

Troubleshooting Guide

Series 60[®] DDEC[®] VI

DETROIT DIESEL
CORPORATION



Detroit Diesel Corporation
13400 Outer Drive, West / Detroit, Michigan 48239-4001
Telephone: 313-592-5000
Fax: 313-592-8176
<http://www.detroitdiesel.com>

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

Detroit Diesel[®], DDC[®], Series 60[®] and the spinning arrows design are registered trademarks of
Detroit Diesel Corporation. DDEC[®] is a registered trademark of Detroit Diesel Corporation.
All other trademarks are the property of their respective owners.

All information subject to change without notice.

6SE567 Copyright © 2006 DETROIT DIESEL CORPORATION. All rights reserved.


Printed in U.S.A.

**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
<p>Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.</p> <ul style="list-style-type: none"> □ 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

DDC®, Detroit Diesel®, DDEC®, Diagnostic Link®, Optimized Idle®, Optimized Idle®, Pro-Link®, and Series 60® are registered trademarks of Detroit Diesel Corporation. All other trademarks used are the property of their respective owners.

MCM/CPC WARNING


 WARNING
<p>Unintended engine startup, acceleration, or shutdown could cause personal injury or death.</p> <p>This MCM and CPC are programmed for specific options. Replacing either with one that has not been programmed with these exact options could have unintended results.</p> <p>Only replace with an MCM or CPC that has the identical inputs and outputs programmed.</p>
45696

Figure 1 MCM/CPC Replacement Warning

SOFTWARE UPGRADES

NOTE:

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

ABSTRACT

This manual provides instruction for troubleshooting DDEC® VI Series 60® engines.

Specifically covered in this manual are troubleshooting and repair steps that apply to the 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 hazard notices labeled "Warnings," "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 "Warnings," "Cautions" and "Notices" are not exhaustive. It is impossible to warn personnel of all the possible hazardous consequences that might result from failure to follow these instructions.

A LETTER TO THE TECHNICIANS

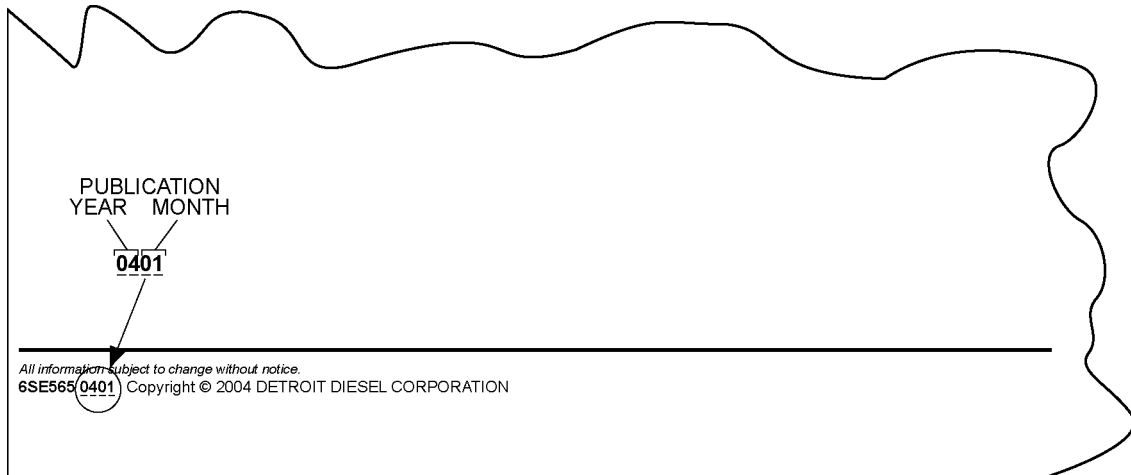
Technicians today are required to have computer skills, excellent comprehension of the written word and possess an extensive diagnostic understanding of the various technological systems and components. Technicians today must perform at a higher level of efficiency and competency than their predecessors 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 Detroit Diesel 2007 Electronics Controls Troubleshooting Guide will provide you with concentrated information that will allow you to excel in 2007 Electronics Controls technology.

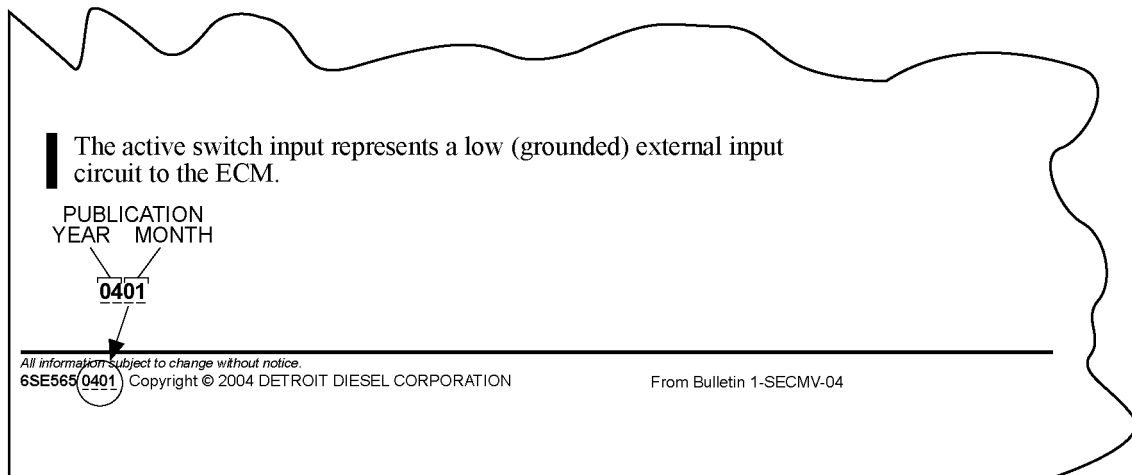
REVISION NOTIFICATION

Modifications to this manual are announced in the form of Service Information Bulletins. The bulletins include attachment pages and are posted on the World Wide Web. (www.detroitdiesel.com/svc/sibinex.htm).

Revisions to this manual will be sent marked with a revision bar (see Example 2). Sections containing revisions will have added information in the page footer (compare Examples 1 and 2).



Example 1 - Unchanged Pages



Example 2 - Changed Pages

TABLE OF CONTENTS

1	INTRODUCTION	
1.1	OVERVIEW	1-3
1.2	SCOPE AND USE OF THIS GUIDE	1-4
1.3	SAFETY PRECAUTIONS	1-6
2	DDEC VI SYSTEM	
2.1	DDEC VI SYSTEM--HOW IT WORKS	2-3
2.2	MOTOR CONTROL MODULE	2-4
2.3	COMMON POWERTRAIN CONTROLLER	2-13
2.4	WIRES AND WIRING	2-25
2.5	CONDUIT AND LOOM	2-39
2.6	TAPE AND TAPING	2-40
2.7	SENSORS	2-41
2.8	INSTRUMENT PANEL LAMPS	2-54
3	SPN 27 - EGR VALVE POSITION CIRCUIT FAULT	
3.1	SPN 27/FMI 3	3-3
3.2	SPN 27/FMI 4	3-4
3.3	SPN 27/FMI 0/1/2/14	3-5
4	SPN 84 – VEHICLE SPEED SENSOR	
4.1	SPN 84/FMI 3	4-3
4.2	SPN 84/FMI 4	4-4
5	SPN 86 – ADAPTIVE CRUISE CONTROL FAULT	
5.1	SPN 86/FMI 14	5-3
6	SPN 91 – ACCELERATOR PEDAL SENSOR FAULT	
6.1	SPN 91/FMI 2	6-3
6.2	SPN 91/FMI 3	6-4
6.3	SPN 91/FMI 4	6-5
7	SPN 100 — ENGINE OIL PRESSURE OUTSIDE OF NORMAL OPERATING RANGE	
7.1	SPN 100/FMI 1	7-3
7.2	SPN 100/FMI 2	7-4
7.3	SPN 100/FMI 3	7-5
7.4	SPN 100/FMI 4	7-7
7.5	SPN 100/FMI 14	7-9
8	SPN 103 – TURBO NO REVOLUTION	
8.1	SPN 103/FMI 0	8-3
8.2	SPN 103/FMI 1	8-4
8.3	SPN 103/FMI 3	8-5
8.4	SPN 103/FMI 4	8-7
8.5	SPN 103/FMI 7	8-8

9	SPN 110 — COOLANT TEMPERATURE ABOVE OR BELOW NORMAL OPERATING RANGE	
9.1	SPN 110/FMI 0	9-3
9.2	SPN 110/FMI 2	9-3
9.3	SPN 110/FMI 3	9-4
9.4	SPN 110/FMI 4	9-7
9.5	SPN 110/FMI 14	9-9
10	SPN 111 – COOLANT LEVEL OUTSIDE NORMAL OPERATING RANGE	
10.1	SPN 111/FMI 1	10-3
10.2	SPN 111/FMI 3	10-5
10.3	SPN 111/FMI 4	10-7
11	SPN 158 — BATTERY CHARGING FAULT	
11.1	SPN 158/FMI 0	11-3
11.2	SPN 158/FMI 1	11-4
11.3	SPN 158/FMI 2	11-6
12	SPN 168 – BATTERY VOLTAGE OUTSIDE NORMAL OPERATING RANGE	
12.1	SPN 168/FMI 0	12-3
12.2	SPN 168/FMI 1	12-4
13	SPN 174 – SUPPLY FUEL TEMPERATURE FAULT	
13.1	SPN 174/FMI 3	13-3
13.2	SPN 174/FMI 4	13-5
14	SPN 175 – ENGINE OIL TEMPERATURE OUT OF NORMAL RANGE	
14.1	SPN 175/FMI 2	14-3
14.2	SPN 175/FMI 3	14-4
14.3	SPN 175/FMI 4	14-6
15	SPN 411 — EGR DIFFERENTIAL PRESSURE OR DELTA P SENSOR CIRCUIT OUTSIDE OF NORMAL OPERATING RANGE	
15.1	SPN 411/FMI 0	15-3
15.2	SPN 411/FMI 1	15-4
15.3	SPN 411/FMI 3	15-5
15.4	SPN 411/FMI 4	15-7
16	SPN 412 - EGR TEMPERATURE IS OUTSIDE OF THE NORMAL RANGE	
16.1	SPN 412/FMI 3	16-3
16.2	SPN 412/FMI 4	16-5
17	SPN 558 - IDLE VALIDATION SWITCH	
17.1	SPN 558/FMI 1	17-3
17.2	SPN 558/FMI 3	17-3
17.3	SPN 558/FMI 4	17-5

18	SPN 599 - CRUISE CONTROL SWITCHES NOT FUNCTIONING PROPERLY	
18.1	SPN 599/FMI 12	18-3
19	SPN 601 - CRUISE CONTROL SWITCHES NOT FUNCTIONING PROPERLY	
19.1	SPN 601/FMI 12	19-3
20	SPN 609 - MCM FAULT (ERRONEOUS DATA)	
20.1	SPN 609/FMI 12	20-3
20.2	SPN 609/FMI 14	20-4
21	SPN 625 - CAN FAULT	
21.1	SPN 625/FMI 2,9,10,13,14	21-3
21.2	SPN 625/FMI 4	21-5
22	SPN 636 — CRANKSHAFT POSITION SENSOR OUTSIDE OF NORMAL OPERATING CONDITIONS	
22.1	SPN 636/FMI 1	22-3
22.2	SPN 636/FMI 3	22-4
22.3	SPN 636/FMI 4	22-6
22.4	SPN 636/FMI 7	22-7
22.5	SPN 636/FMI 8	22-9
23	SPN 651 – INJECTOR #1 NEEDLE VALVE NOT OPERATING NORMALLY	
23.1	SPN 651/FMI 5	23-3
23.2	SPN 651/FMI 10	23-6
24	SPN 652 – INJECTOR #2 NEEDLE VALVE NOT OPERATING NORMALLY	
24.1	SPN 652/FMI 5	24-3
24.2	SPN 652/FMI 10	24-6
25	SPN 653 – INJECTOR #3 NEEDLE VALVE NOT OPERATING NORMALLY	
25.1	SPN 653/FMI 5	25-3
25.2	SPN 653/FMI 10	25-6
26	SPN 654 – INJECTOR #4 NEEDLE VALVE NOT OPERATING NORMALLY	
26.1	SPN 654/FMI 5	26-3
26.2	SPN 654/FMI 10	26-6
27	SPN 655 – INJECTOR #5 NEEDLE VALVE NOT OPERATING NORMALLY	
27.1	SPN 655/FMI 5	27-3
27.2	SPN 655/FMI 10	27-6

28	SPN 656 – INJECTOR #6 NEEDLE VALVE NOT OPERATING NORMALLY	
28.1	SPN 656/FMI 5	28-3
28.2	SPN 656/FMI 10	28-6
29	SPN 701 – JAKE BRAKES LOW (AUX PWM #7) OPEN OR SHORT	
29.1	SPN 701/FMI 3	29-3
29.2	SPN 701/FMI 4	29-5
29.3	SPN 701/FMI 5	29-6
30	SPN 704 - TURBO ACTUATOR CONTROL (AUX PWM #10)	
30.1	SPN 704/FMI 3	30-3
30.2	SPN 704/FMI 4	30-4
30.3	SPN 704/FMI 5	30-5
31	SPN 706 – JAKE BRAKE MEDIUM (AUX PWM #13) OPEN OR SHORT	
31.1	SPN 706/FMI 3	31-3
31.2	SPN 706/FMI 4	31-5
31.3	SPN 706/FMI 5	31-6
32	SPN 709 - SINGLE-SPEED FAN (LOW-SIDE DIGITAL OUTPUT #3) FAULT	
32.1	SPN 709/FMI 3	32-3
32.2	SPN 709/FMI 4	32-5
32.3	SPN 709/FMI 5	32-6
33	SPN 714 - ETHER START (LOW-SIDE DIGITAL OUTPUT #8) FAULT	
33.1	SPN 714/FMI 3	33-3
33.2	SPN 714/FMI 4	33-4
33.3	SPN 714/FMI 5	33-5
34	SPN 723 — CAMSHAFT POSITION SENSOR FAULT	
34.1	SPN 723/FMI 3	34-3
34.2	SPN 723/FMI 4	34-5
34.3	SPN 723/FMI 8	34-6
34.4	SPN 723/FMI 14	34-7
35	SPN 975 - TWO-SPEED FAN (AUX PWM #6) FAULT	
35.1	SPN 975/FMI 3	35-3
35.2	SPN 975/FMI 4	35-5
35.3	SPN 975/FMI 5	35-6
36	SPN 1172 -TURBO COMPRESSOR IN TEMP HIGH OR LOW	
36.1	SPN 1172/FMI 3	36-3
36.2	SPN 1172/FMI 4	36-5
37	SPN 1636 – INTAKE AIR TEMPERATURE OUTSIDE OF NORMAL OPERATING RANGE	
37.1	SPN 1636 /FMI 2	37-3
37.2	SPN 1636/FMI 3	37-4
37.3	SPN 1636/FMI 4	37-6

37.4	SPN 1636/FMI 14	37-7
38	SPN 2629 - TURBO COMPRESSOR OUT TEMP HIGH OR LOW	
38.1	SPN 2629/FMI 3	38-3
38.2	SPN 2629/FMI 4	38-5
38.3	SPN 2629/FMI 20	38-7
38.4	SPN 2629/FMI 21	38-8
39	SPN 2791 – EGR VALVE (AUX PWM #1) FAILED OR OPEN CIRCUIT	
39.1	SPN 2791/FMI 3	39-3
39.2	SPN 2791/FMI 4	39-5
39.3	SPN 2791/FMI 5	39-6
40	SPN 3510 – ACCELERATOR PEDAL SUPPLY OUTSIDE OF NORMAL OPERATING RANGE	
40.1	SPN 3510/FMI 2	40-3
40.2	SPN 3510/FMI 3	40-5
40.3	SPN 3510/FMI 4	40-6
41	SPN 3563– INTAKE MANIFOLD PRESSURE OUTSIDE NORMAL RANGE	
41.1	SPN 3563/FMI 0/1/2	41-3
41.2	SPN 3563/FMI 3	41-6
41.3	SPN 3563/FMI 4	41-7
42	SPN 3659 – INJECTOR #1 SPILL VALVE NOT OPERATING NORMALLY	
42.1	SPN 3659/FMI 5	42-3
42.2	SPN 3659/FMI 10	42-6
43	SPN 3660 - INJECTOR #2 SPILL VALVE NOT OPERATING NORMALLY	
43.1	SPN 3660/FMI 5	43-3
43.2	SPN 3660/FMI 10	43-5
44	SPN 3661 - INJECTOR #3 SPILL VALVE NOT OPERATING NORMALLY	
44.1	SPN 3661/FMI 5	44-3
44.2	SPN 3661/FMI 10	44-5
45	SPN 3662 - INJECTOR #4 SPILL VALVE NOT OPERATING NORMALLY	
45.1	SPN 3662/FMI 5	45-3
45.2	SPN 3662/FMI 10	45-5
46	SPN 3663 - INJECTOR #5 SPILL VALVE NOT OPERATING NORMALLY	
46.1	SPN 3663/FMI 5	46-3
46.2	SPN 3663/FMI 10	46-6

47	SPN 3664 - INJECTOR #6 SPILL VALVE NOT OPERATING NORMALLY	
47.1	SPN 3664/FMI 5	47-3
47.2	SPN 3664/FMI 10	47-6
48	CPC DIGITAL OUTPUTS SPN/FMI	
48.1	CPC DIGITAL OUTPUT FAULT CODES	48-3
48.2	TROUBLESHOOTING THE CPC DIGITAL OUTPUTS	48-3

1 INTRODUCTION

Section	Page
1.1 OVERVIEW	1-3
1.2 SCOPE AND USE OF THIS GUIDE	1-4
1.3 SAFETY PRECAUTIONS	1-6

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.

