 EBC1 MESSAGE MISSING AND ENGINE RETARDER SELECTION SIGNAL IS ERRATIC OR MISSING

Section		Page

78.1 SPN 973/FMI 9

This fault is typically the J1939 EBC1 message from the transmission is missing.

78.1.1 Missing EBC1 Transmission from ABS Check

Check as follows:

1. Check for multiple codes:
   [a] If CPC SPN 168/FMI 0/14/18 (Battery Voltage) are present troubleshoot these first.
   [b] If MCM SPN 625/FMI 9 is present, troubleshoot and repair the CAN line.
   [c] If only a “J1939 Error” fault is present, go to step 2.
2. Has the CPC been recently reprogrammed?
   [a] If yes, check the proper configuration of the CPC.
   [b] If no, connect ServiceLink to determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

78.2 SPN 973/FMI 13

This fault is typically the engine retarder selection signal is missing.

78.2.1 Missing Engine Retarder Selection Signal Check

Check as follows:

1. Check for multiple codes:
   [a] If CPC SPN 168/FMI 0/14/18 (Battery Voltage) are present troubleshoot these first.
   [b] If MCM SPN 625/FMI 9 is present, troubleshoot and repair the CAN line.
   [c] If only a “J1939 Error” fault is present, go to step 2.
2. Has the CPC been recently reprogrammed?
   [a] If yes, check the proper configuration of the CPC.
   [b] If no, connect ServiceLink to determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

78.3 SPN 973/FMI 19

This fault is typically the engine retarder selection signal is erratic.

78.3.1 Erratic Engine Retarder Selection Signal Check

Check as follows:

1. Check for multiple codes:
   [a] If CPC SPN 168/FMI 0/14/18 (Battery Voltage) are present troubleshoot these first.
   [b] If MCM SPN 625/FMI 9 is present, troubleshoot and repair the CAN line.
   [c] If only a “J1939 Error” fault is present, go to step 2.
2. Has the CPC been recently reprogrammed?
   [a] If yes, check the proper configuration of the CPC.
   [b] If no, connect ServiceLink to determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

79 SPN 975 - TWO-SPEED FAN (AUX PWM #6) FAULT

Section **Page**

79.1 SPN 975/FMI 3

This fault code indicates that there is a short to power.

79.1.1 Short to Power Check

Check for short to power as follows:

1. Turn the ignition OFF.
2. Disconnect the fan control solenoid connector.
3. Turn the ignition ON (key ON, engine OFF).
4. Measure the voltage between pin 1 of the fan control solenoid connector and ground.
    [a] If the voltage is greater than 11.5 volts, repair the short to power between pin 1 of the fan control solenoid connector and pin 33 of the 120–pin MCM connector. Refer to section 79.1.2.1.

    [b] If the voltage is less than 11.5 volts, refer to section 79.1.2.

79.1.2 Voltage Check

The voltage check performed indicate that you should not be getting a code. The following is a recheck before requesting a new MCM.

1. Turn vehicle ignition OFF. Reconnect all connectors.
2. Turn ignition ON. Clear codes with diagnostic tool.
3. Start and run the engine for one minute. Stop engine.
4. Put the ignition switch in the OFF position
5. Disconnect the fan control solenoid connector.
6. Turn the ignition ON (key ON, engine OFF).
7. Measure the voltage between pin 1 of the fan control solenoid connector and ground.
    [a] If the voltage is greater than 11.5 volts, repair the short to power between pin 1 of the fan control solenoid connector and pin 33 of the 120–pin MCM connector. Refer to section 79.1.2.1.

    [b] Of the voltage is less than 11.5 volts, contact the Detroit Diesel Customer Support Center (313–592–5800) for authorization to replace the MCM.

79.1.2.1 Verify Repairs

Verify repairs as follows:

1. Turn the vehicle ignition OFF and reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.

3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
   [a] If no codes are present, troubleshooting is complete.
   [b] If code 975/3 is not logged but other codes are logged, troubleshoot the other codes.
   [c] If code 975/3 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313–592–5800).

79.2 SPN 975/FMI 4

This fault indicates that there is a short to ground.

79.2.1 Check for Short to Ground

Check for a short to ground as follows:

1. Turn the vehicle ignition switch to the OFF position.
2. Disconnect the fan control solenoid.
3. Disconnect the 120–pin MCM connector.
4. Measure the resistance between pin 1 of the fan control solenoid and ground.
   - [a] If the resistance is less than 5 Ω, repair the short to ground between pin 1 of the fan control solenoid and pin 33 of the 120–pin MCM connector. Refer to section 79.2.1.1.
   - [b] If the resistance is greater than 5 Ω, repair the short to ground between pin 2 of the fan control solenoid and pin 91 of the 120–pin MCM connector. Refer to section 79.2.1.1.

79.2.1.1 Verify Repairs

Verify repairs as follows:

1. Reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
   - [a] If no codes are present, troubleshooting is complete.
   - [b] If code 975/4 is not logged but other codes are logged, troubleshoot the other codes.
   - [c] If code 975/4 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313–592–5800).

79.3 SPN 975/FMI 5

This fault code indicates that there is an open circuit.

79.3.1 Open Circuit Check

Check for open as follows:

1. Check for multiple codes.
   [a] If SPN 704/5, SPN 708/5, SPN 711/5 and SPN 975/5 are active repair the open in between the pin 91 of the 120–pin MCM connector and the fan and the Jake Brake solenoids. Refer to section 79.3.1.1.
   [b] If only SPN 711/5 is active, go to step 2.
2. Disconnect the fan control solenoid connector.
3. Turn the ignition ON (key ON, engine OFF).
4. Measure the voltage between pin 1 and 2 of the fan control solenoid connector.
   [a] If the voltage is less than 11.5 volts, go to step 5.
   [b] If the voltage is between 11.5 and 13.5 volts, replace the fan control solenoid. Refer to section 79.3.1.1.
5. Measure the voltage between pin 2 of the fan control solenoid connector and ground.
   [a] If the voltage is less than 11.5 volts, repair the open between pin 2 of the fan control solenoid connector and pin 91 of the 120–pin MCM connector. Refer to section 79.3.1.1.
   [b] If the voltage is greater than 11.5, repair the open between pin 1 of the fan control solenoid connector and pin 33 of the 120–pin MCM connector. Refer to section 79.3.1.1.

79.3.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF. Reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
   [a] If no codes are present, troubleshooting is complete.
   [b] If code 975/5 is not logged but other codes are logged, troubleshoot the other codes.
   [c] If code 975/5 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313–592–5800).

80 SPN 986 (CPC) - J1939 CM1 MESSAGE IS MISSING

Section **Page**

80.1 SPN 986/FMI 9

This fault is typically the J1939 CM1 message is missing.

80.1.1 Missing J1939 CM1 Message Check

Check as follows:

1. Check for multiple codes:
   [a] If CPC SPN 168/FMI 0/14/18 (Battery Voltage) are present troubleshoot these first.
   [b] If MCM SPN 625/FMI 9 is present, troubleshoot and repair the CAN line.
   [c] If only a “J1939 Error” fault is present, go to step 2.
2. Has the CPC been recently reprogrammed?
   [a] If yes, check the proper configuration of the CPC.
   [b] If no, connect ServiceLink to determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

81 SPN 1172 -TURBO COMPRESSOR IN TEMP HIGH OR LOW

81.1 SPN 1172/FMI 3

This code is typically sensor or circuit failed high.

81.1.1 Open Circuit Check

Check for an open as follows:

1. Turn the ignition OFF.
2. Disconnect the 31–pin connector.
3. Measure the resistance between pin 27 and pin 28 of the 31–pin connector on the truck side.
   [a] If the resistance is less than 55 Ω, go to step 7.
   [b] If the resistance is greater than 55 Ω, go to step 4.
4. Disconnect the Turbo Compressor In Temperature Sensor (TCI Sensor).
5. Measure the resistance between pin 1 and pin 2 of the TCI Sensor.
   [a] If the resistance is greater than 50 Ω, replace the sensor. Refer to section 81.1.2.1.
   [b] If the resistance is less than 50 Ω, go to step 6.
6. Measure the resistance between pin 1 of the TCI Sensor connector and pin 27 of the 31–pin connector.
   [a] If the resistance is greater than 3 Ω, repair the open between pin 1 of the TCI Sensor connector and pin 27 of the 31–pin connector. Refer to section 81.1.2.1.
   [b] If the resistance is less than 3 Ω, repair the open between pin 2 of the TCI Sensor connector and pin 28 of the 31–pin connector. Refer to section 81.1.2.1.
7. Turn the ignition ON (key ON, engine OFF).
8. Measure the voltage between pin 27 and pin 28 of the 31–pin connector on the engine side.
   [a] If the voltage is less than 4.5 volts, go to step 9.
   [b] If the voltage is greater than 4.5 volts, refer to section 81.1.2.
9. Measure the voltage between pin 27 of the 31–pin connector and ground.
   [a] If the voltage is less than 4.5 volts, repair the open between pin 27 of the 31–pin connector and pin 86 of the 120–pin MCM connector. Refer to section 81.1.2.1.
   [b] If the voltage is between 4.5 volts and 5.5 volts, repair the open between pin 28 of the 31–pin connector and pin 114 of the 120–pin MCM connector. Refer to section 81.1.2.1.

81.1.2 Resistance and Voltage Check

The resistance and voltage check performed indicate that you should not be getting a code. The following is a recheck before requesting a new MCM.

1. Turn the ignition OFF. Reconnect all connectors.
2. Turn ignition ON. Clear codes with diagnostic tool.
3. Measure the voltage between pin 27 and pin 28 of the 31–pin connector on the engine side.
   [a] If the voltage is less than 4.5 volts, refer to section 81.1.1, step 9.
   [b] If the voltage is greater than 4.5 volts, contact the Detroit Diesel Customer Support Center (313–592–5800) for authorization to replace the MCM.

81.1.2.1 Verify Repairs

Perform the following steps to verify repairs.

1. Turn vehicle ignition OFF.
2. Reconnect all connectors. Turn ignition ON.
3. Clear codes with diagnostic tool.
4. Start and run the engine for one minute. Stop engine.
5. Check diagnostic tool for codes.
   [a] If no codes are displayed, troubleshooting is complete.
   [b] If code 1172/3 is not logged, and other codes are logged, troubleshoot the logged codes.
   [c] If code 1172/3 and other codes are logged, review this section to find the error. If no error is found, call the Detroit Diesel Customer Support Center (313–592–5800).

81.2 SPN 1172/FMI 4

This code is typically sensor or circuit failed low.

81.2.1 Short Circuit Check

Check for short as follows:

1. turn the ignition OFF.
2. Disconnect the 31–pin connector.
3. Disconnect the TCI Sensor.
4. Measure resistance between pin 27 and pin 28 of the 31–pin connector on the vehicle side.
   - [a] If the resistance is less than 10 Ω, repair the short between pin 27 and pin 28 of the 31–pin connector. Refer to section 81.2.1.1.
   - [b] If the resistance is greater than 10 Ω, go to step 5.
5. Measure resistance between pin 27 of the 31–pin connector and ground on the vehicle side.
   - [a] If the resistance is less than 5 Ω, repair the short to ground between pin 27 of the 31–pin connector and pin 1 of the TCI Sensor. Refer to section 81.2.1.1.
   - [b] If the resistance is greater than 5 Ω, go to step 6.
6. Measure resistance between pin 28 and ground on the vehicle side.
   - [a] If the resistance is less than 5 Ω, repair the short to ground between pin 28 of the 31–pin connector and pin 2 of the TCI Sensor. Refer to section 81.2.1.1.
   - [b] If the resistance is greater than 5 Ω, go to step 7.
7. Disconnect the 120–pin MCM connector.
8. Measure resistance between pin 27 and pin 28 of the 31–pin connector on the engine side.
   - [a] If the resistance is less than 10 Ω, repair the short between pin 27 and pin 28 between the 31–pin connector and the 120–pin MCM connector. Refer to section 81.2.1.1.
   - [b] If the resistance is greater than 10 Ω, go to step 9.
9. Measure resistance between pin 27 of the 31–pin connector and ground on the engine side.
   - [a] If the resistance is less than 5 Ω, repair the short to ground between pin 27 of the 31–pin connector and ground. Refer to section 81.2.1.1.
   - [b] If the resistance is greater than 5 Ω, go to step 10.
10. Measure resistance between pin 28 of the 31–pin connector and ground on the engine side.
    - [a] If the resistance is less than 5 Ω, repair the short to ground between pin 28 of the 31–pin connector and ground. Refer to section 81.2.1.1.
    - [b] If the resistance is greater than 5 Ω, contact the Detroit Diesel Customer Support Center (313–592–5800) for authorization to replace the MCM.

81.2.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF.
2. Reconnect all connectors. Turn ignition ON.
3. Clear codes with diagnostic tool.
4. Start and run the engine for one minute. Stop engine.
5. Check diagnostic tool for codes.
   [a] If no codes are displayed, troubleshooting is complete.
   [b] If code 1172/4 is not logged, and other codes are logged, troubleshoot the logged codes.
   [c] If code 1172/4 and other codes are logged, review this section to find the error. If no error is found, call the Detroit Diesel Customer Support Center (313–592–5800).

82 SPN 1176 - TURBO COMPRESSOR INLET PRESSURE OUTSIDE NORMAL RANGE

Section **Page**

82.1 SPN 1176/FMI 3

This diagnosis is typically a short to power.

82.1.1 Short to Power Check

Check as follows:

1. Turn the ignition ON (key ON, engine OFF).
2. Check for multiple codes.
   - [a] If 1176/3, 1172/3, 100/3 and 175/3 are present, repair the open between pin 105 on the 120–pin MCM connector and the associated sensors. Refer to section 82.1.1.1.
   - [b] If 1176/3 and 1172/3 are present, go to step 7.
   - [c] If only 1176/2 is present, go to step 4.
3. Turn the ignition OFF.
4. Disconnect the Turbo Pressure/Temp Sensor.
5. Disconnect the 120–pin MCM connector.
6. Measure the resistance between pins 1 and 2 of the Turbo Pressure/Temp Sensor harness connector.
   - [a] If the resistance is greater than 5 Ω, repair the short to power on the circuit between pin 120 of the 120–pin MCM connector and pin 1 of the Turbo Pressure/Temp Sensor harness connector. Refer to section 82.1.1.1.
   - [b] If the resistance is less than 5 Ω, repair the short between pins 120 and 85 of the 120–pin MCM connector. Refer to section 82.1.1.1.
7. Disconnect the Turbo Pressure/Temp Sensor.
8. Measure the resistance between pins 2 and 4 of the Turbo Pressure/Temp Sensor.
   - [a] If the resistance is greater than 140 Ω, replace the Turbo Pressure/Temp Sensor. Refer to section 82.1.1.1.
   - [b] If the resistance is less than 140 Ω, go to step 9.
9. Turn the ignition ON (key ON, engine OFF).
10. Measure the voltage between pin 2 of the Turbo Pressure/Temp Sensor and ground.
    - [a] If the voltage is greater than 2.75 volts, repair the open circuit between pin 105 of the 120–pin MCM connector and pin 4 of the Turbo Pressure/Temp Sensor. Refer to section 82.1.1.1.
    - [b] If the voltage is less than 2.75 volts, repair the open circuit between pin 85 of the 120–pin MCM connector and pin 2 of the Turbo Pressure/Temp Sensor. Refer to section 82.1.1.1.

82.1.1.1 Verify Repairs

Perform the following steps to verify repairs.

1. Turn vehicle ignition OFF.
2. Reconnect all connectors.
3. Turn ignition ON.
4. Clear codes with diagnostic tool.
5. Start and run the engine for one minute.
6. Stop engine.
7. Check diagnostic tool for codes.
   - [a] If no codes are displayed, troubleshooting is complete.
   - [b] If code 1176/3 is not logged, and other codes are logged, troubleshoot the logged codes.
   - [c] If code 1176/3 and other codes are logged, review this section to find the error. If no error is found, call the Detroit Diesel Customer Support Center (313–592–5800).

82.2 SPN 1176/FMI 4

This diagnosis is typically an open short to ground.

