Troubleshooting Guide

MBE 900 DDEC® VI

DETROIT DIESEL CORPORATION

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NOTE:
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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

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MCM/CPC WARNING

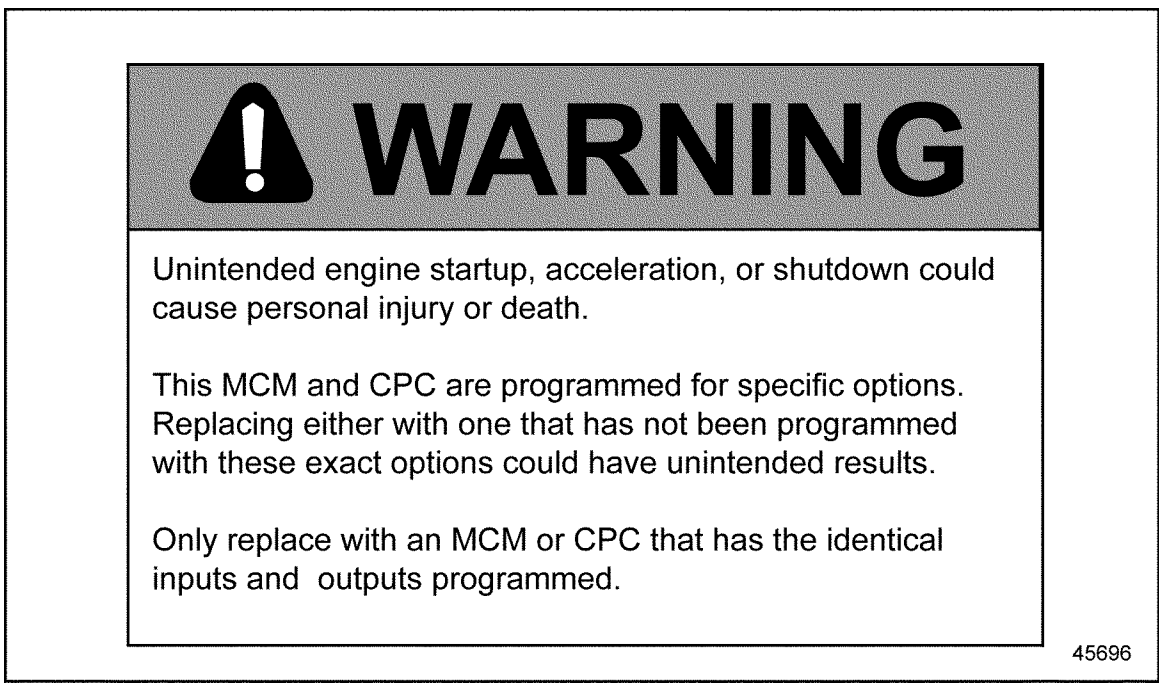

Figure 1 MCM/CPC Replacement Warning

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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 MBE900 Troubleshooting Guide will provide you with concentrated information that will allow you to excel in DDEC VI technology.

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REVISION NOTIFICATION

Modifications to this manual are announced in the form of Service Information Bulletins. The bulletins are posted on the DDC extranet.

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1 INTRODUCTION

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1.3 SAFETY PRECAUTIONS 1-6

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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.

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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.

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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.

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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.

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1.3.1 Ether Start

The DDEC Ether Start System is a fully-automatic engine starting fluid system used to assist a DDEC equipped diesel engine in cold starting conditions. The amount of ether is properly controlled to optimize the starting process and prevent engine damage. DDEC will control ether injection using standard sensors to control the ether injection hardware.

WARNING:

FIRE AND TOXICITY

Some pressurized fluid may be trapped in the system. To avoid personal injury, loosen all connections slowly to avoid contact with fluid. When required, spray fluid into a proper container. The engine starting fluid used in DDEC Ether Start Systems contains extremely flammable and toxic substances.

WARNING:

FIRE AND TOXICITY

To avoid personal injury, spray the fluid from the bottom of the valve into an appropriate container. The engine starting fluid used in DDEC Ether Start Systems contains extremely flammable and toxic substances.

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1.3.2 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.**

1.3.3 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.

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1.3.4 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.**

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WARNING:

FIRE

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

1.3.5 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.

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1.3.6 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.**

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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.

1.3.7 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.

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1.3.8 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.

1.3.9 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.

1.3.10 Diagnostic Equipment

For mobile applications, Detroit Diesel Diagnostic Link 7.0 (DDDL 7.0) 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.

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1.3.11 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.

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1.3.12 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.

1.3.13 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).

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2 FUEL INJECTION MBE900

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2.1 GENERAL FUEL SYSTEM INFORMATION AND TROUBLESHOOTING 2-3
2.2 TEST #1: DOWNSTREAM PRESSURE TEST 2-10
2.3 TEST #2: FLOW TEST — AT NOZZLE HOLDER 2-15
2.4 TEST #3: FLOW TEST — AT FUEL FILTER 2-18
2.5 TEST #4: UPSTREAM PRESSURE TEST 2-22
2.6 TEST #5: LEAK TEST 2-26

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2.1 GENERAL FUEL SYSTEM INFORMATION AND TROUBLESHOOTING

The fuel system contains five sub-systems. See Figure . The five sub-systems are:

- □ Fuel feed
- □ Fuel return
- □ Fuel delivery, low pressure side
- □ Fuel delivery, high pressure side

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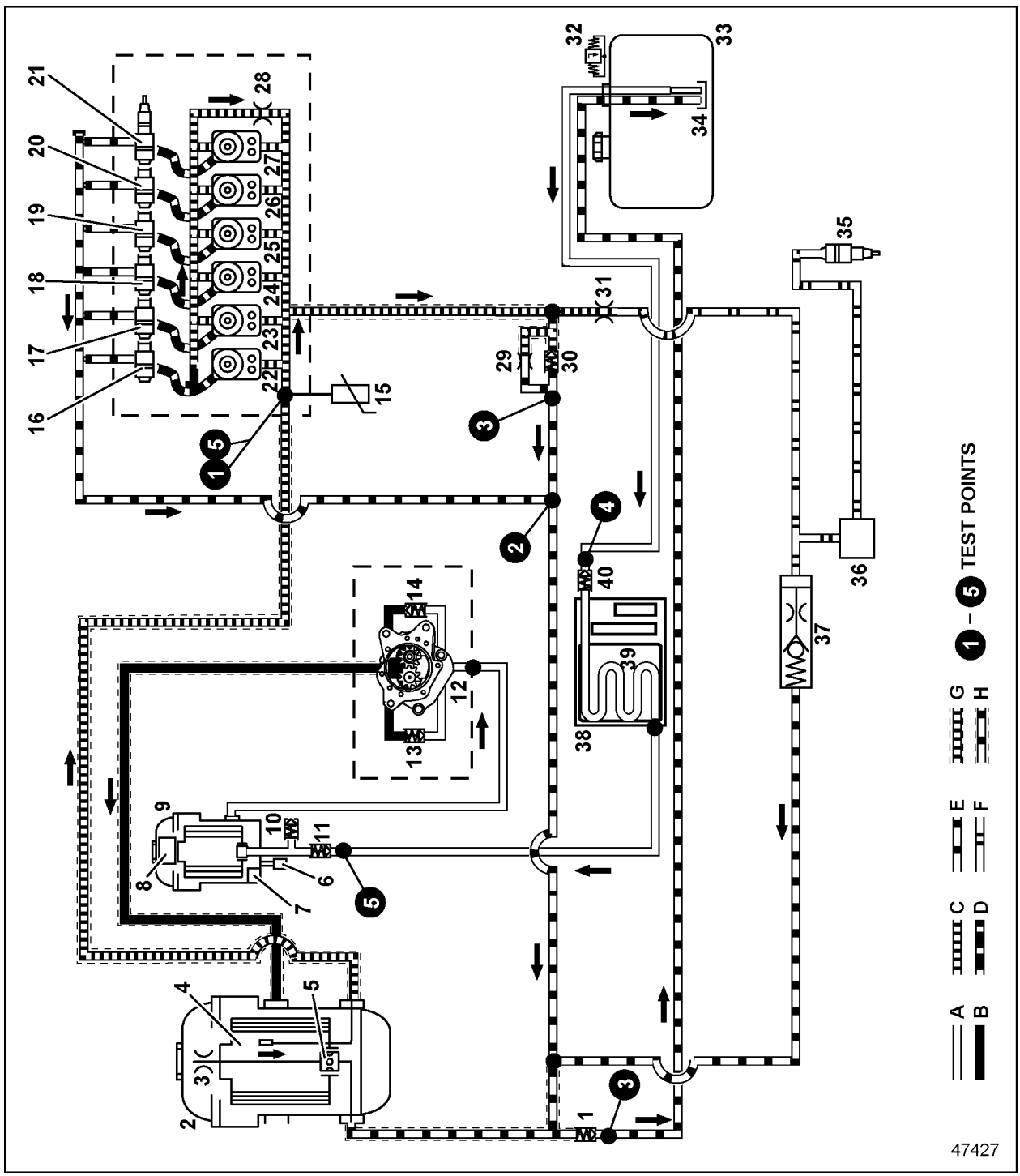
□ Fuel drain



1. Assembly Valve (fuel return)
2. Main Fuel Filter
3. Constant Vent
25. Electronic Unit Pump 4
26. Electronic Unit Pump 5
27. Electronic Unit Pump 6

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4. Main Fuel Filter Element
5. Main Fuel Filter Element
6. Water Separator Drain Valve
7. Water Level Sensor
8. Fuel Pre-heating Element (optional)
9. Fuel Pre Filter with Water Separator
10. Priming Valve
11. Valve in Fuel Feed Line
12. Fuel Pump
13. Bypass Check Valve
14. Pressure Limiting Valve
15. Fuel Temperature Sensor
16. Injector Cylinder 1
17. Injector Cylinder 2
18. Injector Cylinder 3
19. Injector Cylinder 4
20. Injector Cylinder 5
21. Injector Cylinder 6
22. Electronic Unit Pump 1
23. Electronic Unit Pump 2
24. Electronic Unit Pump 3
28. Regulator – Electronic Unit Pumps (flow restrictor)
29. Constant Vent
30. Overflow Valve
31. Regulator – Doser Block (flow restrictor)
32. Vent Valve
33. Fuel Tank
34. Fuel Screen
35. Fuel Doser Valve
36. Doser Block Assembly
37. Doser Block Pressure Regulator
38. Motor Control Module (MCM)
39. Heat Exchanger
40. Assembly Valve (fuel feed)

A – Fuel Supply (suction side)

B – Fuel Supply to Main Filter Element (pressure side - internal fuel gallery)

C – Fuel Supply at Throttle Valve for Doser Block

D – High Pressure Fuel to Injectors

E – Fuel Return

F – Fuel Supply to Doser Block Assembly

G – Fuel Supply to Electronic Unit Pumps (internal fuel gallery

H – Fuel Return (internal to fuel filter housing)

Figure 2-1 Fuel System Schematic

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2.1.1 Principles of Operation

The fuel pump (12) pulls fuel from the fuel tank (33) through the heat exchanger (39) located on the Motor Control Module (MCM) (38) and the fuel prefilter with water separator (9). The prefilter is able to filter particles down to 120 micron. Once the fuel reaches the inlet of the fuel pump (12), the pump acts on the entering fuel and creates system fuel pressure. Inside the fuel pump is a pressure limiting valve (14) and a bypass check valve (13). The pressure limiting valve cracking pressure is between 9.0 and 9.5 bar (130.5 to 138 psi). The bypass check valve cracking pressure is between 0.10 and 0.20 bar (1.5 to 2.9 psi) The prefiltered fuel flows through the pressure side fuel line (B) to the main fuel filter (2). The main fuel filter element (4) filters the particles down to 4 microns. The constant vent (3) in the main fuel filter vents trapped air in the fuel system housing (2).The fuel flows from the main fuel filter housing (2) through an internal engine passage (C), past the fuel temperature sensor (15), and finally reaching the Electronic Unit Pump(s) (EUP).

The Motor Control Module (MCM) (38) uses the signal from the fuel temperature sensor (15) to determine the required fuel volume. When the respective electronic unit ump is controlled, the highly compressed fuel flows from the high pressure fuel line (D) to the appropriate fuel injector. The throttle valve (28) attenuates any pressure spikes in the unit injector fuel line (G).

The injector leak fuel goes through the fuel return line (E) back into the fuel filter housing and then mixes with returned fuel from the doser block assembly (36). The pressure in the unit injector fuel line (G) to the fuel return line (E) is held constant with the overflow valve (30).

The required supply pressure for the fuel doser valve (35) in the fuel supply line to the doser block (F) is achieved with the doser block pressure regulator (37). Variations in pressure due to load or engine speed are compensated using this regulator.

Residual fuel in the fuel supply line to the doser block assembly (F) flows through the doser block pressure regulator (37) and fuel return line (E). From there the fuel mixes with the fuel from the overflow valve (30) and is returned to the fuel tank (33).

2.1.1.1 Additional Information

The assembly valve (40) in the fuel supply line at the inlet of the MCM cooler prevents fuel from leaking when the supply line is removed. A second assembly valve (11) located at the fuel inlet of the filter housing prevents fuel from leaking out of the fuel prefilter when removing the supply line. A third assembly valve (1) is located at the fuel return line located on the fuel filter housing.

The water level sensor (7) notifies the driver when it is necessary to drain the water that has been separated from the fuel. The water is drained using the water drain valve (6) located on the bottom of the fuel filter housing. After changing the fuel prefilter or main filter, the fuel system can be refilled through the priming valve. An optional fuel hand priming pump is available and can be used to prime the fuel system. The fuel prefilter with water separator can be equipped with an optional 250 watt / 12 VDC fuel pre-heating element.

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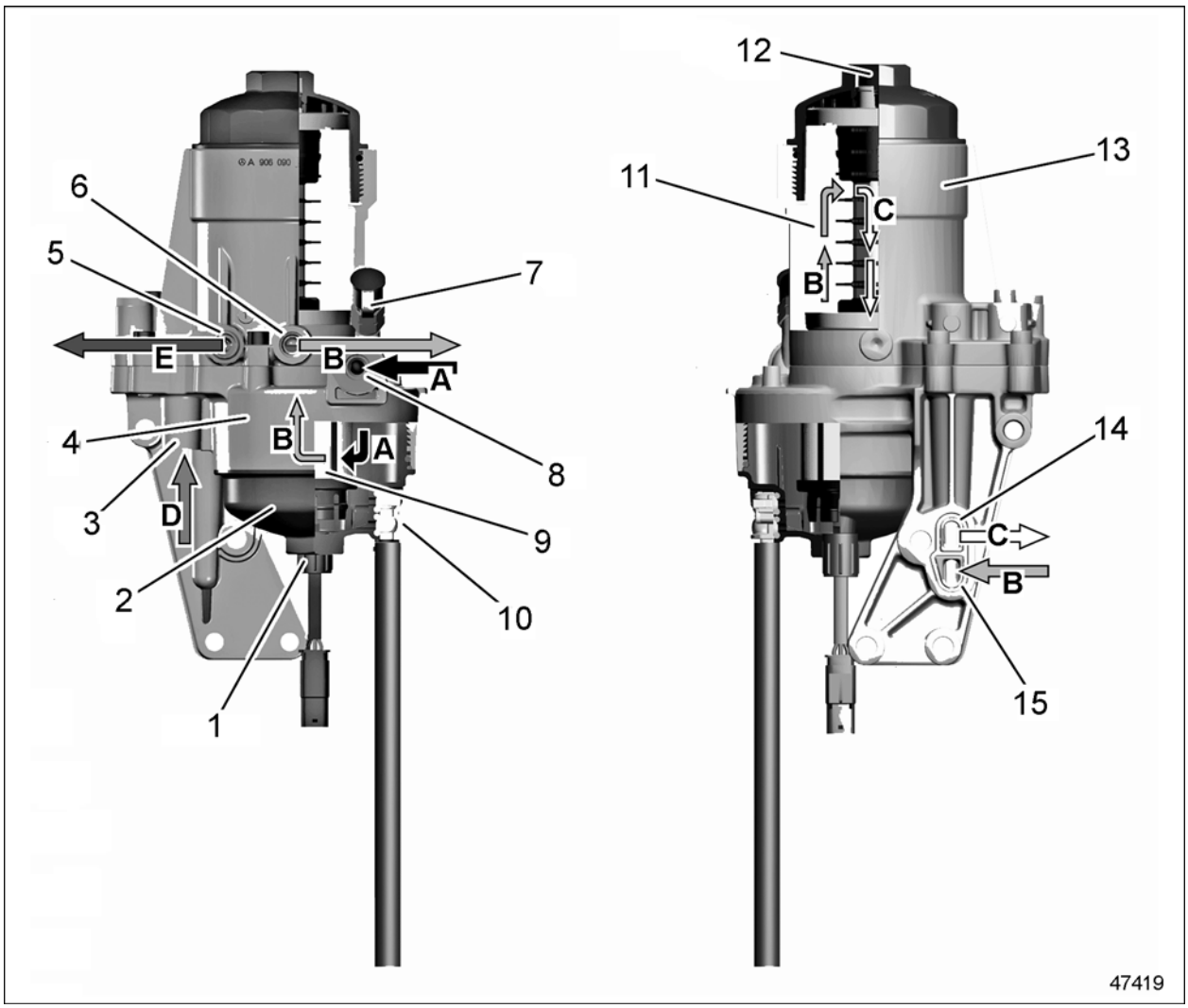

1. Water Level Sensor
2. Water Collection Bowl
3. Main Fuel Filter Return Inlet
4. Fuel Pre-filter with Water Separator
5. Main Fuel Filter Return Outlet
6. Outlet of Fuel Pre-filter with Water Separator
7. Priming Valve
8. Inlet of Fuel Pre-filter with Water Separator
9. Fuel Pre-filter Element
10. Water Separator Drain Valve
11. Main Fuel Filter Element
12. Constant Vent (main fuel filter)
13. Main Fuel Filter Housing
14. Main Fuel Filter Outlet
15. Main Fuel Filter Inlet

A. Unfiltered Fuel from Tank (suction pressure)
B. Pre-filtered Fuel
C. Cleaned Fuel from Main Fuel Filter
D. Overflow and Injector Leak Return Fuel
E. Fuel Return to Tank

Figure 2-2 Fuel Circuit Flow Diagram (filter housing)

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2.1.1.2 Principles of Operation (filter housing)

The unfiltered fuel (A) is drawn in by the fuel pump and flows through the fuel prefilter with water separator (9). The fuel flows from the outside to the inside through the fuel prefilter with water separator element (9). There, any water in the fuel is separated and the larger particles are filtered out. The separated water is collected in the water collection bowl (2).

The prefiltered fuel (B) flows through the outlet of the fuel prefilter with water separator (6) to the fuel pump which pumps it under pressure through main fuel filter inlet (15) into the main fuel filter (11). The prefiltered fuel (B) flows through the main fuel filter element (11) from the outside to the inside where small particles are separated.

The cleaned fuel (C) flows through the main fuel filter outlet (14) to the unit injectors.

The water level sensor (1) recognizes when the separated water in the water collection bowl (2) reaches the maximum level and can display it in the cab. With the engine off, the water is then drained manually from the water drain valve (10).

The high position of the exit bore on the clean side of the main fuel filter (16) ensures that the engine will start without problems after servicing the main fuel filter element (11).

A small bore at the cartridge end plate at the top of the fuel prefilter element (9) ensures that the water separator and the prefilter are vented

After changing the fuel prefilter or main filter, the fuel system can be refilled through the priming valve (7).

A check valve at the inlet of the fuel prefilter with water separator (9) prevents fuel from leaking from the fuel module when dismantling the fuel line from the Motor Control Module (MCM) cooler to the fuel filter module.

A shutoff valve on the main fuel filter return outlet (20) prevents fuel from leaking from the fuel module when dismantling the fuel return line to the fuel tank.

2.1.2 Troubleshooting Tests

Perform the following troubleshooting tests on the engine:

1. Run the engine for two to three minutes at rated speed, 2500 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 pre-filter element for damage, proper installation and correct part number. Replace if necessary.

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4. Inspect the main-filter element for damage, proper installation and correct part number. Replace if necessary.
5. On engines with speed governors, connect minidiag2 to the vehicle and increase the engine speed to 4000 rpm. Note the governed engine speed given.
6. 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.

7. 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: Downstream Pressure Test. Refer to section 2.2.
   [b] Test #2: Flow Test – At Nozzle Holder. Refer to section 2.3.
   [c] Test #3: Flow Test – At Fuel Filter. Refer to section 2.4.
   [d] Test #4: Upstream Pressure Test. Refer to section 2.5.
   [e] Test #5: Leak Test. Refer to section 2.6.
   [f] Troubleshooting tables.
8. 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.
9. 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.

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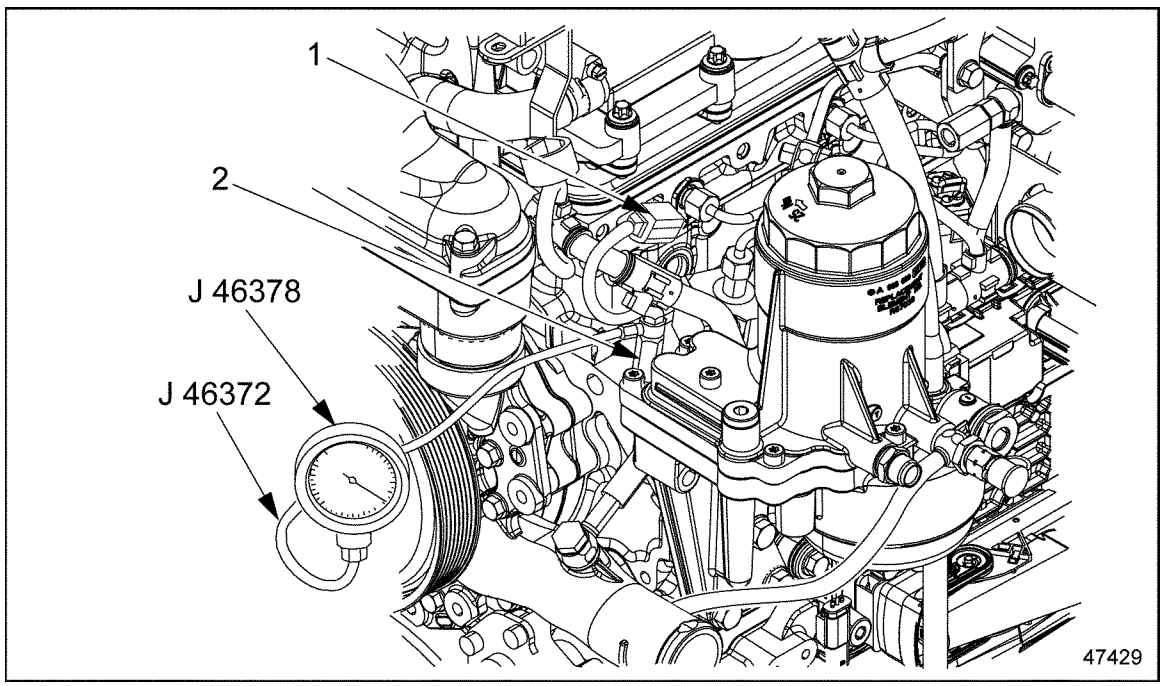
2.2 TEST #1: DOWNSTREAM PRESSURE TEST

Perform the following test set-up and test to determine the downstream pressure.

2.2.1 Test Set-Up

See Figure 2-3



1. Fuel Temperature Sensor
2. Adaptor from kit J-46372

Figure 2-3 Test Setup #1: Downstream Pressure Test

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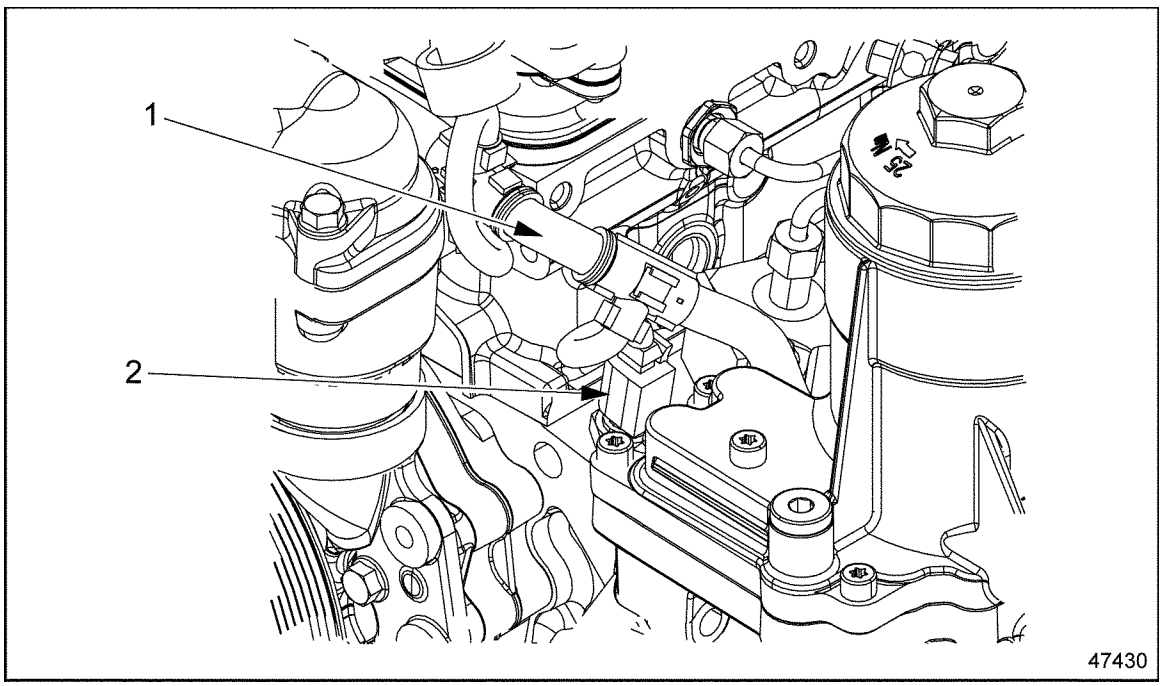
1. Disconnect the engine wiring harness from the fuel temperature sensor. See Figure 2-4.



1.Engine Wiring Harness 2. Fuel Temperature Sensor

Figure 2-4 Disconnecting the Sensor

2. Remove the fuel temperature sensor.
3. Install the disconnected fuel temperature sensor into the engine wiring harness and tie it up out of the way.

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4. Install the adaptor and seal from the fuel adaptor parts kit (J-46377) in the fuel temperature sensor location and tighten adaptor securely. See Figure 2-5 and Figure 2-6.

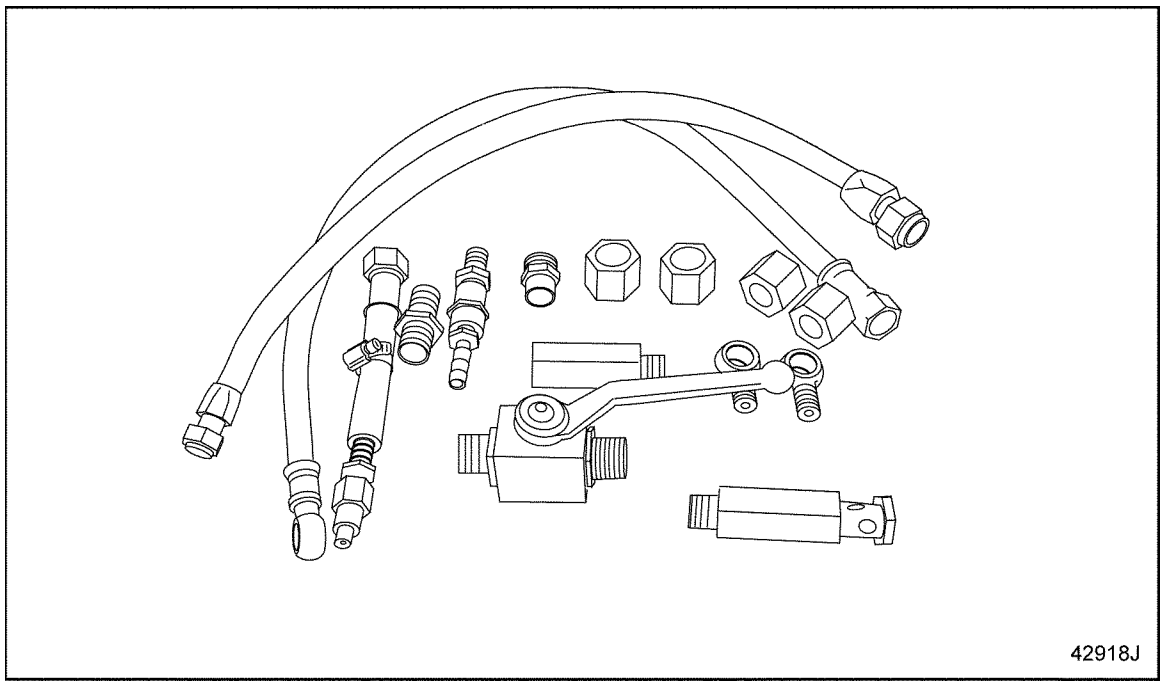
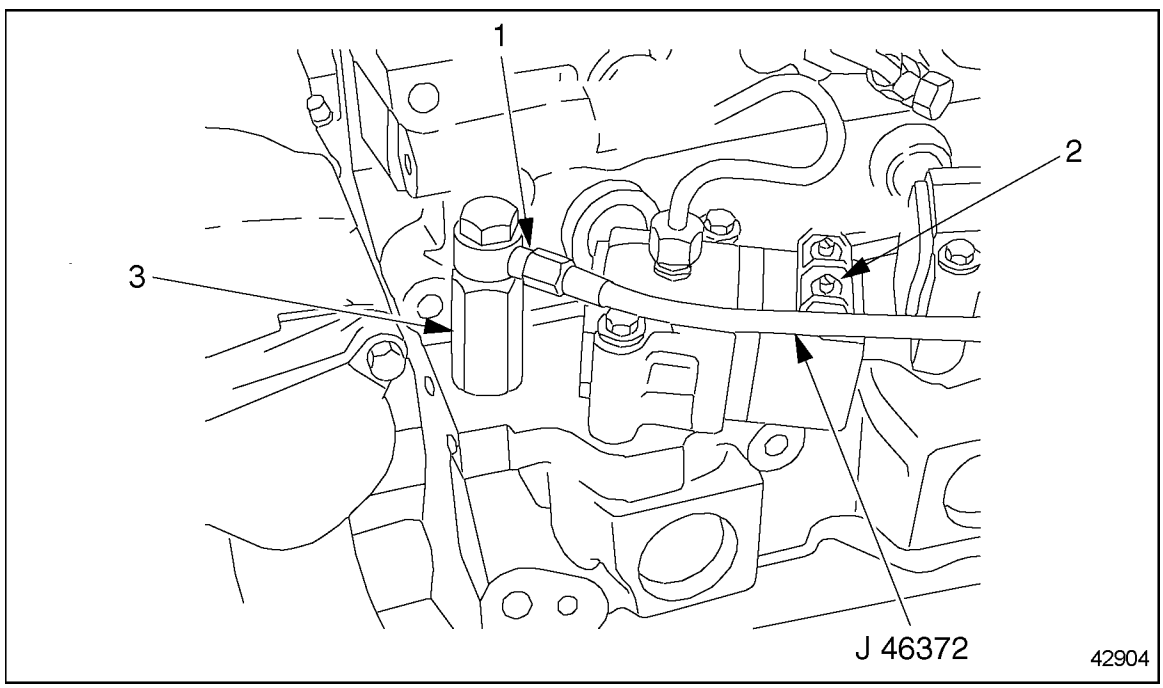


Figure 2-5 Fuel Adaptor Parts Kit J-46377



1. Banjo Fitting
2. Electronic Unit Pump
3. Adaptor from kit J-46377

Figure 2-6 Connecting the Adaptor

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5. Attach the banjo fitting and banjo bolt union from the fuel adaptor kit (J-46377) to the adaptor.
6. Connect the high-pressure fuel line (J-46372) and gauge (J-46378) to the adaptor.

2.2.2 Test #1

Perform the following:

1. Open the fuel fill cap to release pressure in the fuel tank.

⚠ 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 and run it at a slow idle, 600 to 650 rpm.
3. Read off the fuel pressure on the high-pressure gauge. The gauge should read at least 430 kPa (62 psi). If the fuel pressure is too low, perform test #3: Flow Test—At Fuel Filter, and correct the problem. Refer to section 2.4.
4. Increase the engine speed to 2500 rpm.
5. Read off the fuel pressure on the high-pressure gauge. The gauge should read from 400 to 650 kPa (58 to 94 psi).
   [a] If the fuel pressure is within limits, perform test #2: Flow Test—At Nozzle Holder, and correct the problem. Refer to section 2.3.
   [b] If the fuel pressure is too low, perform test #3: Flow Test—At Fuel Filter, and correct the problem. Refer to section 2.4.
   [c] If the fuel pressure is too high, see the causes listed in Table 2-1, “Problem — The Fuel Pressure is Too High Downstream of the Fuel Filter,” and correct the problem. Make any necessary repairs and/or replacements.
6. Remove all test equipment. Reconnect the fuel temperature sensor.

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7. Make sure the fuel fill cap is tightly closed and the vehicle has been restored to operating condition.

Problem — The Fuel Pressure is Too High Downstream of the Fuel Filter	
Possible Cause	**Remedy**
The continuous ventilation port in the cap of the main fuel filter is blocked.	Inspect the continuous ventilation port for blockage. Clean the port and replace the cap if necessary.
The fuel drain lines downstream of the main filter housing are kinked or blocked.	Repair/Replace as necessary.
The check valve in the fuel feed line is blocked or not open wide (the flange at the fitting connection is bent.)	Repair/Replace as necessary.
The fuel return line and/or strainer at the fuel level sensor is blocked or kinked.	Remove the fuel level sensor and repair or replace the line or strainer, as necessary.
The overflow valve is faulty, or the incorrect valve has been installed. The valve jams when closed as a result of wear or impurities in the fuel	Inspect the overflow valve. Replace as necessary. NOTE: Do not attempt to disassemble the overflow valve. The overflow valve cannot be repaired.

Table 2-1 Problem — Fuel Pressure is Too High Downstream of the Fuel Filter

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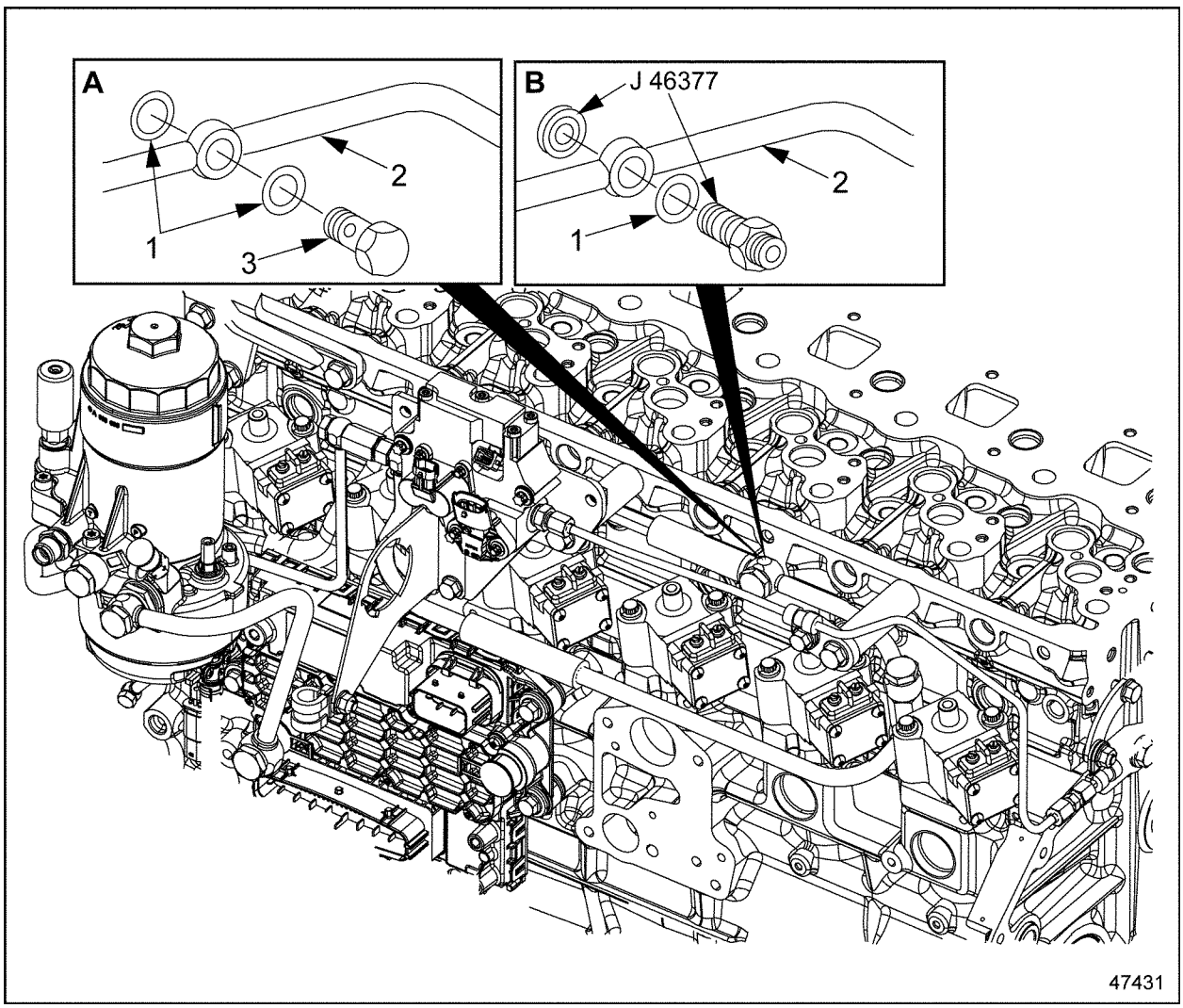
2.3 TEST #2: FLOW TEST — AT NOZZLE HOLDER

Perform the following test set-up and test to determine the flow at the nozzle holder:

2.3.1 Test Set-Up

See Figure 2-7



1. Washers
2. Fuel Return Line
3. Banjo Fitting

Figure 2-7 Test Setup #2: Flow Test at Nozzle Holder

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1. Using the injector line socket (J-46371), remove the injection line at cylinder #4.

NOTE:
When removing the injection line, the transfer tube thrust nut must be held in order to keep the line from twisting.

2. Remove the fuel return line, banjo fitting and washers from the cylinder head at the same cylinder from which the injection line was removed.See Figure 2-7, item A.
3. Using the adaptor and seal rings from the fuel adaptor parts kit (J-46377-A) to install the fuel return line back onto the cylinder head. Tighten adaptor securely.See Figure 2-7, item B.
4. Install the injection line using the injector line socket (J-46371). Torque injection line to 25 N·m (18 lb·ft).
5. Place a clean cloth below the opening in the adaptor to catch any fuel which leaks out of the return line during the test.

2.3.2 Test #2

Perform the following:

1. Open the fuel fill cap to release pressure in the fuel tank.

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 and run it at a slow idle, 600 to 650 rpm until the adaptor opening appears moist. If fuel or coolant flows out of the return line, see the causes listed in Table 2-2, “Problem — Fuel Flows Out of the Fuel Return Line,” and correct the problem. Make any necessary repairs and/or replacements.
3. Increase the engine speed to 2500 rpm. At most, drops of fuel should appear at the adaptor opening. If fuel or coolant flows out of the return line, see the causes listed in Table 2-2, “Problem — Fuel Flows Out of the Fuel Return Line,” and correct the problem. Make any necessary repairs and/or replacements.
4. Remove the adaptor and seal ring part of kit (J-46377-A). Restore the fuel return line to the original installation, as removed. Tighten banjo bolt to 40-50 N·m (30-37 lb·ft).

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5. Make sure the fuel fill cap is tightly closed and the vehicle has been restored to operating condition.

Problem — Fuel Flows Out of the Fuel Return Line	
Possible Cause	**Remedy**
At one or more of the nozzle holders, the transfer tube is leaking, cracked, or incorrectly installed.	Replace the damaged transfer tube(s), or install it correctly.
One or more nozzle holders are leaking, cracked, or incorrectly installed.	Remove and inspect the nozzle holder(s). Replace if necessary.
On one or more nozzle holders, the O-ring between the nozzle holder and the heat isolator is leaking.	Remove the nozzle holder(s) and replace the O-ring(s).
On one or more nozzle holders, the O-ring between the nozzle holder and the cylinder head is leaking.	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.
At one or more nozzle holders, the heat isolator is cracked, faulty, or not sealing properly.	Remove and inspect the heat isolator(s). Replace if necessary.
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.

Table 2-2 Problem — Fuel Flows Out of the Fuel Return Line

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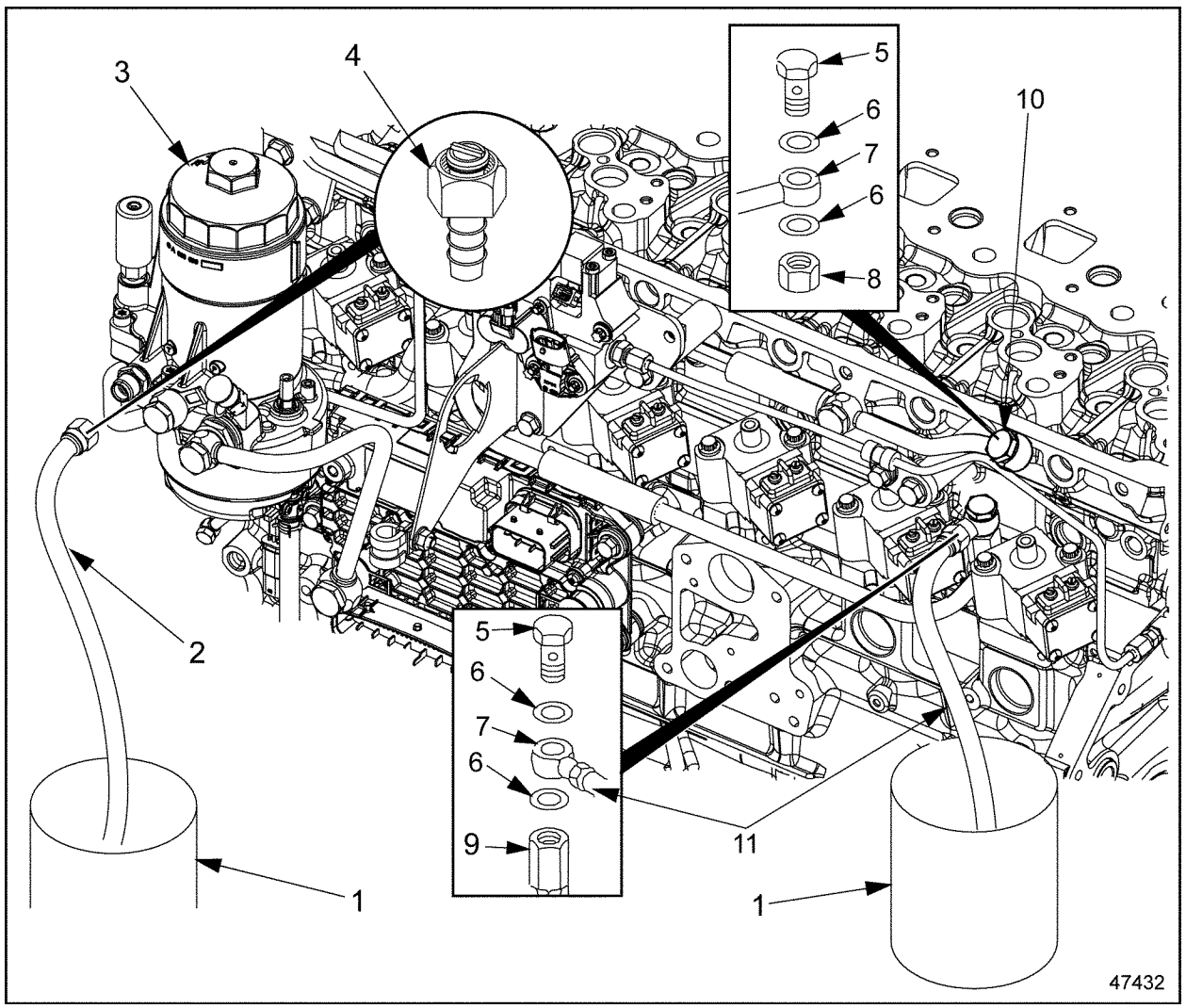
2.4 TEST #3: FLOW TEST — AT FUEL FILTER

Perform the following test set-up and test to determine the flow at the fuel filter.

2.4.1 Test Set-Up

See Figure 2-8



1. Clean Container
2. Hose
3. Main Filter Housing
4. Assembly Valve Adaptor from kit J-46377-A
5. Banjo Bolt
6. Washers
7. Banjo Fitting and Hose from kit J-46377-A
8. Cap from kit J-46377-A
9. Overflow Valve
10. Original Overflow Return Hose

Figure 2-8 Test Setup #3: Flow Test at Fuel Filter

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1. Disconnect the fuel return line at the overflow valve. When loosening the banjo bolt, hold a second wrench on the overflow valve to avoid loosening the valve.
2. Using a banjo bolt, nut, and washer from the fuel adaptor parts kit (J-46377-A), seal off the fuel return line.
3. In place of the fuel return line, attach the hose with a banjo fitting from the fuel adaptor parts kit (J-46377) to the overflow valve. When tightening the union, hold a second wrench on the overflow valve to avoid over-tightening the valve.
4. At the main fuel filter, detach the fuel drain line and its fitting from the main filter housing.
5. In place of the fuel drain line, attach a union from the fuel adaptor parts kit to the main filter housing.
6. At the union, attach a hose and run the other end of the hose into another clean container.

2.4.2 Test #3

Perform the following:

1. Open the fuel fill cap to release pressure in the fuel tank.

⚠ 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 and run it at a slow idle, 600 to 650 rpm, until the fuel flows into the container with little or no bubbling.
3. Check the fuel flow at the fuel filter.

NOTE:
When beginning the timed portion of this test, take the transparent hose out of the clean container and insert it into a calibrated container or measuring cup.

[a] Measure the quantity of fuel that flows out of the hose in one minute (60 seconds). If more than 300 mL (10.1 oz.) flow out, fuel flow at the filter is too high (at idle).

[b] Increase the engine speed to 2500 rpm.

[c] Measure the quantity of fuel that flows out of the hose in one minute. If more than 300 mL (10.1 oz.) flow out, fuel flow at the filter is too high (at rated speed).

NOTE:
If fuel flow on either test is too high, correct the problem. Fuel flow is OK if the system passes both tests.

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4. Check the fuel flow at the overflow valve.

   [a] Reduce engine speed back to slow idle, 600 to 650 rpm.

NOTE:
When beginning the timed portion of this test, take the transparent hose out of the clean container and insert it into a large calibrated container.

   [b] Measure the quantity of fuel that flows out of the hose in one minute (60 seconds). If more than 1.7 Liter (1.8 qt) flows out, overflow valve fuel flow is too high. If less than 0.9 Liter (0.95 qt) flows out, overflow valve fuel flow is too low.

   If between 0.9 Liter (0.95 qt) and 1.7 Liter (1.8 qt) flows out, overflow valve fuel flow is within range.

   [c] Increase the engine speed to 2500 rpm.

   [d] Measure the quantity of fuel that flows out of the hose in one minute. If more than 7.5 Liter (7.9 qt) flows out, overflow fuel flow is too high. If less than 2.7 Liter (2.9 qt) flows out, overflow fuel flow is too low.

   If between 2.7 Liter (2.9 qt) and 7.5 Liter (7.9 qt) flows out, overflow fuel flow is within range.

5. If overflow valve fuel flow is too low and filter fuel flow is too high, see the causes listed in Table 2-3, “Problem – Fuel Flow Quantity is Too Low at the Overflow Valve and Too High at the Filter,” and correct the problem. Make any necessary repairs and/or replacements. If overflow valve fuel flow is too low and fuel flow is OK at the filter, see the causes listed in Table 2-4, “Problem — Fuel Flow Quantity is Too Low at the Overflow Valve and Within Range at the Filter,” and correct the problem. Make any necessary repairs and/or replacements.

   If overflow valve fuel flow is too low and fuel flow is also too low at the filter, perform test #4: Upstream Pressure Test. Refer to section 2.5.

   If overflow valve fuel flow is OK and no fuel flows out at the filter, the continuous ventilation port in the fuel filter is blocked by impurities. Open the fuel filter and clean or replace the blocked port.

   If overflow valve fuel flow is OK and fuel flow is also OK at the filter, the overflow valve is faulty, leaking, jammed open, worn, or incorrectly installed. Replace the overflow valve. Refer to section 2.5.

NOTE:
Do not attempt to disassemble the overflow valve. The overflow valve cannot be repaired.

6. Remove the union, transparent hose, banjo bolt, and nut. Restore the fuel return and drain lines to the original installation, as removed.

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7. Make sure the fuel fill cap is tightly closed and the vehicle has been restored to operating condition.

Problem — Fuel Flow Quantity is Too Low at the Overflow Valve and Too High at the Filter	
Possible Cause	**Remedy**
The main fuel filter is leaking.	Repair or replace the leaking main fuel filter.
The O-ring in the main fuel filter is worn, missing, or incorrectly installed.	Replace the O-ring, or install it correctly.
The main fuel filter cap is loose.	Tighten the to cap 25 N·m (18 lb·ft).
At one or more of the nozzle holders, the transfer tube is leaking, cracked, or incorrectly installed.	Replace the transfer tube(s), or install it correctly.
One or more nozzle holders are leaking, or cracked.	Replace the nozzle holder(s).

Table 2-3 Problem — Fuel Flow Quantity is Too Low at the Overflow Valve and Too High at the Filter

Problem — Fuel Flow Quantity is Too Low at the Overflow Valve and Within Range at the Filter	
Possible Cause	**Remedy**
The filter element in the fuel pre-filter is blocked.	Replace the filter element.
The filter element in the main fuel filter is blocked or contaminated.	Clean the inside of the main fuel filter housing. Replace the filter element.
The fuel feed lines are kinked or blocked.	Inspect the lines, fittings, and check valve for blockage. Repair any kinks and replace the lines.
The suction pipe or the strainer at the fuel level is blocked, or touching the bottom of the fuel tank.	Open the fuel fill cap. Inspect the suction pipe and strainer. Remove any blockages, and reposition the suction pipe, if necessary. Remove the fuel level sensor and replace it if necessary.
The check valve in the fuel feed line is blocked or is not sufficiently open (the opening flange is bent at the fitting).	Repair/replace as necessary.
The overflow valve is faulty, or the incorrect valve has been installed. The valve jams when closed as a result of wear or impurities in the fuel.	Inspect the overflow valve. Replace as necessary. NOTE: Do not attempt to disassemble the overflow valve. The overflow valve cannot be repaired.

Table 2-4 Problem — Fuel Flow Quantity is Too Low at the Overflow Valve and Within Range at the Filter

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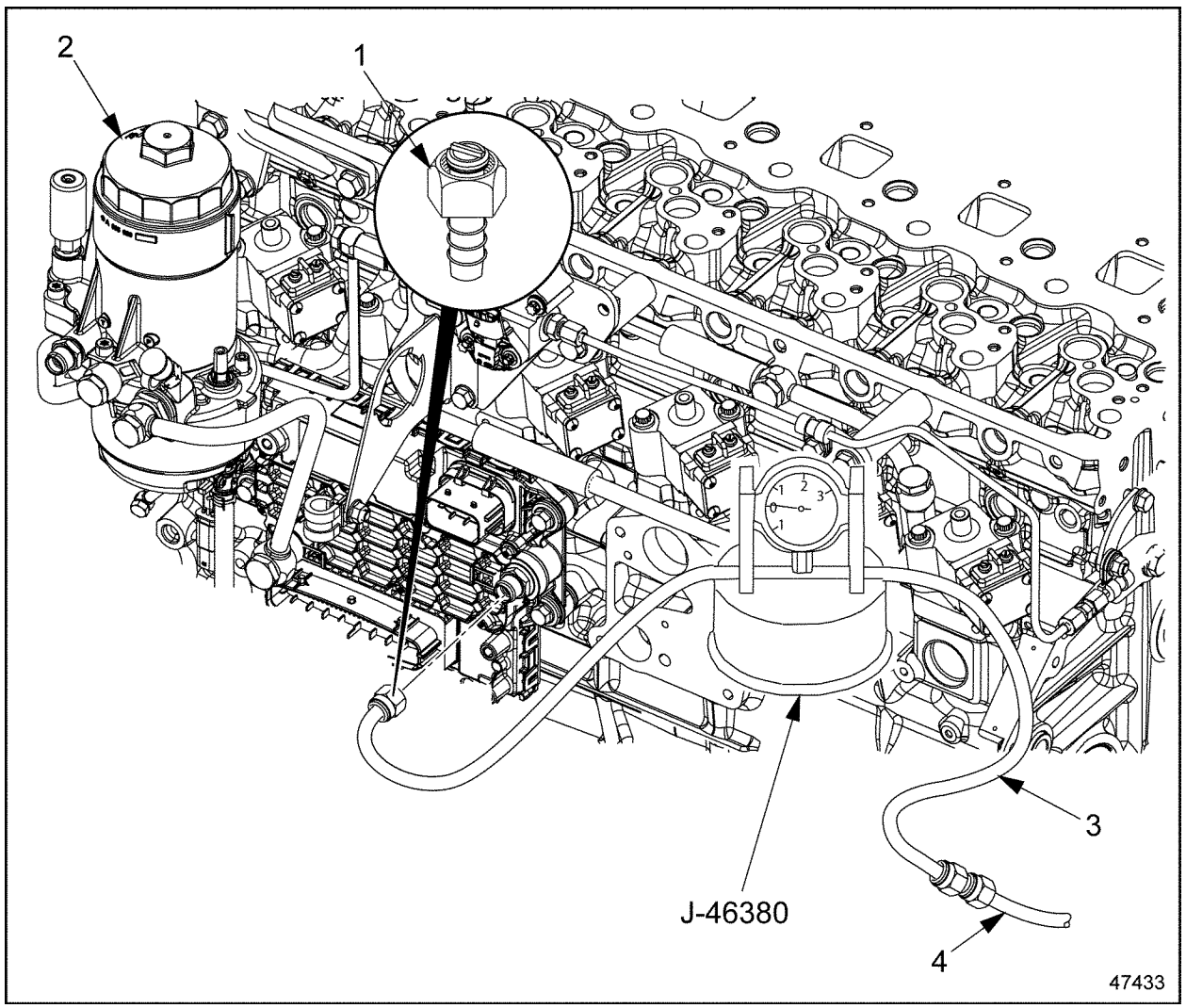
2.5 TEST #4: UPSTREAM PRESSURE TEST

Perform the following test set-up and test to determine the upstream pressure.

2.5.1 Test Set-Up

1. At the Motor Control Module (MCM), disconnect the fuel feed line. See Figure 2-9.



1. Assembly Valve Adaptor from kit J-46377-A
2. Main Fuel Filter
3. Test Hose Included with J-46380
4. Fuel Feed Line (vehicle side)

Figure 2-9 Test Setup #4: Upstream Pressure Test

2. Install the pressure tester (J-46380). Connect one end of the transparent test hose to the MCM cooler, using a union from the fuel adaptor parts kit (J-46377-A). Connect the

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other end of the transparent test hose to the disconnected fuel feed line, using a barbed adaptor to the proper-sized fuel line fitting.

NOTE:
Ensure the correct assembly valve adapter from parts kit (J-46377-A) is used on the MCM side. Using the incorrect fitting will not allow the assembly valve on the MCM to open.

3. 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.
4. Stand the pressure tester on a level spot, such as the frame rail.

NOTE:
The pressure tester must be level to indicate correctly.

2.5.2 Test #4

Perform the following:

1. Open the fuel fill cap to release pressure in the fuel tank.

⚠ 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 and run it at a slow idle, 600 to 650 rpm.

NOTE:
The pressure tester reads in bar. 1 bar = 14.5 psi or 100 kPa.

NOTE:
This test measures suction at the fuel inlet. All pressure values are negative.

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3. Read off the fuel pressure on the pressure tester. The gauge should read from –0.09 bar to –0.12 bar (–1.3 to –1.7 psi [–9 to –12 kPa]). If the fuel pressure is too low (less suction), see the causes listed in Table 2-5, "Problem — The Inlet Pressure is Too Low," and correct the problem. Make any necessary repairs and/or replacements.

   If the fuel pressure is too high (more suction), see the causes listed in Table 2-6, "Problem — The Inlet Pressure is Too High," and correct the problem. Make any necessary repairs and/or replacements.

4. Increase the engine speed to 2500 rpm.

5. Read off the fuel pressure on the pressure tester. The gauge should read between –0.4 and –0.5 bar (–5.8 to –7.3 psi [–40 to –50 kPa]). If the fuel pressure is too low (less suction), see the causes listed in Table 2-5, "Problem — The Inlet Pressure is Too Low," and correct the problem. Make any necessary repairs and/or replacements.

   If the fuel pressure is too high (more suction), see the causes listed in Table 2-6, "Problem — The Inlet Pressure is Too High," and correct the problem. Make any necessary repairs and/or replacements.

6. Remove all test equipment. Reconnect the fuel feed line.

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7. Make sure the fuel fill cap is tightly closed and the vehicle has been restored to operating condition.

Problem — The Fuel Inlet Pressure is Too Low	
Possible Cause	**Remedy**
The pre-filter is leaking (drawing air).	Replace the O-ring. Replace the filter element and tighten the cap on the filter housing 25 N·m (18 lb·ft).
The fuel feed lines and connections are leaking (drawing air).	Replace the seals on the leaking lines. Tighten the fittings on the fuel lines to 25 N·m (18 lb·ft) and perform a fuel leak test.
The fuel pump is worn.	Replace the fuel pump.
The pressure limiting valve in the fuel pump is jammed open or the drive lever is loose or broken.	Replace the fuel pump.
The air-admission valve in the fuel tank is blocked.	Remove air-admission valve blockage.
The suction line and/or strainer at the fuel level sensor is blocked or is touching the bottom of the fuel tank.	Inspect the suction line and/or strainer through the fuel fill opening in the fuel tank. Remove the fuel level sensor and repair or replace the line or strainer, as necessary.

Table 2-5 Problem — The Fuel Inlet Pressure is Too Low

Problem — The Fuel Inlet Pressure is Too High	
Possible Cause	**Remedy**
The fuel feed lines are kinked or blocked.	Inspect the lines and fittings for blockage. Repair/replace as necessary.
The suction line and/or strainer at the fuel level sensor is blocked or is touching the bottom of the fuel tank.	Inspect the suction line and/or strainer through the fuel fill opening in the fuel tank. Remove the fuel level sensor and repair or replace the line or strainer, as necessary.
The check valve in the fuel feed line is blocked or not open wide (the flange at the fitting connection is bent).	Repair/replace as necessary.

Table 2-6 Problem — The Fuel Inlet Pressure is Too High

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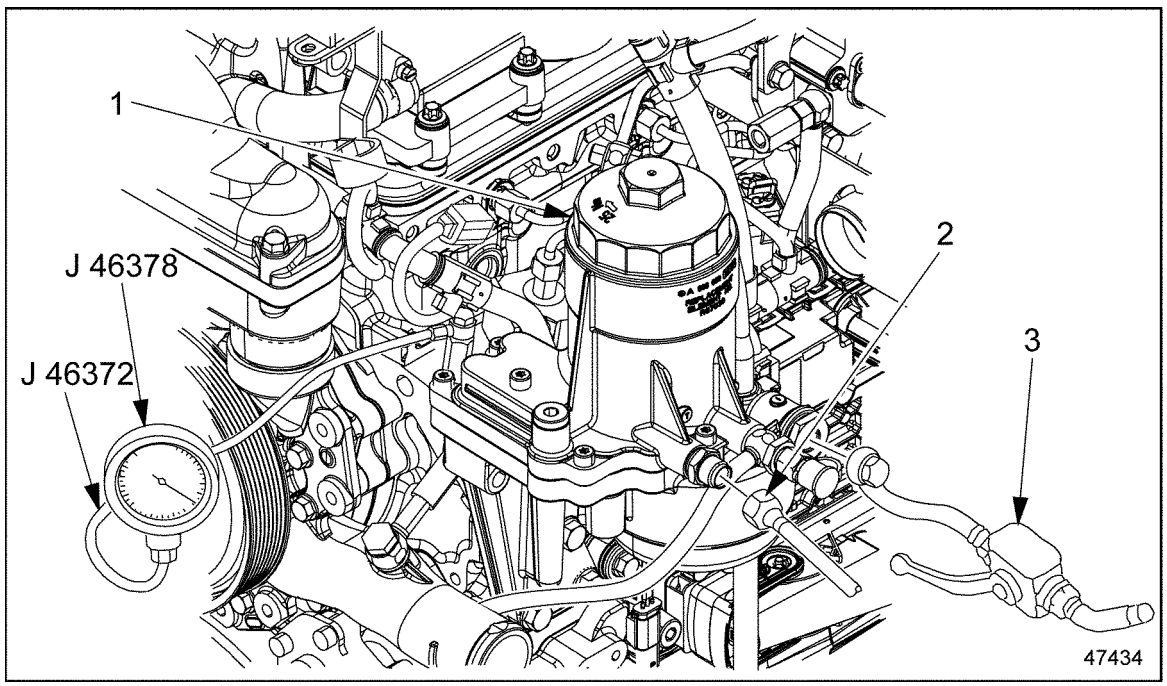
2.6 TEST #5: LEAK TEST

Perform the following test set-up and test to determine if and where the fuel system is leaking.

2.6.1 Test Set-Up

See Figure 2-10



1. Main Filter Housing
2. Fuel Return Line to Tank
3. Shutoff Valve from Adapter kit J-46377-A

Figure 2-10 Test Setup #5: Leak Test

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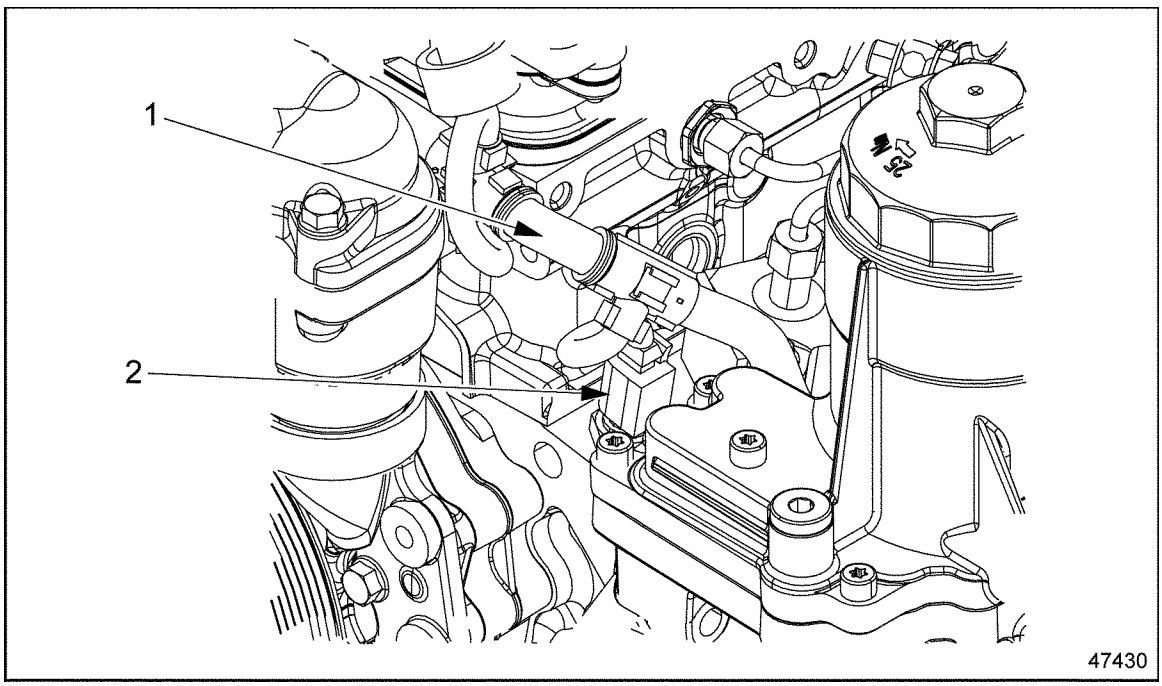
1. Disconnect the fuel temperature sensor. See Figure 2-11.



1. Engine Wiring Harness
2. Fuel Temperature Sensor

Figure 2-11 Disconnecting the Sensor

2. Plug the disconnected fuel temperature sensor into the engine wiring harness and tie it up out of the way.

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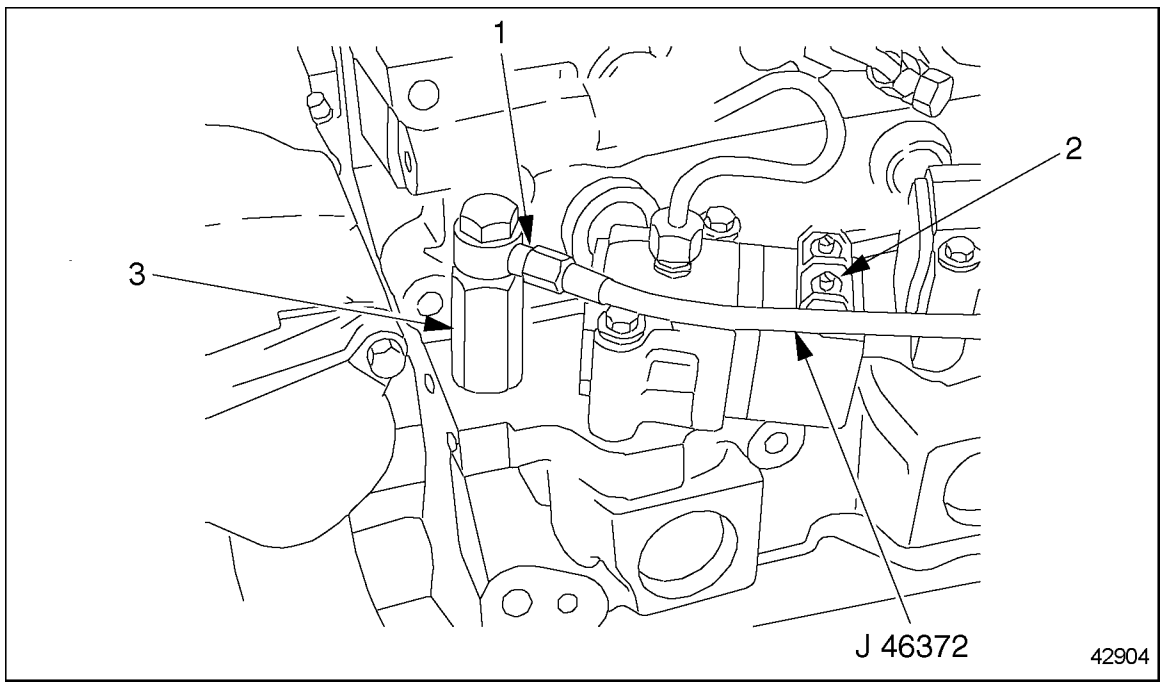
3. Install the adaptor and seal from the fuel adaptor parts kit (J-46377-A). See Figure 2-12.



1. Test Hose from kit J-46377-A
2. Electronic electronic unit ump
3. Adaptor from kit J-46377-A

Figure 2-12 Connecting the Adaptor

4. Attach a banjo fitting to the adaptor, and use that to connect the high-pressure fuel line (J-46372) and gauge (J-46378).
5. Disconnect the fuel return line at the main filter housing. Seal the opening with a cap.
6. 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-A).

2.6.2 Test #5

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, see the causes listed in Table 2-7, “Problem — The Low Pressure Fuel System is Leaking,” and correct the problem. Make any necessary repairs and/or replacements.

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5. Check the engine oil for presence of fuel. If there is fuel in the engine oil, see the causes listed in Table 2-7, “Problem — The Low Pressure Fuel System is Leaking,” and correct the problem. Make any necessary repairs and/or replacements.
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.

Problem — The Low-Pressure Fuel System is Leaking	
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 electronic unit umps 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 electronic unit ump(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 2-7 Problem — The Low-Pressure Fuel System is Leaking

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3 MISFIRING CYLINDER-MBE900

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3.1 POOR VEHICLE GROUND

To determine if poor vehicle ground is causing the cylinder to misfire, perform the following steps:

1. Remove the alternator drive belt, refer to the MBE900 service manual, electrical equipment chapter-drive belts.

⚠ 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

Perform the following steps for negative lead repair:

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, refer to the MBE900 service manual, electrical equipment chapter-drive belts.

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 Verification of Repair for Negative Lead

Perform the following steps to determine if negative lead repair resolved the misfiring cylinder condition:

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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.

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3.2 AERATED FUEL

To determine if aerated fuel is causing the cylinder to misfire, perform the following steps:

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

Perform the following steps to repair the air in the fuel:

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.

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3.2.1.1 Test the Engine with Repair for Aerated Fuel

Perform the following steps to determine if the aerated fuel repair 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 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.

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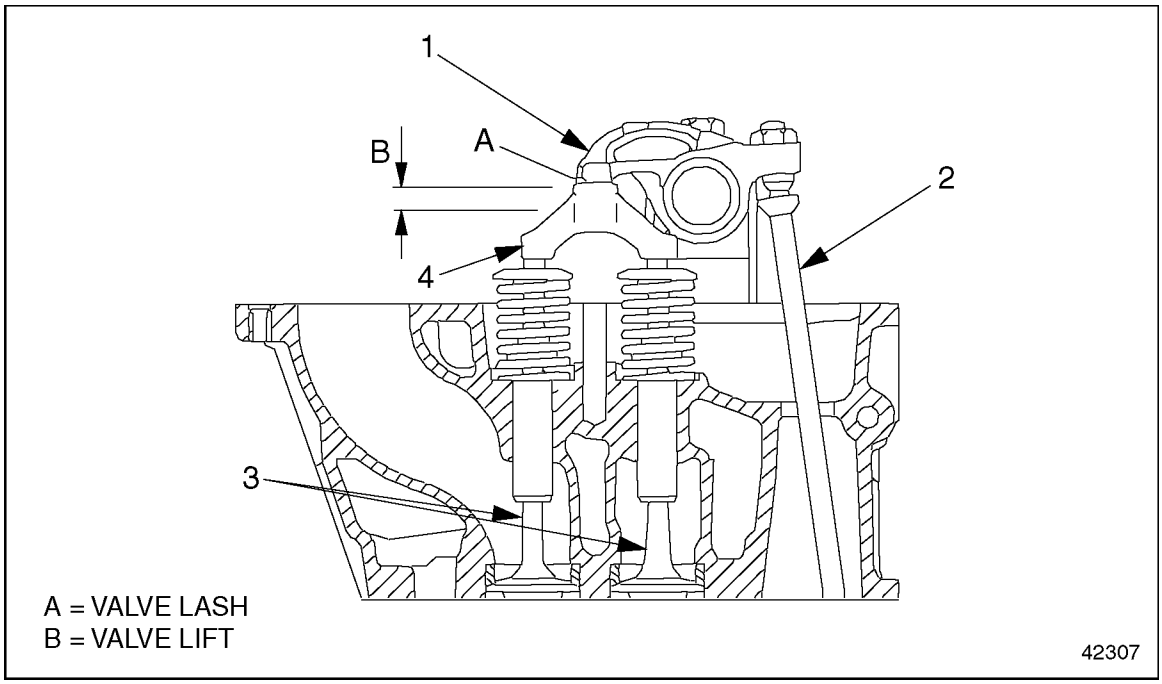
3.3 IMPROPER VALVE CLEARANCE, WORN OR DAMAGED CAMSHAFT LOBES AND ROLLERS

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. Pushrod
3. Intake Valves
4. Valve Bridge

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 MBE900 service manual, engine chapter-valves.

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3.3.1 Verification of Repair for Improper Valve Clearance or Injector Height Setting

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.

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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

Refer to the “Injector Unit Pump”section of the MBE900 service manual, fuel system chapter.for unit pump and nozzle replacement.

3.4.1.1 Verification of Repair for Faulty Fuel Nozzle/Unit Pump

Perform the following steps to determine if the replaced fuel nozzle/unit pump resolved the misfiring cylinder conditions:

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.

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3.5 FAULTY MCM

To determine if a faulty MCMcontrol unit 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 MBE900 service manual, fuel system chapter.

3.5.1 Faulty MCM Repair

There is no authorized repair for the MCM.

3.5.1.1 Verification of Replacement for Faulty MCM

Perform the following steps to determine if the test MCM has 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. 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.

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3.6 WORN OR DAMAGED VALVE OR CYLINDER KIT

Loss of compression in MBE900 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. 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. Remove air compressor; refer to MBE900 service manual, special equipment chapter.
3. Perform a crankcase pressure test. refer to section 3.6.1
4. Remove the vehicle from the chassis dynamometer.
5. Review the crankcase pressure test results.
   [a] If the crankcase pressure was greater than 0.62 kPa (2.5 in. H_2O), refer to section3.6.3
   [b] If the crankcase pressure was less than 0.62 kPa (2.5 in. H_2O), perform a cylinder compression test. refer to section 3.6.2
6. Compare the cylinder compression test results to specifications:refer to section 3.6.2
   [a] If the cylinder compression is below specifications, refer to section 3.6.1
   [b] If the cylinder compression is within specifications, call Detroit Diesel Customer Support Center at 313–592–5800.

3.6.1 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)
5. Run the vehicle to full load and rated speed.

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6. Measure and record crankcase pressure.
7. Shut down the engine.
8. Remove the manometer from the oil dipstick opening and install the dipstick.

3.6.2 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 to 95°C (158 and 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.