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

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

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

1.2 SCOPE AND USE OF THIS GUIDE

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

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

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

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

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

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

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

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

NOTE:

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

1.2.1 Mechanical Troubleshooting

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

1.2.2 Electronic Troubleshooting

The DDEC VI system allows for an increased processor speed and increased memory.

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

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


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


NOTE:

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


1.3 SAFETY PRECAUTIONS

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

 WARNING:
PERSONAL INJURY
<p>Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.</p> <ul style="list-style-type: none"><input type="checkbox"/> Always start and operate an engine in a well ventilated area.<input type="checkbox"/> If operating an engine in an enclosed area, vent the exhaust to the outside.<input type="checkbox"/> Do not modify or tamper with the exhaust system or emission control system.

 WARNING:
PERSONAL INJURY
<p>To avoid injury from accidental engine startup while servicing the engine, disconnect/disable the starting system.</p>

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
<p>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.</p>

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.

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.
<ul style="list-style-type: none"><input type="checkbox"/> Always start and operate an engine in a well ventilated area.<input type="checkbox"/> If operating an engine in an enclosed area, vent the exhaust to the outside.<input type="checkbox"/> 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.

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.

 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.

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.**


 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:
<ul style="list-style-type: none"><input type="checkbox"/> Flush your skin with water.<input type="checkbox"/> Apply baking soda or lime to help neutralize the acid.<input type="checkbox"/> Flush your eyes with water.<input type="checkbox"/> Get medical attention immediately.

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

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

1.3.8 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.

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.

1.3.12 Optimized Idle


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

 CAUTION: UNEXPECTED ENGINE START
<p>To avoid injury from an unexpected startup of an engine equipped with the Optimized Idle system, remove the starter relay from the relay holder.</p>

 WARNING: PERSONAL INJURY
<p>To avoid injury from accidental engine startup, replace a defective ECM with an ECM programmed with identical inputs and outputs.</p>

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
<p>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.</p>

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

2 DDEC VI SYSTEM

Section	Page
2.1 DDEC VI SYSTEM--HOW IT WORKS	2-3
2.2 MOTOR CONTROL MODULE	2-4
2.3 COMMON POWERTRAIN CONTROLLER	2-13
2.4 WIRES AND WIRING	2-25
2.5 CONDUIT AND LOOM	2-39
2.6 TAPE AND TAPING	2-40
2.7 SENSORS	2-41
2.8 INSTRUMENT PANEL LAMPS	2-54

2.1 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.).

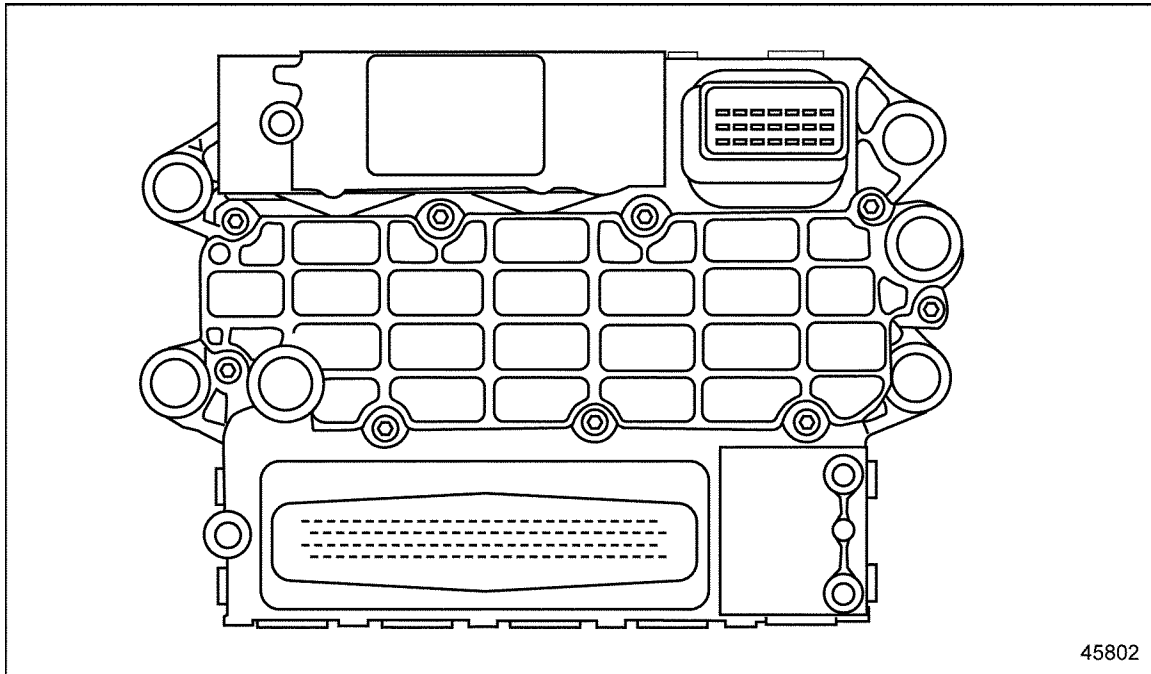
2.1.1 Harnesses

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 CPC to other vehicle systems.

2.2 MOTOR CONTROL MODULE

The engine mounted Motor Control Module (MCM) includes control logic to provide overall engine management. See Figure 2-1.



45802

Figure 2-1 Motor Control Module

NOTE:

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

2.2.1 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 are listed in Table 2-1, Table 2-2, Table 2-3, and Table 2-4.

The pinout for the 21-pin connector is listed in Table 2-5.

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

Table 2-1 MCM Connector – Series 60 (1 of 4) – C Sample

Pin	Function	Connector
31	NC	
32	Jake 1	
33	Two-speed Fan or Variable Speed Fan	
34	NC	
35	Wastegate	
36	NC	
37	NC	
38	Ground	
39	NC	
40	NC	
41	NC	
42	CKP/TRS (-)	
43	CKP/TRS (+)	
44	CMP/SRS (-)	
45	CMP/SRS (+)	
46	NC	
47	Fan Speed	
48	NC	
49	NC	
50	Sensor Ground	
51	Turbo Speed Sensor	
52	Sensor Ground	
53	NC	
54	Engine Oil Pressure Sensor	
55	Sensor Ground	
56	NC	
57	NC	
58	Sensor Power Supply	
59	NC	
60	EGR Valve Position	

Table 2-2 MCM Connector – Series 60 (2 of 4) – C Sample

Pin	Function	Connector
61	EGR Valve	
62	Power Supply	
63	NC	
64	Power Supply	
65	HC Doser	
66	Jake 2	
67	Ground	
68	NC	
69	Fuel Cutoff Valve	
70	Ether Start	
71	NC	
72	NC	
73	NC	
74	VNT CAN (-)	
75	VNT CAN (+)	
76	NC	
77	Fuel Temperature Sensor	
78	NC	
79	NC	
80	NC	
81	NC	
82	Sensor Supply	
83	EGR Temperature Sensor	
84	Fuel Compensation Pressure Sensor	
85	Sensor Supply	
86	Turbo Compressor In Temp	
87	Intake Manifold Pressure Sensor	
88	Sensor Ground	
89	DOC Inlet Temp Sensor	
90	Intake Air Throttle Valve	

Table 2-3 MCM Connector – Series 60 (3 of 4) – C Sample

Pin	Function	Connector
91	Power Supply	
92	NC	
93	Power Supply	
94	NC	
95	NC	
96	NC	
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 Air Temperature Sensor	
107	NC	
108	Engine Oil Temperature Sensor	
109	EGR Delta Pressure Sensor	
110	Engine Coolant Temp Sensor	
111	Fuel Line Pressure Sensor	
112	Turbo Compressor Out Temp	
113	NC	
114	Sensor Ground	
115	DPF Outlet Temp Sensor	
116	NC	
117	Sensor Power Supply	
118	DPF Inlet Pressure Sensor	
119	NC	
120	NC	

Table 2-4 MCM Connector – Series 60 (4 of 4) – C Sample

2.2.1.1 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 Series 60 engine (see Figure 2-2).

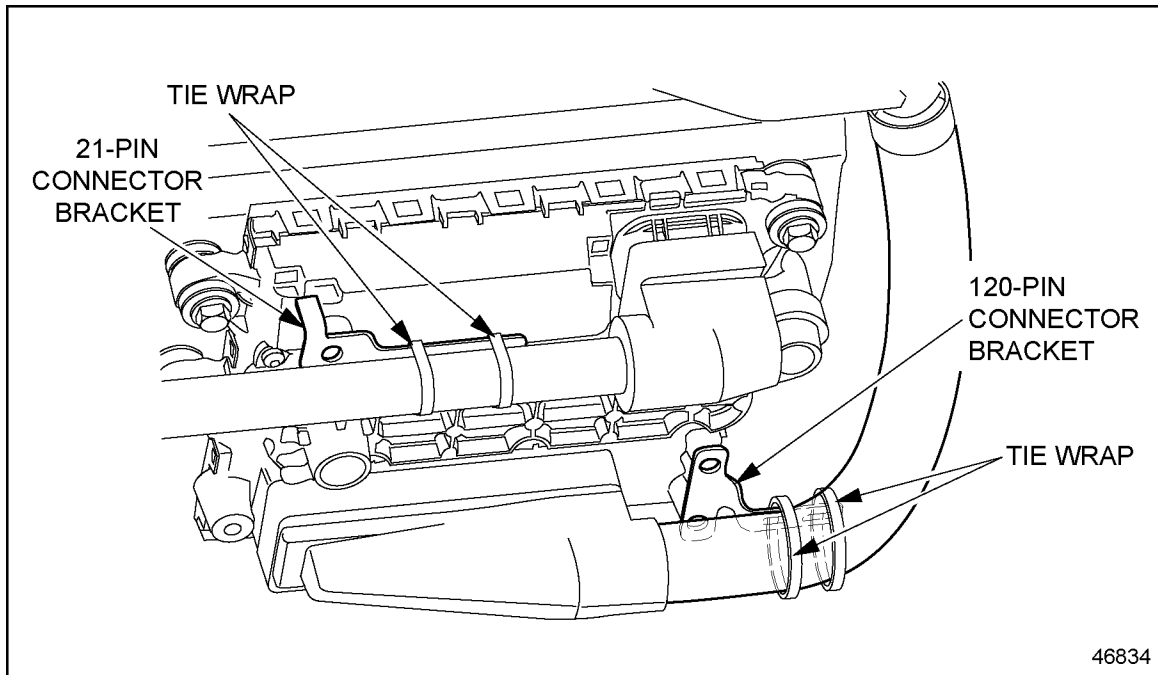


Figure 2-2 **Series 60 Engine 120-pin Connector and 21-pin Connector Tie-wrapped to Brackets**

2.2.1.2 MCM 21-pin and 31-pin Connectors

The wiring for the VIH 21-pin to the MCM is listed in Table 2-5. The side of the connector shown is looking into the pins.

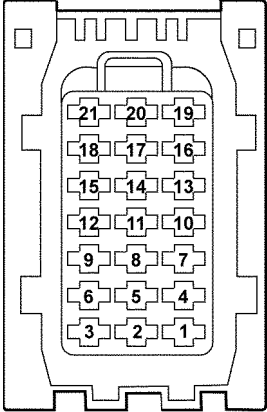
Pin	Signal Type	Function	Connector
21/1	CAN2L	Not Used	 <p style="text-align: center;">45801</p> <p style="text-align: center;">Front Looking into the Pins on the Harness</p>
21/2	CAN2GND	Not Used	
21/3	CAN2H	Not Used	
21/4	CAN2GND	Not Used	
21/5	KL31	Battery (-)	
21/6	KL31	Battery (-)	
21/7	KL15	IGN	
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	

Table 2-5 21-Pin Connector to the MCM

Part	Tyco/Amp Part Number	DDC Part Number
Connector	1-355222-2	A 024 545 91 26
2.5 mm Contact (strip form)	—	A 001 982 02 26
2.5 mm Contact (single)	—	A 000 982 99 26
1.5 mm Contact (strip form)	—	A 014 545 79 26
1.5 mm Contact (single)	—	A 014 545 82 26
Seal	828904-2	—
Backshell	1394050-1	A 001 545 79 83

Table 2-6 21-Pin Connector to the MCM Part Numbers

The pinout for the 31-pin pigtail on the Engine Harness is listed in Table 2-7. The OEM is responsible for wiring to this connector.

Pin	Function	Series 60
31/1	Power Supply #1 — EGR Actuator*	—
31/2	Power Supply #2 — VNT*	—
31/3	Spare	—
31/4	Spare	—
31/5	Full Heater Supply #2†	—
31/6	Power Supply #1 Ground*	—
31/7	Power Supply #2 Ground*	—
31/8	Ether Start	X
31/9	Fan Control #2 – High of Two-speed Fan or Variable Speed Fan	X
31/10	Single Speed Fan or Low for Two-speed Fan	X
31/11	Fuel Heater Ground #1†	—
31/12	Spare	—
31/13	Alternator Remote Sense (FL)	X
31/14	Spare	—
31/15	Spare	—
31/16	Engine Brake Solenoid Control	—
31/17	DOC Outlet Temp Sensor (Exhaust Gas Temperature in Front of Particulate Trap)	X
31/18	DOC Inlet Temp Sensor	X
31/19	DPF Outlet Temp Sensor(Exhaust Gas Temperature After Particulate Trap)	X
31/20	Full Heater Ground #2†	—
31/21	Spare	—
31/22	Power Supply	X
31/23	Fan Speed	X
31/24	Sensor Ground (3V)	X
31/25	Spare	—
31/26	Spare	—
31/27	TCI Temp	X
31/28	Sensor Ground (5V)	X
31/29	Sensor Supply (2V)	X
31/30	DPF Outlet Pressure Sensor (Exhaust Gas Pressure After Particulate Filter)	X
31/31	DPF Inlet Pressure Sensor (Exhaust Gas Pressure Before Particulate Filter)	X

*Fused at 15 amps

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

Table 2-7 31-pin MCM Pigtail Connector

The part numbers for the 31-pin MCM pigtail connector are listed in Table 2-8.

Part	Tyco/Amp Part Number	DDC Part Number
Connector	967363-1	A 008 545 31 26
Terminal (0.5-1.0 mm)	1-929974-4	A 019 545 95 26
Seals (GXL insulation)	828921-1	—
Cavity Plugs	828922-1	—
Backshell	965636-1	A 000 545 99 35

Table 2-8 31-pin MCM Pigtail Connector Part Numbers

2.3 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 2-3.