82.2.1 Open or Short Circuit Check

Check as follows:

1. Turn the ignition ON (key ON, engine OFF).
2. Check for multiple codes.
   [a] If 1176/4, 1172/4, 3610/4, 3609/4, 3250/4, 3242/4 and 3246/4 are present, repair the open between pin 85 on the 120–pin MCM connector and the associated sensors. Refer to section 82.2.1.1.
   [b] If 1176/4 and 1172/4 are present, repair the open between pin 85 on the 120–pin MCM connector and pin 2 on the Turbo Pressure/Temp Sensor. Refer to section 82.2.1.1.
   [c] If only 1176/4 is present, go to step 4.
3. Turn the ignition OFF.
4. Disconnect the Turbo Pressure/Temp Sensor.
5. Measure the resistance between pins 1 and 2 of the Turbo Pressure/Temp Sensor.
   [a] If the resistance is greater than 130k Ω, replace the Turbo Pressure/Temp Sensor. Refer to section 82.2.1.1.
   [b] If the resistance is less than 130k Ω, go to step 6.
6. Measure the resistance between pins 1 and 4 of the Turbo Pressure/Temp Sensor.
   [a] If the resistance is greater than 130k Ω, replace the Turbo Pressure/Temp Sensor. Refer to section 82.2.1.1.
   [b] If the resistance is less than 130k Ω, go to step 7.
7. Disconnect the 120–pin MCM connector.
8. Measure the resistance between pins 1 and 4 of the Turbo Pressure/Temp Sensor harness connector.
   [a] If the resistance is greater than 5 Ω, go to step 9.
   [b] If the resistance is less than 5 Ω, repair the short between wires 120 and 105 of the 120–pin MCM connector. See Figure 82-1. Refer to section 82.2.1.1.
9. Measure the voltage between pin 1 of the Turbo Pressure/Temp Sensor and ground.

[a] If the resistance is greater than 5 Ω, repair the open between pin 1 of the Turbo Pressure/Temp Sensor and pin 120 of the 120–pin MCM connector. See Figure 82-1. Refer to section 82.2.1.1.

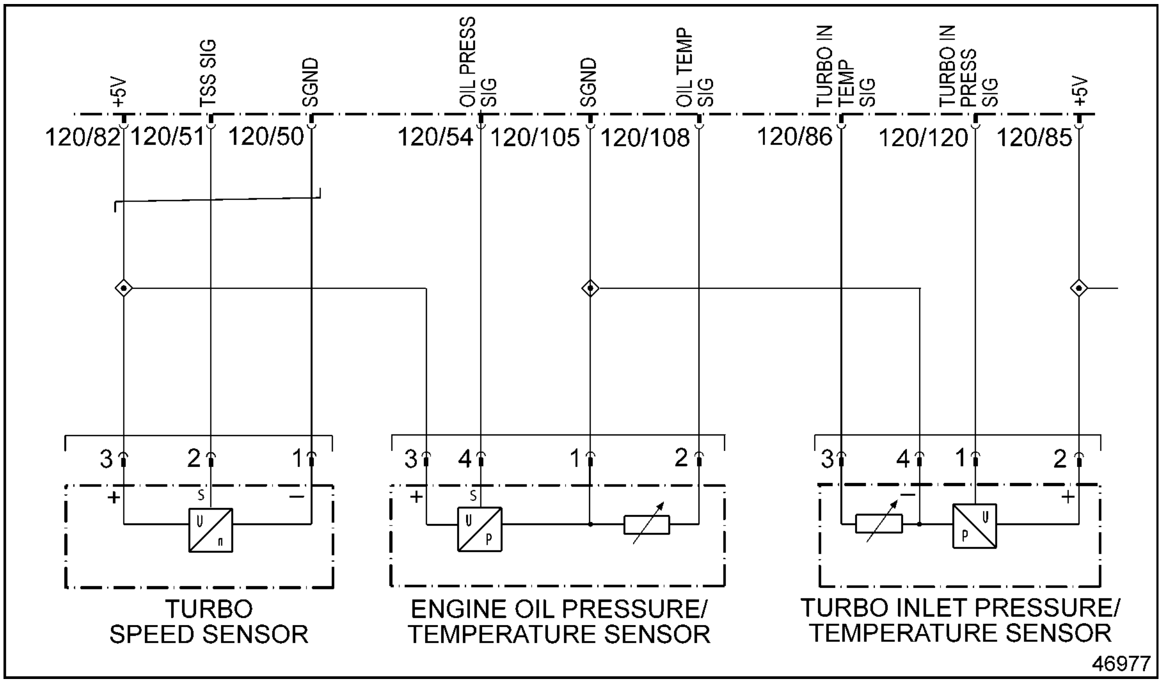


Figure 82-1 Turbo Pressure/Temp Sensor Wiring

[b] If the resistance is less than 5 Ω, repair the short to ground circuit between pin 120 of the 120–pin MCM connector and ground. See Figure 82-1. Refer to section 82.2.1.1.

82.2.1.1 Verify Repairs

Verify repairs as follows:

1. Turn vehicle ignition OFF.
2. Reconnect all connectors. Turn ignition ON.
3. Clear codes with diagnostic tool.
4. Start and run the engine for one minute. Stop engine.
5. Check diagnostic tool for codes.
   [a] If no codes are displayed, troubleshooting is complete.
   [b] If code 1176/4 is not logged, and other codes are logged, troubleshoot the logged codes.
   [c] If code 1176/4 and other codes are logged, review this section to find the error. If no error is found, call the Detroit Diesel Customer Support Center (313–592–5800).

83 SPN 1188 - WASTEGATE VALVE CONTROL (AUX PWM #10)

Section **Page**

83.1 SPN 1188/FMI 3

This diagnosis is typically a short to power.

83.1.1 Short to Power Check

Check for short to power as follows:

1. Disconnect the wastegate valve connector.
2. Turn the ignition ON (key ON, engine OFF).
3. Measure the voltage between pin 3 of the wastegate valve connector and ground.
   [a] If the voltage is greater than 11.5 volts, repair the short to power between pin 3 of the wastegate valve connector and pin 35 of the 120–pin MCM connector.
   [b] If the voltage is less than 11.5 volts, go to step 4. See Figure 83-1.

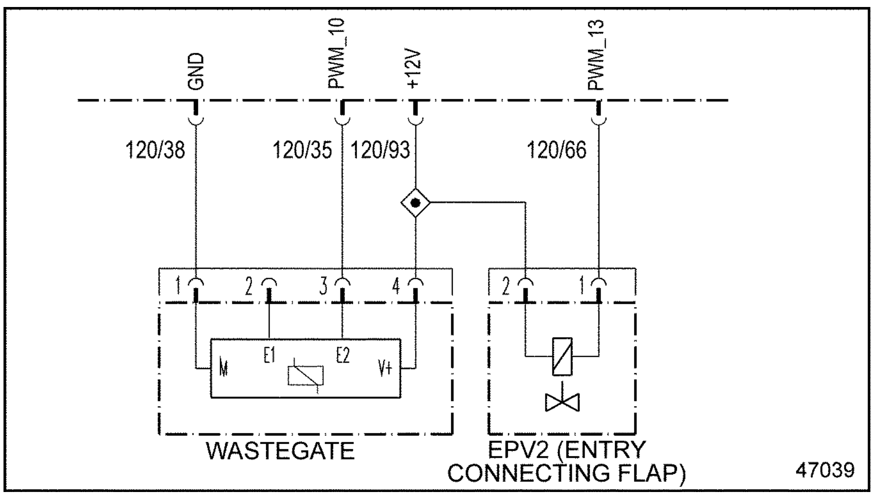


Figure 83-1 Wastegate

4. Turn the ignition OFF.
5. Disconnect the 120–pin MCM connector.
6. Measure the resistance between pins 3 and 4 of the wastegate valve connector.
   [a] If the resistance is less than 5 Ω, repair the short between pins 3 and 4 of the wastegate valve connector and pins 35 and 93 of the 120–pin MCM connector.
   [b] If the resistance is greater than 5 Ω, review steps 1 through 6. If the results are the same, contact the Detroit Diesel Customer Support Center (313–592–5800).

83.1.1.1 Verify Repairs

Verify repairs as follows:

1. Turn ignition OFF.

2. Reconnect any electrical connections that were disconnected to perform the diagnosis.
3. Clear codes with DDDL 7.0 or latest version.
4. Start and bring engine up to operating temperature (over 140°F/60°C).
5. Verify operation is satisfactory and no warning lamps illuminate. If warning lamps illuminate, troubleshoot the codes. If assistance is required, call the Detroit Diesel Customer Support Center at 313–592–5800.

83.2 SPN 1188/FMI 4

This diagnosis is typically a short to ground.

83.2.1 Short to Ground Check

Check for short as follows:

1. Check for multiple codes.
   - [a] If 706/4 is active with 1188/4, repair the short to ground on pin 93 of the MCM 120–pin connector and pin 4 of the wastegate valve and pin 2 of the EPV2 solenoid. Refer to section 83.2.1.1.
   - [b] If only 1188/4 is active, go to step 2.
2. Disconnect the wastegate valve connector.
3. Disconnect the 120–pin MCM connector.
4. Measure the resistance between pins 1 and 3 of the wastegate valve connector. See Figure 83-2.

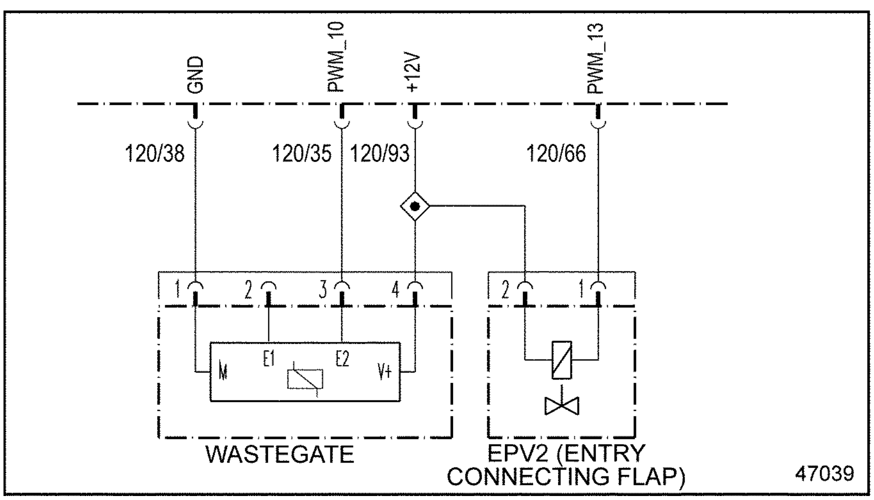


Figure 83-2 Wastegate

   - [a] If the resistance is less than 5 Ω, repair the short between pins 35 and 38 of the 120–pin MCM connector. Refer to section 83.2.1.1.

[b] If the resistance is greater than 5 Ω, go to step 5.

5. Measure the resistance between pin 3 of the wastegate valve connector and ground.

   [a] If the resistance is less than 5 Ω, repair the short between pin 3 of the wastegate valve connector and ground. Refer to section 83.2.1.1.

   [b] If the resistance is greater than 5 Ω, repeat steps 4 and 5. If the results are the same, contact the Detroit Diesel Customer Support Center (313–592–5800).

83.2.1.1 Verify Repairs

Verify repairs as follows:

1. Turn ignition OFF.
2. Reconnect any electrical connections that were disconnected to perform the diagnosis.
3. Clear codes with DDDL 7.0 or latest version.
4. Start and bring engine up to operating temperature (over 140°F/60°C).
5. Verify operation is satisfactory and no warning lamps illuminate. If warning lamps illuminate, troubleshoot the codes. If assistance is required, call the Detroit Diesel Customer Support Center at 313–592–5800.

83.3 SPN 1188/FMI 5

This diagnosis is typically an open circuit.

83.3.1 Open Circuit Check

Check for an open circuit as follows:

1. Check for multiple codes.

[a] If 706/5 is active with 1188/5, repair the open circuit between pin 93 of the MCM 120–pin connector and pin 4 of the wastegate valve and pin 2 of the EPV2 solenoid. See Figure 83-3. Refer to section 83.3.1.1.

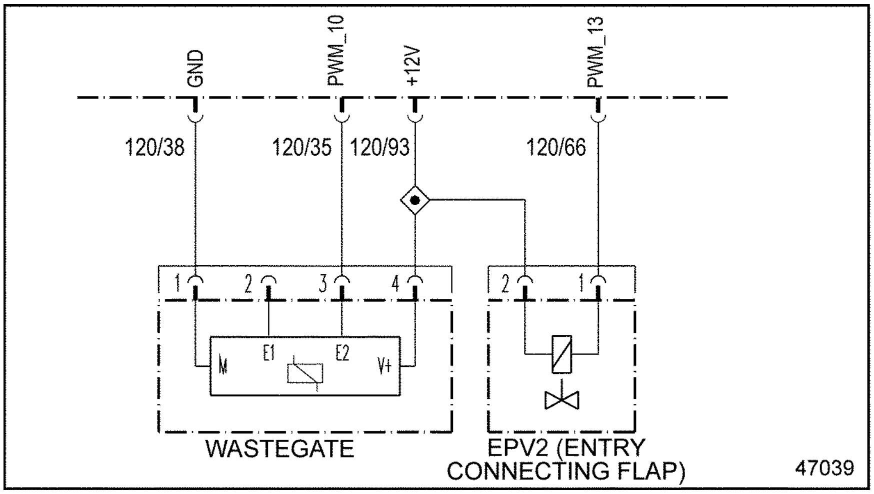


Figure 83-3 Wastegate

[b] If only 1188/4 is active, go to step 2.

2. Disconnect the wastegate valve connector.
3. Turn the ignition ON (key ON, engine OFF).
4. Measure the voltage between pins 1 and 4 of the wastegate valve connector.
   [a] If the voltage is between 11 and 13 volts, go to step 6.
   [b] If the voltage is less than 11 volts, go to step 5.
5. Measure the voltage between pin 4 of the wastegate valve connector and ground.
   [a] If the voltage is between 11 and 13 volts, then repair the open in the wire between pin 38 of the 120–pin MCM connector and pin 1 of the wastegate valve connector. Refer to section 83.3.1.1.
   [b] If the voltage is less than 11 volts, Repair the open in the wire between pin 93 of the 120–pin MCM connector and pin 4 of the wastegate valve connector.
6. Turn the ignition OFF.
7. Disconnect the 120–pin MCM connector.
8. Measure the resistance between pin 3 of the wastegate valve connector and pin 35 of the 120–pin MCM connector.
   [a] If the resistance is less than 3 Ω, repair the open circuit in the wire between pin 3 of the wastegate valve connector and pin 35 of the 120–pin MCM connector. Refer to section 83.3.1.1.
   [b] If the resistance is greater than 5Ω, replace the EPV3 solenoid.

83.3.1.1 Verify Repairs

Verify repairs as follows:

1. Turn ignition OFF.
2. Reconnect any electrical connections that were disconnected to perform the diagnosis.
3. Clear codes with DDDL 7.0 or latest version.
4. Start and bring engine up to operating temperature (over 140°F/60°C).
5. Verify operation is satisfactory and no warning lamps illuminate. If warning lamps illuminate, troubleshoot the codes. If assistance is required, call the Detroit Diesel Customer Support Center at 313–592–5800.

84 SPN 1590 (CPC) - J1939 ACC1 MESSAGE FROM ADAPTIVE CRUISE CONTROL IS MISSING

Section **Page**

84.1 SPN 1590/FMI 9

This fault is typically the J1939 ACC1 messag2 from Adaptive Cruise control is missing.

84.1.1 Missing J1939 ACC1 Message Check

Check as follows:

1. Check for multiple codes:
   [a] If CPC SPN 168/FMI 0/14/18 (Battery Voltage) are present troubleshoot these first.
   [b] If MCM SPN 625/FMI 9 is present, troubleshoot and repair the CAN line.
   [c] If only a “J1939 Error” fault is present, go to step 2.
2. Has the CPC been recently reprogrammed?
   [a] If yes, check the proper configuration of the CPC.
   [b] If no, connect ServiceLink to determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

85 SPN 1624 (CPC) - J1939 TCO1 MESSAGE IS MISSING AND TACHOGRAPH VEHICLE SPEED SIGNAL IS ERRATIC AND MISSING

85.1 SPN 1624/FMI 9

This fault is typically the J1939 TCO1 message is missing.

85.1.1 Missing TCO1 Message Check

Check as follows:

1. Check for multiple codes:
   [a] If CPC SPN 168/FMI 0/14/18 (Battery Voltage) are present troubleshoot these first.
   [b] If MCM SPN 625/FMI 9 is present, troubleshoot and repair the CAN line.
   [c] If only a “J1939 Error” fault is present, go to step 2.
2. Has the CPC been recently reprogrammed?
   [a] If yes, check the proper configuration of the CPC.
   [b] If no, connect ServiceLink to determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

85.2 SPN 1624/FMI 13

This fault is typically the tachograph vehicle speed signal is missing.

85.2.1 Missing Tachograph Vehicle Speed Signal Check

Check as follows:

1. Check for multiple codes:
   [a] If CPC SPN 168/FMI 0/14/18 (Battery Voltage) are present troubleshoot these first.
   [b] If MCM SPN 625/FMI 9 is present, troubleshoot and repair the CAN line.
   [c] If only a “J1939 Error” fault is present, go to step 2.
2. Has the CPC been recently reprogrammed?
   [a] If yes, check the proper configuration of the CPC.
   [b] If no, connect ServiceLink to determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

85.3 SPN 1624/FMI 19

This fault is typically the tachograph vehicle speed signal is erratic.