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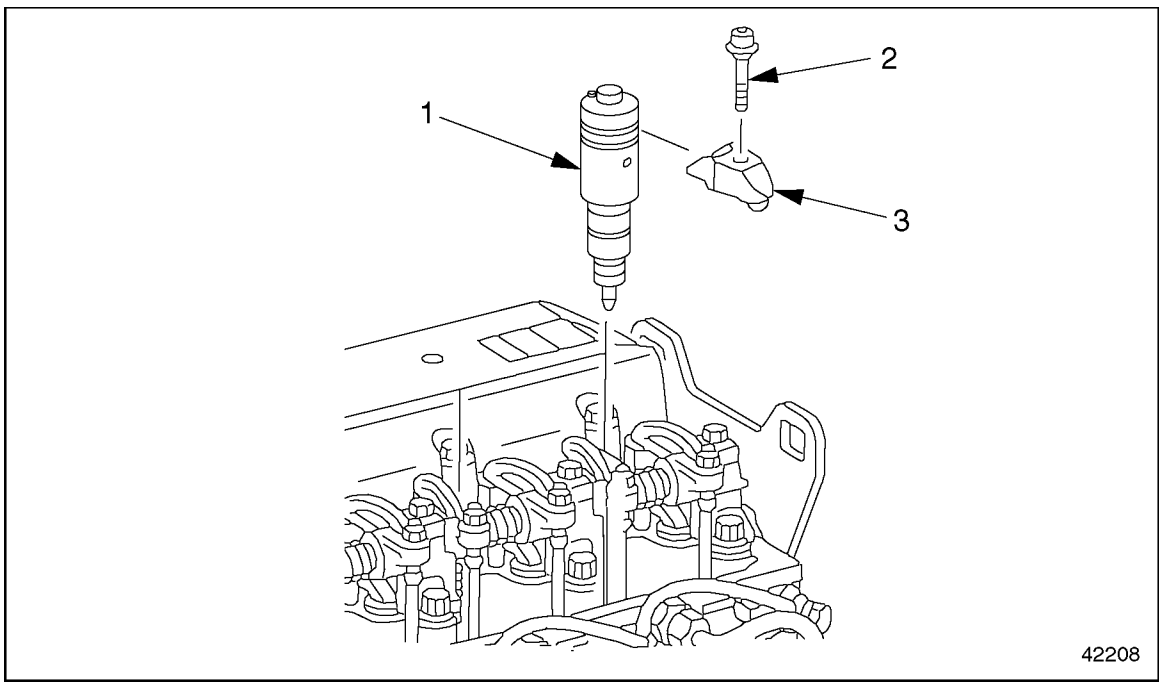
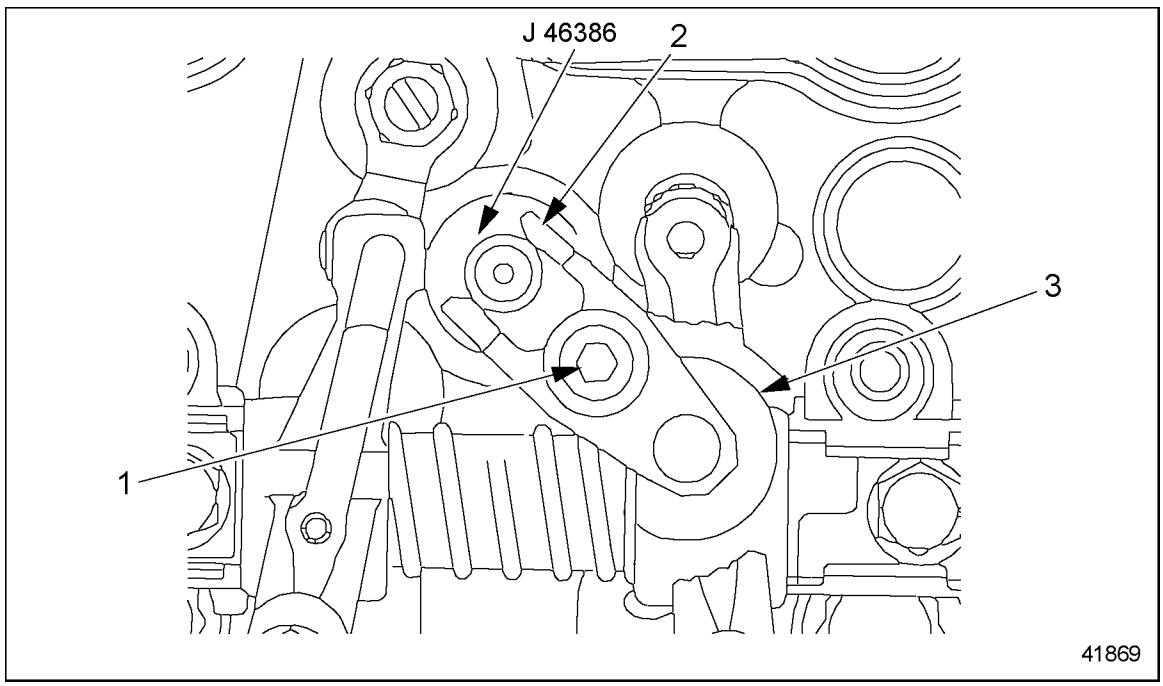
4. Remove the nozzle holder. See Figure 3-2



1. Nozzle Holder
2. Bolt
3. Hold–Down Clamp

Figure 3-2 Removing the Nozzle Holder

5. Insert the compression test adaptor (J–46386) into the cylinder head. See Figure 3-3



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

Figure 3-3 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.

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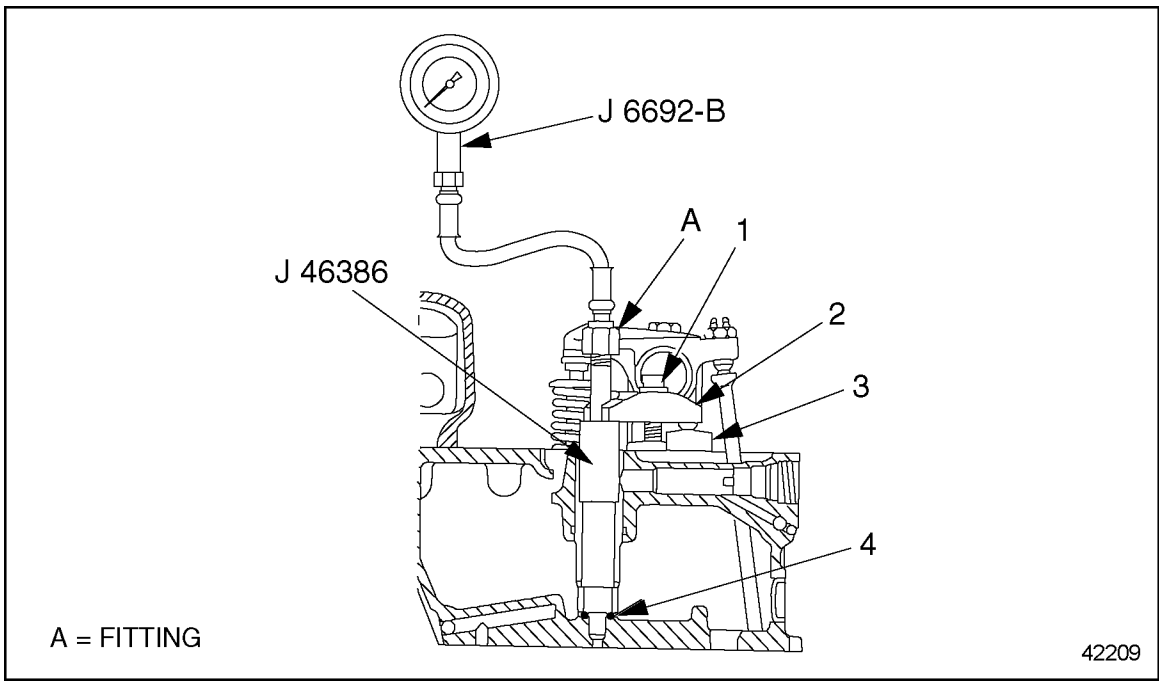
6. Attach the compression tester (J–6692–B) to the test adaptor (J–46386). Thread the fitting at the end of the tester to the top of the test adaptor. See Figure 3-4



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

Figure 3-4 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 3-1

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

Table 3-1 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.

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Install the nozzle holder as follows:

1. Connect the MCM.
2. Connect diagnostic tool 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 3-4
4. Remove the compression test adaptor. See Figure 3-3
5. Install the nozzle holder. See Figure 3-2
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.

3.6.3 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 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 head components for worn or damaged liners examine the pistons or piston rings.
4. Verification of repairs made to cylinder valve(s) or cylinder kit components is required; refer to section 3.6.3.1.

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3.6.3.1 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.
   [b] If the engine is misfiring, call Detroit Diesel Customer Support Center (313-592-5800).

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4 STARTING DIFFICULTY (ENGINE ROTATES) MBE900

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4.1 MCM WIRING HARNESS

To determine if the MCM 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 MCM 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 4.1.1.

4.1.1 Vehicle Circuit Breakers or Fuses Check

To determine if the vehicle circuit breakers are causing starting difficulty, visually check MCM 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; 4.1.3.1
2. If circuit breakers are not tripped, measure the voltage at the MCM 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.

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4.1.2 MCM Unit 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.

4.1.3 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 4.1.3.1.

4.1.3.1 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 4.2.

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4.2 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 4.3.
2. If fuel is below recommended level, refer to section 4.2.1.

4.2.1 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 4.2.1.1.

4.2.1.1 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 4.3.

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4.3 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 4.4.
2. If voltage is less than 10.5 volts (21 volts for a 24-volt system), battery replacement is necessary; refer to section 4.3.1.

4.3.1 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 4.3.1.1.

4.3.1.1 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 4.4

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4.4 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 4.5.
2. If corrosion or damage are found, repair is necessary; refer to section 4.4.1.

4.4.1 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 4.4.1.1.

4.4.1.1 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 4.5.

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4.5 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.

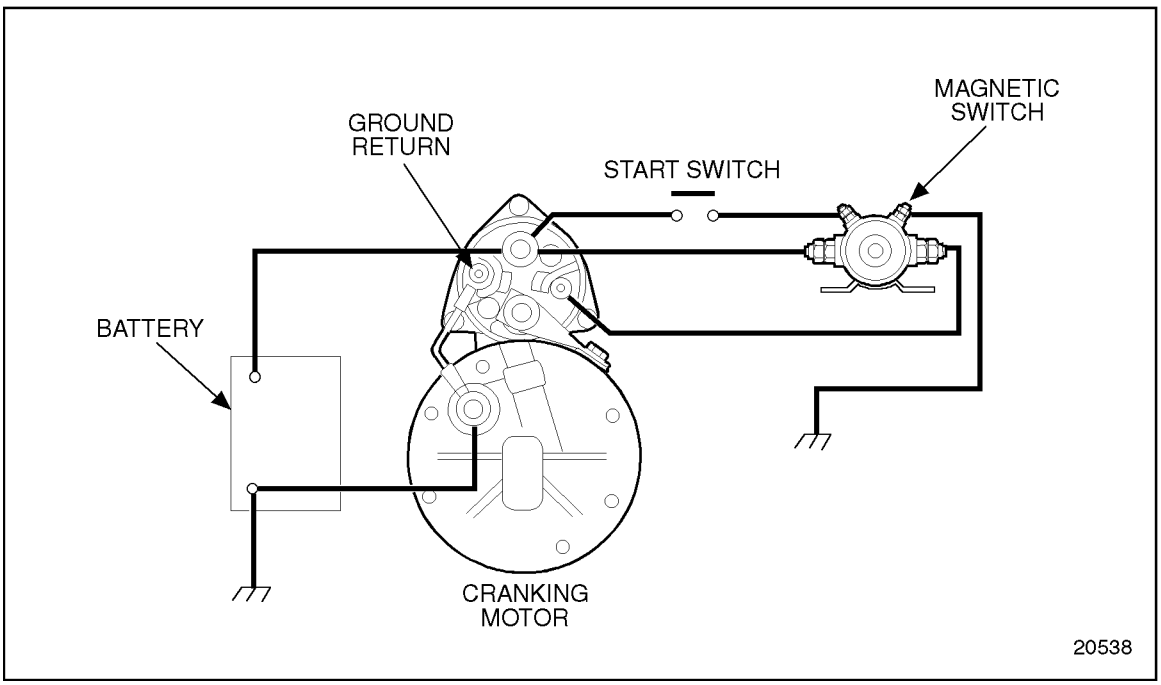

Figure 4-1 Basic Cranking Circuit

[a] If the engine cranked with the jumper cable in place, the magnetic switch must be replaced; refer to section 4.5.1.

[b] If the engine did not crank with the jumper cable in place, check the starter; refer to section 4.6.

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4.5.1 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 4.5.1.1.

4.5.1.1 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 4.6.

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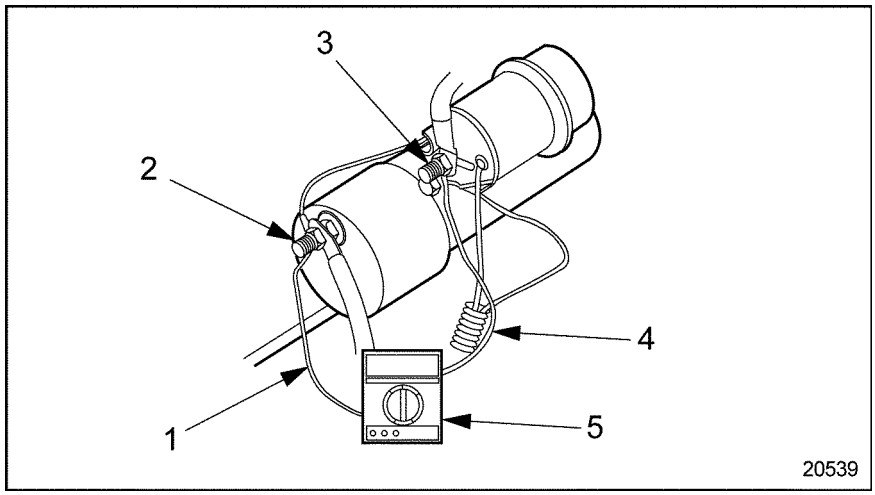
4.6 DEFECTIVE STARTER

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 4-1.
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 4.6.1.
   [b] If the voltage is to specification while cranking the engine, check the cranking speed; refer to section 4.7.

4.6.1 Starter Replacement

Perform the following steps for starter replacement:

1. Replace the starter, refer to them MBE90 service manual, electrical equipment chapter.
2. Verify replacement of starter; refer to section 4.6.1.1.

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4.6.1.1 Test Engine with Replaced Starter

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 4.7.

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4.7 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.

1. If the cranking speed is greater than 100 rpm, check the OEM fuel supply valve; refer to section 4.8.
2. If the cranking speed is less than 100 rpm; refer to section 4.7.1.

4.7.1 Low Cranking Speed Repair

Perform the following steps for low cranking speed repair:

1. Drain the engine oil, refer to MBE900 service manual, preventative maintenance chapter.
2. Remove the oil filter(s).
3. Install new oil filter(s), refer to MBE900 service manual, preventative maintenance chapter.
4. Refill the lubrication system with new oil.
5. Verify low cranking speed repair; refer to section 4.7.1.1.

4.7.1.1 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.

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 supply valve; refer to section 4.8.

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4.8 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 4.9.
2. If the fuel supply valve is closed, repair is necessary; refer to section 4.8.1.

4.8.1 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 MBE900 service manual, operation and verification chapter-preparation for a first time start.
3. Verify fuel supply valve repair; refer to section 4.8.1.1.

4.8.1.1 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 4.9.

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4.9 PLUGGED FUEL FILTER(S)

To determine if a plugged fuel filter(s) is causing starting difficulty, perform the following steps:

1. Disconnect the fuel line return hose from the fitting located at the fuel tank.
2. Place the opened end of the fuel line into a five gallon 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. Clock fuel rate for one minute.
6. Measure the amount of fuel delivered into the container.
   [a] If the fuel flow is greater than 1.7 L/min. (0.5 gal/min.) and aerated (small bubbles), check for air in fuel; refer to section 4.11.
   [b] If the fuel flow is less than 1.7 L/min. (0.5 gal/min.), replace the fuel filters; refer to MBE900 service manual, preventative maintenance chapter.

4.9.1 Plugged Fuel Filter(s) Replacement

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

1. Replace the fuel filter, refer to MBE900 service manual, preventative maintenance chapter.
2. Test the engine to determine if starting has been improved; refer to section 4.9.1.1.

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4.9.1.1 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 4.10.

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4.10 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 4.11.
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 Table4-1.

Problem — The Fuel Inlet Pressure is Too Low	
Possible Cause	**Remedy**
The pre-filter is leaking (drawing air).	Replace the O-ring. Replace the filter element and tighten the cap on the filter housing 25 N·m (18 lb·ft).
The fuel feed lines and connections are leaking (drawing air).	Replace the seals on the leaking lines. Tighten the fittings on the fuel lines to 25 N·m (18 lb·ft) and perform a fuel leak test.
The fuel pump is worn.	Replace the fuel pump.
The pressure limiting valve in the fuel pump is jammed open or the drive lever is loose or broken.	Replace the fuel pump.
The air-admission valve in the fuel tank is blocked.	Remove air-admission valve blockage.
The suction line and/or strainer at the fuel level sensor is blocked or is touching the bottom of the fuel tank.	Inspect the suction line and/or strainer through the fuel fill opening in the fuel tank. Remove the fuel level sensor and repair or replace the line or strainer, as necessary.

Table 4-1 Problem — The Fuel Inlet Pressure is Too Low

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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 4-2.

Problem — The Fuel Inlet Pressure is Too High	
Possible Cause	**Remedy**
The fuel feed lines are kinked or blocked.	Inspect the lines and fittings for blockage. Repair/replace as necessary.
The suction line and/or strainer at the fuel level sensor is blocked or is touching the bottom of the fuel tank.	Inspect the suction line and/or strainer through the fuel fill opening in the fuel tank. Remove the fuel level sensor and repair or replace the line or strainer, as necessary.
The check valve in the fuel feed line is blocked or not open wide (the flange at the fitting connection is bent).	Repair/replace as necessary.

Table 4-2 Problem — The Fuel Inlet Pressure is Too High

4. If a no pressure reading is observed, replace the fuel pump, refer to MBE900 service manual, fuel system chapter.

4.10.1 Fuel Pump Replacement

Perform the following steps for fuel pump replacement:

1. Replace the fuel pump, refer to MBE900 service manual, 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 4.10.1.1.

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4.10.1.1 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 4.11.

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4.11 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 4.11.1.
   [b] If air bubbles are not present, check for a restrictive air filter. Shut down the engine; refer to section 4.12.

4.11.1 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 4.11.1.1.

4.11.1.1 Test Engine with Aerated Fuel Resolution

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

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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 4.12.

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4.12 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 4.12.1.

4.12.1 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 4.12.1.1.

4.12.1.1 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 4.13.

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4.13 LOW COMPRESSION

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

1. Perform a cylinder compression test, refer to MBE900 service manual, engine chapter-cylinder head.
2. Compare cylinder compression test results to specifications aslisted in Table 4-3.

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

Table 4-3 Compression Testing Specifications

[a] If cylinder pressure is below specifications, refer to section 4.13.1.

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

4.13.1 Low Compression Repair

Perform the following steps for low compression repair:

1. Remove 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. Replace damaged valves, refer to MBE900 service manual, 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 4.13.1.1.

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4.13.1.1 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.

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5 NO START (ENGINE WILL NOT ROTATE) MBE900

Section		Page
5.1	DISCHARGED BATTERY	5-3
5.2	DEFECTIVE MAGNETIC SWITCH	5-4
5.3	DEFECTIVE STARTER	5-6
5.4	INTERNAL ENGINE DAMAGE	5-8

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5.1 DISCHARGED BATTERY

To determine if a discharged battery is causing the engine not to start, measure and record the voltage at the battery terminals; refer to OEM guidelines.

1. If, after charging, the voltage recorded is below OEM specifications, voltage is between 10.5 - 14 volts (21 - 26 volts for a 24-volt system), and the engine failed to start, replacement is necessary; refer to section 5.1.1.
2. If the voltage recorded is at recommended OEM specifications and the engine failed to start, check the magnetic switch; refer to section 5.2.

5.1.1 Discharged Battery Resolution

Perform the following steps for battery replacement:

1. Replace the battery; refer to OEM guidelines.
2. Verify replacement of the battery; refer to section 5.1.1.1.

5.1.1.1 Test Engine with New Battery

To determine if the new battery resolved the no start condition, 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 or run, check the magnetic switch; refer to section 5.2.

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5.2 DEFECTIVE MAGNETIC SWITCH

To determine if a defective magnetic switch is causing no start:

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. Clamp a heavy gage battery cable between the two large studs of the magnetic switch. See Figure 5-1.

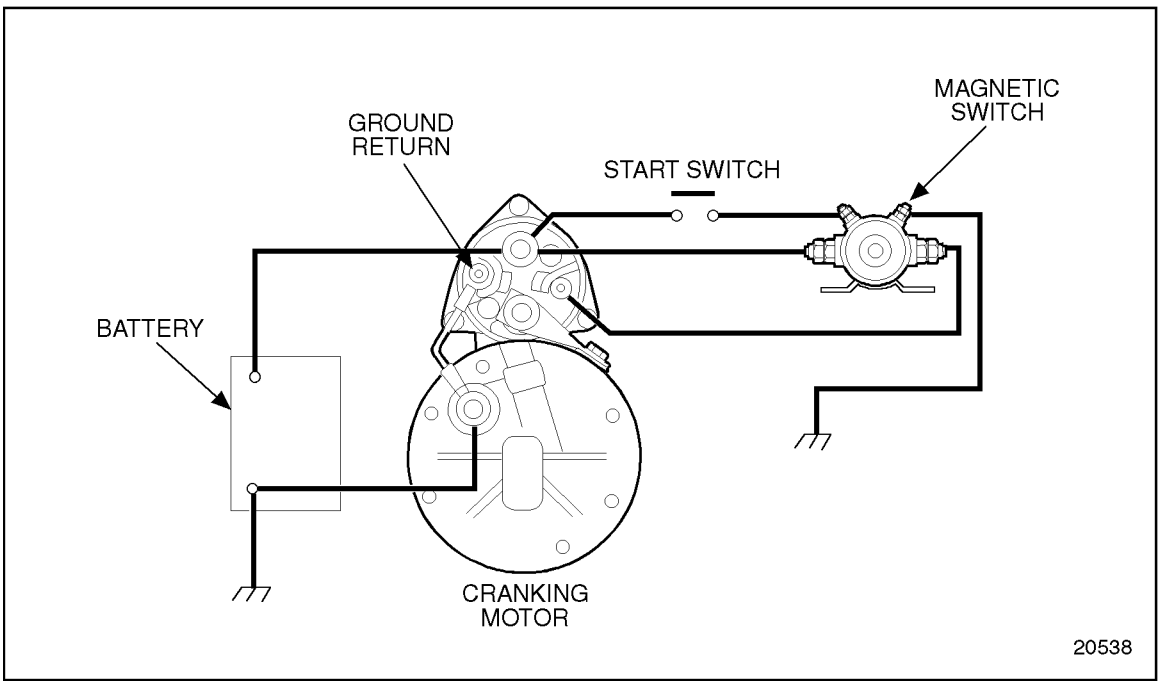

Figure 5-1 Basic Cranking Circuit

[a] If the engine cranked with the jumper cable in place, the magnetic switch must be replaced; refer to section 5.2.1.

[b] If the engine did not crank with the jumper cable in place, check the starter; refer to section 5.3.

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5.2.1 Magnetic Switch Replacement

Perform the following steps for magnetic switch replacement:

1. Replace the magnetic switch; refer to OEM guidelines.
2. Perform verification of magnetic switch replacement; refer to section 5.2.1.1.

5.2.1.1 Test Engine with New Magnetic Switch

To determine if the magnetic switch replacement resolved the no start condition, 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 or run, check the starter; refer to section 5.3.

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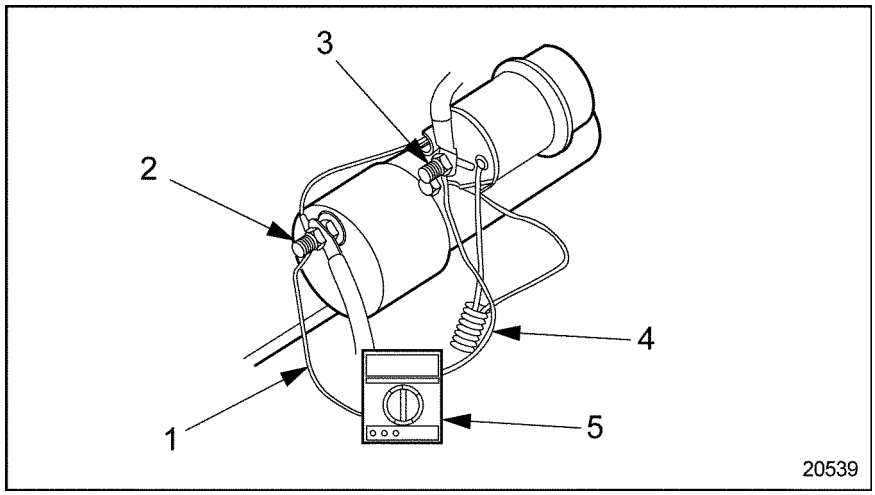
5.3 DEFECTIVE STARTER

To determine if a defective starter is causing no start, perform the following steps:

1. Place the red lead of a voltmeter to the solenoid “BAT” terminal. See Figure 5-2.



1. Black Lead
2. Starter Ground
3. Solenoid Terminal
4. Red Lead
5. Voltmeter

Figure 5-2 Cranking Motor Available Voltage Test

2. Place the black voltmeter lead to the starter ground terminal. See Figure 5-2.
3. Engage the starter switch.
4. View the voltage reading on the meter.
   [a] If the voltage is less than specification (refer to OEM guidelines) while cranking the engine, replace starter; refer to section 5.3.1.
   [b] If the voltage is to specification (refer to OEM guidelines) while attempting to crank the engine, check for internal engine damage; refer to section 5.4.

5.3.1 Starter Replacement

Perform the following steps for starter replacement:

1. Replace the starter; refer to MBE900 service manual, electrical equipment chapter.
2. Verify replacement of starter; refer to section 5.3.1.1.

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5.3.1.1 Test Engine with New Starter

To determine if the new starter resolved no-start conditions, 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 or run, check for internal engine damage. Refer to section 5.4.

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5.4 INTERNAL ENGINE DAMAGE

To determine if internal engine damage is causing no start condition, perform the following steps:

1. Install a 3/4 in. breaker bar or ratchet and attempt to bar the engine over by hand.
2. Determine the severity of internal engine damage.
   [a] If the engine rotates freely, check the MCM wiring harness; refer to section 4.1.
   [b] If the engine binds and will not rotate freely, replace crankshaft bearings and cylinder liners, refer to MBE900 service manual, engine chapter.

5.4.1 Internal Engine Damage Replacement

Perform the following steps for crankshaft bearings, and cylinder liner replacement:

1. Replace the crankshaft bearings, refer to MBE900 service manual, engine chapter.
2. Replace the cylinder liners.
3. Verify replacement of components; refer to section 5.4.1.1.

5.4.1.1 Test Engine with Replaced Components

To determine if the new components resolved no start condition, 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 or run, call Detroit Diesel Customer Support Center at 313-592-5800.

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6 EXCESSIVE OIL CONSUMPTION MBE900

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6.1 MISCALIBRATED DIPSTICK 6-3
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6.3 LEAKING OIL HEAT EXCHANGER 6-6
6.4 DEFECTIVE AIR COMPRESSOR 6-8
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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.

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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 6.3.
   [b] If oil leaks are found, shut down the engine; refer to section 6.2.1.

6.2.1 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 6.2.1.1.

6.2.1.1 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 6.3.

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[b] If external oil leaks are present, refer to section 6.2.1 and repeat.

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6.3 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 6.4.
2. Remove the oil heat exchanger and housing.
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 6.3.1.
   [b] If no cracks are present, complete a lube oil consumption report; call Detroit Diesel Customer Support Center (313-592-5800) for a form.

6.3.1 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 6.3.1.1.
   [b] If oil is present in the coolant, check for a defective turbocharger. Refer to section 6.5.

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6.3.1.1 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 6.4.
2. If the oil consumption report data is not within specifications, call Detroit Diesel Customer Support Center at 313-592-5800.

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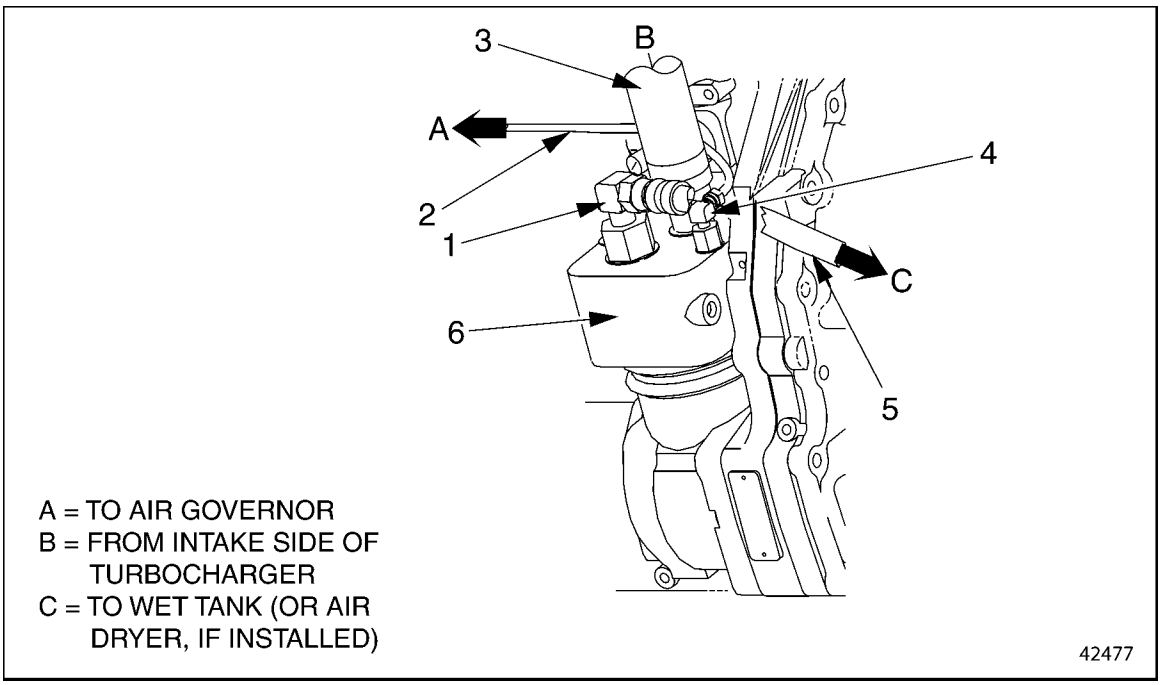
6.4 DEFECTIVE AIR COMPRESSOR

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 6.4.1
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 6.5.
   [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 6.4.2.

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6.4.1 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.

6.4.2 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 6.5.
   [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.

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6.5 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 6.4.1
   [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 section6.5.1.
   [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 6.6.

6.5.1 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 6.4.1.
   [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 6.6.
   [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.

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6.6 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 6.4.1
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 6.6.2.
   [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 6.6.1
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 6.6.2.
    [b] If the cylinder compression is within specifications, call Detroit Diesel Customer Support Center (313-592-5800).

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

Table 6-1 Compression Testing

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6.6.1 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 to 95°C (158 and 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.

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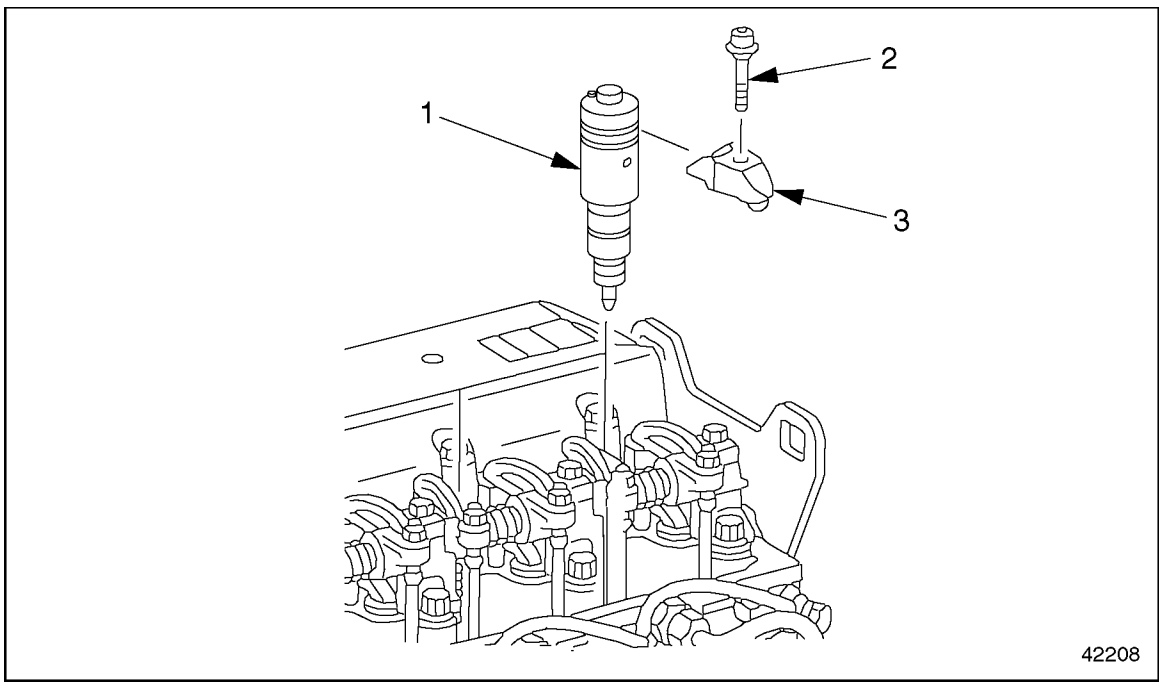
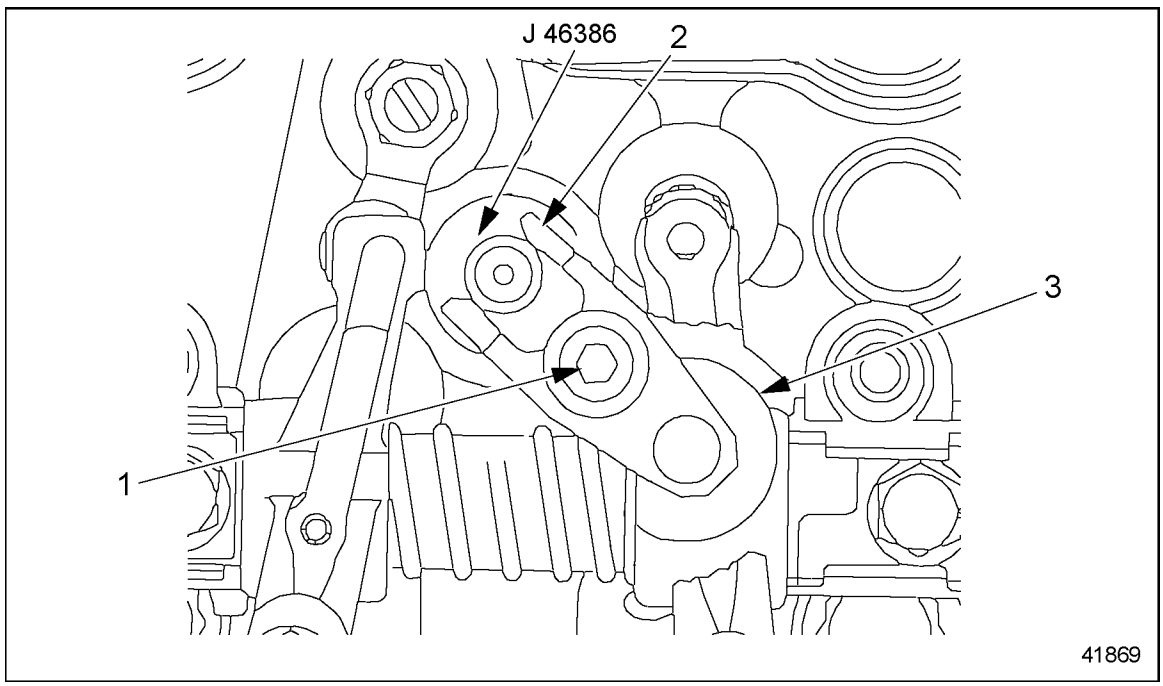
4. Remove the nozzle holder. See Figure 6-2.



1. Nozzle Holder
2. Bolt
3. Hold-Down Clamp

Figure 6-2 Removing the Nozzle Holder

5. Insert the compression test adaptor J-46386 into the cylinder head. See Figure 6-3. Use the hold-down clamp and bolt included in the kit.



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

Figure 6-3 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.

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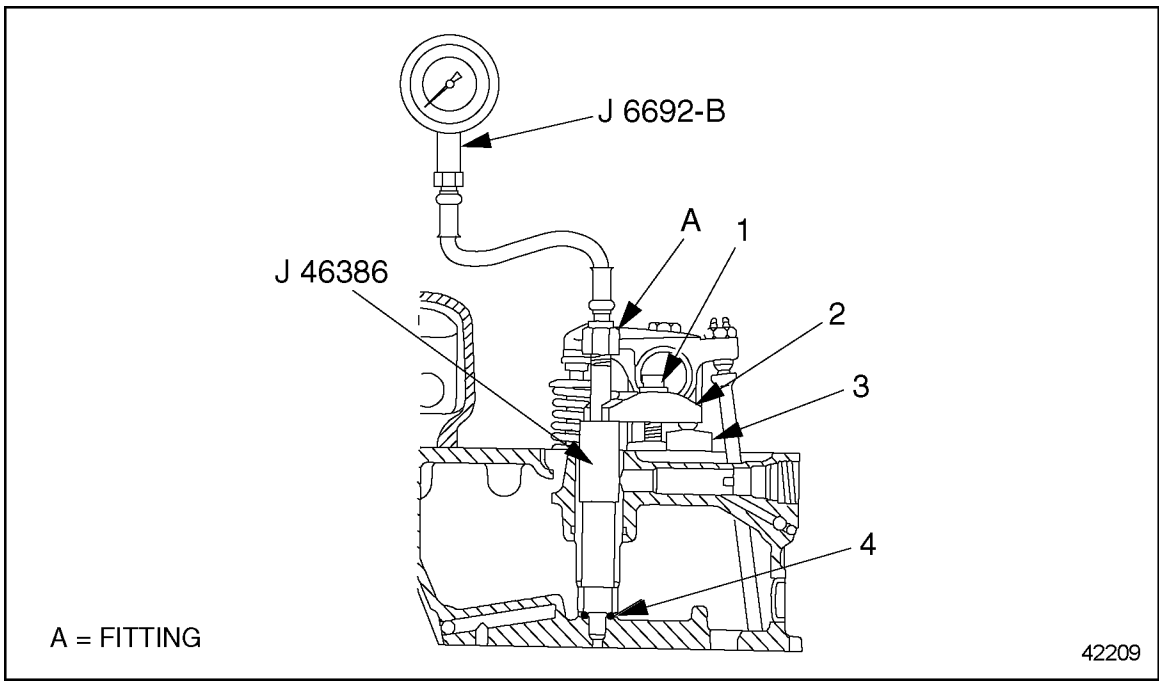
6. Attach the compression tester J-6692–B to the test adaptor J-46386. Thread the fitting at the end of the tester to the top of the test adaptor. See Figure 6-4.



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

Figure 6-4 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.

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Install the nozzle holder as follows:

1. Connect the MCM.
2. Connect minidiag2 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 .
4. Remove the compression test adaptor. See Figure 10-4.
5. Install the nozzle holder. See Figure .
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.

6.6.2 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 6.6.2.1.

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6.6.2.1 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.

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7 EXCESSIVE CRANKCASE PRESSURE MBE900

Section **Page**

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7.1 OBSTRUCTION OR DAMAGE TO CYLINDER HEAD COVER BREATHER

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

1. If the engine crankcase pressure is greater than 0.62 kPa (2.5 in. H_2O), replace wire mesh element; refer to section 7.1.2.
2. If the crankcase pressure remained the same, check the air compressor; refer to section 7.1.2.1.

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 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.

7.1.2 Cylinder Head Cover Breather Resolution

Perform the following steps to replace wire mesh element:

1. Remove the cylinder head cover; refer to MBE900 service manual, engine chapter.
2. Remove the wire mesh element from the cylinder head cover.
3. Install a new wire mesh element to the cylinder head cover.
4. Install the cylinder head cover to the engine, refer to MBE900 service manual, engine chapter.

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5. Verify replacement of the wire mesh element; refer to section 7.1.2.1.

7.1.2.1 Test Engine with New Wire Mesh Element

Perform the following steps to determine if the new wire mesh 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 0.62 kPa (2.5 in. H_2O), no further troubleshooting is required. Shut down the engine.
   [b] If the engine crankcase pressure is greater than 0.62 kPa (2.5 in. H_2O), check the air compressor; refer to section 7.2. Shut down the engine.

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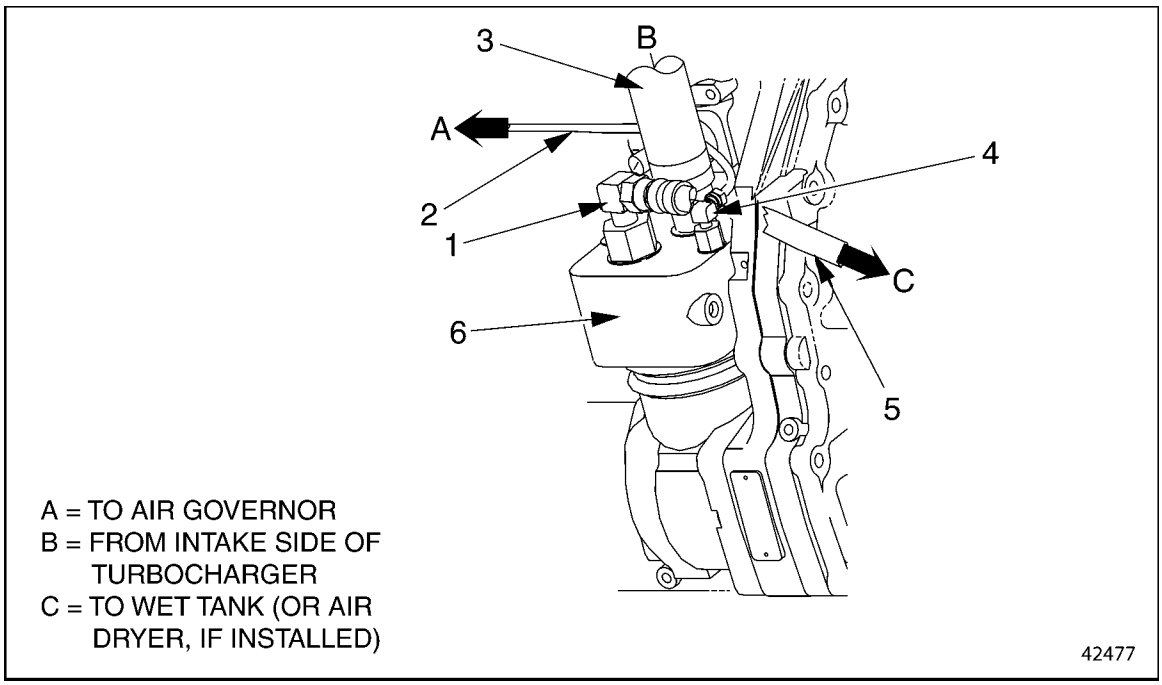
7.2 DEFECTIVE AIR COMPRESSOR

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 section7.1.1
2. Disconnect the air discharge line from the air compressor; see Figure 7-1. , 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 7-1 Air Line Attachments

3. Repeat step 1 and record the test 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 7.3.
   [b] If the engine crankcase pressure decreased, repair or replace the air compressor; refer to MBE900 service manual, special equipment chapter.

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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 0.62 kPa (2.5 in. H_2O), no further troubleshooting is required. Shut down the engine.
   [b] If the engine crankcase pressure is not within 0.62 kPa (2.5 in. H_2O), shut down the engine. Check the turbocharger; refer to section 7.3.

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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 MBE900 service manual, air intake system chapter.
2. Perform a crankcase pressure test;refer to section 7.1.1
   [a] If the engine crankcase pressure is less than 0.62 kPa (2.5 in. H_2O), replace the turbocharger; refer to MBE900 service manual, air intake system chapter. Shut down the engine.
   [b] If the engine crankcase pressure indicates no change, check for a worn or damaged valve or cylinder kit; refer to section 7.3.1.1. Shut down the engine.

7.3.1 Turbocharger Replacement

Perform the following steps to replace a defective turbocharger:

1. Remove the defective turbocharger from the engine; refer to MBE900 service manual, air intake system chapter.
2. Tag the removed turbocharger for remanufacture.
3. Install a replacement turbocharger to the engine; refer to MBE900 service manual, air intake system chapter.
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 0.62 kPa (2.5 in. H_2O) or less, no further troubleshooting is required. Shut down the engine.
2. If the engine crankcase pressure is greater than 0.62 kPa (2.5 in. H_2O), shut down the engine. Check for a worn or damaged valve or cylinder kit; refer to section 7.4.

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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 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. 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 0.62 kPa (2.5 in. H_2O), go to step 11.
    [b] If the crankcase pressure is less than 0.62 kPa (2.5 in. H_2O), no further troubleshooting is required.
11. Perform the cylinder compression test, 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.

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7.4.1 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 to 95°C (158 and 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.

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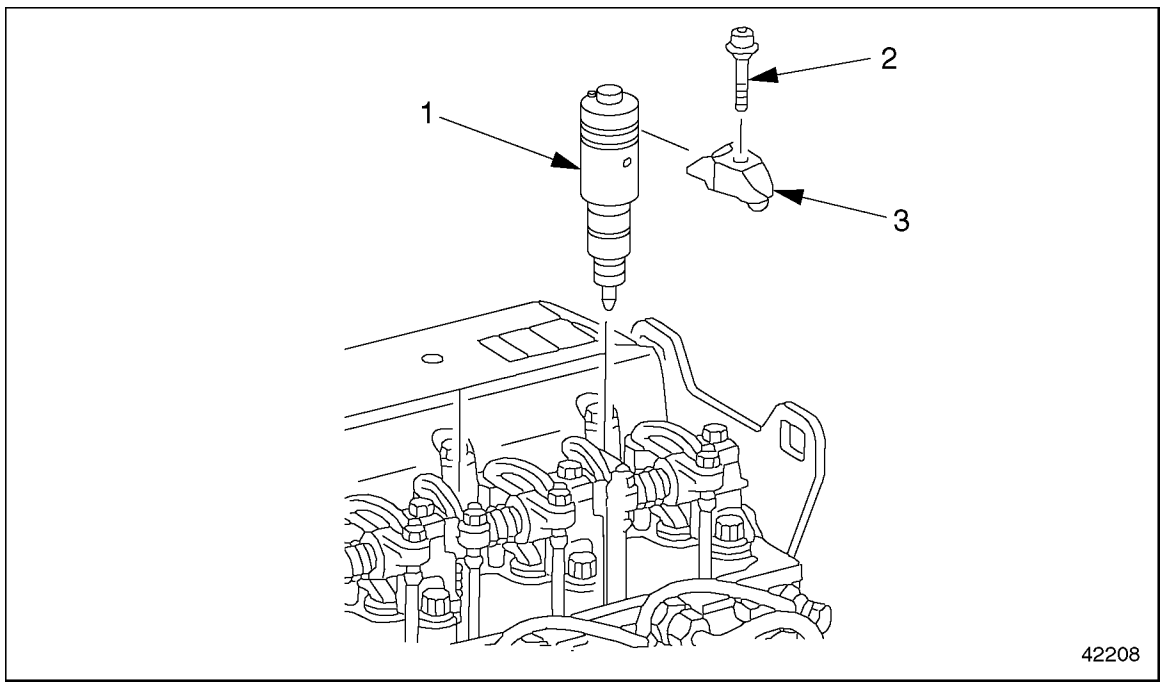
4. Remove the nozzle holder. See Figure 7-2.



1. Nozzle Holder
2. Bolt
3. Hold-Down Clamp

Figure 7-2 Removing the Nozzle Holder

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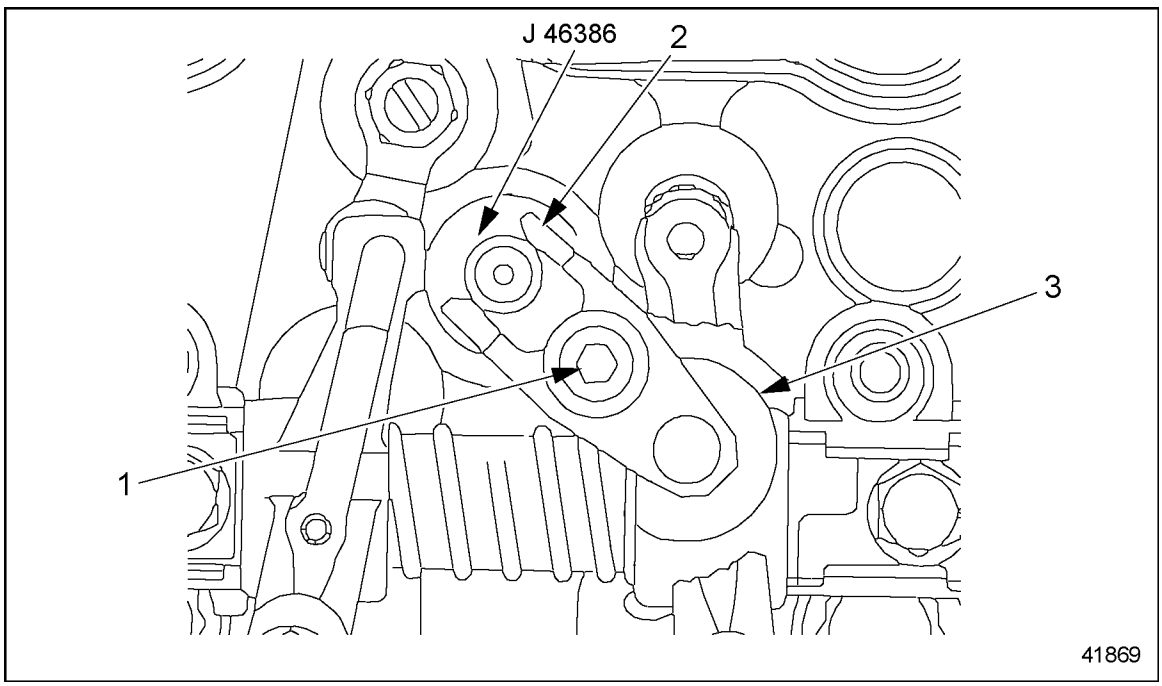
5. Insert the compression test adaptor J-46386 into the cylinder head. See Figure 7-3. Use the hold-down clamp and bolt included in the kit.



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

Figure 7-3 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.

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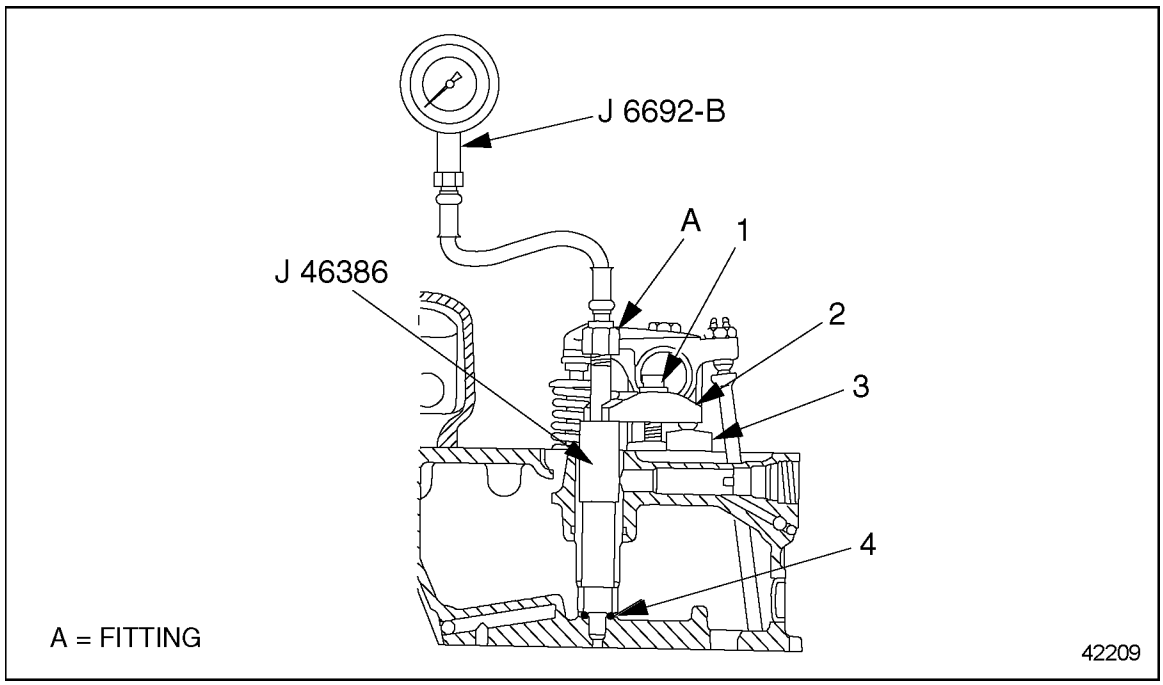
6. Attach the compression tester J-6692–B to the test adaptor J-46386. Thread the fitting at the end of the tester to the top of the test adaptor. See Figure 7-4.



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

Figure 7-4 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 7-1.

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

Table 7-1 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.

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Install the nozzle holder as follows:

1. Connect the MCM.
2. Connect minidiag2 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 .
4. Remove the compression test adaptor. See Figure 10-4.
5. Install the nozzle holder. See Figure .
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.

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 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, piston or piston rings; refer to MBE900 service manual, engine chapter.
4. Verify repair to cylinder valve(s) or cylinder kit components; refer to MBE900 service manual, engine chapter.

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 MBE900 service manual, special equipment chapter.

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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

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8 EXCESSIVE EXHAUST SMOKE (BLACK OR GRAY) MBE900

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8.1 RESTRICTED AIR CLEANER ELEMENT

To determine if a restrictive air cleaner element is causing excessive black or gray smoke, perform the following:

1. Remove the air filter element from the air cleaner container; refer to OEM guidelines.
2. Visually inspect the air cleaner element for damage or clogging.
   [a] If no damage or clogging is found, check the charge air cooler; refer to section 8.2.
   [b] If damage or clogging is found, refer to section 8.1.1.

8.1.1 Air Filter Element Replacement

Perform the following to replace the air filter element:

1. Remove and replace the damaged or clogged air filter element; refer to OEM guidelines.
2. Verify that replacing the air filter element eliminated the excessive exhaust smoke; refer to section8.1.1.1.

8.1.1.1 Test the Engine with Replaced Air Filter Element

Perform the following to determine if the new filter element resolved excessive exhaust smoke:

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. Run the engine at idle with a no-load condition for approximately five minutes, allowing the engine coolant to reach normal operating range, approximately 88-96°C (190-205°F).
3. Visually inspect exhaust for excessive smoke.
   [a] If the engine exhaust emission appears normal, no further troubleshooting is required. Shut down the engine.
   [b] If the engine exhaust emission is excessively black or gray, shut down the engine. Check the charge air cooler; refer to section 8.2.

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8.2 RESTRICTED OR CRACKED CHARGE AIR COOLER

To determine if a charge air cooler is causing excessive exhaust smoke, perform the following:

NOTICE:
To avoid engine damage, follow the installation instructions provided with the air-to-air charge air cooler test kit.

1. Visually inspect the core, tanks, and welds for cracks and holes. If charge air cooler fails visual inspection replace the charge air cooler. Refer to section8.2.1.1.
2. Pressure test the charge air cooler; refer to section 8.2.1.
3. Evaluate the results from pressure testing the charge air cooler.
   [a] If the pressure drop is 34 kPa (5 psi) or less in 15 seconds the cooler is good. Check for faulty air intake manifold. Refer to section 8.3.
   [b] If the pressure drop is greater than 34 kPa (5 psi) in 15 seconds, replace the charge air cooler. Refer to section 8.2.1.1.

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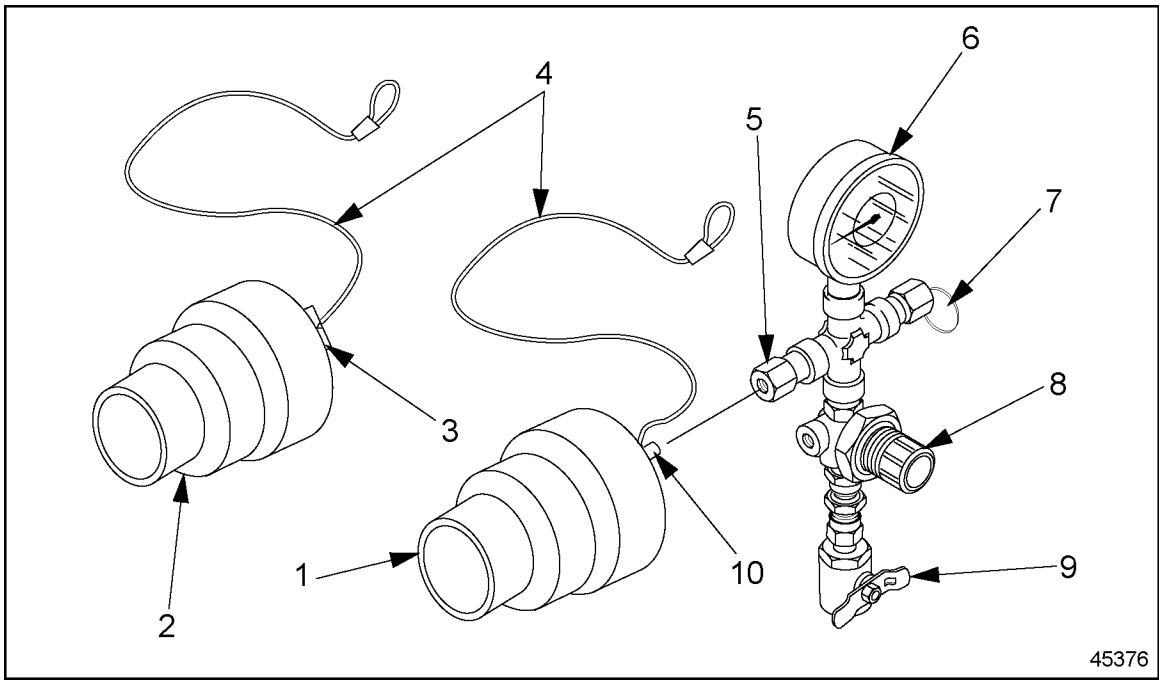
8.2.1 Pressure Testing the Charge Air Cooler

Perform the following to pressure test the charge air cooler:

1. Use the charge air cooler tester (J-41473) to test cooler for leaks. See Figure8-1 for component parts.



1. Gauge Coupler
2. Bleed-off Coupler
3. Bleed Valve
4. Safety Straps
5. Quick Disconnect
6. Gauge
7. Pressure Relief Valve
8. Air Regulator Valve
9. Air Shutoff Valve
10. Quick Disconnect Fitting

Figure 8-1 Charge Air Cooler Tester J-41473

2. Disconnect the air inlet and outlet piping connecting the charge air cooler to the engine.

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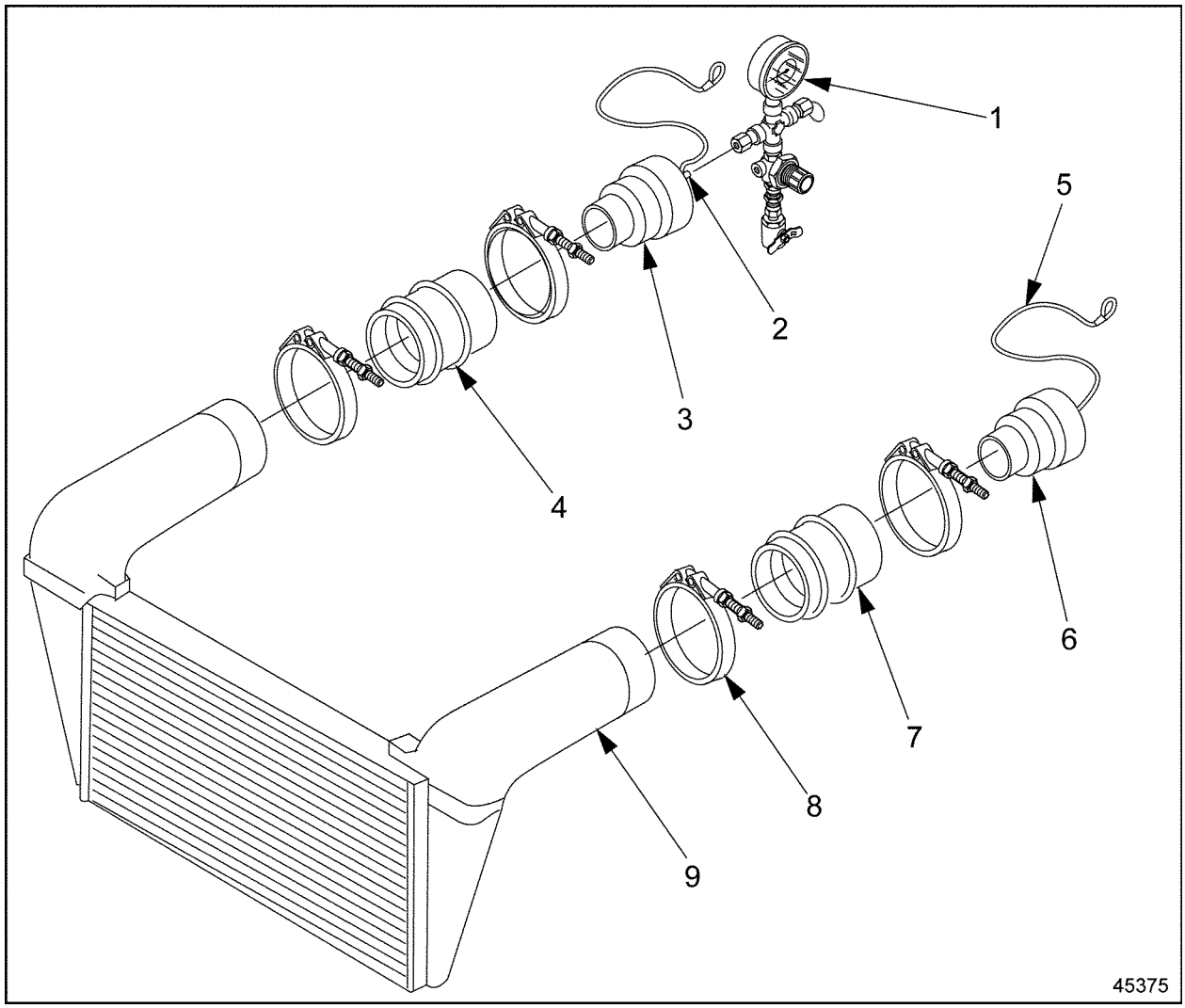
3. Install the charge air cooler test gauge coupler into the inlet hose (hot side) of the charge air cooler coming from the turbocharger compressor. Secure hose and coupler with clamp removed and torque the clamp to 5.6-6.78 N·m (50-60 lb·in.). See Figure 8-2.



1. Gauge/Regulator Assembly
2. Quick Disconnect Fitting
3. Gauge Coupler
4. Charge Air Cooler Hose (Hot Side)
5. Safety Strap
6. Bleed-off Coupler
7. Charge Air Cooler Hose (Cold Side)
8. Clamp
9. Charge Air Cooler

Figure 8-2 Charge Air Cooler and Tester J-41473

4. Attach the gauge/regulator assembly to the quick disconnect fitting on the gauge coupler.
5. Use the clamp removed to attach the bleed-off coupler to the outlet hose (cold side) of the charge air cooler. Torque the clamp to 5.6-6.78 N·m (50-60 lb·in.).

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6. Connect the safety straps on the couplers to any convenient screw on the radiator mounting bracket.

⚠ WARNING:

PRESSURIZED AIR AND FLYING PARTICLES

To avoid injury to eye or face, wear a face shield or goggles when conducting a pressure test.

7. Attach an air pressure line, with filtered air, to the air shutoff valve and gradually pressurize the charge air cooler to a pressure of 205 kPa (30 psi). If necessary, perform the following steps to adjust the air regulator until the gauge reads 205 kPa (30 psi):
   [a] Pull regulator knob outward to unlock.
   [b] Turn knob to adjust pressure to 205 kPa (30 psi).
   [c] Push the regulator knob back into locked position.
8. Close the air shutoff valve and monitor the gauge with a stop watch for 15 seconds. Note any decrease in air pressure.
9. Repeat test at least three times to verify results.
   [a] In pressure drop is 34 kPa (5 psi) or less in 15 seconds the cooler is good.
   [b] If the pressure drop is greater than 34 kPa (5 psi) in 15 seconds, replace the charge air cooler. Refer to section 8.2.1.1.
10. Slowly release pressure with the charge air cooler by opening the valve in the bleed-off coupler.
11. Remove all charge air cooler tester pieces and reconnect charge air cooler piping to the engine.
12. Reconnect air inlet and outlet piping to engine. Torque hose clamps to 5.6 - 6.78 N·m (50 - 60 lb·in.).

8.2.1.1 Charge Air Cooler Replacement

Perform the following steps to replace the charge air cooler:

1. Replace the charge air cooler; refer to OEM guidelines.
2. Verify that the replacement of the charge air cooler eliminated the excessive exhaust smoke; refer to section 8.3.1.

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8.3 FAULTY AIR INTAKE MANIFOLD GASKET

Perform the following steps to troubleshoot the air intake manifold:

1. Remove the air intake manifold; refer to MBE900 service manual, air intake system chapter.
2. Inspect the air intake manifold and gaskets.
3. Install the air intake manifold with new gaskets;
4. Verify repair of the air intake manifold; refer to section 8.3.1.

8.3.1 Test the Engine with a Replaced Charge Air Cooler or Air Intake Manifold Gasket Replacement

To determine if the replaced charge air cooler or air intake manifold gasket resolved the excessive exhaust smoke condition, 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.
2. Run the engine at idle with a no-load condition for approximately five minutes, allowing the engine coolant to reach normal operating range, approximately 88-96°C (190-205°F).
3. Visually inspect exhaust for excessive black or gray smoke.
   [a] If the engine exhaust emission appears normal, no further troubleshooting is required. Shut down the engine.
   [b] If the engine exhaust emission is excessively black or gray, shut down the engine. Check for a faulty exhaust system; refer to section 8.4.

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8.4 FAULTY EXHAUST SYSTEM

To determine if a faulty exhaust system is causing excessive black or gray exhaust smoke, perform the following:

1. Drill an 11/32 in. hole in the exhaust pipe, 125 - 305 mm (5 - 12 in.) from the turbocharger exhaust outlet.

NOTE:
The tapped hole must be in a comparatively straight section of the turbocharger exhaust outlet.

2. Tap the hole to accommodate a 1/8 in. pipe plug.
3. Connect a manometer calibrated to read pressure in kPa or inches of Hg to the tapped hole.

⚠ 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.

4. Start and run the engine.
5. Run the engine at idle with a no-load condition for approximately five minutes, allowing the engine coolant to reach normal operating range, approximately 88-96°C (190-205°F).
6. Run the engine speed to full load.
   [a] If the exhaust back pressure at full load is less than 12 kPa (3.5 in. Hg), check the fuel injectors and nozzles; refer to section 8.6. Shut down the engine.
   [b] If the exhaust back pressure at full load is 12 kPa (3.5 in. Hg) or greater, refer to section 8.4.1. Shut down the engine.

8.4.1 Engine Exhaust System Resolution

Perform the following steps to resolve the engine exhaust system concern:

1. Visually inspect the engine exhaust system: refer to OEM guidelines.
2. Repair and replace defective exhaust system components; refer to OEM guidelines
3. Verify exhaust system resolutionrefer to section 8.4.1.1.

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8.4.1.1 Test the Engine with Replaced Exhaust System

Perform the following steps to determine if replaced engine exhaust manifold has resolved the excessive black or gray exhaust smoke 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 and run the engine.
2. Run the engine at idle with a no-load condition for approximately five minutes, allowing the engine coolant to reach normal operating range, approximately 88-96°C (190-205°F).
3. Visually inspect exhaust for excessive smoke.
   [a] If the engine exhaust emission appears normal, no further troubleshooting is required. Shut down the engine.
   [b] If the engine exhaust emission is excessively black or gray, shut down the engine. Check the fuel nozzles; refer to section 8.5.

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8.5 AERATED FUEL

To determine if aerated fuel is causing excessive exhaust smoke, 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 8.5.1.
   [b] If air bubbles are not present, check for a low compression. Shut down the engine; refer to section8.6.

8.5.1 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.
5. Verify aerated fuel resolution corrected the excessive exhaust smoke condition; refer to section 8.5.1.1.

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8.5.1.1 Test Engine with Aerated Fuel Resolution

To determine if aerated fuel resolution resolved the excessive exhaust smoke concern, 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 with no exhaust smoke, no further troubleshooting is required. Shut down the engine.
2. If the engine still has excessive exhaust smoke, check for faulty fuel nozzle; refer to section 8.6.

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8.6 FAULTY FUEL NOZZLE

To troubleshoot the fuel nozzle, refer to section 2.1.2 on Fuel Injection Troubleshooting. After completing fuel injection troubleshooting, verify that repairs made corrected the excessive exhaust smoke. Refer to section 8.6.1.

8.6.1 Test the Engine with Replaced Fuel Nozzle

Perform the following steps to determine if replaced fuel nozzle has resolved the excessive black or gray exhaust smoke 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 and run the engine.
2. Run the engine at idle with a no-load condition for approximately five minutes, allowing the engine coolant to reach normal operating range, approximately 88-96°C (190-205°F).
3. Visually inspect exhaust for excessive smoke.
   [a] If the engine exhaust emission appears normal, no further troubleshooting is required. Shut down the engine.
   [b] If the engine exhaust emission is excessively black or gray, shut down the engine. Check the turbocharger; refer to section 8.7.

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8.7 DEFECTIVE TURBOCHARGER

To determine if a defective turbocharge is causing excessive exhaust smoke, perform the following:

1. Remove the turbocharger oil drain outlet line connected to the crankcase and place the drain line into a suitable container; refer to MBE900 service manual, air intake system chapter.
2. Rotate turbine wheel to check for free movement. If wheel does not move freely, replace turbocharger; refer to MBE900 service manual, air intake system chapter.
3. Verify that replacing the turbocharger corrected the excessive smoke problem; refer to section 8.7.2.
4. Perform a crankcase pressure test; refer to section 8.7.1.
   [a] If the engine crankcase pressure is less than 0.62 kPa (2.5 in. H_2O), shut down the engine and replace the turbocharger; refer to MBE900 service manual, air intake system chapter. Verify replaced turbocharger corrected the excessive smoke problem; refer to section 8.7.2.
   [b] If the engine crankcase pressure is greater than 0.62 kPa (2.5 in. H_2O), shut down the engine. Connect the oil drain outlet line to the turbocharger and call the Detroit Diesel Customer Support Center at 313-592-5800.

8.7.1 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.

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8. Remove the manometer from the oil dipstick opening and install the dipstick.

8.7.2 Test Engine with a Replaced Turbocharger

Perform the following steps to determine if a replaced turbocharger has resolved the excessive exhaust smoke 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 to full load.
3. Visually inspect the exhaust for excessive black or gray smoke.
   [a] If the engine exhaust emission appears normal, no further troubleshooting is required. Shut down the engine.
   [b] If the engine exhaust emission is excessive, shut down the engine, check for improper grade of fuel. Refer to section 8.8.

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8.8 IMPROPER GRADE OF FUEL

To determine if an improper grade of fuel is causing excessive black or gray smoke, perform the following:

1. Acquire a fuel sample from the vehicle fuel tank(s).
2. Submit fuel sample for an ASTM test analysis.
   [a] If the fuel meets specifications, check for a faulty EGR valve; refer to section 8.9.
   [b] If the fuel did not meet specifications, resolve improper grade of fuel; refer to section 8.8.1 and DDC publication *Lubricating Oil, Fuel, and Filters* (7SE270).

8.8.1 Improper Grade of Fuel Resolution

Perform the following steps to resolve the improper grade of fuel:

1. Drain the fuel tanks, refer to OEM guidelines, and dispose of fuel properly.
2. Refill the fuel tanks with new fuel having a cetane number greater than 45 and cetane index greater than 40.
3. Verify fuel resolution eliminated the excessive exhaust smoke condition; refer to section 8.8.1.1.

8.8.1.1 Test the Engine with New Fuel

Perform the following steps to determine if the fuel refill resolved the excessive exhaust smoke 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 and run the engine.
2. Run the engine at idle under no-load conditions for approximately five minutes, allowing the engine coolant to reach normal operating range, approximately 88-96°C (190-205°F).
3. Visually inspect exhaust for excessive smoke.
   [a] If the engine smoke emission appears normal, no further troubleshooting is required. Shut down the engine.
   [b] If the engine exhaust smoke is excessively black or gray, shut down the engine. Check the EGR valve; refer to section 8.9.

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8.9 FAULTY EGR VALVE

To determine if a faulty EGR valve is causing excessive black or gray smoke, perform the following:

1. Remove the EGR valve; refer to MBE900 service manual, special equipment chapter.
2. Inspect the EGR valve flap for freedom of movement.
   [a] If freedom of movement is restricted remove soot and clean deposits as required.
   [b] If movement of valve is still not free, replace the EGR valve, refer to MBE900 service manual, special equipment chapter. Verify the replacement of the EGR valve corrected the excessive exhaust smoke concern; refer to section 8.9.1
3. Perform a PV2 activation test to verify flap valve functionality. Call Detroit Diesel Customer Support Center at 313-592-5800 for instructions.

8.9.1 Test the Engine with Replaced EGR Valve

Perform the following steps to determine if the replaced EGR valve resolved the excessive exhaust smoke 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 and run the engine.
2. Run the engine at idle under no-load conditions for approximately five minutes, allowing the engine coolant to reach normal operating range, approximately 88-96°C (190-205°F).
3. Visually inspect exhaust for excessive smoke.
   [a] If the engine smoke emission appears normal, no further troubleshooting is required. Shut down the engine.
   [b] If the engine exhaust smoke is excessively black or gray, shut down the engine. Check the exhaust brake valve; refer to section 8.11.

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8.10 INCORRECTLY ADJUSTED EXHAUST BRAKE VALVE

To determine if a misadjusted exhaust brake valve is causing excessive black or gray smoke, perform the following:

1. Readjust the exhaust brake valve; refer to MBE900 service manual, exhaust system chapter for a 6-cylinder engine or for a 4-cylinder engine.
2. Verify the adjustment on the exhaust brake valve; refer to section 8.10.1

8.10.1 Test Engine After Adjusting the Exhaust Brake Valve

Perform the following steps to determine if the exhaust brake adjustment resolved the excessive exhaust smoke 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 and run the engine.
2. Run the engine at idle under no-load conditions for approximately five minutes, allowing the engine coolant to reach normal operating range, approximately 88-96°C (190-205°F).
3. Visually inspect exhaust for excessive smoke.
   [a] If the engine smoke emission appears normal, no further troubleshooting is required. Shut down the engine.
   [b] If the engine exhaust smoke is excessively black or gray, shut down the engine. Check the exhaust brake valve; refer to section 8.11.

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8.11 FAULTY EXHAUST BRAKE VALVE

To determine if a faulty exhaust brake valve is causing excessive black or gray smoke, check exhaust brake valve for freedom of movement.

1. If movement is not free, replace exhaust brake valve; refer to MBE900 service manual, exhaust system chapter. Verify replacement of the exhaust brake valve; refer to section8.11.1.
2. If movement is free, check the exhaust brake cylinder; refer to section 8.12.

8.11.1 Test Engine for Replaced Exhaust Brake Valve

Perform the following steps to determine if the replaced exhaust brake valve resolved the excessive exhaust smoke 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 and run the engine.
2. Run the engine at idle under no-load conditions for approximately five minutes, allowing the engine coolant to reach normal operating range, approximately 88-96°C (190-205°F).
3. Visually inspect exhaust for excessive smoke.
   [a] If the engine smoke emission appears normal, no further troubleshooting is required. Shut down the engine.
   [b] If the engine exhaust smoke is excessively black or gray, shut down the engine. Check the exhaust brake cylinder; refer to section 8.12.

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8.12 FAULTY EXHAUST BRAKE CYLINDER

To determine if a faulty exhaust brake cylinder is causing excessive black or gray smoke, check exhaust brake cylinder for full movement of travel by applying regulated air to cylinder.

1. If movement of travel is not full, replace the exhaust brake cylinder; refer to section 8.12.1. Verify replacement of exhaust brake cylinder corrected the excessive exhaust smoke concern; refer to section 8.12.1.
2. If full movement of travel is obtained, refer to section 8.13.