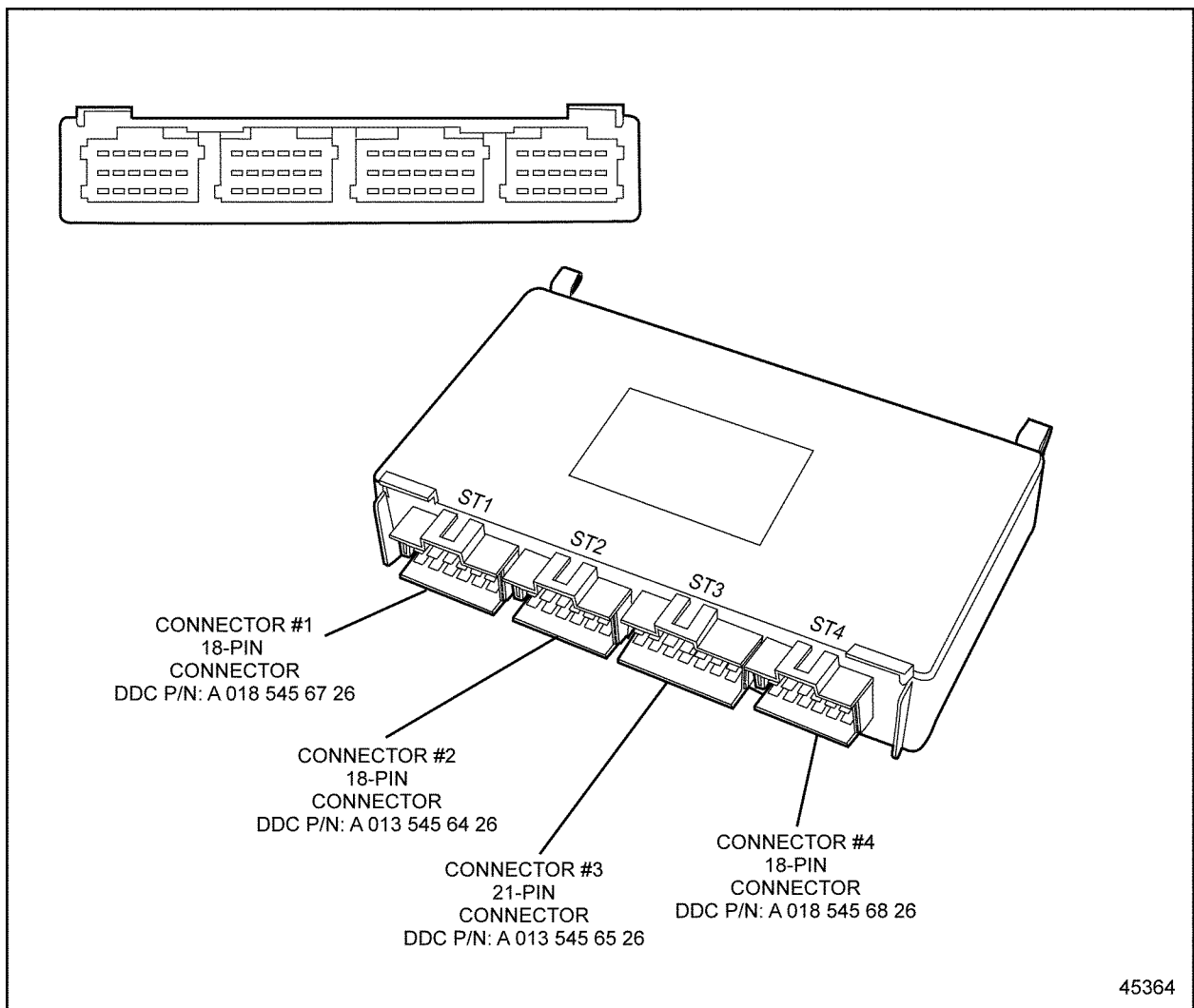


Figure 2-3 The Common Powertrain Controller

The OEM is responsible for mounting this part in an enclosed, protected environment. The mounting bracket is the responsibility of the OEM. There must be maximum physical separation of the VIH from other vehicle/equipment electrical systems. Other electrical system wires should ideally be at least three feet away from the VIH and should not be parallel to the VIH. This will eliminate coupling electromagnetic energy from other systems into the VIH. See Figure 2-4 for the CPC dimensions.

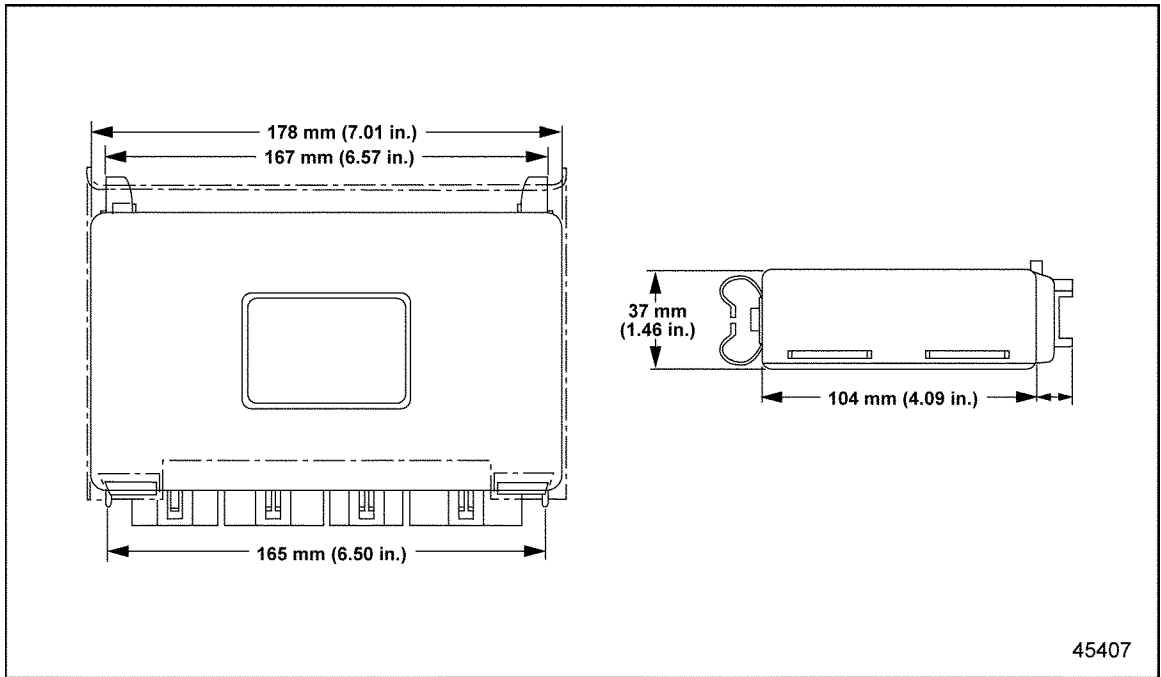


Figure 2-4 CPC Dimensions

NOTE:

The CPC should be mounted with the connectors pointing down.

The CPC communicates over the J1587 and J1939 Data Links to the vehicle (see Figure 2-5).

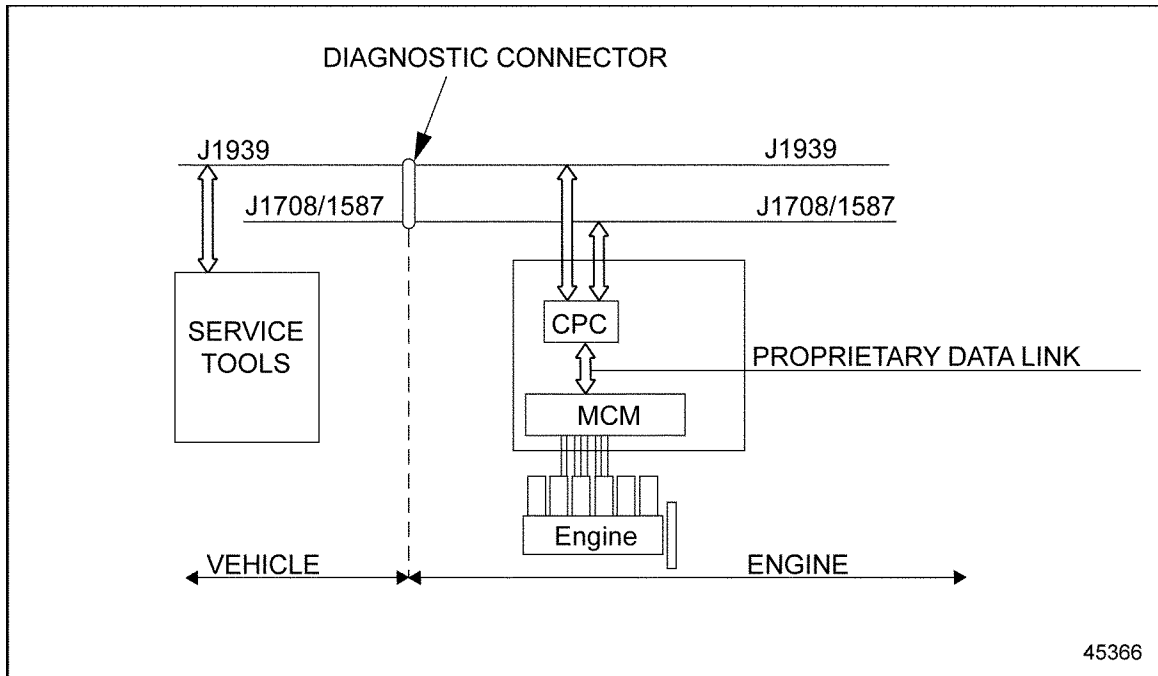


Figure 2-5 NAFTA Architecture On-highway

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.

2.3.1 Environmental Conditions

Temperature, vibration, and water intrusion must be considered.

2.3.1.1 Temperature

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

2.3.1.2 Water Intrusion

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

2.3.2 CPC Vehicle Interface Harness

The OEM supplied Vehicle Interface Harness (VIH) connects the CPC to the MCM and other vehicle systems (see Figure 2-6).

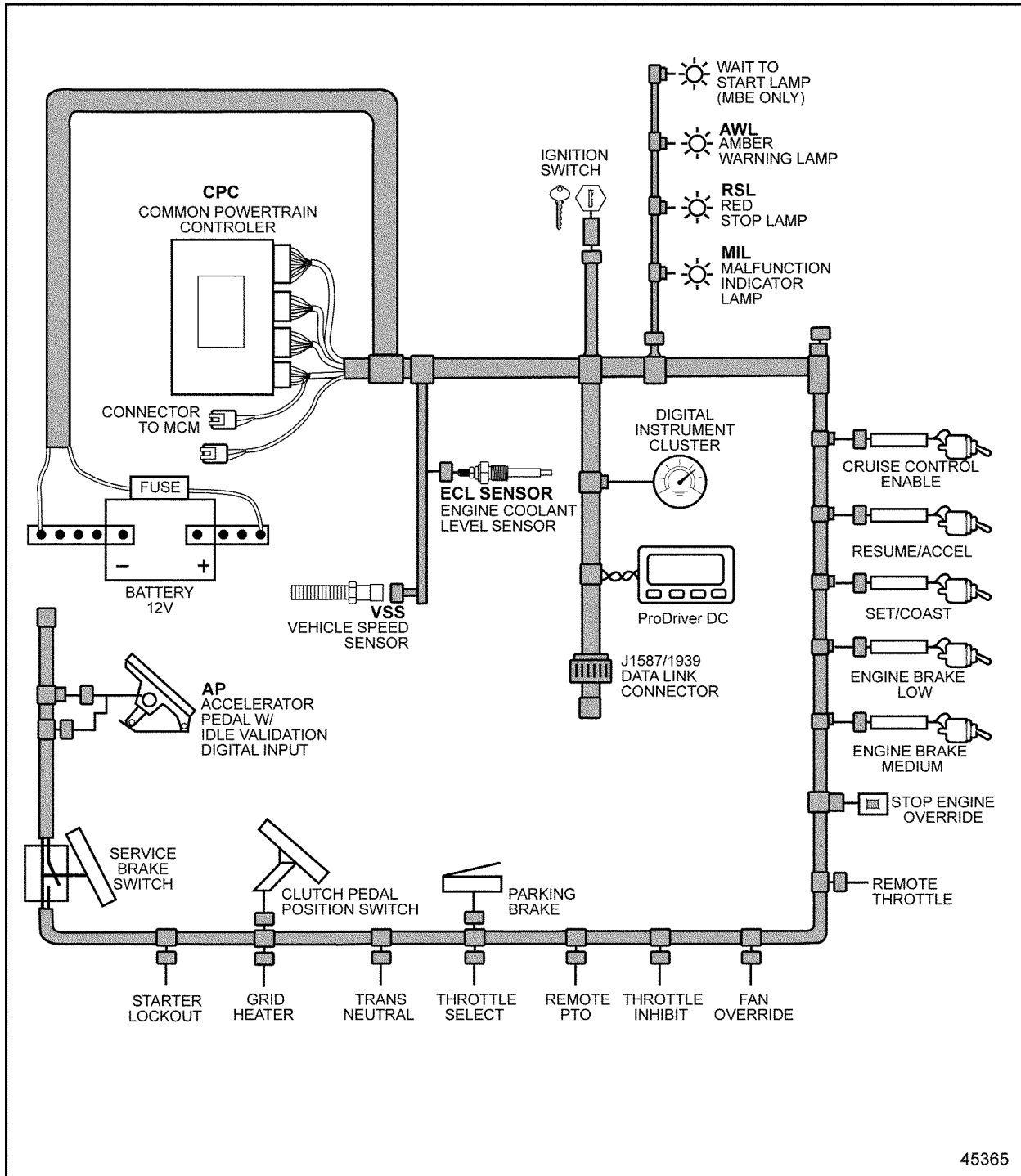


Figure 2-6 Vehicle Interface Harness

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

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

NOTE:

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

NOTE:

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

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

2.3.2.1 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 2-9.

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

Table 2-9 Variable Reluctance Signal Interface

2.3.3 Power Supply – 12 Volt System

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

NOTICE:

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

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

NOTICE:

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

NOTE:

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

2.3.3.1 Average Current Draw

The maximum average current draw is listed in Table 2-10. 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 2-10 Maximum Average Current Draw

The current draw for a CPC configuration is listed in Table 2-11.

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

Table 2-11 Current Draw for CPC Configuration

The current draw for a MCM is listed in Table 2-12.

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

Table 2-12 Current Draw for MCM Configuration**2.3.3.2 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.

2.3.3.3 Main Power Shutdown

The main power supply shutdown schematic shows the DDC approved method for main power switch implementation. See Figure 2-7.

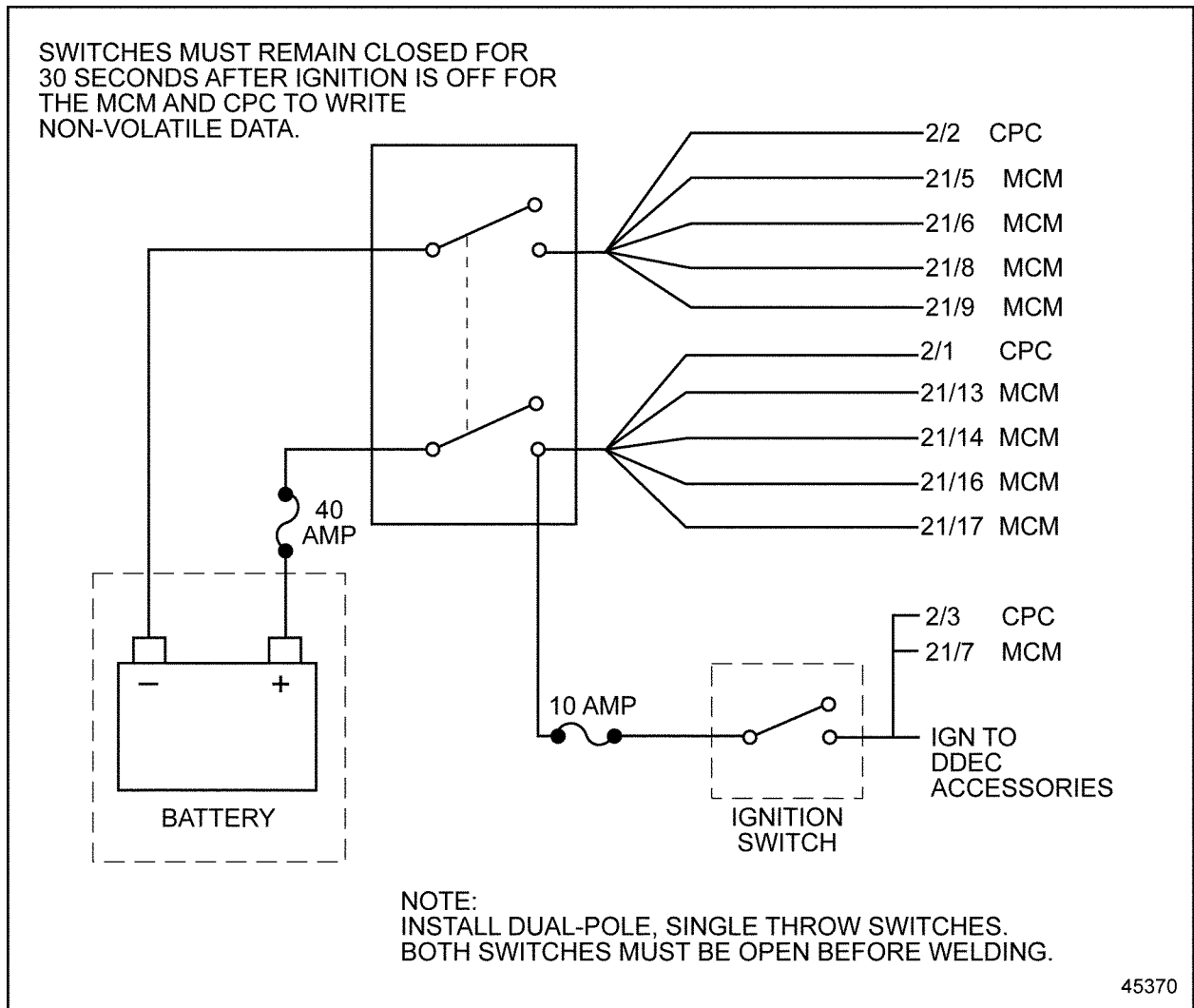


Figure 2-7 Main Power Supply Shutdown

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.