85.3.1 Erratic Tachograph Vehicle Speed Signal Check

Check as follows:

1. Check for multiple codes:
   [a] If CPC SPN 168/FMI 0/14/18 (Battery Voltage) are present troubleshoot these first.
   [b] If MCM SPN 625/FMI 9 is present, troubleshoot and repair the CAN line.
   [c] If only a "J1939 Error" fault is present, go to step 2.
2. Has the CPC been recently reprogrammed?
   [a] If yes, check the proper configuration of the CPC.
   [b] If no, connect ServiceLink to determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

86 SPN 1636 – INTAKE MANIFOLD TEMPERATURE OUTSIDE OF NORMAL OPERATING RANGE

86.1 SPN 1636 /FMI 2

This diagnostic condition is typically erratic data.

86.1.1 Erratic Data Source Check

Check for the source of erratic data as follows:

NOTE:
When diagnosing rationality erratic data faults always refer to any SIBs first for any known issues.

1. Check the air intake, CAC EGR system integrity and the intake throttle system integrity.
2. Connect the diagnostic tool.
3. Monitor the engine RPM, engine coolant temperature, intake manifold temperature, EGR temperature, EGR PW and EGR Delta P counts.
4. With the engine at idle and the coolant temperature above 160°, are the EGR PW less than 7% and the EGR Delta P counts less than 135 (NO EGR FLOW)? Is the intake manifold temperature within __ ° of the EGR temperature?
   [a] If yes, go to step 7.
   [b] If no, go to step 5.
5. Disconnect the Intake Manifold Pressure/Temp Sensor and the 120–pin MCM connector.
6. Bridge pins 1 and 2 of the Intake Manifold Pressure/Temp Sensor, measure the resistance at pins 52 and 106 of the 120–pin MCM connector.
   [a] If the resistance is greater than 3 Ω, repair the harness. Refer to section 86.1.1.1.
   [b] If the resistance is less than 3 Ω, replace the sensor. Refer to section 86.1.1.1.
7. With the engine running at 1500 rpm and coolant temperature above 160°, command EGR PW to 50% (EGR Delta P counts will also rise because of EGR flow). Is the intake manifold temperature within __° of the EGR temperature?
   [a] If yes, contact the Detroit Diesel Customer Support Center (313–592–5800).
   [b] If no, replace the sensor. Refer to section 86.1.1.1.

86.1.1.1 Verify Repairs

Perform the following steps to verify repairs.

1. Turn vehicle ignition OFF. Reconnect all connectors.
2. Turn ignition ON. Clear codes with diagnostic tool.
3. Start and run the engine for one minute. Stop the engine.
4. Check diagnostic tool for codes.

[a] If no codes are displayed, troubleshooting is complete.

[b] If code 1636/2 is not logged, and other codes are logged, troubleshoot the logged codes.

[c] If code 1636/2 and other codes are logged, review this section to find the error. If no error is found, call the Detroit Diesel Customer Support Center (313–592–5800).

86.2 SPN 1636/FMI 3

The diagnostic condition is typically Intake Manifold Temperature Sensor Open Circuit. The following procedures will troubleshoot SPN 1636/3.

86.2.1 Short to Power Check

Perform the following steps to troubleshoot a short to power fault:

1. With the Intake Manifold Pressure/Temperature Sensor connected, check for multiple codes.
   [a] If fault codes 1636/3 and 3563/3 are active, repair open circuit between pin 102 of the 120-pin MCM connector and pin 4 of the sensor. Refer to section 86.2.1.1.
   [b] If only fault code 1636/3 is active, go to step 2.
2. Disconnect the Intake Manifold Pressure/Temperature Sensor.
3. Disconnect the 120–pin MCM connector.
4. Measure the resistance between pins 3 and 4 of the Intake Manifold Pressure/Temperature Sensor harness connector.
   [a] If the resistance is less than 5 Ω, repair the short between pins 102 and 119 of the 120–pin MCM connector. See Figure 86-1. Refer to section 86.2.1.1.

[b] If the resistance is more than 5 Ω, repair the short to power on the circuit between pin 119 of the 120–pin MCM connector and pin 3 of the Intake Manifold Pressure/Temperature Sensor. See Figure 86-1. Refer to section 86.2.1.1.

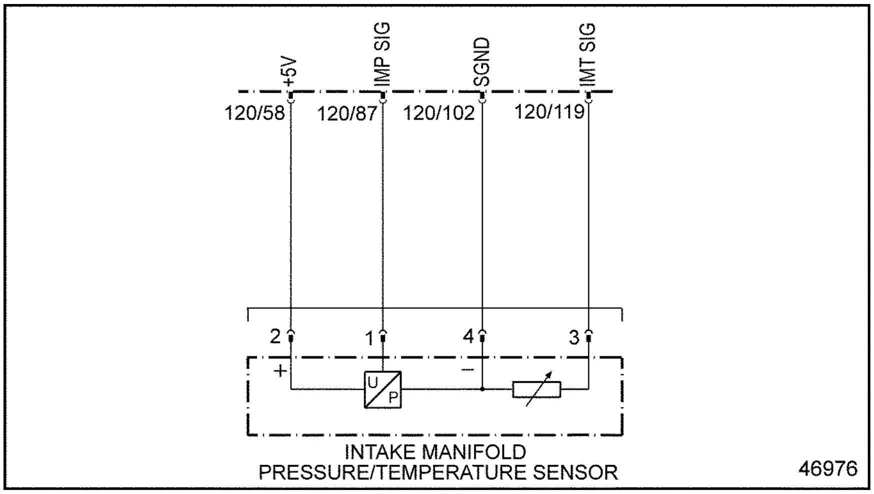


Figure 86-1 Intake Manifold Pressure/Temp Sensor Wiring

86.2.1.1 Verify Repairs

Perform the following steps to verify repairs.

1. Turn vehicle ignition OFF.
2. Reconnect all connectors.
3. Turn ignition ON.
4. Clear codes with diagnostic tool.
5. Start and run the engine for one minute.
6. Stop engine.
7. Check diagnostic tool for codes.

   [a] If no codes are displayed, troubleshooting is complete.

   [b] If code 1636/3 is not logged, and other codes are logged, troubleshoot the logged codes.

   [c] If code 1636/3 and other codes are logged, review this section to find the error. If no error is found, call the Detroit Diesel Customer Support Center (313–592–5800).

86.3 SPN 1636/FMI 4

A typical diagnosis is Intake Manifold Pressure/Temp Sensor Open Short to Ground.

86.3.1 Intake Manifold Pressure/Temp Sensor Open or Short to Ground Check

Perform the following steps to troubleshoot an Intake Manifold Pressure/Temp Sensor open or short to ground fault:

1. Check for multiple codes.
   - [a] If fault code 1636/4 and 3563 are both active, repair the open between pin 58 of the 120–pin MCM connector and pin 2 of the Intake Manifold Pressure/Temp Sensor. Refer to section 86.3.1.1.
   - [b] If only 1636/4 is active, go to step 2.
2. Disconnect the Intake Manifold Pressure/Temp Sensor.
3. Measure the resistance between pins 3 and 4 of the Intake Manifold Pressure/Temp Sensor.
   - [a] If resistance is greater than 130k Ω, replace the sensor. Refer to section 86.3.1.1.
   - [b] If resistance is less than 130k Ω, go to step 5.
4. Turn the ignition ON (key ON, engine OFF).
5. Measure the voltage between pin 3 of the Intake Manifold Pressure/Temp Sensor and ground.
   - [a] If the voltage is greater than 2.75 volts, go to step 6.
   - [b] If the voltage is less than 2.75 volts, repair the open between pin 3 of the Intake Manifold Pressure/Temp Sensor and pin 119 of the 120–pin MCM connector. See Figure 86-2. Refer to section 86.3.1.1.

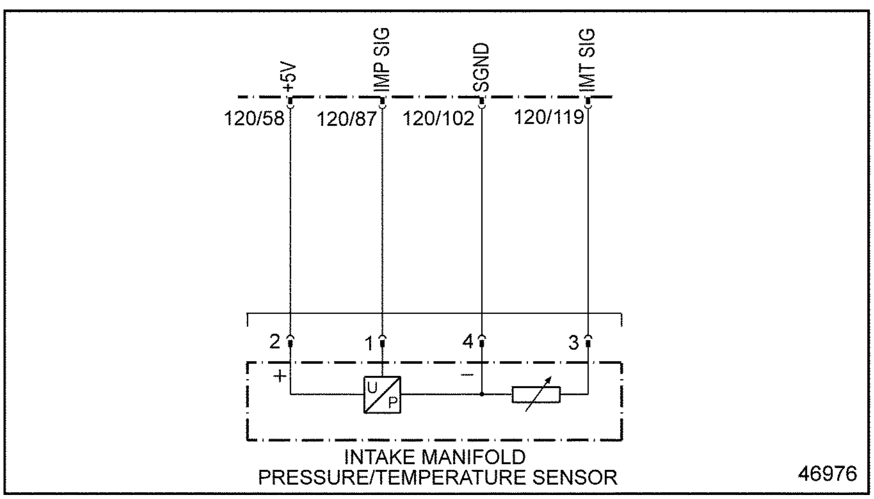


Figure 86-2 Intake Manifold Pressure/Temp Sensor Wiring

6. Turn the ignition OFF.
7. Disconnect the 120–pin MCM connector.
8. Measure the resistance between pins 3 and 4 of the Intake Manifold Pressure/Temp Sensor harness connector.
   [a] If resistance is greater than 5 Ω, repair the short to power on the circuit between pin 119 of the 120–pin MCM connector and pin 3 of the Intake Manifold Pressure/Temp Sensor harness connector. Refer to section 86.3.1.1.
   [b] If resistance is less than 5 Ω, repair the short between wires 102 and ‘119 of the 120–pin MCM connector. Refer to section 86.3.1.1.

86.3.1.1 Verify Repairs

Perform the following steps to verify repairs.

1. Turn vehicle ignition OFF.
2. Reconnect all connectors.
3. Turn ignition ON.
4. Clear codes with diagnostic tool.
5. Start and run the engine for one minute.
6. Stop engine.
7. Check diagnostic tool for codes.
   [a] If no codes are displayed, troubleshooting is complete.
   [b] If code 1636/4 is not logged, and other codes are logged, troubleshoot the logged codes.
   [c] If code 1636/4 and other codes are logged, review this section to find the error. If no error is found, call the Detroit Diesel Customer Support Center (313–592–5800).

86.4 SPN 1636/FMI 14

This code indicates that the Intake Manifold Temperature Sensor has failed a self test.

86.4.1 Temperature Check

Check the temperature as follows:

NOTE:
Prior to performing this diagnostic procedure the engine must have a minimum of a three hour soak (cool down).

1. Connect DDDL 7.0.
2. Turn the ignition ON (key ON, engine OFF).

3. Monitor the intake manifold, engine oil, engine coolant, EGR and turbo outlet temperature parameters.
4. Are any of the temperature readings 15°F greater or less than that of the other sensors?
   [a] If yes, inspect the suspect temperature sensors electrical connector for corrosion, bent or spread pins, repair as necessary. If there are no repairs, replace suspect temperature sensor. Refer to section 86.4.1.1.
   [b] If no, go to step 5.
5. Prepare DDDL 7.0 for a snapshot.
6. Start the engine, idle for 30 seconds, then TURN THE ENGINE OFF.
7. Review the intake manifold, engine oil, engine coolant, EGR and turbo outlet temperature parameters on snapshot.
8. Are any of the temperature readings 20°F greater or less than that of the other sensors?
   [a] If yes, inspect the suspect temperature sensors electrical connector for corrosion, bent or spread pins, repair as necessary. If there are no repairs, replace suspect temperature sensor. Refer to section 86.4.1.1.
   [b] If no, review steps 3 through 8. If the results are the same, contact the Detroit Diesel Customer Support Center (313–592–5800).

86.4.1.1 Verify Repairs

Perform the following steps to verify repairs.

1. Turn vehicle ignition OFF. Reconnect all connectors.
2. Turn ignition ON. Clear codes with diagnostic tool.
3. Start and run the engine for one minute. Stop the engine.
4. Check diagnostic tool for codes.
   [a] If no codes are displayed, troubleshooting is complete.
   [b] If code 1636/14 is not logged, and other codes are logged, troubleshoot the logged codes.
   [c] If code 1636/14 and other codes are logged, review this section to find the error. If no error is found, call the Detroit Diesel Customer Support Center (313–592–5800).

87 SPN 1716 (CPC) - J1939 ERC1 MESSAGE IS MISSING

Section **Page**

87.1 SPN 1716/FMI 9

This fault is typically the J1939 ERC1 message is missing.

87.1.1 Missing ERC1 Message Check

Check as follows:

1. Check for multiple codes:
   [a] If CPC SPN 168/FMI 0/14/18 (Battery Voltage) are present troubleshoot these first.
   [b] If MCM SPN 625/FMI 9 is present, troubleshoot and repair the CAN line.
   [c] If only a “J1939 Error” fault is present, go to step 2.
2. Has the CPC been recently reprogrammed?
   [a] If yes, check the proper configuration of the CPC.
   [b] If no, connect ServiceLink to determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

88 SPN 1845 (CPC) - J1939 TCFG2 MESSAGE IS MISSING

Section **Page**

88.1 SPN 1845/FMI 9

This fault is typically the J1939 TCFG2 message is missing.

88.1.1 Missing TCFG2 Message Check

Check as follows:

1. Check for multiple codes:
   [a] If CPC SPN 168/FMI 0/14/18 (Battery Voltage) are present troubleshoot these first.
   [b] If MCM SPN 625/FMI 9 is present, troubleshoot and repair the CAN line.
   [c] If only a "J1939 Error" fault is present, go to step 2.
2. Has the CPC been recently reprogrammed?
   [a] If yes, check the proper configuration of the CPC.
   [b] If no, connect ServiceLink to determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

89 SPN 2623 (CPC) - PWM ACCELERATOR PEDAL GAS1 AND GAS2 SIGNAL MISSING

Section **Page**

89.1 SPN 2623/FMI 4

This fault is typically the PWM Accelerator Pedal J1939 GAS2 signal is missing.

89.1.1 Missing PWM Accelerator Pedal GAS2 Signal Check

Check as follows:

1. Check for multiple codes:
   [a] If CPC SPN 168/FMI 0/14/18 (Battery Voltage) are present troubleshoot these first.
   [b] If MCM SPN 625/FMI 9 is present, troubleshoot and repair the CAN line.
   [c] If only a "J1939 Error" fault is present, go to step 2.
2. Has the CPC been recently reprogrammed?
   [a] If yes, check the proper configuration of the CPC.
   [b] If no, connect ServiceLink to determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

89.2 SPN 2623/FMI 14

This fault is typically the PWM Accelerator Pedal J1939 GAS1 and GAS2 signals are missing..

89.2.1 Missing PWM Accelerator Pedal GAS1 and GAS2 Signal Check

Check as follows:

1. Check for multiple codes:
   [a] If CPC SPN 168/FMI 0/14/18 (Battery Voltage) are present troubleshoot these first.
   [b] If MCM SPN 625/FMI 9 is present, troubleshoot and repair the CAN line.
   [c] If only a "J1939 Error" fault is present, go to step 2.
2. Has the CPC been recently reprogrammed?
   [a] If yes, check the proper configuration of the CPC.
   [b] If no, connect ServiceLink to determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

90 SPN 2791 – EGR VALVE (AUX PWM #1) FAILED OR OPEN CIRCUIT

90.1 SPN 2791/FMI 3

This diagnostic condition is typically a short to power fault.

90.1.1 Short Circuit Check

Check for short as follows:

1. Disconnect the EGR valve connector.
2. Turn the ignition ON (key ON, engine OFF).
3. Measure the voltage between pin 1 of the EGR valve connector and ground.
   [a] If the voltage is greater than 11.5 volts, repair the short to power between pin 1 of the EGR valve connector and pin 61 of the 120–pin MCM connector. Refer to section 90.1.2.1.
   [b] If the voltage is less than 11.5 volts, go to step 4.
4. Turn the ignition OFF.
5. Disconnect the 120–pin MCM connector.
6. Measure the resistance between pin 1 and pin 2 of the EGR valve connector.
   [a] If the resistance is less than 5 Ω, repair the short between pin 1 and pin 2 of the EGR valve connector and pin 61 and 62 of the 120–pin MCM connector. Refer to section 90.1.2.1
   [b] If the resistance is less than 5 Ω, refer to section 90.1.2.

90.1.2 Resistance and Voltage Check

The resistance and voltage check performed indicate that you should not be getting a code. The following is a recheck before requesting a new MCM.