8.12.1 Test Engine for Replaced Exhaust Brake Cylinder

Perform the following steps to determine if the replaced engine brake cylinder resolved the excessive exhaust smoke 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 and run the engine.
2. Run the engine at idle under no-load conditions for approximately five minutes, allowing the engine coolant to reach normal operating range, approximately 88-96°C (190-205°F).
3. Visually inspect exhaust for excessive smoke.
   [a] If the engine smoke emission appears normal, no further troubleshooting is required. Shut down the engine.
   [b] If the engine exhaust smoke is excessively black or gray, shut down the engine. Check the constant throttle valve; refer to section 8.13.

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8.13 FAULTY CONSTANT THROTTLE VALVE

To determine if a faulty constant throttle valve (CTV) is causing excessive black or gray smoke, measure the resistance between wire 52 in the 55-pin connector and vehicle ground.

1. If the resistance is greater than 30 kΩ, replace the constant throttle valve; refer to MBE900 service manual, lubrication system chapter-oil centrifuge. Verify the replacement of the constant throttle valve; refer to section 8.13.1.
2. If the resistance is less than 30 kΩ, refer to section 8.14.

8.13.1 Test Engine for Replaced Constant Throttle Valve

Perform the following steps to determine if the replaced constant throttle valve resolved the excessive exhaust smoke 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 and run the engine.
2. Run the engine at idle under no-load conditions for approximately five minutes, allowing the engine coolant to reach normal operating range, approximately 88-96°C (190-205°F).
3. Visually inspect exhaust for excessive smoke.
   [a] If the engine smoke emission appears normal, no further troubleshooting is required. Shut down the engine.
   [b] If the engine exhaust smoke is excessively black or gray, shut down the engine. Refer to section 8.14.

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

To determine if an improper valve clearance, worn or damaged camshaft lobes or rollers are causing excessive exhaust smoke, perform the following:

1. Check for improper valve clearance, and worn or damaged camshaft lobes and rollers. Repair as required, refer to MBE900 service manual, engine chapter.
2. Verify valve clearance, worn or damaged camshaft lobes and rollers repair corrected the excessive exhaust smoke concern; refer to section 8.14.1.

8.14.1 Test Engine with Corrected Valve Clearance, Worn or Damaged Camshaft Lobes and Rollers

Perform the following steps to determine if the valve clearance, worn or damaged camshaft lobes and rollers repair has resolved excessive exhaust smoke 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 and run the engine.
2. Run the engine at idle with a no-load condition for approximately five minutes, allowing the engine coolant to reach normal operating range.
3. Visually inspect exhaust for excessive exhaust smoke.
   [a] If the engine exhaust smoke emission appears normal, no further troubleshooting is required. Shut down the engine.
   [b] If the engine exhaust smoke emission is excessive, shut down the engine. Check for low compression; refer to section 8.15.

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8.15 LOW COMPRESSION

To determine if low compression is causing excessive exhaust smoke, perform the following steps:

1. Perform a cylinder compression test; refer to MBE900 service manual, engine chapter-cylinder head.
2. Compare cylinder compression test results to specifications as listed in Table 8-1.

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

Table 8-1 Compression Testing Specifications

[a] If cylinder pressure is below specifications, refer to section 8.15.1.

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

8.15.1 Low Compression Repair

Perform the following steps for low compression repair.

1. Remove 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. Replace damaged valves; refer to MBE900 service manual, 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 have corrected the excessive exhaust smoke concern; refer to section 8.15.1.1.

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

To determine if the cylinder head valve and cylinder kit repair resolved excessive exhaust smoke, 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 without excessive exhaust smoke, no further troubleshooting is required. Shut down the engine.
2. If the engine continues to have excessive exhaust smoke, call the Detroit Diesel Customer Support Center at 313-592-5800.

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9 EXCESSIVE BLUE SMOKE MBE900

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9.1 MISCALIBRATED DIPSTICK

To determine if an overfilled crankcase is causing the excessive blue smoke, 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 chapter..
   [a] If a calibration check indicates that the oil level is off by more than 2 mm (0.079 in.), contact Detroit Diesel Customer Support Center at 313-592-5800.
   [b] Verify that the correct oil level has eliminated the excessive blue smoke concern; refer to section 9.1.1.

9.1.1 Test the Engine with the Correct Oil Level

Perform the following to determine if the correct oil level resolved the excessive blue smoke 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 and run the engine.
2. Run the engine at idle under no-load conditions for approximately five minutes, allowing the engine coolant to reach normal operating range, approximately 88-96°C (190-205°F).
3. Visually inspect exhaust for excessive blue smoke.
   [a] If the engine smoke emission appears normal, no further troubleshooting is required. Shut down the engine.
   [b] If the engine exhaust smoke is excessively blue, shut down the engine. Refer to section 9.2

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9.2 IMPROPER GRADE OF LUBRICATING OIL

To determine if an improper grade of lubricating oil is causing excessive blue smoke, perform the following:

1. Verify that the proper grade of lubricating oil is being used in the engine.
2. See DDC publication *Lubricating Oil, Fuel, and Filters* (7SE270) for oil specifications.
3. If the oil meets specifications, check for defective turbocharger; refer to section 9.3.
4. If the oil did not meet specifications, resolve improper grade of oil; refer to section 9.2.1. See DDC publication *Lubricating Oil, Fuel, and Filters* (7SE270) for oil specifications.

9.2.1 Improper Grade of Lubricating Oil Resolution

Perform the following steps to resolve the improper grade of lubricating oil:

1. Drain the oil pan and filters. Dispose of oil properly.
2. Refill the engine oil pan with recommended oil. See DDC publication *Lubricating Oil, Fuel, and Filters* (7SE270) for oil specifications.
3. Verify the oil resolution corrected the excessive blue smoke condition; refer to section 9.2.1.1.

9.2.1.1 Test Engine with New Lubricating Oil

Perform the following to determine if the new oil level resolved the excessive blue smoke 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 and run the engine.
2. Run the engine at idle under no-load conditions for approximately five minutes, allowing the engine coolant to reach normal operating range, approximately 88-96°C (190-205°F).
3. Visually inspect exhaust for excessive blue smoke.
   [a] If the engine smoke emission appears normal, no further troubleshooting is required. Shut down the engine.
   [b] If the engine exhaust smoke is excessively blue, shut down the engine. Refer to section 9.3.

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9.3 DEFECTIVE TURBOCHARGER

To determine if a defective turbocharger is causing excessive blue exhaust smoke, perform the following:

1. Remove the charge air cooler inlet duct connected between the turbocharger and charge air cooler.
2. Visually inspect the compressor inlet side of the turbocharger.
   [a] If excessive engine lube oil is present, replace the turbocharger, refer to MBE900 service manual, air intake system chapter.
   [b] Verify replacing the turbocharger corrected the excessive blue smoke concern; refer to section 9.3.1.

9.3.1 Test Engine with Replaced Turbocharger

Perform the following steps to determine if a replaced turbocharger has resolved the excessive blue exhaust smoke 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 and run the engine.
2. Run the engine at idle speed with a no-load condition for approximately five minutes, allowing the engine coolant to reach normal operating range, approximately 88-96°C (190-205°F).
3. Visually inspect the exhaust for excessive blue smoke.
   [a] If the engine exhaust smoke emission appears normal, no further troubleshooting is required. Shut down the engine.
   [b] If the engine exhaust smoke is excessively blue, shut down the engine. Check for worn or damaged valves or cylinder kit; refer to section 9.4.

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9.4 WORN OR DAMAGED INTAKE/EXHAUST VALVE OR CYLINDER KIT

To determine if a worn or damaged cylinder kit is causing excessive blue exhaust smoke, perform the following:

1. Move the vehicle requiring testing to the chassis dynamometer; refer to OEM guidelines.
2. Disconnect and remove the air compressor; 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. 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. Review the crankcase pressure test.
    [a] If the crankcase pressure was greater than 0.62 kPa (2.5 in. H_2O), refer to section 9.4.1.
    [b] If the crankcase pressure was less than 0.62 kPa (2.5 in. H_2O), perform a cylinder compression test; refer to MBE900 service manual, engine chapter-cylinder head.
11. Compare the cylinder compression test results to specifications, refer to MBE900 service manual, additional information chapter. and specifications listed in Table9-1.
    [a] If cylinder pressure is below specifications, refer to section 9.4.1.
    [b] If cylinder pressure is 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 9-1 Compression Pressure Test Data

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9.4.1 Worn or Damaged Intake/Exhaust Valve or Cylinder Kit Repair

Perform the following steps for worn or damaged intake/exhaust valves or a cylinder kit:

1. Remove the cylinder head; refer to MBE900 service manual, engine chapter.
2. Inspect the cylinder head for worn or damaged valves and worn or damaged valve stem seals; 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. Verify repair to cylinder valve(s) or cylinder kit components; refer to section 9.4.1.1.

9.4.1.1 Test Engine with Repairs Made to Correct Worn or Damaged Intake/Exhaust Valve or Cylinder Kit

Perform the following to determine if the repaired intake/exhaust valve or cylinder kit has 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 the engine.
2. Run the engine and bring the engine coolant temperature to normal operating range, approximately 88-96°C (190-205°F).
3. Run the vehicle to full load and rated speed.
4. Visually inspect exhaust for excessive blue smoke.
   [a] If the engine exhaust smoke emission appears normal for a rebuilt engine, no further troubleshooting is required. Shut down the engine.
   [b] If the engine exhaust smoke emission is excessively blue, shut down the engine. Call the Detroit Diesel Customer Support Center at 313-592-5800.

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10 EXCESSIVE WHITE SMOKE MBE900

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10.1 FAULTY MCM

To determine if a faulty MCM is causing excessive white smoke, perform the following:

1. Check for faulty MCM. Refer to DDC publication *MBE Troubleshooting Guide* (6SE422) and SID 233.
2. Replace the faulty MCM; refer to MBE900 service manual, fuel system chapter.
3. Verify MCM replacement; refer to section 10.1.1.

10.1.1 Test the Engine with Replaced MCM

Perform the following to determine if the replaced MCM has resolved the excessive white smoke:

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. Run the engine at idle with a no-load condition for approximately five minutes, allowing the engine coolant to reach normal operating range.
3. Visually inspect the exhaust for excessive white smoke.
   [a] If the engine exhaust emission appears normal, no further troubleshooting is required. Shut down the engine.
   [b] If the engine exhaust emission is excessively white, shut down the engine. Refer to section 10.2.

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10.2 FAULTY TURBOCHARGER BOOST SENSOR

To determine if a faulty turbocharger boost sensor is causing excessive white smoke, perform the following:

1. Check the condition of the boost air combination sensor (look for cracks, corrosion, missing or bent pins).
2. Resolve the faulty turbocharger boost sensor; refer to section 10.2.1.

10.2.1 Turbocharger Boost Sensor Resolution

Perform the following steps to resolve a faulty turbocharger boost sensor:

1. Disconnect harness connection from turbocharger boost sensor and remove two bolts securing the boost sensor to the air intake manifold. Discard sensor.
2. Secure the turbocharger boost sensor to the air intake manifold with two bolts. Torque bolts to 11 N·m (96 lb·in.).
3. Connect the harness connector to the boost sensor.
4. Verify the turbocharger boost sensor resolution; refer to section 10.2.1.1.

10.2.1.1 Test Engine with Replace Turbocharger Boost Sensor

Perform the following to determine if replacing the turbocharger boost sensor corrected the excessive white smoke 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 to full load.
3. Visually inspect the exhaust for excessive white smoke.
   [a] If the engine exhaust emission appears normal, no further troubleshooting is required. Shut down the engine.
   [b] If the engine exhaust emission is excessive, shut down the engine, check for a malfunctioning air intake (grid) preheater. Refer to section 10.3.

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10.3 MALFUNCTIONING AIR INTAKE (GRID) PREHEATER

To determine if a malfunctioning air intake (grid) preheater is causing the excessive white smoke, perform the following steps:

1. Check the operation of the air intake (grid) preheater. Refer to DDC publication *MBE Troubleshooting Guide* (6SE422) and PID 45.
   [a] If heater operates correctly; check for a defective fuel pump. Refer to section 10.4.
   [b] If heater does not operate correctly, replace air intake (grid) preheater, refer to MBE900 service manual, air intake system chapter.
2. Verify replacing the air intake (grid) preheater resolved the excessive white smoke condition; refer to section 10.3.1.

10.3.1 Test the Engine with Replaced Air Intake (Grid) Preheater

Perform the following to determine if replacing the air intake (grid) preheater corrected the excessive white smoke 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 to full load.
3. Visually inspect the exhaust for excessive white smoke.
   [a] If the engine exhaust emission appears normal, no further troubleshooting is required. Shut down the engine.
   [b] If the engine exhaust emission is excessive, shut down the engine, check for a defective fuel pump. Refer to section 10.4.

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10.4 DEFECTIVE FUEL PUMP

To determine if the fuel pump is causing excessive white smoke, perform the following to check fuel intake pressure upstream of fuel pump. Refer to section 2.5.

1. If the pressure at idle speed (600-650 rpm) is in the normal range of -0.09 to -0.12 bar (-1.3 to -1.7 psi [-9 to -12 kPa]), check for aerated fuel. Refer to section 10.5.
2. If the pressure at idle speed (600-650 rpm) is greater than -0.09 to -0.12 bar (-1.3 to -1.7 psi [-9 to -12 kPa]); refer to Table 10-1.
3. If the pressure at idle speed (600-650 rpm) is less than -0.09 to -0.12 bar (-1.3 to -1.7 psi [-9 to -12 kPa]); refer to Table 10-2.
4. If a no pressure reading is observed, replace the fuel pump, refer to MBE900 service manual, fuel system chapter.

Problem — The Fuel Inlet Pressure is Too High	
Possible Cause	**Remedy**
The fuel feed lines are kinked or blocked.	Inspect the lines and fittings for blockage. Repair/replace as necessary.
The suction line and/or strainer at the fuel level sensor is blocked or is touching the bottom of the fuel tank.	Inspect the suction line and/or strainer through the fuel fill opening in the fuel tank. Remove the fuel level sensor and repair or replace the line or strainer, as necessary.
The check valve in the fuel feed line is blocked or not open wide (the flange at the fitting connection is bent).	Repair/replace as necessary.

Table 10-1 Problem — The Fuel Inlet Pressure is Too High

Problem — The Fuel Inlet Pressure is Too Low	
Possible Cause	**Remedy**
The pre-filter is leaking (drawing air).	Replace the O-ring. Replace the filter element and tighten the cap on the filter housing 25 N·m (18 lb·ft).
The fuel feed lines and connections are leaking (drawing air).	Replace the seals on the leaking lines. Tighten the fittings on the fuel lines to 25 N·m (18 lb·ft) and perform a fuel leak test.
The fuel pump is worn.	Replace the fuel pump.
The pressure limiting valve in the fuel pump is jammed open or the drive lever is loose or broken.	Replace the fuel pump.
The air-admission valve in the fuel tank is blocked.	Remove air-admission valve blockage.
The suction line and/or strainer at the fuel level sensor is blocked or is touching the bottom of the fuel tank.	Inspect the suction line and/or strainer through the fuel fill opening in the fuel tank. Remove the fuel level sensor and repair or replace the line or strainer, as necessary

Table 10-2

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10.4.1 Replace Faulty Fuel Pump

Perform the following steps for the replacement of the fuel pump:

1. Replace the fuel pump, refer to MBE900 service manual, fuel system chapter.
2. Test the engine to determine if the white smoke problem was resolved; refer to section 10.4.1.1.

10.4.1.1 Engine Test with Replaced Fuel Pump

To determine if the replaced fuel pump resolved excessive white smoke 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. Start and run the engine, if no white smoke is visible, no further troubleshooting is required. Shut down the engine.
2. If white smoke is visible, check for aerated fuel; refer to section 10.5

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10.5 AERATED FUEL

To determine if aerated fuel is causing excessive white smoke, 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 open 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 and run the engine.
4. Operate 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, shut down the engine; refer to section 10.5.1.
   [b] If air bubbles are not present, shut down the engine, check for improper grade of fuel; refer to section10.6.

10.5.1 Aerated Fuel Resolution

Perform the following steps to resolve aerated fuel:

1. Tighten all fuel line connections between fuel tank and fuel pump; refer to OEM guidelines.
2. Visually inspect all fuel lines between fuel tank and fuel pump for leaks.
3. Repair damaged components as required; refer to OEM guidelines.
4. Verify aerated fuel resolution; refer to section 10.5.1.1.

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10.5.1.1 Test the Engine with Aerated Fuel Resolution

Perform the following to determine if aerated fuel resolution resolved excessive white smoke 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 and run the engine.
2. Run the engine at idle with a no-load condition for approximately five minutes, allowing the engine coolant to reach normal operating range.
3. Visually inspect exhaust for excessive white smoke.
   [a] If the engine exhaust emission appears normal, no further troubleshooting is required. Shut down the engine.
   [b] If the engine exhaust emission is excessively white, shut down the engine. Check for improper grade of fuel; refer to section 10.6.

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10.6 IMPROPER GRADE OF FUEL

To determine if an improper grade of fuel is causing the excessive white smoke, perform the following:

1. Acquire a fuel sample from the vehicle fuel tank(s).
2. Submit fuel sample for an ASTM test analysis.
   [a] If the fuel meets specifications, check for a faulty turbocharger control unit; refer to section 10.7.
   [b] If the fuel did not meet specifications, resolve improper grade of fuel; refer to section 10.6.1 and DDC publication *Lubricating Oil, Fuel, and Filters* (7SE270).

10.6.1 Improper Grade of Fuel Resolution

Perform the following steps to resolve the improper grade of fuel:

1. Drain the fuel tanks, refer to OEM guidelines, and dispose of properly.
2. Refill the fuel tanks with new fuel having a cetane number greater than 45 and cetane index greater than 40.
3. Verify fuel resolution eliminated the excessive exhaust smoke condition; refer to section 10.6.1.1.

10.6.1.1 Test the Engine with New Fuel

Perform the following steps to determine if the fuel refill resolved the excessive white smoke 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 and run the engine.
2. Run the engine at idle under no-load conditions for approximately five minutes, allowing the engine coolant to reach normal operating range, approximately 88-96°C (190-205°F).
3. Visually inspect exhaust for excessive smoke.
   [a] If the engine smoke emission appears normal, no further troubleshooting is required. Shut down the engine.

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[b] If the engine exhaust smoke is excessively white, shut down the engine. Check the turbocharger control unit; refer to section 10.7.

10.7 FAULTY TURBOCHARGER CONTROL UNIT

To determine if an improper turbocharger control unit is causing excessive white smoke, inspect the turbocharger control unit for a leaking diaphragm, refer to MBE900 service manual, air intake system chapter.

1. If the control unit diaphragm is leaking replace the turbocharger; refer to MBE900 service manual, air intake system chapter.
2. Verify the replacement of the turbocharger and unit control corrected the excessive white smoke condition; refer to section 10.7.1.

10.7.1 Test Engine with Replaced Turbocharger and Control Unit

Perform the following to determine if replacing the turbocharger and control unit corrected the excessive white smoke 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 to full load.
3. Visually inspect the exhaust for excessive white smoke.
   [a] If the engine exhaust emission appears normal, no further troubleshooting is required. Shut down the engine.
   [b] If the engine exhaust emission is excessive, shut down the engine, check for a restricted or cracked charge air cooler. Refer to section 10.8.

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10.8 RESTRICTED OR CRACKED CHARGE AIR COOLER

To determine if a charge air cooler is causing excessive exhaust smoke, perform the following:

NOTICE:
To avoid engine damage, follow the installation instructions provided with the air-to-air charge air cooler test kit.

1. Visually inspect the core, tanks, and welds for cracks and holes. If cooler fails visual inspection, replace the charge air cooler; refer to section10.8.2.
2. Pressure test the charge air cooler. Refer to section 10.8.1.
3. Evaluate the results from pressure testing the charge air cooler.
   [a] If the pressure drop is 34 kPa (5 psi) or less in 15 seconds the cooler is good. Check for faulty fuel injection nozzle; refer to section 10.9.
   [b] If the pressure drop is greater than 34 kPa (5 psi) in 15 seconds, replace the charge air cooler; refer to section 10.8.2.

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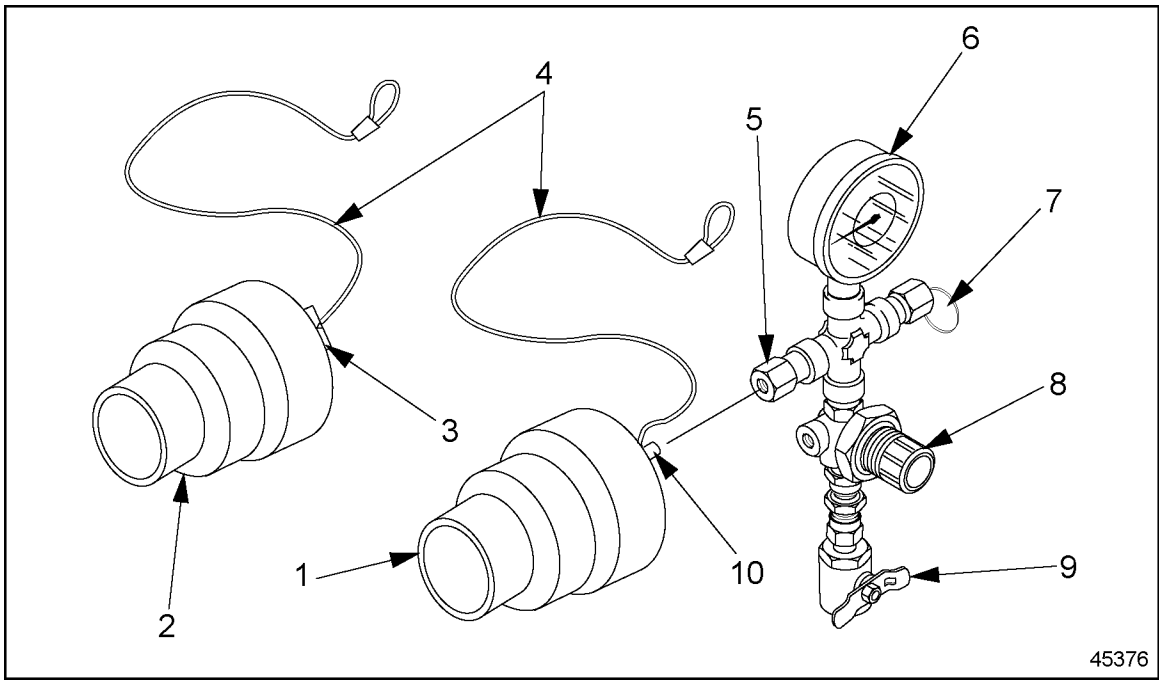
10.8.1 Pressure Testing the Charge Air Cooler

Perform the following to pressure test the charge air cooler:

1. Use the charge air cooler tester (J-41473) to test cooler for leaks. See Figure10-1 for component parts.



1. Gauge Coupler
2. Bleed-off Coupler
3. Bleed Valve
4. Safety Straps
5. Quick Disconnect
6. Gauge
7. Pressure Relief Valve
8. Air Regulator Valve
9. Air Shutoff Valve
10. Quick Disconnect Fitting

Figure 10-1 Charge Air Cooler Tester J-41473

2. Disconnect the air inlet and outlet piping connecting the charge air cooler to the engine.

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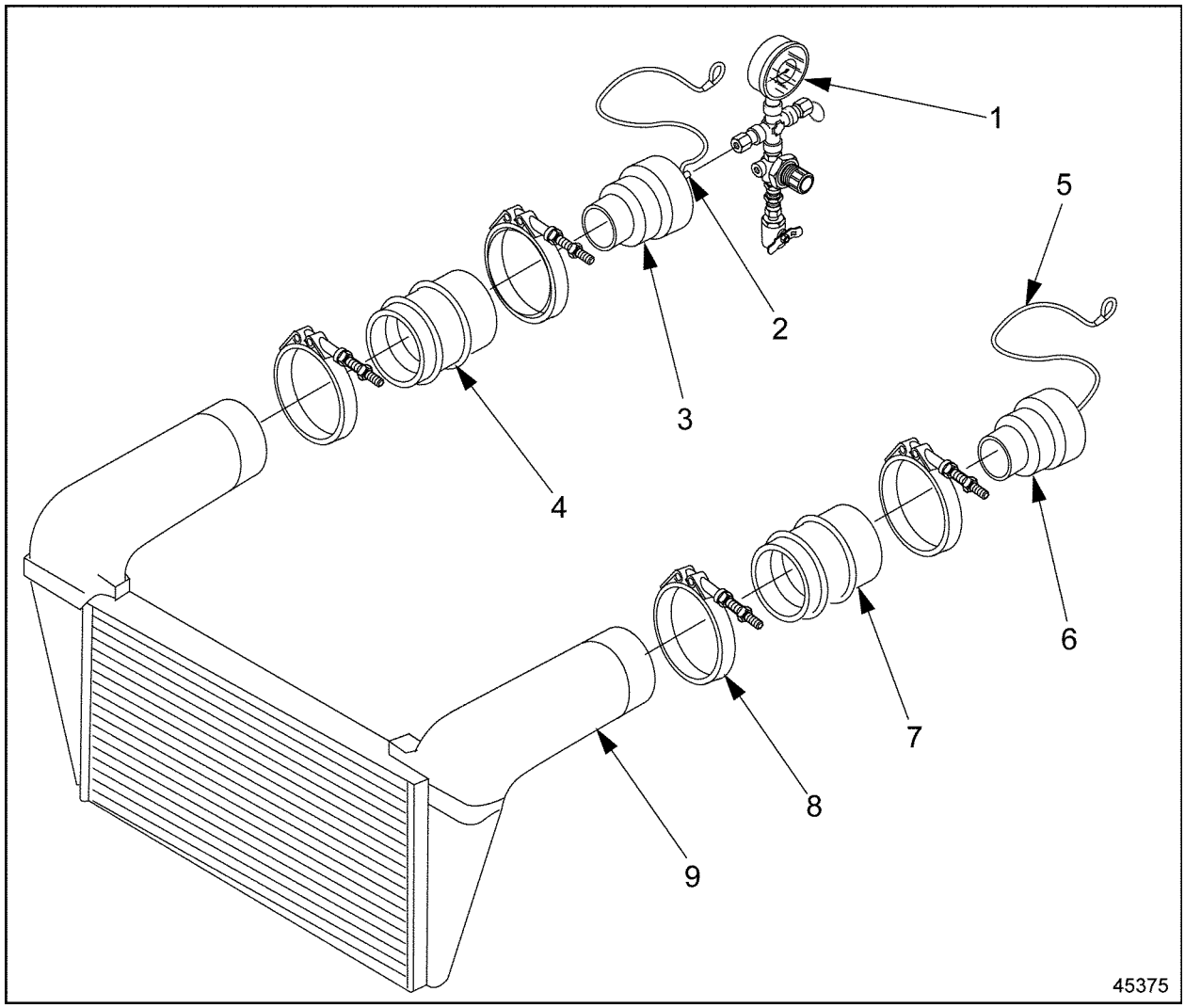
3. Install the charge air cooler test gauge coupler into the inlet hose (hot side) of the charge air cooler coming from the turbocharger compressor. Secure hose and coupler with clamp removed and torque the clamp to 5.6-6.78 N·m (50-60 lb·in.). See Figure10-2.



1. Gauge/Regulator Assembly
2. Quick Disconnect Fitting
3. Gauge Coupler
4. Charge Air Cooler Hose (Hot Side)
5. Safety Strap
6. Bleed-off Coupler
7. Charge Air Cooler Hose (Cold Side)
8. Clamp
9. Charge Air Cooler

Figure 10-2 Charge Air Cooler and Tester J-41473

4. Attach the gauge/regulator assembly to the quick disconnect fitting on the gauge coupler.
5. Use the clamp removed to attach the bleed-off coupler to the outlet hose (cold side) of the charge air cooler. Torque the clamp to 5.6-6.78 N·m (50-60 lb·in.).

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6. Connect the safety straps on the couplers to any convenient screw on the radiator mounting bracket.

⚠ WARNING:

PRESSURIZED AIR AND FLYING PARTICLES

To avoid injury to eye or face, wear a face shield or goggles when conducting a pressure test.

7. Attach an air pressure line, with filtered air, to the air shutoff valve and gradually pressurize the charge air cooler to a pressure of 205 kPa (30 psi). If necessary, perform the following steps to adjust the air regulator until the gauge reads 205 kPa (30 psi):
   [a] Pull regulator knob outward to unlock.
   [b] Turn knob to adjust pressure to 205 kPa (30 psi).
   [c] Push the regulator knob back into locked position.
8. Close the air shutoff valve and monitor the gauge with a stop watch for 15 seconds. Note any decrease in air pressure.
9. Repeat test at least three times to verify results.
   [a] In pressure drop is 34 kPa (5 psi) or less in 15 seconds the cooler is good.
   [b] If the pressure drop is greater than 34 kPa (5 psi) in 15 seconds, replace the charge air cooler. Refer to section 10.8.2.
10. Slowly release pressure with the charge air cooler by opening the valve in the bleed-off coupler.
11. Remove all charge air cooler tester pieces and reconnect charge air cooler piping to the engine.
12. Reconnect air inlet and outlet piping to engine. Torque hose clamps to 5.6 - 6.78 N·m (50 - 60 lb·in.).

10.8.2 Charge Air Cooler Replacement

Perform the following steps to replace the charge air cooler:

1. Replace the charge air cooler; refer to OEM guidelines.
2. Verify that the replacement of the charge air cooler eliminated the excessive white exhaust smoke; refer to section 10.8.3.

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10.8.3 Test the Engine with a Replaced Charge Air Cooler

To determine if the replaced charge air cooler resolved the excessive white exhaust smoke condition, 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.
2. Run the engine at idle with a no-load condition for approximately five minutes, allowing the engine coolant to reach normal operating range, approximately 88-96°C (190-205°F).
3. Visually inspect exhaust for excessive white smoke.
   [a] If the engine exhaust emission appears normal, no further troubleshooting is required. Shut down the engine.
   [b] If the engine exhaust emission is excessively white, shut down the engine. Check for a faulty fuel injection nozzle holder; refer to section 10.9.

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10.9 FAULTY FUEL INJECTION NOZZLE HOLDER

To determine if a faulty fuel injection nozzle holder is causing excessive white smoke, perform the following:

1. Check for faulty fuel injection nozzle holder; perform “Flow Test at Nozzle Holder”. Refer to section2.3.
2. Repair or replace the faulty fuel injection nozzle holder; refer to MBE900 service manual, fuel system chapter.
3. Verify fuel injection nozzle holder repair or replacement; refer to section 10.9.1.

10.9.1 Test the Engine with Repaired Fuel Injection Nozzle Holder

To determine if a faulty fuel injector nozzle holder is causing excessive white smoke, 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.
2. Run the engine at idle with a no-load condition for approximately five minutes, allowing the engine coolant to reach normal operating range, approximately 88-96°C (190-205°F).
3. Visually inspect exhaust for excessive white smoke.
   [a] If the engine exhaust emission appears normal, no further troubleshooting is required. Shut down the engine.
   [b] If the engine exhaust emission is excessively white, shut down the engine. Check for improper valve clearance or damaged camshaft lobes and rollers; refer to section 10.10.

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

To determine if an improper valve clearance, worn or damaged camshaft lobes or rollers are causing excessive white exhaust smoke, perform the following:

1. Check for improper valve clearance, and worn or damaged camshaft lobes and rollers. Repair as required, refer to MBE900 service manual, engine chapter.
2. Verify valve clearance, worn or damaged camshaft lobes and rollers repair corrected the excessive white exhaust smoke concern; refer to section 10.10.1.

10.10.1 Test Engine with Corrected Valve Clearance, Worn or Damaged Camshaft Lobes and Rollers

Perform the following steps to determine if the valve clearance, worn or damaged camshaft lobes and rollers repair has resolved excessive white exhaust smoke 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 and run the engine.
2. Run the engine at idle with a no-load condition for approximately five minutes, allowing the engine coolant to reach normal operating range.
3. Visually inspect exhaust for excessive white exhaust smoke.
   [a] If the engine exhaust smoke emission appears normal, no further troubleshooting is required. Shut down the engine.
   [b] If the engine exhaust smoke emission is excessive, shut down the engine. Check for low cylinder compression; refer to section 10.11.

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10.11 LOW CYLINDER COMPRESSION

To determine if low compression is causing excessive white smoke condition, perform the following steps:

1. Perform a cylinder compression test; refer to section 10.11.1
2. Compare cylinder compression test results to specifications as listed in Table 10-3.

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

Table 10-3 Compression Testing Specifications

[a] If cylinder pressure is below specifications, refer to section 4.13.1.

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

10.11.1 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 to 95°C (158 and 203°F).

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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.

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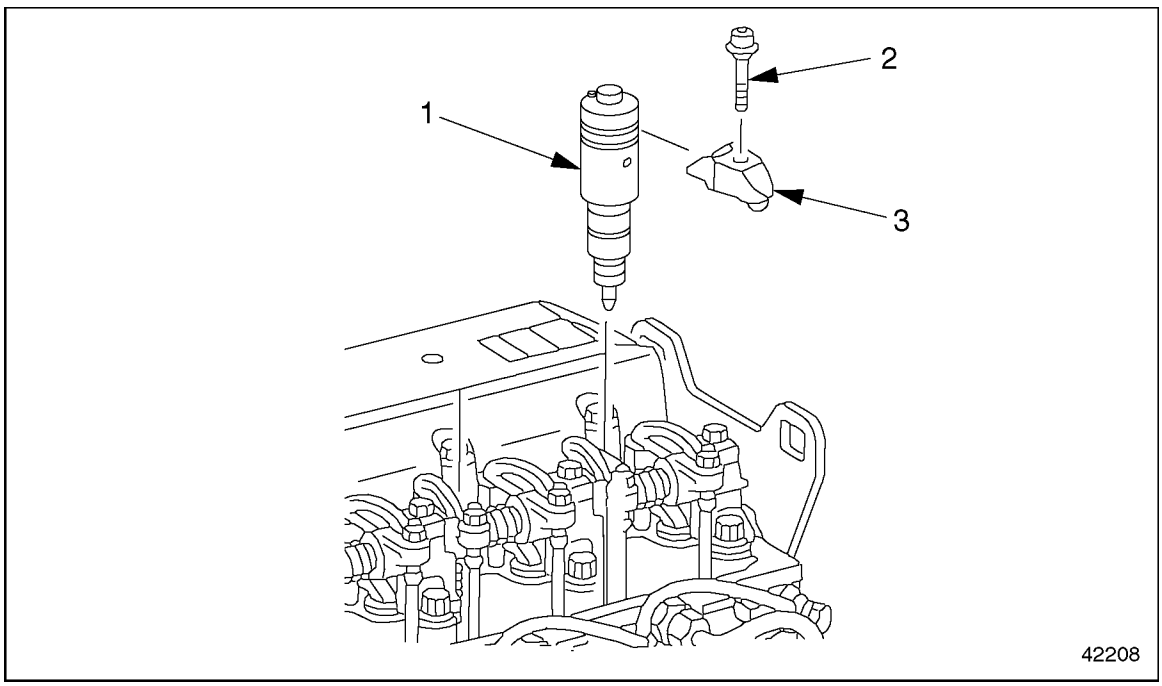
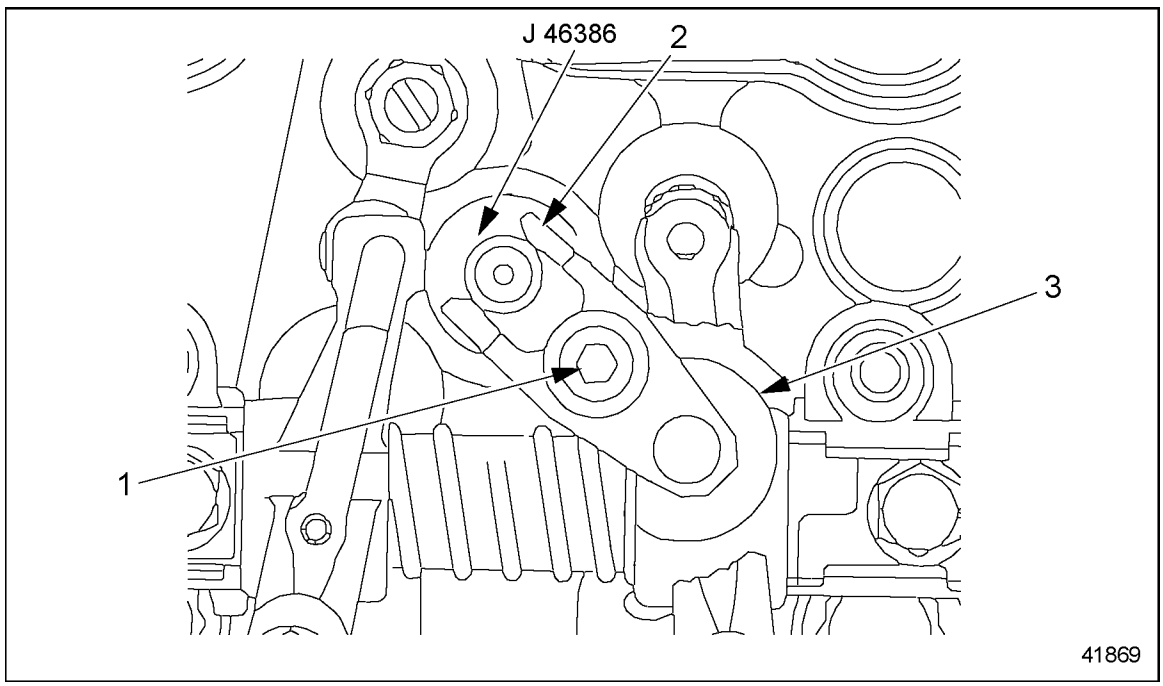
4. Remove the nozzle holder. See Figure 10-3.



1. Nozzle Holder
2. Bolt
3. Hold-Down Clamp

Figure 10-3 Removing the Nozzle Holder

5. Insert the compression test adaptor J-46386 into the cylinder head. See Figure 10-4. Use the hold-down clamp and bolt included in the kit.



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

Figure 10-4 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.

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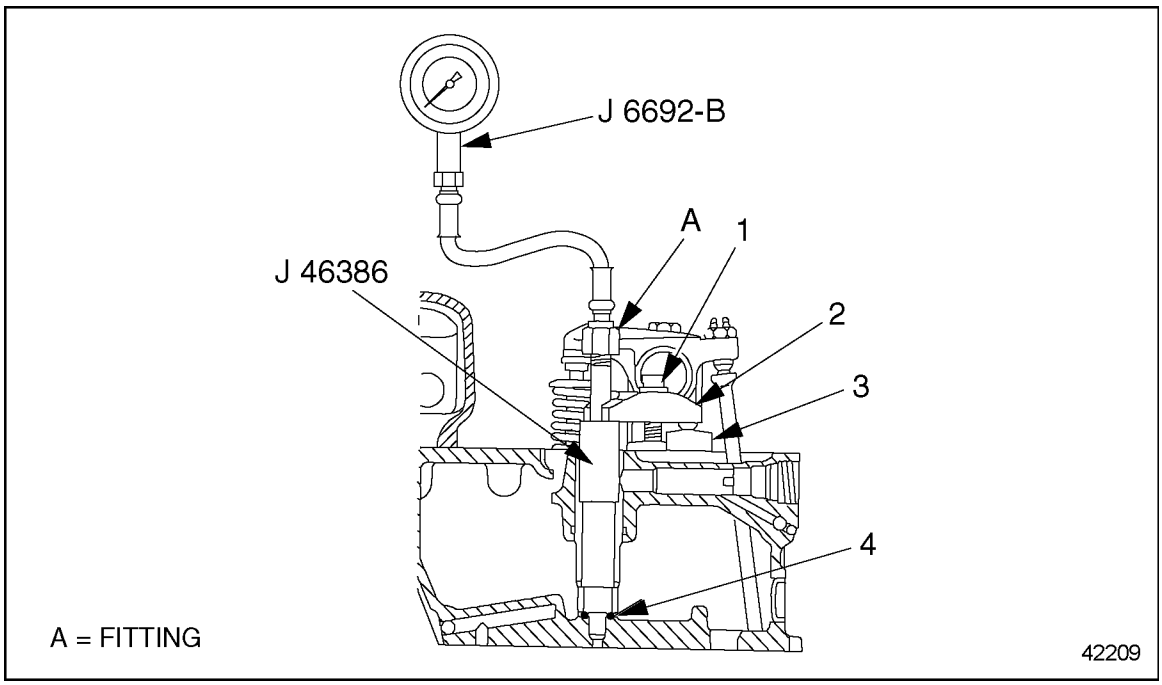
6. Attach the compression tester J-6692–B to the test adaptor J-46386. Thread the fitting at the end of the tester to the top of the test adaptor. See Figure 10-5.



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

Figure 10-5 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 10-4.

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

Table 10-4 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.

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Install the nozzle holder as follows:

1. Connect the MCM.
2. Connect minidiag2 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 .
4. Remove the compression test adaptor. See Figure 10-4.
5. Install the nozzle holder. See Figure .
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.

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11 ROUGH RUNNING OR STALLING MBE900

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11.2 AERATED FUEL 11-4
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11.1 LOW BATTERY VOLTAGE

To determine if a weak battery is causing rough running or stalling, 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. Start and run the engine.
2. Measure the battery voltage; refer to OEM guidelines.
   [a] If the battery voltage is greater than or equal to 10.5 volts, check for aerated fuel; refer to section 11.2.
   [b] If the battery voltage is less than 10.5 volts, replace the battery; refer to section 11.1.1.

11.1.1 Battery Replacement

Perform the following steps for battery replacement:

1. Remove and replace the battery; refer to OEM guidelines.
2. Verify battery replacement; refer to section 11.1.1.1.

11.1.1.1 Test Engine with Replaced Battery

Perform the following steps to determine if the battery replacement resolved the concern:

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. Run the engine at idle with a no-load condition for approximately five minutes, allowing the engine coolant to reach normal operating range, 88-96°C (190-205°F).
   [a] If the engine is not running rough or stalling, no further troubleshooting is required. Shut down the engine.
   [b] If the engine is running rough or stalling, shut down the engine. Check for aerated fuel; refer to section 11.2.

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11.2 AERATED FUEL

To determine if aerated fuel is causing rough running or stalling, perform the following steps:

1. Disconnect the fuel line return hose from the fitting at the fuel tank; refer to OEM guidelines.
2. Place the open 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 and run the engine.
4. Operate 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, shut down the engine; refer to section 11.2.1.
   [b] If air bubbles are not present, shut down the engine. Check for high fuel temperature return, which would be an indication of insufficient fuel flow.

11.2.1 Aerated Fuel Resolution

Perform the following steps to resolve aerated fuel:

1. Tighten all fuel line connections between fuel tank and fuel pump; refer to OEM guidelines.
2. Visually inspect all fuel lines for leaks between fuel tank and fuel pump.
3. Repair damaged components as required; refer to OEM guidelines.
4. Verify aerated fuel resolution; refer to section 11.2.1.1.

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11.2.1.1 Test the Engine with Aerated Fuel Resolution

Perform the following to determine if aerated fuel resolution has resolved rough running or stalling 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 and run the engine.
2. Run the engine at idle with a no-load condition for approximately five minutes, allowing the engine coolant to reach normal operating range.
3. Test for rough running condition.
   [a] If the engine appears normal, no further troubleshooting is required. Shut down the engine.
   [b] If the engine is still running rough, shut down the engine. Check for insufficient fuel flow. Refer to section 11.3.

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11.3 INSUFFICIENT FUEL FLOW

To determine if insufficient fuel flow is causing rough running or stalling, do the following steps:

1. Perform Fuel Flow Test #3 and measure the fuel return flow rate. Refer to section 2.4 and see Figure .
2. Analyze the fuel flow test results.
   [a] If the fuel rate is 0.9 L/min. (0.2 gal/min.) or more, no further troubleshooting is required. Contact Detroit Diesel Customer Support Center at 313-592-5800.
   [b] If the fuel rate is less than 0.9 L/min. (0.2 gal/min.), resolve the insufficient fuel flow; refer to section 11.3.1.

11.3.1 Insufficient Fuel Flow Resolution

Perform the following steps to resolve the insufficient fuel flow:

1. Replace the fuel filter(s); refer to section 4.9.1.

NOTE:
Always fill the filter(s) with clean fuel oil before installing. Turn the filter(s) until they contact the gasket fully. Then turn them an additional two-thirds by hand.

2. Inspect the fuel lines for restrictions due to pinching, kinking, or other damage. If damage is found, repair as necessary; refer to OEM guidelines.
3. Inspect the fuel return check valve for restrictive movement.
4. Inspect the fuel pump drive assembly. If damage is found, repair as necessary; refer to MBE900 service manual, fuel system chapter.
5. Verify repairs done to correct insufficient fuel flow; refer to section 11.3.1.1.

11.3.1.1 Test the Engine with Resolved Fuel Flow

Perform the following steps to determine if the fuel flow resolution resolved rough running or stalling:

⚠ 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. Run the engine at idle with a no-load capacity for approximately five minutes, allowing the engine coolant to reach normal operating range, 88-96°C (190-205°F).

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[a] If the engine is not running rough or stalling, no further troubleshooting is required. Shut down the engine.

[b] If the engine is running rough or stalling, shut down the engine. Contact Detroit Diesel Customer Support Center at 313-592-5800.

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12 LACK OF POWER MBE900

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12.1 AERATED FUEL

To determine if aerated fuel is causing lack of power, perform the following steps:

1. Test for aerated fuel.
2. Disconnect the fuel line return hose from the fitting located at the fuel tank; refer to OEM guidelines.
3. Place the open 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.

4. Start and run the engine.
5. Operate the engine at 1000 rpm.
6. Visually check to see if air bubbles are rising to the surface of the fuel that collects within the container.
   [a] If air bubbles are not present, shut down the engine, check for high fuel pressure; refer to section 12.2.
   [b] If air bubbles are present, shut down the engine; refer to section 12.1.1.

12.1.1 Aerated Fuel Resolution

Perform the following steps to resolve aerated fuel condition:

1. Tighten all fuel line connections between fuel tank and fuel pump; refer to OEM guidelines.
2. Visually inspect all fuel lines between fuel tank and fuel pump for leaks.
3. Repair damaged components as required; refer to OEM guidelines.
4. Verify aerated fuel resolution; refer to section 12.1.1.1.

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12.1.1.1 Test the Engine with Aerated Fuel Resolution

Perform the following steps to determine if aerated fuel resolution has resolved lack of power 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 and run the engine.
2. Run the engine at idle with a no-load condition for approximately five minutes, allowing the engine coolant to reach normal operating range.
3. Test drive the vehicle to ensure lack of power has been resolved.
   [a] If no lack of power occurred during the test drive, no further troubleshooting is required. Shut down the engine.
   [b] If lack of power occurred during the test drive, shut down the engine. Check for high fuel pressure; refer to section 12.2.

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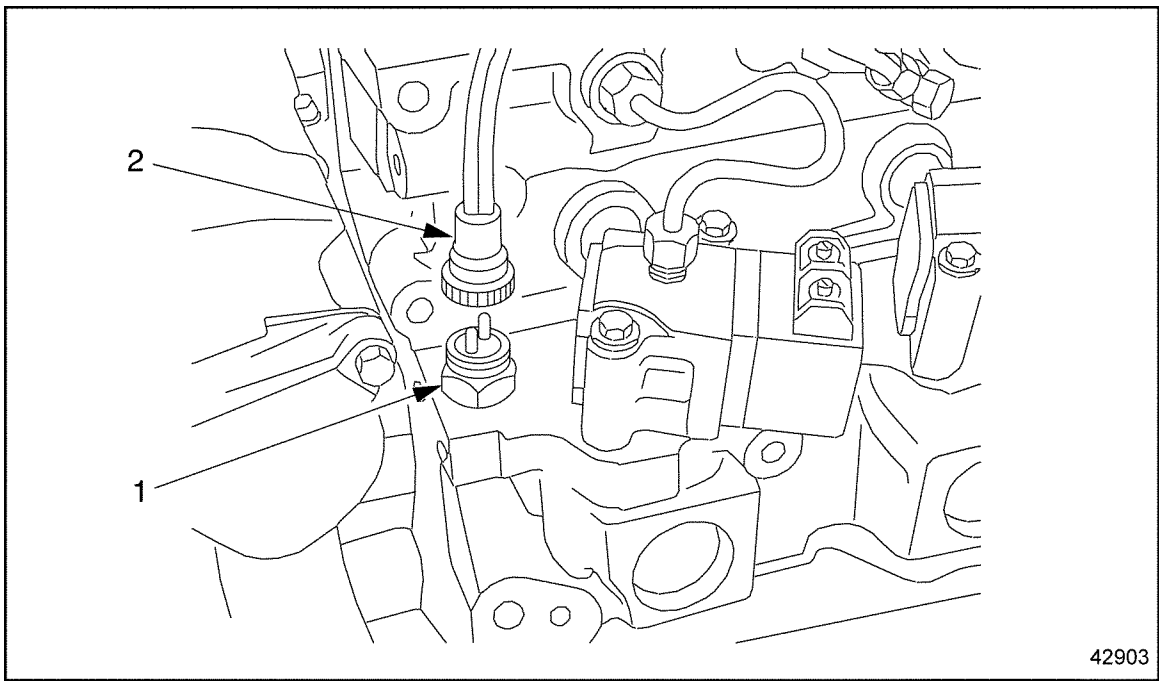
12.2 HIGH FUEL PRESSURE

To determine if high fuel pressure is causing a lack of power, perform the following steps:

1. Remove the fuel temperature sensor. See Figure 12-1.



1. Fuel Temperature Sensor
2. Engine Wiring Harness

Figure 12-1 Disconnecting the Sensor

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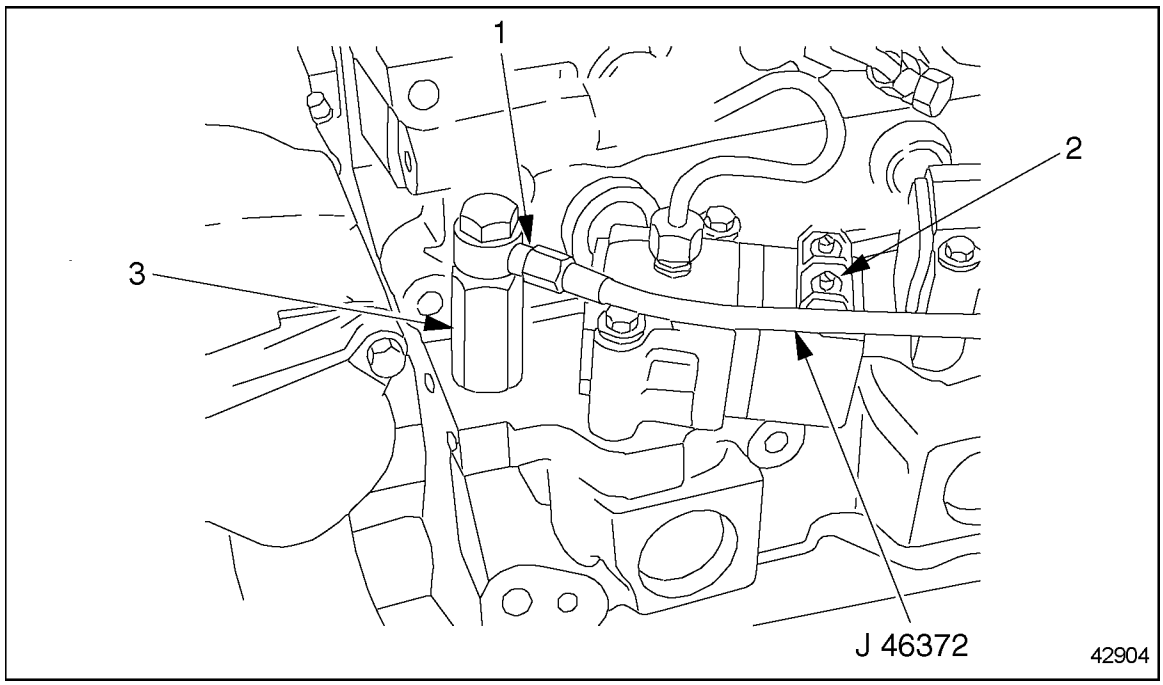
2. Install the adaptor and banjo fitting, part of kit (J-46377), and high pressure line (J-46372). See Figure 12-2.



1. Banjo Fitting
2. Solenoid Unit Pump
3. Adaptor from kit J-46377

Figure 12-2 Connecting the Adaptor

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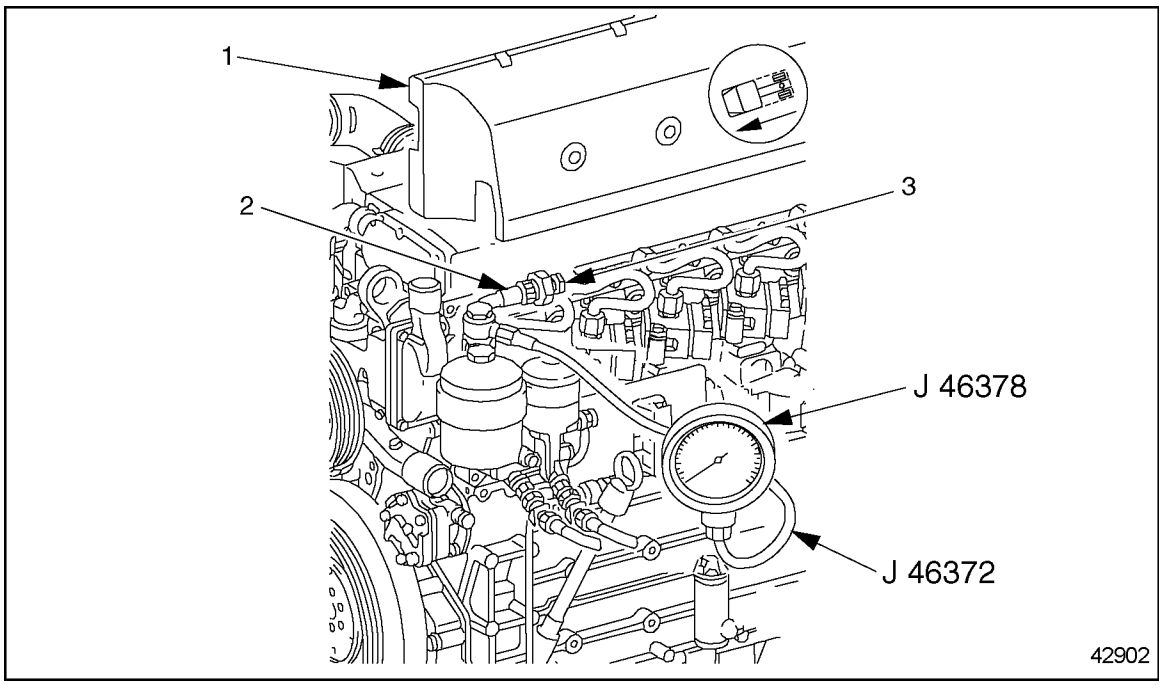
3. Attach a calibrated gauge (J-46378) capable of reading 0-100 psi, to the high-pressure fuel line (J-46372), leading to the tee-fitting. See Figure 12-3.



1. Engine Trim Panel
2. Engine Wiring Harness
3. Fuel Temperature Sensor

Figure 12-3 Attaching the Calibrated Gauge

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.

4. Start and run the engine to the speeds listed in Table 12-1 and record the fuel pressure.

Engine Speed, rpm	Fuel Pressure, kPa (psi)
600-650	430 (62)
2500	400-650 (58-94)

Table 12-1 Fuel Pressure at Various Speeds

5. Shut down the engine.
6. Remove the adaptor, banjo fitting, high pressure line, and high pressure gauge.

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7. Reinstall the fuel temperature sensor.
8. Analyze the measure fuel pressure readings.
   [a] If the fuel pressure is within specifications listed in Table 12-1, check for high fuel temperature return; refer to section 12.4.
   [b] If the fuel pressure is greater than specifications listed in Table 12-1, refer to section 12.3.1.

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12.3 FAULTY OVERFLOW VALVE

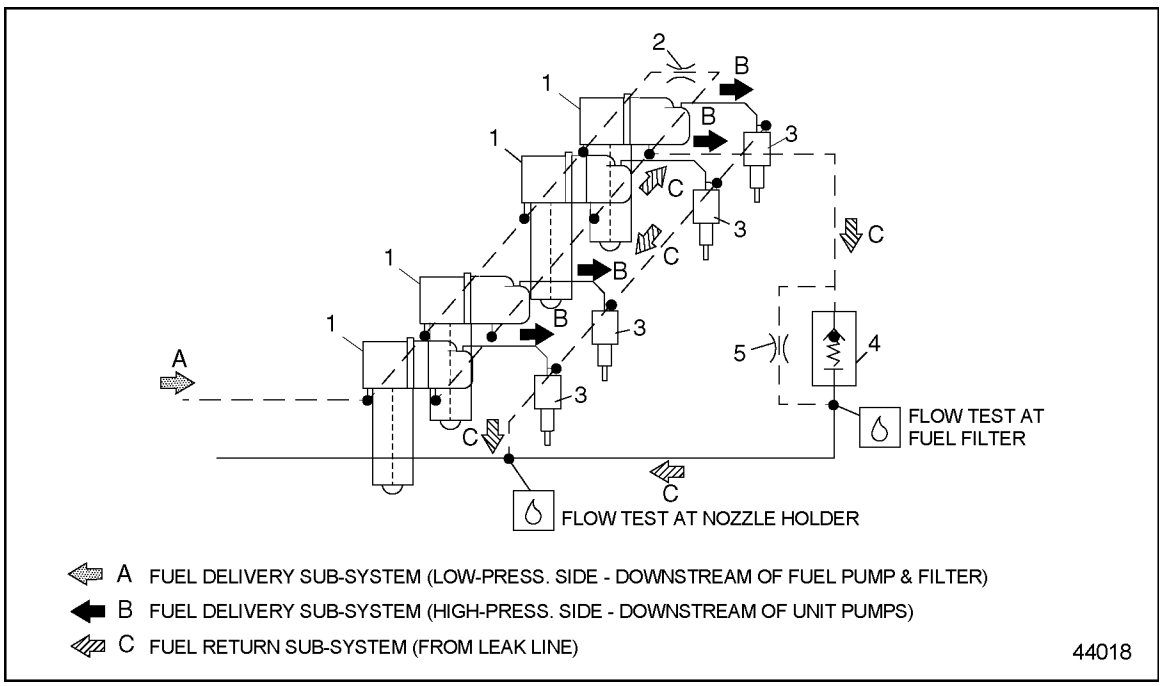
To determine if a faulty overflow valve is causing a lack of power, perform the following steps:

1. Run Fuel system Test #1: Downstream Pressure Test. Refer to section 2.2.
2. If Test #1 indicates faulty overflow valve, proceed to step 3.
3. Run fuel system Test #3: Flow Test – At Fuel Filter. Refer to section 2.4.
4. If the overflow valve is found to be faulty, replace the overflow valve. Refer to section 12.3.1.

12.3.1 Overflow Valve Replacement

Perform the following steps to replace the overflow valve.

1. Remove the overflow valve from the fuel return line.
2. Install a new overflow valve. Tighten the valve to 48-52 N·m (35-38 lb·ft). See Figure 12-4.



1. Unit Pump
2. Bypass to Fuel Return Port
3. Nozzle Holder
4. Overflow Valve
5. Constant Ventilation (overflow)

Figure 12-4 Overflow Valve Location

3. Verify overflow valve replacement; refer to section 12.3.1.1.

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12.3.1.1 Test the Engine with Replaced Overflow Valve

Perform the following steps to determine if the replaced overflow valve has resolved lack of power 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 and run the engine.
2. Run the engine at idle with a no-load condition for approximately five minutes, allowing the engine coolant to reach normal operating range.
3. Test drive the vehicle to ensure lack of power has been resolved.
   [a] If no lack of power occurred during the test drive, no further troubleshooting is required. Shut down the engine.
   [b] If lack of power occurred during the test drive, shut down the engine. Check for high fuel temperature return; refer to section 12.4.

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12.4 HIGH FUEL TEMPERATURE RETURN

To determine if high fuel temperature return is causing lack of power, perform the following steps:

1. Test for high fuel temperature return.
2. Analyze the high fuel temperature test results.
   [a] If the return fuel temperature is less than or equal to 60°C (140°F), check for air cleaner restriction; refer to section 12.5.
   [b] If the return fuel temperature is greater than 60°C (140°F), resolve the high fuel temperature return condition; refer to section 12.4.1.

12.4.1 High Fuel Temperature Resolution

Perform the following steps to resolve high fuel temperature return:

1. Remove and replace fuel filter(s), refer to MBE900 service manual, fuel system chapter.
2. Verify high fuel temperature repair; refer to section 12.4.1.1.

12.4.1.1 Test the Engine with Resolved High Fuel Temperature

Perform the following steps to determine if high fuel temperature repairs have resolved lack of power 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 and run the engine.
2. Test drive the vehicle to ensure lack of power has been resolved.
   [a] If lack of power did not occur during the test drive, no further troubleshooting is required. Shut down the engine.
   [b] If lack of occurred during the test drive, shut down the engine. Check for a restricted air cleaner element; refer to section 12.5.

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12.5 RESTRICTED AIR CLEANER ELEMENT

To determine if a restricted air cleaner element is causing lack of power, perform the following steps:

1. Remove the air filter element from the air cleaner container; refer to OEM guidelines.
2. Visually inspect the air cleaner element for damage or clogging.
   [a] If no damage or clogging is found, check the charge air cooler; refer to section 12.6.
   [b] If damage or clogging is found, refer to section 12.5.1.

12.5.1 Air Filter Element Replacement

Perform the following steps to replace the air filter element:

1. Remove and replace the damaged or clogged air filter element; refer to OEM guidelines.
2. Verify air filter element replacement; refer to section 12.5.1.1.

12.5.1.1 Test the Engine with Replaced Air Filter Element

Perform the following steps to determine if the new air filter element has resolved lack of power:

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. Test drive the vehicle to ensure lack of power has been resolved.
   [a] If lack of power did not occur during the test drive, no further troubleshooting is required. Shut down the engine.
   [b] If lack of power occurred during the test drive, shut down the engine. Check the charge air cooler; refer to section 12.6.

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12.6 RESTRICTED OR CRACKED CHARGE AIR COOLER

To determine if a restricted or cracked charge air cooler is causing lack of power, perform the following steps:

NOTICE:
To avoid engine damage, follow the installation instructions provided with the air-to-air charge air cooler test kit.

1. Visually inspect the core, tanks, and welds for cracks and holes. If cooler fails visual inspection replace the charge air cooler; refer to section 12.6.2.
2. Pressure test the charge air cooler; refer to section 12.6.1.
3. Evaluate the results from pressure testing the charge air cooler.
   [a] If the pressure drop is 34 kPa (5 psi) or less in 15 seconds, the cooler is good. Check for faulty air intake manifold; refer to section 12.7.
   [b] If the pressure drop is greater than 34 kPa (5 psi) in 15 seconds, replace the charge air cooler; refer to section 12.6.2.

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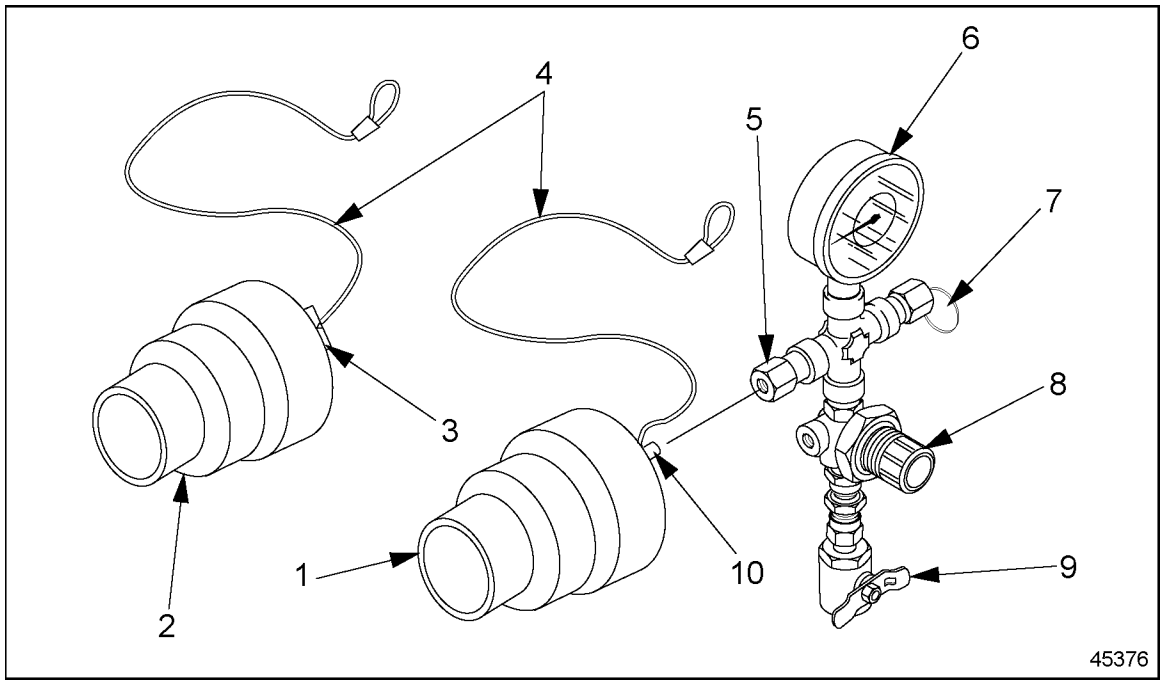
12.6.1 Pressure Testing the Charge Air Cooler

Perform the following to pressure test the charge air cooler:

1. Use the charge air cooler tester (J-41473) to test cooler for leaks. See Figure12-5 for component parts.



1. Gauge Coupler
2. Bleed-off Coupler
3. Bleed Valve
4. Safety Straps
5. Quick Disconnect
6. Gauge
7. Pressure Relief Valve
8. Air Regulator Valve
9. Air Shutoff Valve
10. Quick Disconnect Fitting

Figure 12-5 Charge Air Cooler Tester J-41473

2. Disconnect the air inlet and outlet piping connecting the charge air cooler to the engine.

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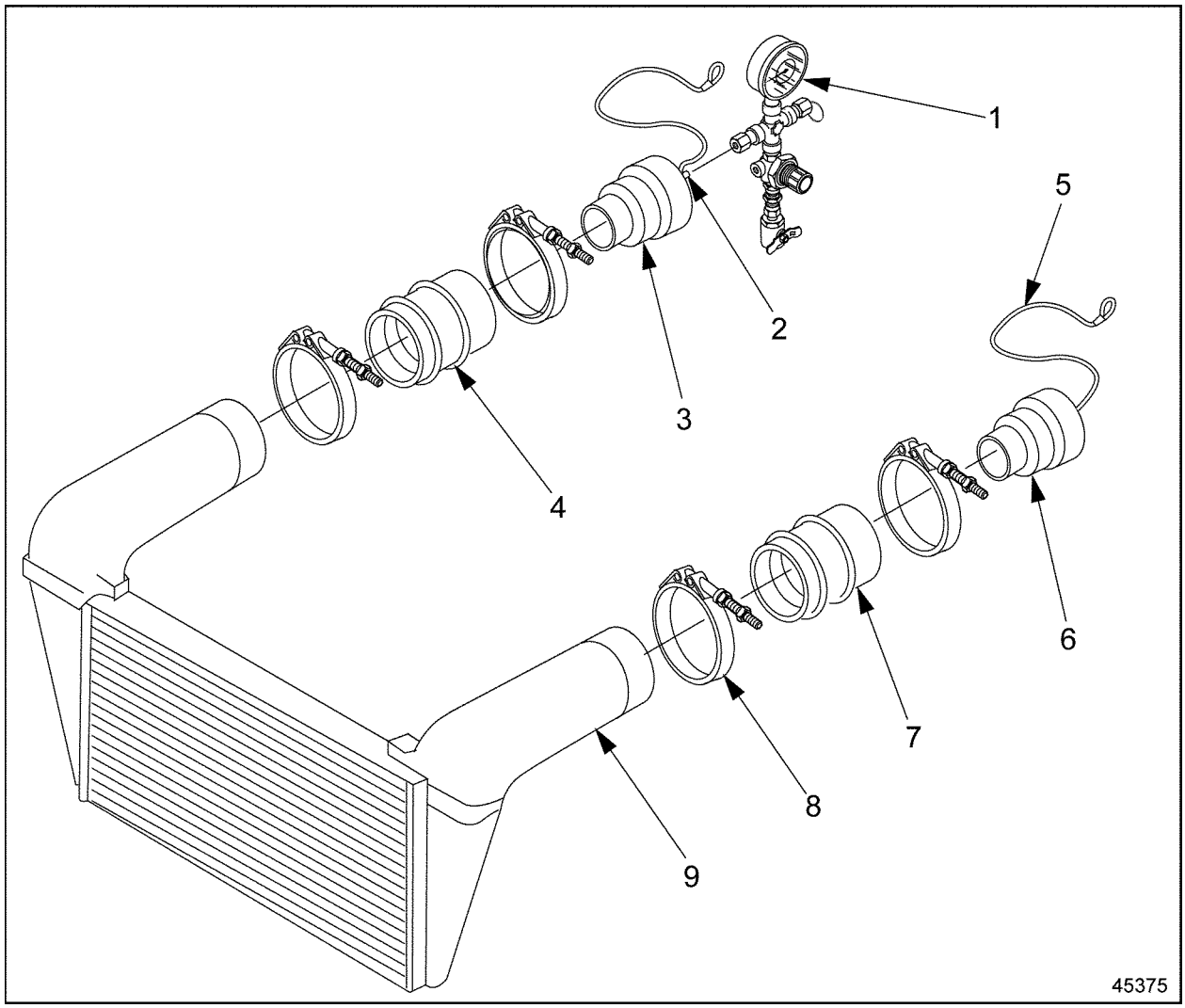
3. Install the charge air cooler test gauge coupler into the inlet hose (hot side) of the charge air cooler coming from the turbocharger compressor. Secure hose and coupler with clamp removed and torque the clamp to 5.6-6.78 N·m (50-60 lb·in.). See Figure12-6.



1. Gauge/Regulator Assembly
2. Quick Disconnect Fitting
3. Gauge Coupler
4. Charge Air Cooler Hose (Hot Side)
5. Safety Strap
6. Bleed-off Coupler
7. Charge Air Cooler Hose (Cold Side)
8. Clamp
9. Charge Air Cooler

Figure 12-6 Charge Air Cooler and Tester J-41473

4. Attach the gauge/regulator assembly to the quick disconnect fitting on the gauge coupler.
5. Use the clamp removed to attach the bleed-off coupler to the outlet hose (cold side) of the charge air cooler. Torque the clamp to 5.6-6.78 N·m (50-60 lb·in.).

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6. Connect the safety straps on the couplers to any convenient screw on the radiator mounting bracket.

WARNING:

PRESSURIZED AIR AND FLYING PARTICLES

To avoid injury to eye or face, wear a face shield or goggles when conducting a pressure test.

7. Attach an air pressure line, with filtered air, to the air shutoff valve and gradually pressurize the charge air cooler to a pressure of 205 kPa (30 psi). If necessary, perform the following steps to adjust the air regulator until the gauge reads 205 kPa (30 psi):
   [a] Pull regulator knob outward to unlock.
   [b] Turn knob to adjust pressure to 205 kPa (30 psi).
   [c] Push the regulator knob back into locked position.
8. Close the air shutoff valve and monitor the gauge with a stop watch for 15 seconds. Note any decrease in air pressure.
9. Repeat test at least three times to verify results.
   [a] In pressure drop is 34 kPa (5 psi) or less in 15 seconds the cooler is good.
   [b] If the pressure drop is greater than 34 kPa (5 psi) in 15 seconds, replace the charge air cooler. Refer to section 12.6.2.
10. Slowly release pressure with the charge air cooler by opening the valve in the bleed-off coupler.
11. Remove all charge air cooler tester pieces and reconnect charge air cooler piping to the engine.
12. Reconnect air inlet and outlet piping to engine. Torque hose clamps to 5.6 - 6.78 N·m (50 - 60 lb·in.).

12.6.2 Charge Air Cooler Replacement

Perform the following steps to replace the charge air cooler:

1. Remove and replace the charge air cooler; refer to OEM guidelines.
2. Verify replacement of the charge air cooler; refer to section 12.7.1.

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12.7 FAULTY AIR INTAKE MANIFOLD GASKET

Perform the following steps to troubleshoot a faulty air intake manifold gasket:

1. Remove the air intake manifold; refer to MBE900 service manual, air intake system chapter.
2. Inspect the air intake manifold and gaskets.
3. Install the air intake manifold with new gaskets;refer to MBE900 service manual, air intake system chapter.
4. Verify repair of the intake manifold; refer to section 12.7.1.

12.7.1 Test the Engine with Replaced Charge Air Cooler or Air Intake Manifold Gasket

To determine if the repairs resolved the lack of power condition, 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. Start and run the engine.
2. Test drive the vehicle to ensure lack of power has been resolved.
   [a] If no lack of power occurred during the test drive, no further troubleshooting is required. Shut down the engine.
   [b] If lack of power occurred during the test drive, shut down the engine. Check the exhaust system; refer to section 12.8.

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12.8 FAULTY EXHAUST SYSTEM

To determine if a faulty exhaust system is causing lack of power, perform the following steps:

1. Drill an 11/32 in. hole in the exhaust pipe, 125-305 mm (5-12 in.) from the turbocharger exhaust outlet.

NOTE:
The tapped hole must be in a comparatively straight area of the turbocharger exhaust outlet.

2. Tap the hole to accommodate a 1/8 in. pipe plug.
3. Connect a manometer calibrated to read pressure in kPa or inches of Hg.

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.

4. Start and run the engine.
5. Run the engine at idle with a no-load condition for approximately five minutes, allowing the engine coolant to reach normal operating range, approximately 88-96°C (190-205°F).
6. Run the engine speed to full load.
   [a] If the exhaust back pressure at full load is less than 12 kPa (3.5 in. Hg), check for high inlet air temperature; refer to section 12.9.
   [b] If the exhaust back pressure at full load is 12 kPa (3.5 in. Hg) or greater, refer to section 12.8.1.

12.8.1 Engine Exhaust System Resolution

Perform the following steps to resolve the engine exhaust system concern:

1. Visually inspect the engine exhaust system; refer to OEM guidelines.
2. Repair or replace defective exhaust system components; refer to OEM guidelines.
3. Verify exhaust system resolution; refer to section 12.8.1.1.

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12.8.1.1 Test the Engine with Replaced Exhaust System

Perform the following steps to determine if replaced engine exhaust system components have resolved the lack of power 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 and run the engine.
2. Test drive the vehicle to ensure lack of power has been resolved.
   [a] If no lack of power occurred during the test drive, no further troubleshooting is required. Shut down the engine.
   [b] If lack of power occurred during the test drive, shut down the engine. Check for high inlet air temperature; refer to section 12.9.

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12.9 HIGH INLET AIR TEMPERATURE

To determine if high inlet air temperature is causing lack of power, test/check the radiator fan, fan drive, or fan shroud for proper operation or configuration. Refer to OEM guidelines.

1. If the radiator fan, fan drive, or fan shroud pass the OEM test, check camshaft timing; refer to section 12.10.
2. If the radiator fan, drive or shroud did not operate correctly, refer to section 12.9.1.