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.

2.3.4 Fuses

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

**CAUTION:****FIRE**

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

**CAUTION:****FIRE**

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

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

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

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

Bussmann ATC-30 and Delphi Packard Electric Systems MaxiFuse 30 amp rated fuses or equivalent will satisfy these requirements. Acceptable blow times versus current and temperature derating characteristics are listed in Table 2-13 and Table 2-14.

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

Table 2-13 Fuse Current and Blow Time

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

Table 2-14 Fuse Temperature and Current

2.3.5 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.

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 2-15 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 2-16 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 2-17 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 2-18 Connector #4, 18-pin Connector, Key C

Part	Tyco/Amp Part Number	DDC Part Number
Connector	1-355222-2	A 024 545 91 26
2.5 mm Contact (strip form)	—	A 001 982 02 26
2.5 mm Contact (single)	—	A 000 982 99 26
1.5 mm Contact (strip form)	—	A 014 545 79 26
1.5 mm Contact (single)	—	A 014 545 82 26
Seal	828904-2	—
Backshell	1394050-1	A 001 545 79 83

Table 2-19 21-Pin Connector to the MCM Part Numbers

Part	Tyco/Amp Part Number	DDC Part Number
Connector	967363-1	A 008 545 31 26
Terminal	1-929974-4	A 019 545 95 26
Seals (GXL insulation)	828921-1	—
Cavity Plugs	828922-1	—
Backshell	965636-1	A 000 545 99 35

Table 2-20 31-pin MCM Pigtail Connector

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

Table 2-21 FCI Part Numbers for the DPF 10-pin Connector

2.3.5.1 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 Detroit Diesel Diagnostic Link 7.0 (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 2-22 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 2-22 VIH Components to Incorporate an SAE J1939/J1587 Data Link

The following illustration shows the wiring for the nine-pin connector (see see Figure 2-8).

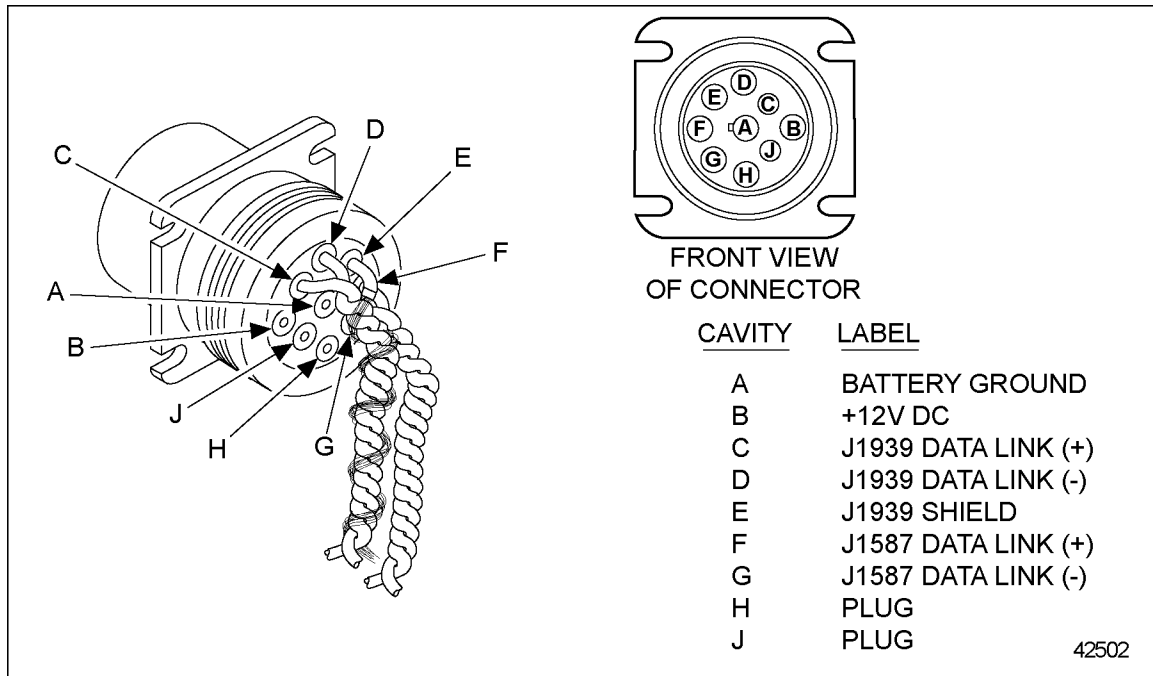


Figure 2-8 Wiring for 9-pin Data Link Connector

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).

2.4 WIRES AND WIRING

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

2.4.1 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.

2.4.2 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 2.6 and refer to section 2.5.
- 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).

2.4.3 Crimp tools

The part numbers for the crimp tools for working with the MCM and CPC connectors are listed in Table 2-23.

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 2-23 Crimp Tools

2.4.4 Deutsch Terminal Installation And Removal

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

2.4.4.1 Deutsch Terminal Installation Guidelines

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

NOTICE:

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

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

NOTICE:

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

NOTICE:

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

Use the following instructions for installing Deutsch terminals:

1. Strip approximately .25 inch (6 mm) of insulation from the cable.
2. Remove the lock clip, raise the wire gage selector, and rotate the knob to the number matching the gage wire that is being used.
3. Lower the selector and insert the lock clip.
4. Position the contact so that the crimp barrel is 1/32 of an inch above the four indenters. See Figure 2-9. Crimp the cable.

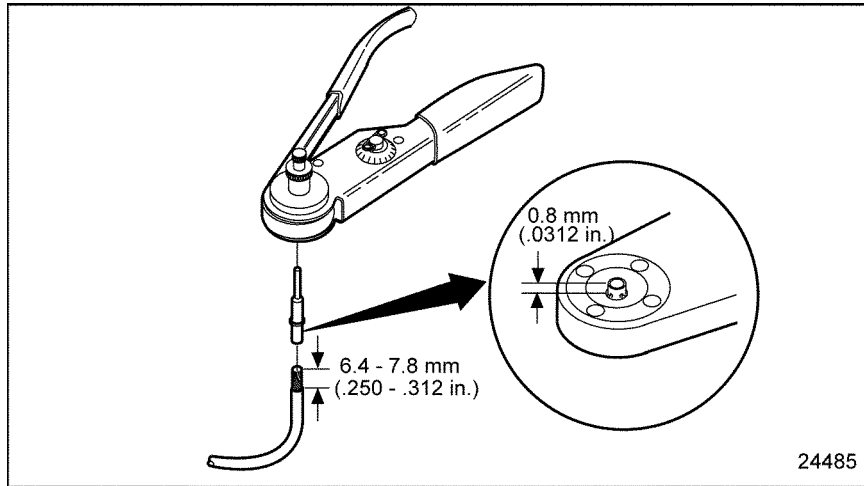


Figure 2-9 **Setting Wire Gage Selector and Positioning the Contact**

5. Grasp the contact approximately one inch behind the contact crimp barrel. Hold the connector with the rear grommet facing you. See Figure 2-10.

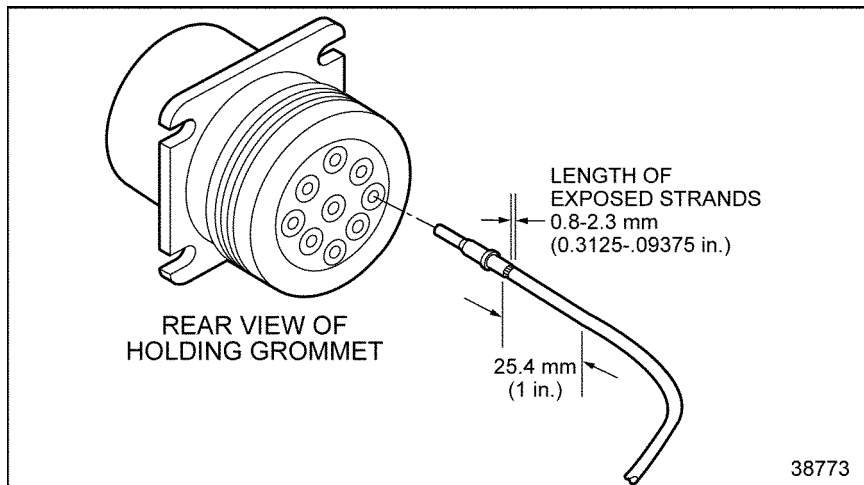


Figure 2-10 **Pushing Contact Into Grommet**

6. Push the contact into the grommet until a positive stop is felt. See Figure 2-10. A slight tug will confirm that it is properly locked into place. See Figure 2-11.

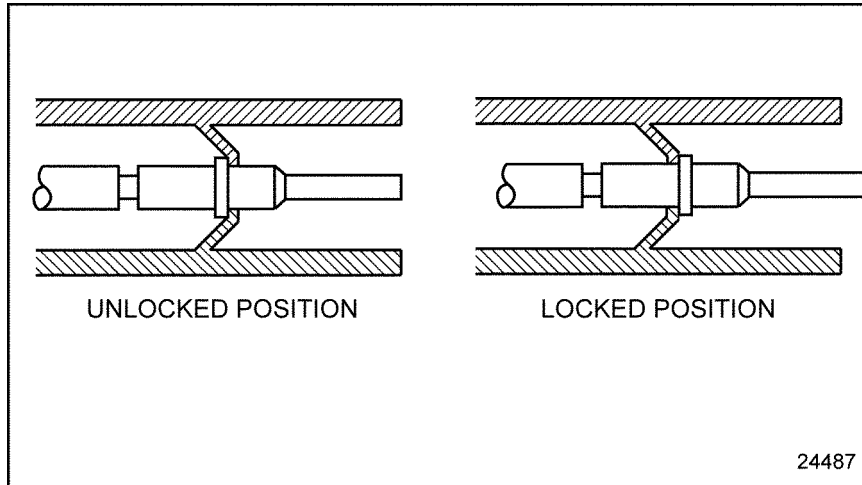


Figure 2-11 Locking Terminal Into Connector

2.4.4.2 Deutsch Terminal Removal

The appropriate size removal tool should be used when removing cables from connectors. The proper removal tools are listed in Table 2-24.

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

Table 2-24 Removal Tools for Deutsch Terminals

Remove Deutsch terminals as follows:

1. With the rear insert toward you, snap the appropriate size remover tool over the cable of contact to be removed. See Figure 2-12.

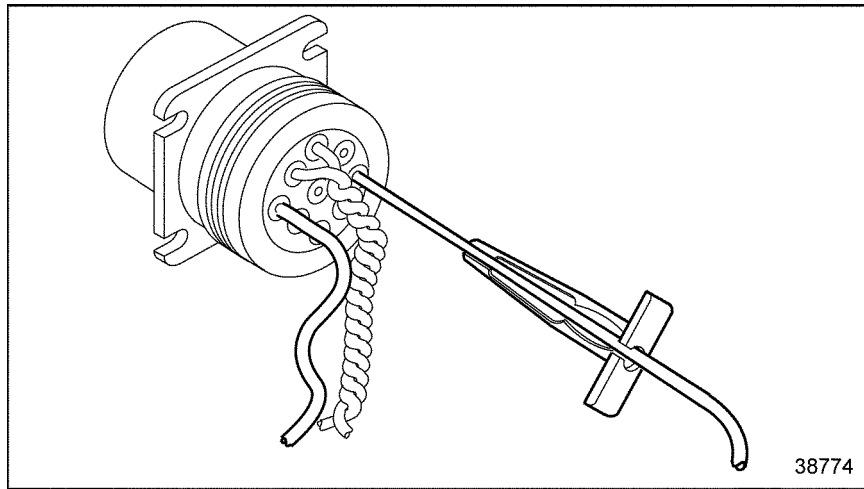


Figure 2-12 **Removal Tool Position**

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 2-13.

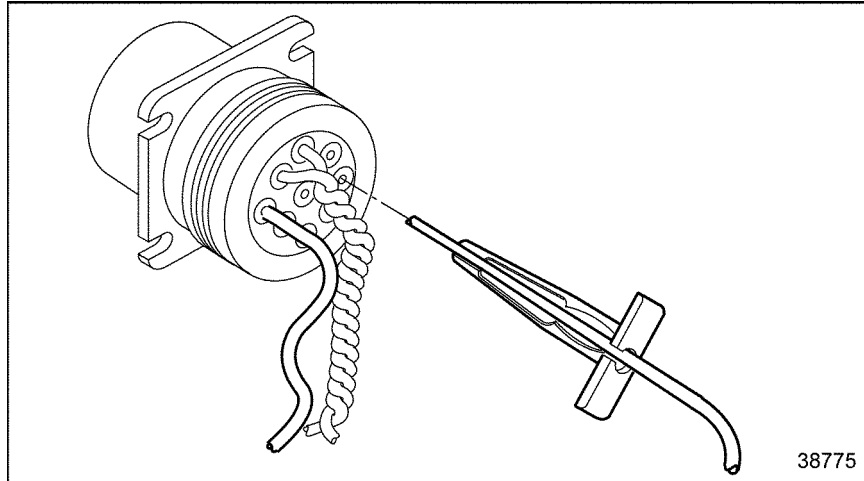


Figure 2-13 **Removal Tool Insertion**

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

2.4.5 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.

2.4.5.1 Clipped and Soldered Splicing Method

The tools required are listed in Table 2-25.

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 2-25 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.

Soldering splice connectors is optional. To solder splice connectors:

1. Position the leads, so one overlaps the other. See Figure 2-14.

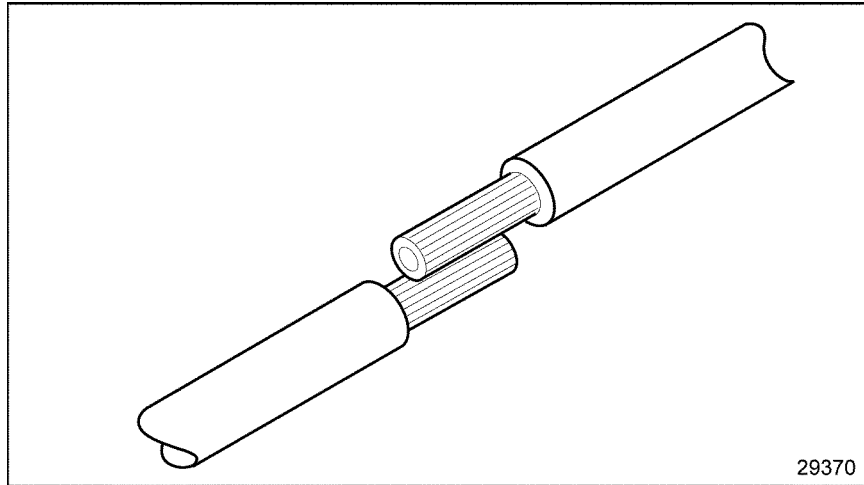


Figure 2-14 **Positioning the Leads**

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

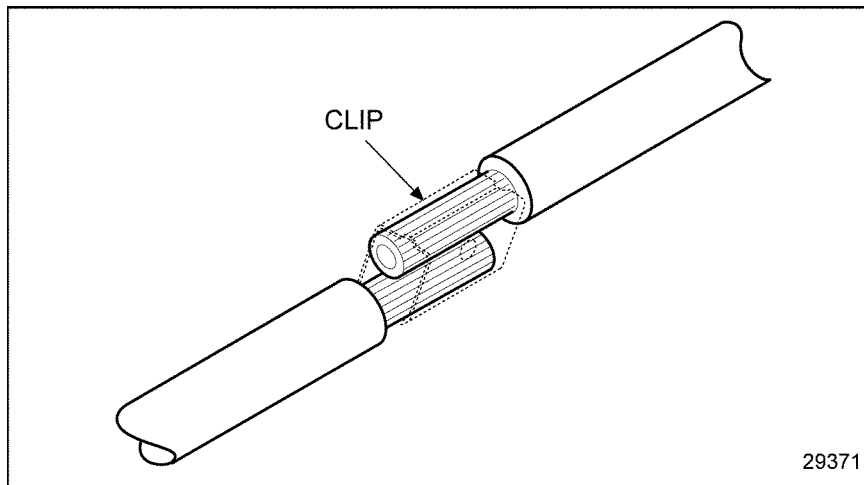


Figure 2-15 **Securing the Leads With a Clip**

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.

- Pull on wire to assure crimping and soldering integrity. The criteria listed in Table 2-26 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 2-26 Applied Load Criteria for Terminals

- Loop the lead back over the spliced joint and tape. See Figure 2-16.