1. Turn ignition ON. Reconnect all connectors.
2. Clear codes with diagnostic tool.
3. Start and run the engine for one minute. Stop engine.
4. Measure the voltage between pin 1 of the EGR valve connector and ground.
   [a] If the voltage is greater than 11.5 volts, repair the short to power between pin 1 of the EGR valve connector and pin 61 of the 120–pin MCM connector. Refer to section 90.1.2.1.
   [b] If the voltage is less than 11.5 volts, go to step 5.
5. Turn the ignition switch to the OFF position.
6. Disconnect the 120–pin MCM connector.
7. Measure the resistance between pin 1 and pin 2 of the EGR valve connector.

[a] If the resistance is less than 5 Ω, repair the short between pin 1 and pin 2 of the EGR valve connector and pin 61 and 62 of the 120–pin MCM connector. Refer to section 90.1.2.1.

[b] If the resistance is less than 5 Ω, call the Detroit Diesel Customer Support Center (313–592–5800) for authorization to replace the MCM.

90.1.2.1 Verify Repairs

Verify repairs as follows:

1. Turn the vehicle OFF. Reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes

   [a] If no codes are present, troubleshooting is complete.

   [b] If code 2791/3 is not logged but other codes are logged, troubleshoot the other codes.

   [c] If code 2791/3 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313–592–5800).

90.2 SPN 2791/FMI 4

This diagnosis is typically short to ground.

90.2.1 Short Circuit Check

Check for a short as follows:

1. Disconnect EGR valve connector.
2. Disconnect 120–pin MCM connector.
3. Measure the resistance between pin 1 of the EGR valve connector and ground.
    [a] If the resistance is less than 5 Ω, repair the short circuit between pin 1 of the EGR valve connector and ground. Refer to section 90.2.2.1.
    [b] If the resistance is greater than 5 Ω, go to step 4.
4. Measure the resistance between pin 2 of the EGR valve connector and ground.
    [a] If the resistance is less than 5 Ω, repair the short circuit between pin 2 of the EGR valve connector and ground. Refer to section 90.2.2.1.
    [b] If the resistance is greater than 5 Ω, Refer to section 90.2.2.1.

90.2.2 Resistance and Voltage Check

The resistance and voltage check performed indicate that you should not be getting a code. The following is a recheck before requesting a new MCM.

1. Reconnect all connectors.
2. Turn the ignition ON (key ON, engine OFF), and clear codes.
3. Disconnect EGR valve connector.
4. Disconnect 120–pin MCM connector.
5. Measure the resistance between pin 1 of the EGR valve connector and ground.
    [a] If the resistance is less than 5 Ω, repair the short circuit between pin 1 of the EGR valve connector and ground. Refer to section 90.2.2.1.
    [b] If the resistance is greater than 5 Ω, go to step 6.
6. Measure the resistance between pin 2 of the EGR valve connector and ground.
    [a] If the resistance is less than 5 Ω, repair the short circuit between pin 2 of the EGR valve connector and ground. Refer to section 90.2.2.1.
    [b] If the resistance is greater than 5 Ω, call the Detroit Diesel Customer Support Center (313–592–5800) for authorization to replace the MCM.

90.2.2.1 Verify Repairs

Verify repairs as follows:

1. Turn the vehicle ignition OFF and reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
   [a] If no codes are present, troubleshooting is complete.
   [b] If code 2791/4 is not logged but other codes are logged, troubleshoot the other codes.
   [c] If code 2791/4 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313–592–5800).

90.3 SPN 2791/FMI 5

This diagnostic condition is typically an open circuit fault.

90.3.1 Open Circuit Check

Check for open as follows:

1. Disconnect the EGR valve connector.
2. Turn the ignition ON (key ON, engine OFF).
3. Measure the voltage between pin 2 and pin 3 of the EGR valve connector.
   [a] If the voltage is between 11 and 13 volts, go to step 6.
   [b] If the voltage is less than 11 volts, go to step 4.
4. Measure voltage between pin 2 of EGR valve connector and ground.
   [a] If the voltage is between 11 and 13 volts, repair the open in the wire between pin 95 of the 120–pin MCM connector and pin 3 of the EGR valve connector. Refer to section 90.3.1.1.
   [b] If the voltage is less than 11 volts, go to step 5.
5. Turn the ignition OFF and measure the resistance between pin 2 of EGR valve connector and pin 62 of the 120–pin MCM connector.
   [a] If the resistance is greater than 3 Ω, repair the open circuit in the wire between pin 62 of the 120–pin MCM connector and pin 2 of EGR valve connector. Refer to section 90.3.1.1.
   [b] If the resistance is less than 3 Ω, replace the MCM.
6. Turn the ignition OFF and measure the resistance between pin 1 of the EGR valve connector and pin 61 of the 120–pin MCM connector.

[a] If the resistance is greater than 3 Ω, repair the open circuit in the wire between pin 61 of the 120–pin MCM connector and pin 1 of EGR valve connector. Refer to section 90.3.1.1.

[b] If the resistance is less than 3 Ω, replace the EGR valve.

90.3.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the vehicle ignition OFF and reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
   [a] If no codes are present, troubleshooting is complete.
   [b] If code 2791/5 is not logged but other codes are logged, troubleshoot the other codes.
   [c] If code 2791/5 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313–592–5800).

91 SPN 2795 - CAN COMMUNICATION ERROR

Section **Page**

91.1 SPN 2795/FMI 9

This diagnosis is typically a CAN3 communication error.

91.1.1 CAN3 Check

Check as follows:

1. Check for multiple codes.
   [a] If codes other than SPN 2795/FMI 9 are present, repair those first.
   [b] If only SPN 2795/FMI 9 is present, go to step 2.
2. Disconnect the turbo actuator connector.
3. Turn the ignition ON (key ON, engine OFF).
4. Measure the voltage between pin 1 of the turbo actuator connector and ground.
   [a] If the voltage is less than 11 volts, repair the cause of low or no voltage between pin 1 of the turbo actuator connector and pin 93 of the MCM 120–pin connector. Refer to section 91.1.1.1.
   [b] If the voltage is greater than 11 volts, go to step 5.
5. Turn the ignition OFF.
6. Disconnect the MCM 120–pin connector.
7. Measure the resistance between pin 4 of the turbo actuator connector and ground.
   [a] If the resistance is less than 5 Ω, repair the short to ground between pin 4 of the turbo actuator connector and pin 75 of the MCM 120–pin connector. Refer to section 91.1.1.1.
   [b] If the resistance is greater than 5 Ω, go to step 8.
8. Measure the resistance between pin 2 of the turbo actuator connector and pin 38 of the MCM 120–pin connector.
   [a] If the resistance is greater than 5 Ω, repair the open between pin 2 of the turbo actuator connector and pin 38 of the MCM 120–pin connector. Refer to section 91.1.1.1.
   [b] If the resistance is less than 5 Ω, go to step 9.
9. Measure the resistance between pin 3 of the turbo actuator connector and pin 74 of the MCM 120–pin connector.
   [a] If the resistance is greater than 5 Ω, repair the open between pin 3 of the turbo actuator connector and pin 74 of the MCM 120–pin connector. Refer to section 91.1.1.1.
   [b] If the resistance is less than 5 Ω, go to step 10.
10. Measure the resistance between pin 4 of the turbo actuator connector and pin 75 of the MCM 120–pin connector.

[a] If the resistance is greater than 5 Ω, repair the open between pin 4 of the turbo actuator connector and pin 75 of the MCM 120–pin connector. Refer to section 91.1.1.1.

[b] If the resistance is less than 5 Ω, replace the turbo actuator. Refer to section 91.1.1.1.

91.1.1.1 Verify Repairs

Verify repairs as follows:

1. Turn ignition OFF.
2. Reconnect any electrical connections that were disconnected to perform the diagnosis.
3. Clear codes with DDDL 7.0 or latest version.
4. Start and bring engine up to operating temperature (over 140°F/60°C).
5. Verify operation is satisfactory and no warning lamps illuminate. If warning lamps illuminate, troubleshoot the codes. If assistance is required, call the Detroit Diesel Customer Support Center at 313–592–5800.

92 SPN 2900 (CPC) - J1939 ETC7 MESSAGE IS MISSING

Section **Page**

92.1 SPN 2900/FMI 9

This fault is typically the J1939 ETC7 message is missing.

92.1.1 Missing ETC7 Message Check

Check as follows:

1. Check for multiple codes:
   [a] If CPC SPN 168/FMI 0/14/18 (Battery Voltage) are present troubleshoot these first.
   [b] If MCM SPN 625/FMI 9 is present, troubleshoot and repair the CAN line.
   [c] If only a “J1939 Error” fault is present, go to step 2.
2. Has the CPC been recently reprogrammed?
   [a] If yes, check the proper configuration of the CPC.
   [b] If no, connect ServiceLink to determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

93 SPN 3242 - DOC INLET TEMPERATURE SENSOR ABOVE OR BELOW NORMAL OPERATING RANGE

Section **Page**

93.1 SPN 3242/FMI 2, 3, 4 OR 10

The troubleshooting procedures for this SPN can be found in the *Aftertreatment System Technician's Guide* (7SE63), refer to Chapter 9.

94 SPN 3246 - DPF OUTLET TEMPERATURE SENSOR OPERATING ABOVE OR BELOW NORMAL

Section **Page**

94.1 SPN 3246/FMI 0, 2, 3, 4, 10, 14, 31

The troubleshooting procedures for this SPN can be found in the *Aftertreatment System Technician's Guide* (7SE63), refer to Chapter 10.

95 SPN 3250 - DPF INLET TEMPERATURE SENSOR ABOVE OR BELOW NORMAL OPERATING RANGE

Section **Page**

95.1 SPN 3250/FMI 0, 2, 3, 4, 10, 14, 31

The troubleshooting procedures for this SPN can be found in the *Aftertreatment System Technician's Guide* (7SE63), refer to Chapter 11.

96 SPN 3251 - DPF OUTLET PRESSURE ABOVE OR BELOW NORMAL OPERATING RANGE

Section **Page**

96.1 SPN 3251/FMI 0, 1 OR 16

The troubleshooting procedures for this SPN can be found in the *Aftertreatment System Technician's Guide* (7SE63), refer to Chapter 12.

97 SPN 3471 - ELECTRONIC DOSING VALVE SENSOR ABOVE OR BELOW NORMAL OPERATING RANGE

97.1 SPN 3471/FMI 1, 3, 4 OR 5

The troubleshooting procedures for this SPN can be found in the *Aftertreatment System Technician's Guide* (7SE63), refer to Chapter 13.

98 SPN 3480 - FUEL LINE PRESSURE SENSOR ABOVE OR BELOW NORMAL OPERATING RANGE

Section **Page**

98.1 SPN 3480/FMI 1, 2 OR 14

The troubleshooting procedures for this SPN can be found in the *Aftertreatment System Technician's Guide* (7SE63), refer to Chapter 14.

99 SPN 3482 - FUEL CUTOFF VALVE SENSOR ABOVE OR BELOW NORMAL OPERATING RANGE

Section **Page**

99.1 SPN 3482/FMI 3, 4, 5 OR 7

The troubleshooting procedures for this SPN can be found in the Aftertreatment System Technician's Guide (7SE63), refer to Chapter 15.

100 SPN 3509 - MULTIPLEXER 1 CHANNEL 1 OR 2 SHORT OR OPEN CIRCUIT HIGH

Section **Page**

100.1 SPN 3509/FMI 3

This diagnosis typically is Multiplexer 1, Channel 1 or 2 has a short or open circuit high.

100.1.1 Channel 1

Multiplexer 1 Channel 1, shorted high will set if the input voltage from either the DOC Temp In, DOC Temp Out or DPF Temp Out exceeds 2.97 volts, which may be caused by a short circuit, or more likely an open circuit. This is an information code only indicating a default value will be used for the other sensor inputs.

100.1.2 Channel 2

Multiplexer 1 Channel 2, shorted high will set if the input voltage from the Turbo Compressor Inlet Temperature Sensor exceeds 2.97 volts, which may be caused by a short circuit, or more likely an open circuit. This is an information code only indicating a default value will be used for the sensor input.

101 SPN 3510 - MULTIPLEXER 2 CHANNEL 1 OR 2 SHORT OR OPEN CIRCUIT HIGH

Section **Page**

101.1 SPN 3510/FMI 3

This diagnosis is typically Multiplexer 2 Channel 1 or 2 short or open circuit high.

101.1.1 Channel 1

Multiplexer 2 Channel 1, shorted high will set if the input voltage from either the Engine Coolant Temperature Sensor, EGR Temperature Sensor or Turbo Compressor Outlet Temperature Sensor exceeds 2.97 volts, which may be caused by a short circuit, or more likely an open circuit. This is an information code only indicating a default value will be used for the other sensor inputs.

101.1.2 Channel 2

Multiplexer 2 Channel 2, shorted high will set if the input voltage from either the Engine Oil Temperature Sensor or Engine Fuel Temperature Sensor exceeds 2.97 volts, which may be caused by a short circuit, or more likely an open circuit. This is an information code only indicating a default value will be used for the other sensor inputs.

102 SPN 3510 — ACCELERATOR PEDAL SUPPLY OUTSIDE OF NORMAL OPERATING RANGE

Section **Page**

102.1 SPN 3510/FMI 2

This fault indicates that the throttle pedal supply is receiving erratic data.

102.1.1 Erratic Data Check

Check for erratic data as follows:

1. Disconnect the Accelerator Pedal (AP).
2. Turn the ignition ON (key ON, engine OFF).
3. Measure the voltage between pins 1 and 3 of the AP harness connector. See Figure 102-1.

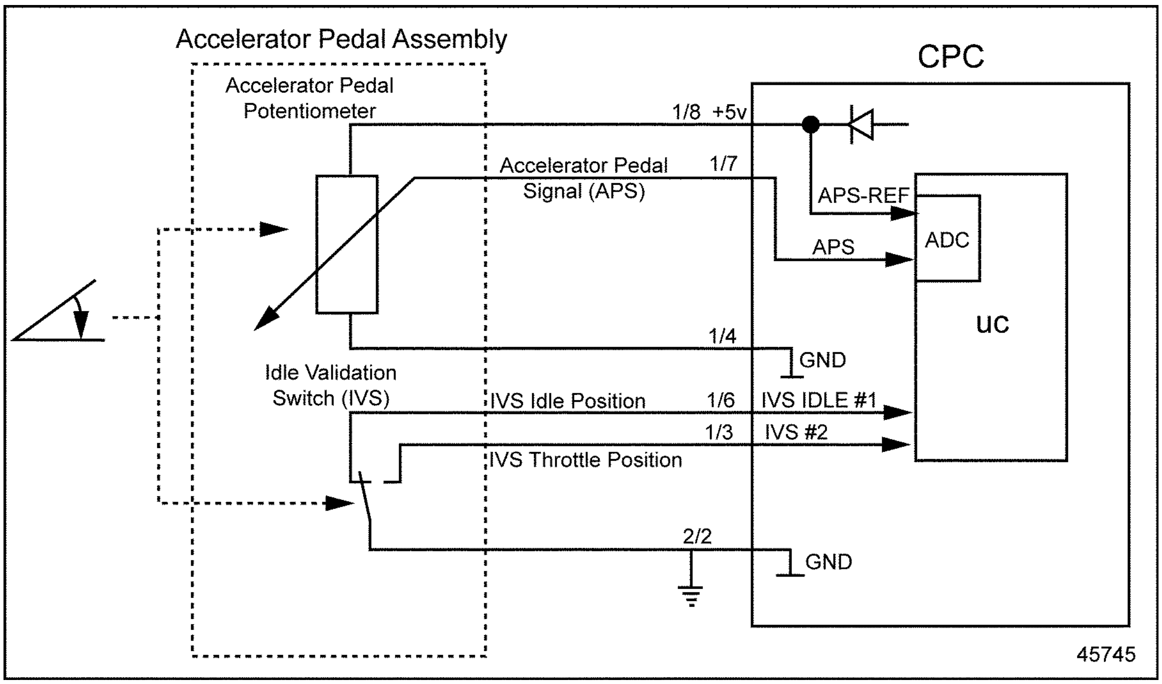


Figure 102-1 Accelerator Pedal Assembly Installation

[a] If the voltage is between 4.5 and 5.5 volts, go to step 5.

[b] If the voltage is less than 4.5, go to step 4.

4. Measure the voltage between pins 1 of the AP harness connector and ground.

   [a] If the voltage is between 4.5 and 5.5 volts, repair the open circuit between pin 3 of the AP harness connector and pin 4 of the CPC #1 connector. Refer to section 102.1.1.1.

   [b] If the voltage is less than 4.5, repair the open circuit between pin 1 of the AP harness connector and pin 8 of the CPC #1 connector. Refer to section 102.1.1.1.

5. Turn the ignition switch to the OFF position.
6. Disconnect the CPC #1 connector.

7. Measure the resistance between pin 2 of the AP harness connector and pin 7 of the CPC #1 connector.
   [a] If the resistance is greater than 3 Ω, repair the open between pin 2 of the AP harness connector and pin 7 of the CPC #1 connector. Refer to section 102.1.1.1.
   [b] If the resistance is less than 3 Ω, replace the Accelerator Pedal. Refer to section 102.1.1.1.