12.9.1 Radiator Fan, Drive and Shroud Replacement

Perform the following steps to replace the radiator fan, drive, and or shroud:

1. Remove and replace the radiator fan, drive, and/or shroud; refer to OEM guidelines.
2. Verify replacement; refer to section 12.9.1.1.

12.9.1.1

Perform the following steps to determine if replaced radiator fan, fan drive, or fan shroud resolved lack of power 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 and run the engine.
2. Test drive the vehicle to ensure lack of power has been resolved.
   [a] If no lack of power occurred during the test drive, no further troubleshooting is required. Shut down the engine.
   [b] If lack of power occurred during the test drive, shut down the engine. Check camshaft timing; refer to section 12.10.

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12.10 INCORRECT CAMSHAFT TIMING

To determine if incorrect camshaft timing is causing lack of power, check the camshaft timing; refer to MBE900 service manual, engine chapter.

1. If the dial indicator reading on the unit pump lobe is 13.8 mm (0.54 in.) or above, no further troubleshooting in required.
2. If the dial indicator reading is not above 13.8 mm (0.54 in.), check engine timing; refer to section 12.10.1.

12.10.1 Engine Timing Resolution

Perform the following steps to resolve incorrect engine timing:

1. Perform an engine gear train timing check; refer to MBE900 service manual, engine chapter.
2. Verify engine timing resolution; refer to section 12.10.1.1.

12.10.1.1 Test Engine with Correct Timing

Perform the following steps to determine if corrected engine timing has resolved lack of power 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 and run the engine.
2. Test drive the vehicle to ensure lack of power has been resolved.
   [a] If no lack of power occurred during the test drive, no further troubleshooting is required. Shut down the engine.
   [b] If lack of power occurred during the test drive, shut down the engine. Call Detroit Diesel Customer Support Center at 313-592-5800.

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13 HIGH ENGINE COOLANT TEMPERATURE MBE900

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13.1 IMPROPER ENGINE COOLANT LEVEL

To determine if improper engine coolant level is causing high engine coolant temperature, visually inspect the radiator coolant level; refer to OEM guidelines.

1. If the radiator coolant level is within approximately 50 mm (2.0 in.) of the radiator filler neck, check for insufficient radiator air circulation; refer to section 13.2.
2. If the radiator coolant level is not within approximately 50 mm (2.0 in.) of the radiator filler neck, refer to section 13.1.1.

13.1.1 Improper Coolant Level Resolution

Perform the following steps to resolve improper coolant level:

1. Fill coolant system to correct level, refer to MBE900 service manual, cooling system chapter.
2. Verify coolant level resolution; refer to section 13.1.1.1.

13.1.1.1 Test Engine with Proper Coolant Level

Perform the following to determine if proper coolant level resolved high engine coolant temperature:

⚠ 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. Run the engine through its operating range with no-load for approximately five minutes, allowing the engine coolant to reach normal operating range.
   [a] If the engine coolant temperature is 82-105°C (180-221°F), no further troubleshooting is required. Shut down the engine.
   [b] If the engine coolant temperature is not 82-105°C (180-221°F), shut down the engine. Check for insufficient radiator air circulation; refer to section 13.2.

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13.2 INSUFFICIENT RADIATOR AIR CIRCULATION

To determine if insufficient radiator air circulation is causing high engine coolant temperature, visually examine the radiator and radiator shrouding.

1. If the radiator is absent of clogging, debris, and dirt, check the pressure control cap; refer to section 13.3.
2. If the radiator has excessive clogging, debris, or dirt, refer to section 13.2.1.
3. If the radiator shrouding is not damaged, incorrectly positioned, or inadequate, check the pressure control cap; refer to section 13.3.
4. If the radiator shrouding is damaged, incorrectly positioned, or inadequate, refer to section 13.2.2.

13.2.1 Exterior Radiator Repair

Perform the following for exterior radiator repair:

1. Clean the exterior radiator of all clogging, debris, or excessive dirt; refer to OEM guidelines.
2. Verify exterior radiator repair; refer to section 13.2.2.1.

13.2.2 Radiator Shroud Repair

Perform the following for radiator shroud repair:

1. Repair or replace damaged radiator shrouding; refer to OEM guidelines.
2. Verify exterior radiator repair; refer to section 13.2.2.1.

13.2.2.1 Test Engine with Repaired Exterior Radiator and Shrouding

Perform the following to determine if exterior radiator and shrouding repair resolved high engine coolant temperature:

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. Run the engine through its operating range with no-load for approximately five minutes, allowing the engine coolant to reach normal operating range.

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[a] If the engine coolant temperature is 82-105°C (180-221°F), no further troubleshooting is required. Shut down the engine.

[b] If the engine coolant temperature is not 82-105°C (180-221°F), shut down the engine. Check the pressure control cap; refer to section 13.3.

13.3 FAULTY PRESSURE CONTROL CAP

To determine if a faulty pressure control cap is causing high engine coolant temperature, perform coolant pressure control cap tests.

1. If the cooling system pressure is less than or equal to 62 kPa (9 psi), check the coolant hoses; refer to section 13.4.
2. If the cooling system pressure is greater than 62 kPa (9 psi), refer to section 13.3.1.

13.3.1 Pressure Control Cap Resolution

Perform the following steps to resolve faulty pressure control cap:

1. Remove and replace pressure control cap; refer to OEM guidelines.
2. Install a new pressure control cap; refer to OEM guidelines.
3. Verify pressure control cap repair; refer to section 13.3.1.1.

13.3.1.1 Test Engine with Replaced Pressure Control Cap

Perform the following to determine if exterior radiator repair resolved high engine coolant temperature:

⚠ 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. Run the engine through its operating range with no-load for approximately five minutes, allowing the engine coolant to reach normal operating range.

   [a] If the engine coolant temperature is normal, no further troubleshooting is required. Shut down the engine.

   [b] If the engine coolant temperature is not normal, shut down the engine. Check coolant hoses; refer to section 13.4.

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13.4 DEFECTIVE COOLANT HOSES

To determine if defective coolant hoses are causing high engine coolant temperature, visually examine cooling system hoses; refer to OEM guidelines.

1. If cooling system hoses are not soft, deteriorated, collapsed, or have leaking connections, check the fan belts; refer to section 13.5.
2. If cooling system hoses are soft, deteriorated, collapsed, or have leaking connections, refer to section 13.4.1.

13.4.1 Coolant System Hoses Replacement

Perform the following steps to resolve worn or damaged coolant system hoses:

1. Remove and replace damaged or worn coolant hoses as necessary; refer to OEM guidelines.
2. Install new coolant hoses as necessary; refer to OEM guidelines.
3. Verify replaced coolant system hoses; refer to section 13.4.1.1.

13.4.1.1 Test Engine with Replaced Coolant Hoses

Perform the following to determine if the new coolant hoses resolved high engine coolant temperature:

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. Run the engine through its operating range with no-load for approximately five minutes, allowing the engine coolant to reach normal operating range, and visually examine replaced hoses for any leaks.
   [a] If the engine coolant temperature is 82-105°C (180-221°F) and no leaks are found, no further troubleshooting is required.
   [b] If the engine coolant temperature is 82-105°C (180-221°F) and leaks are found, repair the leaks; refer to section 13.4.1. Shut down the engine.
   [c] If the engine coolant temperature is not 82-105°C (180-221°F) and no leaks are found, shut down the engine. Check fan belt; refer to section 13.5.

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13.5 INCORRECTLY ADJUSTED FAN BELT

To determine is a misadjusted fan belt is causing high engine coolant temperature, perform the following steps:

1. Check the auto tensioner for spring loading.
2. Compare tension to belt specifications.
   [a] If the belt tension is normal, check the thermo-modulated fan; refer to section 13.6.
   [b] If the belt tension is not normal, refer to section 13.5.1.

13.5.1 Belt Tension Resolution

Perform the following steps to resolve incorrect belt tension:

1. Replace the auto tensioner as required.
2. Verify belt tension resolution; refer to section 13.5.1.1.

13.5.1.1 Test Engine with Correct Belt Tension

Perform the following to determine if belt tension resolved high engine coolant temperature:

⚠ 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. Run the engine through its operating range with no-load for approximately five minutes, allowing the engine coolant to reach normal operating range.
   [a] If the engine coolant temperature is 82-105°C (180-221°F), no further troubleshooting is required. Shut down the engine.
   [b] If the engine coolant temperature is not 82-105°C (180-221°F), shut down the engine. Check thermo-modulated fan; refer to section 13.6.

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13.6 INOPERATIVE THERMO-MODULATED FAN

To determine if an inoperative thermo-modulated fan is causing high engine coolant temperature, test the thermo-modulated fan. Refer to OEM guidelines.

1. If the thermo-modulated fan is functioning correctly, check thermostats; refer to section 13.7.
2. If the thermo-modulated fan is not functioning correctly, refer to section 13.6.1.

13.6.1 Thermo-Modulated Fan Replacement

Perform the following steps to replace inoperative thermo-modulated fan:

1. Replace inoperative thermo-modulated fan; refer to OEM guidelines.
2. Verify thermo-modulated fan replacement; refer to section 13.6.1.1.

13.6.1.1 Test Engine with Replaced Thermo-Modulated Fan

Perform the following steps to determine if thermo-modulated fan replacement resolved high engine coolant temperature:

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. Run the engine through its operating range with no-load for approximately five minutes, allowing the engine coolant to reach normal operating range.
   [a] If the engine coolant temperature is 82-105°C (180-221°F), no further troubleshooting is required. Shut down the engine.
   [b] If the engine coolant temperature is not 82-105°C (180-221°F), shut down the engine. Check thermostats; refer to section 13.7.

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13.7 FAULTY THERMOSTATS

To determine if faulty thermostats are causing high engine coolant temperature, perform the following:

1. Remove thermostat from the thermostat housing, refer to MBE900 service manual, cooling system chapter.
2. Inspect thermostat for correct operation, refer to MBE900 service manual, cooling system chapter.
   [a] If thermostat is fully open at 95°C (203°F), check coolant pump; refer to section 13.8.
   [b] If thermostat is not fully open at 95°C (203°F), refer to section 13.7.1.

13.7.1 Thermostat Replacement

Perform the following steps to replace thermostats:

1. Install new thermostat, refer to MBE900 service manual, cooling system chapter.
2. Verify replaced thermostat; refer to section 13.7.1.1.

13.7.1.1 Test Engine with New Thermostat

Perform the following steps to determine if thermostat replacement resolved high engine coolant temperature:

⚠ 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. Run the engine through its operating range with no-load for approximately five minutes, allowing the engine coolant to reach normal operating range.
   [a] If the engine coolant temperature is 82-105°C (180-221°F), no further troubleshooting is required. Shut down the engine.
   [b] If the engine coolant temperature is not 82-105°C (180-221°F), shut down the engine. Check coolant pump; refer to section 13.8.

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13.8 FAULTY COOLANT PUMP

To determine if a faulty coolant pump is causing high engine coolant temperature, perform the following:

1. Remove the coolant pump and inspect pump for failed shaft or rotor. For Non-EGR and EGR engines, refer to MBE900 service manual, cooling system chapter.
2. Replace coolant pump if damaged. For Non-EGR and EGR engines, refer to MBE900 service manual, cooling system chapter.

13.8.1 Test Engine with Replaced coolant pump

Perform the following steps to determine if thermo-modulated fan replacement resolved high engine coolant temperature:

⚠ 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. Run the engine through its operating range with no-load for approximately five minutes, allowing the engine coolant to reach normal operating range.
   [a] If the engine coolant temperature is 82-105°C (180-221°F), no further troubleshooting is required. Shut down the engine.
   [b] If the engine coolant temperature is not 82-105°C (180-221°F), shut down the engine. Check combustion gases in coolant; refer to section 13.9.

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13.9 COMBUSTION GASES IN COOLANT

To determine if combustion gases in coolant is causing high engine coolant temperature, perform a cylinder compression test; refer to MBE900 service manual, engine chapter-cylinder head.

1. If test results are to specifications; check radiator coolant flow; refer to section 13.10.
2. If test results are not to specifications, refer to section 13.9.1.

13.9.1 Cylinder Head Gasket Replacement

Perform the following steps to replace cylinder head gasket:

1. Remove and replace cylinder head gasket; refer to MBE900 service manual, engine chapter.
2. Verify new cylinder head gasket replacement; refer to section 13.9.1.1.

13.9.1.1 Test Engine with Replaced Cylinder Head Gasket

Perform the following to determine if cylinder head gasket replacement resolved high engine coolant temperature:

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. Run the engine through its operating range with no-load for approximately five minutes, allowing the engine coolant to reach normal operating range.
   [a] If the engine coolant temperature is 82-105°C (180-221°F), no further troubleshooting is required. Shut down the engine.
   [b] If the engine coolant temperature is not 82-105°C (180-221°F), shut down the engine. Check radiator coolant flow; refer to section 13.10.

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13.10 ABNORMAL RADIATOR COOLANT FLOW

To determine if abnormal radiator coolant flow is causing high engine coolant temperature, perform the following:

1. Install a sight glass with string (both ends) to the radiator outlet hose near radiator and before fill and heater return lines; see Figure 13-1.

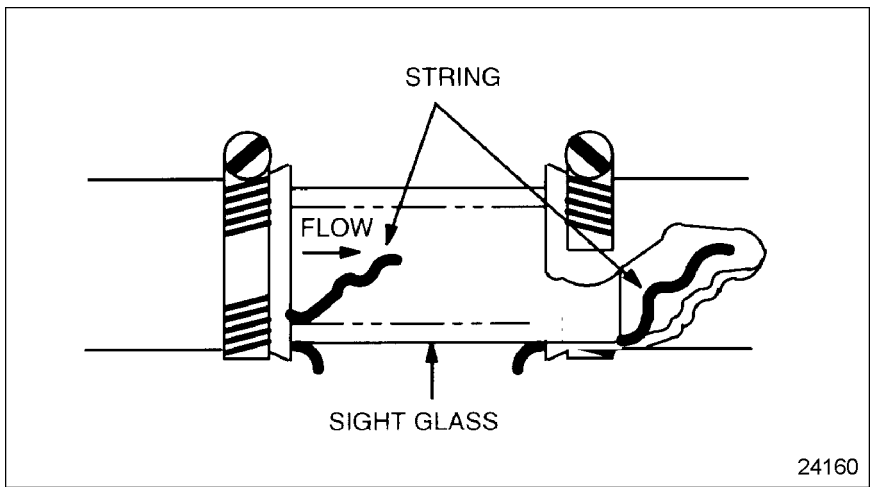

Figure 13-1 Radiator Flow Check

⚠ 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 at full load.
3. Observe the string for flow and direction as well as the fill and bleed lines. Continue observation while varying the engine speed between 1800-2400 rpm.
   [a] If a balanced coolant flow is observed in the sight glass, call Detroit Diesel Customer Support Center at 313-592-5800. Shut down the engine.
   [b] If a balanced coolant flow is not observed in the sight glass, refer to section 13.10.1. Shut down the engine.

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13.10.1 Abnormal Radiator Coolant Flow Resolution

Perform the following steps, as necessary, to resolve abnormal radiator coolant flow:

1. Correct bleed line size; refer to OEM guidelines.
2. Correct fill line size or connector fitting size; refer to OEM guidelines.
3. Correct restrictive top tank opening; refer to OEM guidelines.
4. Correct location of standpipe; refer to OEM guidelines.
5. Verify repairs made to correct abnormal radiator coolant flow; refer to section 13.10.1.1.

13.10.1.1 Test Engine with Resolved Radiator Coolant Flow

Perform the following to determine if abnormal radiator coolant flow repair resolved high engine coolant temperature:

⚠ 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. Run the engine through its operating range with no-load for approximately five minutes, allowing the engine coolant to reach normal operating range.
   [a] If the engine coolant temperature is 82-105°C (180-221°F), no further troubleshooting is required. Shut down the engine.
   [b] If the engine coolant temperature is not 82-105°C (180-221°F), shut down the engine. Call the Detroit Diesel Customer Support Center at 313-592-5800.

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14 LOW OIL PRESSURE MBE900

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14.1 IMPROPER ENGINE OIL LEVEL

To determine if improper engine oil level is causing low oil pressure, check the engine oil level listed in Table 14-1.

1. If the engine oil level is correct, check lubricating oil viscosity; refer to section 14.2.
2. If the engine oil level is incorrect, refer to section 14.1.1.

Description	4–Cylinder Engines	6–Cylinder Engines
Oil Fill Capacity*	15.8 L (16.7 qt.)	29.0 L (30.6 qt.)

* In standard pan, including oil filter.

Table 14-1 Lubricating Oil Capacity

14.1.1 Low Engine Oil Level Resolution

Perform the following steps for low engine oil level:

1. Fill engine oil pan to correct level listed in Table 14-1.
2. Verify low engine oil resolution; refer to section 14.1.1.1.

14.1.1.1 Test for Proper Engine Oil Level

Perform the following steps to determine if properly filled oil pan has resolved low oil 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 vary engine speed between 1800-2100 rpm.
2. Measure engine oil pressure.
   [a] If the oil pressure is 241 kPa (35 psi) or more, no further troubleshooting is required. Shut down the engine.
   [b] If the oil pressure at rated speed is less than 241 kPa (35 psi), shut down the engine. Check lubricating oil viscosity; refer to section 14.2.

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14.2 IMPROPER LUBRICATING OIL VISCOSITY

To determine if improper lubricating oil viscosity is causing low oil pressure, perform the following steps:

1. Acquire a lubricating oil sample from the engine oil pan.
2. Submit oil sample for an ASTM test analysis.
   [a] If engine oil sample meets ASTM specifications, check to determine if lubricating oil is diluted with fuel or coolant; refer to section 14.3.
   [b] If engine oil sample did not meet ASTM specifications, refer to section 14.2.1 and DDC publication *Lubricating Oil, Fuel, and Filters* (7SE270).

14.2.1 Lubricating Oil Replacement

Perform the following steps to replace engine oil:

1. Drain and refill engine with new lubricating oil. Engine oil capacities are listed in Table 14-1.
2. Verify lubricating oil replacement; refer to section 14.2.1.1.

14.2.1.1 Test Engine with Replaced Lubricating Oil

Perform the following steps to determine if replaced lubricating oil resolved low oil 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 engine at rated speed.
2. Measure engine oil pressure.
   [a] If the oil pressure is 241 kPa (35 psi) or more, no further troubleshooting is required. Shut down the engine.
   [b] If the oil pressure at rated speed is less than 241 kPa (35 psi), shut down the engine. Check the lubricating oil for fuel and engine coolant dilution; refer to section 14.3.

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14.3 LUBRICATING OIL DILUTED WITH FUEL OR ENGINE COOLANT

To determine if lubricating oil diluted with fuel or engine coolant is causing low oil pressure, perform the following steps:

1. Acquire a lubricating oil sample from the engine oil pan.
2. Visually examine lubricating oil sample for presence of engine coolant or fuel.
   [a] If coolant or fuel are not present, check for a faulty oil pressure gauge; refer to section 14.4.
   [b] If coolant or fuel are present, refer to section 14.3.1.

14.3.1 Contaminated Lubricating Oil Resolution

Perform the following steps to resolve contaminated lubricating oil:

1. If coolant is present, consider head gasket replacement and repair as required.
2. If fuel is present, consider fuel nozzle replacement and repair as required.
3. Drain engine oil pan.
4. Refill engine crankcase with new oil.
5. Verify lubricating oil replacement; refer to section 14.3.1.1.

14.3.1.1 Test Replaced Lubricating Oil

To determine if replaced lubricating oil resolved low oil pressure, 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 at rated speed, if the oil pressure is 241 kPa (35 psi) or more, no further troubleshooting is required.
2. If the oil pressure at rated speed is less than 241 kPa (35 psi), shut down the engine. Check for faulty oil pressure gauge sensor; refer to section 14.4.

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14.4 FAULTY OIL PRESSURE GAUGE SENSOR

To determine if a faulty oil pressure gauge sensor is causing low oil pressure, perform the following steps:

1. Install the Diagnostic Data Reader (DDR).

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 vary the engine speed between 1800 - 2100 rpm.
3. Visually examine the DDR for oil pressure reading.
   [a] If the oil pressure is greater than or equal to 241 kPa (35 psi) at rated speed, shut down the engine. No further troubleshooting is required.
   [b] If the oil pressure is less than 241 kPa (35 psi) at rated speed, shut down the engine; refer to section 14.4.1.

14.4.1 Oil Pressure Gauge Sensor Replacement

Perform the following steps to replace the oil pressure gauge sensor:

1. Remove and replace the oil pressure gauge sensor; refer to OEM guidelines.
2. Verify oil pressure gauge sensor replacement; refer to section 14.4.1.1

14.4.1.1 Test Replaced Oil Pressure Gauge Sensor

To determine if replaced oil pressure gauge sensor resolved the low oil pressure concern, 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 at rated speed, if the oil pressure is 241 kPa (35 psi) or more, no further troubleshooting is required.
2. If the oil pressure at rated speed is less than is 241 kPa (35 psi), shut down the engine. Check for an obstructed oil pressure gauge line; refer to section 14.5.

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14.5 OIL PRESSURE GAUGE LINE OBSTRUCTED

To determine if an oil pressure gauge line obstruction is causing low oil pressure, perform the following steps:

1. Disconnect oil gauge line from oil pressure gauge; refer to OEM guidelines.
2. Visually inspect oil gauge line for obstructions.
   [a] If no obstructions are found, check to determine if rocker arm shaft plugs are missing (new or rebuilt engines only).
   [b] If obstructions are found, refer to section 14.5.1.

14.5.1 Obstructed Oil Pressure Gauge Line Repair

Perform the following steps to resolve oil pressure gauge line obstructions:

1. Remove oil pressure gauge line; refer to OEM guidelines.
2. Clean oil gauge line by soaking in cleaning solution for five minutes.
3. Blow out residue contamination in oil gauge line with compressed air.
4. Install cleaned oil gauge line; refer to OEM guidelines.
5. Verify oil gauge line repair; refer to section 14.5.1.1.

14.5.1.1 Test the Engine with Repaired Oil Gauge Line

To determine if repaired oil pressure gauge line resolved low oil pressure, 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. Start and run the engine at rated speed. If the oil pressure at rated speed is 241 kPa (35 psi) or more, no further troubleshooting in required. Shut down the engine.
2. If the oil pressure at rated speed is less than 241 kPa (35 psi), shut down the engine. Check for restricted heat exchanger; refer to section 14.6.

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14.6 RESTRICTED HEAT EXCHANGER

To determine if a restricted heat exchanger is causing low oil pressure, 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. Start and run the engine at rated speed.
2. Run the engine at rated speed with a no-load condition for approximately five minutes, allowing the engine coolant to reach normal operating range 88-96°C (190-205°F).
   [a] If the oil temperature sensor is indicating a lubricating oil temperature less than or equal to 110°C (230°F), shut down the engine and check for a defective oil filter bypass valve; refer to section 14.7.
   [b] If the oil temperature sensor is indicating a lubricating oil temperature greater than 110°C (230°F), shut down the engine and repair heat exchanger; refer to section 14.6.1.

14.6.1 Heat Exchanger Inspection

Perform the following steps to repair the heat exchanger:

1. Remove the heat exchanger; refer to MBE900 service manual, lubrication system chapter.
2. Clean the heat exchanger before sludge hardens. Flush oil passages with clean, hot water.
3. Inspect the heat exchanger for damage and replace if necessary.
4. Install heat exchanger; refer to MBE900 service manual, lubrication system chapter.
5. Verify repair of heat exchanger; refer to section 14.6.1.1.

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14.6.1.1 Test Engine with Replaced Heat Exchanger

Perform the following steps to determine if replaced heat exchanger resolved low oil 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 at rated speed.
2. Run the engine through its operating range with no-load condition for approximately five minutes, allowing the engine coolant to reach normal operating range, 88-96°C (190-205°F).
   [a] If the DDR indicates 241 kPa (35 psi) or more at rated speed, shut down the engine and disconnect the DDR. No further troubleshooting is required.
   [b] If the DDR indicates less than 241 kPa (35 psi) at rated speed, shut down the engine and disconnect the DDR. Check for defective oil filter bypass valve; refer to section 14.7.

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14.7 DEFECTIVE OIL FILTER BYPASS VALVE

To determine if a defective oil filter bypass valve is causing low oil pressure, perform the following steps:

1. Remove the oil filter cover and element, refer to MBE900 service manual, lubrication system chapter.
2. Inspect the oil filter bypass valve components.
   [a] If no damage is found with the oil filter housing bypass valve components, check for defective pressure relief valve; refer to section 14.8.
   [b] If damage is found with the oil filter housing bypass valve bore, replace housing, refer to MBE900 service manual, lubrication system chapter.

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14.8 DEFECTIVE OIL PUMP PRESSURE RELIEF VALVE

To determine if a defective oil pump pressure relief valve is causing low oil pressure, perform the following steps:

1. Remove the oil pump pressure relief valve.
2. Inspect the oil pump pressure relief valve.
   [a] If the relief valve moves freely in the valve body, reinstall the oil pressure relief valve. Check the suction pipe for defects.
   [b] If the relief valve will not move freely in the valve body, refer to section 14.8.1.

14.8.1 Oil Pump Pressure Relief Valve Repair

Perform the following steps to repair the oil pump pressure relief valve:

1. Disassemble the pressure relief valve and replace damaged components.
2. Assemble and install the pressure relief valve.
3. Verify repair of the pressure relief valve; refer to section 14.8.1.1.

14.8.1.1 Test Engine with Repaired Oil Pump Pressure Relief Valve

Perform the following steps to determine if repaired oil pump pressure relief valve resolved low oil pressure:

1. Install the DDR.

⚠ 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 engine speed at rated speed.
3. Visually examine the DDR for oil pressure reading.
   [a] If the DDR indicates 241 kPa (35 psi) or more at rated speed, shut down the engine and disconnect the DDR. No further troubleshooting is required.
   [b] If the DDR indicates less than 241 kPa (35 psi) at rated speed, shut down the engine and disconnect the DDR. Check for defective suction pipe; refer to section 14.9.

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14.9 DEFECTIVE SUCTION PIPE

To determine if a defective suction pipe is causing low oil pressure, perform the following steps:

1. Remove suction pipe, refer to MBE900 service manual, lubrication system chapter-oil pump.
2. Visually inspect suction pipe.
   [a] If no stress cracks, twisting, or cracked flange are found, check for defective crankshaft main bearing shells; refer to section 14.10.
   [b] If stress cracks, twisting, or cracked flange are found, refer to section 14.9.1.

14.9.1 Suction Pipe Replacement

Perform the following steps to replace the suction pipe:

1. Replace all damaged components identified during inspection and install, refer to MBE900 service manual, lubrication system chapter-oil pump.
2. Verify replacement of suction pipe; refer to section 14.9.1.1.

14.9.1.1 Test Engine with Replaced Suction Pipe

Perform the following steps to determine if a replaced suction pipe resolved low oil 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 speed at rated speed.
2. Visually examine oil pressure reading.
   [a] If the oil pressure at rated speed is 241 kPa (35 psi) or more, no further troubleshooting is required.
   [b] If the oil pressure at rated speed is less than 241 kPa (35 psi), check for defective crankshaft main bearing shells; refer to section 14.10.

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14.10 DEFECTIVE CRANKSHAFT MAIN BEARING SHELLS

To determine if defective crankshaft main bearing shells are causing low oil pressure, check main bearing to crankshaft journal clearances.

1. If main bearing shell-to-journal clearance is within 0.051-0.127 mm (0.002-0.005 in.), check for defective oil pump assembly; refer to section 14.11.
2. If main bearing shell-to-journal clearance is not within 0.051-0.127 mm (0.002-0.005 in.), refer to section14.10.1.

14.10.1 Crankshaft Main Bearing Shell Repair

Perform the following steps to repair crankshaft main bearing shells:

1. Remove and replace defective crankshaft main bearing shells.
2. Verify crankshaft main bearing shells repair; refer to section 14.10.1.1.

14.10.1.1 Test Engine with New Crankshaft Main Bearing Shells

Perform the following steps to determine if new crankshaft main bearing shells have resolved low oil 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 engine at rated speed.
2. Visually examine the oil pressure reading.
   [a] If the oil pressure at rated speed is 241 kPa (35 psi) or more, no further troubleshooting is required. Shut down the engine.
   [b] If the oil pressure at rated speed is less than 241 kPa (35 psi), shut down the engine. Check the oil pump assembly; refer to section 14.11.

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14.11 DEFECTIVE OIL PUMP ASSEMBLY

To determine if a defective oil pump is causing low oil pressure, perform the following steps:

1. Remove the oil pump assembly; refer to MBE900 service manual, lubrication system chapter.
2. Manually rotate the oil pump drive gear.
   [a] If the drive gear rotates freely in the pump housing, call Detroit Diesel Customer Support Center at 313-592-5800.
   [b] If the drive gear does not rotate freely, replace the oil pump assembly and verify repair; refer to section 14.11.1.

14.11.1 Test Engine with Replaced Oil Pump Assembly

Perform the following steps to determine if oil pump replacement resolved low oil 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 speed at rated speed.
2. Visually examine the oil pressure reading.
   [a] If the oil pressure at rated speed is 241 kPa (35 psi) or more, no further troubleshooting is required. Shut down the engine.
   [b] If the oil pressure at rated speed is less than 241 kPa (35 psi), shut down the engine and call Detroit Diesel Customer Support Center at 313-592-5800.

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15 LOW COOLANT TEMPERATURE MBE900

Section **Page**

15.1 FAULTY THERMOSTATS 15-3
15.2 INSUFFICIENT RADIATOR AIR CIRCULATION 15-4

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15.1 FAULTY THERMOSTATS

To determine if faulty thermostats are causing low engine coolant temperature, perform the following steps:

1. Remove thermostat from the thermostat housing; refer to MBE900 service manual, cooling system chapter.
2. Inspect thermostat for correct operation; refer to MBE900 service manual, cooling system chapter.
   [a] If the thermostat is fully open at 95°C (203°F), check insufficient radiator air circulation; refer to section 15.2.
   [b] If the thermostat is not fully open at 95°C (203°F), refer to section 15.1.1.

15.1.1 Thermostat Replacement

Perform the following steps to replace thermostats:

1. Install new thermostat; refer to MBE900 service manual, cooling system chapter.
2. Verify replaced thermostat; refer to section 15.1.1.1.

15.1.1.1 Test Engine with New Thermostat

Perform the following steps to determine if thermostat replacement resolved low engine coolant temperature:

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. Run the engine through its operating range with no-load for approximately five minutes, allowing the engine coolant to reach normal operating range.
   [a] If the engine coolant temperature is 82-105°C (180-221°F), no further troubleshooting is required. Shut down the engine.
   [b] If the engine coolant temperature is not 82-105°C (180-221°F), shut down the engine. Check insufficient radiator air circulation; refer to section 15.2.

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15.2 INSUFFICIENT RADIATOR AIR CIRCULATION

To determine if insufficient radiator air circulation is causing low engine coolant temperature, visually examine the radiator and radiator shrouding.

1. If the radiator has excessive clogging, debris, or dirt, refer to section 15.2.1.
2. If the radiator shrouding is not damaged, incorrectly positioned, or inadequate, and if the radiator is absent of clogging, debris, and dirt, then call Detroit Diesel Customer Support Center at 313-592-5800.
3. If the radiator shrouding is damaged, incorrectly positioned, or inadequate, refer to section 15.2.2.

15.2.1 Exterior Radiator Repair

Perform the following steps for exterior radiator repair:

1. Clean the exterior radiator of all clogging, debris, or excessive dirt; refer to OEM guidelines.
2. Verify exterior radiator repair; refer to section 15.2.2.1.

15.2.2 Radiator Shroud Repair

Perform the following steps for radiator shroud repair:

1. Repair or replace damaged radiator shrouding; refer to OEM guidelines.
2. Verify exterior radiator repair; refer to section 15.2.2.1.

15.2.2.1 Test Engine with Repaired Exterior Radiator and Shrouding

Perform the following steps to determine if exterior radiator or shrouding repair resolved the low engine coolant temperature:

⚠ 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. Run the engine through its operating range with no-load condition for approximately five minutes, allowing the engine coolant to reach normal operating range.
   [a] If the engine coolant temperature is 82-105°C (180-221°F), no further troubleshooting is required. Shut down the engine.

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[b] If the engine coolant temperature is not 82-105°C (180-221°F), shut down the engine. Call Detroit Diesel Customer Support Center at 313-592-5800.

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16 POOR FUEL ECONOMY MBE900

Section **Page**

16.1 POOR FUEL ECONOMY 16-3

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16.1 POOR FUEL ECONOMY

Customer expectations of fuel economy are usually based on past experiences, recommendations from colleagues or sales staff, and wishful thinking. It is paramount that the end user attain reasonable expectations, based on sound predictions. Fuel economy management can be accomplished with the aid of Detroit Diesel's Spec Manager® computer program. The program takes into consideration a number of factors such as vehicle design, duty cycle, and route profile as it predicts real world fuel economy. Contact the local Detroit Diesel distributor for Spec Manager support, prior to contacting the factory. Make sure that there is sound basis for the poor fuel economy complaint. These precautions applies to both new and in-service vehicles.

There are many variables which may affect fuel economy. Included are:

- □ Vehicle Frontal Area
- □ Vehicle Weight
- □ Rolling Resistance (Static and rolling)
- □ Air Resistance (Excessive add-ons increase air resistance; trailer gap too large)
- □ Engine Speed
- □ Tire Size (Revs/mile)
- □ Axle Ratio
- □ Transmission Gear Ratios
- □ Road Surface (Cement, blacktop, gravel)
- □ Duty Schedule (Highway, stop-and-go, excessive idling)
- □ Vehicle Maintenance (Plugged air filter, low tire pressure, poor wheel alignment, brakes dragging)
- □ Vehicle Cruise Speed
- □ Driver Habits
- □ Weather Conditions

NOTE:
If any of these variables is not optimized, a serious penalty in fuel economy will result. Many of these items are out of the operator's control. However, there are factors that can be controlled and have a major impact on fuel economy.

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16.1.1 Guidelines for Vehicle Cruise Speed

One of the most common factors that reduces fuel economy is vehicle cruise speed.

Maintain as slow a cruising speed as possible. Listed in Table 16-1 are the approximate percentages of fuel economy reduction based on vehicle cruising speed.

Vehicle Cruise Speed (mph)	Approximate Reduction in Fuel Economy (%)
50–51	2
51–52	3
52–53	4
53–54	5
54–55	10
55–65	10
75	20

Table 16-1 Fuel Economy Reduction based on Cruising Speed

16.1.2 Guidelines for Excessive Engine Idling

Another factor to consider is excessive engine idling. Aside from the fact that the operator is getting 0 mpg during idling, combustion is less than ideal. Poor combustion can compromise the efficiency of the turbocharger. Regarding the notion that idling maintains cab heat in the winter, some tests have shown that during the first hour after full load operation, the engine actually cools down at a faster rate when idling than when turned off. Therefore, to increase fuel economy minimize engine idling.

16.1.3 Guidelines for Fuel Economy in Cold Weather

It is not uncommon to experience a loss in fuel economy during the winter. Cold ambient conditions bring on more engine idling and increased resistance in moving parts such as engine, transmission, and axle, due to fluid viscosity increase. There is also the issue of winter-blended fuel. Blended fuel typically does not contain as much energy as summer fuel. Therefore, it takes more fuel to move the equipment. Tests have shown that there can be as much as a 7% penalty in fuel economy due to blended fuels. Therefore, to save on fuel economy, comparisons must be made for the same yearly time frame.

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17 DDEC VI SYSTEM

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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.

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17.2 MOTOR CONTROL MODULE

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

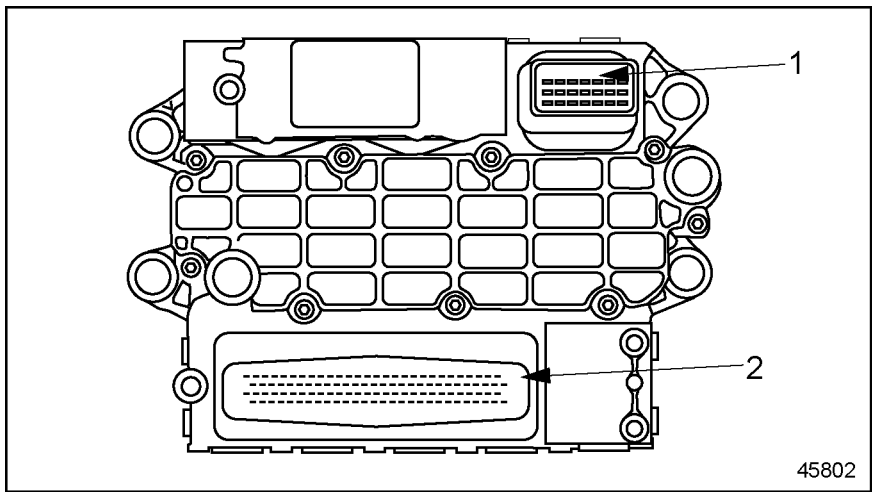

Figure 17-1 Motor Control Module

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17.2.1 MBE 900 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 900 engine are listed in Table 17-1, Table 17-2, Table 17-3, and Table 17-4.

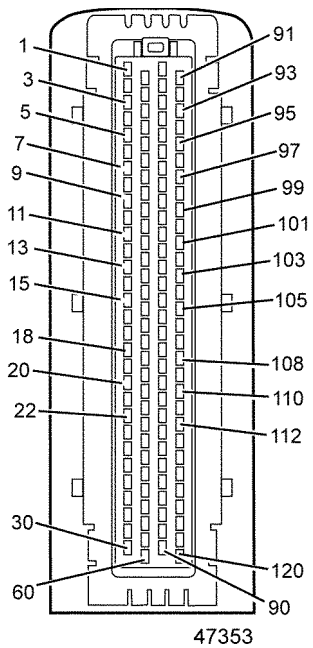
Pin	Function	Connector
1	NC	
2	NC	
3	NC	
4	Electronic Unit Pump (cyl 4) – pin 2	
5	Electronic Unit Pump Common (cyl 4) – pin 1	
6	Electronic Unit Pump (cyl 6) – pin 2	
7	Electronic Unit Pump Common (cyl 6)1 – pin 1	
8	Electronic Unit Pump (cyl 5) – pin 2	
9	Electronic Unit Pump Common (cyl 5) – pin 1	
10	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 900 (1 of 4) – C Sample

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Pin	Function	Connector
31	NC	
32	Constant Throttle Valve	
33	Two-speed Fan or Variable Speed Fan	
34	NC	
35	NC	
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	Water-in-Fuel Sensor	
58	Sensor Power Supply	
59	NC	
60	EGR Throttle Position	

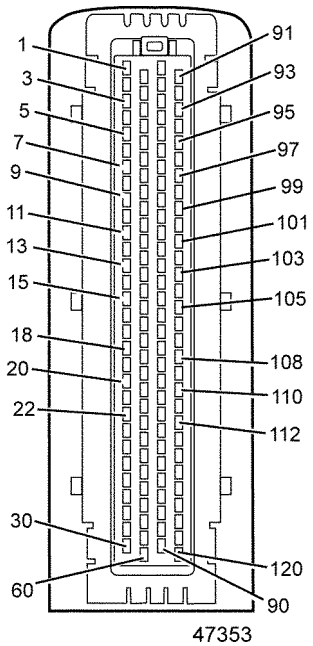

Table 17-2 MCM Connector – MBE 900 (2 of 4) – C Sample

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Pin	Function	Connector
61	EGR Valve	
62	Power Supply	
63	NC	
64	Power Supply	
65	Doser	
66	NC	
67	Ground	
68	NC	
69	Fuel Cutoff Valve	
70	NC	
71	NC	
72	NC	
73	CKP (-)	
74	Wastegate CAN (-)	
75	Wastegate CAN (+)	
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 Pressure/Temperature Sensor	
87	Intake Manifold Pressure Sensor	
88	Sensor Ground	
89	DOC Inlet Temp Sensor	
90	Intake Air Throttle Position	

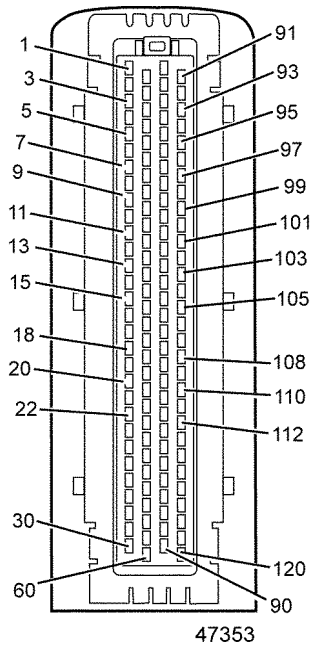

Table 17-3 MCM Connector – MBE 900 (3 of 4) – C Sample

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

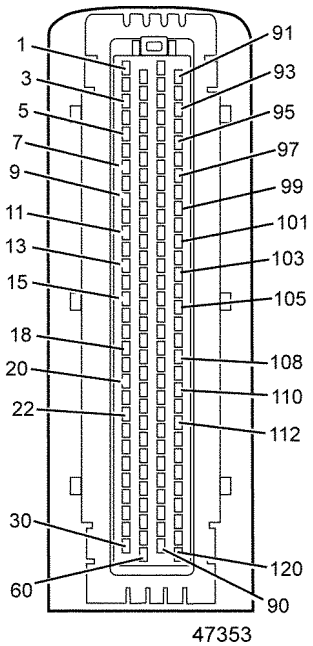

Table 17-4 MCM Connector – MBE 900 (4 of 4) – C Sample

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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).

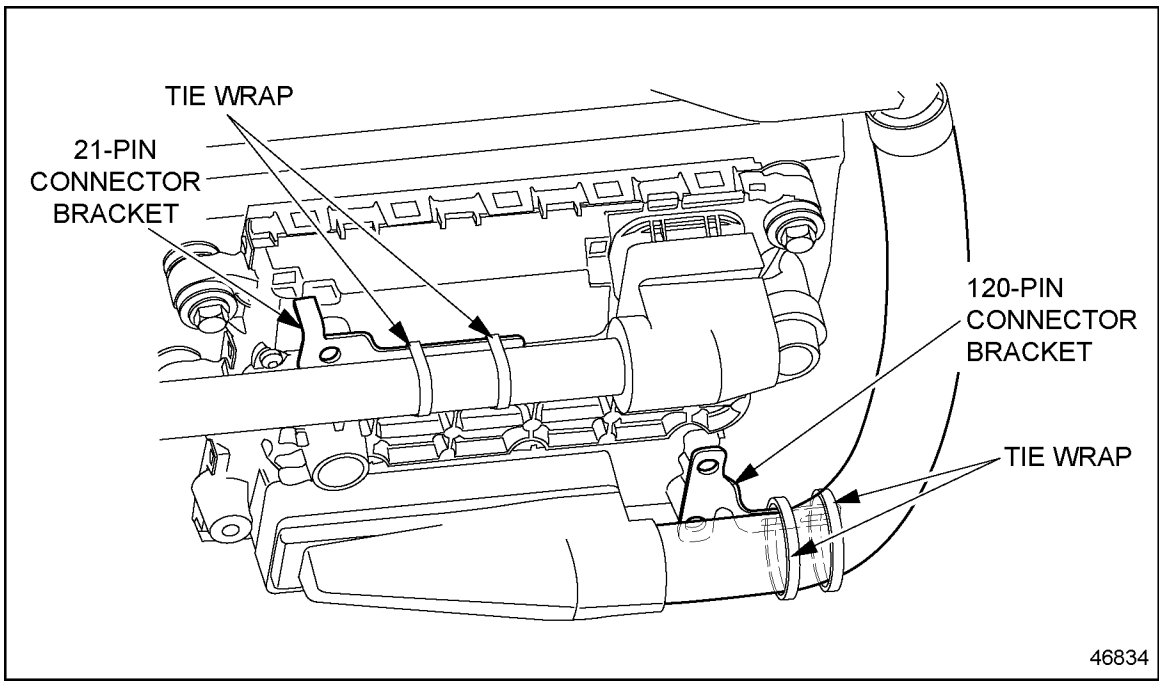
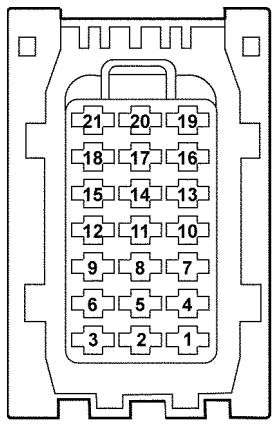


Figure 17-2 MBE 900 120–pin Connector and 21–pin Connector Tie-wrapped to Brackets

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	
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		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	



Front
Looking into the Pins on the Harness

Table 17-5 21–Pin Connector to the MCM

Part	Tyco/Amp Part Number
Connector	1–1534127–1
Terminal (strip form)	1–968855–1
Terminal (single)	1–968875–1
Seal	828904–2
Backshell	9–1394050–1

Table 17-6 21–Pin Connector to the MCM Part Numbers

The pinout for the 31–pin pigtail on the Engine Harness is listed in Table 17-7. The OEM is responsible for wiring to this connector.

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Pin	Function	Series 60	MBE900	MBE 4000	HDE
31/1	Power Supply #1 — EGR Actuator*	—	—	X	X
31/2	Power Supply #2 — VNT*	—	—	—	X
31/3	Fuel Heater Supply #1†	—	X	-	X
31/4	AC Compressor Supply (FL)	X	X	X	X
31/5	Full Heater Supply #2†	—	X	—	X
31/6	Power Supply #1 Ground*	—	—	X	X
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)	X	X	X	X
31/13	Alternator Remote Sense (FL)	X	X	X	X
31/14	Spare	—	—	—	—
31/15	Spare	—	—	—	—
31/16	Engine Brake Solenoid Control	—	X	—	—
31/17	DPF – Sensor Temperature Exhaust Gas in Front of Particulate Filter	X	X	X	X
31/18	DPF – Sensor Temperature Diesel Oxidation Catalyst Inlet Temperature	X	X	X	X
31/19	DPF – Sensor Temperature Exhaust Gas After Particulate Filter	X	X	X	X
31/20	Full Heater Ground #2†	—	X	—	X
31/21	Alternator Charge Indicator Lamp (FL)	X	X	X	X
31/22	Power Supply	X	X	X	X
31/23	Fan Speed	X	X	X	X
31/24	Sensor Ground (3V)	X	X	X	X
31/25	Spare	—	—	—	—
31/26	Spare	—	—	—	—
31/27	TCI Temp	X	—	—	—
31/28	Sensor Ground (5V)	X	X	X	X
31/29	Sensor Supply (2V)	X	X	X	X
31/30	DPF – Sensor Temperature Exhaust Gas After Particulate Filter	X	X	X	X
31/31	DPF – Sensor Temperature Exhaust Gas 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 17-7 31–pin MCM Pigtail Connector

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The part numbers for the 31–pin MCM pigtail connector are listed in Table 17-8.

Part	Tyco/Amp Part Number
Connector	967363–1
Terminal	1–929974–4
Seals (GXL insulation)	828921–1
Cavity Plugs	828922–1
Backshell	965636–1

Table 17-8 31–pin MCM Pigtail Connector Part Numbers

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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 17-3.

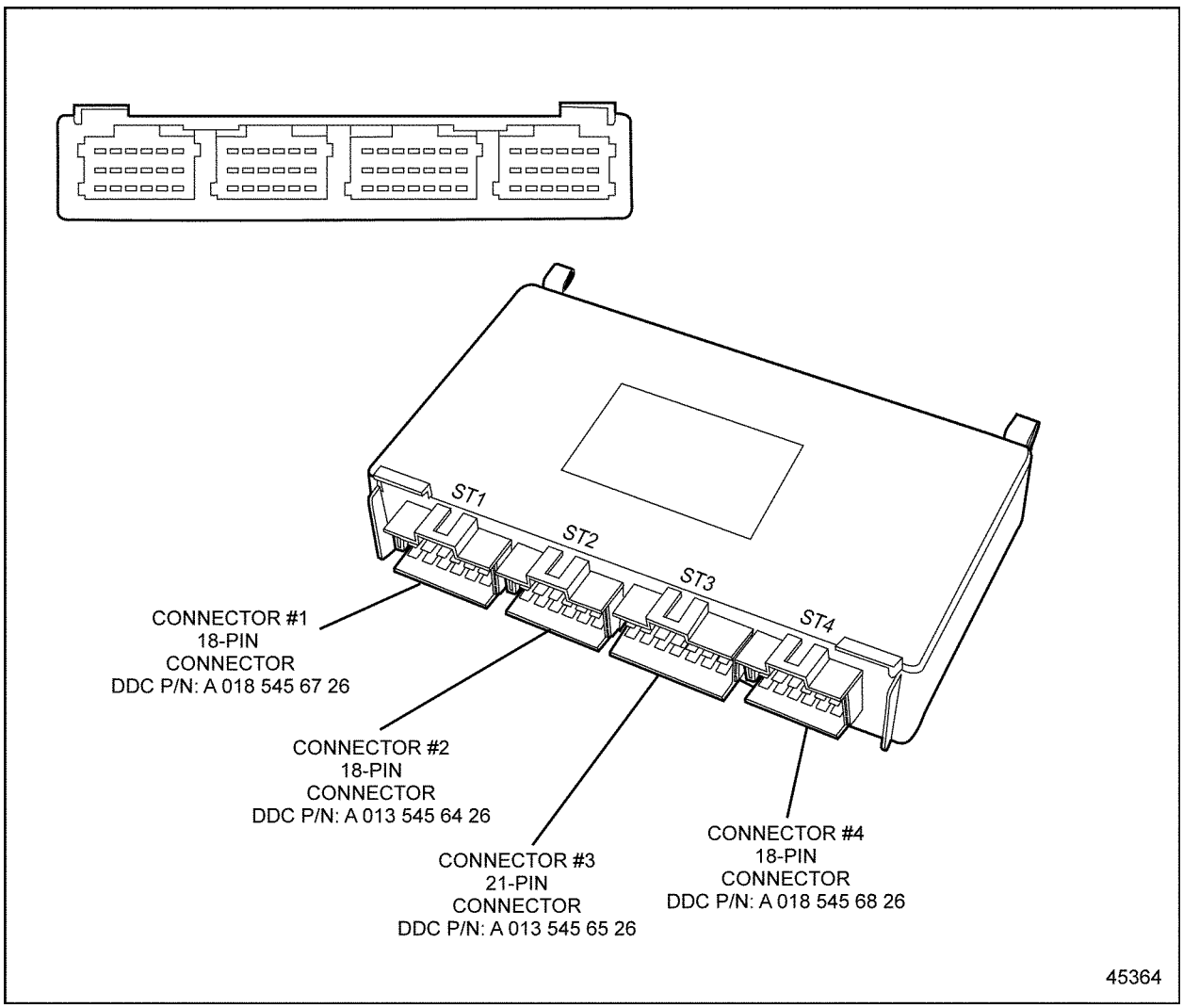

Figure 17-3 The Common Powertrain Controller

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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 17-4 for the CPC dimensions.

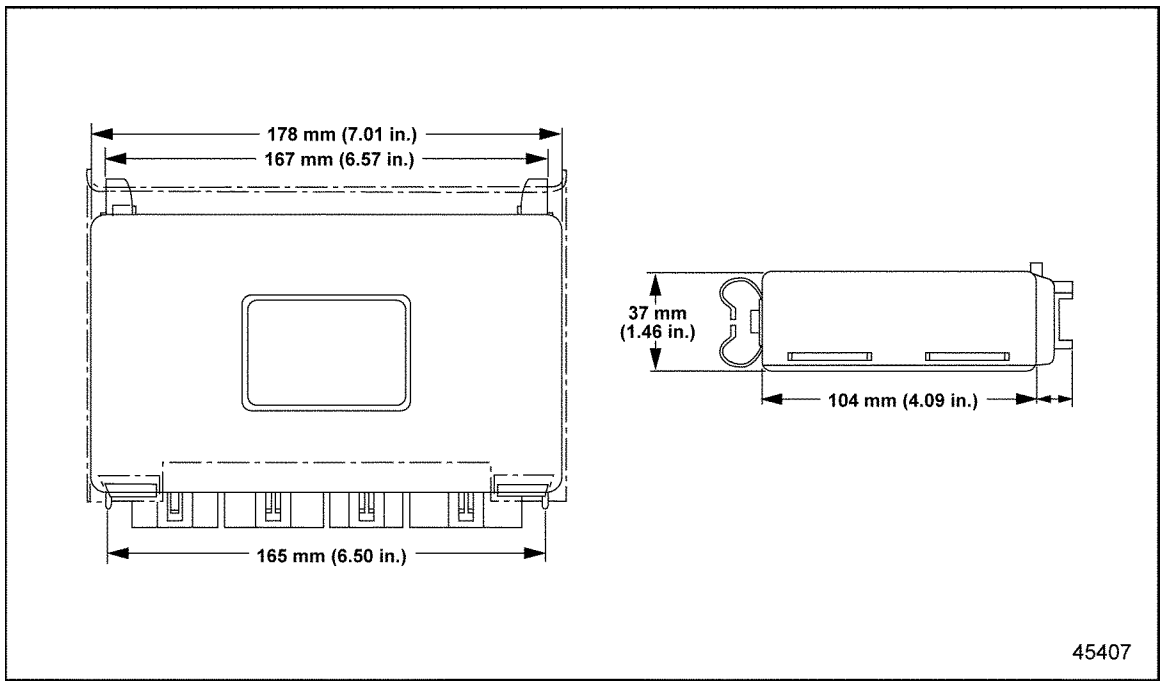

Figure 17-4 CPC Dimensions

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

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The CPC communicates over the J1587 and J1939 Data Links to the vehicle (see Figure 17-5).

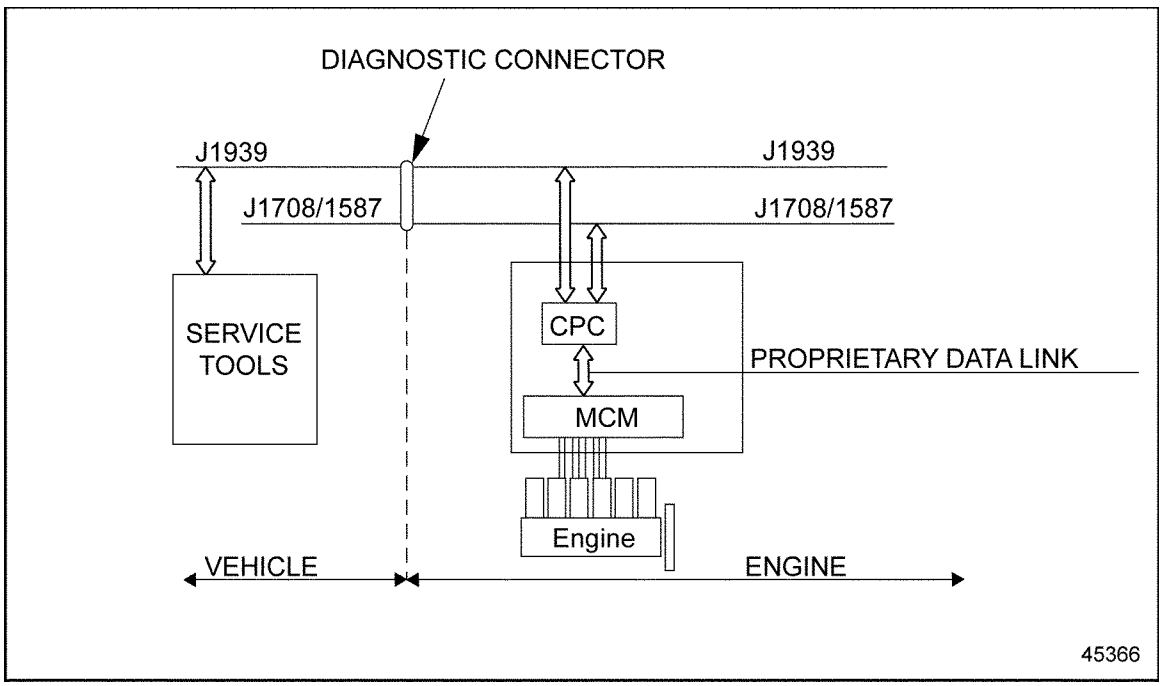

Figure 17-5 NAFTA Architecture On-highway

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 17-6).

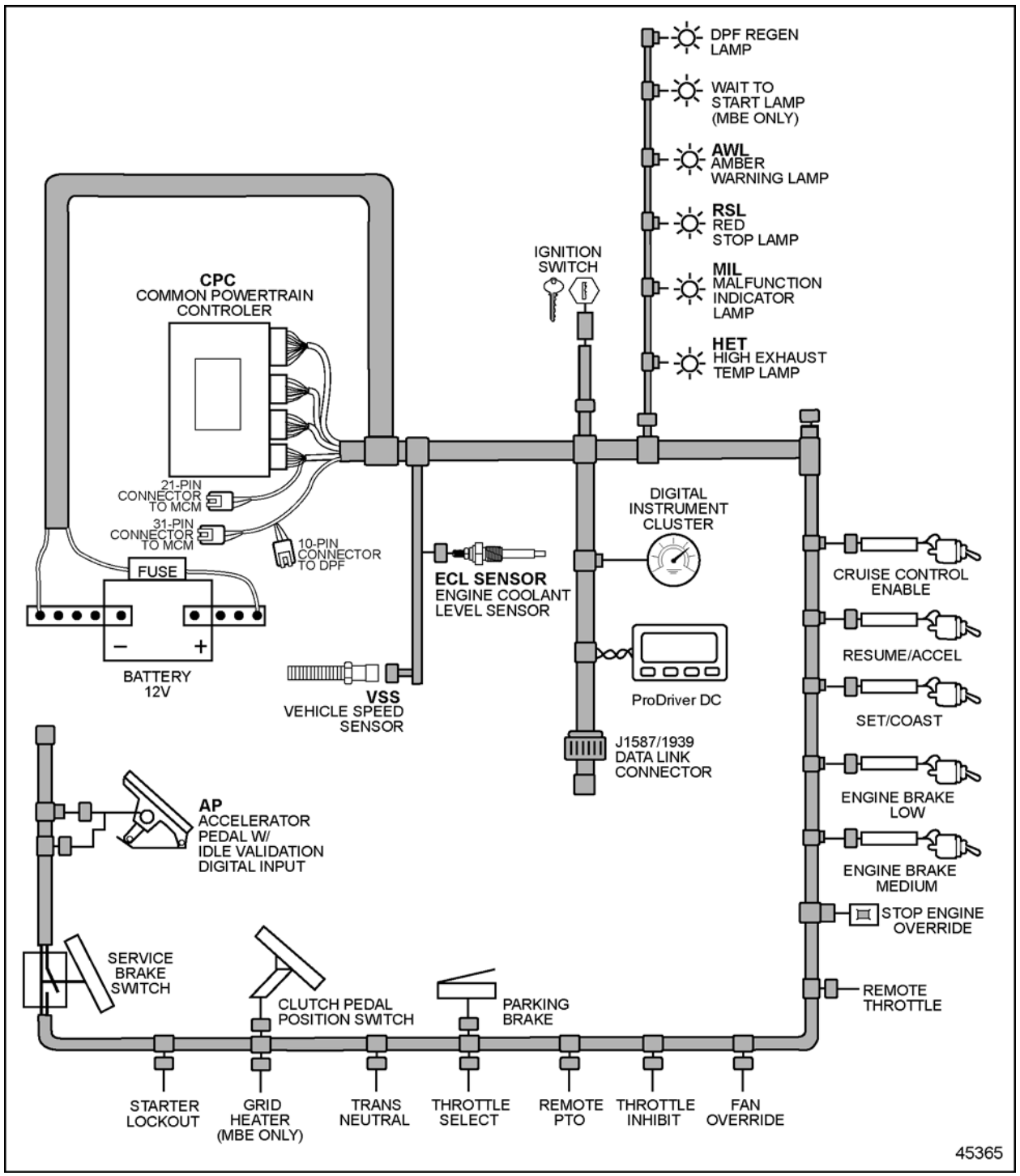

Figure 17-6 Vehicle Interface Harness

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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.)

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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	300 µA
	Ignition On and Engine Stopped	175 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.

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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 17-7.

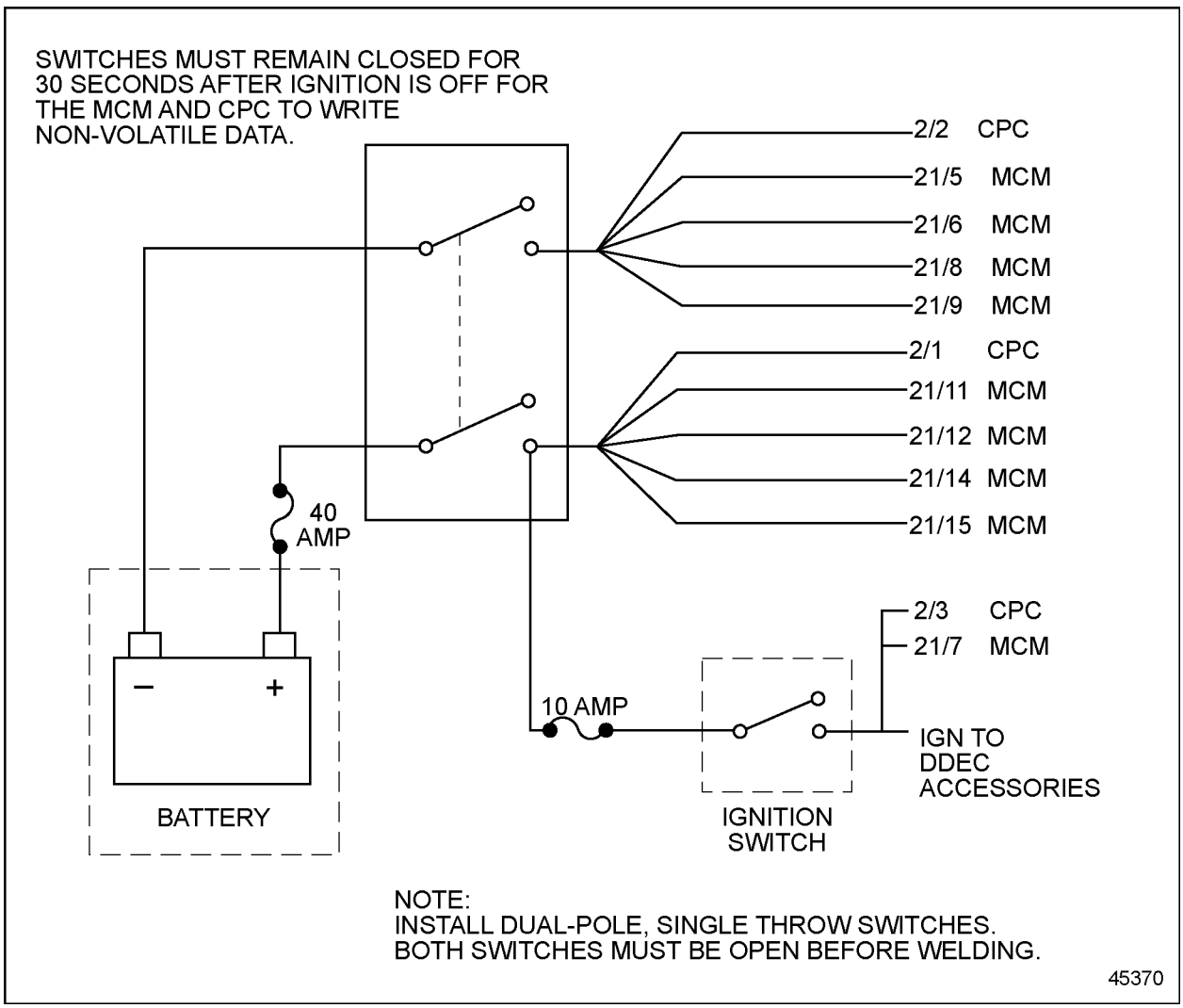

Figure 17-7 Main Power Supply Shutdown

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.

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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.

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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.

The part numbers for the CPC connectors, the 21–pin connector at the MCM, the 31–pin MCM pigtail connector and the 10–pin DPF connector are listed in the following tables.

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Part	Tyco/Amp Part Number	DDC Part Number
CPC - 18 Pin Connector - B Key	7-968974-2	A 018 545 67 26
CPC - socket 0.5-1.0mm wire (single)	—	A 013 545 76 26
CPC - socket 1.0-2.5mm wire (single)	1-968873-3	A 013 545 78 26
CPC - socket 1.0-2.5mm wire (strip)	1-968851-3	—

Table 17-15 Connector #1, 18–pin Connector, B Key

Part	Tyco/Amp Part Number	DDC Part Number
CPC - 18 Pin Connector - A Key	8-968974-2	A 013 545 64 26
CPC - socket 0.5-1.0mm wire (single)	—	A 013 545 76 26
CPC - socket 1.0-2.5mm wire (single)	1-968873-3	A 013 545 78 26
CPC - socket 1.0-2.5mm wire (strip)	1-968851-3	—

Table 17-16 Connector #2, 18–pin Connector, A Key

Part	Tyco/Amp Part Number	DDC Part Number
CPC - 21 Pin Connector - A Key	8-968975-2	A 013 545 65 26
CPC - socket 0.5-1.0mm wire (single)	—	A 013 545 76 26
CPC - socket 1.0-2.5mm wire (single)	1-968873-3	A 013 545 78 26
CPC - socket 1.0-2.5mm wire (strip)	1-968851-3	—

Table 17-17 Connector #3, 21–pin Connector, Key A

Part	Tyco/Amp Part Number	DDC Part Number
CPC - 18 Pin Connector - C Key	6–968974–2	A 018 545 68 26
CPC - socket 0.5-1.0mm wire (single)	—	A 013 545 76 26
CPC - socket 1.0-2.5mm wire (single)	1–968873–3	A 013 545 78 26
CPC - socket 1.0-2.5mm wire (strip)	1-968851-3	—

Table 17-18 Connector #4, 18–pin Connector, Key C

Part	Tyco/Amp Part Number
Connector	1–1534127–1
Terminal (strip form)	1–968855–1
Terminal (single)	1–968875–1
Seal	828904–2
Backshell	9–1394050–1

Table 17-19 21–Pin Connector to the MCM

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Part	Tyco/Amp Part Number
Connector	967363–1
Terminal	1–929974–4
Seals (GXL insulation)	828921–1
Cavity Plugs	828922–1
Backshell	965636–1

Table 17-20 31–pin MCM Pigtail Connector

Part	FCI Part Numbers
Connector	54201016
Terminal	LSP –1811 – 58AU
Plug	54200005

Table 17-21 FCI Part Numbers for the DPF 10-pin Connector

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 components listed in Table 17-22 are required to incorporate a SAE J1939/J1587 Data Link in a VIH for diagnostic and reprogramming devices.

Component	DDC Part Number	Deutsch Part Number
Nine-pin Deutsch Connector	23529496	HD10-9-1939P
Connector Cover	23529497	HDC 16–9
Two (2) Cavity Plugs	23507136	114017
Seven (7) Terminals	23507132	0460-202-16141

Table 17-22 VIH Components to Incorporate an SAE J1939/J1587 Data Link

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The following illustration shows the wiring for the nine-pin connector (see see Figure 17-8).

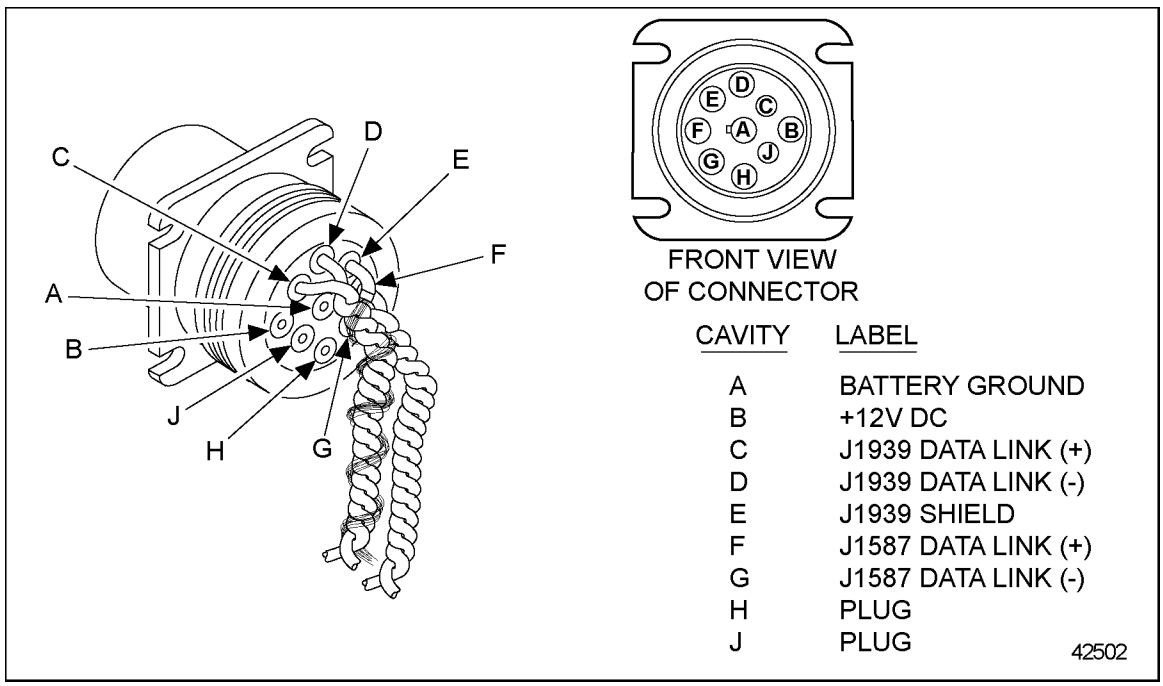

Figure 17-8 Wiring for 9-pin Data Link Connector

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).

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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).

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17.4.3 Crimp tools

The part numbers for the crimp tools for working with the MCM and CPC connectors are listed in Table 17-23.

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 17-23 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.

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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 17-9. Crimp the cable.

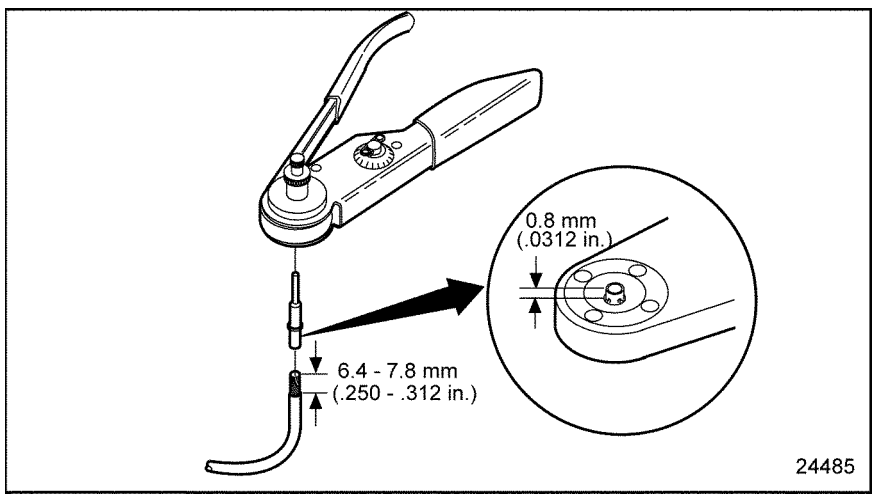

Figure 17-9 Setting Wire Gage Selector and Positioning the Contact

5. Grasp the contact approximately one inch behind the contact crimp barrel. Hold the connector with the rear grommet facing you. See Figure 17-10.

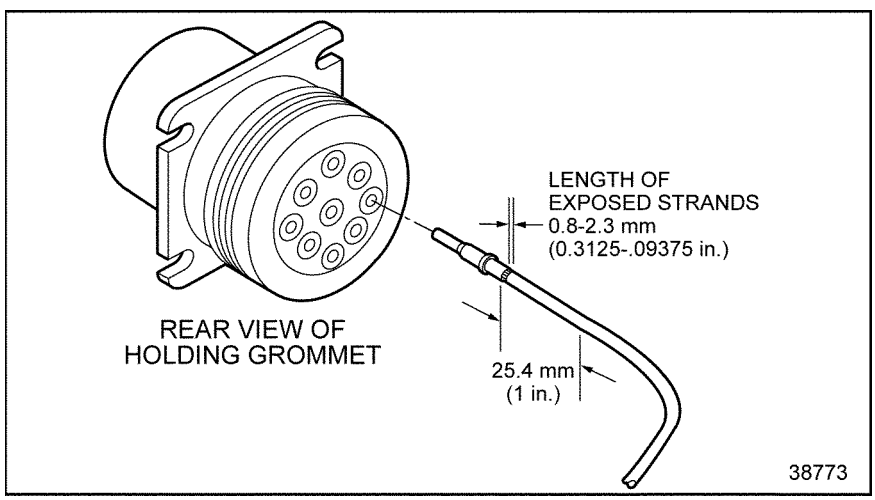

Figure 17-10 Pushing Contact Into Grommet

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6. Push the contact into the grommet until a positive stop is felt. See Figure 17-10. A slight tug will confirm that it is properly locked into place. See Figure 17-11.

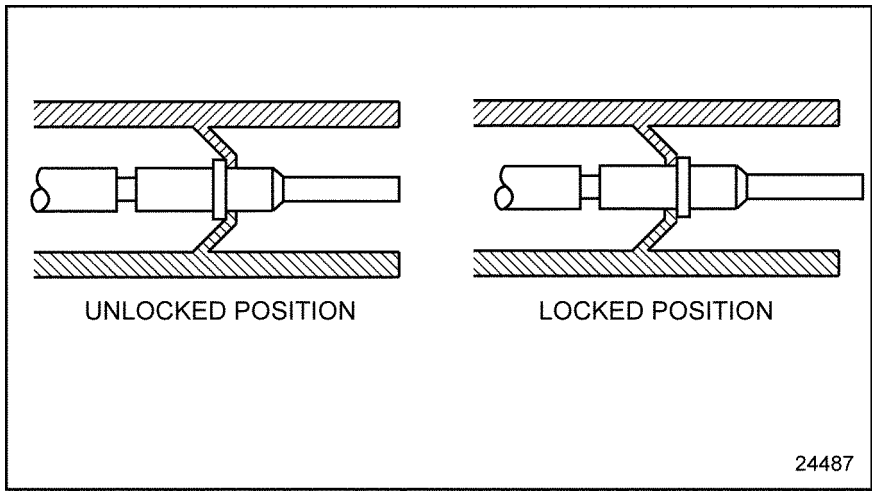

Figure 17-11 Locking Terminal Into Connector

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 17-24.

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

Table 17-24 Removal Tools for Deutsch Terminals

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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 17-12.

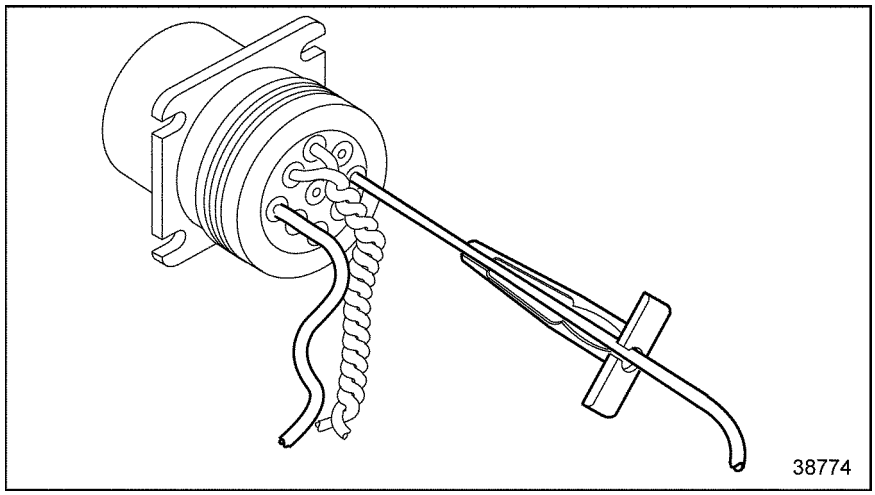

Figure 17-12 Removal Tool Position

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 17-13.