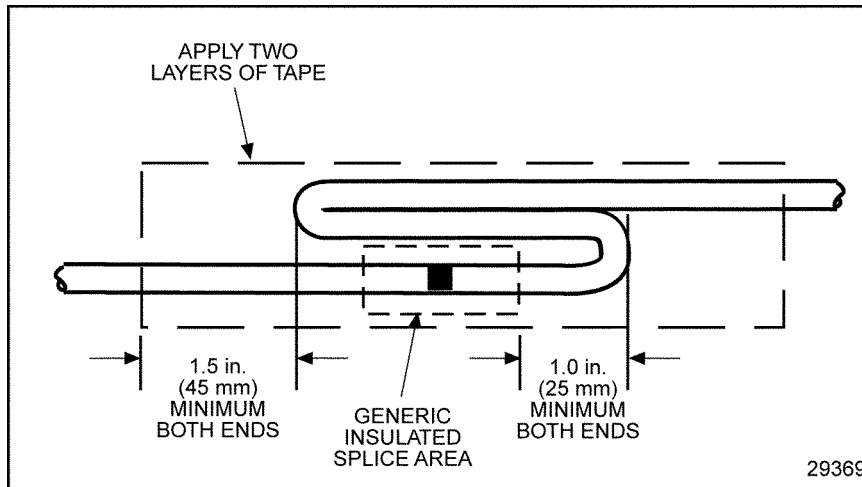


Figure 2-16 Recommended Strain Relief of Spliced Joint

2.4.5.2 Splicing and Repairing Straight Leads-Alternate Method 1

The tools required are listed in Table 2-27.

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 2-27 Recommended Splicing Tools

NOTE:

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

The recommended method to splice straight leads follows:

1. Locate broken wire.
2. Remove insulation as required; be sure exposed wire is clean and not corroded.
3. Insert one wire into the splice clip until it butts against the clip. Stop and crimp (see Figure 2-17, A).
4. Insert the other wire into the splice clip until it butts against the clip stop (see Figure 2-17, 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 2-28 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 2-28 Applied Load Criteria for Terminals

7. Shrink the splice clip insulative casing with a heat gun to seal the splice (see Figure 2-17, C).

NOTICE:

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

8. Loop the lead back over the spliced joint and tape. See Figure 2-16.

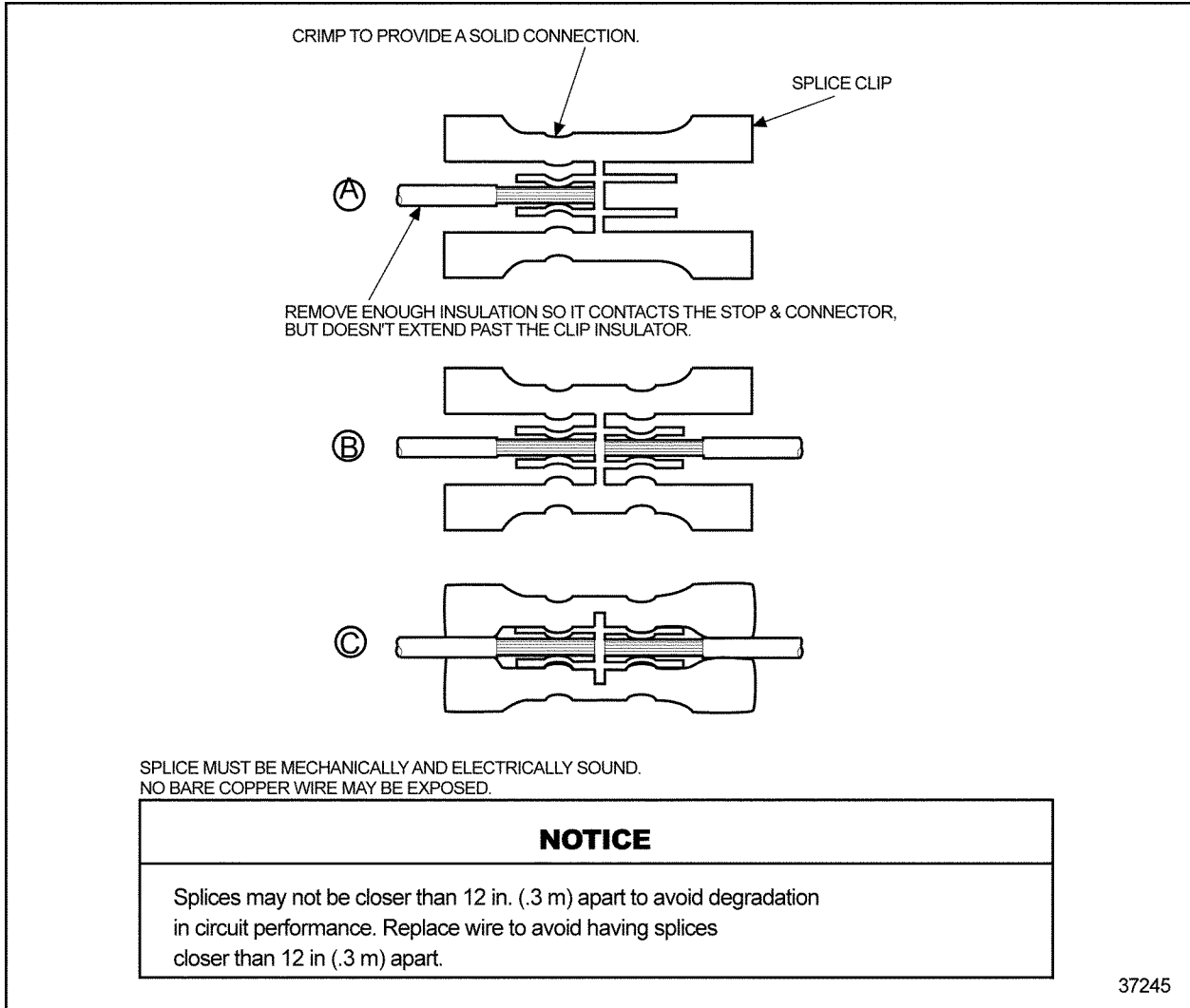


Figure 2-17 Splicing Straight Leads - Alternate Method 1

2.4.5.3 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 2-29.

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 2-29 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 2-18, A).
4. Insert one wire into splice clip until it butts against the splice clip. Stop and crimp (see Figure 2-18, 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 2-18, 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 2-18, C).
8. Shrink tubing with a heat gun to seal the splice (see Figure 2-18, D).

NOTICE:

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

9. Loop the lead back over the spliced joint and tape. See Figure 2-16.

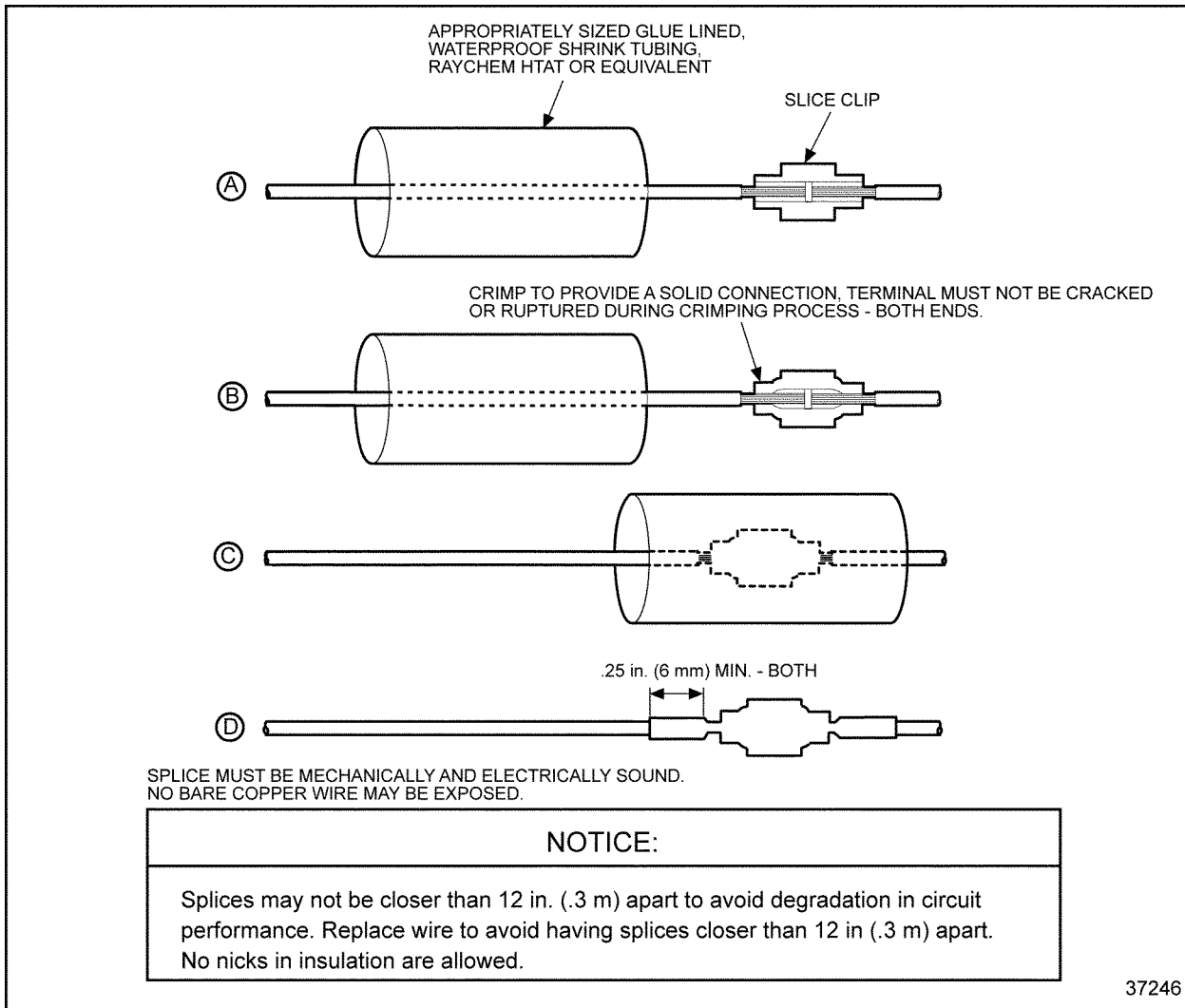


Figure 2-18 Splicing Straight Leads - Alternate Method 2

2.4.5.4 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).

2.4.5.5 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 2-19) so there is at least a 2.5 in. (65 mm) separation between splices.

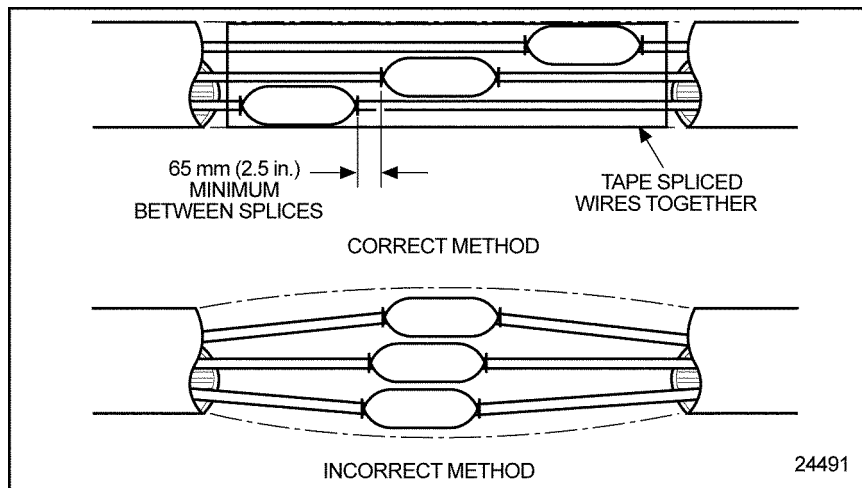


Figure 2-19 The Correct and Incorrect Method of Staggering Multiple Splices

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 2.5.

2.5 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.

2.5.1 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.

2.6 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.

2.6.1 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.

2.6.2 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.

2.7 SENSORS

DDEC is designed to operate with several types of sensors as listed in Table 2-30.

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 2-30 Sensor Types

The sensors integrated into the Engine Harness are factory-installed (refer to section 2.7.1). The sensors integrated into the Vehicle Interface Harness are installed by the OEM (refer to section 2.7.2).

2.7.1 Factory-installed Sensors

The sensors integrated into the factory-installed Engine Harness are listed in Table 2-31.

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 Temperature Out 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 Temperature In	DOC Temperature In - Temperature measured at the inlet of the after-treatment device in the exhaust system of the vehicle. Located before the DOC that is within the after-treatment device.
DOC Temperature Out	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 2-31 Function of Factory-installed Sensors

See Figure 2-20 for the location of the sensors for the DOC and DPF.

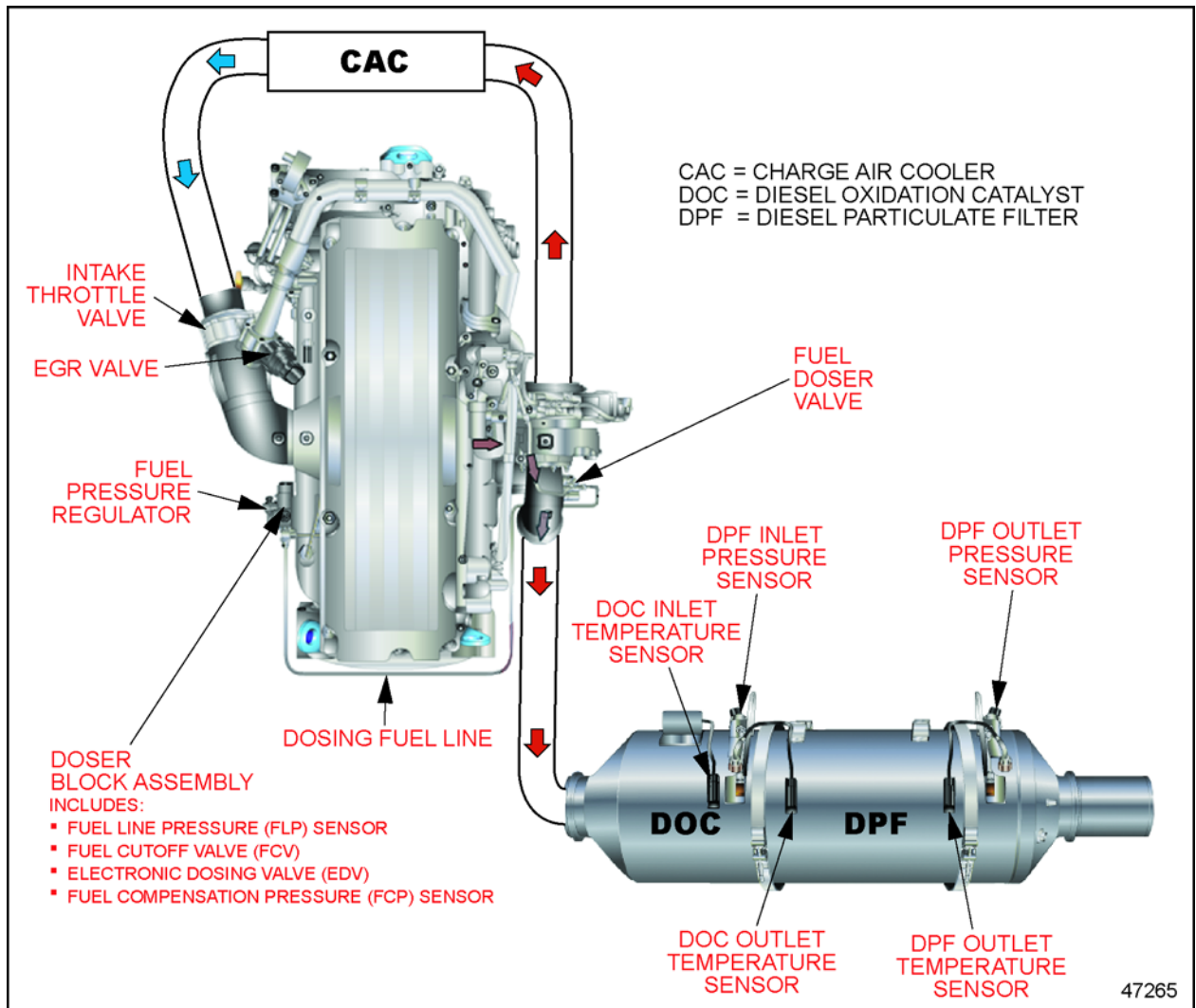


Figure 2-20 **Sensor Location for the DOC and DPF**

2.7.2 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 2-32.

Sensor	Part Number	Function
Engine Coolant Level Sensor (ECL Sensor)	23526906 23526905 23526907	Senses coolant level for engine protection. Refer to section 2.7.3.
Turbo Compressor In Temperature Sensor	23527831	Senses the temperature of the turbo compressor inlet. Refer to section 2.7.4.
Vehicle Speed Sensor (VSS)	—	Senses vehicle speed for Cruise Control and Vehicle Speed Limiting. Refer to section 2.7.5.

* Available in some applications

Table 2-32 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.