102.1.1.1 Verify Repairs

Verify repairs as follows:

1. Turn vehicle ignition OFF.
2. Reconnect all connectors. Turn ignition ON.
3. Clear codes with diagnostic tool.
4. Start and run the engine for one minute. Stop engine.
5. Check diagnostic tool for codes.
   [a] If no codes are displayed, troubleshooting is complete.
   [b] If code 3510/2 is not logged, and other codes are logged, troubleshoot the logged codes.
   [c] If code 3510/2 and other codes are logged, review this section to find the error. If no error is found, call the Detroit Diesel Customer Support Center (313–592–5800).

102.2 SPN 3510/FMI 3

The typical diagnosis for this fault is high voltage.

102.2.1 High Voltage Check

Check for high voltage as follows:

1. Disconnect the Accelerator Pedal (AP).
2. Turn the ignition ON (key ON, engine OFF).
3. Measure the voltage between pins 1 and 3 of the AP harness connector.
   - [a] If the voltage is between 4.5 and 5.5 volts, go to step 5.
   - [b] If the voltage is less than 4.5, go to step 4.
4. Measure the voltage between pins 1 of the AP harness connector and ground.
   - [a] If the voltage is between 4.5 and 5.5 volts, repair the open circuit between pin 3 of the AP harness connector and pin 4 of the CPC #1 connector. Refer to section 102.2.1.1.
   - [b] If the voltage is less than 4.5, repair the open circuit between pin 1 of the AP harness connector and pin 8 of the CPC #1 connector. Refer to section 102.2.1.1.
5. Turn the ignition OFF.
6. Disconnect the CPC #1 connector.
7. Measure the resistance between pin 2 of the AP harness connector and pin 7 of the CPC #1 connector.
   - [a] Measure the resistance between pin 2 of the AP harness connector and pin 7 of the CPC #1 connector. Refer to section 102.2.1.1.
   - [b] If the resistance is less than 3 Ω, replace the Accelerator Pedal. Refer to section 102.2.1.1.

102.2.1.1 Verify Repairs

Verify repairs as follows:

1. Turn vehicle ignition OFF.
2. Reconnect all connectors. Turn ignition ON.
3. Clear codes with diagnostic tool.
4. Start and run the engine for one minute. Stop engine.
5. Check diagnostic tool for codes.
   - [a] If no codes are displayed, troubleshooting is complete.
   - [b] If code 3510/3 is not logged, and other codes are logged, troubleshoot the logged codes.

[c] If code 3510/3 and other codes are logged, review this section to find the error. If no error is found, call the Detroit Diesel Customer Support Center (313–592–5800).

102.3 SPN 3510/FMI 4

The typical diagnosis for this fault is voltage low.

102.3.1 Low Voltage Check

Perform the following steps to troubleshoot low voltage.

1. Disconnect the Accelerator Pedal (AP) connector.
2. Disconnect the #1 connector of the CPC.
3. Measure the resistance between pin 1 and pin 3 of the AP connector.
   - [a] If the resistance is less than 5 Ω, repair the short between wires 8 and 4 of the CPC #1 connector. Refer to section 102.3.1.1.
   - [b] If the resistance is greater than 5 Ω, go to step 4.
4. Measure the resistance between pin 2 and 3 of the AP connector.
   - [a] If the resistance is less than 5 Ω, repair the short between wires 7 and 14 of the CPC #! connector. Refer to section 102.3.1.1.
   - [b] If the resistance is greater than 5 Ω, go to step 5.
5. Measure the resistance between pin 1 of the AP connector and ground.
   - [a] If the resistance is less than 5 Ω, repair the short circuit between pin 1 of the AP connector and ground. Refer to section 102.3.1.1.
   - [b] If the resistance is greater than 5 Ω, go to step 6.
6. Measure the resistance between pin 2 of the AP connector and ground.
   - [a] If the resistance is less than 5 Ω, repair the short circuit between pin 2 of the AP connector and ground. Refer to section 102.3.1.1.
   - [b] If the resistance is greater than 5 Ω, replace the Accelerator Pedal. Refer to section 102.3.1.1.

102.3.1.1 Verify Repairs

Verify repairs as follows:

1. Turn vehicle ignition OFF.
2. Reconnect all connectors. Turn ignition ON.
3. Clear codes with diagnostic tool.
4. Start and run the engine for one minute. Stop engine.
5. Check diagnostic tool for codes.
   [a] If no codes are displayed, troubleshooting is complete.
   [b] If code 3510/4 is not logged, and other codes are logged, troubleshoot the logged codes.
   [c] If code 3510/4 and other codes are logged, review this section to find the error. If no error is found, call the Detroit Diesel Customer Support Center (313–592–5800).

103 SPN 3511 - MULTIPLEXER 3 CHANNEL 1 0R 2 SHORT OR OPEN CIRCUIT HIGH

Section **Page**

103.1 SPN 3511/FMI 3

This diagnosis typically is Multiplexer 3, Channel 1 or 2 has a short or open circuit high.

103.1.1 Channel 1

Multiplexer 3 Channel 1, shorted high will set if the input voltage from either the Intake Manifold Temperature Sensor, Engine Oil Temperature Sensor, Engine Coolant Temperature Sensor or Engine Fuel Temperature Sensor exceeds 2.97 volts, which may be caused by a short circuit, or more likely an open circuit. This is an information code only indicating a default value will be used for the other sensor inputs.

103.1.2 Channel 2

Multiplexer 3 Channel 2, shorted high will set if the input voltage from the Barometric Pressure Sensor exceeds 2.97 volts, which may be caused by a short circuit, or more likely an open circuit. This is an information code only indicating a default value will be used for the sensor input.

104 SPN 3556 - ELECTRONIC DOSING VALVE ABOVE OR BELOW NORMAL OPERATING RANGE

104.1 SPN 3556/FMI 0 OR 1

The troubleshooting procedures for this SPN can be found in the *Aftertreatment System Technician's Guide* (7SE63), refer to Chapter 16.

105 SPN 3563 – INTAKE MANIFOLD PRESSURE OUTSIDE NORMAL RANGE

Section **Page**

105.1 SPN 3563/FMI 0/1/2

The following procedures will troubleshoot SPN 3563/FMI 0/1/2, intake manifold pressure high or low or erratic data.

105.1.1 Code Check

Perform the following steps to check for codes:

1. Turn the ignition ON (key ON, engine OFF).
2. Using the diagnostic tool, check for codes
3. Check for historic fault codes in addition to 3563/0/1/2.
   - [a] If other historic fault codes are present, troubleshoot other fault codes first.
   - [b] If only fault code 3563/0 or 3563/1 or 3563/2 is present, refer to section 105.1.2.

105.1.2 Low (Boost) Pressure Check

Check as follows:

1. Check for a restricted air filter or air intake system.
   - [a] If the air filter or air intake system is restricted, replace the air filter and/or eliminate the restriction in the air intake system. Refer to section 105.1.3.1.
   - [b] If the air filter or air intake system is not restricted, go to step 2.
2. Check the condition of the boost air sensor.
   - [a] If sensor is not in good condition, replace sensor. Refer to section 105.1.3.1.
   - [b] If sensor is in good condition, go to step 3.
3. Visually inspect the CAC (charge air cooler) and the CAC hoses for leaks.
   - [a] If leaks are found, repair or replace the CAC and/or CAC hoses. Refer to section 105.1.3.1.
   - [b] If no leaks are found, go to step 4.
4. Check for a faulty turbocharger (compressor wheel does not spin freely or is rubbing on side walls).
   - [a] If the turbocharger is faulty, replace it. Refer to section 105.1.3.1.
   - [b] If the turbocharger is not faulty, go to step 5.
5. Verify that fuel delivery is within specifications (no restrictions to fuel flow).
   - [a] If fuel delivery is not within specifications, eliminate restrictions in fuel delivery system. Refer to section 105.1.3.1.
   - [b] If fuel delivery is within specifications, check for erratic data. Refer to section 105.1.3.

105.1.3 Erratic Data Check

Check for erratic data as follows:

1. Turn the ignition ON (key ON, engine OFF).
2. Find the altitude for your local area and use Table 1 to determine the kPa value for the local altitude.
3. Open DDDL 7.0 7.0 and change the units to metric. (Tool menu > Options > Metric).
4. Using DDDL 7.0, read the value of the Barometric Pressure Sensor. The value should be within X kPa of the value in Table 1.
   [a] If the value is greater than X kPa, replace the Intake Manifold Pressure/Temp Sensor. Refer to section 105.1.3.1.
   [b] If the value is less than X kPa,, go to step 5.
5. Using DDDL 7.0, read the value of the Barometric Pressure Sensor. The value should be within X kPa of the value in Table 1.
   [a] If the value is greater than X kPa, replace the Barometric Pressure Sensor. Due to its location in the MCM, replacing the Barometric Pressure Sensor means replacing the MCM.Refer to section 105.1.3.1.
   [b] If the value is less than X kPa,, go to step 6.
6. Start the engine and run at idle.
7. Using DDDL 7.0, read the value of the Intake Manifold Pressure/Temp Sensor (boost pressure). The value should be within X kPa of 0.00.
   [a] If the value is not within X kPa, replace the Intake Manifold Pressure/Temp Sensor. Refer to section 105.1.3.1.
   [b] If the value is within X kPa, go to step 8.
8. Using DDDL 7.0, read the value of the Barometric Pressure Sensor.
   [a] If the value is not within X kPa, replace the Barometric Pressure Sensor. Due to its location in the MCM, replacing the Barometric Pressure Sensor means replacing the MCM.Refer to section 105.1.3.1.
   [b] If the value is within X kPa,, go to step 9.
9. Run the engine to 1500 rpm.
10. Using DDDL 7.0, read the value of the Intake Manifold Pressure/Temp Sensor (boost pressure). The value should be X kPa at 1500 rpm.
    [a] If the value is not within 2 kPa, replace the sensor.
    [b] If the value is within 2 kPa, go to step 11.
11. Using DDDL 7.0, read the value of the Barometric Pressure Sensor.

[a] If the value is not within X kPa, replace the Barometric Pressure Sensor. Due to its location in the MCM, replacing the Barometric Pressure Sensor means replacing the MCM.Refer to section 105.1.3.1.

[b] If the value is within X kPa, contact Detroit Diesel Customer Support Center (313–592–5800).

105.1.3.1 Verify Repairs

Perform the following steps to verify repairs.

1. Turn vehicle ignition OFF.
2. Reconnect all connectors. Turn ignition ON.
3. Clear codes with diagnostic tool.
4. Start and run the engine for one minute. Stop engine.
5. Check diagnostic tool for codes.

   [a] If no codes are displayed, troubleshooting is complete.

   [b] If code 3563/0/1/2 is not logged, and other codes are logged, troubleshoot the logged codes.

   [c] If code 3563/0/21 and other codes are logged, review this section to find the error. If no error is found, call the Detroit Diesel Customer Support Center (313–592–5800).

105.2 SPN 3563/FMI 3

The following procedures will troubleshoot SPN 3563/FMI 3, Intake Manifold Pressure/Temp Sensor short to power.

105.2.1 Short to Power Check

Check as follows:

1. Check for multiple codes.
   - [a] If fault code 3563/3 and 1636/3 are present, repair open circuit between pin 102 of the 120-pin MCM connector and pin 4 of the Intake Manifold Pressure/Temp Sensor. See Figure 105-1. Refer to section 105.2.1.1.
   - [b] If only fault code 3563/3 is present, go to step 2.
2. Disconnect the Intake Manifold Pressure/Temp Sensor.
3. Disconnect the 120-pin MCM connector.
4. Measure the resistance between pins 1 and 4 of the Intake Manifold Pressure/Temp Sensor harness connector. See Figure 105-1.

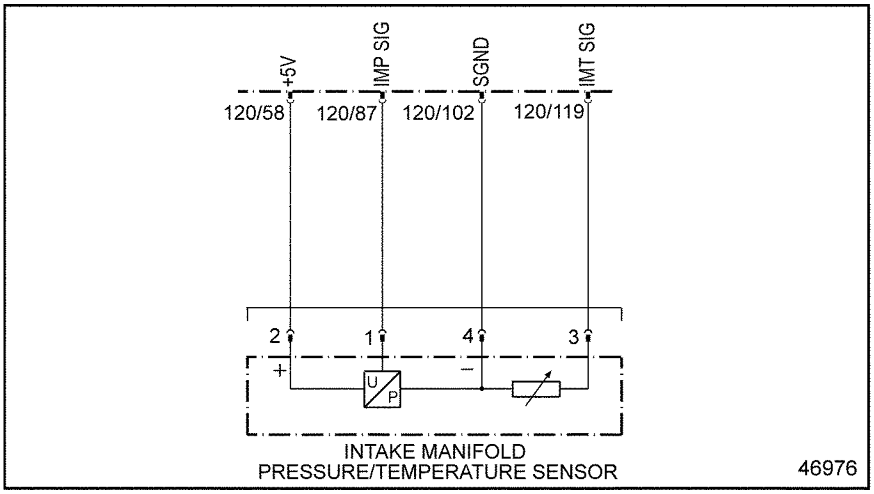


Figure 105-1 Intake Manifold Pressure/Temp Sensor

   - [a] If the resistance is greater than 5 Ω, repair short to power in the circuit between pin 87 of the 120-pin MCM connector and pin 1 of the Intake Manifold Pressure/Temp Sensor. See Figure 105-1. Refer to section 105.2.1.1.
   - [b] If the resistance is less than 5 Ω, repair the short between wire 58 and 87 of the 120-pin MCM connector. See Figure 105-1. Refer to section 105.2.1.1.

105.2.1.1 Verify Repairs

Perform the following steps to verify repairs.

1. Turn vehicle ignition OFF.
2. Reconnect all connectors. Turn ignition ON.
3. Clear codes with diagnostic tool.
4. Start and run the engine for one minute. Stop engine.
5. Check diagnostic tool for codes.
   [a] If no codes are displayed, troubleshooting is complete.
   [b] If code 3563/3 is not logged, and other codes are logged, troubleshoot the logged codes.
   [c] If code 3563/3 and other codes are logged, review this section to find the error. If no error is found, call the Detroit Diesel Customer Support Center (313–592–5800).

105.3 SPN 3563/FMI 4

The following procedures will troubleshoot SPN 3563/FMI 4, Intake Manifold Pressure/Temp Sensor short to ground.

105.3.1 Open or Short to Ground Check

Check as follows:

1. Check for multiple codes.
   [a] If faults 3563/4 and 1636/4 are present, go to step 2.
   [b] If only 3563/4 is present, go to step 7.
2. Disconnect the Intake Manifold Pressure/Temp Sensor.
3. Measure the resistance between pins 1 and 2 of the Intake Manifold Pressure/Temp Sensor. See Figure 105-2.

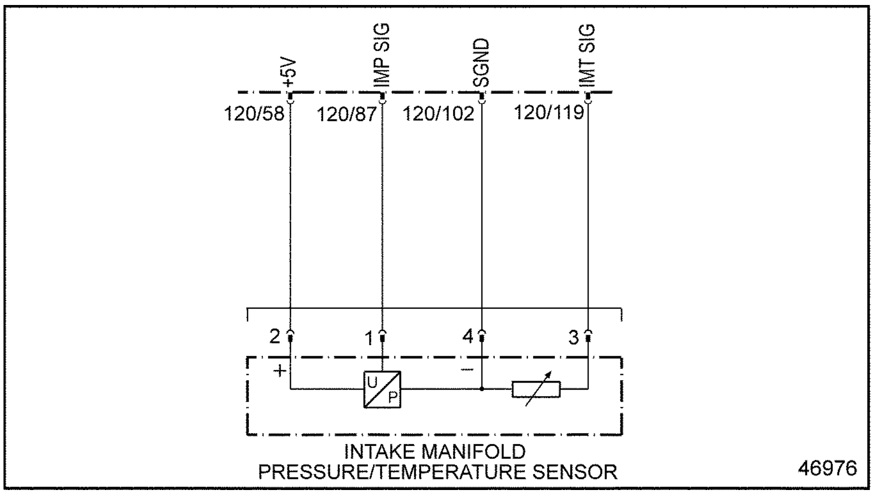


Figure 105-2 Intake Manifold Pressure/Temp Sensor

   [a] If resistance is greater than 130k Ω, replace the sensor.Refer to section 105.3.1.1.
   [b] If resistance is less than 130k Ω, go to step 4.
4. Measure the resistance between pins 2 and 4 of the Intake Manifold Pressure/Temp Sensor. See Figure 105-2.
   [a] If resistance is greater than 130k Ω, replace the sensor.Refer to section 105.3.1.1.
   [b] If resistance is less than 130k Ω, go to step 5.
5. Turn the ignition ON (key ON, engine OFF).
6. Measure the voltage between pin 2 of the Intake Manifold Pressure/Temp Sensor and ground.