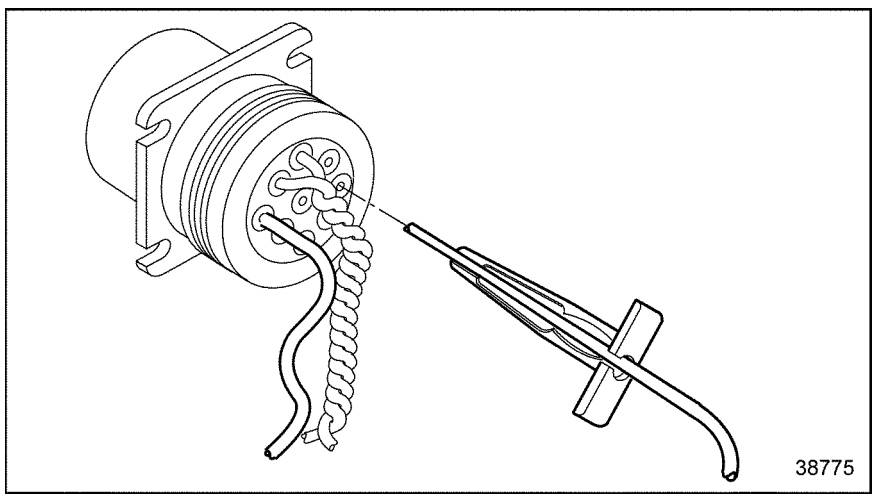

Figure 17-13 Removal Tool Insertion

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

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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 17-25.

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 17-25 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.

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Soldering splice connectors is optional. To solder splice connectors:

1. Position the leads, so one overlaps the other. See Figure 17-14.

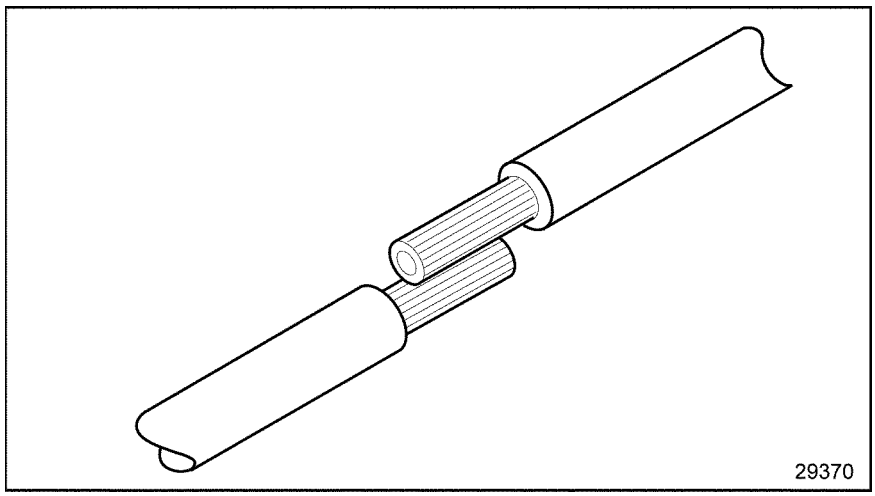

Figure 17-14 Positioning the Leads

2. Secure the leads with a commercially available clip and hand tool. See Figure 17-15.

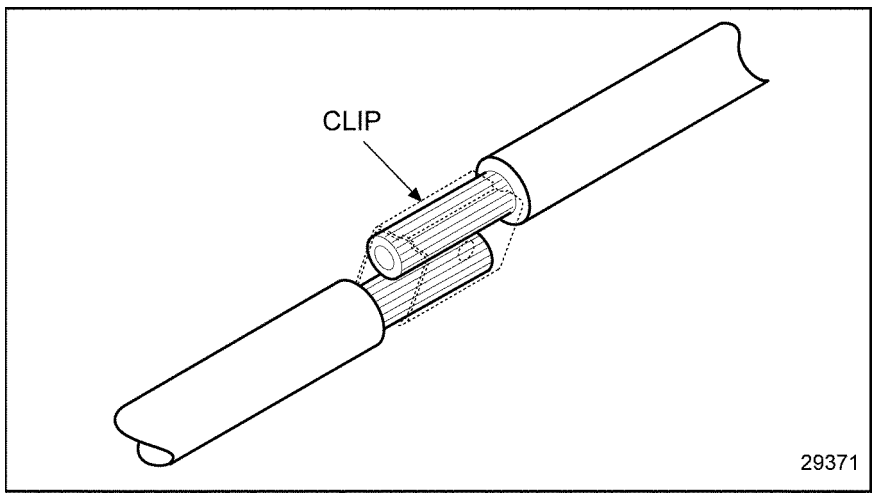

Figure 17-15 Securing the Leads With a Clip

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.

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4. Pull on wire to assure crimping and soldering integrity. The criteria listed in Table 17-26 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 17-26 Applied Load Criteria for Terminals

5. Loop the lead back over the spliced joint and tape. See Figure 17-16.

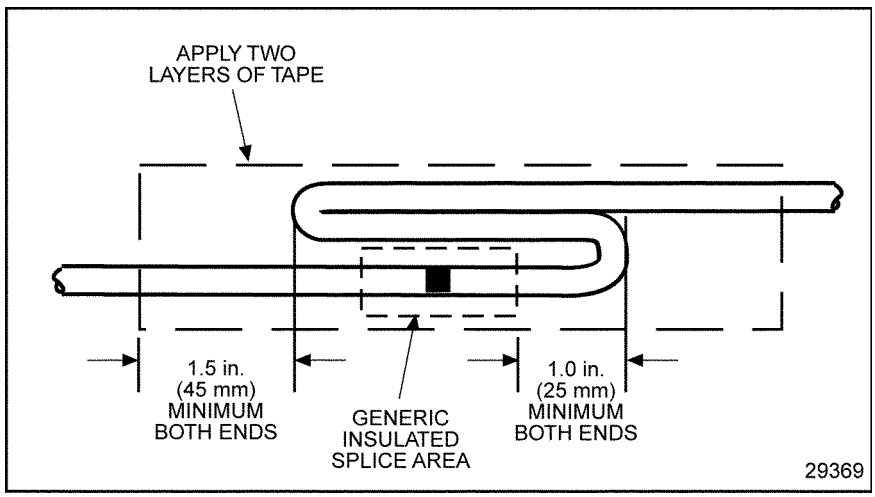

Figure 17-16 Recommended Strain Relief of Spliced Joint

17.4.5.2 Splicing and Repairing Straight Leads-Alternate Method 1

The tools required are listed in Table 17-27.

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 17-27 Recommended Splicing Tools

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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 17-17, A).
4. Insert the other wire into the splice clip until it butts against the clip stop (see Figure 17-17, 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 17-28 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 17-28 Applied Load Criteria for Terminals

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

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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 17-16.

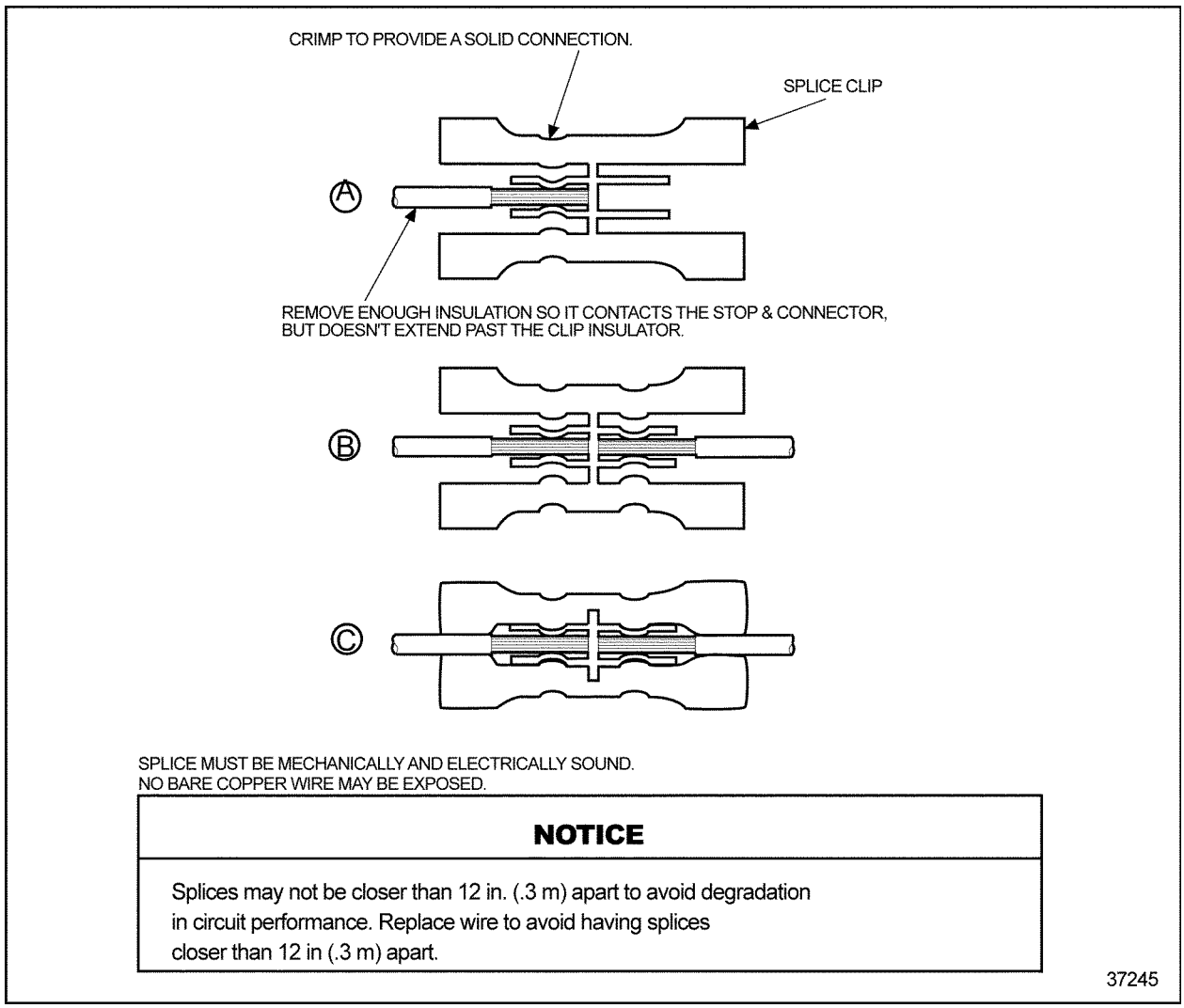

Figure 17-17 Splicing Straight Leads - Alternate Method 1

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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 17-29.

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 17-29 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 17-18, A).
4. Insert one wire into splice clip until it butts against the splice clip. Stop and crimp (see Figure 17-18, 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 17-18, 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 17-18, C).
8. Shrink tubing with a heat gun to seal the splice (see Figure 17-18, D).

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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 17-16.

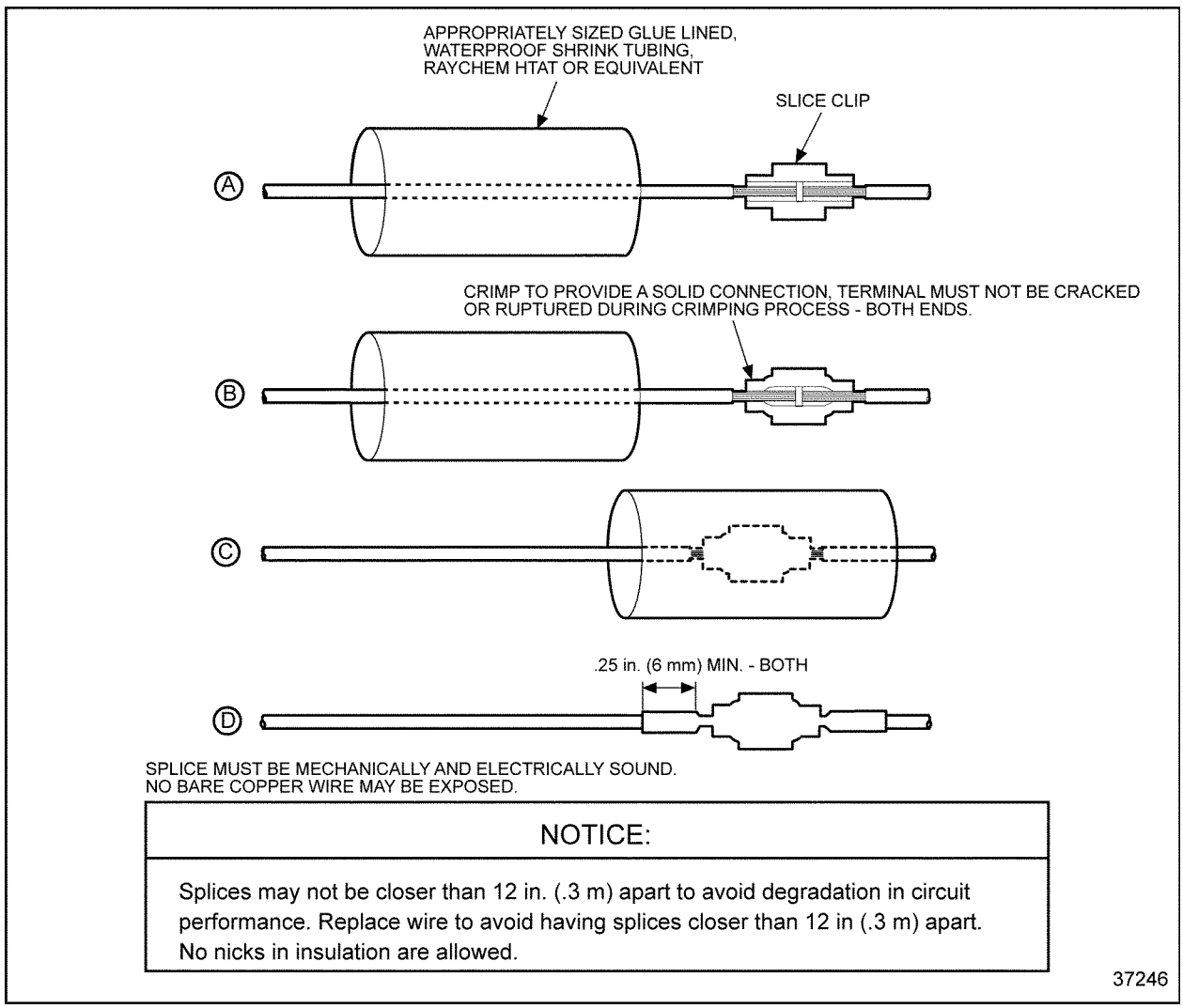

Figure 17-18 Splicing Straight Leads - Alternate Method 2

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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).

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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 17-19) so there is at least a 2.5 in. (65 mm) separation between splices.

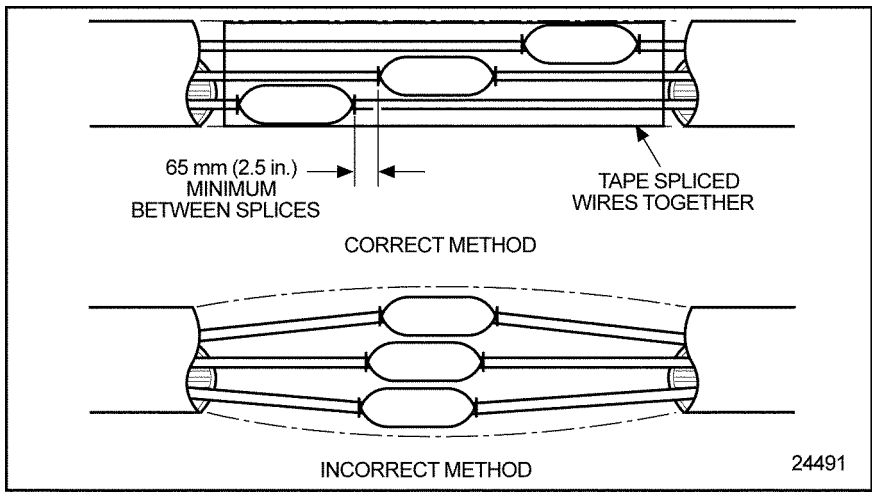

Figure 17-19 The Correct and Incorrect Method of Staggering Multiple Splices

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.

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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.

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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.

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17.7 SENSORS

DDEC is designed to operate with several types of sensors as listed in Table 17-30.

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 17-30 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).

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17.7.1 Factory-installed Sensors

The sensors integrated into the factory-installed Engine Harness are listed in Table 17-31.

Sensor	Function
Camshaft Position Sensor (CMP Sensor)	Senses crankshaft position and engine speed for functions such as fuel control strategy.
Crankshaft Position Sensor (CKP Sensor)	Indicates a specific cylinder in the firing order.
DPF Inlet 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 after-treatment device.
DPF Outlet Pressure Sensor	Sensor measures pressure between the Diesel Oxidation Catalyst (DOC) and the Diesel Particulate Filter (DPF) in the after-treatment assembly located in the exhaust system of the vehicle.
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 after-treatment unit.
DOC Inlet Temperature	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 after-treatment 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 Temperature Sensor	Senses EGR exhaust temperature after EGR cooler. Used for EGR system diagnosis.
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.
Intake Manifold Pressure Sensor (IMP 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.

Table 17-31 Function of Factory-installed Sensors

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See Figure 17-20 for the location of the sensors for the DOC and DPF.

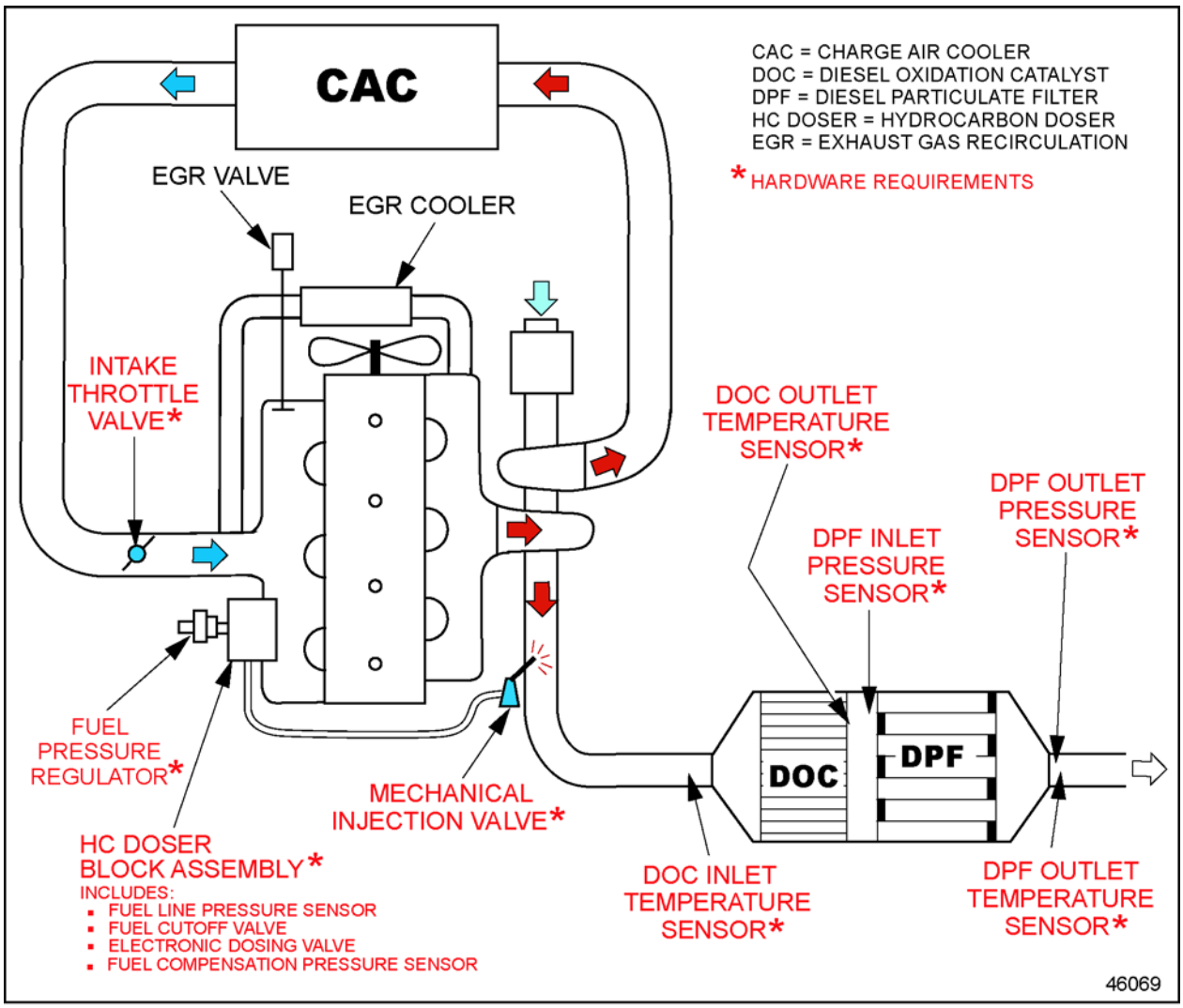

Figure 17-20 Sensor Location for the DOC and DPF

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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 17-32.

Sensor	Part Number	Function
Engine Coolant Level Sensor (ECL Sensor)	23526906 23526905 23526907	Senses coolant level for engine protection. Refer to section 17.7.3.
Turbo Compressor In Temperature Sensor	23527831	Senses the temperature of the turbo compressor inlet. Refer to section 17.7.4.
Vehicle Speed Sensor (VSS)	-—	Senses vehicle speed for Cruise Control and Vehicle Speed Limiting. Refer to section 17.7.5.

* Available in some applications

Table 17-32 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.

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17.7.3 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 17-21).

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.

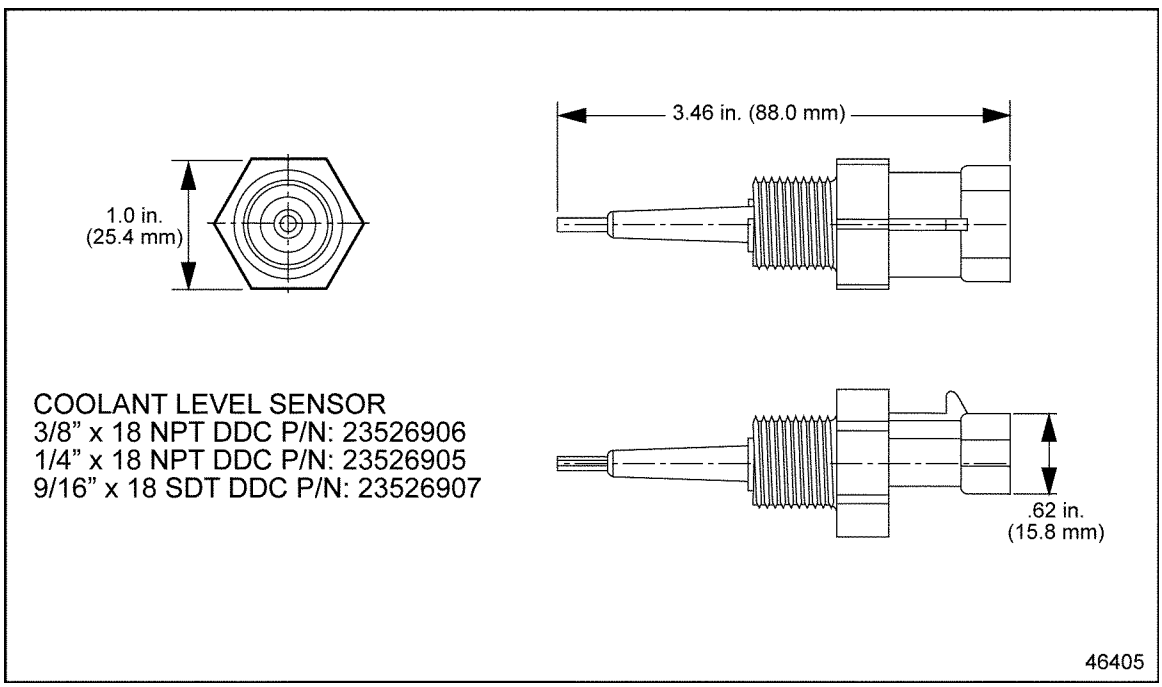

Figure 17-21 Engine Coolant Level Sensor Specifications

The connector listed in Table 17-33 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 17-33 Metri-Pack 280 Connectors and Part Numbers

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The OEM must connect the ECL Sensor probe as shown in the next illustration (see Figure 17-22). Polarity of the ground and signal must be correct for proper operation.

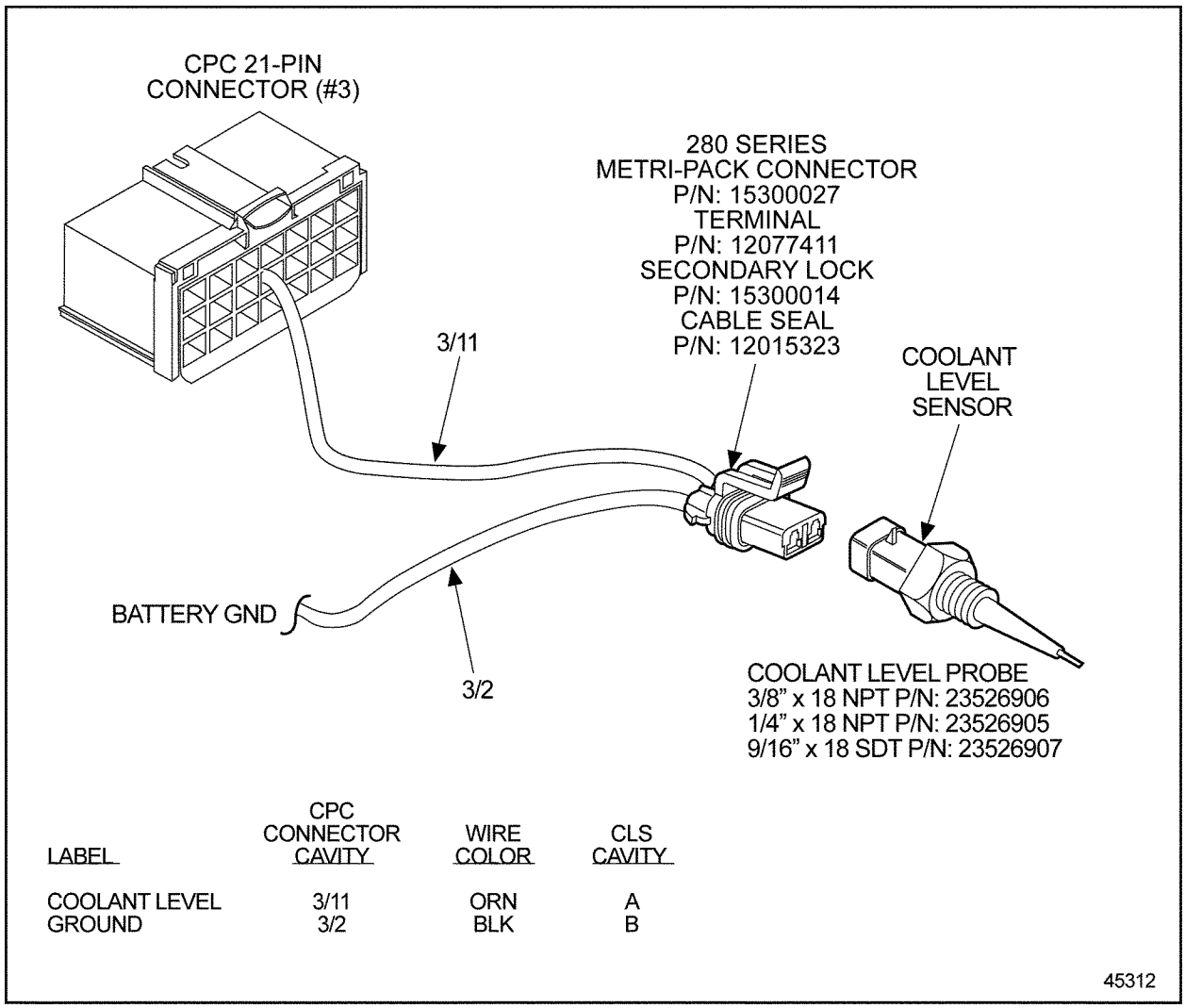

Figure 17-22 Engine Coolant Level Sensor Installation for CPC

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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 17-23.

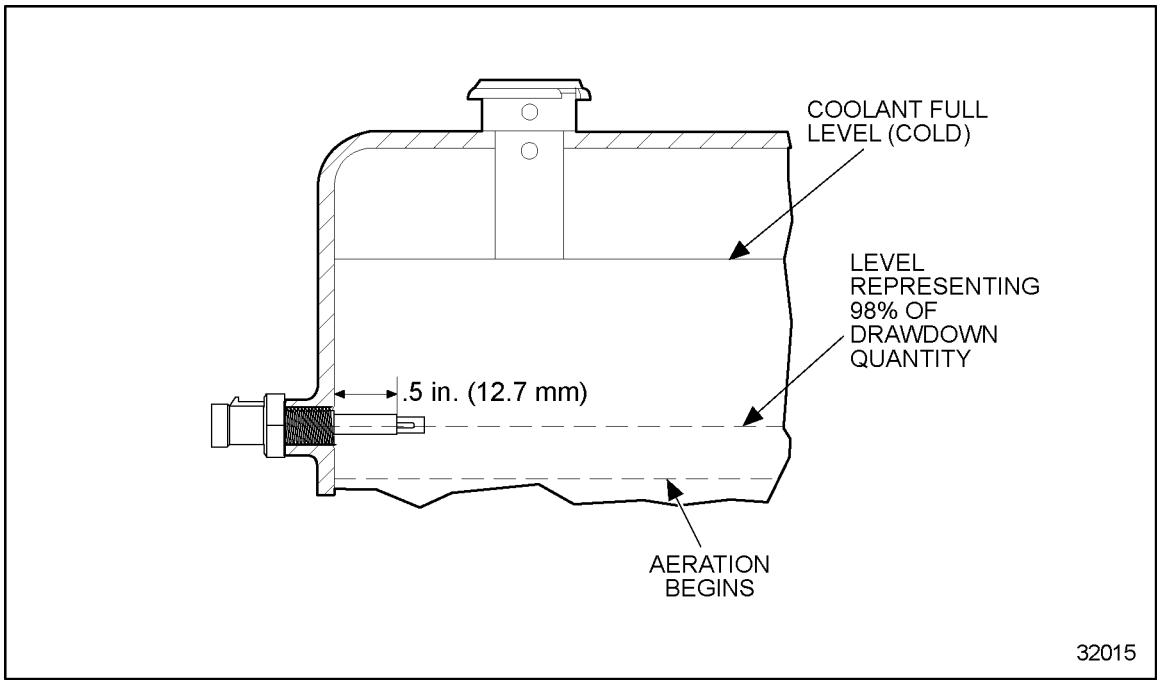

Figure 17-23 Engine Coolant Level Sensor Location - Top of Radiator Tank

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 17-34 and Table 17-35 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 17-34 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 17-35 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 17-36.

Parameter	Options	Default
Cool Level Sensor Input Enable	0 = Disabled 1 = Dual Level Probe Sensor (IMO) 2 = Single Level Probe Sensor 3 = Dual Level Float Sensor (FTL)	2

Table 17-36 Enabling the Engine Coolant Level Sensor

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17.7.4 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 17-24.

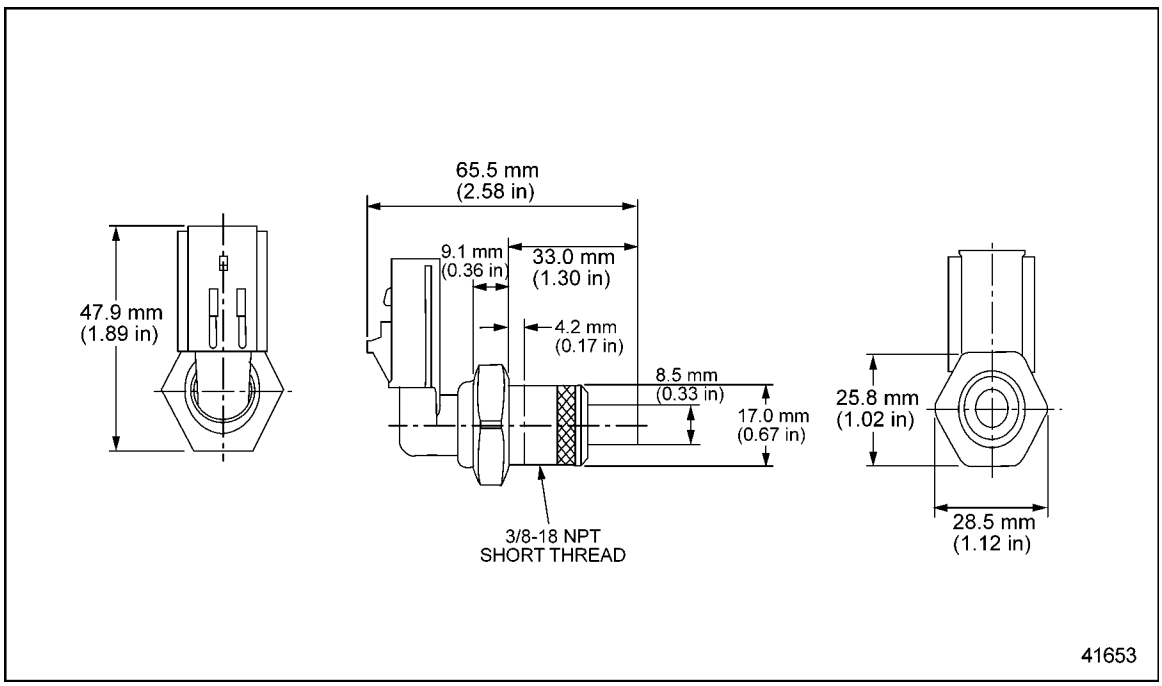

Figure 17-24 Turbo Compressor In Temperature Sensor

This sensor is required for the Series 60.

The maximum vibration for the sensor is 5 g. The sensor must be torqued between 10 ft lb and 20 ft lb. The harness must be fastened within 6 in of the sensor. The maximum operating temperature for this sensor is 248°F (120°C).

Install the Turbo Compressor In Temperature Sensor in the filtered air side of the air filter canister. Otherwise it must be mounted between the air cleaner and the turbocharger compressor inlet. This sensor has a pigtail on the Engine Harness. It it does not fit your application, this circuit is also available in the 31–pin Engine Harness connector. The OEM is responsible for wiring this sensor to either location.

17.7.5 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 17-25) 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.

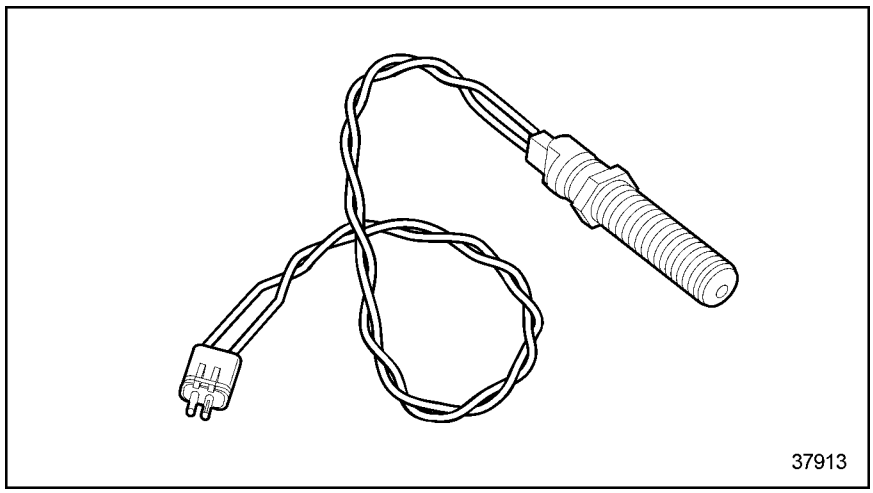

Figure 17-25 Vehicle Speed Sensor

To obtain accurate vehicle mileage, the parameters listed in Table 17-37 must be programmed with VEPS, DRS, or DDDL 7.0.

Parameter	Range	Default
Vehicle Speed Sensor	0 = No Sensor 1 = C3 Sensor 2 = Square Wave (Hall Sensor) 3 = Vehicle Speed over J1939 (ECT1) 4 = Magnetic Pickup 5 = Vehicle Speed via J1939 (TCO1, SPN 1624) 8 = Vehicle Speed via J1939 (CCVS, SPN 84)	4 = Magnetic
Axle Ratio	1 – 20.0	5.29
Number of Output Shaft Teeth	0 – 250	16
Tire Revs per Unit Distance	160 – 1599	312
Top Gear Ratio	0.1 – 2.55	1
Second Highest Gear Ratio	0.1 – 2.55	1
Two Spd Axle Second Axle Ratio	1 – 20.0	5.29
Anti Tamper	0 = Disable 1 = Enable VSS ABS Anti Tampering Function 2 = Enable VSS without ABS Anti Tampering Function	0 = Disable

Table 17-37 Vehicle Speed Sensor Parameters

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17.7.5.1 Magnetic Pickup

The magnetic pickup requirements are listed in Table 17-38. 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 17-38 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 17-39.

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

Table 17-39 Vehicle Speed Sensor Wiring

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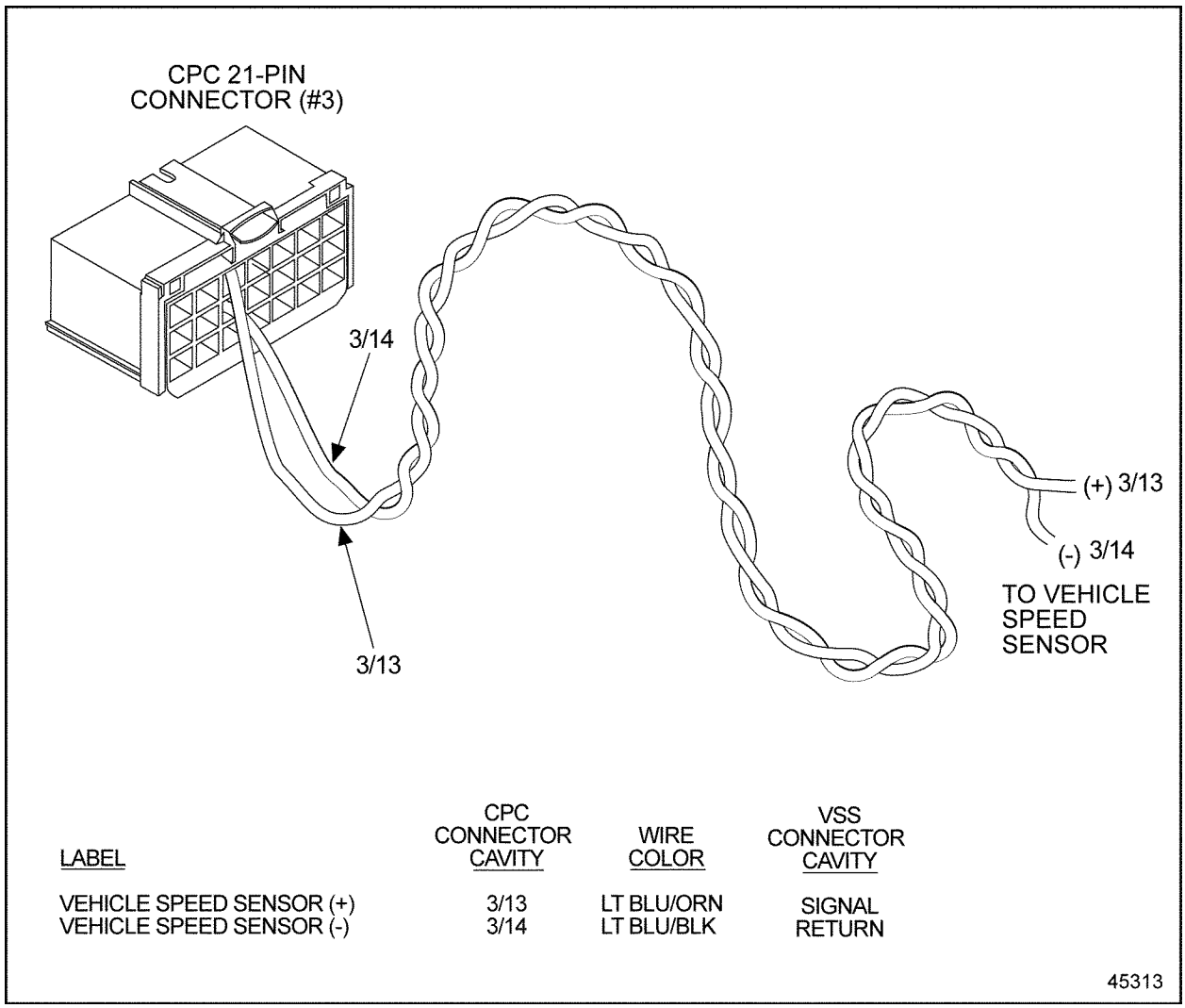
See Figure 17-26 for the installation of the Magnetic VSS.



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 17-26 Magnetic Vehicle Speed Sensor Installation – CPC

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17.7.5.2 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 17-40 must be programmed with VEPS.

Parameter	Range	Default
Vehicle Speed Sensor	0 = No Sensor 1 = C3 Sensor 2 = Square Wave (Hall Sensor) 3 = Vehicle Speed over J1939 4 = Magnetic Pickup 5 = Vehicle Speed via J1939 (TCO1, SPN 1624) 8 = Vehicle Speed via J1939 (CCVS, SPN 84)	4 = Magnetic
Axle Ratio	1 – 20.0	5.29
Tire Revs per Unit Distance	160 – 1599	312
Top Gear Ratio	0.1 – 2.55	1
Second Highest Gear Ratio	0 — 5.75	2.55
Two Spd Axle Second Axle Ratio	1 – 20.0	5.29
Anti Tamper	0 = Disable 1 = Enable VSS ABS Anti Tampering Function 2 = Enable VSS without ABS Anti Tampering Function	0 = Disable

Table 17-40 Vehicle Speed Sensor Parameters for Transmission Output Shaft Speed

17.7.5.3 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.

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17.8 INSTRUMENT PANEL LAMPS

The instrument panel lamps are listed in Table 17-41.

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 17-41 Instrument Panel Lamps

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18 SPN 27 - EGR VALVE POSITION CIRCUIT FAULT

Section **Page**

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18.2 SPN 27/FMI 4 18-4
18.3 SPN 27/FMI 0/1/2/14 18-5

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18.1 SPN 27/FMI 3

This diagnostic condition is typically a short to ground.

18.1.1 Short to Ground Check

Check as follows:

1. Disconnect the EGR valve connector.
2. Disconnect the MCM 120–pin connector.
3. Measure the resistance from pin 4 of the EGR valve connector to ground.
   [a] If the resistance is less than 5 Ω, repair the short to ground in the wire between pin 4 of the EGR valve connector and pin 60 of the MCM 120–pin connector. Refer to section 18.1.1.1.
   [b] If the resistance is greater than 5 Ω, measure the resistance again. If you receive the same results, contact the Detroit Diesel Customer Support Center (313–592–5800).

18.1.1.1 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 SPN 27/3 is not logged and other codes are logged, troubleshoot the logged codes.
   [c] If SPN 27/3 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).

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18.2 SPN 27/FMI 4

This diagnostic condition is typically a short in the wires.

18.2.1 Short Circuit Check

Check as follows:

1. Disconnect the EGR valve connector.
2. Disconnect the MCM 120–pin connector.
3. Measure the resistance between pin 2 and pin 4 of the EGR valve connector.
   [a] If the resistance is less than 5 Ω, repair the short in wires between pins 2 and 4 of the EGR valve connector and pins 60 and 62 of the 120–pin MCM connector. Refer to section 18.2.1.1.
   [b] If the resistance is greater than 5 Ω, repair the short to power in the wire between pin 4 of the EGR valve connector and pin 60 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 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 SPN 27/4 is not logged and other codes are logged, troubleshoot the logged codes.
   [c] If SPN 27/4 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).

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18.3 SPN 27/FMI 0/1/2/14

This diagnostic condition is typically a valve plausibility error (the valve is not working properly).

18.3.1 Valve Function Check

Check as follows:

1. Turn the ignition ON (key ON, engine OFF).
2. Check for multiple codes. If other codes are present, service them first.
3. Disconnect the EGR valve electrical connector. Inspect the connector for corrosion, bent or spread pins.
   [a] If connector damage is found, repair as necessary. Refer to section 18.3.1.1.
   [b] If there is no connector damage, go to step 4.
4. Turn the ignition OFF.
5. Reconnect the EGR valve electrical connector.
6. Connect diagnostic tool for DDEC VI.
7. Turn the ignition ON.
8. Monitor the EGR valve actual position.
9. Does the EGR valve actual position read less than 3%?
   [a] If yes, go to step 10.
   [b] If no, go to step 14.
10. Command the EGR pulse width to 50%.
11. Does the EGR valve actual position read between 46% and 54%?
   [a] If yes, go to step 12.
   [b] If no, go to step 14.
12. Command the EGR pulse width to 100%.
13. Does the EGR valve actual position read above 95%?
   [a] If yes, repeat steps 3 through 13. If the results are the same, call the Detroit Diesel Customer Support Center.
   [b] If no, go to step 14.
14. Remove the EGR valve.
15. Visually inspect the EGR valve for Physical damage or excessive carbon/sludge buildup.
   [a] If the EGR valve is damaged, replace it. Refer to section 18.3.1.1.
   [b] If excessive carbon/sludge buildup is found, replace the EGR valve and inspect the EGR cooler for internal failure.

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18.3.1.1 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 the engine.
5. Check diagnostic tool for codes.
   [a] If no codes are displayed, troubleshooting is complete.
   [b] If SPN 27/0/1/2/14 is not logged and other codes are logged, troubleshoot the logged codes.
   [c] If SPN 27/0/1/2/14 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).

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19 SPN 84 – VEHICLE SPEED SENSOR

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19.2 SPN 84/FMI 4 19-4

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19.1 SPN 84/FMI 3

This diagnostic condition is typically VSS open circuit.

19.1.1 Open Circuit Check

Check as follows:

1. Disconnect the VSS.
2. Turn the ignition ON (key ON, engine OFF).
3. Measure the voltage between pins 1 and 2 of the VSS harness connector.
   [a] If the voltage is between 4.5 and 5.5 volts, refer to section 19.1.2.
   [b] If the voltage is less than 4.5 volts, go to step 4.
4. Measure the voltage between pin 1 of the VSS harness connector and a good ground..
   [a] If the voltage is greater than 4.5 volts, repair the open wire between pin 14 of the CPC #3 connector (21–pin) and pin 2 of the VSS harness connector. Refer to section 19.1.2.1.
   [b] If the voltage is less than 4.5 volts, repair the open wire between pin 13 of the CPC #3 connector (21–pin) and pin 1 of the VSS harness connector. Refer to section 19.1.2.1.

19.1.2 Short Circuit Check

Check as follows:

1. Turn the ignition OFF.
2. Disconnect the CPC #3 connector (21–pin).
3. Measure the resistance between
   [a] If the resistance measurement is less than 5 Ω, repair the short in the harness between pin 13 and pin 14 of the CPC #3 connector (21–pin). Refer to section 19.1.2.1.
   [b] If the resistance measurement is greater than 5 Ω, replace the VSS. Refer to section 19.1.2.1.

19.1.2.1 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.

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[a] If no codes are displayed, troubleshooting is complete.

[b] If code 84/3 is not logged, and other codes are logged, troubleshoot the logged codes.

[c] If code 84/3 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).

19.2 SPN 84/FMI 4

This diagnostic condition is typically VSS short circuit.

19.2.1 Short Circuit Check

Check 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 19.2.1.1.
   [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 19.2.1.1.
   [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 2of the VSS harness connector. Refer to section 19.2.1.1.
   [b] If the resistance measurement is greater than 5 Ω, replace the VSS. Refer to section 19.2.1.1.

19.2.1.1 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.

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[a] If no codes are displayed, troubleshooting is complete.

[b] If code 84/4 is not logged, and other codes are logged, troubleshoot the logged codes.

[c] If code 84/4 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).

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20 SPN 86 – ADAPTIVE CRUISE CONTROL FAULT

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20.1 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.

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21 SPN 91 – ACCELERATOR PEDAL SENSOR FAULT

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21.1 SPN 91/FMI 2

A typical diagnosis for the fault is erratic data.

21.1.1 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 21-1. Refer to section 21.1.1.1.
   [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 21-1. Refer to section 21.1.1.1.

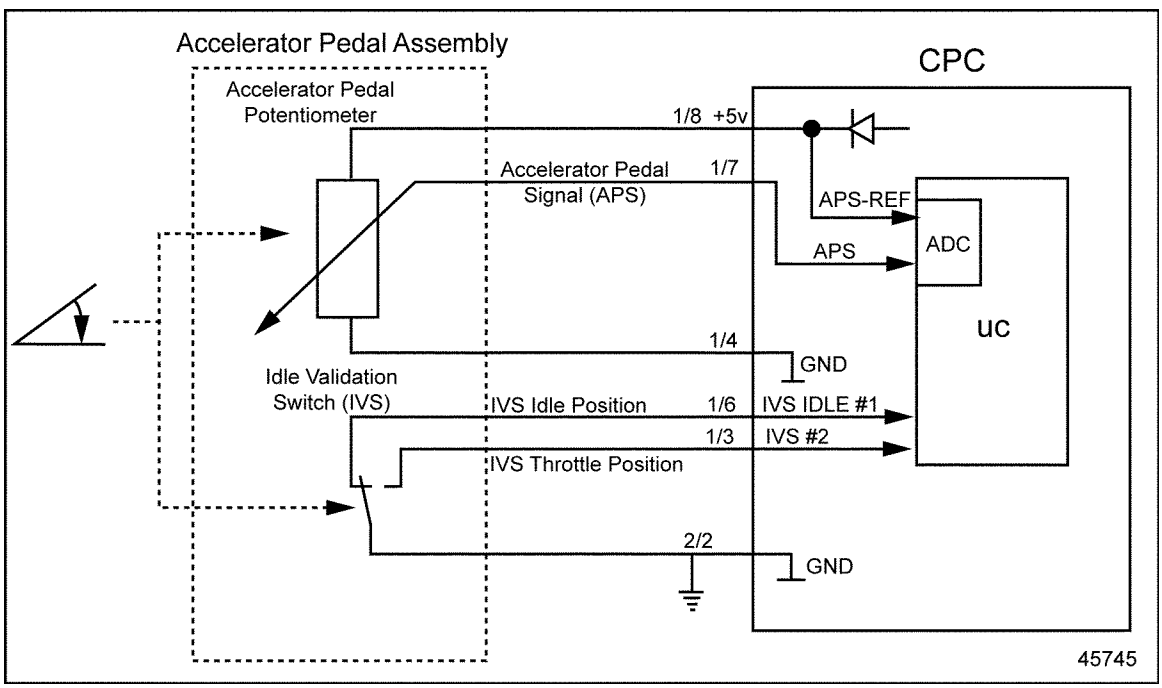

Figure 21-1 Accelerator Pedal Assembly Installation

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 21.1.1.1.
   [b] If the resistance is less than 3 Ω, replace the Accelerator Pedal. Refer to section 21.1.1.1.

21.1.1.1 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 91/2 is not logged, and other codes are logged, troubleshoot the logged codes.
   [c] If code 91/2 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).

21.2 SPN 91/FMI 3

The typical diagnosis for this fault is high voltage.

21.2.1 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 21-2. Refer to section 21.2.1.1.

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[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 21-2. Refer to section 21.2.1.1.

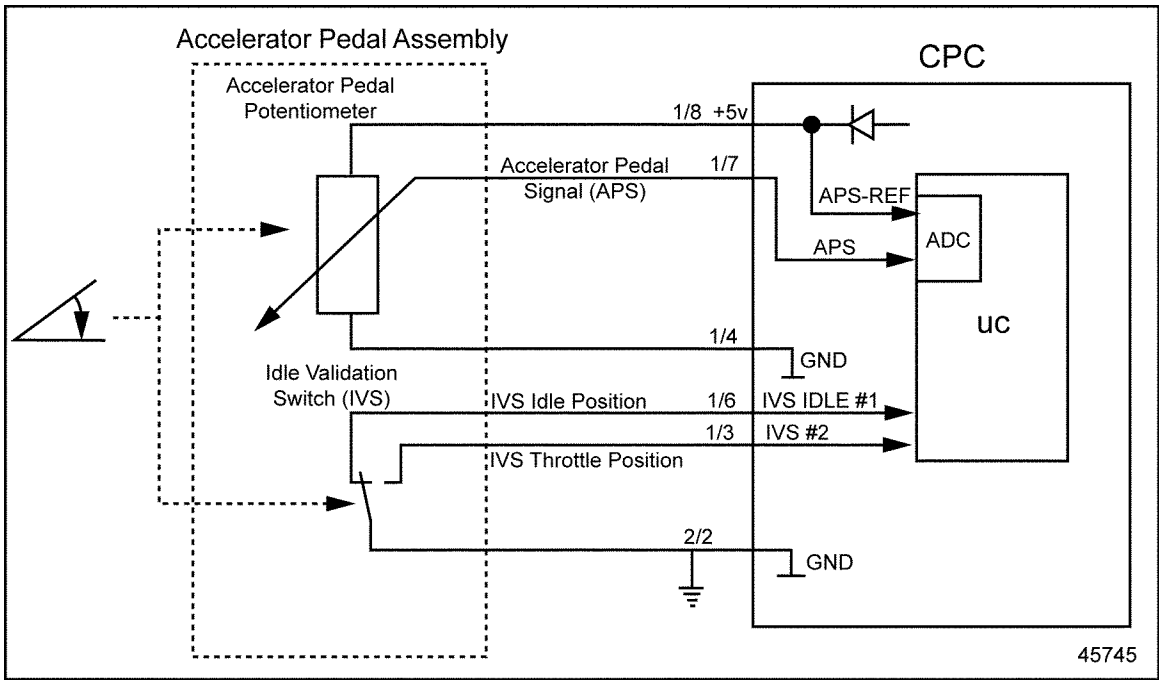

Figure 21-2 Accelerator Pedal Assembly Installation

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 21.2.1.1.
   [b] If the resistance is less than 3 Ω, replace the Accelerator Pedal. Refer to section 21.2.1.1.

21.2.1.1 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.

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[a] If no codes are displayed, troubleshooting is complete.

[b] If code 91/3 is not logged, and other codes are logged, troubleshoot the logged codes.

[c] If code 91/3 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).

21.3 SPN 91/FMI 4

The typical diagnosis for this fault is voltage low.

21.3.1 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 21-3. Refer to section 21.3.1.1.
   [b] If the resistance is greater than 5 Ω, go to step 4.

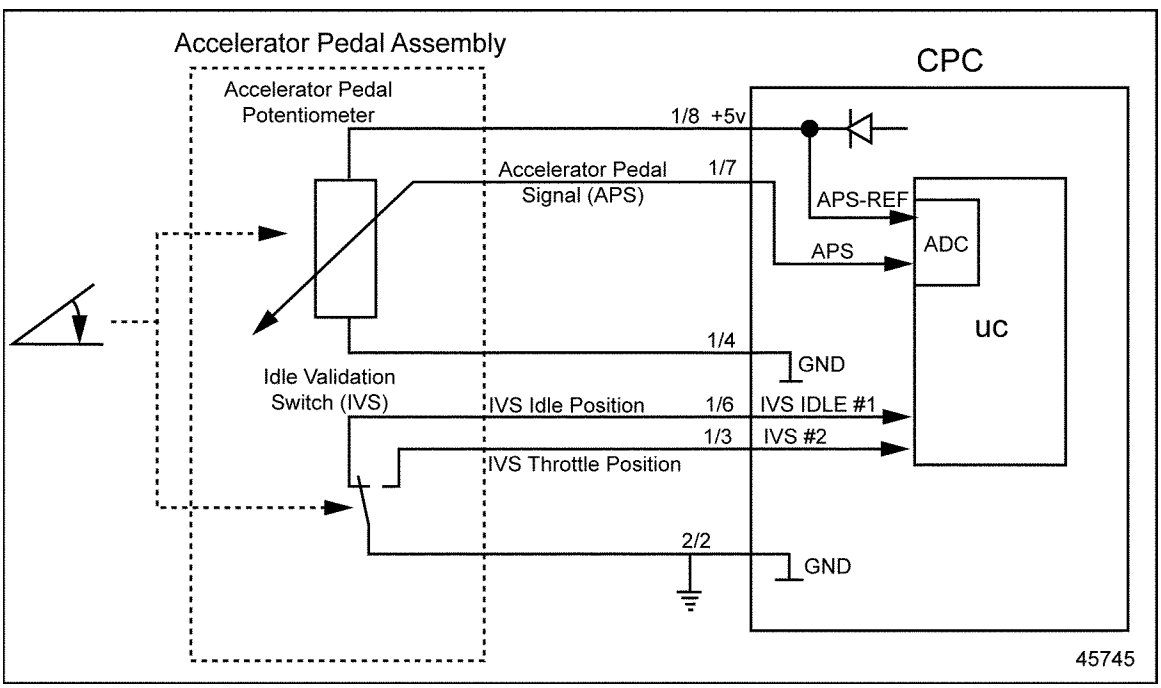

Figure 21-3 Accelerator Pedal Assembly Installation

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 21.3.1.1.

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[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 21.3.1.1.
   [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 21.3.1.1.
   [b] If the resistance is greater than 5 Ω, replace the Accelerator Pedal. Refer to section 21.3.1.1.

21.3.1.1 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 91/4 is not logged, and other codes are logged, troubleshoot the logged codes.
   [c] If code 91/4 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).

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22 SPN 100 — ENGINE OIL PRESSURE OUTSIDE NORMAL OPERATING RANGE

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22.1 SPN 100/FMI 1

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

22.1.1 Low Oil Pressure Check

Check as follows::

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 22.4.1.
   [b] If fault codes 100/1 and 100/4 are both active, refer to section 22.3.1
   [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 22.1.1.1.
   [b] If the engine oil level is low, fill oil to proper level. Refer to section 22.1.1.1.
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 22.1.1.1.
   [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 22.1.1.1.
   [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 22.1.1.1.
   [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 22.1.1.1.

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[b] If the relief valve is fine, refer to section 22.1.1.1.

22.1.1.1 Verify Repairs

Verify repairs as follows:

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 100/1 is not logged, and other codes are logged, troubleshoot the logged codes.
   [c] If code 100/1 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).

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22.2 SPN 100/FMI 2

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

22.2.1 Erratic Data From the Engine Oil Pressure Switch

Check 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 22.2.1.1.
   [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 22.4.1.
   [b] If fault code 100/4 is active in addition to code 100/2, refer to section 22.3.1.
   [c] If only fault code 100/2 is active, check and clean switch contacts (remove any corrosion). Refer to section 22.2.1.1.

22.2.1.1 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).

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22.3 SPN 100/FMI 3

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

22.3.1 Open Short to Power Check

Check as follows:

1. Check for multiple codes.
   [a] If 100/3, 174/3, 115/3, 110/3 and 100/3 are present, repair the open between pin 55 of the 120–pin connector and the associated switches. Refer to section 22.3.1.1.
   [b] If only 100/3 is present, go to step 2.
2. Disconnect the Engine Oil Pressure Switch.
3. Turn the ignition ON (key ON, engine OFF).
4. Measure the voltage between pins 1 and 2 of the Engine Oil Pressure Switch harness connector.
   [a] If the voltage is between 2.5 and 3 volts, replace the Engine Oil Pressure Switch. Refer to section 22.3.1.1.
   [b] If the voltage is less than 2.5 volts, go to step 5.
5. Measure the voltage between pin 2 of the Engine Oil Pressure Switch harness connector and ground.
   [a] If the voltage is between 2.5 and 3 volts, repair the open circuit between pin 1 of the Engine Oil Pressure Switch harness connector and pin 55 of the 120–pin MCM connector. Refer to section 22.3.1.1.
   [b] If the voltage is less than 2.5 volts, repair the open circuit between pin 2 of the Engine Oil Pressure Switch harness connector and pin 54 of the 120–pin MCM connector. Refer to section 22.3.1.1.

22.3.1.1 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 100/3 is not logged, and other codes are logged, troubleshoot the logged codes.

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[c] If code 100/3 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).

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22.4 SPN 100/FMI 4

A typical diagnosis is an Engine Oil Pressure Switch open short to ground.

22.4.1 Open Short to Ground Check

Check as follows:

1. Disconnect the Engine Oil Pressure Switch.
2. Disconnect the 120–pin MCM connector.
3. Measure the resistance between pins 1 and 2 of the Engine Oil Pressure Switch.
   [a] If the resistance is greater than 5Ω, go to step 4.
   [b] If the resistance is less than 5Ω, repair the short between wires 54 and 55 of the 120–pin MCM connector. Refer to section 22.4.1.1.
4. Measure the resistance between pins 1 of the Engine Oil Pressure Switch harness connector and ground.
   [a] If the resistance is greater than 5Ω, go to step 5.
   [b] If the resistance is less than 5Ω, repair the short circuit between pin 1 of the Engine Oil Pressure Switch harness connector and chassis ground. Refer to section 22.4.1.1.
5. Measure the resistance between pin 2 of the Engine Oil Pressure Switch harness connector and ground.
   [a] If the resistance is greater than 5 Ω, replace the switch. Refer to section 22.4.1.1.
   [b] If the resistance is less than 5 Ω, repair the short between pin 2 of the Engine Oil Pressure Switch harness connector and ground. Refer to section 22.4.1.1.

22.4.1.1 Verify Repairs

Verify repairs as follows:

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 100/4 is not logged, and other codes are logged, troubleshoot the logged codes.

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[c] If code 100/4 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).

22.5 SPN 100/FMI 14

This diagnosis is typically oil pressure very low. Perform the following steps to troubleshoot an oil pressure very low fault

22.5.1 Oil Pressure, Oil Pump and Oil Gauges Check

Check as follows

1. Check for multiple codes.
   [a] If fault code 100/3 is active in addition to code 100/14, refer to section 22.4.1.
   [b] If fault code 100 /4 is active in addition to code 100/14, refer to section 22.3.1.
   [c] If only fault code 100/14 is active, go to step 2.
2. Start engine and check oil pressure.
   [a] If pressure is fluctuating, go to step 3.
   [b] If pressure is low but stable, go to step 4.
3. 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 22.5.1.1
4. 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 5.
   [b] If oil is not above maximum level, contact Detroit Diesel Customer Support Center (313–592–5800).
5. Check for possible fuel in oil.
   [a] If fuel is found, locate and repair source of fuel leak. Change the oil. Refer to section 22.5.1.1.
   [b] If fuel is not found, contact Detroit Diesel Customer Support Center (313–592–5800).

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22.5.1.1 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 100/14 is not logged, and other codes are logged, troubleshoot the logged codes.
   [c] If code 100/14 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).

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23 SPN 103 – TURBO NO REVOLUTION

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23.1 SPN 103/FMI 0

This diagnosis is typically turbocharger speed above threshold.

23.1.1 Equipment Check

Check 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 23.1.1.1.
   [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 23.1.1.1.
   [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 23.1.1.1.
   [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 23.1.1.1.
   [b] If the fuel pressure is within specifications, contact the Detroit Diesel Customer Support Center (313–592–5800).

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23.1.1.1 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 103/0 is not logged, and other codes are logged, troubleshoot the logged codes.
   [c] If code 103/0 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).

23.2 SPN 103/FMI 1

This diagnosis is typically turbocharger speed below threshold

23.2.1 Equipment Check

Check 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 23.2.1.1.
   [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 23.2.1.1.
   [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 23.2.1.1.
   [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 23.2.1.1.

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[b] If the oil pressure is within specifications, contact the Detroit Diesel Customer Support Center (313–592–5800).

23.2.1.1 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 103/1 is not logged, and other codes are logged, troubleshoot the logged codes.
   [c] If code 103/1 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).

23.3 SPN 103/FMI 3

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

23.3.1 Open Circuit Check

Check as follows:

1. Disconnect the Turbo Speed Sensor (TSS).
2. Measure the resistance across pins 1 and 2 of the sensor (see Figure 23-1).
   [a] If the resistance is greater than 1k Ω, replace the sensor. Refer to section 23.3.2.1.
   [b] If the resistance is less than 1k Ω, go to step 3.
3. Turn the ignition ON (key ON, engine OFF).
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 23.3.2.
   [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 23-1. Refer to section 23.3.2.1.

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[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 23-1. Refer to section 23.3.2.1.

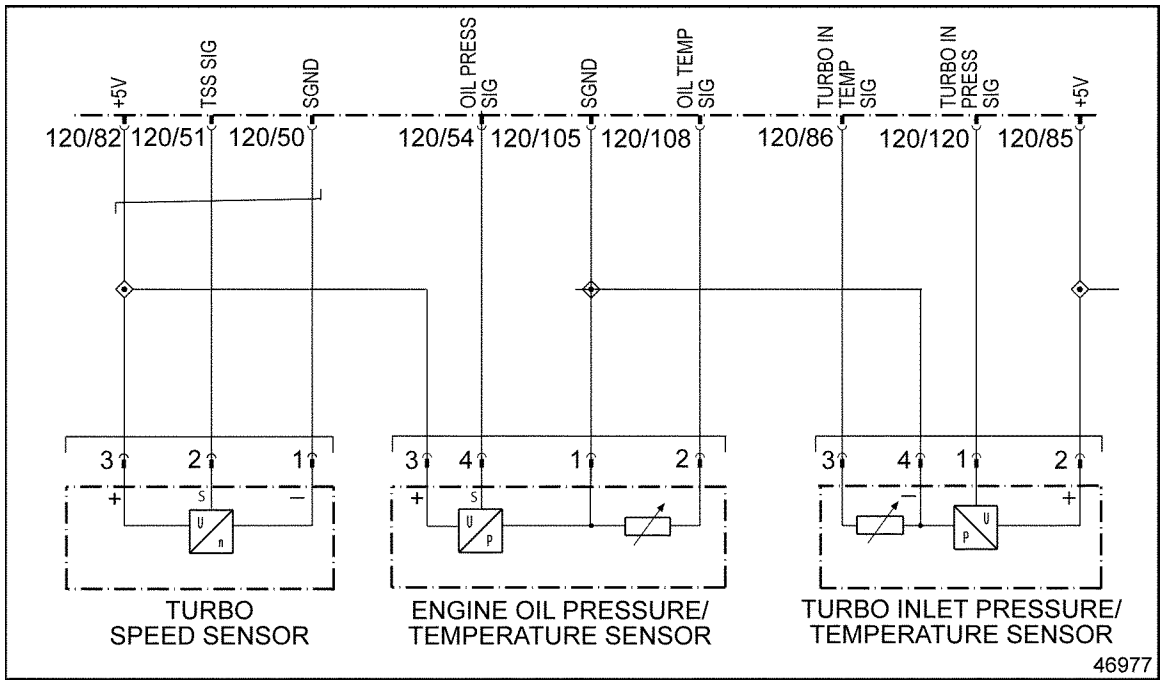

Figure 23-1 Turbo Speed Sensor Terminal and Wire Locations

23.3.2 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 23.3.2.1.
   [b] If the resistance is less than 1.1k Ω, go to step 7.
7. Turn the ignition ON (key ON, engine OFF).
8. Measure the voltage between pins 1 and 2 of the TSS harness connector.

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[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 23.3.1, step 5.

23.3.2.1 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 103/3 is not logged, and other codes are logged, troubleshoot the logged codes.
   [c] If code 103/3 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).

23.4 SPN 103/FMI 4

This diagnosis is typically short to ground.

23.4.1 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 23.4.2.1.
   [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 23.4.2.1.
   [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 23.4.2.1.

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[b] If the resistance is greater than 5 Ω, refer to section 23.4.2.1.

23.4.2 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 23.4.2.1.
   [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 23.4.2.1.
   [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 23.4.2.1.
   [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.

23.4.2.1 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.

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[b] If code 103/4 is not logged, and other codes are logged, troubleshoot the logged codes.

[c] If code 103/4 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).

23.5 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).

23.5.1 Turbo Speed Sensor Check

Check 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 23.5.2.
   [b] If resistance is zero or higher than 950 Ω, replace the sensor. Refer to section 23.5.2.1.

23.5.2 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 23.5.2.1.

23.5.2.1 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.

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[b] If code 103/7 is not logged, and other codes are logged, troubleshoot the logged codes.

[c] If code 103/7 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).

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

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24.1 SPN 110/FMI 0

The diagnostic condition is typically engine coolant temperature high.

24.1.1 System Checks to Resolve Fault

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

1. Check for multiple codes.
   [a] If fault 110/3 is active in addition to 110/0, refer to section 24.3.
   [b] If fault 110/4 is active in addition to 110/0, refer to section 24.4.
   [c] If fault 111/1 is active in addition to 110/0, refer to section 25.1.
   [d] If only fault code 110/0 is active, go to step 2.
2. Check for coolant loss.
3. Check for blockage in radiator and charge air cooler.
4. Check fan belt condition (slippage).
5. Check for proper location of fan shroud.
6. Check for proper radiator hose condition (no collapsed hoses).
7. Check for proper viscous fan operation.
8. Once checks and repairs are finished, refer to section 24.1.1.1.

24.1.1.1 Verify Repairs

Verify repairs as follows:

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).

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24.2 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.

24.2.1 Rationality Check for Temperature Drift

Check 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 24.2.1.1.
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 24.2.1.1.

24.2.1.1 Verify Repairs

Verify repairs as follows:

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).

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24.3 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).

24.3.1 Open Circuit Check

Check as follows:

1. Check for multiple 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 24.3.1.1.
   [b] If only fault 110/3 is active, go to step 2.
2. Disconnect the ECT Sensor.
3. 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 24.3.1.1.
   [b] If the resistance is less than 4 kΩ, go to step 4.
4. Turn the ignition ON.
5. 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 7.
   [b] If the voltage is less than 2.75 volts, go to step 6.
6. 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 24-1). Refer to section 24.3.1.1.

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[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 24-1). Refer to section 24.3.1.1.

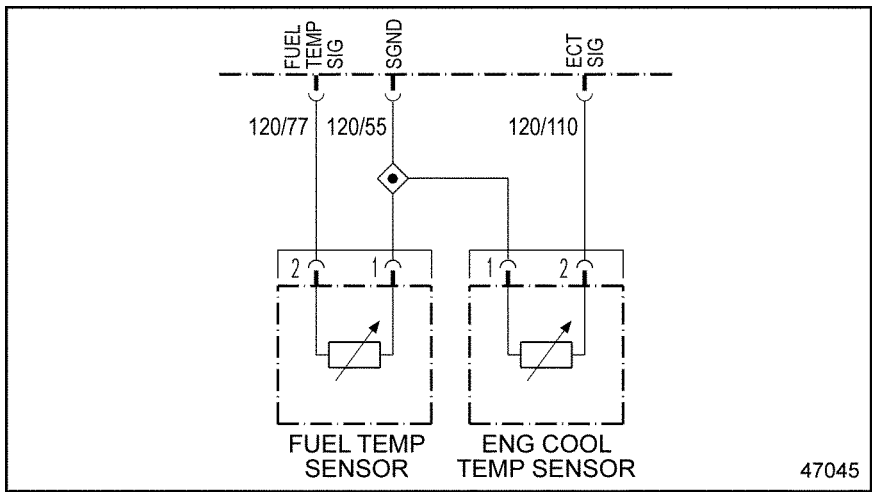

Figure 24-1 Engine Coolant Temperature Sensor

7. 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 24.3.1.1.
   [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 24.3.1.1.

24.3.1.1 Verify Repairs

Verify repairs as follows:

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 code 110/3 or 110/4 and any 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) for authorization to replace the MCM. Set parameters on the new MCM.

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24.4 SPN 110/FMI 4

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

24.4.1 Short to Ground Check

Check as follows:

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 24-2.

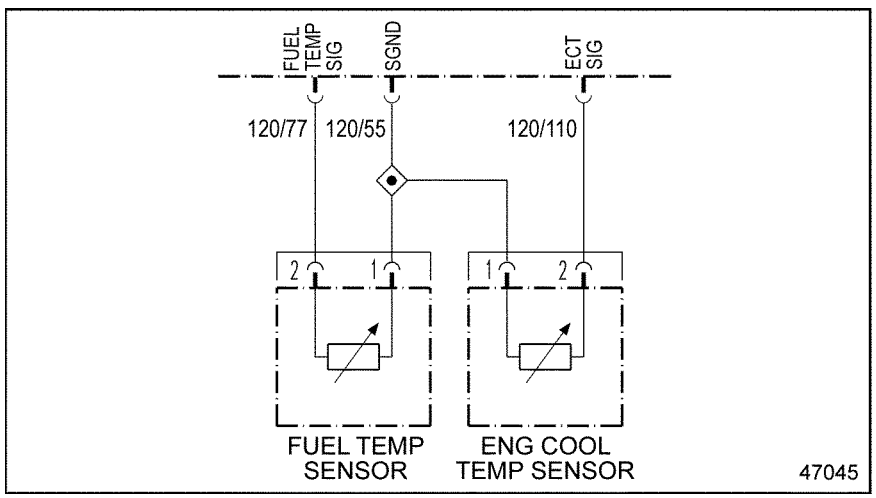

Figure 24-2 Engine Coolant Temperature Sensor

[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 24.4.1.1.

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 24.4.1.1.

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 24.4.1.1.

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24.4.1.1 Verify Repairs

Verify repairs as follows:

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 code 110/3 or 110/4 and any 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) for authorization to replace the MCM. Set parameters on the new MCM.

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24.5 SPN 110/FMI 14

The diagnostic condition is typically engine coolant temperature very high.

24.5.1 Multiple Code Check

Check as follows:

1. Turn the ignition ON.
2. Plug in the DDDL 7.0.
3. Read active codes:
   [a] If only fault code 110/14 is active, refer to section 24.5.2.
   [b] If fault code 110/3 is active in addition to fault code 110/14, refer to section 24.3.1.
   [c] If fault code 110/4 is active in addition to fault code 110/14, refer to section 24.4.1.

24.5.2 System Checks to Resolve Fault

Perform the following checks and make any corrections necessary to resolve a coolant temperature very 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 24.5.2.1.

24.5.2.1 Verify Repairs

Perform the following steps to verify repairs.

1. Turn the 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).

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25 SPN 111 – COOLANT LEVEL OUTSIDE NORMAL OPERATING RANGE

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25.1 SPN 111/FMI 1

This is typically low coolant level.

25.1.1 Coolant Level Check

Check as follows:

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 25-1.