2.7.3 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 2-21).

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.

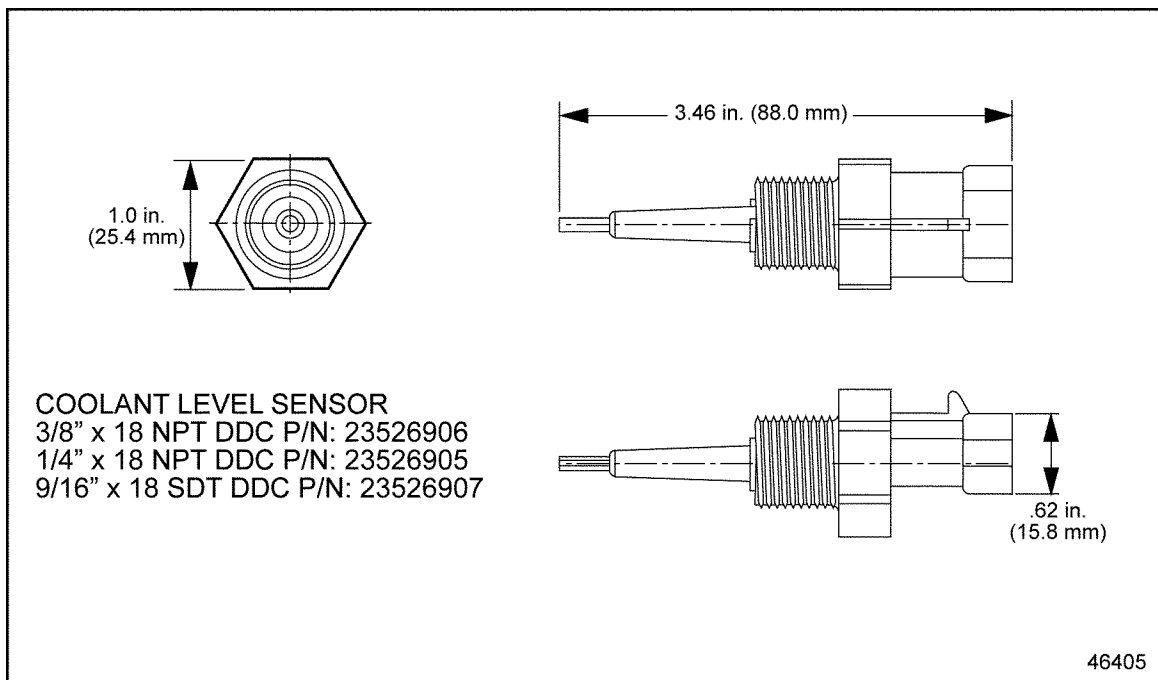


Figure 2-21 Engine Coolant Level Sensor Specifications

The connector listed in Table 2-33 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 2-33 Metri-Pack 280 Connectors and Part Numbers

The OEM must connect the ECL Sensor probe as shown in the next illustration (see Figure 2-22). Polarity of the ground and signal must be correct for proper operation.

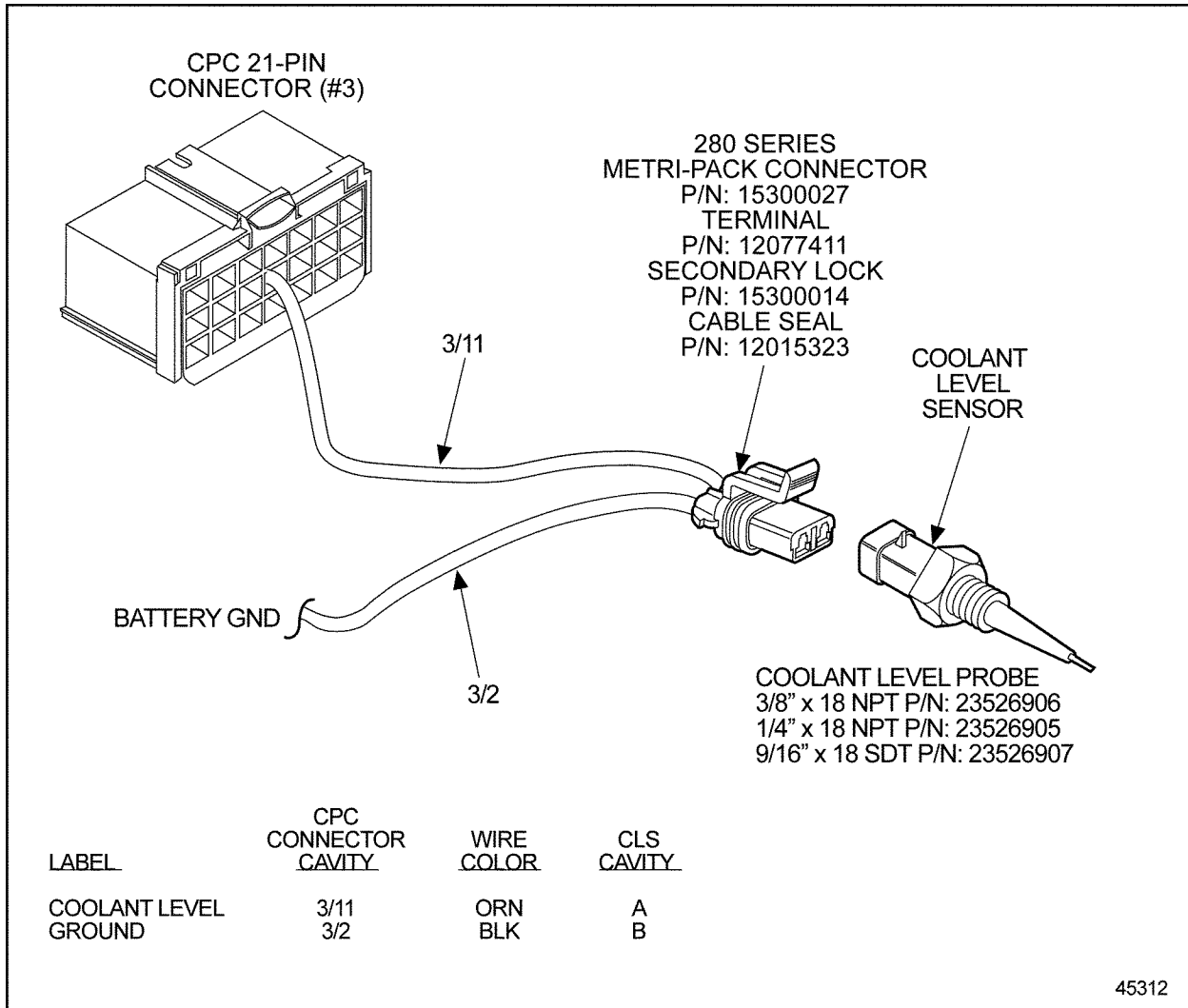


Figure 2-22 Engine Coolant Level Sensor Installation for CPC

The probe should be located in either the radiator top tank or a remote mounted surge tank. It should be mounted horizontally in the center of the tank and must be in a position to signal low coolant before aeration occurs. Typically, this is a height representing 98% of the drawdown quantity. The probe should be located so that it is not splashed by deaeration line, stand pipe or coolant return line flows. The insulated portion of the probe should be inserted into the coolant 1/2 in. or more past the inside wall of the tank. See Figure 2-23.

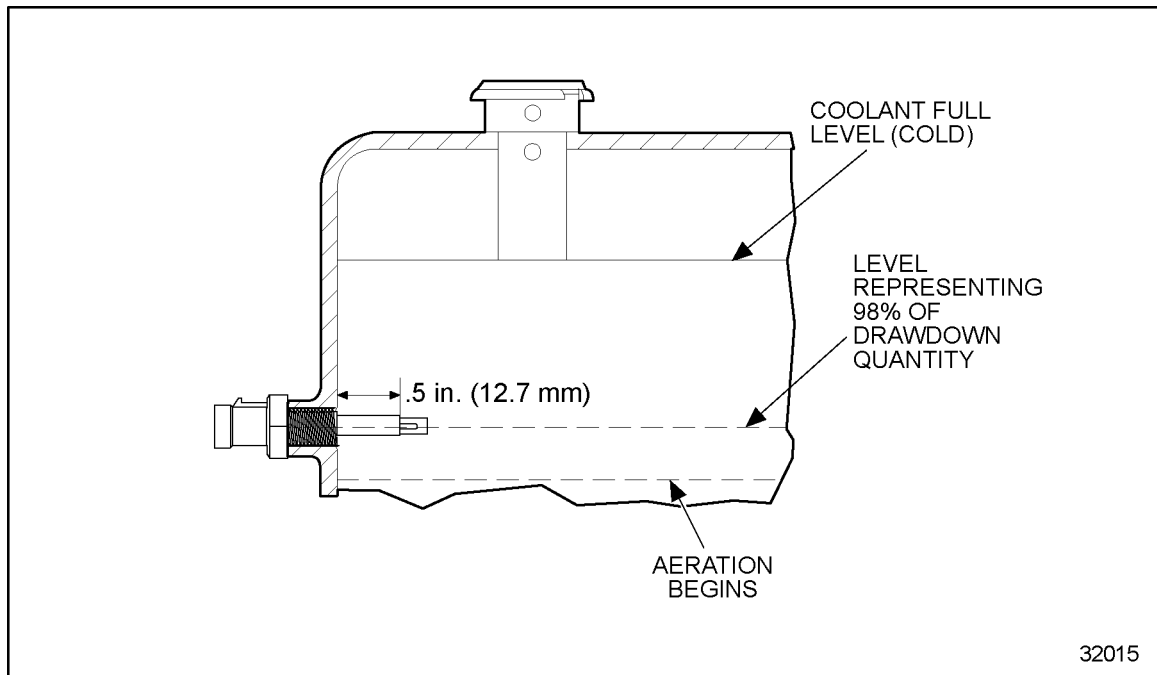


Figure 2-23 Engine Coolant Level Sensor Location - Top of Radiator Tank

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 2-34 and Table 2-35 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 2-34 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 2-35 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 2-36.

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

Table 2-36 Enabling the Engine Coolant Level Sensor

2.7.4 Turbo Compressor In Temperature Sensor

The Turbo Compressor In Temperature Sensor (required for Series 60) produces a signal representing the temperature of the turbo compressor inlet. See Figure 2-24 and Figure 2-25.

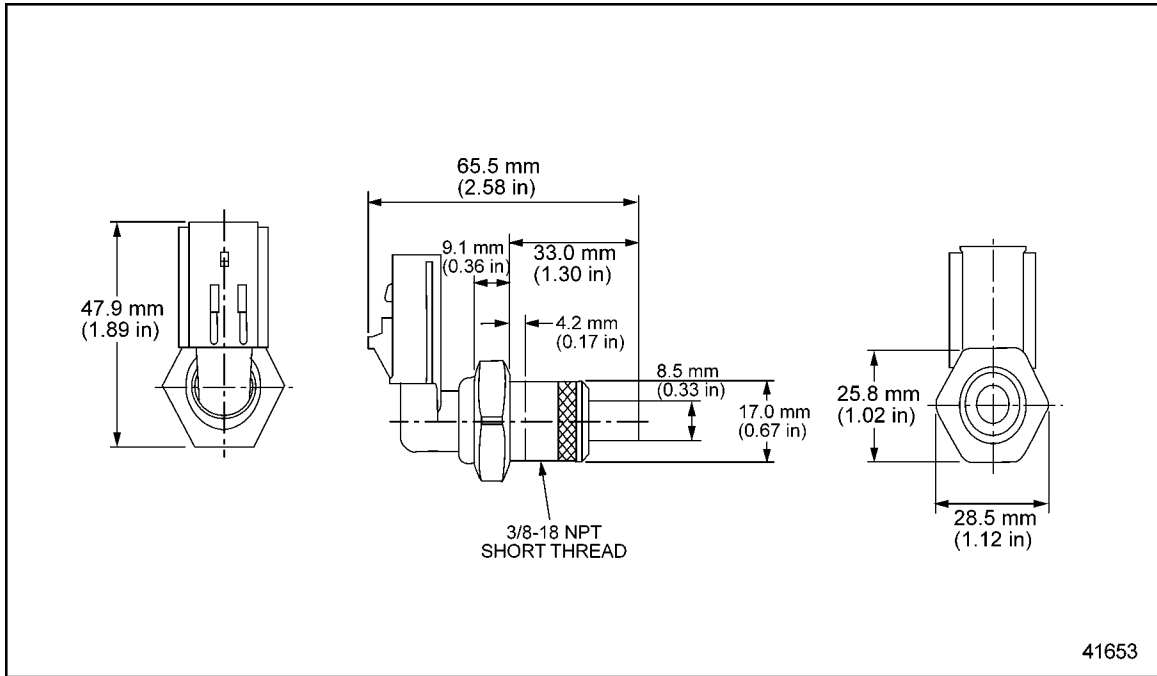


Figure 2-24 Turbo Compressor In Temperature Sensor

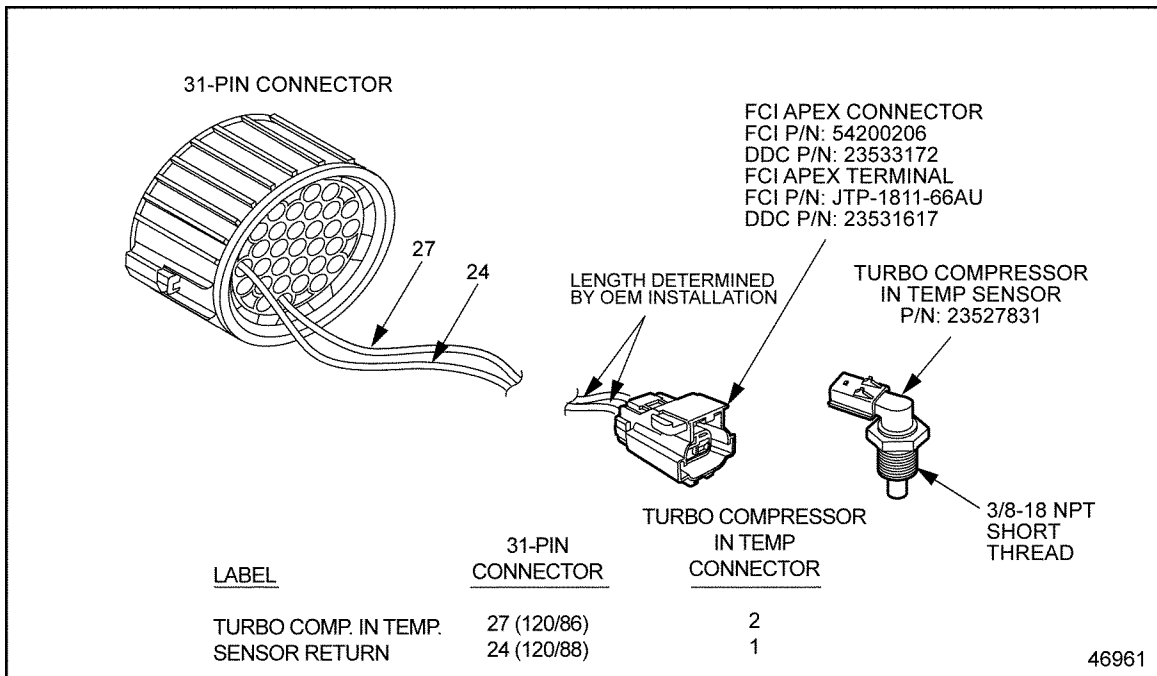


Figure 2-25 Turbo Compressor In Temperature Sensor Installation

2.7.5 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 2-26) 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.

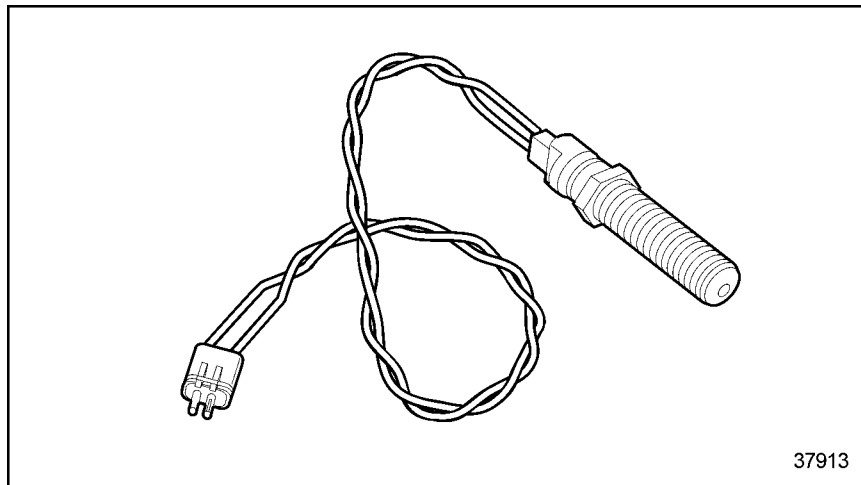


Figure 2-26 Vehicle Speed Sensor

To obtain accurate vehicle mileage, the parameters listed in Table 2-37 must be programmed with VEPS, DRS, or DDDL 7.0.