[a] If the voltage is greater than 2.75 volts, repair the open between pin 4 of the Intake Manifold Pressure/Temp Sensor and pin 102 of the 120–pin MCM connector. Refer to section 105.3.1.1.

[b] If the voltage is less than 2.75 volts, repair the open between pin 2 of the Intake Manifold Pressure/Temp Sensor and pin 108 of the 120–pin MCM connector. Refer to section 105.3.1.1.

7. Turn the ignition OFF.
8. Disconnect the Intake manifold Pressure/Temp Sensor.
9. Disconnect the 120–pin MCM connector.
10. Measure the resistance between pins 1 and 2 of the Intake Manifold Pressure/Temp Sensor harness connector.

[a] If the resistance is greater than 5 Ω, repair the short to power on the circuit between pin 87 of the 120–pin MCM connector and pin 1 of the Intake Manifold Pressure/Temp Sensor harness connector. Refer to section 105.3.1.1.

[b] If the resistance is less than 5 Ω, repair the short between wires 58 and 87 of the 120–pin MCM connector. Refer to section 105.3.1.1.

105.3.1.1 Verify Repairs

Perform the following steps to verify repairs.

1. Turn vehicle ignition OFF.
2. Reconnect all connectors. Turn ignition ON.
3. Clear codes with diagnostic tool.
4. Start and run the engine for one minute. Stop engine.
5. Check diagnostic tool for codes.

[a] If no codes are displayed, troubleshooting is complete.

[b] If code 3563/4 is not logged, and other codes are logged, troubleshoot the logged codes.

[c] If code 3563/4 and other codes are logged, review this section to find the error. If no error is found, call the Detroit Diesel Customer Support Center (313–592–5800).

106 SPN 3603 (CPC) - J1939 ESS MESSAGE IS MISSING

106.1 SPN 3603/FMI 9

This fault is typically the J1939 ESS message is missing.

106.1.1 Missing ESS Message Check

Check as follows:

1. Check for multiple codes:
   [a] If CPC SPN 168/FMI 0/14/18 (Battery Voltage) are present troubleshoot these first.
   [b] If MCM SPN 625/FMI 9 is present, troubleshoot and repair the CAN line.
   [c] If only a "J1939 Error" fault is present, go to step 2.
2. Has the CPC been recently reprogrammed?
   [a] If yes, check the proper configuration of the CPC.
   [b] If no, connect ServiceLink to determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

107 SPN 3609 - DPF INLET PRESSURE SENSOR ABOVE OR BELOW NORMAL OPERATING RANGE

Section **Page**

107.1 SPN 3609FMI 2, 3, 4, 10, 20 OR 21

The troubleshooting procedures for this SPN can be found in the *Aftertreatment System Technician's Guide* (7SE63), refer to Chapter 17.

108 SPN 3610 - DPF OUTLET PRESSURE SENSOR ABOVE OR BELOW NORMAL OPERATING RANGE

Section	Page

108.1 SPN 3610/FMI 2, 3, 4, 14, 20 OR 21

The troubleshooting procedures for this SPN can be found in the *Aftertreatment System Technician's Guide* (7SE63), refer to Chapter 18.

109 SPN 3659 — ELECTRONIC UNIT PUMP #1 NOT OPERATING NORMALLY

Section **Page**

109.1 SPN 3659/FMI 5

This diagnosis is typically the Electronic Unit Pump current is below normal or an open circuit fault.

109.1.1 Open Circuit Check

Check as follows:

1. Check for multiple codes.
   [a] If fault code 168/1 is active in addition to 3659/5, service 168/1 first. Refer to section 31.2.
   [b] If fault 3660/5 and 3661/5 are active in addition to 3659/5, contact the Detroit Diesel Customer Support Center (313–592–5800) for MCM replacement.
   [c] If only fault code 3659/5 is active, go to step 2.
2. The ignition should still be ON (key ON, engine OFF).
3. Measure the voltage between pins 1 and 2 of Electronic Unit Pump #1. See Figure 109-1.

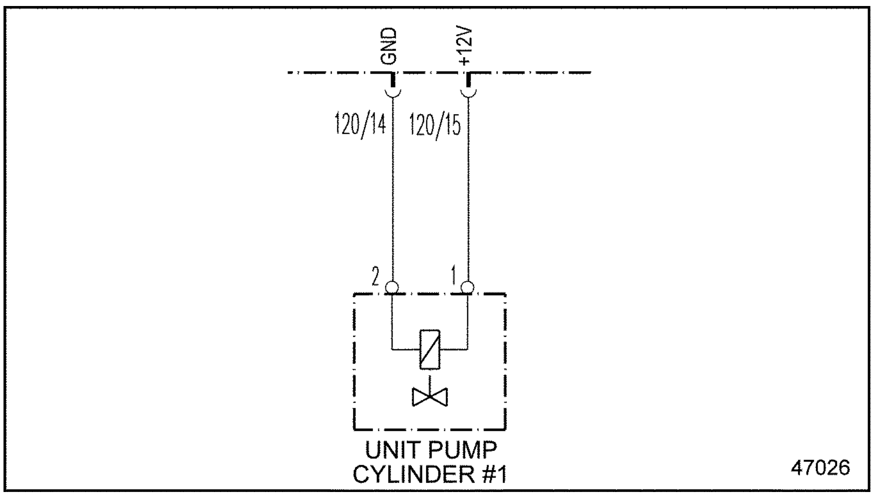


Figure 109-1 Electronic Unit Pump #1

   [a] If the voltage is greater than 11.5 volts, replace Electronic Unit Pump #1.
   [b] If the voltage is less than 11.5 volts, go to step 4.
4. Measure the voltage between pin 1 of Electronic Unit Pump #1 and ground.
   [a] If the voltage is greater than 11.5 volts, repair the open between pin 14 of the 120–pin MCM connector and pin 2 of Electronic Unit Pump #1. Refer to section 109.1.1.1.
   [b] If the voltage is less than 11.5 volts, repair the open between pin 15 of the 120–pin MCM connector and pin 1 of Electronic Unit Pump #1. Refer to section 109.1.1.1.

109.1.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF and reconnect all connectors.
2. Turn the ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
   [a] If no codes are present, troubleshooting is complete.
   [b] If code 3659/5 is not logged but other codes are logged, troubleshoot the other codes.
   [c] If code 3659/5 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313–592–5800).

109.2 SPN 3659/FMI 10

This diagnostic condition is typically a short to ground.

109.2.1 Short to Ground Check

Check as follows:

1. Turn the ignition OFF.
2. Disconnect the 120–pin MCM connector.
3. Disconnect pins 1 and 2 of Electronic Unit Pump #1.
4. Measure the resistance between pins 1 and 2 of the Electronic Unit Pump #1 harness. See Figure 109-2.
   [a] If the resistance is less than 5 Ω, repair the short between pins 1 and 2 of the Electronic Unit Pump #1 harness and pins 15 and 14 of the 120–pin MCM connector.Refer to section 109.2.1.1.
   [b] If the resistance is greater than 5 Ω, go to step 5.

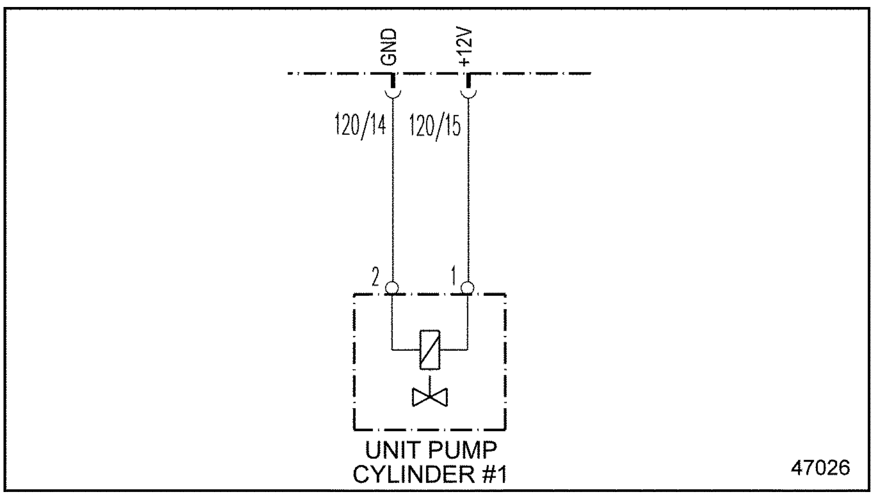


Figure 109-2 Electronic Unit Pump #1

5. Measure the resistance between pin 1 of the Electronic Unit Pump #1 harness and ground.
   [a] If the resistance is less than 5 Ω, repair the short to ground between pin 1of the Electronic Unit Pump #1 harness and pin 15 of the MCM 120–pin connector. Refer to section 109.2.1.1.
   [b] If the resistance is greater than 5 Ω, repair the short to ground between pin 2 of the Electronic Unit Pump #1 harness and pin 14 of the MCM 120–pin connector. Refer to section 109.2.1.1.

109.2.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF and reconnect all connectors.
2. Turn the ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
   [a] If no codes are present, troubleshooting is complete.
   [b] If code 3659/10 is not logged but other codes are logged, troubleshoot the other codes.
   [c] If code 3659/10 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313–592–5800).

110 SPN 3660 - ELECTRONIC UNIT PUMP #2 NOT OPERATING NORMALLY

Section **Page**

110.1 SPN 3660/FMI 5

This diagnosis is typically the Electronic Unit Pump current is below normal or an open circuit fault.

110.1.1 Open Circuit Check

Check as follows:

1. Check for multiple codes.
   - [a] If fault code 168/1 is active in addition to 3660/5, service 168/1 first. Refer to section 31.2.
   - [b] If fault 3659/5 and 3661/5 are active in addition to 3660/5, contact the Detroit Diesel Customer Support Center (313–592–5800) for MCM replacement.
   - [c] If only fault code 3660/5 is active, go to step 2.
2. The ignition should still be ON (key ON, engine OFF).
3. Measure the voltage between pins 1 and 2 of Electronic Unit Pump #2. See Figure 110-1.

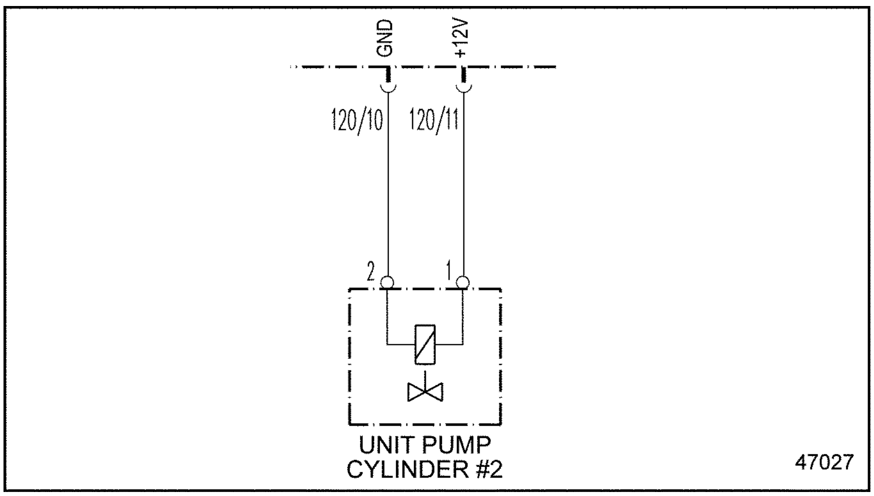


Figure 110-1 Electronic Unit Pump #2

   - [a] If the voltage is greater than 11.5 volts, replace Electronic Unit Pump #2.
   - [b] If the voltage is less than 11.5 volts, go to step 4.
4. Measure the voltage between pin 1 of the Electronic Unit Pump #2 and ground.
   - [a] If the voltage is greater than 11.5 volts, repair the open between pin 10 of the 120–pin MCM connector and pin 2 of Electronic Unit Pump #2. Refer to section 110.1.1.1.
   - [b] If the voltage is less than 11.5 volts, repair the open between pin 11 of the 120–pin MCM connector and pin 1 of Electronic Unit Pump #2. Refer to section 110.1.1.1.

110.1.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the vehicle ignition OFF and reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
   [a] If no codes are present, troubleshooting is complete.
   [b] If code 3660/5 is not logged but other codes are logged, troubleshoot the other codes.
   [c] If code 3660/5 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313–592–5800).

110.2 SPN 3660/FMI 10

This diagnostic condition is typically a short to ground.

110.2.1 Short to Ground Check

Check as follows:

1. Turn the ignition OFF.
2. Disconnect the 120–pin MCM connector.
3. Disconnect pins 1 and 2 of Electronic Unit Pump #2. See Figure 110-2.

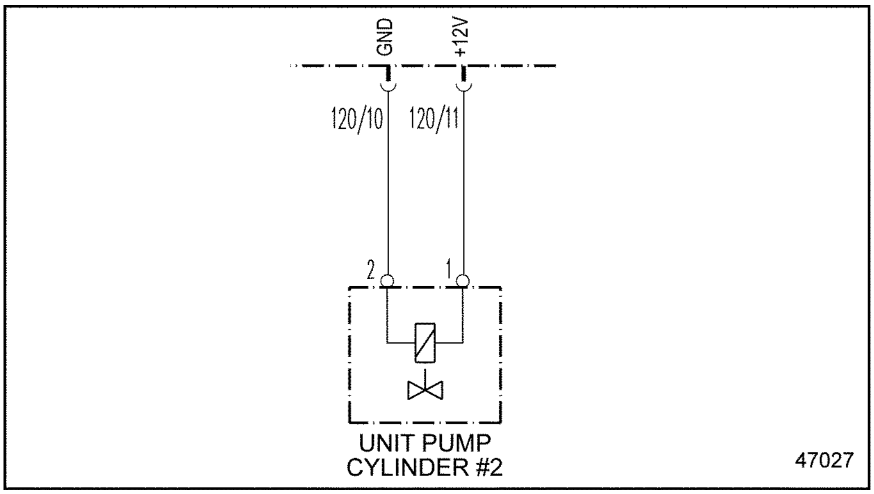


Figure 110-2 Electronic Unit Pump #2

4. Measure the resistance between pins 1 and 2 of the Electronic Unit Pump #2 harness.
   [a] If the resistance is less than 5 Ω, repair the short between pins 1 and 2 of the Electronic Unit Pump #2 harness and pins 11 and 10 of the 120–pin MCM connector. Refer to section 110.2.1.1.
   [b] If the resistance is greater than 5 Ω, go to step 5.
5. Measure the resistance between pin 1 of the Electronic Unit Pump #2 harness and ground.
   [a] If the resistance is less than 5 Ω, repair the short to ground between pin 1 of the Electronic Unit Pump #2 harness and pin 11 of the MCM 120–pin connector. Refer to section 110.2.1.1.
   [b] If the resistance is greater than 5 Ω, repair the short to ground between pin 2 of the Electronic Unit Pump #2 harness and pin 10 of the MCM 120–pin connector. Refer to section 110.2.1.1.

110.2.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the vehicle ignition OFF and reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
   [a] If no codes are present, troubleshooting is complete.
   [b] If code 3660/10 is not logged but other codes are logged, troubleshoot the other codes.
   [c] If code 3660/10 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313–592–5800).

111 SPN 3661 - ELECTRONIC UNIT PUMP #3 NOT OPERATING NORMALLY

111.1 SPN 3661/FMI 5

This diagnosis is typically the Electronic Unit Pump current is below normal or an open circuit fault.

111.1.1 Check for Open Circuits

Check as follows:

1. Check for multiple codes.
   [a] If fault code 168/1 is active in addition to 3661/5, service 168/1 first. Refer to section 31.2.
   [b] If fault 3659/5 and 3660/5 are active in addition to 3661/5, contact the Detroit Diesel Customer Support Center (313–592–5800) for MCM replacement.
   [c] If only fault code 3661/5 is active, go to step 2.
2. The ignition should still be ON (key ON, engine OFF).
3. Measure the voltage between pins 1 and 2 of Electronic Unit Pump #3. See Figure 111-1.