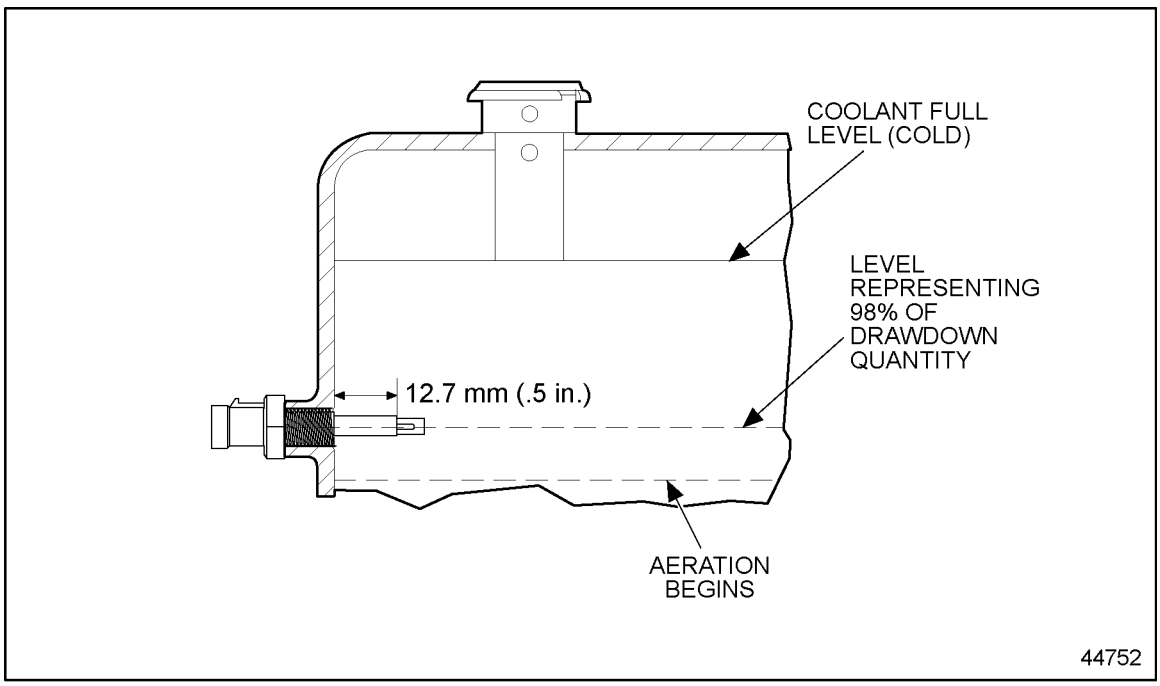

Figure 25-1 Engine Coolant Level Sensor Mounted in Radiator Top Tank

[a] If the coolant level in the reservoir is not within limit, refer to section 25.1.2.

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[b] If the coolant level in the reservoir is within limit, replace the sensor (see Figure 25-2). Refer to section 25.1.2.1.

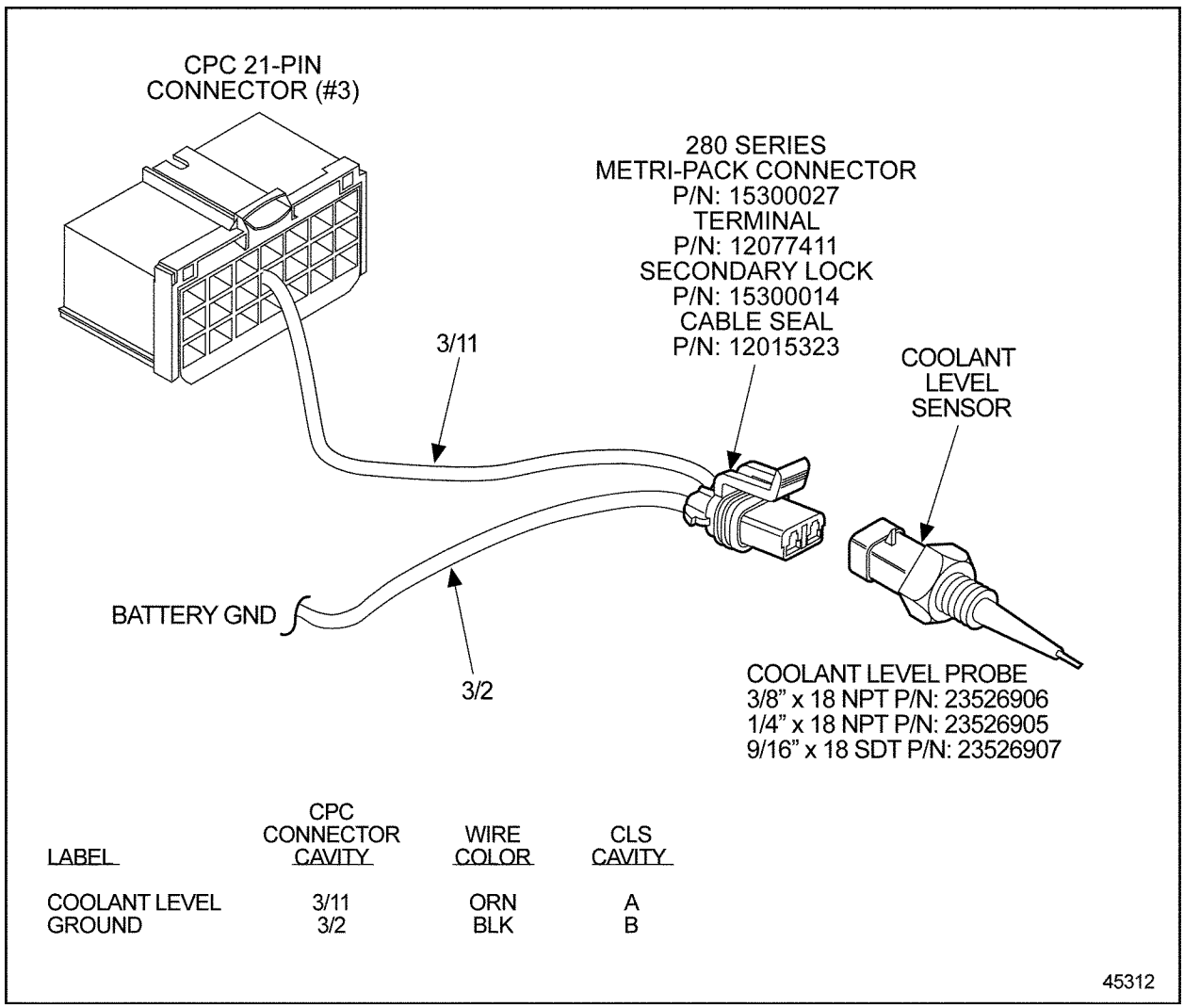

Figure 25-2 Engine Coolant Level Sensor Installation for CPC

25.1.2 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 25.1.2.1.

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25.1.2.1 Verify Repairs

Verify repairs as follows:

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.

25.2 SPN 111/FMI 3

This condition is typically an open circuit fault.

25.2.1 Open Circuit Check

Check as follows:

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.

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2. Check the voltage between the CPC #3 connector (21-pin) wire 3/11 on the ECL Sensor. See Figure 25-3.

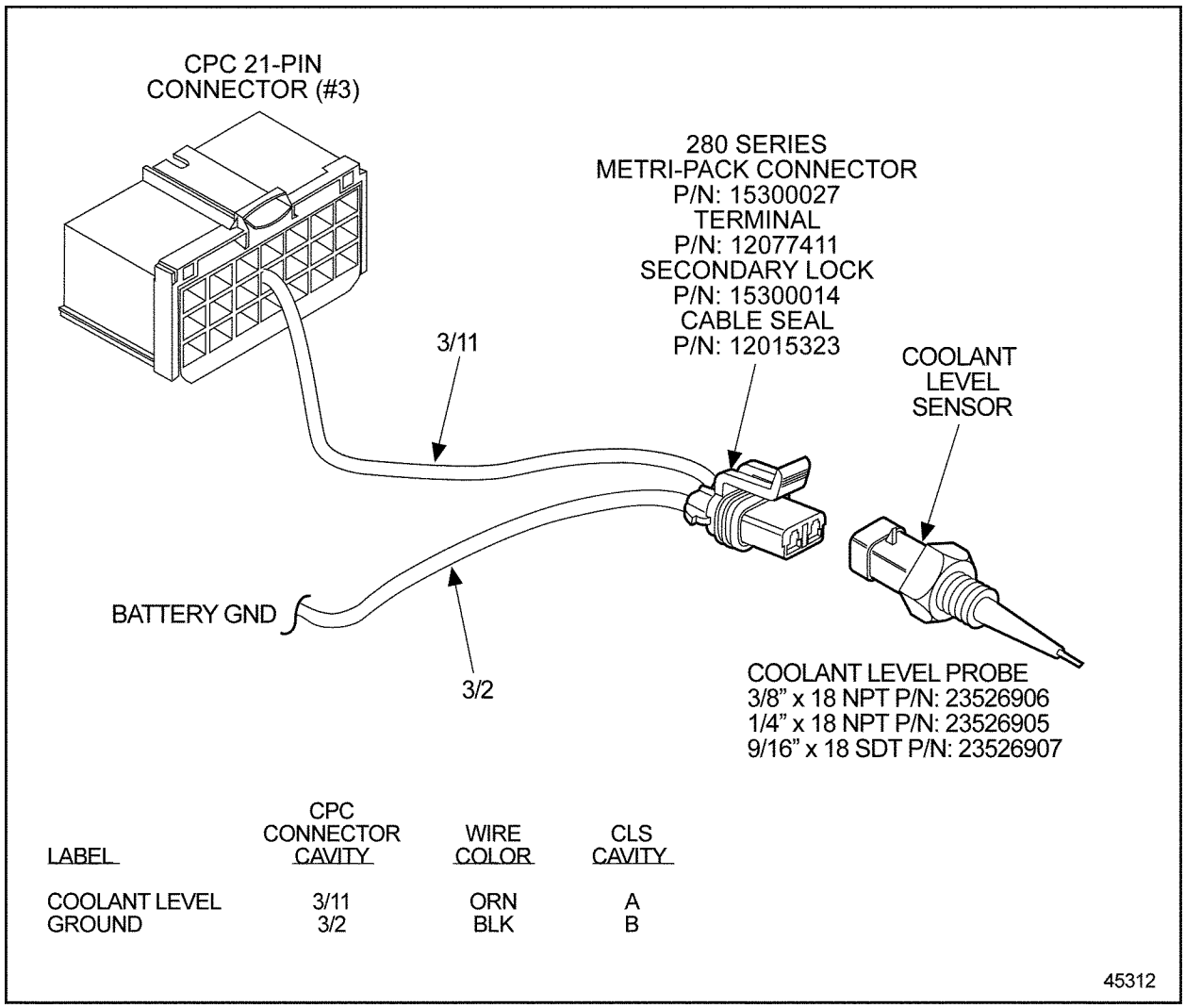

Figure 25-3 Engine Coolant Level Sensor Installation for CPC

[a] If voltage is about 5 volts, replace ECL sensor. Refer to section 25.2.1.1.

[b] If voltage is the same as battery voltage, repair short to wire in ECL Sensor wire 3/11. Refer to section 25.2.1.1.

[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 25.2.1.1.

[b] If fault 111/4 is active, repair open circuit in ECL Sensor wire 3/2. Refer to section 25.2.1.1.

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25.2.1.1 Verify Repairs

Verify repairs as follows:

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.

25.3 SPN 111/FMI 4

This fault is typically a short to ground.

25.3.1 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.

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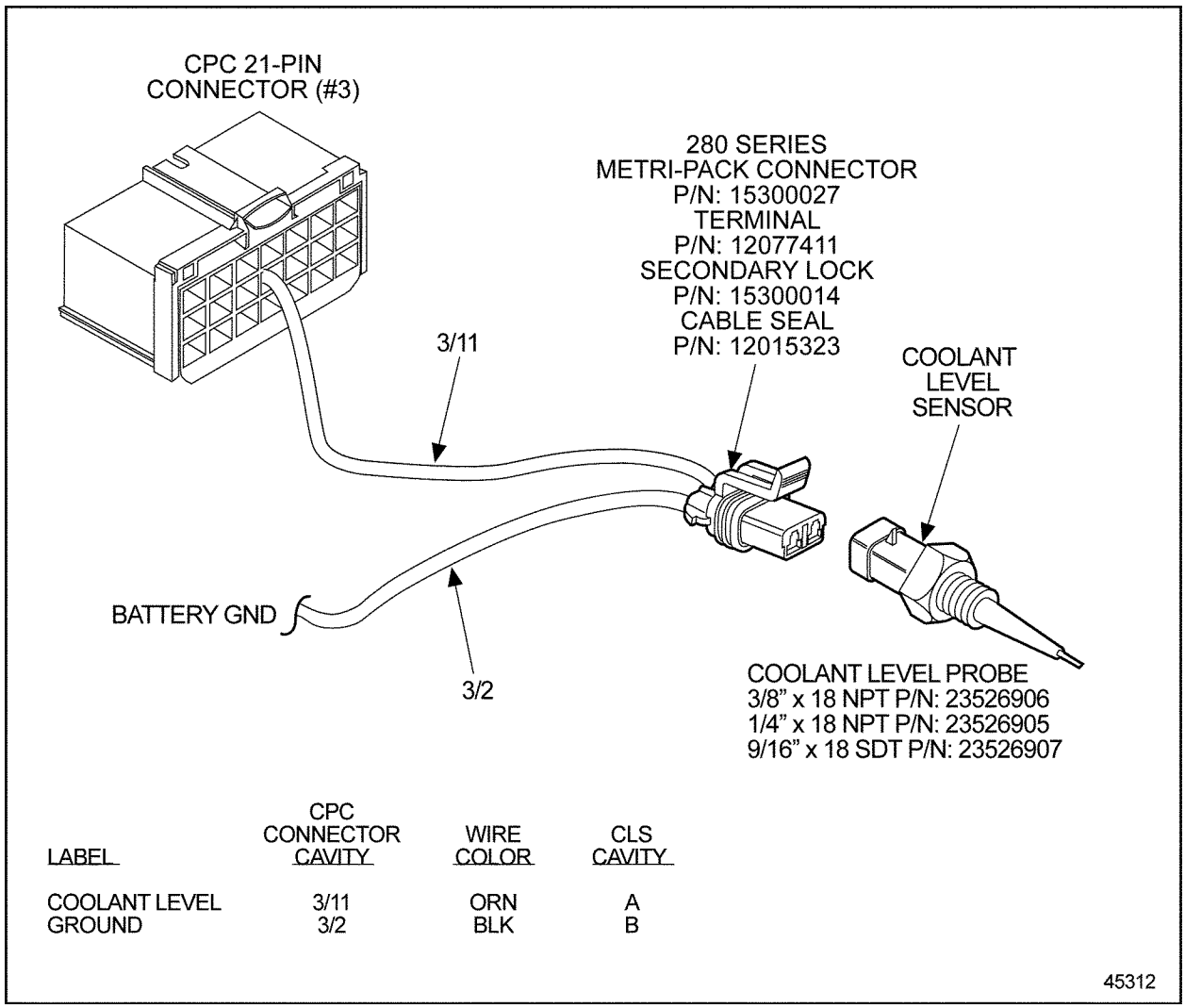
2. Disconnect the ECL Sensor. See Figure 25-4.



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

Figure 25-4 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 25.3.1.1.

   [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 25.3.1.1.

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[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 25.3.1.1.
   [b] If the resistance is greater than 5 Ω, review steps 25.3.1.1 through 6. If the results are the same, call the Detroit Diesel Customer Support Center (313–592–5800).

25.3.1.1 Verify Repairs

Verify repairs as follows:

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.

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26 SPN 158 — BATTERY CHARGING FAULT

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26.2 SPN 158/FMI 1 26-4
26.3 SPN 158/FMI 2 26-6

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26.1 SPN 158/FMI 0

The diagnostic condition is typically high system voltage.

26.1.1 Battery High Voltage Check

Check 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 26.1.1.1.

26.1.1.1 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 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).

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26.2 SPN 158/FMI 1

The diagnostic condition is typically low system voltage.

26.2.1 Battery Voltage Switched – Low

Check as follows:

1. Turn the ignition ON (key ON, engine OFF).
2. Measure the voltage across the battery terminals. See Figure 26-1.

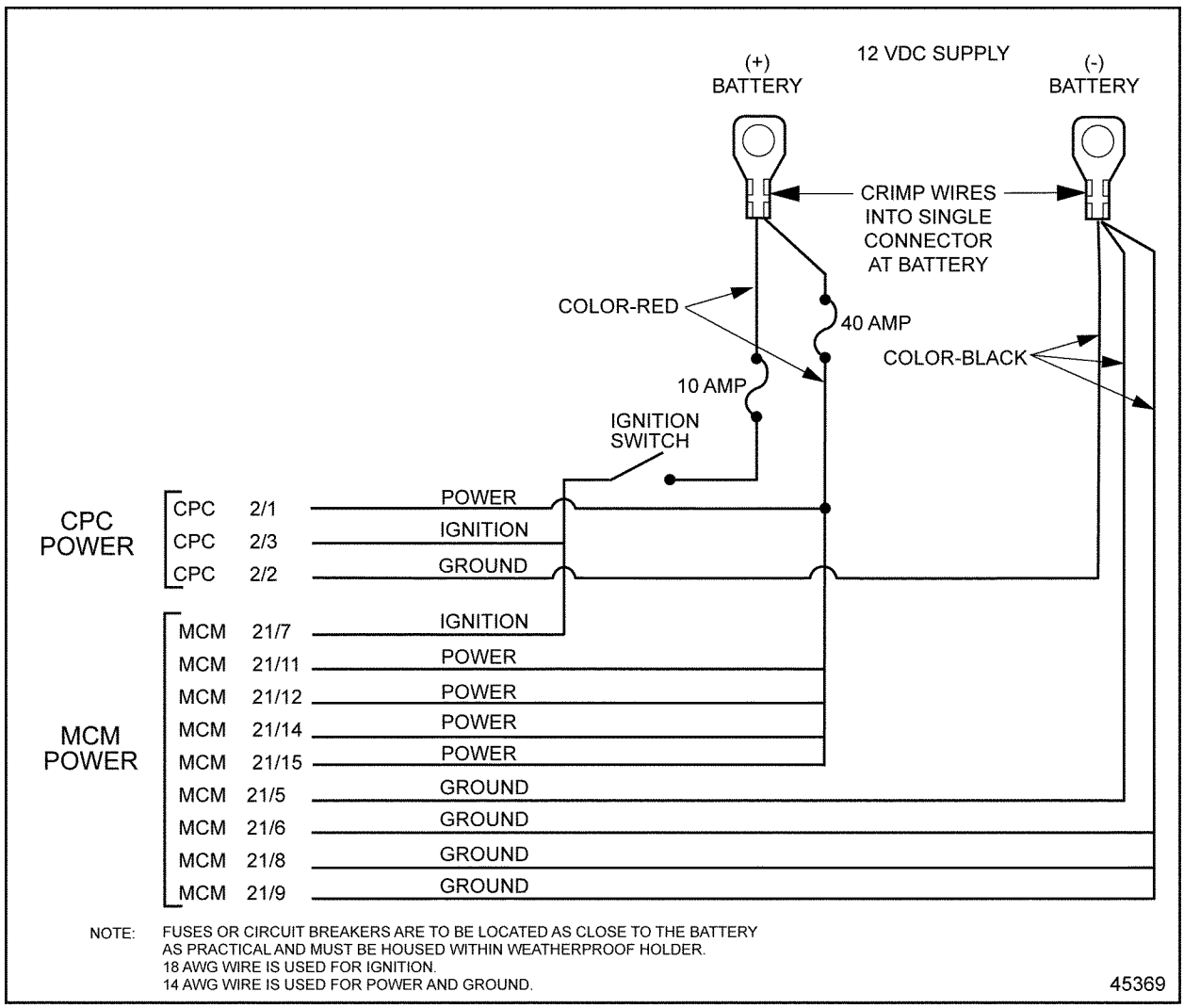

Figure 26-1 Power Wiring

[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.

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3. Measure the voltage between pins 2/2 and 2/3 of the CPC #2 connector (18-pin). See Figure 26-1.
   [a] If the voltage is between 11.0 and 16 V, replace the CPC. Refer to section 26.2.1.1.
   [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 26.2.1.1.
   [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 26.2.1.1.
   [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).

26.2.1.1 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 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).

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26.3 SPN 158/FMI 2

This diagnostic is typically unmatched MCM and CPC signals.

26.3.1 MCM and CPC Signals Check

Check as follows:

1. Check for multiple codes.
   [a] If fault codes 158/2 and 168/0 are both still active, refer to section 27.1.
   [b] If fault codes 158/2 and 158/1 are both still active, refer to section 26.2.1
   [c] If fault codes 158/2 and 158/0 are both still active, refer to section 26.1.1.
   [d] If fault codes 158/2 and 168/1 are both still active, refer to section 27.2.
   [e] If only fault code 158/2 is present, go to step 2.
2. Measure the difference in voltage inputs between the CPC and the MCM. See Figure 26-2.
   [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.

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

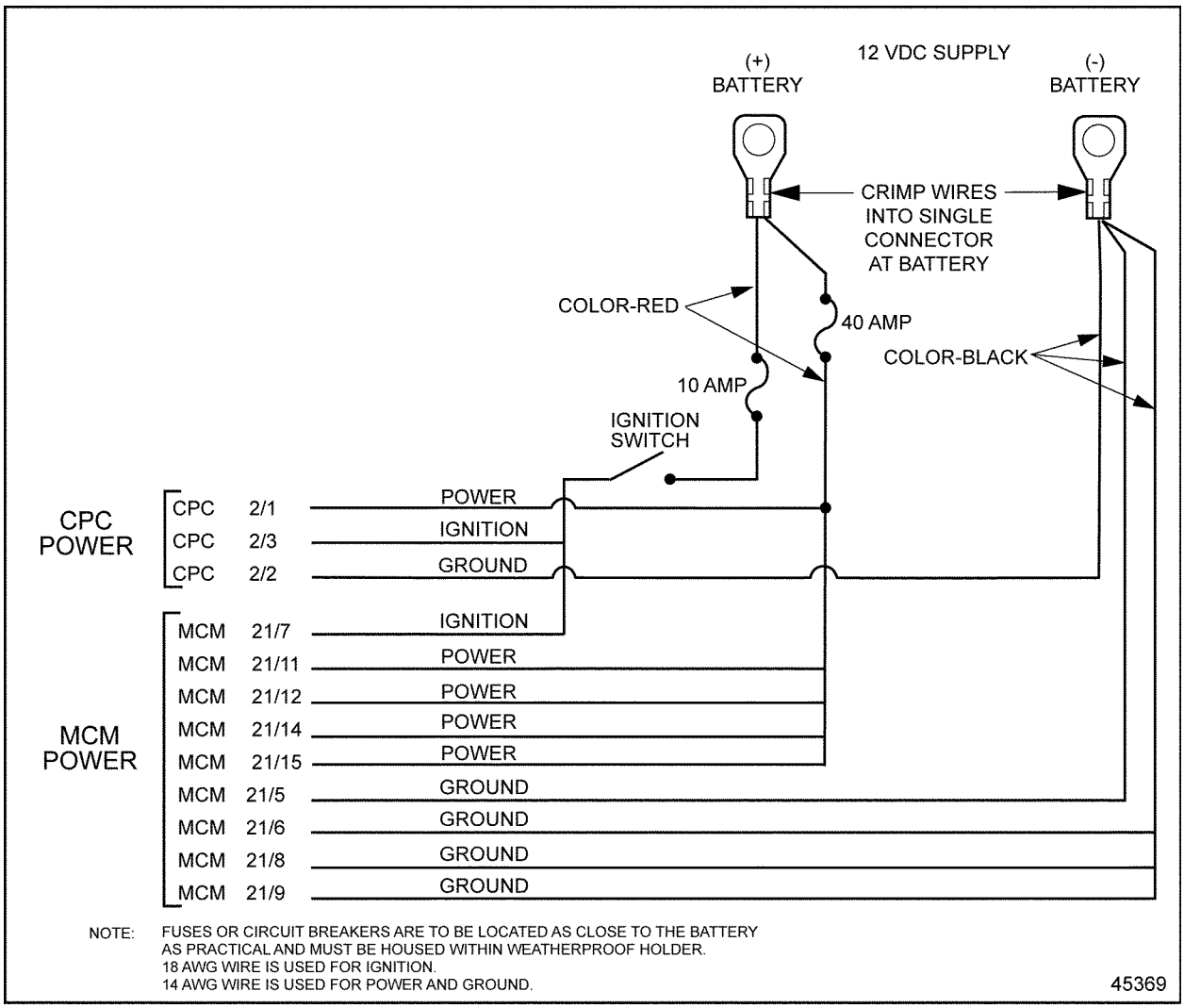

Figure 26-2 Power Wiring

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 26.3.1.1.
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 26.3.1.1.

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26.3.1.1 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 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).

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27 SPN 168 – BATTERY VOLTAGE OUTSIDE NORMAL OPERATING RANGE

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27.2 SPN 168/FMI 1 27-4

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27.1 SPN 168/FMI 0

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

27.1.1 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 27.1.1.1.

27.1.1.1 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).

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27.2 SPN 168/FMI 1

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

27.2.1 Check the Alternator and the Battery

Check 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 27.2.2.1.
   [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 27.2.2.1.
   [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 27.2.2.1.
   [b] If fault is still active, go to step 1.

27.2.2 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 27-1.
   [a] If resistance is greater than 0.5 Ω in any wire, repair or replace the wire and connector.Refer to section 27.2.2.1.

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

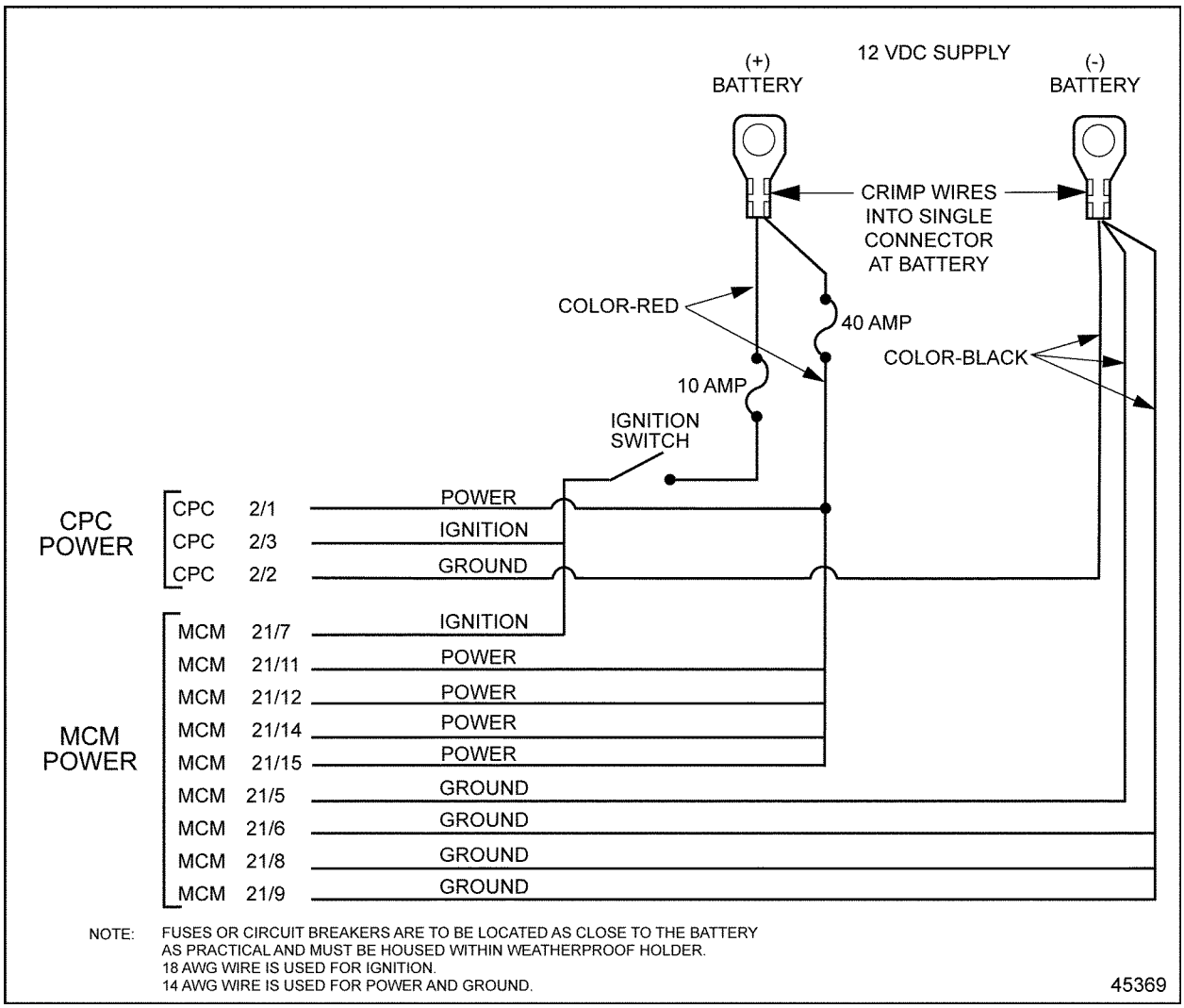

Figure 27-1 Power Wiring

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 27-1.

   [a] If resistance is greater than 0.5 Ω in any wire, repair or replace the power circuit wires and connector. Refer to section 27.2.2.1.

   [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 27-1.

   [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 27.2.2.1.

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

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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 27-1
   [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 27.2.2.1.
   [b] If the current drop is more than 0.2 volts in any wire, refer to section 27.2.2.1.

27.2.2.1 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).

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28 SPN 174 – SUPPLY FUEL TEMPERATURE FAULT

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28.2 SPN 174/FMI 4 28-5

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28.1 SPN 174/FMI 3

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

28.1.1 Open Circuit Check

Check 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 28.1.1.1.
   [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 28-1.

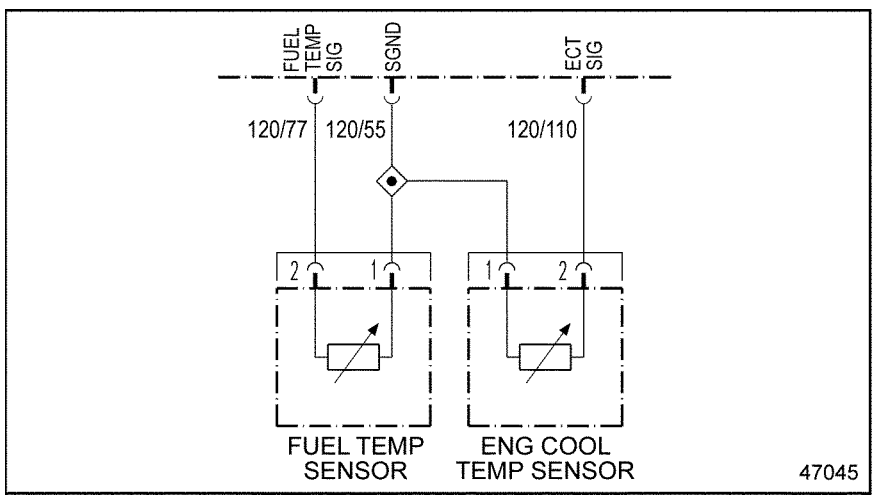

Figure 28-1 Supply Fuel Temperature Sensor

   [a] If the resistance is greater than 4k Ω, replace SFT Sensor. Refer to section 28.1.1.1.
   [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 28-2. Refer to section 28.1.1.1.

[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 28-2. Refer to section 28.1.1.1.

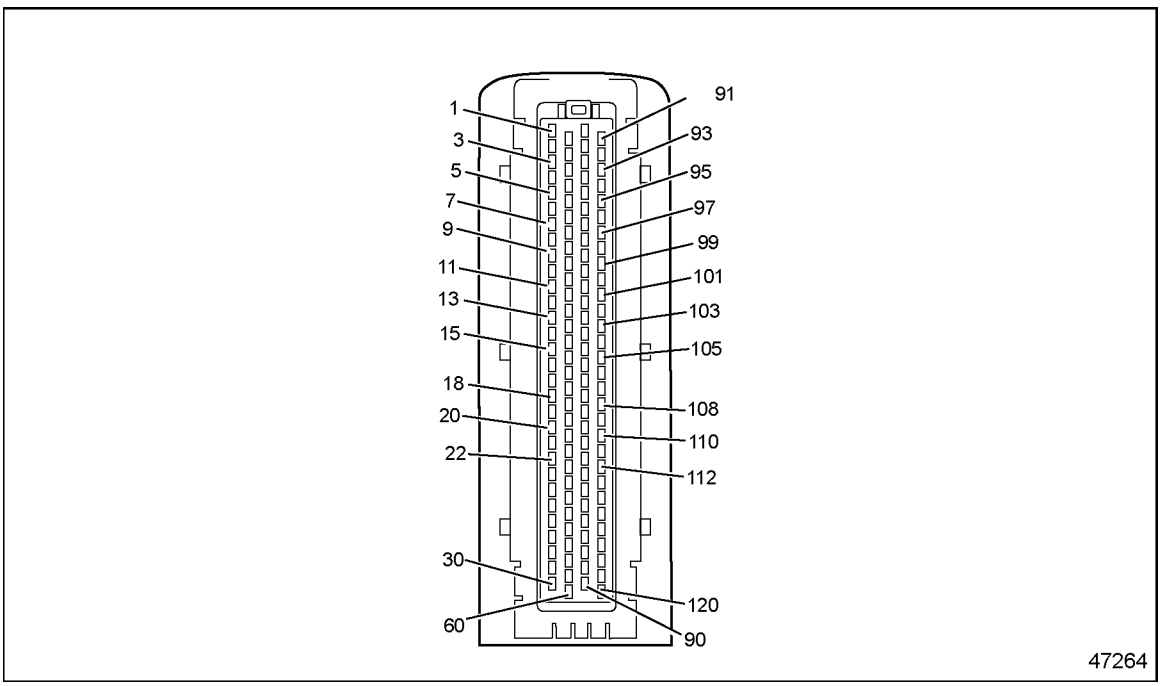

Figure 28-2 MCM 120–pin Connector

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 28.1.1.1.

   [b] If the resistance is greater than 5 Ω, replace the sensor. Refer to section 28.1.1.1.

28.1.1.1 Verify Repairs

Verify repairs as follows:

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.

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[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.

28.2 SPN 174/FMI 4

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

28.2.1 Short to Ground Check

Check as follows:

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 28.2.1.1.
   [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 28-3.

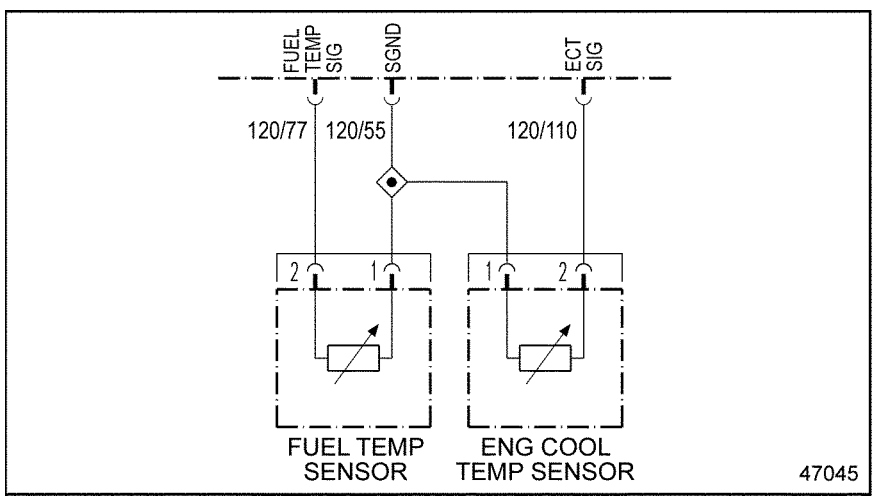

Figure 28-3 Supply Fuel Temperature Sensor

[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 28.2.1.1.

[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.

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[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 28.2.1.1.

[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).

28.2.1.1 Verify Repairs

Verify repairs as follows:

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.

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29 SPN 175 – ENGINE OIL TEMPERATURE OUTSIDE NORMAL RANGE

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29.3 SPN 175/FMI 4 29-5

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29.1 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.

29.1.1 Rationality Check for Temperature Drift

Check 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 Temperature 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 29.1.1.1.

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 Temperature 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 29.1.1.1.

29.1.1.1 Verify Repairs

Verify repairs as follows:

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.

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[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).

29.2 SPN 175/FMI 3

This diagnosis is typically engine oil temperature short to power.

29.2.1 Check for Open Short to Power

Check as follows:

1. Check for multiple codes..
   [a] If codes 110/3, 174/3 and 175/3 are active at the same time, repair the open between pin 55 of the 120–pin MCM connector and associated sensors. Refer to section 29.2.1.1.
   [b] If only fault 175/3 is active, go to step 2.
2. Disconnect the Engine Oil Temperature Sensor.
3. Measure the resistance between pins 1 and 2 of the Engine Oil Temperature Sensor.
   [a] If the resistance is greater than 4k Ω, replace the Engine Oil Temperature Sensor. Refer to section 29.2.1.1.
   [b] If he 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 Engine Oil Temperature Sensor harness connector.
   [a] If the voltage is between 2.5 and 3 volts, refer to section 29.2.1.1.
   [b] If the voltage is less than 2.5 volts, go to step 6.
6. Measure the voltage between pin 2 of the Engine Oil Temperature Sensor harness connector and ground.
   [a] If the voltage is between 2.5 and 3 volts, repair the open circuit between pin 55 of the 120–pin MCM connector and pin 1 of the Engine Oil Temperature Sensor harness connector. Refer to section 29.2.1.1.
   [b] If the voltage is less than 2.5 volts, repair the open circuit between pin 108 of the 120–pin MCM connector and pin 2 of the Engine Oil Temperature Sensor harness connector. Refer to section 29.2.1.1.

29.2.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF and reconnect all connectors.

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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).

29.3 SPN 175/FMI 4

This diagnosis is typically oil temperature sensor open short to ground.

29.3.1 Check for Short to Ground

Check as follows:

1. Disconnect the Engine Oil Temperature Sensor.
2. Disconnect the 120–pin MCM connector.
3. Measure the resistance between pins 1 and 2 of the Engine Oil Temperature Sensor connector.
   [a] If the resistance is greater than 5Ω, go to step 4.
   [b] If the resistance is less than 5Ω, repair the short between pins 55 and 108 of 120–pin MCM connector. See Figure 29-1. Refer to section 29.3.1.1.

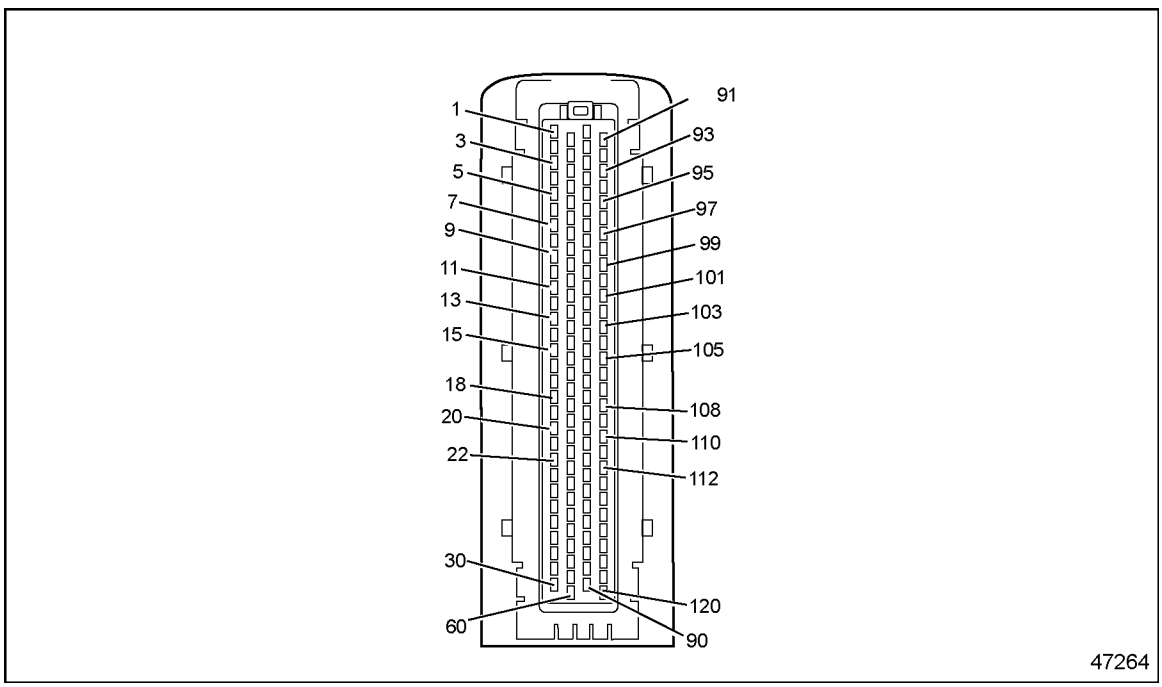

Figure 29-1 120–pin MCM Connector

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4. Measure the resistance between pin 1 of the Engine Oil Temperature Sensor connector and ground.
   [a] If the resistance is greater than 5Ω, go to step 5.
   [b] If the resistance is less than 5Ω, repair the short circuit between pin 1 of the Engine Oil Temperature Sensor connector and chassis ground. Refer to section 29.3.1.1.
5. Measure the resistance between pin 2 of the Engine Oil Temperature Sensor connector and ground.
   [a] If the resistance is greater than 5Ω, repeat steps 3 through 5. If the results are the same, call the Detroit Diesel Customer Support Center (313–592–5800).
   [b] If the resistance is less than 5Ω, repair the short circuit between pin 2 of the Engine Oil Temperature Sensor harness connector and ground. Refer to section 29.3.1.1.

29.3.1.1 Verify Repairs

Verify repairs as follows:

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).

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30 SPN 411 — EGR DIFFERENTIAL PRESSURE OR INTAKE AIR DELTA P SENSOR CIRCUIT OUTSIDE OF NORMAL OPERATING RANGE

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30.3 SPN 411/FMI 3 30-6
30.4 SPN 411/FMI 4 30-7

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30.1 SPN 411/FMI 0

This diagnosis is typically EGR differential pressure failed high.

30.1.1 Check for Coolant Loss and Multiple Codes

Check 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 30.1.2.

30.1.2 Check EGR Components

Check as follows:

1. Connect DDDL 7.0 and monitor the coolant temperature, Intake Air 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 Intake Air 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 30.1.1 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 30.1.2.1.
   [b] If OK, go to step 7.
7. Disconnect the Intake Air Delta P Sensor and inspect the EGR venturi tubes for blockage.
   [a] If the tubes are blocked, clean them. Refer to section 30.1.2.1.
   [b] If the tubes are not blocked, replace the Intake Air Delta P Sensor. Refer to section 30.1.2.1.

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30.1.2.1 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 411/0 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).

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30.2 SPN 411/FMI 1

This diagnosis is typically EGR differential pressure failed low.

30.2.1 Check for Multiple Codes

Check 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, refer to section 30.2.2.

30.2.2 Check EGR Components

Check as follows:

1. Using DDDL 7.0, monitor the coolant temperature, Intake Air Delta P, EGR PW, EGR valve position and EGR temperature.
2. Idle the engine with the EGR PW less than 3% and the EGR position less than 5% (NO EGR FLOW COMMANDED).
3. Is the Intake Air 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 30.2.2.1.
   [b] If no, go to step 4.
4. Turn the engine OFF.
5. Disconnect the Intake Air Delta P Sensor and inspect the EGR tubes for blockage.
   [a] If the tubes are blocked, clean them. Refer to section 30.2.2.1.
   [b] If the tubes are not blocked, replace the Intake Air Delta P Sensor. Refer to section 30.2.2.1

30.2.2.1 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.

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[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).

30.3 SPN 411/FMI 3

This diagnosis is typically Intake Air Delta P Sensor short circuit.

30.3.1 Check for Short

Check as follows:

1. Disconnect the Intake Air Delta P Sensor.
2. Disconnect the 120–pin MCM connector.
3. Measure the resistance across pins 1 and 3of the Intake Air Delta P Sensor. See Figure 30-1.

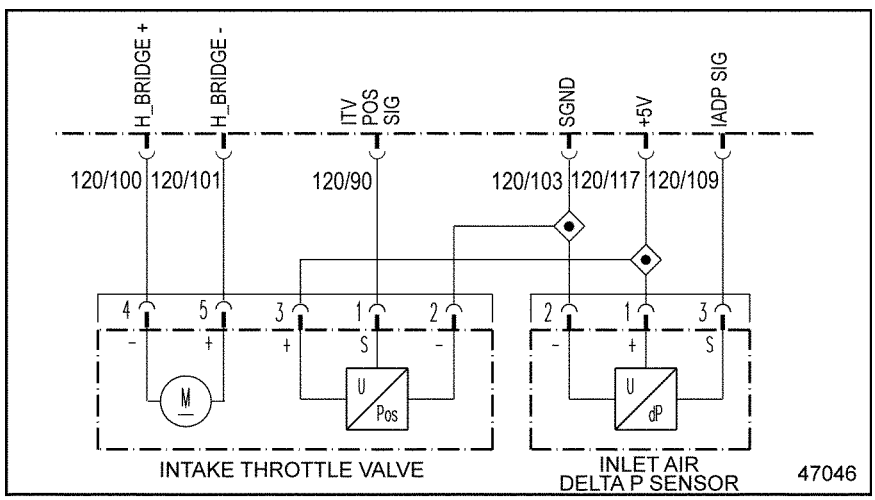

Figure 30-1 Intake Air Delta P Sensor

[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 30.3.1.1.

[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 30.3.1.1.

30.3.1.1 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

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[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).

30.4 SPN 411/FMI 4

This diagnosis is typically Intake Air Delta P Sensor open circuit.

30.4.1 Check for Open Circuit

Check for a short as follows:

1. Disconnect the Intake Air Delta P Sensor.
2. Measure the resistance across pins 1 and 3 of the Intake Air Delta P Sensor. See Figure 30-2.

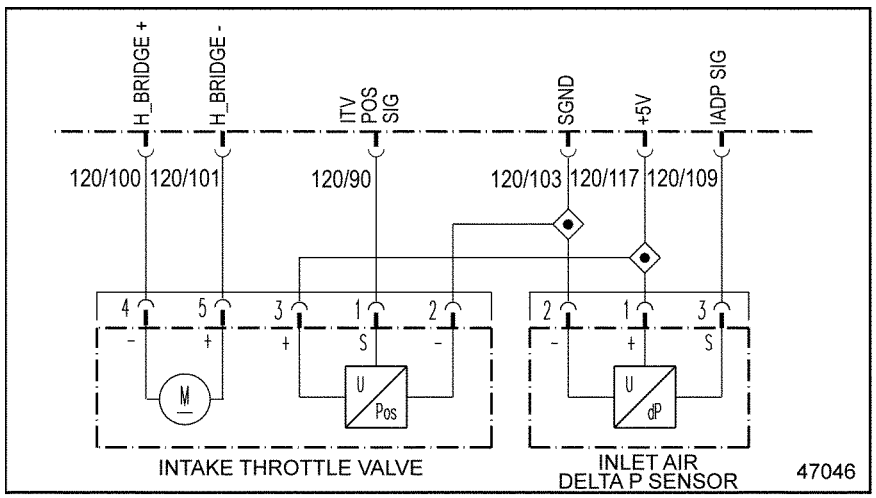

Figure 30-2

[a] If the resistance is greater than 130 kΩ, replace the Intake Air Delta P Sensor. Refer to section 30.4.1.1.

[b] If the resistance is less than 130 kΩ, go to step 3.

3. Measure the resistance between pins 1 and 2 of the Intake Air Delta P Sensor.

[a] If the resistance is greater than 130 kΩ, replace the Intake Air Delta P Sensor. Refer to section 30.4.1.1.

[b] If the resistance is less than 130 kΩ,, go to step 4.

4. Turn the ignition ON (key ON, engine OFF).
5. Measure the voltage between pins 1 and 3 of the Intake Air 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 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 3 of the Intake Air Delta P Sensor harness connector and pin 109 of the 120–pin MCM connector. Refer to section 30.4.1.1.

   [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 30.4.1.1.

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 Intake Air 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 Intake Air Delta P Sensor harness connector and pins 117 and 109 of the 120–pin MCM connector. Refer to section 30.3.1.1.

   [b] If the resistance is greater than 5 Ω, go to step 10.

10. Measure the resistance across pins 2 and 3 of the Intake Air 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 30.3.1.1

    [b] If the resistance is greater than 5 Ω, go to step 11.

11. Measure the resistance between pin 1of the Intake Air 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 30.3.1.1.

    [b] If the resistance is greater than 5 Ω, go to step 12.

12. Measure the resistance between pin 3 of the Intake Air 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 30.4.1.1.

    [b] If the resistance is greater than 5 Ω, repair the open circuit between pin 3 of the Intake Air Delta P Sensor harness connector and pin 109 of the 120–pin MCM connector. Refer to section 30.4.1.1.

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30.4.1.1 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).

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31 SPN 558 - IDLE VALIDATION SWITCH

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31.3 SPN 558/FMI 4 31-5

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31.1 SPN 558/FMI 1

This fault is a typically incorrect wiring of the Idle Validation Switch (IVS).

31.1.1 Idle Validation Switch Wiring Check

Check as follows:

1. Connect the diagnostic tool
2. Turn ignition ON (key ON, engine OFF).
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).

31.2 SPN 558/FMI 3

This diagnostic condition is typically an open circuit.

31.2.1 Open Circuit Check

Check 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 31.2.1.1.
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 31.2.1.1.
   [b] If the resistance is less than 5Ω, replace the Idle Validation Switch. Refer to section 31.2.1.1.

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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 31.2.1.1.
   [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 31.2.1.1.

31.2.1.1 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).

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31.3 SPN 558/FMI 4

This diagnostic condition is typically a short to ground.

31.3.1 Short to Ground Check

Check as follows:

1. Disconnect the Idle Validation Switch. See Figure 31-1.

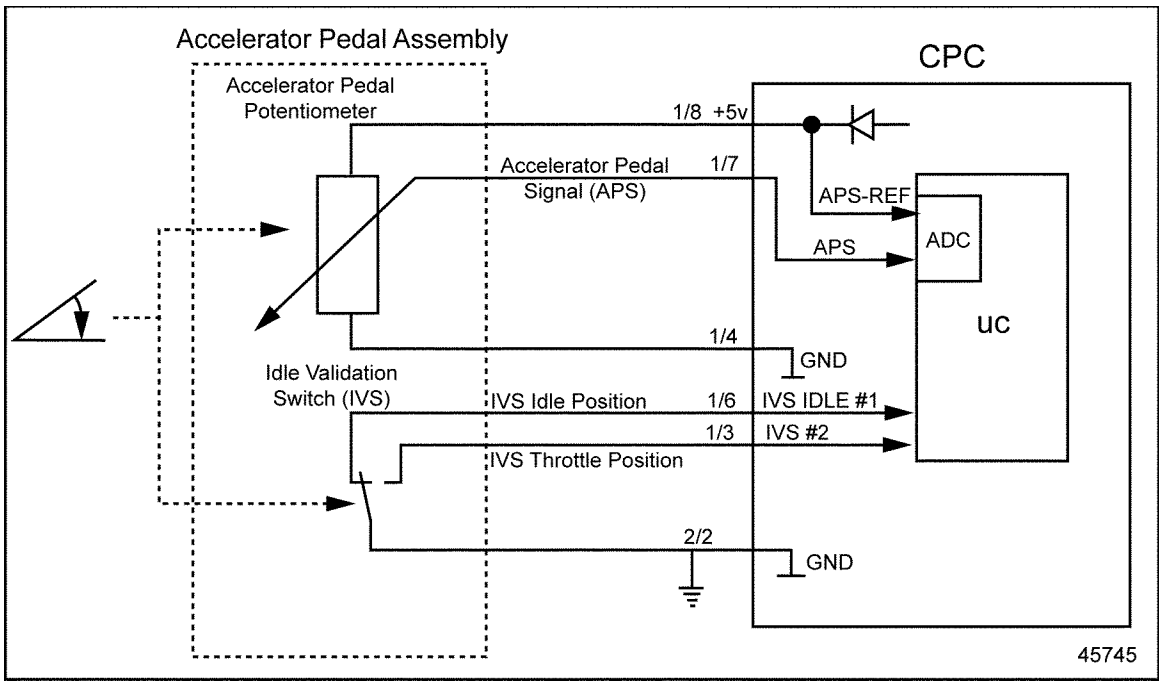

Figure 31-1 Idle Validation Switch, Part of the Accelerator Pedal Assembly

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 31.3.1.1.
   [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 31.3.1.1.
   [b] If the resistance is greater than 5 Ω, replace the Idle Validation Switch.

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31.3.1.1 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).

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32 SPN 599 - CRUISE CONTROL SWITCHES NOT FUNCTIONING PROPERLY

Section **Page**

32.1 SPN 599/FMI 12 32-3

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32.1 SPN 599/FMI 12

This diagnosis is typically both Cruise Control switches, SET and RES, are shorted to ground.

32.1.1 Short to Ground Check

Check 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 32.1.1.1.
   [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 32.1.1.1.
4. Unplug the SET Cruise Control Switch.
   [a] If SET status is no longer displayed, replace the Cruise Control SET Switch. Refer to section 32.1.1.1.
   [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 32.1.1.1.

32.1.1.1 Verify Repairs

Verify repairs as follows:

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).

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33 SPN 601 - CRUISE CONTROL SWITCHES NOT FUNCTIONING PROPERLY

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33.1 SPN 601/FMI 12 33-3

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33.1 SPN 601/FMI 12

This diagnosis is typically both Cruise Control switches, SET and RES, are shorted to ground.

33.1.1 Short to Ground

Check 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 33.1.1.1.
   [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 33.1.1.1.
4. Unplug the SET Cruise Control Switch.
   [a] If SET status is no longer displayed, replace the Cruise Control SET Switch. Refer to section 33.1.1.1.
   [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 33.1.1.1.

33.1.1.1 Verify Repairs

Verify repairs. as follows:

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).

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34 SPN 609 - MCM FAULT (ERRONEOUS DATA)

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34.2 SPN 609/FMI 14 34-4

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34.1 SPN 609/FMI 12

This diagnostic condition is typically MCM failed or programmed incorrectly.

34.1.1 MCM Parameter Check

Check 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.

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34.2 SPN 609/FMI 14

This diagnostic condition is typically MCM incorrectly programmed.

34.2.1 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.

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35 SPN 615 - ELECTROSTATIC OIL SEPARATOR OUTSIDE OF NORMAL OPERATING RANGE

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35.1 SPN 615/FMI 3 35-3

35.2 SPN 615/FMI 4 35-4

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35.1 SPN 615/FMI 3

This is typically a short to power.

35.1.1 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 35.1.1.1.
   [b] If only 615/3 is present, turn the ignition OFF and 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 35-1. Refer to section 35.1.1.1.

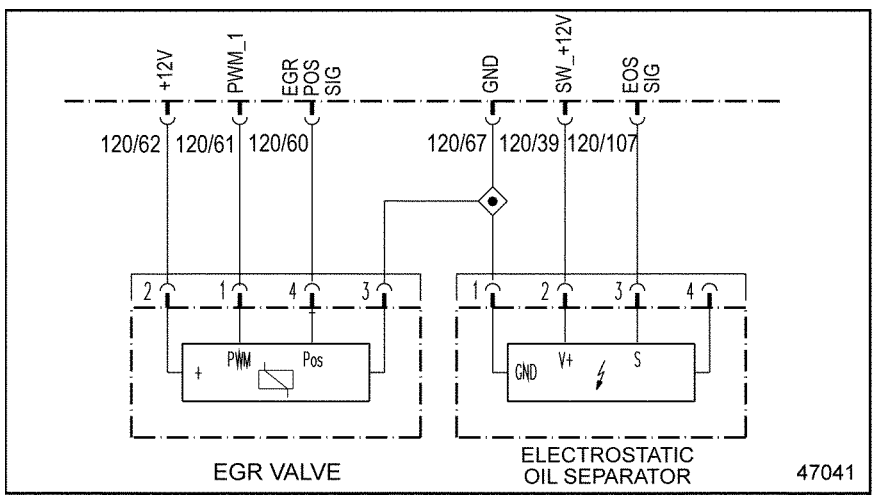

Figure 35-1 Electrostatic Oil Separator Wiring

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 35.1.1.1.

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[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 35.1.1.1.

35.1.1.1 Verify Repairs

Verify repairs as follows:

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).

35.2 SPN 615/FMI 4

This is typically an open/short to ground.

35.2.1 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 35-2. Refer to section 35.2.1.1.

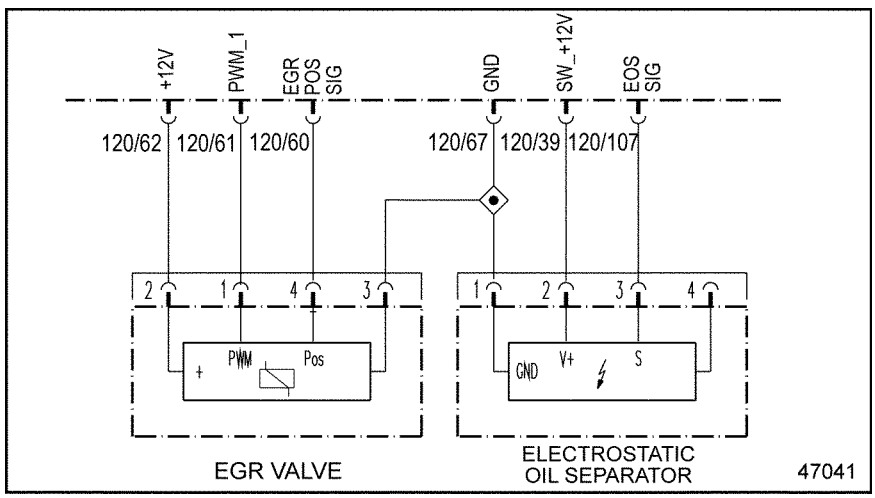

Figure 35-2 Electrostatic Oil Separator Wiring

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[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 35.2.1.1.
   [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 35.2.1.1.
   [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 35.2.1.1.

35.2.1.1 Verify Repairs

Verify repairs as follows:

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).

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36 SPN 615 - INTAKE AIR DELTA PRESSURE OUTSIDE OF NORMAL OPERATING RANGE

Section **Page**

36.1 SPN 615/FMI 3 36-3

36.2 SPN 615/FMI 4 36-5

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36.1 SPN 615/FMI 3

This diagnosis is typically an open circuit.

36.1.1 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 36-1. Refer to section 36.1.1.1.

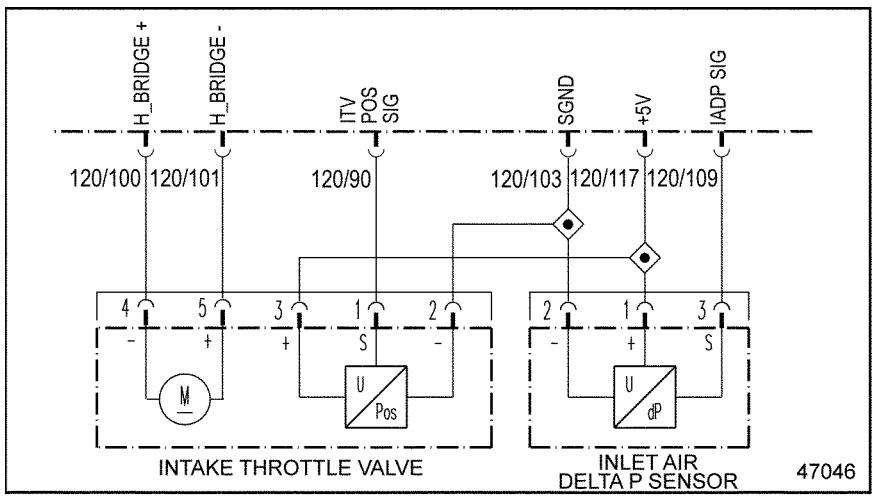

Figure 36-1 Intake Air Delta P Sensor

   [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.

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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 36-2. Refer to section 36.1.1.1.

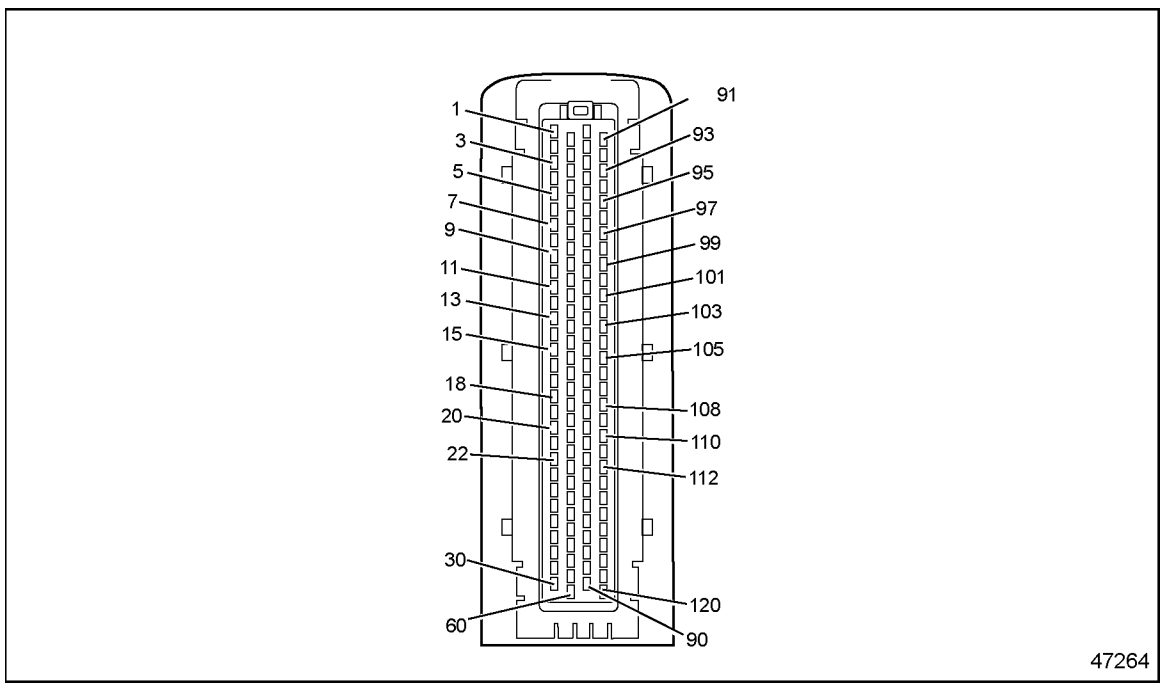

Figure 36-2 120–pin MCM Connector

   [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 36.1.1.1.

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 36.1.1.1.

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 36.1.1.1.

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[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).

36.1.1.1 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).

36.2 SPN 615/FMI 4

This diagnosis is typically a short to ground.

36.2.1 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 36-3.

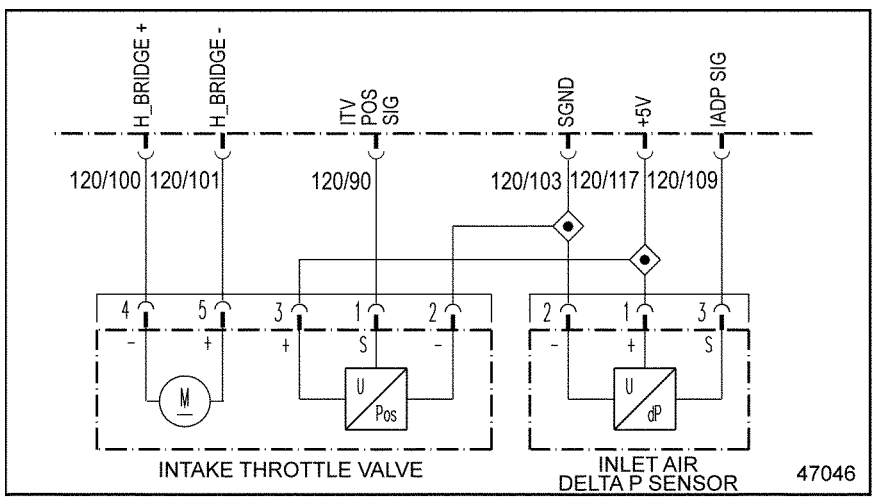

Figure 36-3 Intake Air Delta P Sensor

[a] If the resistance is less than 5Ω, repair the short between pins 117 and 103 of the 120–pin MCM connector. See Figure 36-4. Refer to section 36.2.1.1.

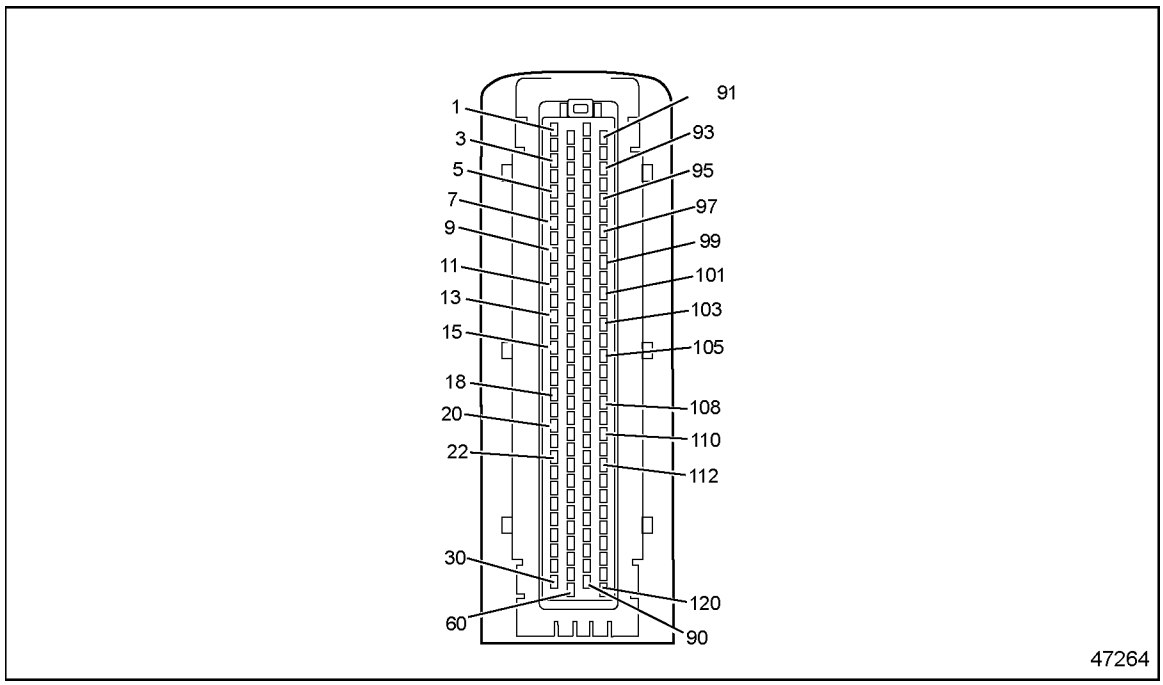

Figure 36-4 120–pin MCM Connector

[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 36.2.1.1.

   [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 36.2.1.1.

   [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 36.2.1.1.

   [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).

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36.2.1.1 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).

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37 SPN 625 - CAN FAULT

Section **Page**

37.1 SPN 625/FMI 2, 9, 10, 13, 14 37-3
37.2 SPN 625/FMI 4 37-5

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37.1 SPN 625/FMI 2, 9, 10, 13, 14

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.

37.1.1 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 37.1.1.1.
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 37.1.1.1.
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.

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[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 37.1.1.1.

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 37.1.1.1.

    [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 37.1.1.1.

    [b] If the resistance is less than 5 Ω, call the DDC Customer Support Center (313–592–5800).

37.1.1.1 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 625/2,9,10,13,14 is not logged but other codes are logged, troubleshoot the other codes.

    [c] If code 625/2,9,10,13,14 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313–592–5800).

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37.2 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.

37.2.1 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 37.2.1.1.
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 37.2.1.1.
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 37.2.1.1.
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 37.2.1.1.
   [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 37.2.1.1.
   [b] If the resistance is less than 5 Ω, call the DDC Customer Support Center (313–592–5800).

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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 625/4 is not logged but other codes are logged, troubleshoot the other codes.
   [c] If code 625/4 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313–592–5800).

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38 SPN 636 — CRANKSHAFT POSITION SENSOR OUTSIDE OF NORMAL OPERATING CONDITIONS

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38.1 SPN 636/FMI 1

The diagnostic condition is typically CKP Sensor Signal Voltage Too Low.

38.1.1 Low Signal Voltage Check

Check 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 38-1.

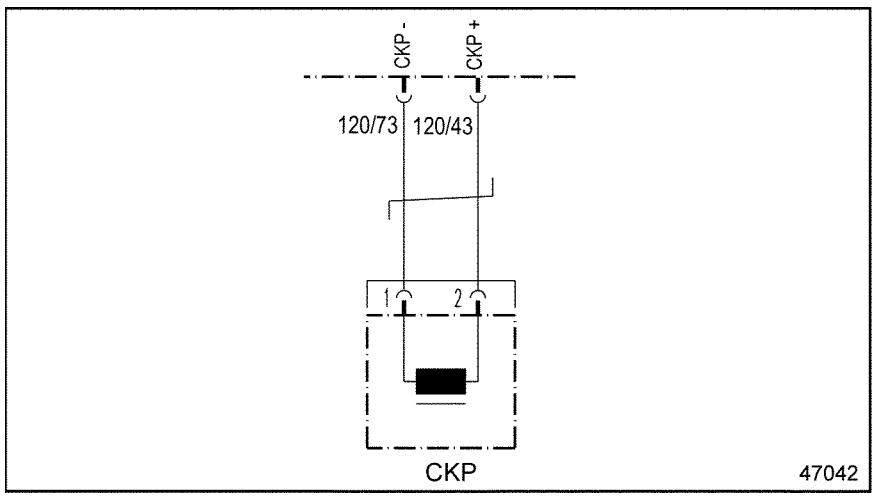

Figure 38-1 Crankshaft Position Sensor Wiring

   [a] If wires are not correctly wired, repair or replace wires as required. Refer to section 38.1.1.1.

   [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 38.1.1.1.

   [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 38.1.1.1.

   [b] If sthe flywheel is not out of position, go to step 4.

4. Check crankshaft axial play.

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[a] If axial play is not within specifications, repair or replace crankshaft thrust bearings, as required. Refer to section 38.1.1.1.

[b] If axial play is within specifications, replace the MCM. Refer to section 38.1.1.1.

38.1.1.1 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 636/1 is not logged, and other codes are logged, troubleshoot the logged codes.
   [c] If code 636/1 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).

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38.2 SPN 636/FMI 3

The diagnostic condition is typically CKP Sensor has an open circuit.

38.2.1 Open Circuit Check

Check as follows:

1. Disconnect the CKP Sensor.
2. Measure the resistance across pins 1 and 2 of the CKP Sensor. See Figure 38-2.

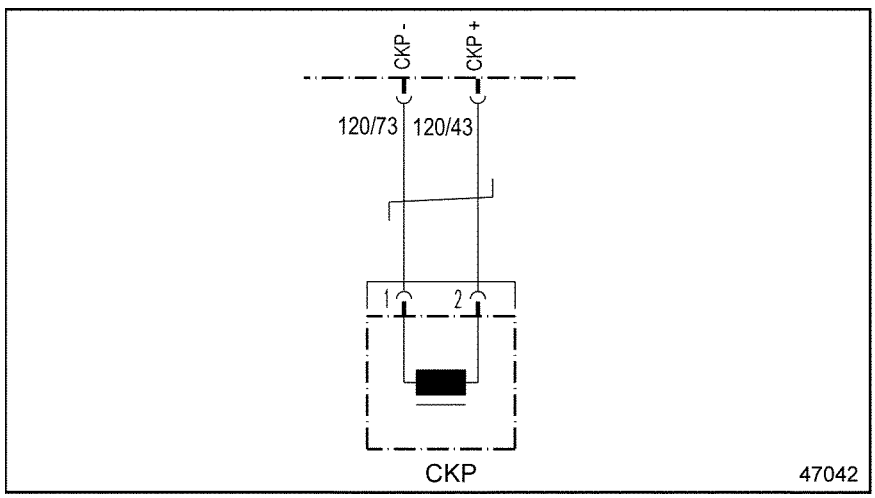

Figure 38-2 Crankshaft Position Sensor Wiring

   [a] If the resistance is greater than 140 Ω, replace CKP Sensor. Refer to section 38.2.2.1.

   [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 38.2.2.1.

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 38.2.2.1.

   [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 38.2.2.1.
   [b] If the resistance is less than 5 Ω, refer to section 38.2.2.

38.2.2 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 38.2.2.1. If the problem returns, the pulse wheel may be loose or bad or damaged.

38.2.2.1 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 636/3 is not logged, and other codes are logged, troubleshoot the logged codes.
   [c] If code 636/3 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).

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38.3 SPN 636/FMI 4

This diagnostic condition is typically the CKP Sensor shorted to ground.

38.3.1 Short to Ground Check

Check 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 38.3.1.1.
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 38.3.1.1.
4. Disconnect the 120–pin MCM connector.
5. Measure the resistance across pins 1 and 2 of the CKP Sensor harness connector. See Figure 38-3.

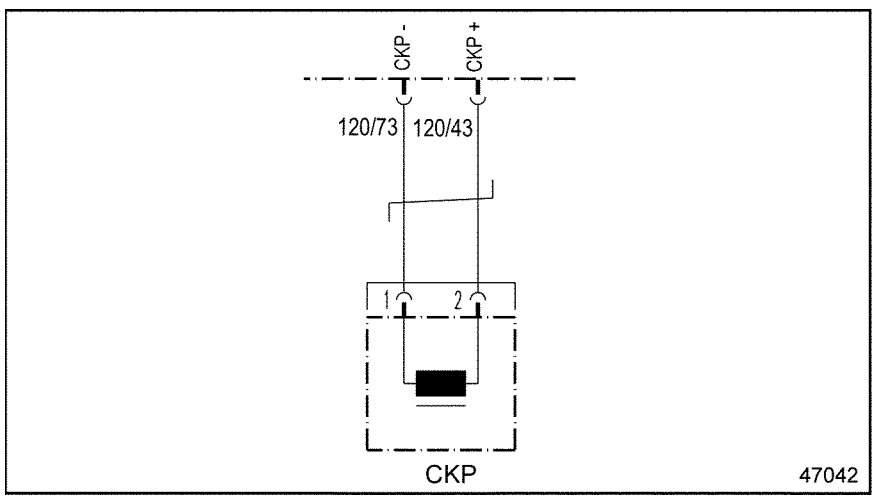

Figure 38-3 Crankshaft Position Sensor Wiring

   [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 38.3.1.1.
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 38.3.1.1.

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 38.3.1.1.

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38.3.1.1 Verify Repairs

Verify repairs ad 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 636/4 is not logged, and other codes are logged, troubleshoot the logged codes.
   [c] If code 636/4 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).

38.4 SPN 636/FMI 7

This diagnostic condition is typically camshaft and crankshaft signals not matching.

38.4.1 Camshaft and Crankshaft Signals Not Matching Check

Check 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 38.4.1.1.
   [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 38.4.1.1.
   [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 38.4.1.1.
   [b] If the sensor resistance is between 1000 Ω and 1385 Ω, go to step 7.

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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 38.4.1.1.
   [b] If the flywheel holes or slots are all present, go to step 8.
8. Replace the MCM. Refer to section 38.4.1.1.