Parameter Group	Parameter	Range	Default
8	Vehicle Speed Sensor	0 = No Sensor 1 = C3 Sensor 2 = Square Wave (Hall Sensor) 3 = J1939 (ECT1) 4 = Magnetic Pickup 5 = J1939 (TCO1) 6 = J1939 (CCVS Source 1) 7 = J1939 (CCVS Source 2) 8 = J1939 (CCVS Source 3)	4 = Magnetic
8	Axle Ratio	1 – 20.0	5.29
8	Number of Output Shaft Teeth	0 – 250	16
8	Tire Revs per Unit Distance	160 – 1599	312
8	Top Gear Ratio	0.1 – 2.55	1
8	Second Highest Gear Ratio	0.1 – 5.75	2.54
8	Two Spd Axle Second Axle Ratio	1 – 20.0	5.29
8	Anti Tamper	0 = Disable 1 = Enable VSS Anti Tamper Function via ABS 2 = Enable Anti Tamper Function via Gear Ration	0 = Disable
8	Gear Ratio Tolerance	0 — 60	2

Table 2-37 Vehicle Speed Sensor Parameters

2.7.5.1 Magnetic Pickup

The magnetic pickup requirements are listed in Table 2-38. 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 2-38 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 2-39.

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

Table 2-39 Vehicle Speed Sensor Wiring

See Figure 2-27 for the installation of the Magnetic VSS.

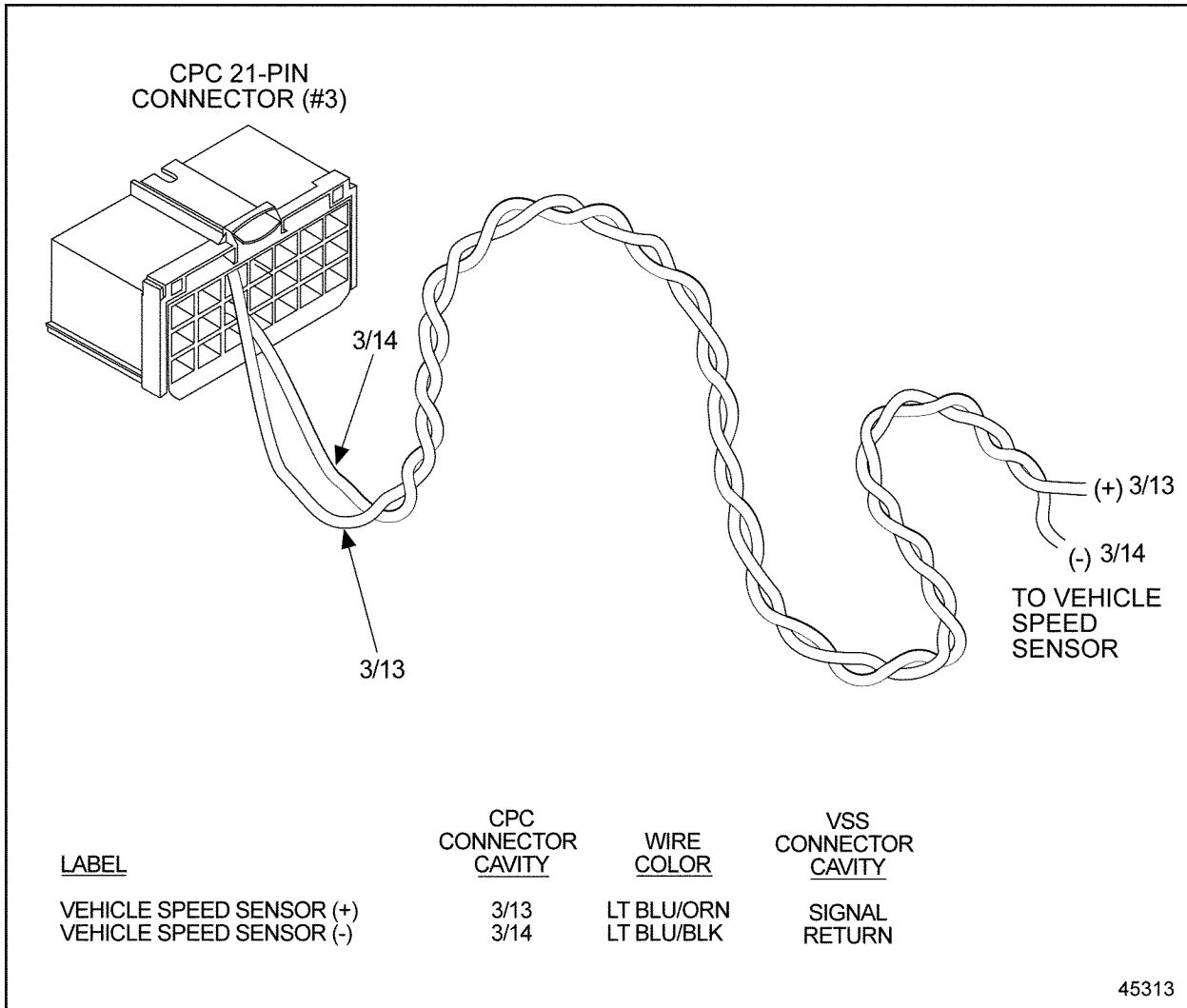


Figure 2-27 Magnetic Vehicle Speed Sensor Installation – CPC

2.7.5.2 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 2-40 must be programmed with VEPS.

Parameter Group	Parameter	Range	Default
8	Vehicle Speed Sensor	0 = No Sensor 1 = C3 Sensor 2 = Square Wave (Hall Sensor) 3 = J1939 (ECT1) 4 = Magnetic Pickup 5 = J1939 (TCO1) 6 = J1939 (CCVS Source 1) 7 = J1939 (CCVS Source 2) 8 = J1939 (CCVS Source 3)	4 = Magnetic
8	Axle Ratio	1 – 20.0	5.29
8	Tire Revs per Unit Distance	160 – 1599	312
8	Top Gear Ratio	0.1 – 2.55	1
8	Second Highest Gear Ratio	0 — 5.75	2.54
8	Two Spd Axle Second Axle Ratio	1 – 20.0	5.29
8	Anti Tamper	0 = Disable 1 = Enable VSS ABS Anti Tampering Function 2 = Enable VSS without ABS Anti Tampering Function	0 = Disable
8	Gear Ratio Tolerance	0 — 60	2

Table 2-40 Vehicle Speed Sensor Parameters for Transmission Output Shaft Speed

2.7.5.3 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.

2.8 INSTRUMENT PANEL LAMPS

The instrument panel lamps are listed in Table 2-41.






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 2-41 Instrument Panel Lamps

3 SPN 27 - EGR VALVE POSITION CIRCUIT FAULT

Section	Page
3.1 SPN 27/FMI 3	3-3
3.2 SPN 27/FMI 4	3-4
3.3 SPN 27/FMI 0/1/2/14	3-5

3.1 SPN 27/FMI 3

This diagnostic condition is typically a short to ground.

3.1.1 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 3.1.1.1.
 - [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).

3.1.1.1 Verify Repairs

Verify repairs as follows:

1. Turn ignition OFF. Reconnect all connectors.
2. Turn ignition ON. Clear codes with DDDL 7.0.
3. Start and run the engine for one minute. Stop engine.
4. Check DDDL 7.0 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).

3.2 SPN 27/FMI 4

This diagnostic condition is typically a short in the wires.

3.2.1 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 61 of the 120-pin MCM connector. Refer to section 3.2.1.1.
 - [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 3.2.1.1.

3.2.1.1 Verify Repairs

Verify repairs as follows:

1. Turn vehicle ignition OFF. Reconnect all connectors.
2. Turn ignition ON. Clear codes with DDDL 7.0.
3. Start and run the engine for one minute. Stop engine.
4. Check DDDL 7.0 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).

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

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

3.3.1 Valve Function Check

Check the valve function as follows:

1. Check for multiple codes. If other codes are present, service them first.
2. 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 3.3.1.1.
 - [b] If there is no connector damage, go to step 3.
3. Reconnect the EGR valve electrical connector.
4. Connect DDDL 7.0.
5. Turn the ignition ON (key ON, engine OFF).
6. Monitor the EGR valve actual position.
7. Does the EGR valve actual position read less than 3%?
 - [a] If yes, go to step 8.
 - [b] If no, go to step 12.
8. Command the EGR pulse width to 50%.
9. Does the EGR valve actual position read between 46% and 54%?
 - [a] If yes, go to step 10.
 - [b] If no, go to step 12.
10. Command the EGR pulse width to 100%.
11. Does the EGR valve actual position read above 95%?
 - [a] If yes, repeat steps 2 through 11. If the results are the same, call the Detroit Diesel Customer Support Center (313-592-5800).
 - [b] If no, go to step 12.
12. Remove the EGR valve.
13. 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 3.3.1.1.
 - [b] If excessive carbon/sludge buildup is found, replace the EGR valve and inspect the EGR cooler for internal failure.

3.3.1.1 Verify Repairs

Verify repairs as follows:

1. Turn vehicle ignition OFF. Reconnect all connectors.
2. Turn ignition ON. Clear codes with DDDL 7.0.
3. Start and run the engine for one minute. Stop the engine.
4. Check DDDL 7.0 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).

4 SPN 84 – VEHICLE SPEED SENSOR

Section	Page
4.1 SPN 84/FMI 3	4-3
4.2 SPN 84/FMI 4	4-4

4.1 SPN 84/FMI 3

This diagnostic condition is typically VSS open circuit.

4.1.1 Open Circuit Check

Check as follows:

1. Disconnect the VSS.
2. Turn ON the ignition (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 check the VSS circuit, go to step 5.
 - [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 4.1.1.1.
 - [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 4.1.1.1.
5. Turn OFF the ignition.
6. Disconnect the CPC #3 connector (21-pin).
7. 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 4.1.1.1.
 - [b] If the resistance measurement is greater than 5 Ω , replace the VSS. Refer to section 4.1.1.1.

4.1.1.1 Verify Repairs

Verify repairs as follows:

1. Turn OFF the ignition. Reconnect all connectors.
2. Turn ON the ignition. 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 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).

4.2 SPN 84/FMI 4

This diagnostic condition is typically VSS short circuit.

4.2.1 Short Circuit Check

Check for a short as follows:

1. Disconnect the VSS connector.
2. Disconnect the CPC #3 connector (21-pin).
3. Measure the resistance between pin 1 and pin 2 of the VSS harness connector.
 - [a] If the resistance measurement is less than 5 Ω , repair the short pin 13 and pin 14 of the CPC #3 connector (21-pin). Refer to section 4.2.1.1.
 - [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 4.2.1.1.
 - [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 2 of the VSS harness connector. Refer to section 4.2.1.1.
 - [b] If the resistance measurement is greater than 5 Ω , replace the VSS. Refer to section 4.2.1.1.

4.2.1.1 Verify Repairs

Verify repairs as follows:

1. Turn OFF the ignition. Reconnect all connectors.
2. Turn ON the ignition. 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 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).

5 SPN 86 – ADAPTIVE CRUISE CONTROL FAULT

Section	Page
5.1 SPN 86/FMI 14	5-3

5.1 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.

6 SPN 91 – ACCELERATOR PEDAL SENSOR FAULT

Section	Page
6.1 SPN 91/FMI 2	6-3
6.2 SPN 91/FMI 3	6-4
6.3 SPN 91/FMI 4	6-5

6.1 SPN 91/FMI 2

A typical diagnosis for the fault is erratic data.

6.1.1 Erratic Data Check

Check as follows:

1. Disconnect the Accelerator Pedal (AP).
2. Turn ON the ignition (key ON, engine OFF).
3. Measure the voltage between pins 1 and 3 of the AP harness connector. See Figure 6-1.

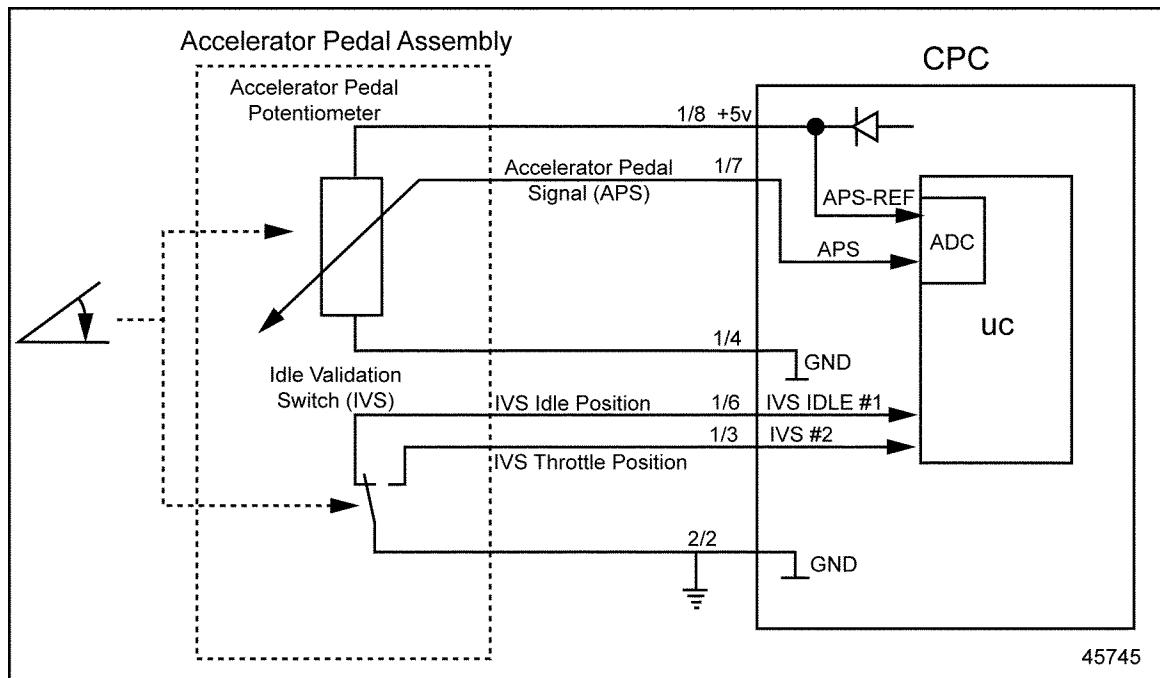


Figure 6-1 Accelerator Pedal Assembly Installation

- [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 6.1.1.1.
 - [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 6.1.1.1.
5. Turn OFF the ignition.
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 6.1.1.1.
 - [b] If the resistance is less than 3 Ω , replace the Accelerator Pedal. Refer to section 6.1.1.1.

6.1.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF. Reconnect all connectors.
2. Turn ignition ON. Clear codes with diagnostic tool.
3. Start and run the engine for one minute. Stop engine.
4. 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).

6.2 SPN 91/FMI 3

The typical diagnosis for this fault is high voltage.

6.2.1 High Voltage Check

Check as follows:

1. Disconnect the Accelerator Pedal (AP).
2. Turn ON the ignition (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. Refer to section 6.2.1.1.
 - [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 6.2.1.1.
5. Turn OFF the ignition.
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 6.2.1.1.
 - [b] If the resistance is less than 3 Ω , replace the Accelerator Pedal. Refer to section 6.2.1.1.

6.2.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF. Reconnect all connectors.
2. Turn ignition ON. Clear codes with diagnostic tool.
3. Start and run the engine for one minute. Stop engine.
4. Check diagnostic tool for codes.
 - [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).

6.3 SPN 91/FMI 4

The typical diagnosis for this fault is voltage low.

6.3.1 Low Voltage Check

Perform the following steps to troubleshoot low voltage.

1. Disconnect the Accelerator Pedal (AP) connector.
2. Disconnect the #1 connector of the CPC.
3. Measure the resistance between pin 1 and pin 3 of the AP connector.
 - [a] If the resistance is less than 5 Ω , repair the short between wires 8 and 4 of the CPC #1 connector. Refer to section 6.3.1.1.
 - [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 #1 connector. Refer to section 6.3.1.1.
 - [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 6.3.1.1.
- [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 6.3.1.1.
 - [b] If the resistance is greater than 5 Ω , replace the Accelerator Pedal. Refer to section 6.3.1.1.

6.3.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF. Reconnect all connectors.
2. Turn ignition ON. Clear codes with diagnostic tool.
3. Start and run the engine for one minute. Stop engine.
4. 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).

7 SPN 100 — ENGINE OIL PRESSURE OUTSIDE OF NORMAL OPERATING RANGE

Section	Page
7.1 SPN 100/FMI 1	7-3
7.2 SPN 100/FMI 2	7-4
7.3 SPN 100/FMI 3	7-5
7.4 SPN 100/FMI 4	7-7
7.5 SPN 100/FMI 14	7-9

7.1 SPN 100/FMI 1

SPN 100/FMI is typically low engine oil pressure.