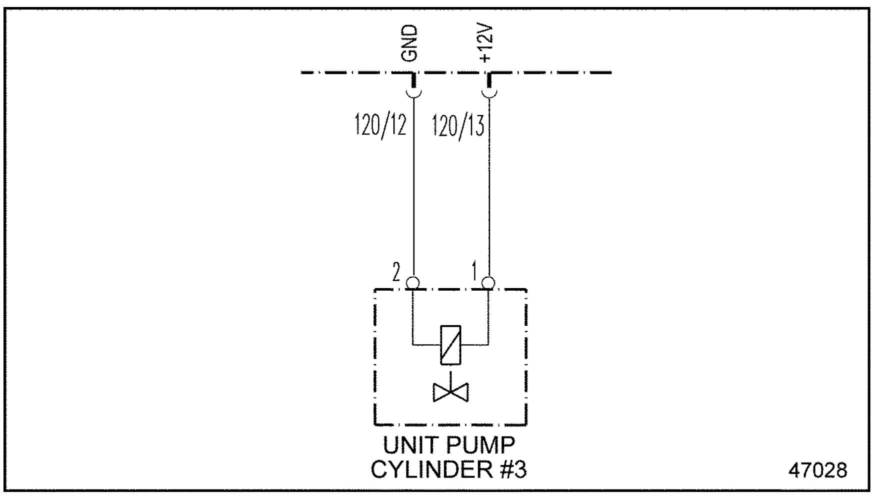


Figure 111-1 Electronic Unit Pump #3

   [a] If the voltage is greater than 11.5 volts, replace Electronic Unit Pump # 3.
   [b] If the voltage is less than 11.5 volts, go to step 4.
4. Measure the voltage between pin 1 of the Electronic Unit Pump #3 and ground.
   [a] If the voltage is greater than 11.5 volts, repair the open between pin 12 of the 120–pin MCM connector and pin 2 of Electronic Unit Pump #3. Refer to section 111.1.1.1.
   [b] If the voltage is less than 11.5 volts, repair the open between pin 13 of the 120–pin MCM connector and pin 1 of Electronic Unit Pump #3. Refer to section 111.1.1.1.

111.1.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the vehicle ignition OFF and reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
   - [a] If no codes are present, troubleshooting is complete.
   - [b] If code 3661/5 is not logged but other codes are logged, troubleshoot the other codes.
   - [c] If code 3661/5 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313–592–5800).

111.2 SPN 3661/FMI 10

This diagnostic condition is typically a short.

111.2.1 Check for Short

Check as follows:

1. Turn the ignition OFF.
2. Disconnect the 120–pin MCM connector.
3. Disconnect pins 1 and 2 of Electronic Unit Pump #3. See Figure 111-2.

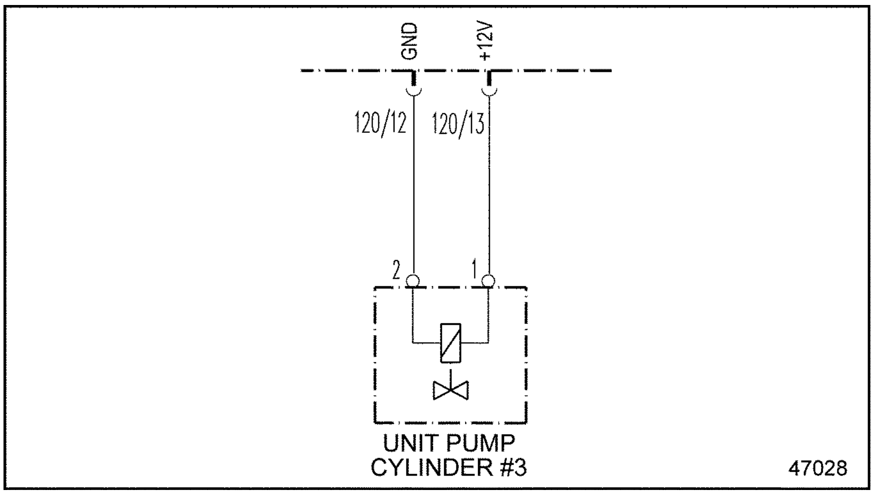


Figure 111-2 Electronic Unit Pump #3

4. Measure the resistance between pins 1 and 2 of the Electronic Unit Pump #3 harness.
   [a] If the resistance is less than 5 Ω, repair the short between pins 1 and 2 of the Electronic Unit Pump #3 harness and pins 13 and 102 of the 120–pin MCM connector.Refer to section 111.2.1.1.
   [b] If the resistance is greater than 5 Ω, go to step 5.
5. Measure the resistance between pin 1 of the Electronic Unit Pump #3 harness and ground.
   [a] If the resistance is less than 5 Ω, repair the short to ground between pin 1 of the Electronic Unit Pump #3 harness and pin 13 of the MCM 120–pin connector. Refer to section 111.2.1.1.
   [b] If the resistance is greater than 5 Ω, repair the short to ground between pin 2 of the Electronic Unit Pump #3 harness and pin 12 of the MCM 120–pin connector. Refer to section 111.2.1.1.

111.2.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the vehicle ignition OFF and reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
   [a] If no codes are present, troubleshooting is complete.
   [b] If code 3661/10 is not logged but other codes are logged, troubleshoot the other codes.
   [c] If code 3661/10 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313–592–5800).

112 SPN 3662 - ELECTRONIC UNIT PUMP #4 NOT OPERATING NORMALLY

Section **Page**

112.1 SPN 3662/FMI 5

This diagnosis is typically the Electronic Unit Pump current is below normal or an open circuit fault.

112.1.1 Open Circuit Check

Check as follows:

1. Check for multiple codes.
   [a] If fault code 168/1 is active in addition to 3662/5, service 168/1 first. Refer to section 31.2.
   [b] If fault 3663/5 and 3664/5 are active in addition to 3662/5, contact the Detroit Diesel Customer Support Center (313–592–5800) for MCM replacement.
   [c] If only fault code 3662/5 is active, go to step 2.
2. The ignition should still be ON (key ON, engine OFF).
3. Measure the voltage between pins 1 and 2 of Electronic Unit Pump #4. See Figure 112-1.

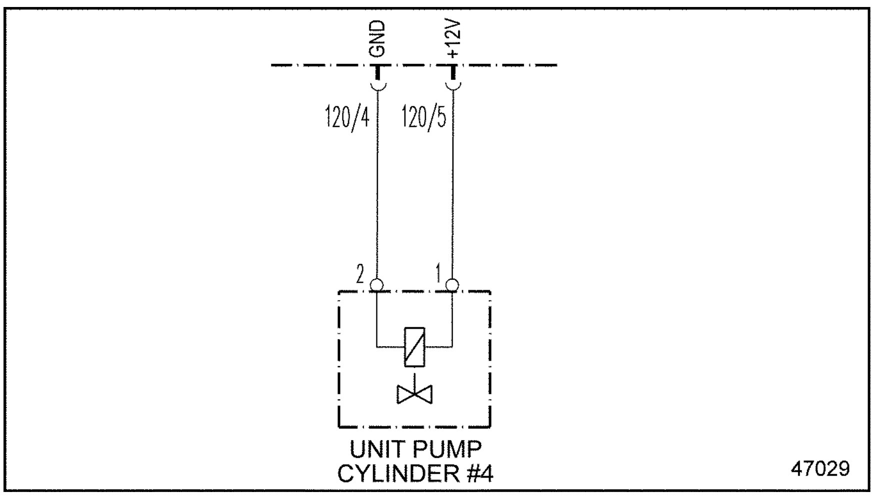


Figure 112-1 Electronic Unit Pump #4

   [a] If the voltage is greater than 11.5 volts, replace Electronic Unit Pump #4.
   [b] If the voltage is less than 11.5 volts, go to step 4.
4. Measure the voltage between pin 1 of the Electronic Unit Pump #4 and ground.
   [a] If the voltage is greater than 11.5 volts, repair the open between pin 4 of the 120–pin MCM connector and pin 2 of Electronic Unit Pump #4. Refer to section 112.1.1.1.
   [b] If the voltage is less than 11.5 volts, repair the open between pin 5 of the 120–pin MCM connector and pin 1 of Electronic Unit Pump #4. Refer to section 112.1.1.1.

112.1.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the vehicle ignition OFF and reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
   [a] If no codes are present, troubleshooting is complete.
   [b] If code 3662/5 is not logged but other codes are logged, troubleshoot the other codes.
   [c] If code 3662/5 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313–592–5800).

112.2 SPN 3662/FMI 10

This diagnostic condition is typically a short to ground.

112.2.1 Short to Ground Check

Check as follows:

1. Turn the ignition OFF.
2. Disconnect the 120–pin MCM connector.
3. Disconnect pins 1 and 2 of Electronic Unit Pump #4. See Figure 112-2.

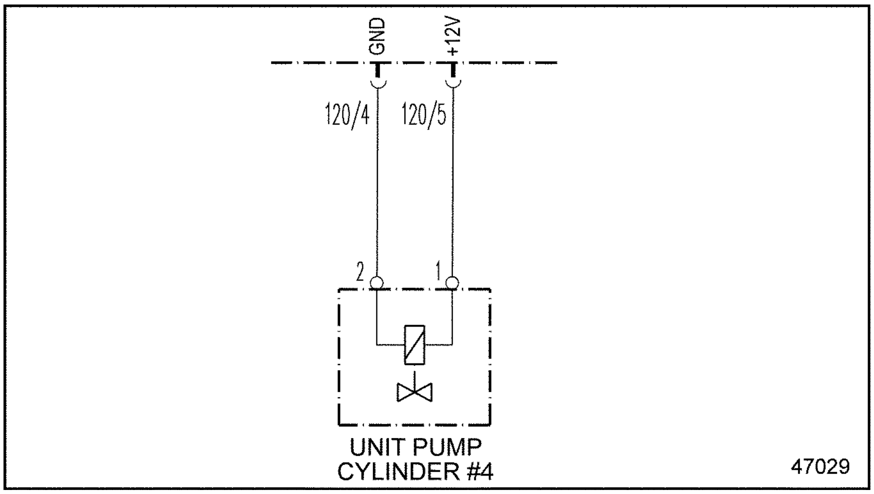


Figure 112-2 Electronic Unit Pump #4

4. Measure the resistance between pins 1 and 2 of the Electronic Unit Pump #4 harness.
   [a] If the resistance is less than 5 Ω, repair the short between pins 1 and 2 of the Electronic Unit Pump #4 harness and pins 5 and 4 of the 120–pin MCM connector. Refer to section 112.2.1.1.
   [b] If the resistance is greater than 5 Ω, go to step 5.
5. Measure the resistance between pin 1 of the Electronic Unit Pump #4 harness and ground.
   [a] If the resistance is less than 5 Ω, repair the short to ground between pin 1 of the Electronic Unit Pump #4 harness and pin 5 of the MCM 120–pin connector. Refer to section 112.2.1.1.
   [b] If the resistance is greater than 5 Ω, repair the short to ground between pin 2 of the Electronic Unit Pump #4 harness and pin 4 of the MCM 120–pin connector. Refer to section 112.2.1.1.

112.2.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the vehicle ignition OFF and reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
   [a] If no codes are present, troubleshooting is complete.
   [b] If code 3662/10 is not logged but other codes are logged, troubleshoot the other codes.
   [c] If code 3662/10 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313–592–5800).

113 SPN 3663 - ELECTRONIC UNIT PUMP #5 NOT OPERATING NORMALLY

Section **Page**

113.1 SPN 3663/FMI 5

This diagnosis is typically the Electronic Unit Pump current is below normal or an open circuit fault.

113.1.1 Open Circuit Check

Check as follows:

1. Check for multiple codes.
   - [a] If fault code 168/1 is active in addition to 3663/5, service 168/1 first. Refer to section 31.2.
   - [b] If fault 3662/5 and 3664/5 are active in addition to 3663/5, contact the Detroit Diesel Customer Support Center (313–592–5800) for MCM replacement.
   - [c] If only fault code 3663/5 is active, go to step 2.
2. The ignition should still be ON (key ON, engine OFF).
3. Measure the voltage between pins 1 and 2 of Electronic Unit Pump #5. See Figure 113-1.

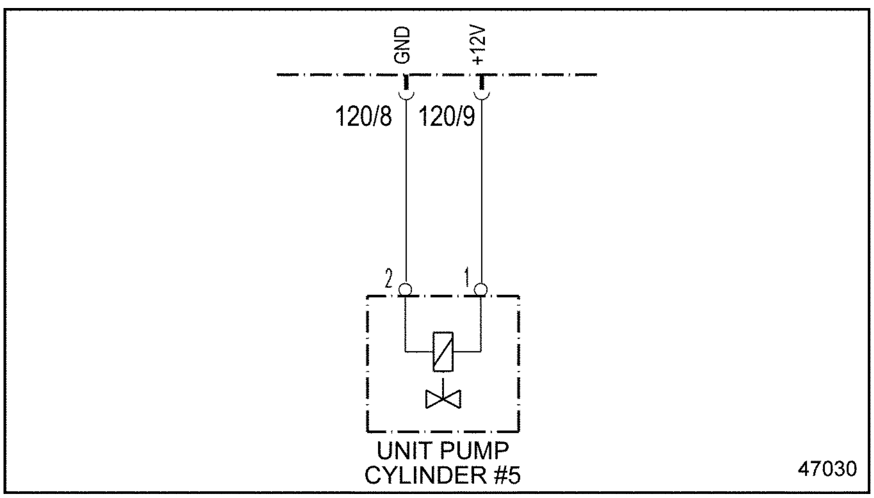


Figure 113-1 Electronic Unit Pump #5

   - [a] If the voltage is greater than 11.5 volts, replace Electronic Unit Pump #5.
   - [b] If the voltage is less than 11.5 volts, go to step 4.
4. Measure the voltage between pin 1 of the Electronic Unit Pump #5 and ground.
   - [a] If the voltage is greater than 11.5 volts, repair the open between pin 8 of the 120–pin MCM connector and pin 2 of Electronic Unit Pump #5. Refer to section 113.1.1.1.
   - [b] If the voltage is less than 11.5 volts, repair the open between pin 9 of the 120–pin MCM connector and pin 1 of Electronic Unit Pump #5. Refer to section 113.1.1.1.

113.1.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF and reconnect all connectors.
2. Turn the ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
   [a] If no codes are present, troubleshooting is complete.
   [b] If code 3663/5 is not logged but other codes are logged, troubleshoot the other codes.
   [c] If code 3663/5 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313–592–5800).

113.2 SPN 3663/FMI 10

This diagnostic condition is typically a short to ground.

113.2.1 Short to Ground Check

Check as follows:

1. Turn the ignition OFF.
2. Disconnect the 120–pin MCM connector.
3. Disconnect pins 1 and 2 of Electronic Unit Pump #5. See Figure 113-2.

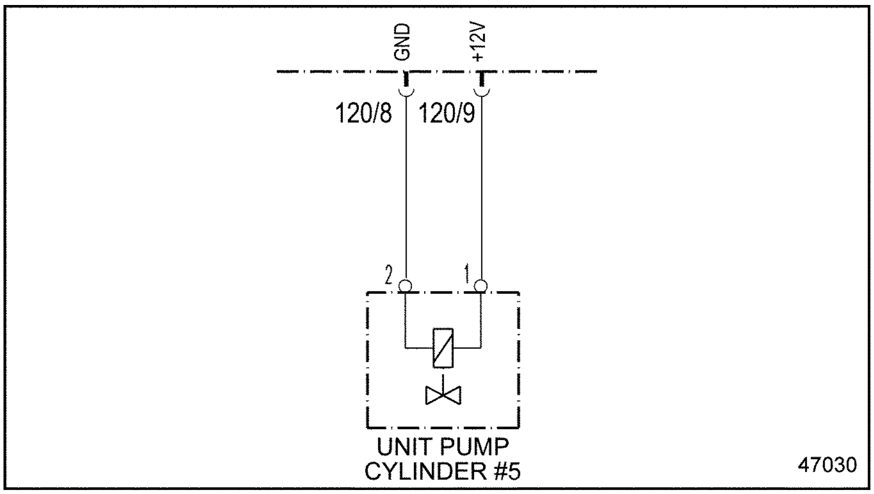


Figure 113-2 Electronic Unit Pump #5

4. Measure the resistance between pins 1 and 2 of the Electronic Unit Pump #5 harness.
   [a] If the resistance is less than 5 Ω, repair the short between pins 1 and 2 of the Electronic Unit Pump #5 harness and pins 9 and 8 of the 120–pin MCM connector. Refer to section 113.2.1.1.
   [b] If the resistance is greater than 5 Ω, go to step 5.
5. Measure the resistance between pin 1 of the Electronic Unit Pump #5 harness and ground.
   [a] If the resistance is less than 5 Ω, repair the short to ground between pin 1 of the Electronic Unit Pump #5 harness and pin 9 of the MCM 120–pin connector. Refer to section 113.2.1.1.
   [b] If the resistance is greater than 5 Ω, repair the short to ground between pin 2 of the Electronic Unit Pump #5 harness and pin 8 of the MCM 120–pin connector. Refer to section 113.2.1.1.

113.2.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the vehicle ignition OFF and reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
   [a] If no codes are present, troubleshooting is complete.
   [b] If code 3663/10 is not logged but other codes are logged, troubleshoot the other codes.
   [c] If code 3663/10 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313–592–5800).

114 SPN 3664 - ELECTRONIC UNIT PUMP #6 NOT OPERATING NORMALLY

Section **Page**

114.1 SPN 3664/FMI 5

This diagnosis is typically the Electronic Unit Pump current is below normal or an open circuit fault.