38.4.1.1 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 636/7 is not logged, and other codes are logged, troubleshoot the logged codes.
   [c] If code 636/7 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).

38.5 SPN 636/FMI 8

The diagnostic condition is typically CKP Sensor Time Out.

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38.5.1 Sensor Time Out Check

Check as follows:

1. Plug in your diagnostic tool.
2. Turn ON ignition and start the engine.
3. Check for multiple codes.
   [a] If fault 636/3 is active in addition to fault 636/8 with the engine running, refer to section 38.2.1.
   [b] If fault 636/4 is active in addition to fault s 636/8 with the engine running, refer to section 38.3.1.
   [c] If only fault s 636/8 is active with the engine running, refer to section 38.5.1.
4. Check the CKP Sensor position.
   [a] If fault 636/8 is not active after checking position, replace CKP Sensor clamping sleeve. Refer to section 38.5.1.1.
   [b] If fault 636/8 is active after checking position, go to step 5.
5. Replace the Vehicle Speed Sensor.
   [a] If fault s 636/8 is not active, refer to section 38.5.1.1.
   [b] If fault s 636/8 is still active, go to step 6.
6. 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 38-4.

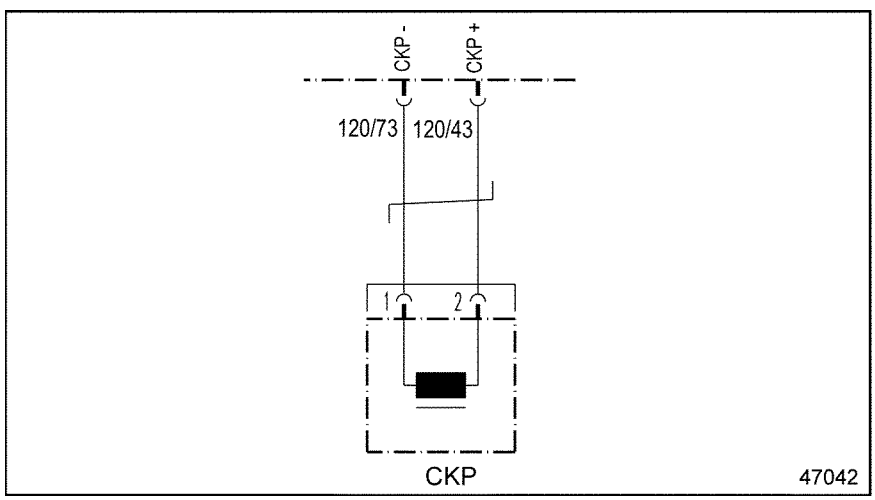

Figure 38-4 Crankshaft Position Sensor

   [b] If sensors are not out of position, go to step 7.

7. Check crankshaft axial play.

   [a] If axial play is not within specifications, repair or replace crankshaft thrust bearings, as required. Refer to section 38.5.1.1.

   [b] If axial play is within specifications, contact the Detroit Diesel Customer Support Center (313-592-5800).

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38.5.1.1 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 636/8 is not logged, and other codes are logged, troubleshoot the logged codes.
   [c] If code 636/8 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).

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39 SPN 651 – INJECTOR #1 NOT OPERATING NORMALLY

Section **Page**

39.1 SPN 651/FMI 5 39-3

39.2 SPN 651/FMI 10 39-5

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39.1 SPN 651/FMI 5

This diagnosis is typically the injector current is below normal or an open circuit fault.

39.1.1 Open Circuit Check

Check as follows:

1. Check for multiple codes.
   [a] If fault code 168/1 is active in addition to 651/5, service 168/1 first. Refer to section 27.2.
   [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 authorization.
   [c] If only fault code 651/5 is active, go to step 2.
2. Turn the ignition OFF.
3. Disconnect the Injector Harness 12–pin connector.
4. Measure the resistance between pins 1and 2 on the valve cover side of the connector. See Figure 39-1.

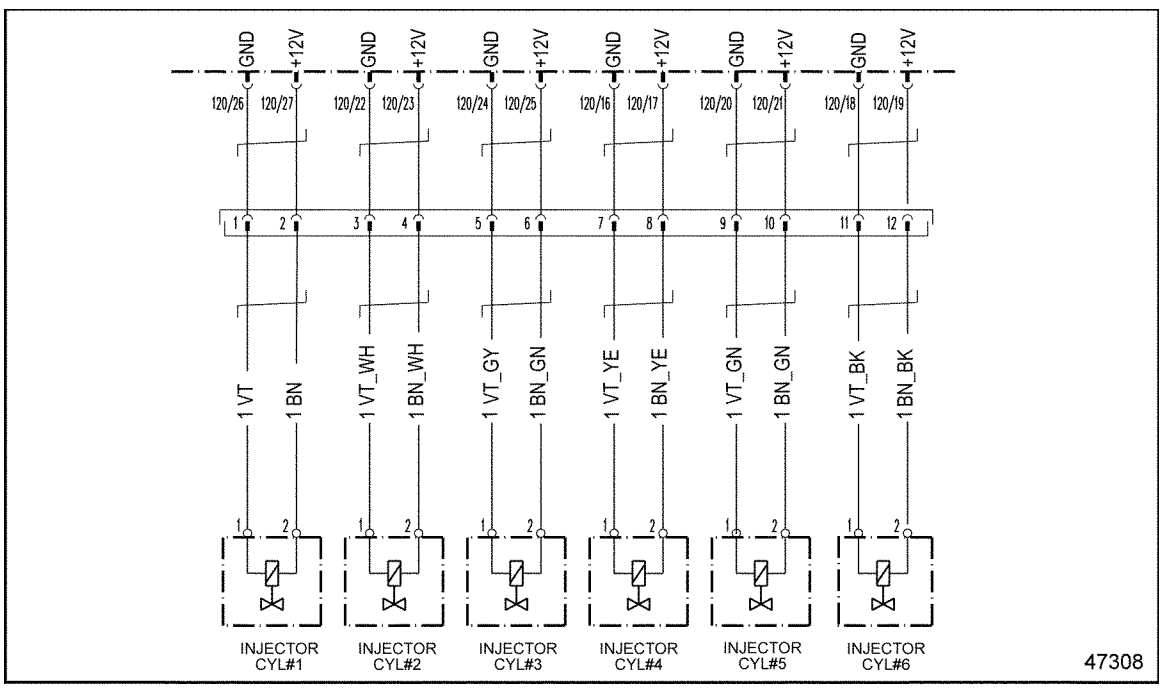

Figure 39-1 MBE 900 Injectors

   [a] If the resistance is less than 9Ω, go to step 9.
   [b] If the resistance is greater than 9Ω, go to step 5.
5. Remove valve cover

6. Disconnect the injector #1 connector.
7. Measure the resistance between pin 1 of the injector connector and pin 1 of the Injector Harness 12–pin connector.
   [a] If the resistance is less than 3Ω, go to step 8.
   [b] If the resistance is greater than 3Ω, repair the open between pin 1 of the injector connector and pin 1 of the Injector Harness 12–pin connector. Refer to section 39.1.1.1.
8. Measure the resistance between pin 2 of the injector connector and pin 2 of the Injector Harness 12–pin connector.
   [a] If the resistance is less than 3Ω, replace the #1 injector.
   [b] If the resistance is greater than 3Ω, repair the open between pin 2 of the injector connector and pin 2 of the Injector Harness 12–pin connector. Refer to section 39.1.1.1.
9. Turn the ignition On (key ON, engine OFF).
10. Measure the voltage between pins 1 and 2 on the engine side of the Injector Harness 12–pin connector.
    [a] If the voltage is less than 11.5 volts, go to step 11.
    [b] If the voltage is between 11.5 and 13.5 volts, repeat steps 2 through 10. If the results are the same, contact the Detroit Diesel Customer Support Center (313–592–5800).
11. Measure the voltage between pin 2 on the engine side of the Injector Harness 12–pin connector and ground.
    [a] If the voltage is less than 11.5 volts, repair the open between pin 2 on the engine side of the Injector Harness 12–pin connector and pin 27 of the 120–pin MCM connector. Refer to section 39.1.1.1.
    [b] If the voltage is between 11.5 and 13.5 volts, repair the open between pin 1 on the engine side of the Injector Harness 12–pin connector and pin 26 of the 120–pin MCM connector. Refer to section 39.1.1.1.

39.1.1.1 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.

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[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).

39.2 SPN 651/FMI 10

This diagnostic condition is typically a short to ground.

39.2.1 Short to Ground Check

Check as follows:

1. Turn the ignition OFF.
2. Disconnect the Injector Harness 12–pin connector.
3. Measure the resistance between pin 1 of injector #1 and ground on the valve cover side of the Injector Harness 12–pin connector. See Figure 39-2.

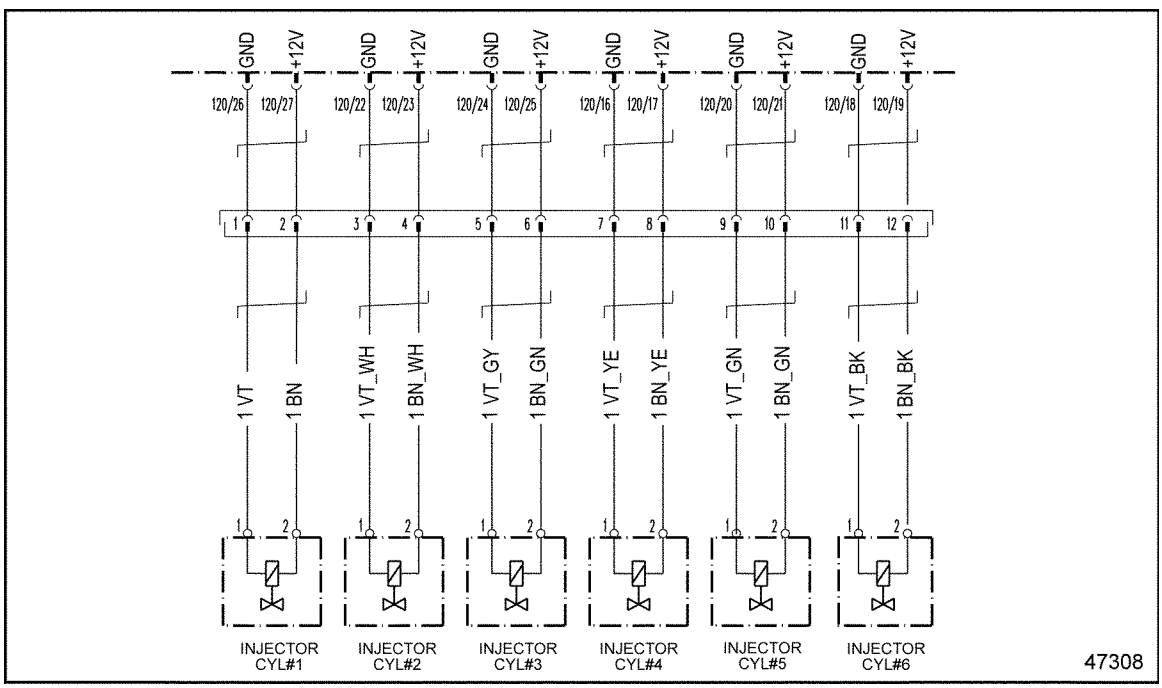

Figure 39-2 MBE 900 Injectors

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

[b] If the resistance is greater than 5 Ω, go to step 8.

4. Remove the valve cover.
5. Disconnect the Injector Harness from the injector.
6. Measure the resistance between pin 1 and ground on the valve cover side of the Injector Harness 12–pin connector.

[a] If the resistance is less than 5 Ω, repair the short to ground between pin 1 of the Injector Harness 12–pin connector and pin 1 of injector #1. Refer to section 39.2.1.1.

[b] If the resistance is greater than 5 Ω, go to step 7.

7. Measure the resistance between pin 1 of injector #1 and ground.

   [a] If the resistance is less than 5 Ω, replace the injector.

   [b] If the resistance is greater than 5 Ω, repair the short to ground between pin 2 of the Injector Harness 12–pin connector and pin 2 of injector #1. Refer to section 39.2.1.1.

8. Disconnect the 120–pin MCM connector.

9. Measure the resistance between pin 1 and ground on the engine side of the Injector Harness 12–pin connector.

   [a] If the resistance is less than 5 Ω, repair the short to ground between pin 1 of the Injector Harness 12–pin connector and pin 26 of the 120–pin MCM connector. Refer to section 39.2.1.1.

   [b] If the resistance is greater than 5 Ω, go to step 10.

10. Measure the resistance between pin 2 and ground on the engine side of the Injector Harness 12–pin connector.

    [a] If the resistance is less than 5 Ω, repair the short to ground between pin 2 of the Injector Harness 12–pin connector and pin 27 of the 120–pin MCM connector. Refer to section 39.2.1.1.

    [b] If the resistance is greater than 5 Ω, go to step 11

11. Clear the codes. Check for active codes.

    [a] If code 651/10 is still active, call the Detroit Diesel Customer Support Center (313–592–5800) for authorization to replace the MCM.

    [b] If there are no active codes, troubleshooting is finished.

39.2.1.1 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).

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40 SPN 652 – INJECTOR #2 NOT OPERATING NORMALLY

Section **Page**

40.1 SPN 652/FMI 5 40-3

40.2 SPN 652/FMI 10 40-5

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40.1 SPN 652/FMI 5

This diagnosis is typically the injector current is below normal or an open circuit fault.

40.1.1 Open Circuit Check

Check as follows:

1. Check for multiple codes.
   [a] If fault code 168/1 is active in addition to 652/5, service 168/1 first. Refer to section 27.2.
   [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 authorization.
   [c] If only fault code 652/5 is active, go to step 2.
2. Turn the ignition OFF.
3. Disconnect the Injector Harness 12–pin connector.
4. Measure the resistance between pins 3 and 4 on the valve cover side of the connector. See Figure 40-1.

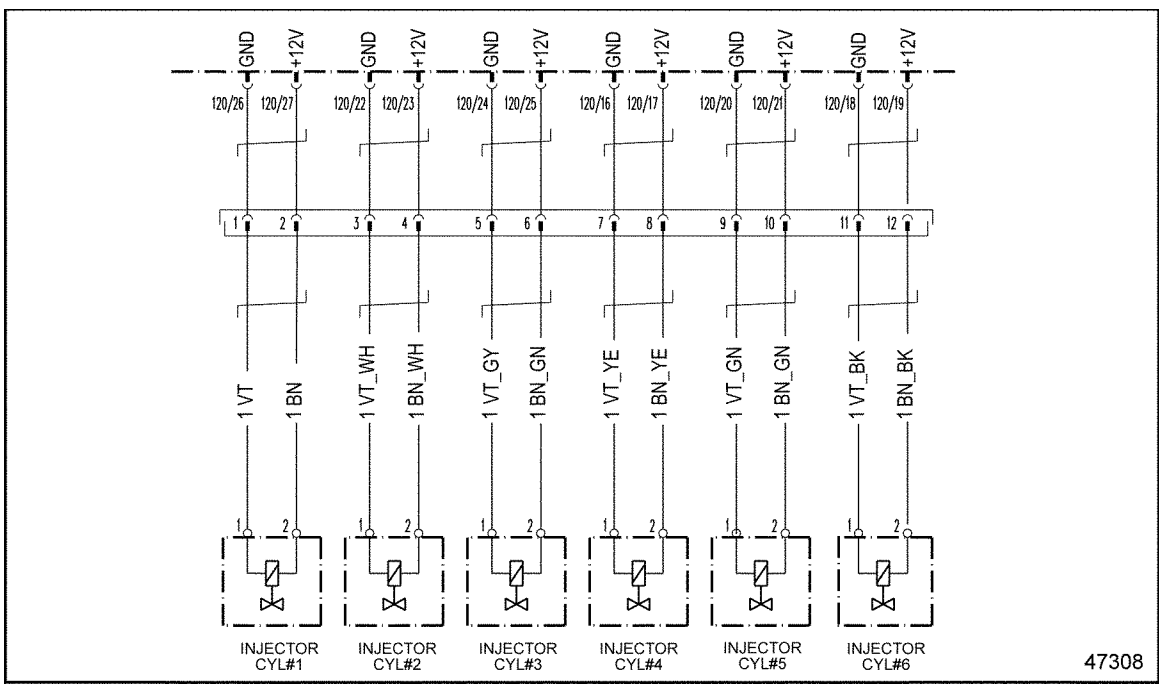

Figure 40-1 MBE 900 Injectors

   [a] If the resistance is less than 9Ω, go to step 9.
   [b] If the resistance is greater than 9Ω, go to step 5.
5. Remove valve cover

6. Disconnect the injector #2 connector.
7. Measure the resistance between pin 1 of the injector connector and pin 3 of the Injector Harness 12–pin connector.
   [a] If the resistance is less than 3Ω, go to step 8.
   [b] If the resistance is greater than 3Ω, repair the open between pin 1 of the injector connector and pin 3 of the Injector Harness 12–pin connector. Refer to section 40.1.1.1.
8. Measure the resistance between pin 2 of the injector connector and pin 4 of the Injector Harness 12–pin connector.
   [a] If the resistance is less than 3Ω, replace the #2 injector.
   [b] If the resistance is greater than 3Ω, repair the open between pin 2 of the injector connector and pin 4 of the Injector Harness 12–pin connector. Refer to section 40.1.1.1.
9. Turn the ignition ON (key ON, engine OFF).
10. Measure the voltage between pins 3 and 4 on the engine side of the Injector Harness 12–pin connector.
    [a] If the voltage is less than 11.5 volts, go to step 11.
    [b] If the voltage is between 11.5 and 13.5 volts, repeat steps 2 through 10. If the results are the same, contact the Detroit Diesel Customer Support Center (313–592–5800).
11. Measure the voltage between pin 4 on the engine side of the Injector Harness 12–pin connector and ground.
    [a] If the voltage is less than 11.5 volts, repair the open between pin 4 on the engine side of the Injector Harness 12–pin connector and pin 23 of the 120–pin MCM connector. Refer to section 40.1.1.1.
    [b] If the voltage is between 11.5 and 13.5 volts, repair the open between pin 3 on the engine side of the Injector Harness 12–pin connector and pin 22 of the 120–pin MCM connector. Refer to section 40.1.1.1.

40.1.1.1 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.

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[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).

40.2 SPN 652/FMI 10

This diagnostic condition is typically a short to ground.

40.2.1 Short to Ground Check

Check as follows:

1. Turn the ignition OFF.
2. Disconnect the Injector Harness 12–pin connector.
3. Measure the resistance between pin 3 of injector #2 and ground on the valve cover side of the Injector Harness 12–pin connector. See Figure 40-2.

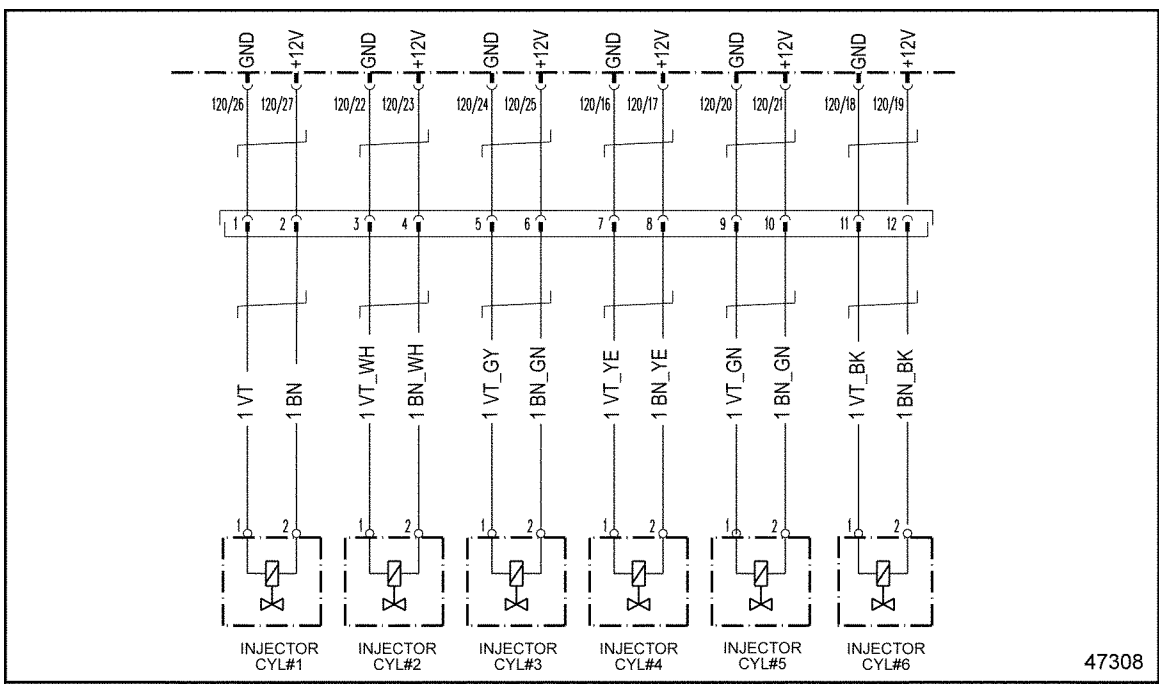

Figure 40-2 MBE 900 Injectors

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

[b] If the resistance is greater than 5 Ω, go to step 8.

4. Remove the valve cover.
5. Disconnect the Injector Harness from the injector.
6. Measure the resistance between pin 3 and ground on the valve cover side of the Injector Harness 12–pin connector.

[a] If the resistance is less than 5 Ω, repair the short to ground between pin 3 of the Injector Harness 12–pin connector and pin 1 of injector #2. Refer to section 40.2.1.1.

[b] If the resistance is greater than 5 Ω, go to step 7.

7. Measure the resistance between pin 1 of injector #2 and ground.

   [a] If the resistance is less than 5 Ω, replace the injector.

   [b] If the resistance is greater than 5 Ω, repair the short to ground between pin 4 of the Injector Harness 12–pin connector and pin 2 of injector #2. Refer to section 40.2.1.1.

8. Disconnect the 120–pin MCM connector.

9. Measure the resistance between pin 3 and ground on the engine side of the Injector Harness 12–pin connector.

   [a] If the resistance is less than 5 Ω, repair the short to ground between pin 3 of the Injector Harness 12–pin connector and pin 22 of the 120–pin MCM connector. Refer to section 40.2.1.1.

   [b] If the resistance is greater than 5 Ω, go to step 10.

10. Measure the resistance between pin 4 and ground on the engine side of the Injector Harness 12–pin connector.

    [a] If the resistance is less than 5 Ω, repair the short to ground between pin 4 of the Injector Harness 12–pin connector and pin 23 of the 120–pin MCM connector. Refer to section 40.2.1.1.

    [b] If the resistance is greater than 5 Ω, go to step 11.

11. Clear the codes. Check for active codes.

    [a] If code 651/10 is still active, call the Detroit Diesel Customer Support Center (313–592–5800) for authorization to replace the MCM.

    [b] If there are no active codes, troubleshooting is finished.

40.2.1.1 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).

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41 SPN 653 – INJECTOR #3 NOT OPERATING NORMALLY

Section **Page**

41.1 TROUBLESHOOTING SPN 653/FMI 5 41-3
41.2 TROUBLESHOOTING SPN 653/FMI 10 41-5

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41.1 TROUBLESHOOTING SPN 653/FMI 5

This diagnosis is typically the injector current is below normal or an open circuit fault.

41.1.1 Open Circuit Check

Check as follows:

1. Check for multiple codes.
   [a] If fault code 168/1 is active in addition to 653/5, service 168/1 first. Refer to section 27.2.
   [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 authorization.
   [c] If only fault code 653/5 is active, go to step 2.
2. Turn the ignition OFF.
3. Disconnect the Injector Harness 12–pin connector.
4. Measure the resistance between pins 5 and 6 on the valve cover side of the connector. See Figure 41-1.

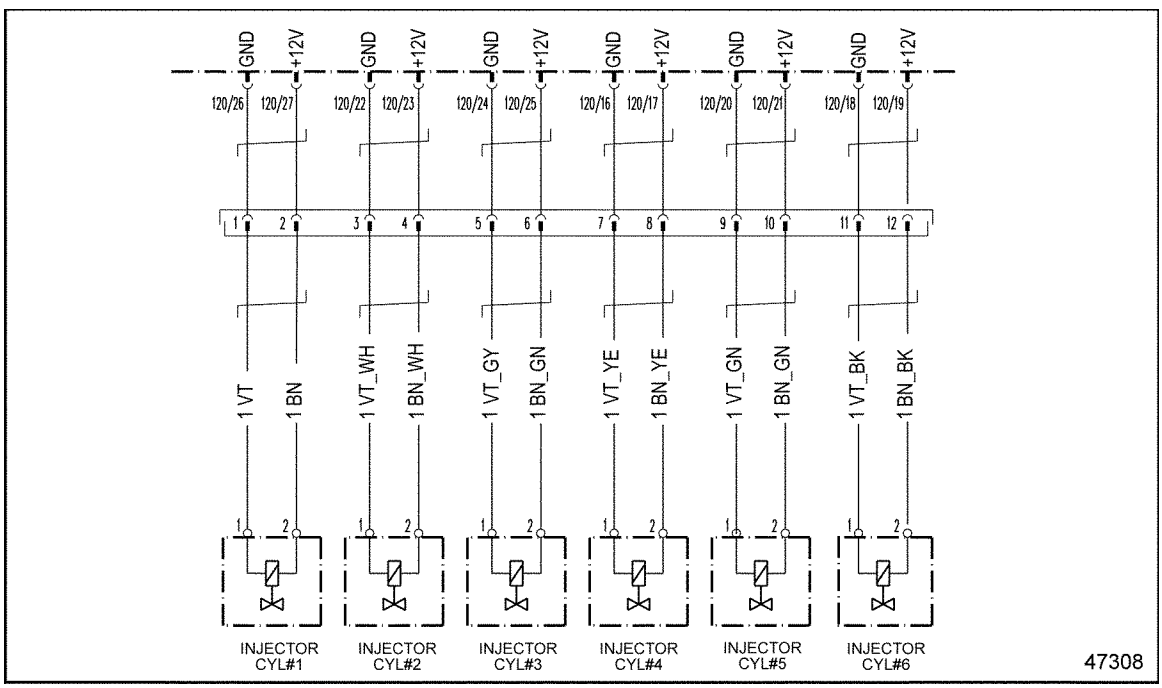

Figure 41-1 MBE 900 Injectors

   [a] If the resistance is less than 9Ω, go to step 9.
   [b] If the resistance is greater than 9Ω, go to step 5.
5. Remove valve cover.

6. Disconnect the injector #3 connector.
7. Measure the resistance between pin 1 of the injector connector and pin 5 of the Injector Harness 12–pin connector.
   [a] If the resistance is less than 3Ω, go to step 8.
   [b] If the resistance is greater than 3Ω, repair the open between pin 1 of the injector connector and pin 5 of the Injector Harness 12–pin connector. Refer to section 41.1.1.1.
8. Measure the resistance between pin 2 of the injector connector and pin 6 of the Injector Harness 12–pin connector.
   [a] If the resistance is less than 3Ω, replace the #3 injector.
   [b] If the resistance is greater than 3Ω, repair the open between pin 2 of the injector connector and pin 6 of the Injector Harness 12–pin connector. Refer to section 41.1.1.1.
9. Turn the ignition ON (key ON, engine OFF).
10. Measure the voltage between pins 5 and 6 on the engine side of the Injector Harness 12–pin connector.
    [a] If the voltage is less than 11.5 volts, go to step 11.
    [b] If the voltage is between 11.5 and 13.5 volts, repeat steps 2 through 10. If the results are the same, contact the Detroit Diesel Customer Support Center (313–592–5800).
11. Measure the voltage between pin 6 on the engine side of the Injector Harness 12–pin connector and ground.
    [a] If the voltage is less than 11.5 volts, repair the open between pin 6 on the engine side of the Injector Harness 12–pin connector and pin 24 of the 120–pin MCM connector. Refer to section 41.1.1.1.
    [b] If the voltage is between 11.5 and 13.5 volts, repair the open between pin 5 on the engine side of the Injector Harness 12–pin connector and pin 26 of the 120–pin MCM connector. Refer to section 41.1.1.1.

41.1.1.1 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.

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[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).

41.2 TROUBLESHOOTING SPN 653/FMI 10

This diagnostic condition is typically a short to ground.

41.2.1 Short to Ground Check

Check as follows:

1. Turn the ignition OFF.
2. Disconnect the Injector Harness 12–pin connector.
3. Measure the resistance between pin 5 of injector #3 and ground on the valve cover side of the Injector Harness 12–pin connector. See Figure 41-2.

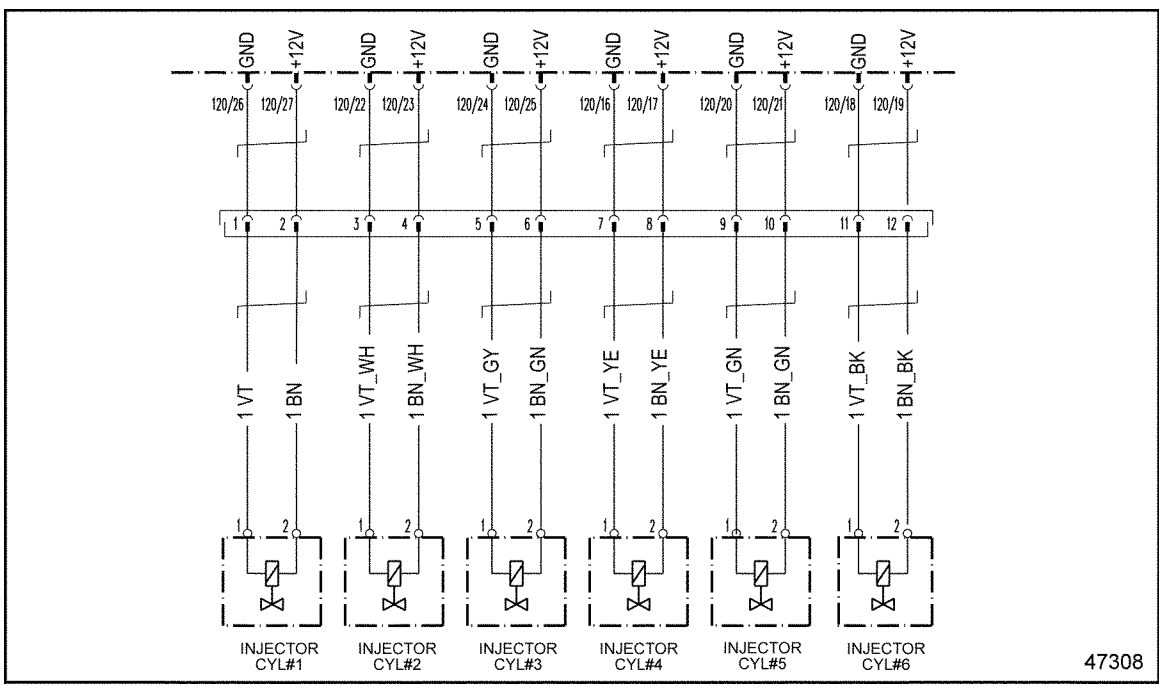

Figure 41-2 MBE 900 Injectors

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

[b] If the resistance is greater than 5 Ω, go to step 8.

4. Remove the valve cover.
5. Disconnect the Injector Harness from the injector.
6. Measure the resistance between pin 5 and ground on the valve cover side of the Injector Harness 12–pin connector.

[a] If the resistance is less than 5 Ω, repair the short to ground between pin 5 of the Injector Harness 12–pin connector and pin 1 of injector #3. Refer to section 41.2.1.1.

[b] If the resistance is greater than 5 Ω, go to step 7.

7. Measure the resistance between pin 1 of injector #3 and ground.

   [a] If the resistance is less than 5 Ω, replace the injector.

   [b] If the resistance is greater than 5 Ω, repair the short to ground between pin 6 of the Injector Harness 12–pin connector and pin 2 of injector #3. Refer to section 41.2.1.1.

8. Disconnect the 120–pin MCM connector.

9. Measure the resistance between pin 5 and ground on the engine side of the Injector Harness 12–pin connector.

   [a] If the resistance is less than 5 Ω, repair the short to ground between pin 5 of the Injector Harness 12–pin connector and pin 24 of the 120–pin MCM connector. Refer to section 41.2.1.1.

   [b] If the resistance is greater than 5 Ω, go to step 10.

10. Measure the resistance between pin 6 and ground on the engine side of the Injector Harness 12–pin connector.

    [a] If the resistance is less than 5 Ω, repair the short to ground between pin 6 of the Injector Harness 12–pin connector and pin 25 of the 120–pin MCM connector. Refer to section 41.2.1.1.

    [b] If the resistance is greater than 5 Ω, go to step 11.

11. Clear the codes. Check for active codes

    [a] If code 653/10 is still active, call the Detroit Diesel Customer Support Center (313–592–5800) for authorization to replace the MCM.

    [b] If there are no active codes, troubleshooting is finished.

41.2.1.1 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).

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42 SPN 654 – INJECTOR #4 NOT OPERATING NORMALLY

Section **Page**

42.1 TROUBLESHOOTING SPN 654/FMI 5 42-3

42.2 TROUBLESHOOTING SPN 654/FMI 10 42-5

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42.1 TROUBLESHOOTING SPN 654/FMI 5

This diagnosis is typically the injector current is below normal or an open circuit fault.

42.1.1 Open Circuit Check

Check as follows:

1. Check for multiple codes.
   [a] If fault code 168/1 is active in addition to 654/5, service 168/1 first. Refer to section 27.2.
   [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. Disconnect the Injector Harness 12–pin connector.
4. Measure the resistance between pins 7 and 8 on the valve cover side of the connector. See Figure 42-1.

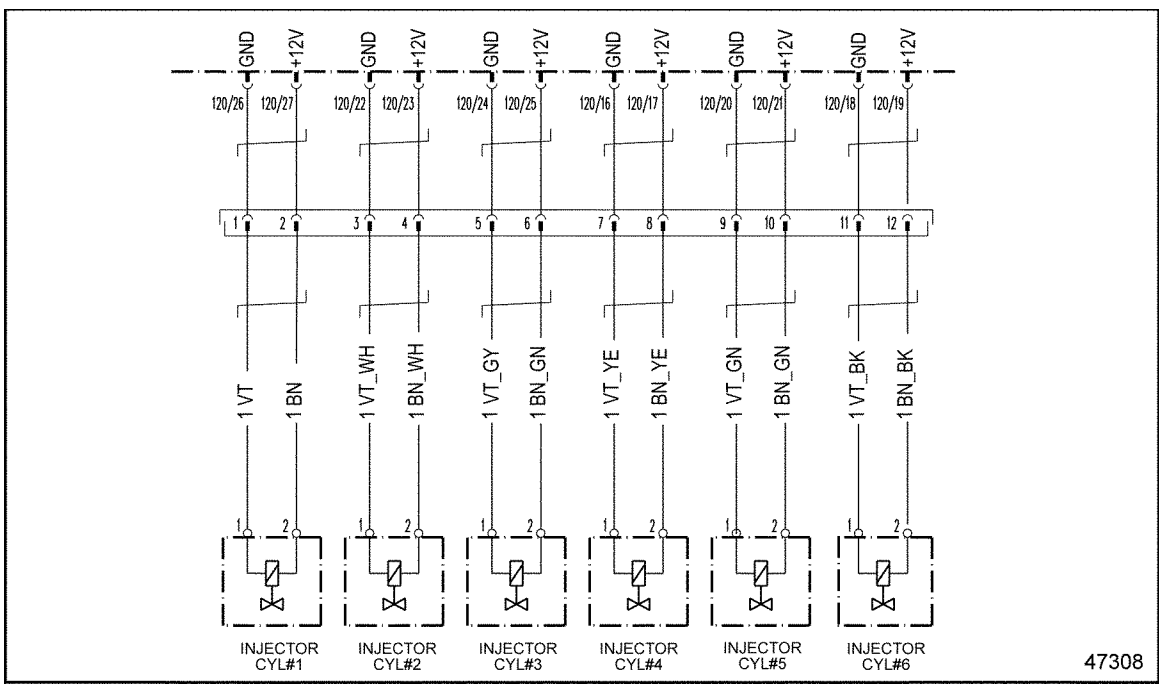

Figure 42-1 MBE 900 Injectors

   [a] If the resistance is less than 9Ω, go to step 9.
   [b] If the resistance is greater than 9Ω, go to step 5.
5. Remove valve cover.

6. Disconnect the injector #4 connector.
7. Measure the resistance between pin 1 of the injector connector and pin 7 of the Injector Harness 12–pin connector.
   [a] If the resistance is less than 3Ω, go to step 8.
   [b] If the resistance is greater than 3Ω, repair the open between pin 1 of the injector connector and pin 7 of the Injector Harness 12–pin connector. Refer to section 42.1.1.1.
8. Measure the resistance between pin 2 of the injector connector and pin 8 of the Injector Harness 12–pin connector.
   [a] If the resistance is less than 3Ω, replace the #4 injector.
   [b] If the resistance is greater than 3Ω, repair the open between pin 2 of the injector connector and pin 8 of the Injector Harness 12–pin connector. Refer to section 42.1.1.1.
9. Turn the ignition ON (key ON, engine OFF).
10. Measure the voltage between pins 7 and 8 on the engine side of the Injector Harness 12–pin connector.
    [a] If the voltage is less than 11.5 volts, go to step 11.
    [b] If the voltage is between 11.5 and 13.5 volts, repeat steps 2 through 10. If the results are the same, contact the Detroit Diesel Customer Support Center (313–592–5800).
11. Measure the voltage between pin 8 on the engine side of the Injector Harness 12–pin connector and ground.
    [a] If the voltage is less than 11.5 volts, repair the open between pin 7 on the engine side of the Injector Harness 12–pin connector and pin 16 of the 120–pin MCM connector. Refer to section 42.1.1.1.
    [b] If the voltage is between 11.5 and 13.5 volts, repair the open between pin 8 on the engine side of the Injector Harness 12–pin connector and pin 17 of the 120–pin MCM connector. Refer to section 42.1.1.1.

42.1.1.1 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.

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[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).

42.2 TROUBLESHOOTING SPN 654/FMI 10

This diagnostic condition is typically a short to ground.

42.2.1 Check for Short to Ground

Check as follows:

1. Turn the ignition OFF.
2. Disconnect the Injector Harness 12–pin connector.
3. Measure the resistance between pin 1 of injector #4 and ground on the valve cover side of the Injector Harness 12–pin connector. See Figure 42-2.

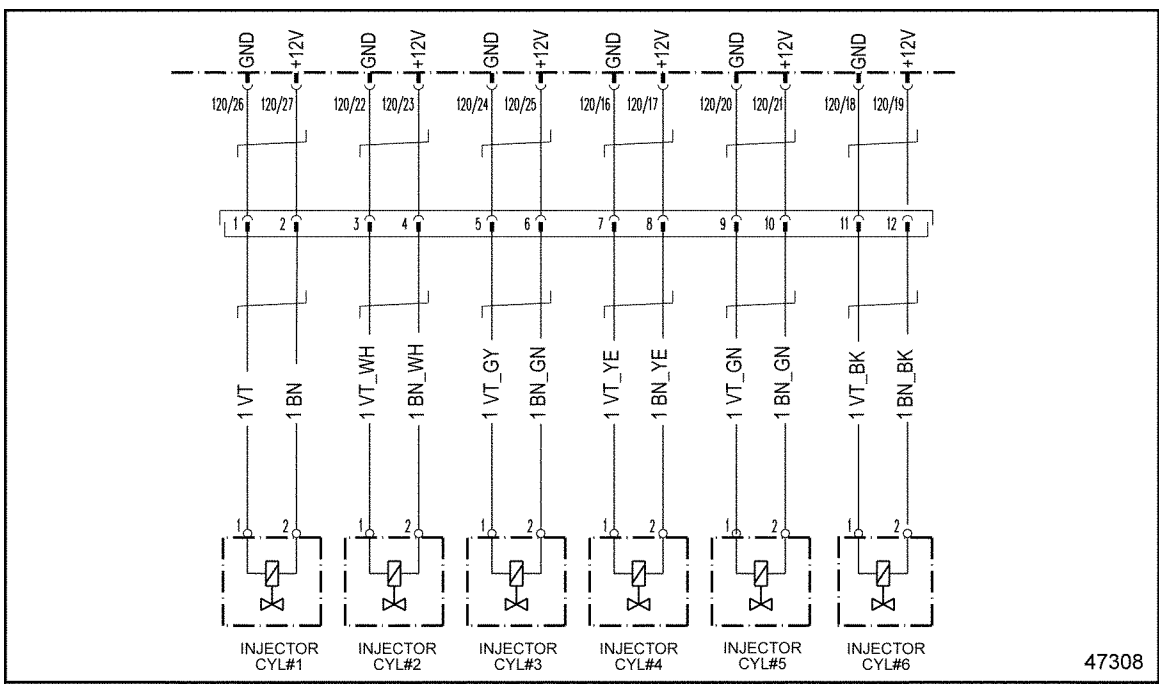

Figure 42-2 MBE 900 Injectors

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

[b] If the resistance is greater than 5 Ω, go to step 8.

4. Remove the valve cover.
5. Disconnect the Injector Harness from the injector.
6. Measure the resistance between pin 7 and ground on the valve cover side of the Injector Harness 12–pin connector.

[a] If the resistance is less than 5 Ω, repair the short to ground between pin 7 of the Injector Harness 12–pin connector and pin 1 of injector #4. Refer to section 42.2.1.1.

[b] If the resistance is greater than 5 Ω, go to step 7.

7. Measure the resistance between pin 1 of injector #4 and ground.

   [a] If the resistance is less than 5 Ω, replace the injector.

   [b] If the resistance is greater than 5 Ω, repair the short to ground between pin 8 of the Injector Harness 12–pin connector and pin 2 of injector #4. Refer to section 42.2.1.1.

8. Disconnect the 120–pin MCM connector.

9. Measure the resistance between pin 7 and ground on the engine side of the Injector Harness 12–pin connector.

   [a] If the resistance is less than 5 Ω, repair the short to ground between pin 7 of the Injector Harness 12–pin connector and pin 16 of the 120–pin MCM connector. Refer to section 42.2.1.1.

   [b] If the resistance is greater than 5 Ω, go to step 10.

10. Measure the resistance between pin 8 and ground on the engine side of the Injector Harness 12–pin connector.

    [a] If the resistance is less than 5 Ω, repair the short to ground between pin 2 of the Injector Harness 12–pin connector and pin 17 of the 120–pin MCM connector. Refer to section 42.2.1.1.

    [b] If the resistance is greater than 5 Ω, go to step 11.

11. Clear the codes. Check for active codes.

    [a] If code 654/10 is still active, call the Detroit Diesel Customer Support Center (313–592–5800) for authorization to replace the MCM.

    [b] If there are no active codes, troubleshooting is finished.

42.2.1.1 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).

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43 SPN 655 – INJECTOR #5 NOT OPERATING NORMALLY

Section **Page**

43.1 SPN 655/FMI 5 43-3

43.2 SPN 655/FMI 10 43-5

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43.1 SPN 655/FMI 5

This diagnosis is typically the injector current is below normal or an open circuit fault.

43.1.1 Open Circuit Check

Check as follows:

1. Check for multiple codes.
   [a] If fault code 168/1 is active in addition to 655/5, service 168/1 first. Refer to section 27.2.
   [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, refer to section 43.1.1.
2. Turn the ignition OFF.
3. Disconnect the Injector Harness 12–pin connector.
4. Measure the resistance between pins 9 and 10 on the valve cover side of the connector. See Figure 43-1.

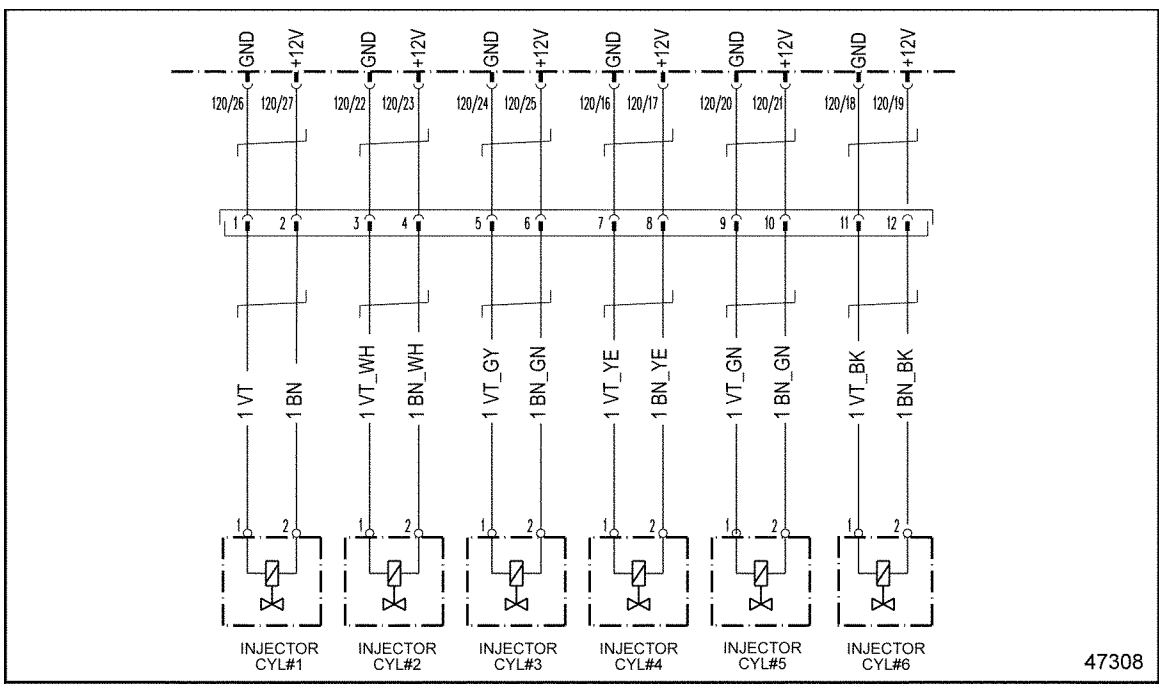

Figure 43-1 MBE 900 Injectors

   [a] If the resistance is less than 5 Ω, go to step 9.
   [b] If the resistance is greater than 5 Ω, go to step 5.
5. Remove valve cover.

6. Disconnect the injector #5 connector.
7. Measure the resistance between pin 1 of the injector connector and pin 9 of the Injector Harness 12–pin connector.
   [a] If the resistance is less than 3Ω, go to step 8.
   [b] If the resistance is greater than 3Ω, repair the open between pin 2 of the injector connector and pin 9 of the Injector Harness 12–pin connector. Refer to section 43.1.1.1.
8. Measure the resistance between pin 2 of the injector connector and pin 10 of the Injector Harness 12–pin connector.
   [a] If the resistance is less than 3Ω, replace the #5 injector.
   [b] If the resistance is greater than 3Ω, repair the open between pin 2 of the injector connector and pin 10 of the Injector Harness 12–pin connector. Refer to section 43.1.1.1.
9. Turn the ignition ON (key ON, engine OFF).
10. Measure the voltage between pins 9 and 10 on the engine side of the Injector Harness 12–pin connector.
    [a] If the voltage is less than 11.5 volts, go to step 11.
    [b] If the voltage is between 11.5 and 13.5 volts, repeat steps 2 through 10. If the results are the same, contact the Detroit Diesel Customer Support Center (313–592–5800).
11. Measure the voltage between pin 10 on the engine side of the Injector Harness 12–pin connector and ground.
    [a] If the voltage is less than 11.5 volts, repair the open between pin 10 on the engine side of the Injector Harness 12–pin connector and pin 21 of the 120–pin MCM connector. Refer to section 43.1.1.1.
    [b] If the voltage is between 11.5 and 13.5 volts, repair the open between pin 9 on the engine side of the Injector Harness 12–pin connector and pin 20 of the 120–pin MCM connector. Refer to section 43.1.1.1.

43.1.1.1 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.

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[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).

43.2 SPN 655/FMI 10

This diagnostic condition is typically a short to ground.

43.2.1 Short to Ground Check

Check as follows:

1. Turn the ignition OFF.
2. Disconnect the 120–pin MCM connector.
3. Measure the resistance between pin 9 of injector #5 and ground on the valve cover side of the Injector Harness 12–pin connector. See Figure 43-2.

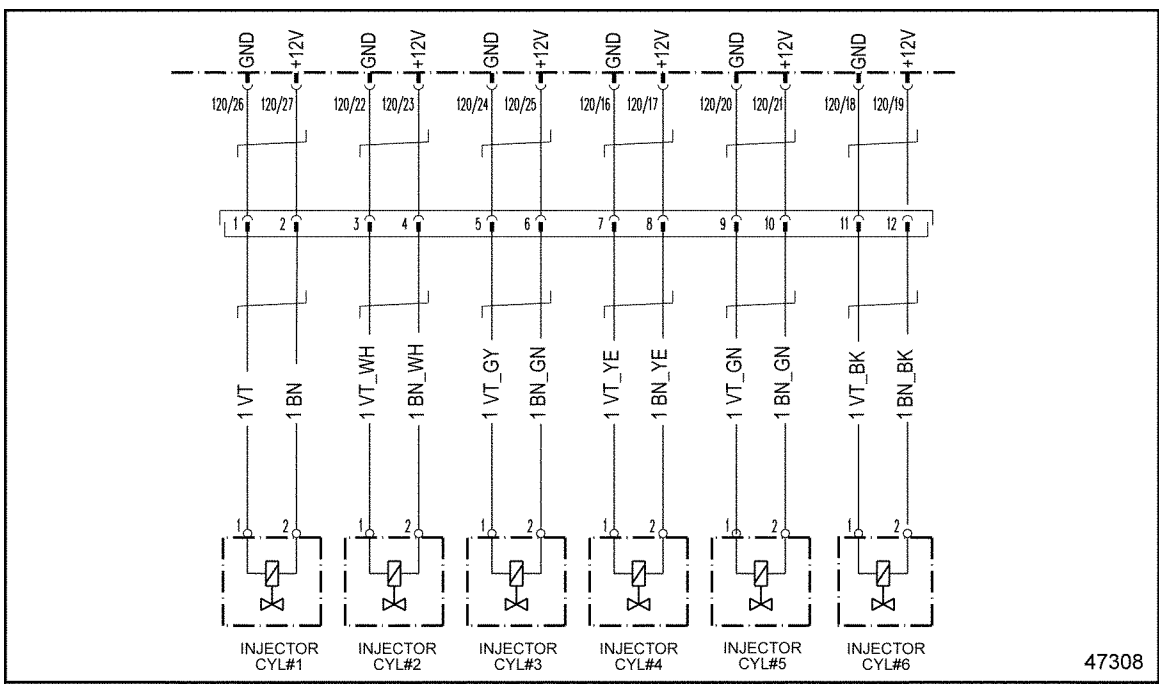

Figure 43-2 MBE 900 Injectors

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

[b] If the resistance is greater than 5 Ω, go to step 8.

4. Remove the valve cover.
5. Disconnect the Injector Harness from the injector.
6. Measure the resistance between pin 9 and ground on the valve cover side of the Injector Harness 12–pin connector.

[a] If the resistance is less than 5 Ω, repair the short to ground between pin 9 of the Injector Harness 12–pin connector and pin 1 of injector #5. Refer to section 43.2.1.1.

[b] If the resistance is greater than 5 Ω, go to step 7.

7. Measure the resistance between pin 1 of injector #5 and ground.

   [a] If the resistance is less than 5 Ω, replace the injector.

   [b] If the resistance is greater than 5 Ω, repair the short to ground between pin 10 of the Injector Harness 12–pin connector and pin 2 of injector #5. Refer to section 43.2.1.1.

8. Disconnect the 120–pin MCM connector

9. Measure the resistance between pin 9 and ground on the engine side of the Injector Harness 12–pin connector.

   [a] If the resistance is less than 5 Ω, repair the short to ground between pin 9 of the Injector Harness 12–pin connector and pin 20 of the 120–pin MCM connector. Refer to section 43.2.1.1.

   [b] If the resistance is greater than 5 Ω, go to step 10.

10. Measure the resistance between pin 10 and ground on the engine side of the Injector Harness 12–pin connector.

    [a] If the resistance is less than 5 Ω, repair the short to ground between pin 10 of the Injector Harness 12–pin connector and pin 21 of the 120–pin MCM connector. Refer to section 43.2.1.1.

    [b] If the resistance is greater than 5 Ω, go to step 11.

11. Clear the codes. Check for active codes.

    [a] If code 655/10 is still active, call the Detroit Diesel Customer Support Center (313–592–5800) for authorization to replace the MCM.

    [b] If there are no active codes, troubleshooting is finished.

43.2.1.1 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).

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44 SPN 656 – INJECTOR #6 NOT OPERATING NORMALLY

Section **Page**

44.1 SPN 656/FMI 5 44-3

44.2 SPN 656/FMI 10 44-5

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44.1 SPN 656/FMI 5

This diagnosis is typically the injector current is below normal or an open circuit fault.

44.1.1 Open Circuit Check

Check as follows:

1. Check for multiple codes.
   [a] If fault code 168/1 is active in addition to 656/5, service 168/1 first. Refer to section 27.2.
   [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, refer to section 44.1.1.
2. Turn the ignition OFF.
3. Disconnect the Injector Harness 12–pin connector.
4. Measure the resistance between pins 1and 2 on the valve cover side of the connector. See Figure 44-1.

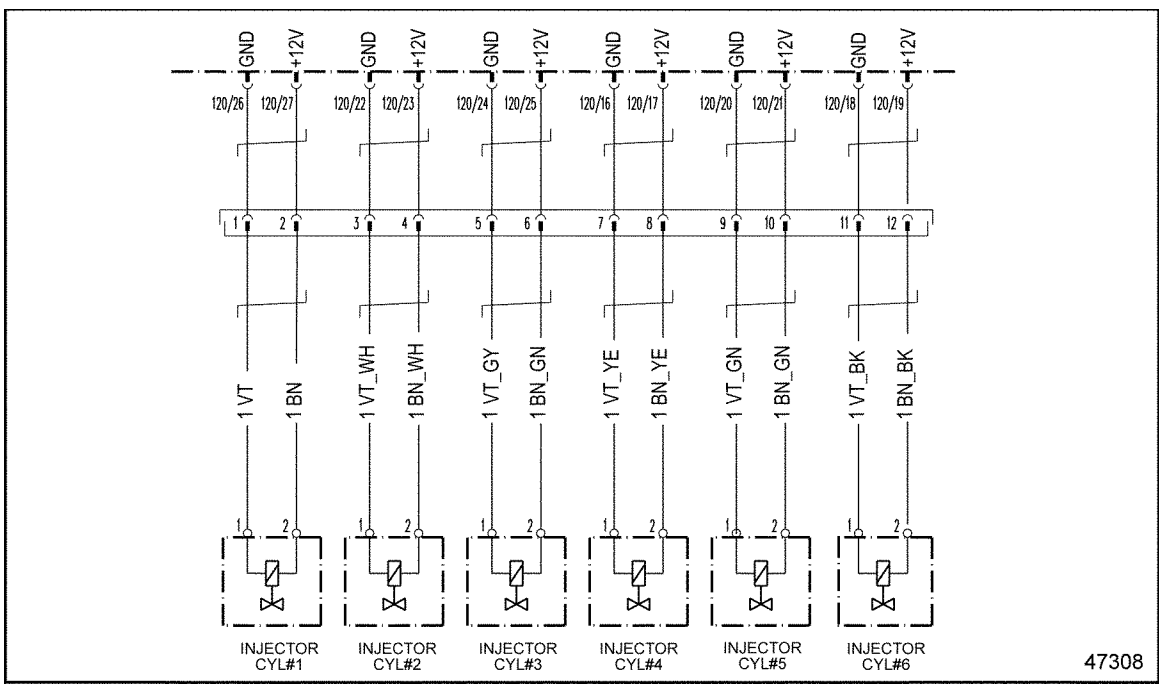

Figure 44-1 MBE 900 Injectors

   [a] If the resistance is less than 9Ω, go to step 9.
   [b] If the resistance is greater than 9Ω, go to step 5.
5. Remove valve cover.

6. Disconnect the injector #6 connector.
7. Measure the resistance between pin 1 of the injector connector and pin 11 of the Injector Harness 12–pin connector.
   [a] If the resistance is less than 3Ω, go to step 8.
   [b] If the resistance is greater than 3Ω, repair the open between pin 1 of the injector connector and pin 11 of the Injector Harness 12–pin connector. Refer to section 44.1.1.1.
8. Measure the resistance between pin 2 of the injector connector and pin 12 of the Injector Harness 12–pin connector.
   [a] If the resistance is less than 3Ω, replace the #6 injector.
   [b] If the resistance is greater than 3Ω, repair the open between pin 2 of the injector connector and pin 12 of the Injector Harness 12–pin connector. Refer to section 44.1.1.1.
9. Turn the ignition ON (key ON, engine OFF).
10. Measure the voltage between pins 11 and 12 on the engine side of the Injector Harness 12–pin connector.
    [a] If the voltage is less than 11.5 volts, go to step 11.
    [b] If the voltage is between 11.5 and 13.5 volts, repeat steps 2 through 10. If the results are the same, contact the Detroit Diesel Customer Support Center (313–592–5800).
11. Measure the voltage between pin 12 on the engine side of the Injector Harness 12–pin connector and ground.
    [a] If the voltage is less than 11.5 volts, repair the open between pin 12 on the engine side of the Injector Harness 12–pin connector and pin 19 of the 120–pin MCM connector. Refer to section 44.1.1.1.
    [b] If the voltage is between 11.5 and 13.5 volts, repair the open between pin 11 on the engine side of the Injector Harness 12–pin connector and pin 18 of the 120–pin MCM connector. Refer to section 44.1.1.1.

44.1.1.1 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.

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[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).

44.2 SPN 656/FMI 10

This diagnostic condition is typically a short to ground.

44.2.1 Short to Ground Check

Check as follows:

1. Turn the ignition OFF.
2. Disconnect the Injector Harness 12–pin connector.
3. Measure the resistance between pin 11 of injector #6 and ground on the valve cover side of the Injector Harness 12–pin connector. See Figure 44-2.

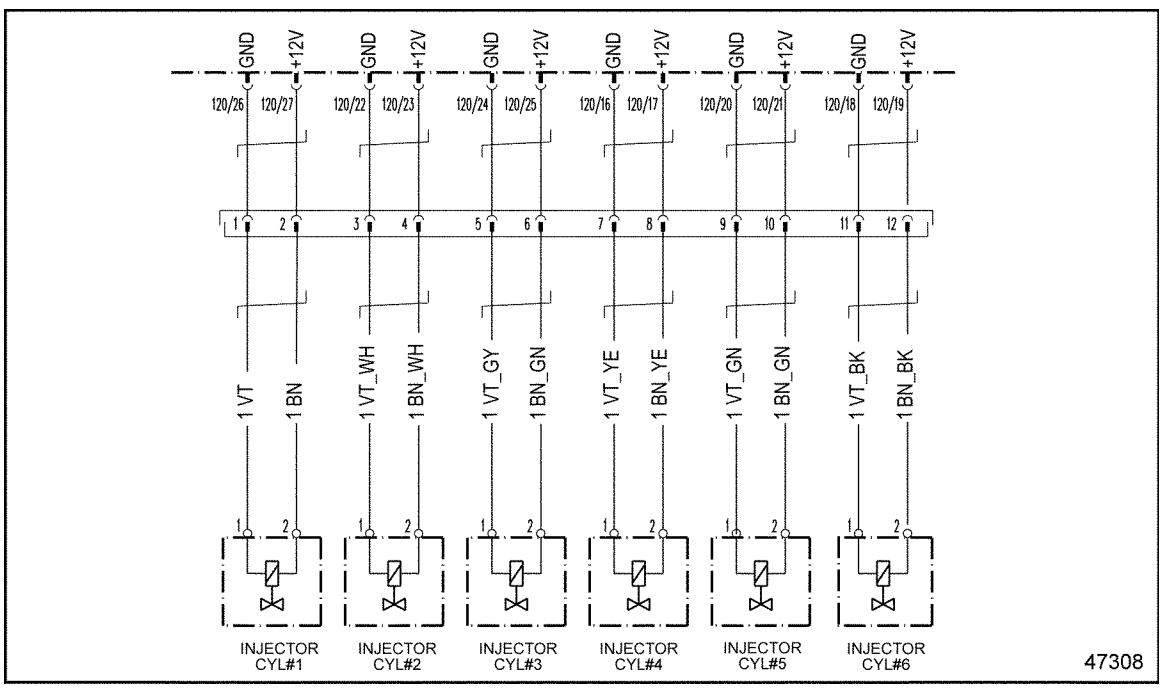

Figure 44-2 MBE 900 Injectors

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

[b] If the resistance is greater than 5 Ω, go to step 8.

4. Remove the valve cover.
5. Disconnect the Injector Harness from the injector.
6. Measure the resistance between pin 11 and ground on the valve cover side of the Injector Harness 12–pin connector.

[a] If the resistance is less than 5 Ω, repair the short to ground between pin 11 of the Injector Harness 12–pin connector and pin 1 of injector #6. Refer to section 44.2.1.1.

[b] If the resistance is greater than 5 Ω, go to step 7.

7. Measure the resistance between pin 1 of injector #6 and ground.

   [a] If the resistance is less than 5 Ω, replace the injector.

   [b] If the resistance is greater than 5 Ω, repair the short to ground between pin 12 of the Injector Harness 12–pin connector and pin 2 of injector #6. Refer to section 44.2.1.1.

8. Disconnect the 120–pin MCM connector.

9. Measure the resistance between pin 11 and ground on the engine side of the Injector Harness 12–pin connector.

   [a] If the resistance is less than 5 Ω, repair the short to ground between pin 11 of the Injector Harness 12–pin connector and pin 18 of the 120–pin MCM connector. Refer to section 44.2.1.1.

   [b] If the resistance is greater than 5 Ω, go to step 10.

10. Measure the resistance between pin 12 and ground on the engine side of the Injector Harness 12–pin connector.

    [a] If the resistance is less than 5 Ω, repair the short to ground between pin 12 of the Injector Harness 12–pin connector and pin 19 of the 120–pin MCM connector. Refer to section 44.2.1.1.

    [b] If the resistance is greater than 5 Ω, go to step 11.

11. Clear the codes. Check for active codes.

    [a] If code 656/10 is still active, call the Detroit Diesel Customer Support Center (313–592–5800) for authorization to replace the MCM.

    [b] If there are no active codes, troubleshooting is finished.

44.2.1.1 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).

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45 SPN 701 - CONSTANT THROTTLE VALVE (AUX PWM #7) NOT OPERATING NORMALLY

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45.1 SPN 701/FMI 3 45-3
45.2 SPN 701/FMI 4 45-4
45.3 SPN 701/FMI 5 45-6

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45.1 SPN 701/FMI 3

This diagnosis is typically a short to power.

45.1.1 Short to Power Check

Check as follows:

1. Disconnect the Constant Throttle Valve connector.
2. Turn the ignition ON (key ON, engine OFF).
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 45-1. Refer to section 45.1.1.1.

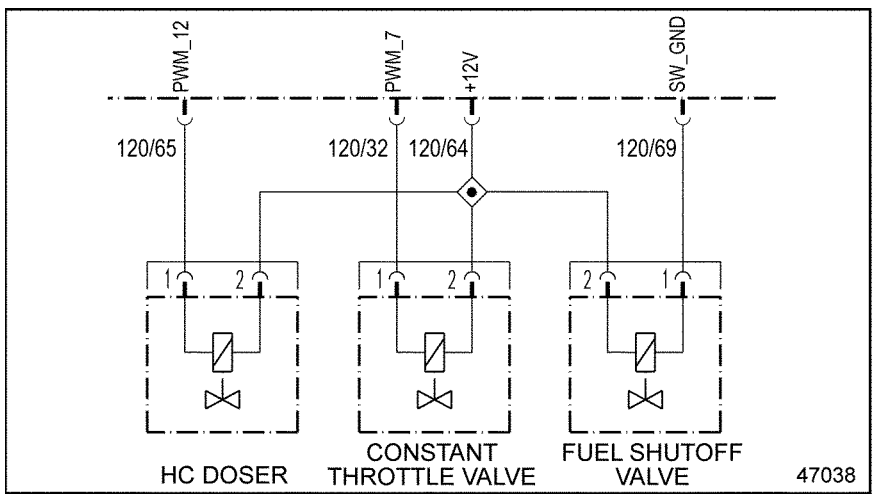

Figure 45-1 Constant Throttle Valve

   [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 45.1.1.1.

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45.1.1.1 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 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).

45.2 SPN 701/FMI 4

This diagnosis is typically a short to ground.

45.2.1 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 45-2. Refer to section 45.2.1.1.
   [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.

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[b] If the resistance is less than 5Ω, repair the short between wires 32 and 64 of the 120–pin MCM connector. See Figure 45-2. Refer to section 45.2.1.1.

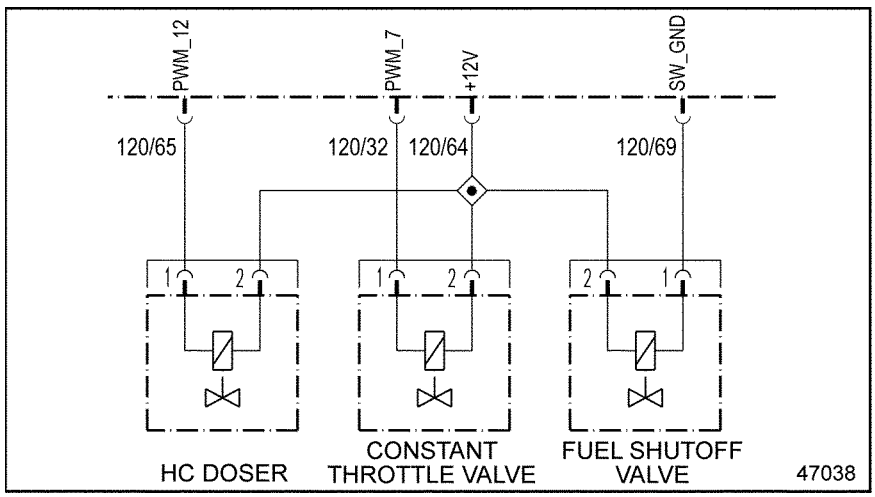

Figure 45-2 Constant Throttle Valve

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 45.2.1.1.

45.2.1.1 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 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).

45.3 SPN 701/FMI 5

This diagnosis is typically an open circuit

45.3.1 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 45-3. Refer to section 45.2.1.1.

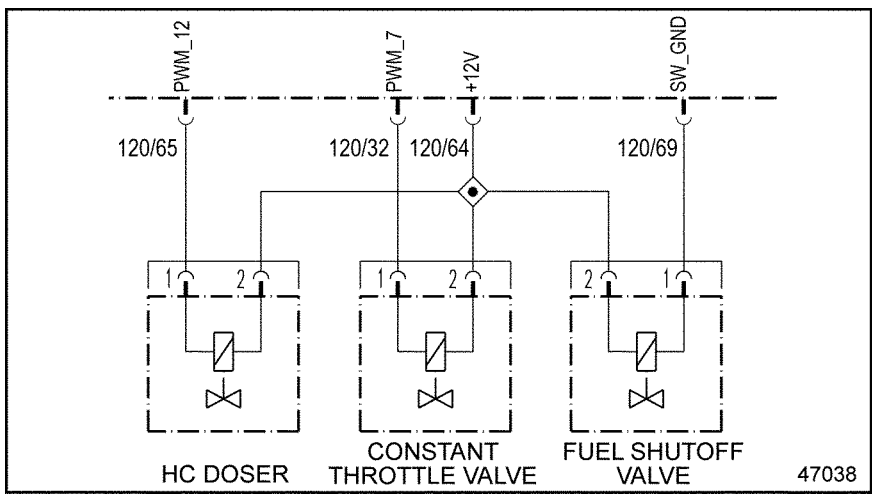

Figure 45-3 Constant Throttle Valve

   [b] If only 701/4 is active, go to step 2.
2. Disconnect the Constant Throttle Valve connector.
3. Turn the ignition ON (key ON, engine OFF).
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 45-3. Refer to section 45.3.1.1.
   [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 45-3. Refer to section 45.3.1.1.

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45.3.1.1 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 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).

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46 SPN 704 - WASTEGATE VALVE CONTROL (AUX PWM #10)

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46.2 SPN 704/FMI 4 46-4
46.3 SPN 704/FMI 5 46-6

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46.1 SPN 704/FMI 3

This diagnosis is typically a short to power.

46.1.1 Short to Power Check

Check 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 46-1.

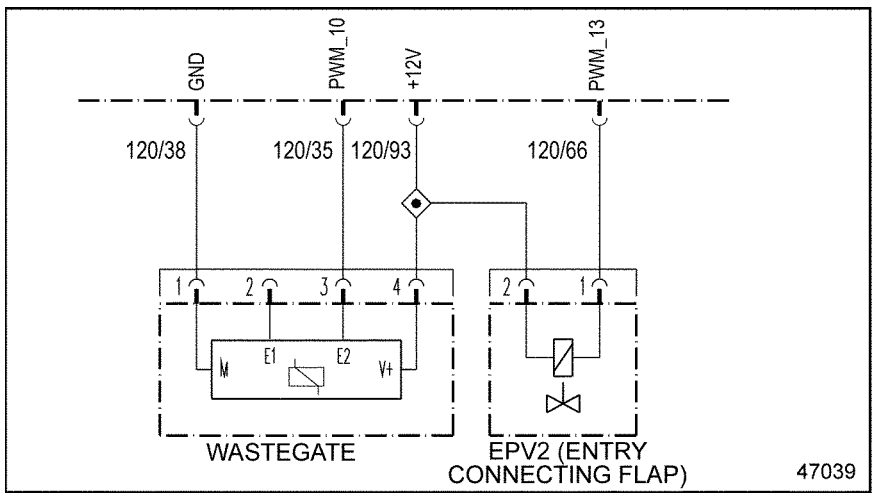

Figure 46-1 Wastegate

4. Turn the ignition switch to the OFF position.
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).

46.1.1.1 Verify Repairs

Verify repairs as follows:

1. Turn vehicle ignition OFF.

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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 SPN 704/3 is not logged and other codes are logged, troubleshoot the logged codes.
   [c] If SPN 704/3 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).

46.2 SPN 704/FMI 4

This diagnosis is typically a short to ground.

46.2.1 Short to Ground Check

Check as follows:

1. Check for multiple codes.
   [a] If 706/4 is active with 704/4, 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 46.2.1.1.
   [b] If only 704/4 is active, go to step 2.
2. Disconnect the wastegate valve connector.
3. Disconnect the 120–pin MCM connector.

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4. Measure the resistance between pins 1 and 3 of the wastegate valve connector. See Figure 46-2.

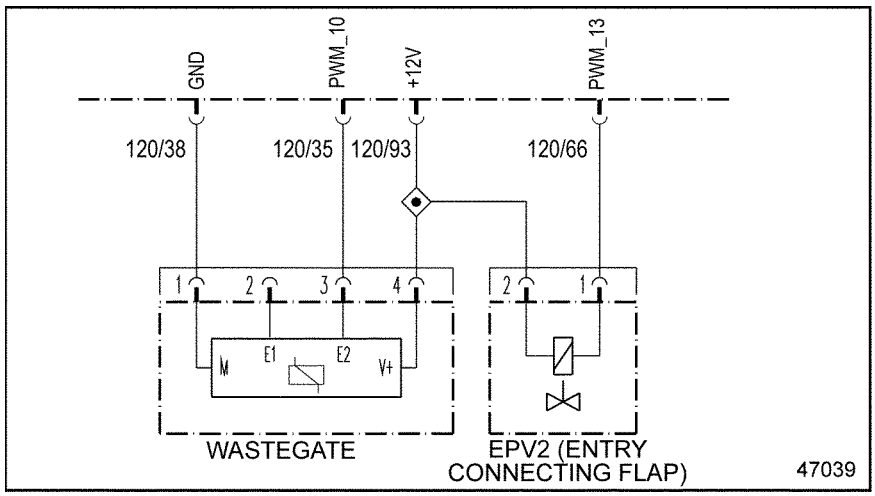

Figure 46-2 Wastegate

[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 46.2.1.1.

[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 46.2.1.1.

[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).

46.2.1.1 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 SPN 704/4 is not logged and other codes are logged, troubleshoot the logged codes.

[c] If SPN 704/4 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).

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46.3 SPN 704/FMI 5

This diagnosis is typically an open circuit.

46.3.1 Open Circuit Check

Check as follows:

1. Check for multiple codes.
   [a] If 706/5 is active with 704/5, 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 46-3. Refer to section 46.3.1.1.

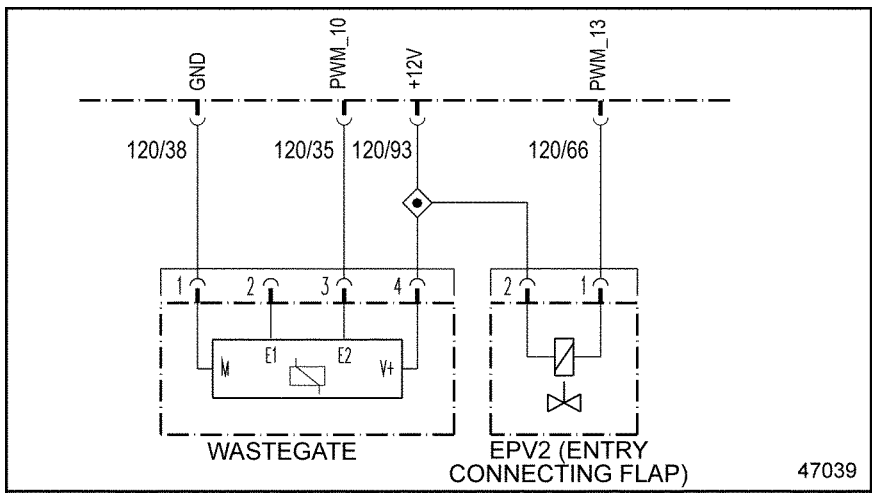

Figure 46-3 Wastegate

   [b] If only 704/4 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 46.3.1.1.
   [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.

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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 46.3.1.1.
   [b] If the resistance is greater than 5Ω, replace the EPV3 solenoid.

46.3.1.1 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 SPN 704/5 is not logged and other codes are logged, troubleshoot the logged codes.
   [c] If SPN 704/5 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).

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47 SPN 706 - ELECTRONIC PROPORTIONING VALVE CONTROL #2 NOT OPERATING NORMALLY

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47.1 SPN 706/FMI 3 47-3
47.2 SPN 706/FMI 4 47-5
47.3 SPN 706/FMI 5 47-7

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47.1 SPN 706/FMI 3

This diagnosis is typically a short to power.

47.1.1 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 Entry Connecting Flap valve and ground. See Figure 47-1.

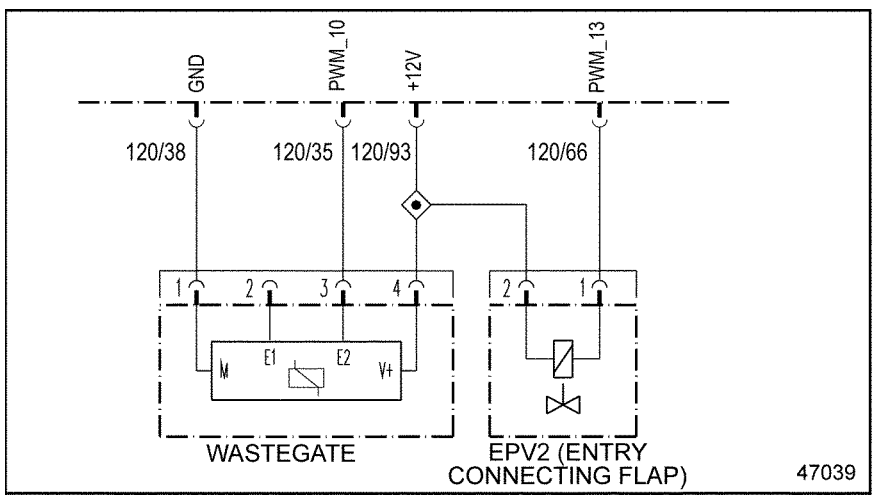

Figure 47-1 EPV2 (Entry Connecting Flap) and Wastegate

   [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 47.1.1.1.

   [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 47.1.1.1.

   [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 47.1.1.1.

47.1.1.1 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).

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47.2 SPN 706/FMI 4

This diagnosis is typically a short to ground.

47.2.1 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 47-2. Refer to section 47.2.1.1.

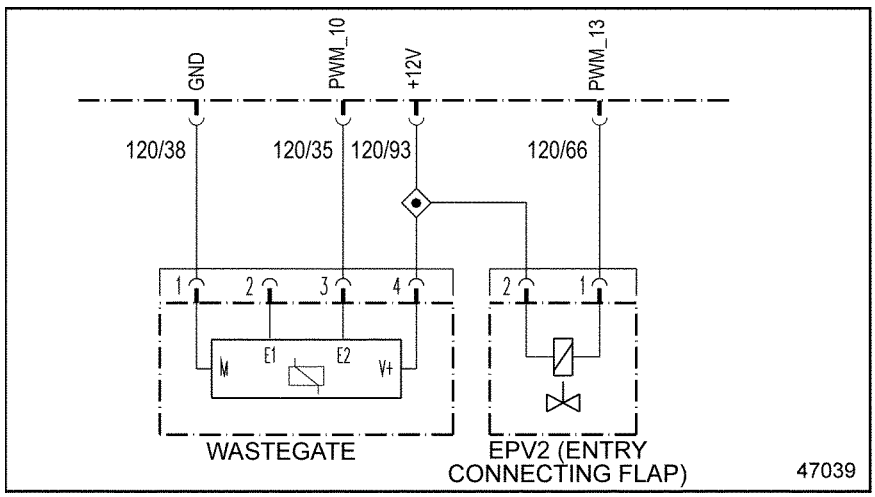

Figure 47-2 EPV2 (Entry Connecting Flap) and Wastegate

   [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 47.2.1.1.
   [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 47.2.1.1.
   [b] If the resistance is greater than 5 Ω, refer to section 47.2.1.1.

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47.2.1.1 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).

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47.3 SPN 706/FMI 5

This diagnosis is typically an open circuit.

47.3.1 Open Circuit Check

Check as follows:

1. Disconnect the EPV2 connector.
2. Turn the ignition ON.
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 47.3.1.1.
   [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 47-3. Refer to section 47.3.1.1.

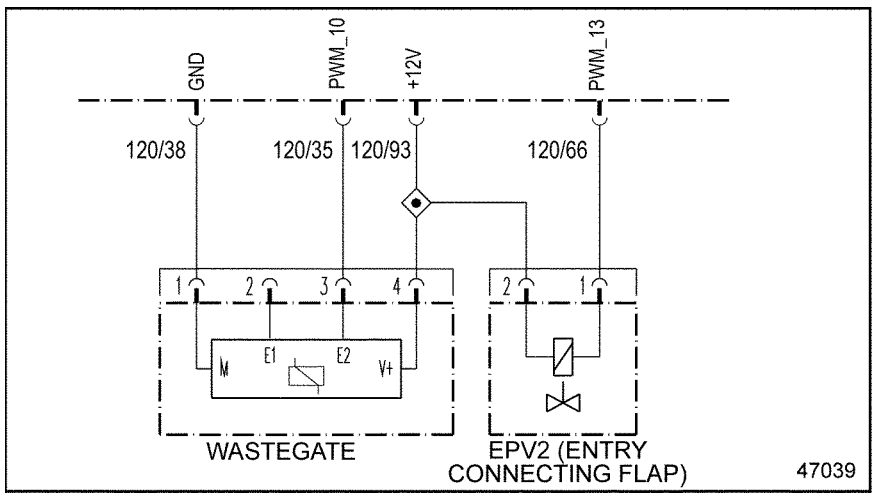

Figure 47-3 EPV2 (Entry Connecting Flap) and Wastegate

   [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 47.3.1.1.

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47.3.1.1 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).

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48 SPN 709 - SINGLE-SPEED FAN (LOW-SIDE DIGITAL OUTPUT #3) FAULT

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48.1 SPN 709/FMI 3

This fault code indicates that there is a short to power.

48.1.1 Short to Power Check

Check 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 48.1.2.1.
   [b] If the voltage is less than 11.5 volts, refer to section 48.1.2.

48.1.2 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 switch to the ON position.
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 48.1.2.1.
   [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.

48.1.2.1 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.

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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).

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48.2 SPN 709/FMI 4

This fault code indicates that there is a short to ground.

48.2.1 Short to Ground Check

Check as follows:

1. Put the ignition switch in the OFF position
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 48.2.1.1.
   [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 48.2.1.1.

48.2.1.1 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).

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48.3 SPN 709/FMI 5

This fault code indicates that there is an open circuit.

48.3.1 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 48.3.1.1.
   [b] If only SPN 709/5 is active, go to step 2.
2. Disconnect the fan control solenoid connector.
3. Turn the ignition to the ON position.
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 48.3.1.1.
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 48.3.1.1.
   [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 48.3.1.1.
   [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 48.3.1.1.

48.3.1.1 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).

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49 SPN 710 - ELECTRONIC PROPORTIONING VALVE 1 (ENTRY SHUTOFF FLAP) NOT OPERATING NORMALLY

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49.2 SPN 710/FMI 4 49-4
49.3 SPN 710/FMI 5 49-6

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49.1 SPN 710/FMI 3

This diagnosis is typically a short to power.

49.1.1 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 49-1. Refer to section 49.1.1.1.

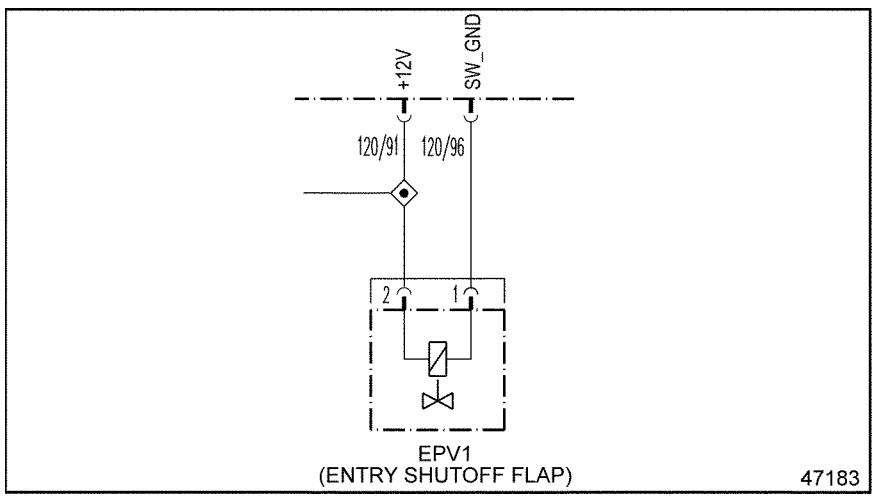

Figure 49-1 EPV1 (Entry Shutoff Flap)

   [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 49.1.1.1.

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49.1.1.1 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).

49.2 SPN 710/FMI 4

This diagnosis is typically a short to ground.

49.2.1 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 49-2. Refer to section 49.2.1.1.

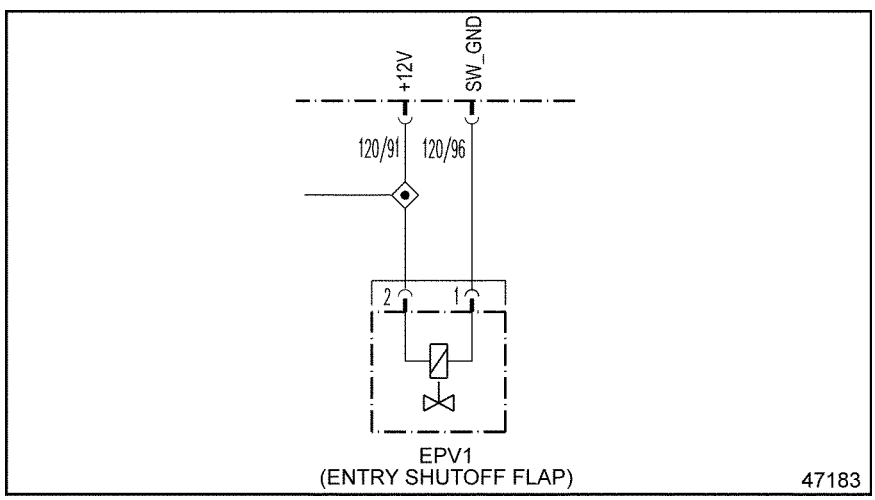

Figure 49-2 EPV1 (Entry Shutoff Flap)

   [b] If only 710/4 is active, go to step 2.

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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 49.2.1.1.
   [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 49.2.1.1.
   [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).

49.2.1.1 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).

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49.3 SPN 710/FMI 5

This diagnosis is typically an open circuit.

49.3.1 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 49.3.1.1.
   [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 49-3. Refer to section 49.3.1.1.

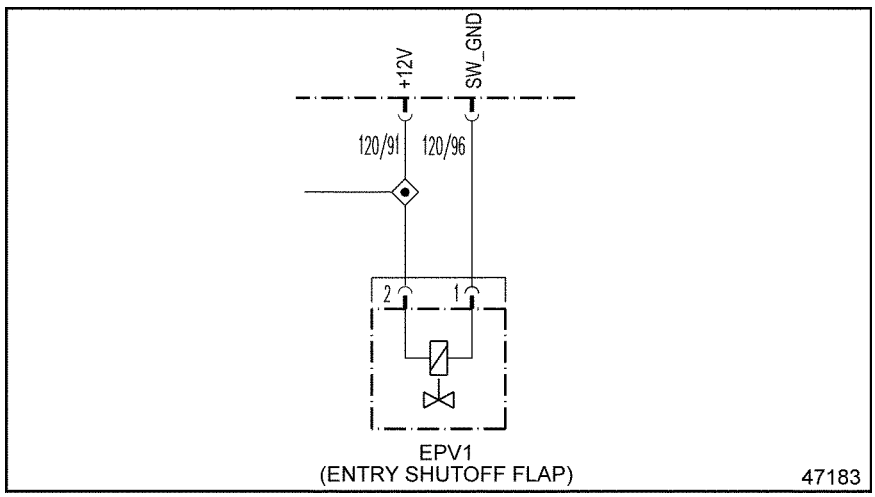

Figure 49-3 EPV1 (Entry Shutoff Flap)

   [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 49.3.1.1.
   [b] the EPV1 connector for the Entry Shutoff Fla go to step 6.

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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 49.3.1.1.
   [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 49.3.1.1.

49.3.1.1 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).

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50 SPN 729 - GRID HEATER NOT OPERATING NORMALLY

Section **Page**

50.1 SPN 729/FMI 3 50-3

50.2 SPN 729/FMI 4 50-5

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50.1 SPN 729/FMI 3

This diagnosis is typically a short to power/open.

50.1.1 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 50-1.

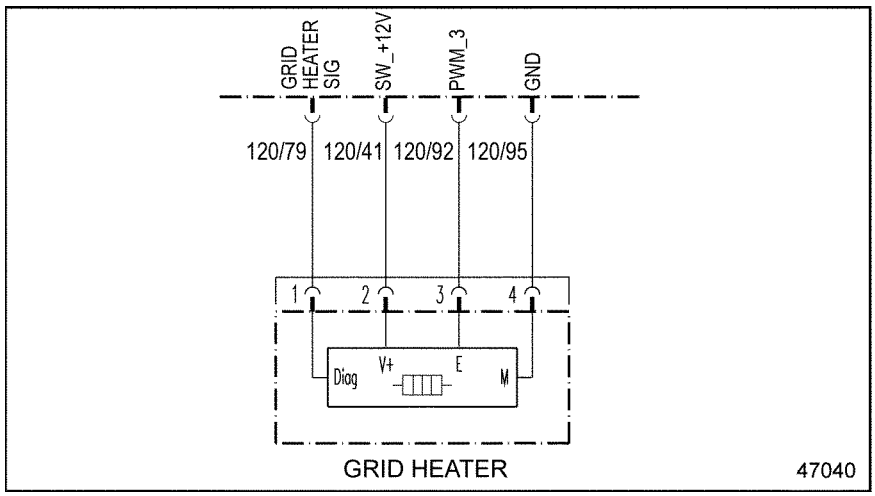

Figure 50-1 Grid Heater Wiring

   [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 50.1.1.1.

   [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 50.1.1.1.

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 50.1.1.1.

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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 50.1.1.1.
   [b] If the resistance is less than 5 Ω, replace the Grid Heater.

50.1.1.1 Verify Repairs

Verify repairs as follows:

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).

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50.2 SPN 729/FMI 4

This diagnosis is typically a short to ground.

50.2.1 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 50.2.1.1.
   [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 50.2.1.1.
   [b] If the resistance is greater than 5 Ω, replace the Grid Heater.

50.2.1.1 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 729/4 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).

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51 SPN 723 — CAMSHAFT POSITION SENSOR FAULT

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51.3 SPN 723/FMI 8 51-6
51.4 SPN 723/FMI 14 51-7

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51.1 SPN 723/FMI 3

The diagnostic condition is typically an open circuit.

51.1.1 Open Circuit Check

Check as follows:

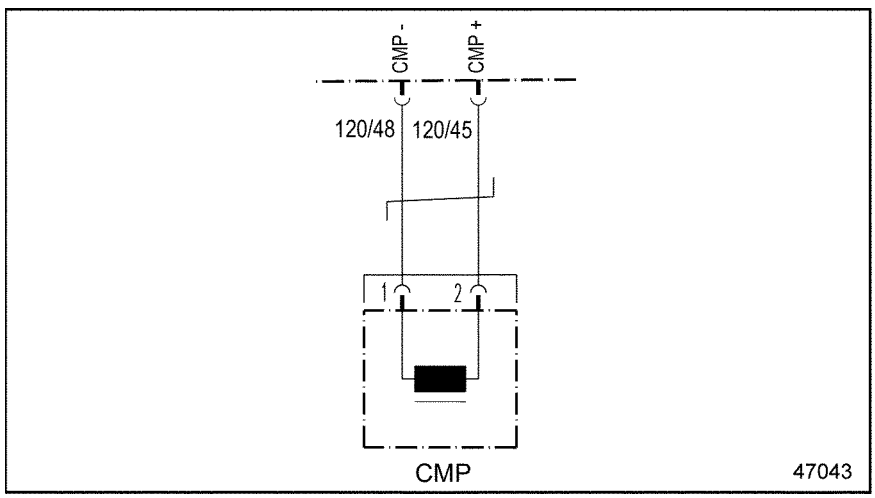

Figure 51-1 MCM — Camshaft Position Sensor Schematic

1. Disconnect CMP Sensor
2. Measure the resistance across pins 1 and 2 of the CMP Sensor.See Figure 51-1.
   [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 51.1.1.1.
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 51.1.1.1.
   [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 51.1.1.1.
   [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.

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[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 51.1.1.1.

[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).

51.1.1.1 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.

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51.2 SPN 723/FMI 4

A typical diagnosis is a short to ground.

51.2.1 Short to Ground Check

Check as follows:

1. Disconnect the CMP Sensor.
2. Measure the resistance between pin 1 of the CMP Sensor and ground. See Figure 51-2.

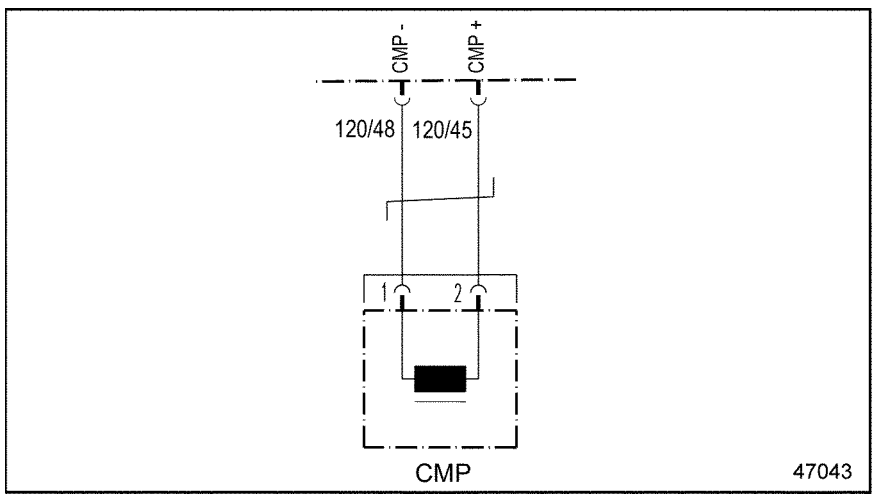

Figure 51-2 MCM — Camshaft Position Sensor Schematic

   [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 51.2.1.1.

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 51.2.1.1.

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 51.2.1.1.

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.

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[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 51.2.1.1.

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 51.2.1.1.

51.2.1.1 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.

51.3 SPN 723/FMI 8

A typical diagnosis is time out.

51.3.1 Time Out Check

Check as follows:

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 51.1.

   [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 51.3.2.

3. Shutdown the engine.
4. Ensure that the sensor is correctly positioned and check for active codes.

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[a] If the sensor position is correct and fault code 723/8 is active, refer to section 51.3.2.

[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 51.3.2.1.

51.3.2 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 51.3.2.1.
2. Check the Camshaft Position Sensor for proper axial play. Repair as necessary if the axial play is incorrect. Refer to section 51.3.2.1.

51.3.2.1 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.

51.4 SPN 723/FMI 14

A typical diagnosis is swapped pins.

51.4.1 Swapped Pins Check

Check as follows:

1. If fault code 723/14 is active, check the engine speed sensor for reversed polarity.
2. Reseat the camshaft and crankshaft sensors.

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3. Ensure that the 120-pin connector wires are not crossed. If crossed, repair as necessary. See Figure 51-3. Refer to section 51.4.1.1.

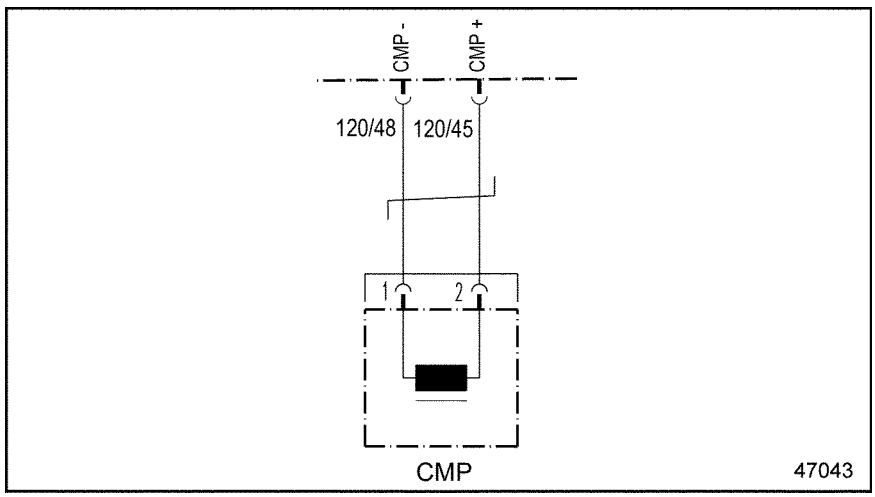

Figure 51-3 Camshaft Position Sensor

51.4.1.1 Verify Repairs

Verify repair 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 723/14 are logged, troubleshoot those codes.

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52 SPN 975 - TWO-SPEED FAN (AUX PWM #6) FAULT

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52.2 SPN 975/FMI 4 52-5
52.3 SPN 975/FMI 5 52-6

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52.1 SPN 975/FMI 3

This fault code indicates that there is a short to power.

52.1.1 Short to Power Check

Check 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 52.1.2.1.
   [b] If the voltage is less than 11.5 volts, refer to section 52.1.2.

52.1.2 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 switch to the ON position.
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 52.1.2.1.
   [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.

52.1.2.1 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.

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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).

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52.2 SPN 975/FMI 4

This fault indicates that there is a short to ground.

52.2.1 Check for Short to Ground

Check 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 52.2.1.1.
   [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 52.2.1.1.

52.2.1.1 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).

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52.3 SPN 975/FMI 5

This fault code indicates that there is an open circuit.

52.3.1 Open Circuit Check

Check 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 52.3.1.1.
   [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 52.3.1.1.
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 52.3.1.1.
   [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 52.3.1.1.

52.3.1.1 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).

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53 SPN 1172 -TURBO COMPRESSOR IN TEMP HIGH OR LOW

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53.2 SPN 1172/FMI 4 53-5

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53.1 SPN 1172/FMI 3

This code is typically sensor or circuit failed high.

53.1.1 Open Circuit Check

Check 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 53.1.2.1.
   [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 53.1.2.1.
   [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 53.1.2.1.
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 53.1.2.
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 53.1.2.1.
   [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 53.1.2.1.

53.1.2 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.

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1. Turn vehicle 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 53.1.1, 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.

53.1.2.1 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 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).

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53.2 SPN 1172/FMI 4

This code is typically sensor or circuit failed low.

53.2.1 Short Circuit Check

Check as follows:

1. Place ignition switch in the OFF position.
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 53.2.1.1.
   [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 53.2.1.1.
   [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 53.2.1.1.
   [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 53.2.1.1.
   [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 53.2.1.1.
   [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 53.2.1.1.
    [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.

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53.2.1.1 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 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).

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54 SPN 1176 - TURBO COMPRESSOR INLET PRESSURE OUTSIDE NORMAL RANGE

Section **Page**

54.1 SPN 1176/FMI 3 54-3

54.2 SPN 1176/FMI 4 54-5

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54.1 SPN 1176/FMI 3

This diagnosis is typically a short to power.

54.1.1 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 54.1.1.1.
   [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 switch 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 54.1.1.1.
   [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 54.1.1.1.
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 54.1.1.1.
   [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 54.1.1.1.
    [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 54.1.1.1.

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54.1.1.1 Verify Repairs

Verify repairs as follows:

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).

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54.2 SPN 1176/FMI 4

This diagnosis is typically an open short to ground.

54.2.1 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 54.2.1.1.
   [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 54.2.1.1.
   [c] If only 1176/4 is present, go to step 4.
3. Turn the ignition switch 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 54.2.1.1.
   [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 54.2.1.1.
   [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 54-1. Refer to section 54.2.1.1.
9. Measure the voltage between pin 1 of the Turbo Pressure/Temp Sensor and ground.

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[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 54-1. Refer to section 54.2.1.1.

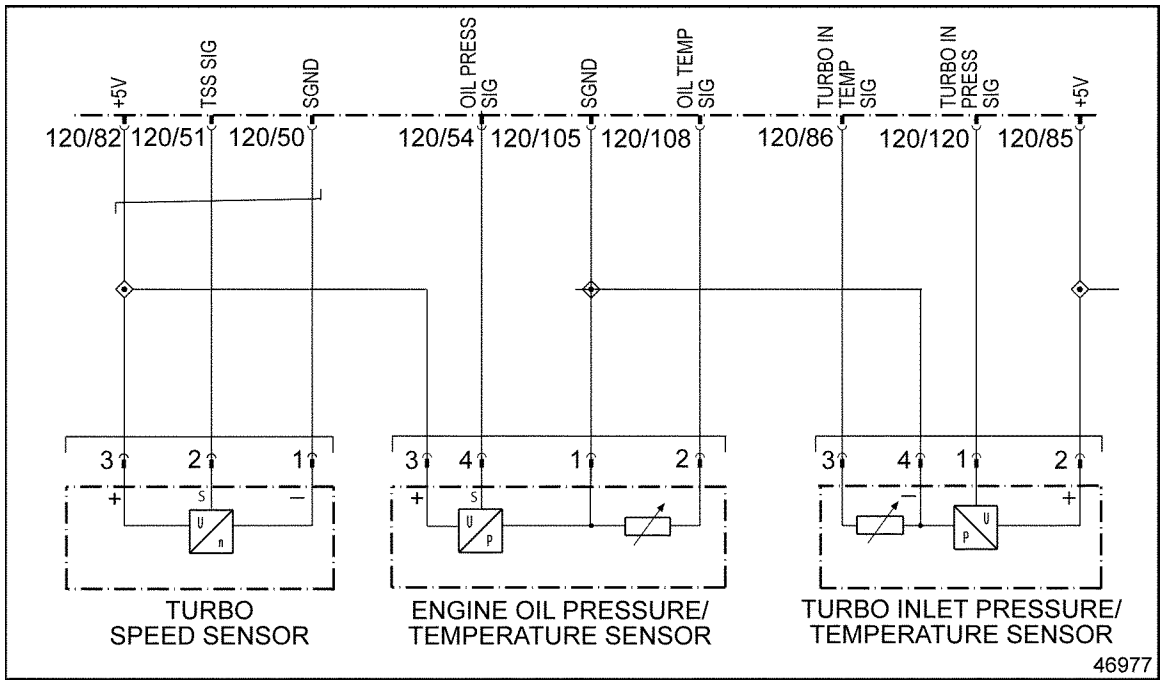

Figure 54-1 Turbo Pressure/Temp Sensor Wiring

[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 54-1. Refer to section 54.2.1.1.

54.2.1.1 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).

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55 SPN 1636 – INTAKE MANIFOLD TEMPERATURE OUTSIDE OF NORMAL OPERATING RANGE

Section **Page**

55.1 SPN 1636 /FMI 2 55-3
55.2 SPN 1636/FMI 3 55-4
55.3 SPN 1636/FMI 4 55-6
55.4 SPN 1636/FMI 14 55-7

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55.1 SPN 1636 /FMI 2

This diagnostic condition is typically erratic data.

55.1.1 Erratic Data Source Check

Check 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 55.1.1.1.
   [b] If the resistance is less than 3 Ω, replace the sensor. Refer to section 55.1.1.1.
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 55.1.1.1.

55.1.1.1 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.

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[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).

55.2 SPN 1636/FMI 3

The diagnostic condition is typically Intake Manifold Temperature Sensor Open Circuit. The following procedures will troubleshoot SPN 1636/3.

55.2.1 Short to Power Check

Check as follows:

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 52 of the 120-pin MCM connector and pin 4 of the sensor. Refer to section 55.2.1.1.
   [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 52 and 106 of the 120–pin MCM connector. See Figure 55-1. Refer to section 55.2.1.1.

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[b] If the resistance is more than 5 Ω, repair the short to power on the circuit between pin 106 of the 120–pin MCM connector and pin 3 of the Intake Manifold Pressure/Temperature Sensor. See Figure 55-1. Refer to section 55.2.1.1.

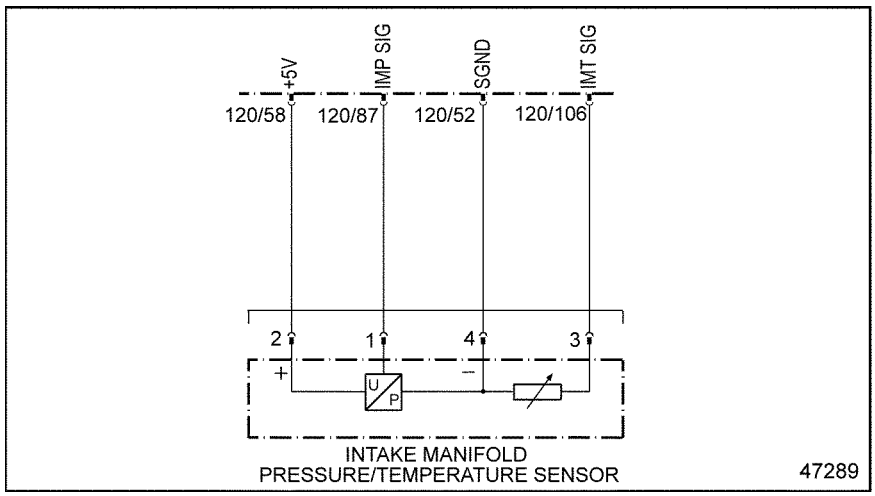

Figure 55-1 Intake Manifold Pressure/Temp Sensor Wiring

55.2.1.1 Verify Repairs

Verify repairs as follows:

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).

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55.3 SPN 1636/FMI 4

A typical diagnosis is Intake Manifold Pressure/Temp Sensor Open Short to Ground.

55.3.1 Intake Manifold Pressure/Temp Sensor Open or Short to Ground Check

Check as follows:

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 55.3.1.1.
   [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 55.3.1.1.
   [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 106 of the 120–pin MCM connector. See Figure 55-2. Refer to section 55.3.1.1.

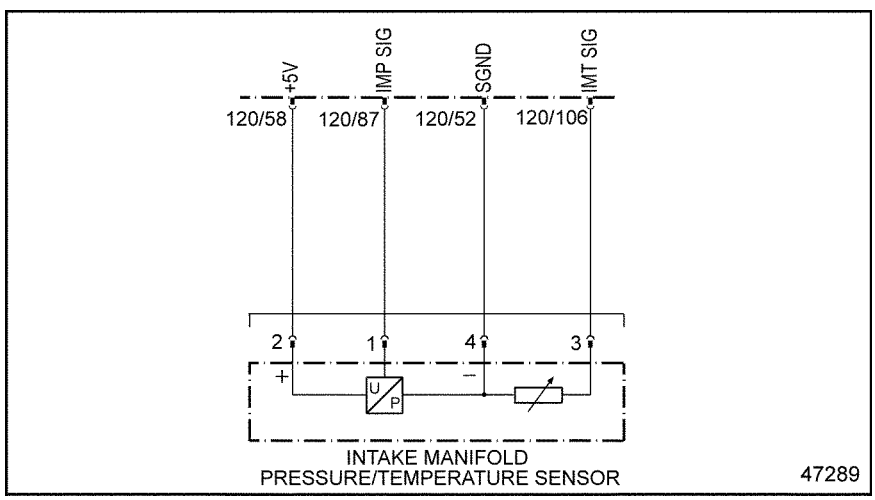

Figure 55-2 Intake Manifold Pressure/Temp Sensor Wiring

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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 106 of the 120–pin MCM connector and pin 3 of the Intake Manifold Pressure/Temp Sensor harness connector. Refer to section 55.3.1.1.
   [b] If resistance is less than 5 Ω, repair the short between wires 52 and ‘106 of the 120–pin MCM connector. Refer to section 55.3.1.1.

55.3.1.1 Verify Repairs

Verify repairs as follows:

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).

55.4 SPN 1636/FMI 14

This code indicates that the Intake Manifold Temperature Sensor has failed a self test.

55.4.1 Temperature Check

Check 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.
2. Turn the ignition ON (key ON, engine OFF).

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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 55.4.1.1.
   [b] If no, go to step 5.
5. Prepare DDDL for a snapshot.
6. Start the engine, idle for 30 seconds, then TURN THE ENGINE OFF.
7. Review the 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 55.4.1.1.
   [b] If no, review steps 3 through 8. If the results are the same, contact the Detroit Diesel Customer Support Center (313–592–5800).

55.4.1.1 Verify Repairs

Verify repairs as follows:

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).

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56 SPN 2629 - TURBO COMPRESSOR OUT TEMP HIGH OR LOW

Section **Page**

56.1 SPN 2629/FMI 3 56-3

56.2 SPN 2629/FMI 4 56-4

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56.1 SPN 2629/FMI 3

This condition is typically open circuit.

56.1.1 Open Circuit Check

Check as follows:

1. Check for multiple codes.
   [a] If codes 1636/3, 412/3 and 2629/3 are active at the same time, repair the open circuit between pin 52 of the 120–pin MCM Connector and pin 1 of the EGR, IMT, and TCO temperature sensors. Refer to section 56.1.1.1.
   [b] If only fault 2629/3 is active, go to step 2.
2. Disconnect the TCO Sensor.
3. Measure the resistance across pins 1 and 2 of the TCO Sensor.
   [a] If the resistance is greater than 4k Ω, replace the TCO Sensor. Refer to section 56.1.1.1
   [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 TCO 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 TCO 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 TCO Sensor harness connector and pin 52 of the 120–pin MCM connector. Refer to section 56.1.1.1.
   [b] If the voltage is less than 2.75 volts, repair the open circuit between pin 2 of the TCO Sensor harness connector and pin 112 of the 120–pin MCM connector. Refer to section 56.1.1.1.
7. Disconnect the 120–pin MCM connector. Measure the resistance between pins 1 and 2 of the TCO Sensor harness connector.
   [a] If the resistance is less than 5 Ω, repair the short between pins 52 and 112 of the 120–pin MCM connector. Refer to section 56.1.1.1.
   [b] If the resistance is greater than 5 Ω, replace the TCO Sensor. Refer to section 56.1.1.1.

56.1.1.1 Verify Repairs

Verify repairs as follows:

1. Turn vehicle ignition OFF. Reconnect all connectors and turn ignition ON.

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2. Clear codes with diagnostic tool.
3. Start and run the engine for one minute. Stop engine.
4. Check diagnostic tool for codes.
   [a] If no codes are displayed, troubleshooting is complete.
   [b] If code 2629/3 is not logged, and other codes are logged, troubleshoot the logged codes.
   [c] If code 2629/3 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).

56.2 SPN 2629/FMI 4

This condition is typically a short circuit.

56.2.1 Short Circuit Check

Check as follows:

1. Disconnect the TCO Sensor.
2. Disconnect the 120–pin MCM connector.
3. Measure the resistance
   [a] If the resistance is less than 5k Ω, repair the short between the 120–pin MCM connector wire 50 and 112. Refer to section 56.2.1.1.
   [b] If the resistance is greater than 5k Ω, go to step 4.
4. Measure the resistance between pin 1 of the TCO Sensor connector and ground.
   [a] If the resistance is less than 5k Ω, repair the short circuit between pin 1 of the TCO Sensor connector and ground. Refer to section 56.2.1.1.
   [b] If the resistance is greater than 5k Ω, go to step 5.
5. Measure the resistance between pin 2 of the TCO Sensor connector and ground.
   [a] If the resistance is less than 5k Ω, repair the short circuit between pin 2 of the TCO Sensor connector and ground. Refer to section 56.2.1.1.
   [b] If the resistance is greater than 5k Ω, contact the Detroit Diesel Customer Support Center (313–592–5800) for authorization to replace the MCM.

56.2.1.1 Verify Repairs

Verify repairs as follows:

1. Turn vehicle ignition OFF. Reconnect all connectors and turn ignition ON.
2. Clear codes with diagnostic tool.
3. Start and run the engine for one minute. Stop engine.

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4. Check diagnostic tool for codes.

   [a] If no codes are displayed, troubleshooting is complete.

   [b] If code 2629/4 is not logged, and other codes are logged, troubleshoot the logged codes.

   [c] If code 2629/4 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).

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57 SPN 2791 – EGR VALVE (AUX PWM #1) FAILED OR OPEN CIRCUIT

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57.2 SPN 2791/FMI 4 57-5
57.3 SPN 2791/FMI 5 57-6

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57.1 SPN 2791/FMI 3

This diagnostic condition is typically a short to power fault.

57.1.1 Short 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 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 57.1.2.1.
   [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 57.1.2.1
   [b] If the resistance is less than 5 Ω, refer to section 57.1.2.

57.1.2 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 57.1.2.1.
   [b] If the voltage is less than 11.5 volts, go to step 5.
5. Turn the ignition OFF.
6. Disconnect the 120–pin MCM connector.
7. Measure the resistance between pin 1 and pin 2 of the EGR valve connector.

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[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 57.1.2.1.

[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.

57.1.2.1 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).

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57.2 SPN 2791/FMI 4

This diagnosis is typically short to ground.

57.2.1 Short Circuit Check

Check 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 57.2.2.1.
   [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 57.2.2.1.
   [b] If the resistance is greater than 5 Ω, Refer to section 57.2.2.1.

57.2.2 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 vehicle 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 57.2.2.1.
   [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 57.2.2.1.
   [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.

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57.2.2.1 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).

57.3 SPN 2791/FMI 5

This diagnostic condition is typically an open circuit fault.

57.3.1 Open 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 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 57.3.1.1.
   [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 57.3.1.1.
   [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.

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[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 57.3.1.1.

[b] If the resistance is less than 3 Ω, replace the EGR valve.

57.3.1.1 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).

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58 SPN 3510 — ACCELERATOR PEDAL SUPPLY OUTSIDE OF NORMAL OPERATING RANGE

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58.1 SPN 3510/FMI 2

This fault indicates that the throttle pedal supply is receiving erratic data.

58.1.1 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 58-1.

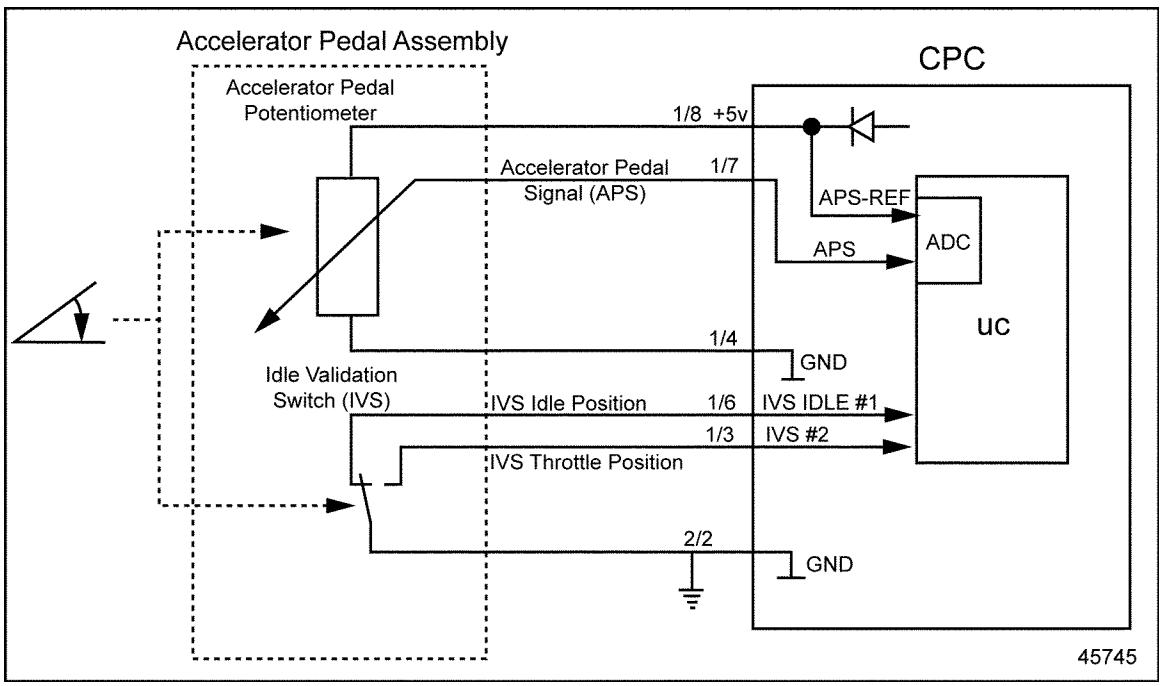

Figure 58-1 Accelerator Pedal Assembly Installation

   [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 58.1.1.1.

   [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 58.1.1.1.

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] 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 58.1.1.1.
   [b] If the resistance is less than 3 Ω, replace the Accelerator Pedal. Refer to section 58.1.1.1.

58.1.1.1 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 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).

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58.2 SPN 3510/FMI 3

The typical diagnosis for this fault is high voltage.

58.2.1 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, 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 58.2.1.1.
   [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 58.2.1.1.
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] Measure the resistance between pin 2 of the AP harness connector and pin 7 of the CPC #1 connector. Refer to section 58.2.1.1.
   [b] If the resistance is less than 3 Ω, replace the Accelerator Pedal. Refer to section 58.2.1.1.

58.2.1.1 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 3510/3 is not logged, and other codes are logged, troubleshoot the logged codes.

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[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).

58.3 SPN 3510/FMI 4

The typical diagnosis for this fault is voltage low.

58.3.1 Low Voltage Check

Check as follows:

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 58.3.1.1.
   [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 58.3.1.1.
   [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 58.3.1.1.
   [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 58.3.1.1.
   [b] If the resistance is greater than 5 Ω, replace the Accelerator Pedal. Refer to section 58.3.1.1.

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58.3.1.1 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 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).

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59 SPN 3563 – INTAKE MANIFOLD PRESSURE OUTSIDE NORMAL RANGE

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59.1 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.

59.1.1 Low (Boost) Pressure Check

Check as follows:

1. Turn the ignition ON (key ON, engine OFF).
2. 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, go to step 3.
3. 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 59.1.2.1.
   [b] If the air filter or air intake system is not restricted, go to step 4.
4. Check the condition of the boost air sensor.
   [a] If sensor is not in good condition, replace sensor. Refer to section 59.1.2.1.
   [b] If sensor is in good condition, go to step 5.
5. 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 59.1.2.1.
   [b] If no leaks are found, go to step 6.
6. 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 59.1.2.1.
   [b] If the turbocharger is not faulty, go to step 7.
7. 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 59.1.2.1.
   [b] If fuel delivery is within specifications, check for erratic data. Refer to section 59.1.2.

59.1.2 Erratic Data Check

Check for erratic data:

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

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2. Find the altitude for your local area and use Table 1 to determine the kPa value for the local altitude.
3. Open DDDL and change the units to metric. (Tool menu > Options > Metric).
4. Using DDDL, 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 59.1.2.1.
   [b] If the value is less than X kPa,, go to step 5.
5. Using DDDL, 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 59.1.2.1.
   [b] If the value is less than X kPa,, go to step 6.
6. Start the engine and run at idle.
7. Using DDDL, 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 59.1.2.1.
   [b] If the value is within X kPa, go to step 8.
8. Using DDDL, 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 59.1.2.1.
   [b] If the value is within X kPa,, go to step 9.
9. Run the engine to 1500 rpm.
10. Using DDDL, 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, 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 59.1.2.1.
    [b] If the value is within X kPa, contact Detroit Diesel Customer Support Center (313–592–5800).

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59.1.2.1 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 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).

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59.2 SPN 3563/FMI 3

The following procedures will troubleshoot SPN 3563/FMI 3, Intake Manifold Pressure/Temp Sensor short to power.

59.2.1 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 59-1. Refer to section 59.2.1.1.
   [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 59-1.

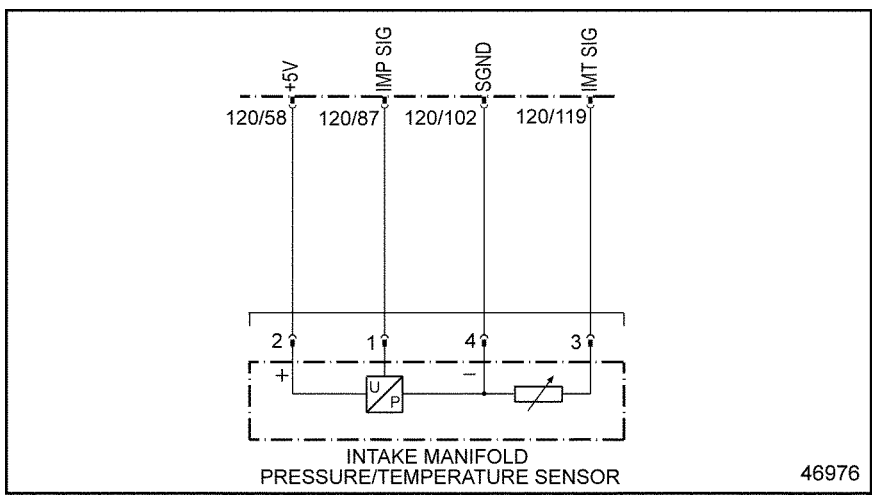

Figure 59-1 Intake Manifold Pressure/Temp Sensor

[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 59-1. Refer to section 59.2.1.1.

[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 59-1. Refer to section 59.2.1.1.

59.2.1.1 Verify Repairs

Perform the following steps to verify repairs.

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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).

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59.3 SPN 3563/FMI 4

The following procedures will troubleshoot SPN 3563/FMI 4, Intake Manifold Pressure/Temp Sensor short to ground.

59.3.1 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 59-2.

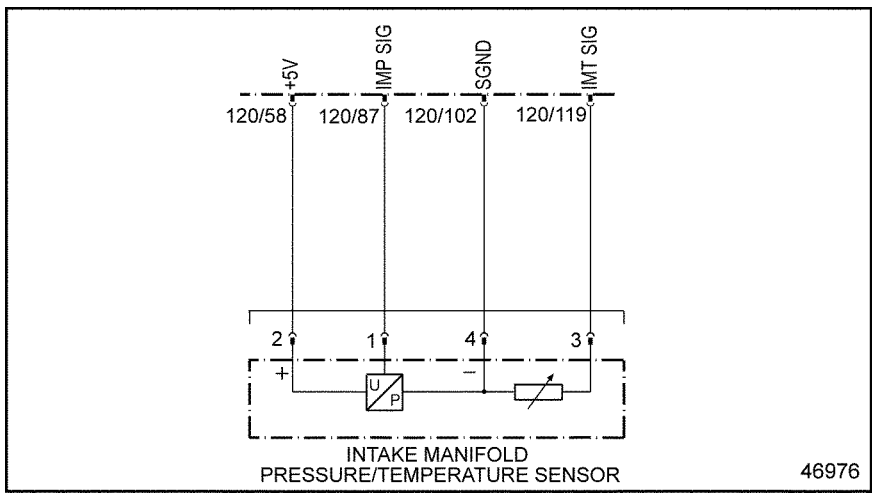

Figure 59-2 Intake Manifold Pressure/Temp Sensor

   [a] If resistance is greater than 130k Ω, replace the sensor.Refer to section 59.3.1.1.
   [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 59-2.
   [a] If resistance is greater than 130k Ω, replace the sensor.Refer to section 59.3.1.1.
   [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.

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[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 59.3.1.1.

[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 59.3.1.1.

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 59.3.1.1.

[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 59.3.1.1.

59.3.1.1 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).

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60 SPN 3659 — ELECTRONIC UNIT PUMP #1 NOT OPERATING NORMALLY

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60.1 SPN 3659/FMI 5

This diagnosis is typically the Electronic Unit Pump current is below normal or an open circuit fault.

60.1.1 Open Circuit Check

Check as follows:

1. Turn the ignition ON (key ON, engine OFF).
2. Check for multiple codes.
   [a] If fault code 168/1 is active in addition to 3659/5, service 168/1 first. Refer to section 27.2.
   [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 3.
3. Measure the voltage between pins 1 and 2 of Electronic Unit Pump #1. See Figure 60-1.

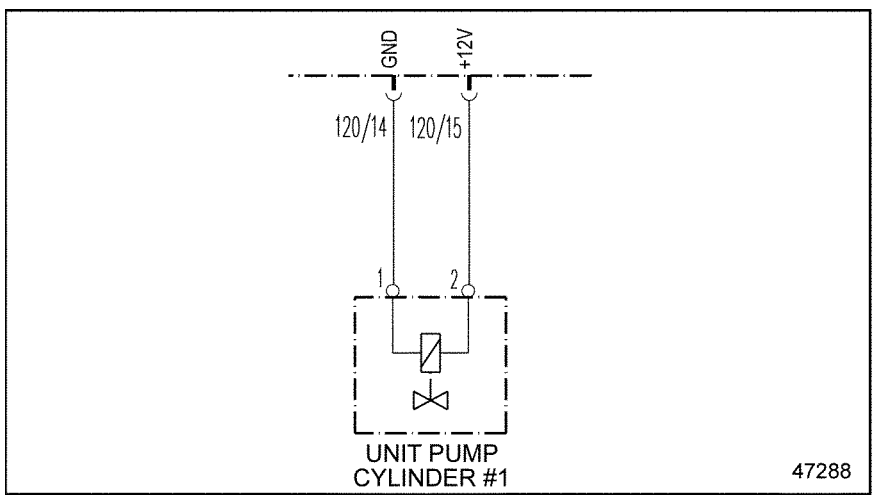

Figure 60-1 Electronic Unit Pump #1

   [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 2 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 1 of Electronic Unit Pump #1. Refer to section 60.1.1.1.
   [b] If the voltage is less than 11.5 volts, repair the open between pin 15 of the 120–pin MCM connector and pin 2 of Electronic Unit Pump #1. Refer to section 60.1.1.1.

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60.1.1.1 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).

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60.2 SPN 3659/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. 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 60-2.
   [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 14 and 15 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 5.

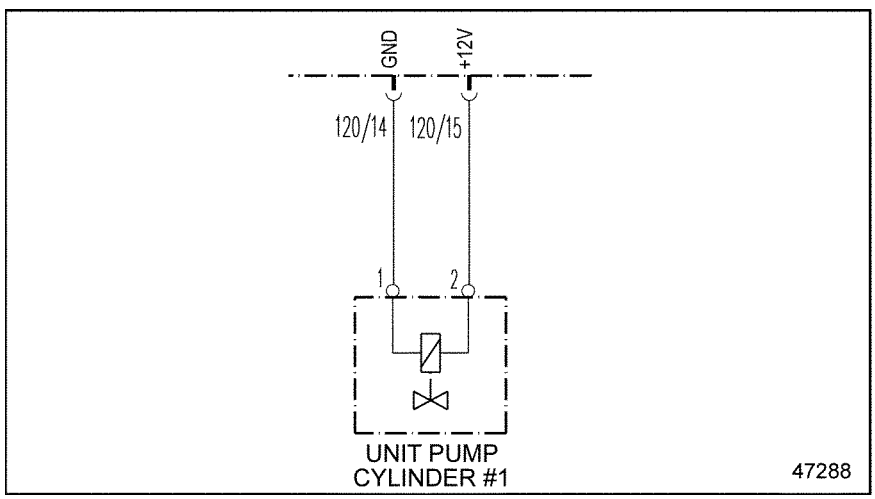

Figure 60-2 Electronic Unit Pump #1

5. Measure the resistance between pin 2 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 2 of the Electronic Unit Pump #1 harness and pin 15 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 1 of the Electronic Unit Pump #1 harness and pin 14 of the MCM 120–pin connector. Refer to section 60.2.1.1.

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60.2.1.1 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).

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61 SPN 3660 - ELECTRONIC UNIT PUMP #2 NOT OPERATING NORMALLY

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61.2 SPN 3660/FMI 10 61-5

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61.1 SPN 3660/FMI 5

This diagnosis is typically the Electronic Unit Pump current is below normal or an open circuit fault.

61.1.1 Open Circuit Check

Check as follows:

1. Turn the ignition ON (key ON, engine OFF).
2. Check for multiple codes.
   [a] If fault code 168/1 is active in addition to 3660/5, service 168/1 first. Refer to section 27.2.
   [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 3.
3. Measure the voltage between pins 1 and 2 of Electronic Unit Pump #2. See Figure 61-1.

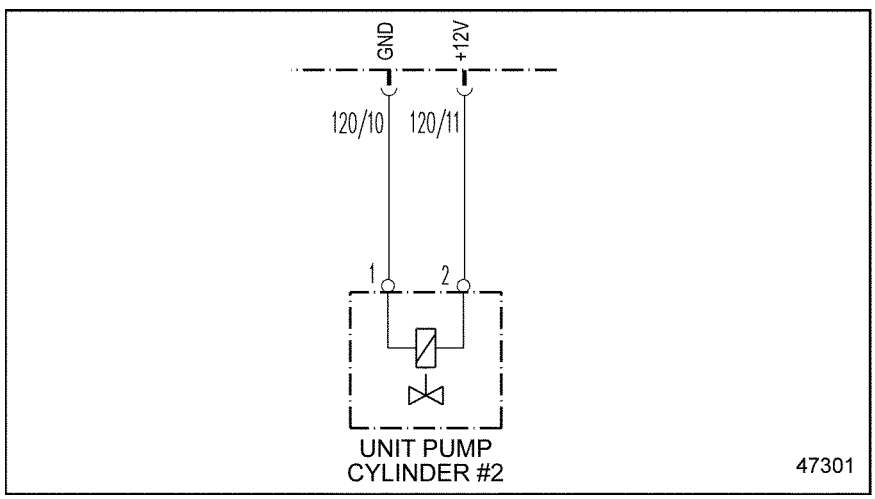

Figure 61-1 Electronic Unit Pump #2

   [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 2 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 1 of Electronic Unit Pump #2. Refer to section 61.1.1.1.
   [b] If the voltage is less than 11.5 volts, repair the open between pin 11 of the 120–pin MCM connector and pin 2 of Electronic Unit Pump #2. Refer to section 61.1.1.1.

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61.1.1.1 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).

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61.2 SPN 3660/FMI 10

This diagnostic condition is typically a short to ground.

61.2.1 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 61-2.

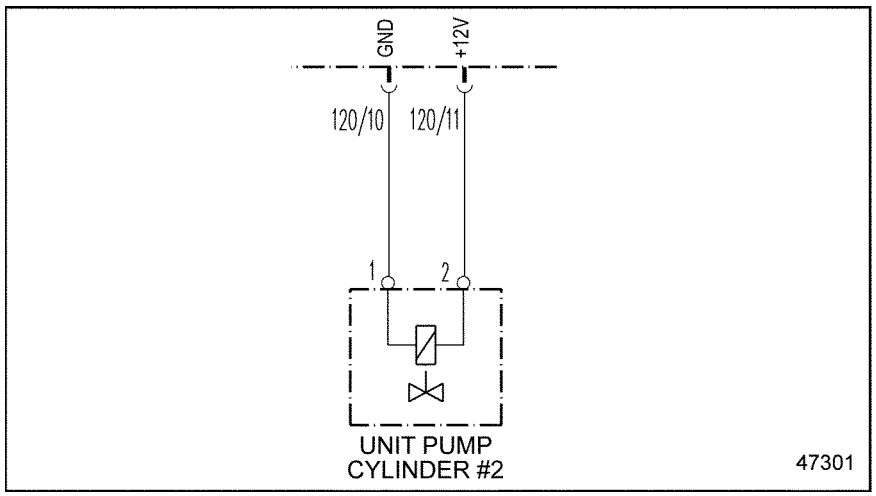

Figure 61-2 Electronic Unit Pump #2

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 10 and 11 of the 120–pin MCM connector. Refer to section 61.2.1.1.
   [b] If the resistance is greater than 5 Ω, go to step 5.
5. Measure the resistance between pin 2 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 2 of the Electronic Unit Pump #2 harness and pin 11 of the MCM 120–pin connector. Refer to section 61.2.1.1.
   [b] If the resistance is greater than 5 Ω, repair the short to ground between pin 1 of the Electronic Unit Pump #2 harness and pin 10 of the MCM 120–pin connector. Refer to section 61.2.1.1.

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61.2.1.1 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).

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62 SPN 3661 - ELECTRONIC UNIT PUMP #3 NOT OPERATING NORMALLY

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62.1 SPN 3661/FMI 5 62-3

62.2 SPN 3661/FMI 10 62-5

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62.1 SPN 3661/FMI 5

This diagnosis is typically the Electronic Unit Pump current is below normal or an open circuit fault.

62.1.1 Check for Open Circuits

Check as follows:

1. Turn the ignition ON (key ON, engine OFF).
2. Check for multiple codes.
   [a] If fault code 168/1 is active in addition to 3661/5, service 168/1 first. Refer to section 27.2.
   [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 3.
3. Measure the voltage between pins 1 and 2 of Electronic Unit Pump #3. See Figure 62-1.

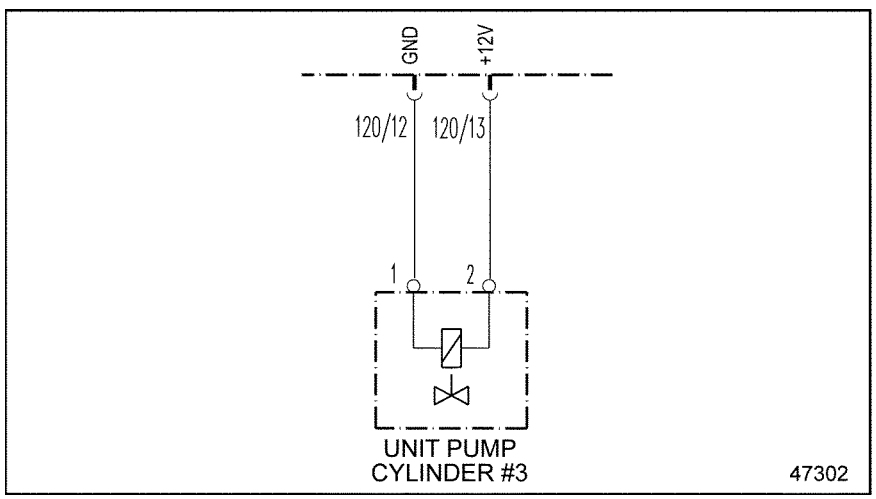

Figure 62-1 Electronic Unit Pump #3

   [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 2 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 1 of Electronic Unit Pump #3. Refer to section 62.1.1.1.
   [b] If the voltage is less than 11.5 volts, repair the open between pin 13 of the 120–pin MCM connector and pin 2 of Electronic Unit Pump #3. Refer to section 62.1.1.1.

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62.1.1.1 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).

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62.2 SPN 3661/FMI 10

This diagnostic condition is typically a short.

62.2.1 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 62-2.

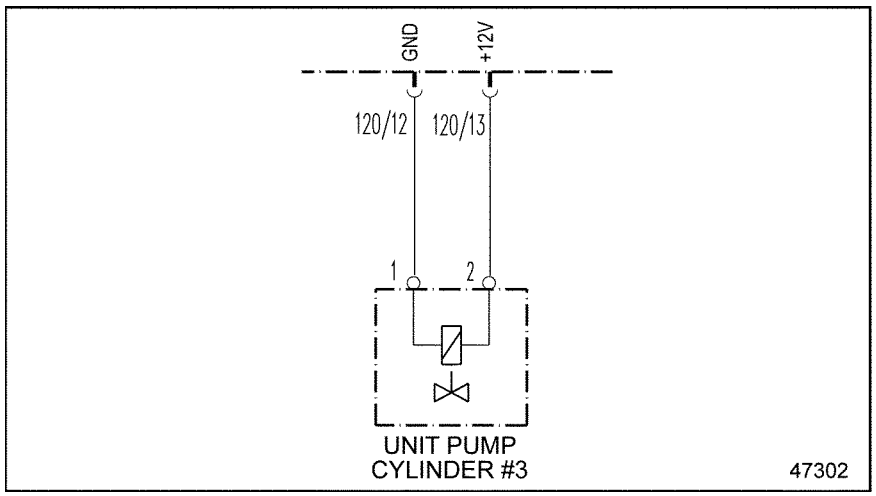

Figure 62-2 Electronic Unit Pump #3

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 12 and 13 of the 120–pin MCM connector.Refer to section 62.2.1.1.
   [b] If the resistance is greater than 5 Ω, go to step 5.
5. Measure the resistance between pin 2 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 2 of the Electronic Unit Pump #3 harness and pin 13 of the MCM 120–pin connector. Refer to section 62.2.1.1.
   [b] If the resistance is greater than 5 Ω, repair the short to ground between pin 1 of the Electronic Unit Pump #3 harness and pin 12 of the MCM 120–pin connector. Refer to section 62.2.1.1.

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62.2.1.1 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).

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63 SPN 3662 - ELECTRONIC UNIT PUMP #4 NOT OPERATING NORMALLY

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63.2 SPN 3662/FMI 10 63-5

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63.1 SPN 3662/FMI 5

This diagnosis is typically the Electronic Unit Pump current is below normal or an open circuit fault.

63.1.1 Open Circuit Check

Check as follows:

1. Turn the ignition ON (key ON, engine OFF).
2. Check for multiple codes.
   [a] If fault code 168/1 is active in addition to 3662/5, service 168/1 first. Refer to section 27.2.
   [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 3.
3. Measure the voltage between pins 1 and 2 of Electronic Unit Pump #4. See Figure 63-1.

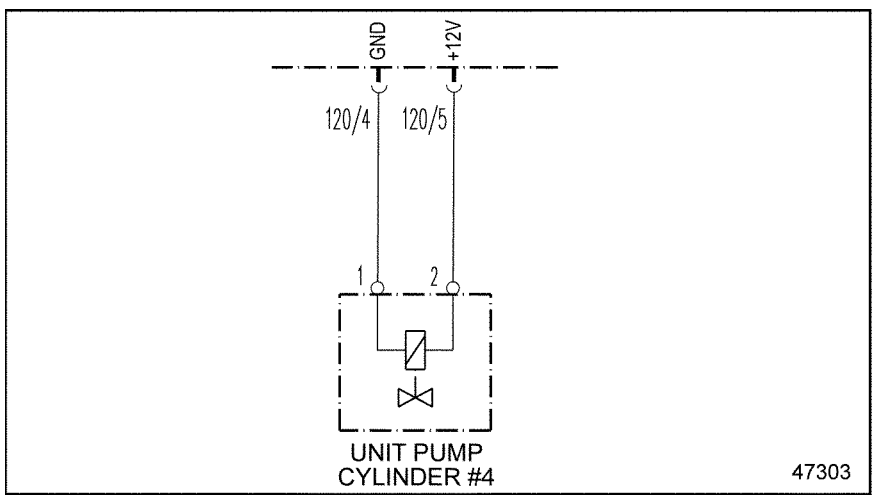

Figure 63-1 Electronic Unit Pump #4

   [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 2 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 1 of Electronic Unit Pump #4. Refer to section 63.1.1.1.
   [b] If the voltage is less than 11.5 volts, repair the open between pin 5 of the 120–pin MCM connector and pin 2 of Electronic Unit Pump #4. Refer to section 63.1.1.1.

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63.1.1.1 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).

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63.2 SPN 3662/FMI 10

This diagnostic condition is typically a short to ground.

63.2.1 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 63-2.

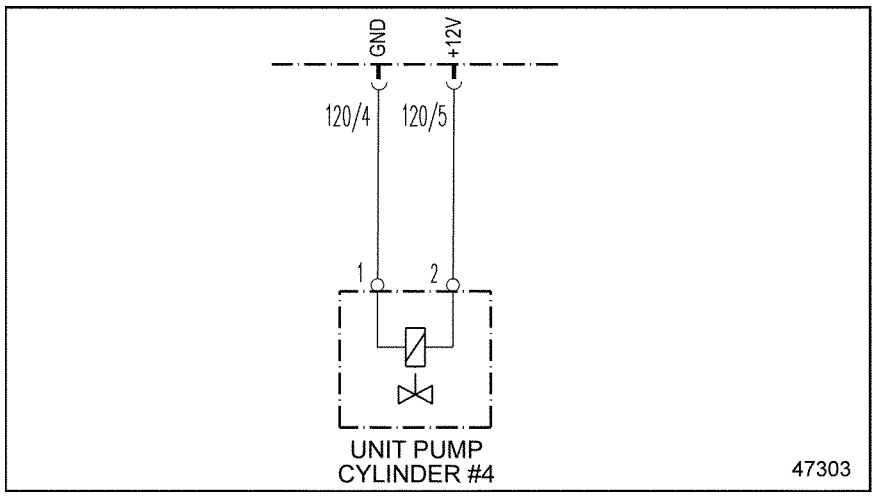

Figure 63-2 Electronic Unit Pump #4

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 4 and 5 of the 120–pin MCM connector. Refer to section 63.2.1.1.
   [b] If the resistance is greater than 5 Ω, go to step 5.
5. Measure the resistance between pin 2 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 2 of the Electronic Unit Pump #4 harness and pin 5 of the MCM 120–pin connector. Refer to section 63.2.1.1.
   [b] If the resistance is greater than 5 Ω, repair the short to ground between pin 1 of the Electronic Unit Pump #4 harness and pin 4 of the MCM 120–pin connector. Refer to section 63.2.1.1.

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63.2.1.1 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).

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64 SPN 3663 - ELECTRONIC UNIT PUMP #5 NOT OPERATING NORMALLY

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64.2 SPN 3663/FMI 10 64-5

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64.1 SPN 3663/FMI 5

This diagnosis is typically the Electronic Unit Pump current is below normal or an open circuit fault.

64.1.1 Open Circuit Check

Check as follows:

1. Turn the ignition ON (key ON, engine OFF).
2. Check for multiple codes.
   [a] If fault code 168/1 is active in addition to 3663/5, service 168/1 first. Refer to section 27.2.
   [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 3.
3. Measure the voltage between pins 1 and 2 of Electronic Unit Pump #5. See Figure 64-1.

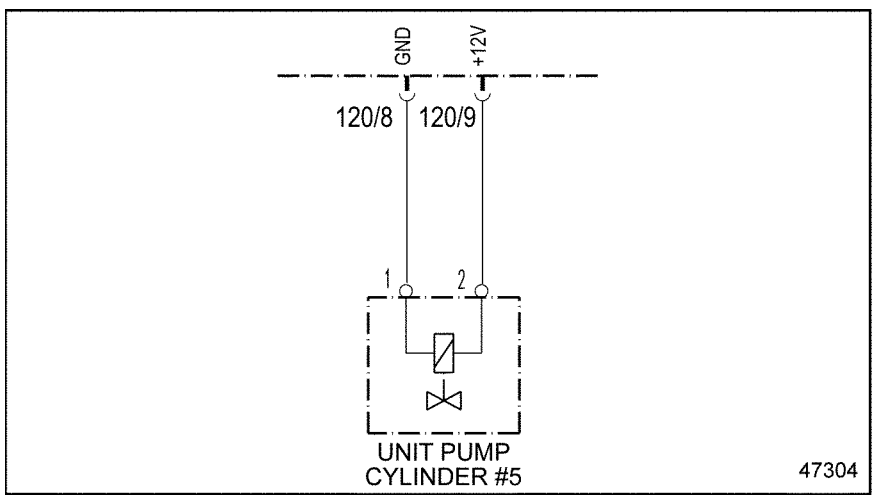

Figure 64-1 Electronic Unit Pump #5

   [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 2 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 1 of Electronic Unit Pump #5. Refer to section 64.1.1.1.
   [b] If the voltage is less than 11.5 volts, repair the open between pin 9 of the 120–pin MCM connector and pin 2 of Electronic Unit Pump #5. Refer to section 64.1.1.1.

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64.1.1.1 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 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).

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64.2 SPN 3663/FMI 10

This diagnostic condition is typically a short to ground.

64.2.1 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 64-2.

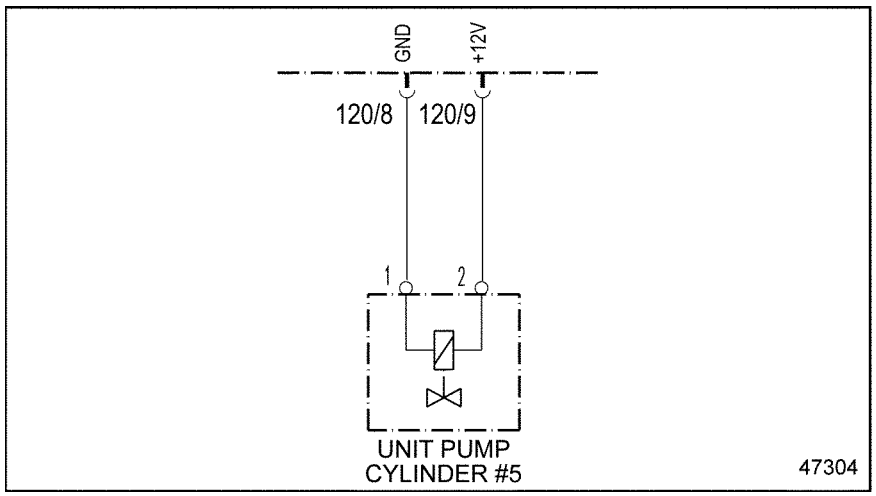

Figure 64-2 Electronic Unit Pump #5

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 8 and 9 of the 120–pin MCM connector. Refer to section 64.2.1.1.
   [b] If the resistance is greater than 5 Ω, go to step 5.
5. Measure the resistance between pin 2 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 2 of the Electronic Unit Pump #5 harness and pin 9 of the MCM 120–pin connector. Refer to section 64.2.1.1.
   [b] If the resistance is greater than 5 Ω, repair the short to ground between pin 1 of the Electronic Unit Pump #5 harness and pin 8 of the MCM 120–pin connector. Refer to section 64.2.1.1.

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64.2.1.1 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).

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65 SPN 3664 - ELECTRONIC UNIT PUMP #6 NOT OPERATING NORMALLY

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65.2 SPN 3664/FMI 10 65-5

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65.1 SPN 3664/FMI 5

This diagnosis is typically the Electronic Unit Pump current is below normal or an open circuit fault.

65.1.1 Open Circuit Check

Check as follows:

1. Turn the ignition ON (key ON, engine OFF).
2. Check for multiple codes.
   [a] If fault code 168/1 is active in addition to 3664/5, service 168/1 first. Refer to section 27.2.
   [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 65.1.1.1.
   [c] If only fault code 3664/5 is active, go to step 3.
3. Measure the voltage between pins 1 and 2 of Electronic Unit Pump #6. See Figure 65-1.

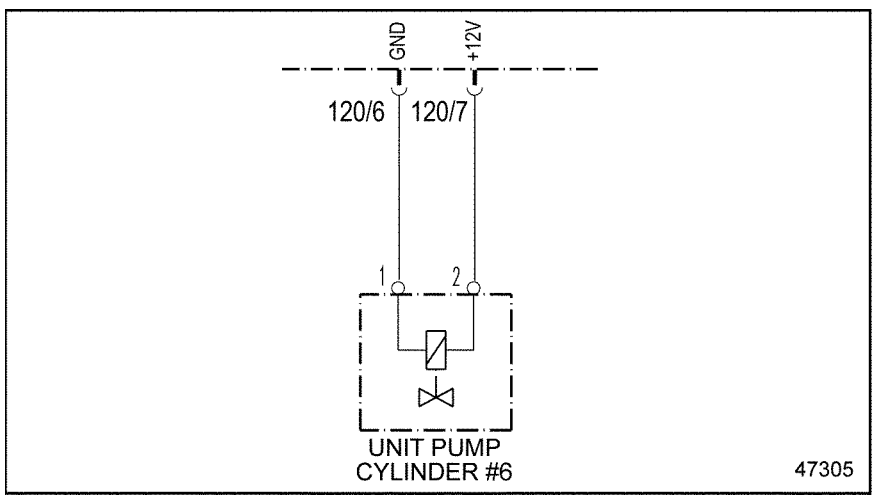

Figure 65-1 Electronic Unit Pump #6

   [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 2 of the Electronic Unit Pump #6 and ground.
   [a] If the voltage is greater than 11.5 volts, repair the open between pin 6 of the 120–pin MCM connector and pin 1 of Electronic Unit Pump #6. Refer to section 65.1.1.1.
   [b] If the voltage is less than 11.5 volts, repair the open between pin 7 of the 120–pin MCM connector and pin 2 of Electronic Unit Pump #6. Refer to section 65.1.1.1.

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65.1.1.1 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).

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65.2 SPN 3664/FMI 10

This diagnostic condition is typically a short to ground.

65.2.1 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 65-2.

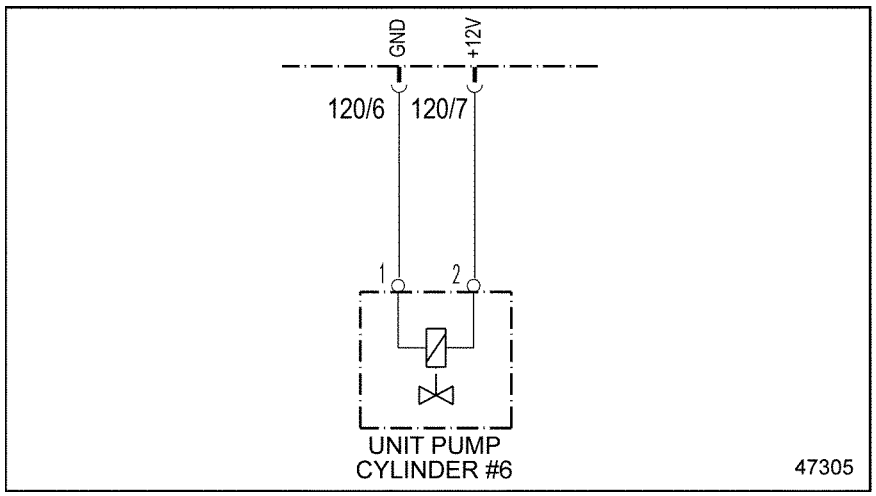

Figure 65-2 Electronic Unit Pump #6

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 6 and 7 of the 120–pin MCM connector. Refer to section 65.2.1.1.
   [b] If the resistance is greater than 5 Ω, go to step 5.
5. Measure the resistance between pin 2 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 2 of the Electronic Unit Pump #6 harness and pin 7 of the MCM 120–pin connector. Refer to section 65.2.1.1.
   [b] If the resistance is greater than 5 Ω, repair the short to ground between pin 1 of the Electronic Unit Pump #6 harness and pin 6 of the MCM 120–pin connector. Refer to section 65.2.1.1.

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65.2.1.1 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).

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66 CPC DIGITAL OUTPUTS SPN/FMI

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66.1 CPC DIGITAL OUTPUT FAULT CODES

These CPC digital outputs have the same SPN as some MCM faults. DDDL for DDEC VI makes the distinction between the MCM and CPC when diagnosing a fault.

66.2 TROUBLESHOOTING THE CPC DIGITAL OUTPUTS

These faults deal with procedures that must be supplied by the OEMs. The CPC digital output SPNs and FMIs are listed in Table 66-1.

Module	SPN	FMI	Description
CPC	703	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.
CPC	703	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.
CPC	704	3	HIGH EXHAUST TEMP LAMP - indicates a short to power/open circuit on pin 7 of the CPC #4 connector. For wiring schematic information refer to OEM literature.
CPC	704	4	HIGH EXHAUST TEMP LAMP - indicates a short to ground on the pin 7 circuit of the CPC #4 connector. For wiring schematic information refer to OEM literature.
CPC	705	3	MIL LAMP - indicates a short to power/open circuit on pin 13of the CPC #1 connector. For wiring schematic information refer to OEM literature.
CPC	705	4	MIL LAMP - indicates a short to ground on the pin 13 circuit of the CPC #1 connector. For wiring schematic information refer to OEM literature.
CPC	706	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.
CPC	706	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.
CPC	707	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.
CPC	707	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.
CPC	708	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.
CPC	708	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.
CPC	709	3	RED STOP LAMP (RSL) - indicates a short to power/open circuit on pin 16 of the CPC #3 connector. For wiring schematic information refer to OEM literature.

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Module	SPN	FMI	Description
CPC	709	4	RED STOP LAMP (RSL) - indicates a short to ground on the pin 16 circuit of the CPC #3 connector. For wiring schematic information refer to OEM literature.
CPC	711	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.
CPC	711	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.
CPC	713	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.
CPC	713	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.
CPC	713	5	TOP2 LOCKOUT SOLENOID - indicates a open circuit on the pin 7 circuit of the CPC #3 connector. For wiring schematic information refer to OEM literature.
CPC	714	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.
CPC	714	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.
CPC	714	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.
CPC	715	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.
CPC	715	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.
CPC	715	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.

Table 66-1 CPC Digital Output Faults

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