114.1.1 Open Circuit Check

Check as follows:

1. Check for multiple codes.
   [a] If fault code 168/1 is active in addition to 3664/5, service 168/1 first. Refer to section 31.2.
   [b] If fault 3662/5 and 3663/5 are active in addition to 3664/5, contact the Detroit Diesel Customer Support Center (313–592–5800) for MCM replacement. Refer to section 114.1.1.1.
   [c] If only fault code 3664/5 is active, go to step 2.
2. The ignition should still be ON (key OFF, engine ON).
3. Measure the voltage between pins 1 and 2 of Electronic Unit Pump #6. See Figure 114-1.

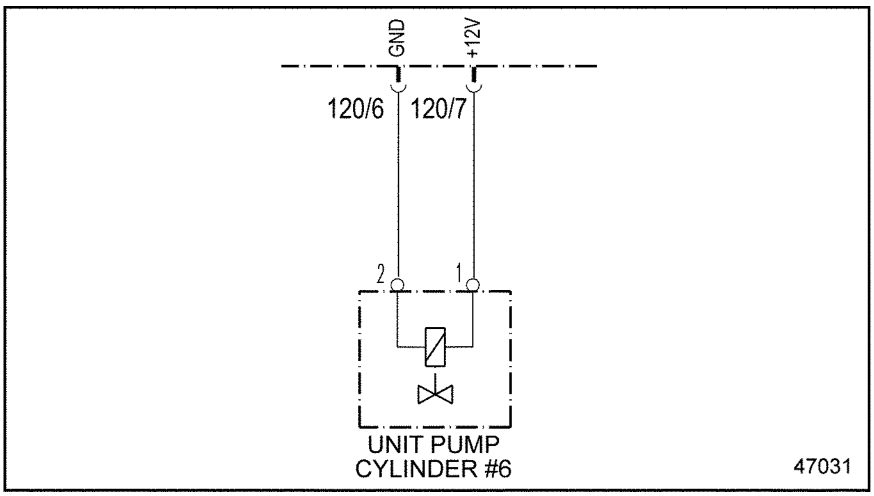


Figure 114-1 Electronic Unit Pump #6

   [a] If the voltage is greater than 11.5 volts, replace Electronic Unit Pump #6.
   [b] If the voltage is less than 11.5 volts, go to step 4.
4. Measure the voltage between pin 1 of the Electronic Unit Pump #6 and ground.
   [a] If the voltage is greater than 11.5 volts, repair the open between pin 7 of the 120–pin MCM connector and pin 2 of Electronic Unit Pump #6. Refer to section 114.1.1.1.
   [b] If the voltage is less than 11.5 volts, repair the open between pin 7 of the 120–pin MCM connector and pin 1 of Electronic Unit Pump #6. Refer to section 114.1.1.1.

114.1.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the vehicle ignition OFF and reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
   [a] If no codes are present, troubleshooting is complete.
   [b] If code 3664/5 is not logged but other codes are logged, troubleshoot the other codes.
   [c] If code 3664/5 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313–592–5800).

114.2 SPN 3664/FMI 10

This diagnostic condition is typically a short to ground.

114.2.1 Check for Short

Check as follows:

1. Turn the ignition OFF.
2. Disconnect the 120–pin MCM connector.
3. Disconnect pins 1 and 2 of Electronic Unit Pump #6. See Figure 114-2.

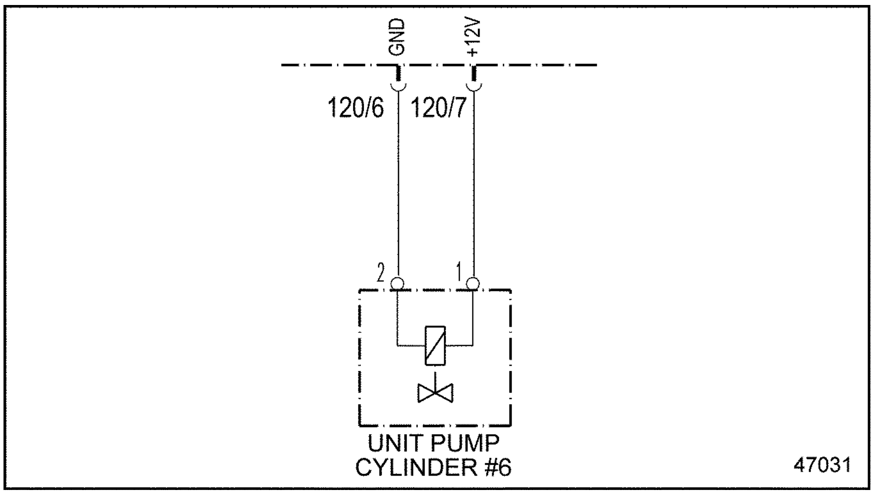


Figure 114-2 Electronic Unit Pump #6

4. Measure the resistance between pins 1 and 2 of the Electronic Unit Pump #6 harness.
   [a] If the resistance is less than 5 Ω, repair the short between pins 1 and 2 of the Electronic Unit Pump #6 harness and pins 7 and 6 of the 120–pin MCM connector. Refer to section 114.2.1.1.
   [b] If the resistance is greater than 5 Ω, go to step 5.
5. Measure the resistance between pin 1 of the Electronic Unit Pump #6 harness and ground.
   [a] If the resistance is less than 5 Ω, repair the short to ground between pin 1 of the Electronic Unit Pump #6 harness and pin 7 of the MCM 120–pin connector. Refer to section 114.2.1.1.
   [b] If the resistance is greater than 5 Ω, repair the short to ground between pin 2 of the Electronic Unit Pump #6 harness and pin 6 of the MCM 120–pin connector. Refer to section 114.2.1.1.

114.2.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the vehicle ignition OFF and reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
   [a] If no codes are present, troubleshooting is complete.
   [b] If code 3664/10 is not logged but other codes are logged, troubleshoot the other codes.
   [c] If code 3664/10 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313–592–5800).

115 SPN 3695 (CPC) - DPF REGEN MUX SWITCH MESSAGES NOT OPERATING NORMALLY

Section **Page**

115.1 SPN 3695/FMI 9

This fault is typically one of the following:

- DPF Regen Inhibit Switch message stopped arriving
- DPF Regen Force Switch message stopped arriving

115.1.1 Missing DPF Regen Inhibit Switch or Force Switch Message Check

Check as follows:

1. Check for multiple codes:
   - [a] If CPC SPN 168/FMI 0/14/18 (Battery Voltage) are present troubleshoot and repair these first.
   - [b] If MCM SPN 625/FMI 9 is present, troubleshoot and repair the CAN line.
   - [c] If only a “J1939 Error” fault is present, go to step 2.
2. Has the CPC been recently reprogrammed?
   - [a] If yes, check the proper configuration of the CPC.
   - [b] If no, connect ServiceLink to determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

115.2 SPN 3695/FMI 13

This fault is typically one of the following: .

- DPF Regen Inhibit Switch message contains a SNV indicator
- DPF Regen Force Switch message contains a SNV indicator

115.2.1 DPF Regen Inhibit Switch or Force Switch Message SNV Indicator Check

Check as follows:

1. Check for multiple codes:
   [a] If CPC SPN 168/FMI 0/14/18 (Battery Voltage) are present troubleshoot and repair these first.
   [b] If MCM SPN 625/FMI 9 is present, troubleshoot and repair the CAN line.
   [c] If only a "J1939 Error" fault is present, go to step 2.
2. Has the CPC been recently reprogrammed?
   [a] If yes, check the proper configuration of the CPC.
   [b] If no, connect ServiceLink to determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

115.3 SPN 3695/FMI 14

This fault is typically one of the following:

- DPF Regen Inhibit Switch message not received this ignition cycle
- DPF Regen Force Switch message not received this ignition cycle

115.3.1 DPF Regen Inhibit Switch or Force Switch Message not Received Check

Check as follows:

1. Check for multiple codes:
   [a] If CPC SPN 168/FMI 0/14/18 (Battery Voltage) are present troubleshoot and repair these first.
   [b] If MCM SPN 625/FMI 9 is present, troubleshoot and repair the CAN line.
   [c] If only a "J1939 Error" fault is present, go to step 2.
2. Has the CPC been recently reprogrammed?
   [a] If yes, check the proper configuration of the CPC.

[b] If no, connect ServiceLink to determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

115.4 SPN 3695/FMI 19

This fault is typically one of the following:

- DPF Regen Inhibit Switch message contains a data error indicator
- DPF Regen Force Switch message contains a data error indicator

115.4.1 DPF Regen Inhibit Switch or Force Switch Message Data Error Indicator Check

Check as follows:

1. Check for multiple codes:
   [a] If CPC SPN 168/FMI 0/14/18 (Battery Voltage) are present troubleshoot and repair these first.
   [b] If MCM SPN 625/FMI 9 is present, troubleshoot and repair the CAN line.
   [c] If only a “J1939 Error” fault is present, go to step 2.
2. Has the CPC been recently reprogrammed?
   [a] If yes, check the proper configuration of the CPC.
   [b] If no, connect ServiceLink to determine which modules are configured for the vehicle and their communication status. Once this is done, follow the appropriate module communication troubleshooting procedures for the affected module.

116 SPN 3719 - SOOT LEVEL ABOVE NORMAL

Section **Page**

116.1 SPN 3719/FMI 0, 15,16,OR 31

The troubleshooting procedures for this SPN can be found in the *Aftertreatment System Technician's Guide* (7SE63), refer to Chapter 19.

117 SPN 3720 - ASH LEVEL ABOVE NORMAL

Section **Page**

117.1 SPN 3720/FMI 15 OR 16

The troubleshooting procedures for this SPN can be found in the *Aftertreatment System Technician's Guide* (7SE63), refer to Chapter 20.

118 SPN 4077 FUEL LINE PRESSURE SENSOR CIRCUIT FAULT

Section **Page**

118.1 SPN 4077/FMI 3, 4 OR 14

The troubleshooting procedures for this SPN can be found in the *Aftertreatment System Technician's Guide* (7SE63), refer to Chapter 21.

119 SPN 4227 - ELECTROSTATIC OIL SEPARATOR OUTSIDE OF NORMAL OPERATING RANGE

Section **Page**

119.1 SPN 4227/FMI 3

This is typically a short to power.

119.1.1 Short to Power Check

Check as follows:

1. Check for multiple codes.
   - [a] If 615/3 and 2791/3 are present, repair the open between pin 67 of the 120–pin MCM connector and pin 1 of the Electrostatic Oil Separator connector and pin 3 of the EGR valve connector. Refer to section 119.1.1.1.
   - [b] If only 4227/3 is present, go to step 2.
2. Disconnect the Electrostatic Oil Separator connector.
3. Turn ignition ON (key ON, engine OFF).
4. Measure the voltage between pins 1 and 2 of the Electrostatic Oil Separator connector.
   - [a] If the voltage is greater than 11.5 volts, go to step 5.
   - [b] If the voltage is less than 11.5 volts, repair the open between pin 1 of the Electrostatic Oil Separator connector and pin 67 of the 120–pin MCM connector. See Figure 119-1. Refer to section 119.1.1.1.

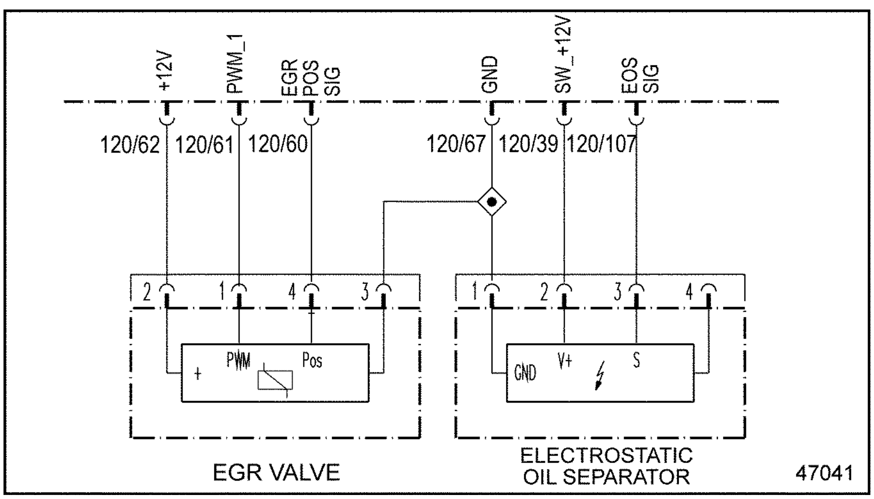


Figure 119-1 Electrostatic Oil Separator Wiring

5. Turn the ignition OFF.
6. Disconnect the 120–pin MCM connector.
7. Measure the resistance between pins 2 and 3 of the Electrostatic Oil Separator connector.
   - [a] If the resistance is greater than 5 Ω, repair the open between pin 2 of the Electrostatic Oil Separator connector and pin 39 of the 120–pin MCM connector. Refer to section 119.1.1.1.

[b] If the resistance is less than 5 Ω, repair the short between pin 2 and 3 of the Electrostatic Oil Separator connector and pins 39 and 107 of the 120–pin MCM connector. Refer to section 119.1.1.1.

119.1.1.1 Verify Repairs

Verify repairs as follows:

1. Turn ignition OFF.
2. Reconnect any electrical connections that were disconnected to perform the diagnosis.
3. Clear codes with DDDL 7.0 or latest version.
4. Start and bring engine up to operating temperature (over 140°F/60°C).
5. Verify operation is satisfactory and no warning lamps illuminate. If warning lamps illuminate, troubleshoot the codes. If assistance is required, call the Detroit Diesel Customer Support Center at 313–592–5800.

119.2 SPN 4227/FMI 4

This is typically an open/short to ground.

119.2.1 Open/Short to Ground Check

Check as follows:

1. Disconnect the Electrostatic Oil Separator connector.
2. Measure the resistance between pins 1 and 2 of the Electrostatic Oil Separator.

   [a] If the resistance is greater than 150 Ω, replace the Electrostatic Oil Separator. See Figure 119-2. Refer to section 119.2.1.1.

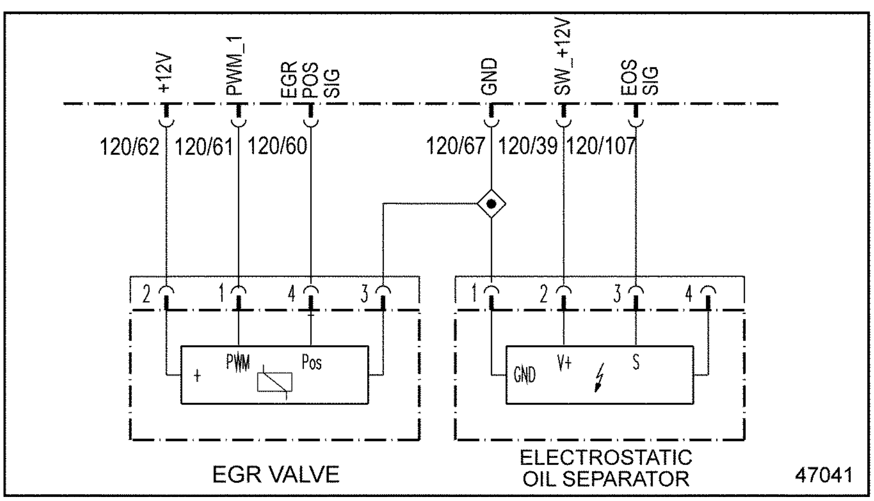


Figure 119-2 Electrostatic Oil Separator Wiring

[b] If the resistance is less than 150 Ω, go to step 3.

3. Measure the resistance between pins 1 and 3 of the Electrostatic Oil Separator.
   [a] If the resistance is greater than 150 Ω, replace the Electrostatic Oil Separator. Refer to section 119.2.1.1.
   [b] If the resistance is less than 150 Ω, go to step 4.
4. Turn the ignition OFF.
5. Disconnect the 120–pin MCM connector.
6. Measure the resistance between pin 3 of the Electrostatic Oil Separator connector and ground.
   [a] If the resistance is greater than 5 Ω, repair the open between pin 3 of the Electrostatic Oil Separator connector and pin 107 of the 120–pin MCM connector. Refer to section 119.2.1.1.
   [b] If the resistance is less than 5 Ω, repair the short to ground between pin 3 of the Electrostatic Oil Separator connector and pin 107 of the 120–pin MCM connector. Refer to section 119.2.1.1.

119.2.1.1 Verify Repairs

Verify repairs as follows:

1. Turn ignition OFF.
2. Reconnect any electrical connections that were disconnected to perform the diagnosis.
3. Clear codes with DDDL 7.0 or latest version.
4. Start and bring engine up to operating temperature (over 140°F/60°C).
5. Verify operation is satisfactory and no warning lamps illuminate. If warning lamps illuminate, troubleshoot the codes. If assistance is required, call the Detroit Diesel Customer Support Center at 313–592–5800.

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