7.1.1 Low Oil Pressure Check

Check as follows:

1. Check for multiple codes.
 - [a] If fault codes 100/1 and 100/3 are both active, refer to section 7.3.1.
 - [b] If fault codes 100/1 and 100/4 are both active, refer to section 7.4.1
 - [c] If only fault code 100/1 is active, go to step 2.
2. Observe the stability of the oil pressure.
 - [a] If the oil pressure is in normal operating range and stable, go to step 3.
 - [b] If the oil pressure is fluctuating, go to step 4.
3. 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 7.1.1.1.
 - [b] If the engine oil level is low, fill oil to proper level. Refer to section 7.1.1.1.
4. 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 7.1.1.1.
 - [b] If the oil gage readings are fine, go to step 5.
5. 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 7.1.1.1.
 - [b] If there is no problem with the oil pump suction pipe, go to step 6.
6. 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 7.1.1.1.
 - [b] If neither gear is loose, go to step 7.
7. 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 7.1.1.1.
 - [b] If the relief valve is fine, refer to section 7.1.1.1.

7.1.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF. Reconnect all connectors.
2. Turn ignition ON. Clear codes with diagnostic tool.
3. Start and run the engine for one minute. Stop engine.
4. 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).

7.2 SPN 100/FMI 2

The diagnosis for this code is typically erratic data from the Engine Oil Pressure Sensor. Perform the following steps to troubleshoot erratic data from the Engine Oil Pressure Sensor.

7.2.1 Erratic Data From the Engine Oil Pressure Sensor Check

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

1. With the engine shut down, all oil drained into the oil pan, and the vehicle on a level surface, check the oil level.
 - [a] If the oil level is not within the “normal” operating range on the dipstick, add the recommended oil to bring it to the proper level. Refer to section 7.2.1.1.
 - [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 7.3.1.
 - [b] If fault code 100/4 is active in addition to code 100/2, refer to section 7.4.1.

- [c] If only fault code 100/2 is active, check and clean sensor contacts (remove any corrosion). See Figure 7-1. Refer to section 7.2.1.1.

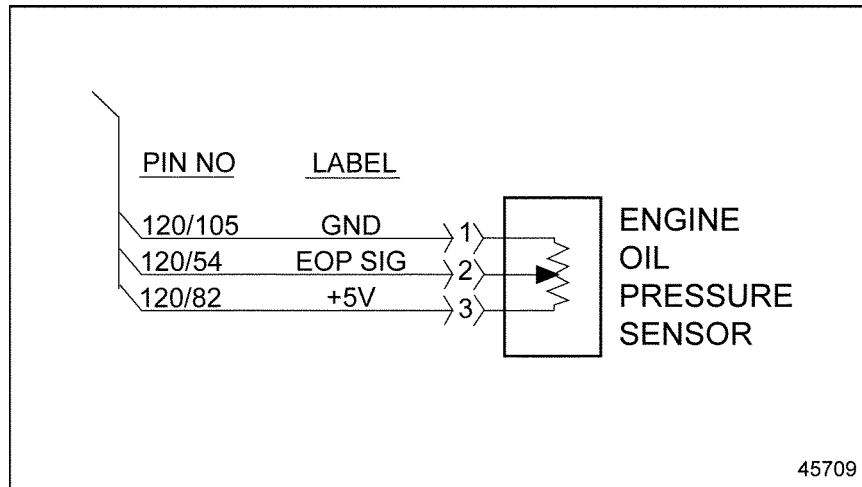


Figure 7-1 Engine Oil Pressure Sensor Wiring

7.2.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF. Reconnect all connectors.
2. Turn ignition ON. Clear codes with diagnostic tool.
3. Start and run the engine for one minute. Stop engine.
4. 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).

7.3 SPN 100/FMI 3

A typical diagnosis is an Engine Oil Pressure Sensor short circuit.

7.3.1 Short Circuit Check

Check for an Engine Oil Pressure Sensor short circuit as follows:

1. Disconnect the sensor.
2. Disconnect the 120-pin MCM connector.

3. Measure the resistance across pins 2 and 3 of the EOP Sensor connector. See Figure 7-2.

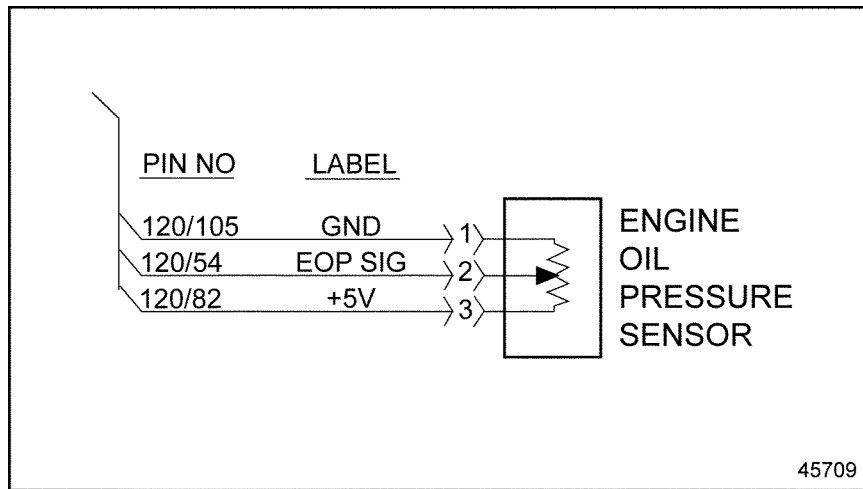


Figure 7-2 Engine Oil Pressure Sensor Wiring

- [a] If resistance is greater than 5 Ω, repair the short to power on wire 54 of the 120-pin MCM connector (see Figure 7-3). Refer to section 7.3.1.1.
- [b] If resistance is less than 5 Ω, repair the short between pins 54 and 82 of the 120-pin MCM connector (see Figure 7-3). Refer to section 7.3.1.1.

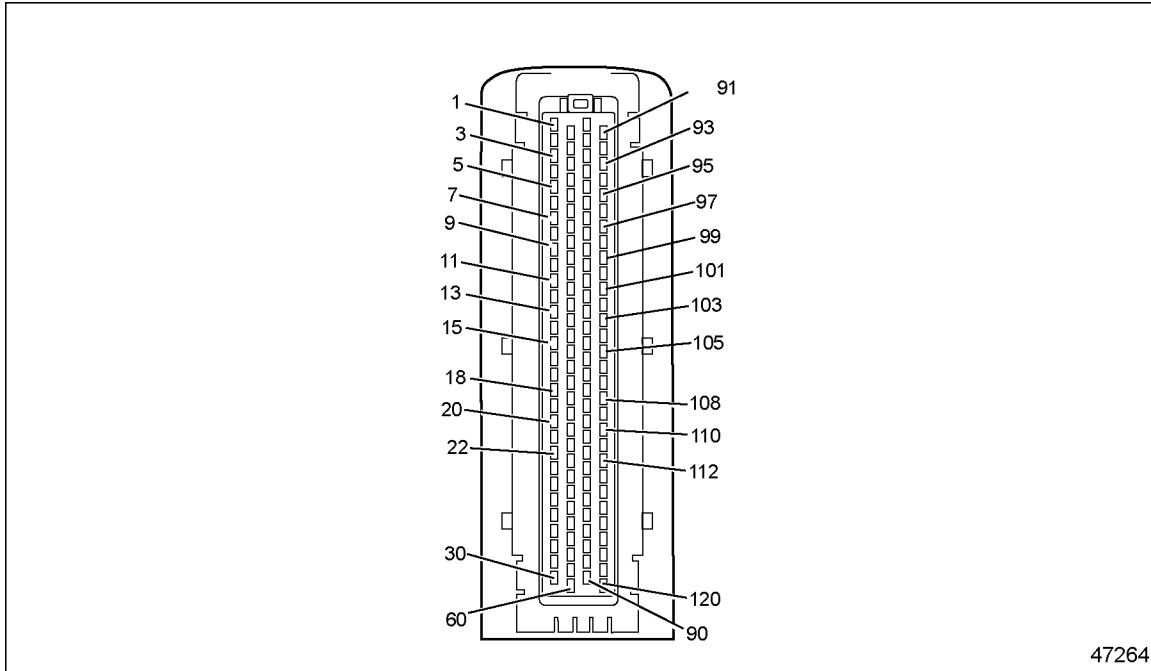


Figure 7-3 120-pin MCM Connector

7.3.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF. Reconnect all connectors.
2. Turn ignition ON. Clear codes with diagnostic tool.
3. Start and run the engine for one minute. Stop engine.
4. 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.
 - [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).

7.4 SPN 100/FMI 4

This diagnosis is typically an Engine Oil Pressure Sensor open circuit fault.

7.4.1 Open Circuit Check

Check for an open circuit as follows:

1. Disconnect the Engine Oil Pressure Sensor.
2. Measure the resistance between pins 1 and 3 of the EOP Sensor. See Figure 7-4.

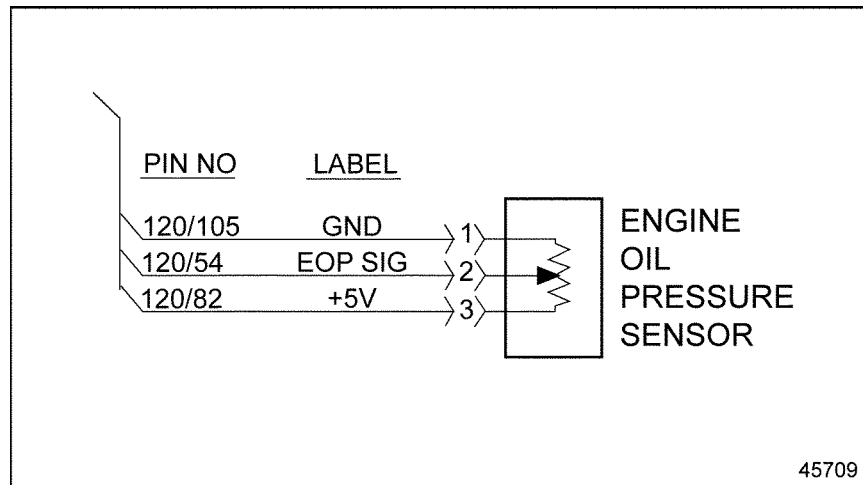


Figure 7-4 Engine Oil Pressure Sensor Wiring

- [a] If resistance is greater than 130k Ω , replace the EOP Sensor. Refer to section 7.4.1.1.
 - [b] If resistance is less than 130k Ω , go to step 3.
3. Measure the resistance between pins 1 and 2 of the EOP Sensor. See Figure 7-4.

- [a] If resistance is greater than 130k Ω , replace the EOP Sensor. Refer to section 7.4.1.1.
- [b] If resistance is less than 130k Ω , go to step 4.
4. Turn the ignition ON (key ON, engine OFF).
5. Measure the voltage between pins 1 and 3 of the EOP 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 3 of the EOP Sensor 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 EOP Sensor harness connector and pin 105 of the 120-pin MCM connector. Refer to section 7.4.1.1.
 - [b] If the voltage is less than 4.5 volts, repair the open circuit between pin 3 of the EOP Sensor harness connector and pin 82 of the 120-pin MCM connector. Refer to section 7.4.1.1.
7. Turn the ignition OFF.
8. Disconnect the 120-pin MCM connector.
9. Measure the resistance between pins 1 and 3 of the EOP Sensor harness connector.
 - [a] If the resistance is greater than 5 Ω , go to step 10.
 - [b] If the resistance is less than 5 Ω , repair the short between pins 105 and 82 of the 120-pin MCM connector. Refer to section 7.4.1.1.
10. Measure the resistance between pins 1 and 2 of the EOP 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 between pins 105 and 54 of the 120-pin MCM connector. Refer to section 7.4.1.1.
11. Measure the resistance between pin 3 of the EOP Sensor harness connector and ground.
 - [a] If the resistance is greater than 5 Ω , go to step 12.
 - [b] If the resistance is less than 5 Ω , repair the short between pin 82 of the 120-pin MCM connector and ground. Refer to section 7.4.1.1.
12. Measure the resistance between pin 2 of the EOP Sensor harness connector and ground.
 - [a] If the resistance is greater than 5 Ω , repair the open circuit between pin 2 of the EOP Sensor harness connector and pin 54 of the 120-pin MCM connector. Refer to section 7.4.1.1.
 - [b] If the resistance is less than 5 Ω , repair the short between pin 54 of the 120-pin MCM connector. Refer to section 7.4.1.1.

7.4.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF. Reconnect all connectors.
2. Turn ignition ON. Clear codes with diagnostic tool.
3. Start and run the engine for one minute. Stop engine.
4. 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.
 - [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).

7.5 SPN 100/FMI 14

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

7.5.1 Multiple Codes Check

Check for multiple codes as follows:

1. Check for additional active fault codes.
 - [a] If fault code 100/3 is active in addition to code 100/4, refer to section 7.3.1.
 - [b] If fault code 100/4 is active in addition to code 100/4, refer to section 7.4.1.
 - [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 7.5.1.1.
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 7.5.1.1.
 - [b] If fuel is not found, contact Detroit Diesel Customer Support Center (313-592-5800).

7.5.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF. Reconnect all connectors.
2. Turn ignition ON. Clear codes with diagnostic tool.
3. Start and run the engine for one minute. Stop engine.
4. 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).

8 SPN 103 – TURBO NO REVOLUTION

Section	Page
8.1 SPN 103/FMI 0	8-3
8.2 SPN 103/FMI 1	8-4
8.3 SPN 103/FMI 3	8-5
8.4 SPN 103/FMI 4	8-7
8.5 SPN 103/FMI 7	8-8

8.1 SPN 103/FMI 0

This diagnosis is typically turbocharger speed above threshold.

8.1.1 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 8.1.1.1.
 - [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 8.1.1.1.
 - [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 8.1.1.1.
 - [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 8.1.1.1.
 - [b] If the fuel pressure is within specifications, contact the Detroit Diesel Customer Support Center (313-592-5800).

8.1.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF. Reconnect all connectors.
2. Turn ignition ON. Clear codes with diagnostic tool.
3. Start and run the engine for one minute. Stop engine.
4. 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).

8.2 SPN 103/FMI 1

This diagnosis is typically turbocharger speed below threshold

8.2.1 Equipment Check

Check equipment as follows:

1. Disconnect the Turbo Speed Sensor.
2. Measure the resistance across pins 1 and 2 of the Turbo Speed Sensor.
 - [a] If the resistance is 0 or greater than 1k Ω , replace the Turbo Speed Sensor. Refer to section 8.2.1.1.
 - [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 8.2.1.1.
 - [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 8.2.1.1.
 - [b] If the self test results are satisfactory, go to step 5.
5. Check 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 8.2.1.1.
 - [b] If the oil pressure is within specifications, contact the Detroit Diesel Customer Support Center (313–592–5800).

8.2.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF. Reconnect all connectors.
2. Turn ignition ON. Clear codes with diagnostic tool.
3. Start and run the engine for one minute. Stop engine.
4. 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).

8.3 SPN 103/FMI 3

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

8.3.1 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 8-1).

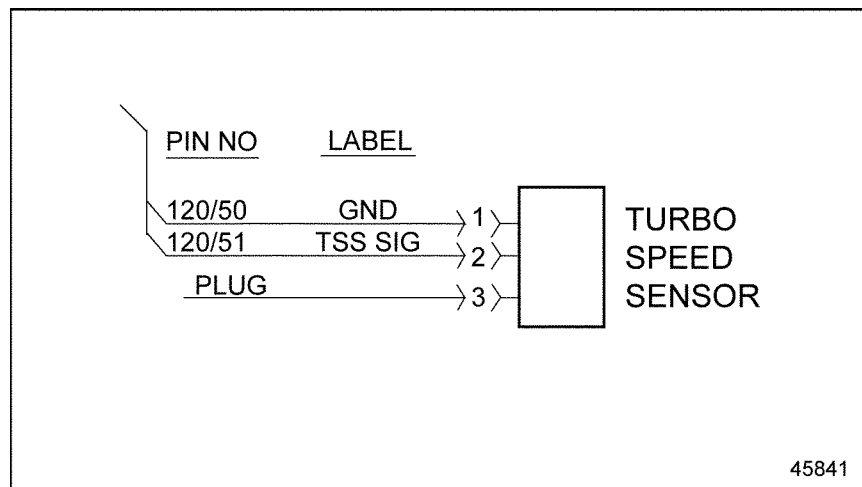


Figure 8-1 Turbo Speed Sensor Terminal and Wire Locations

- [a] If the resistance is greater than 1k Ω , replace the sensor. Refer to section 8.3.2.1.
 - [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 8.3.2.
 - [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. Refer to section 8.3.2.1.
 - [b] If the voltage is less than 4.5 volts, repair the open circuit between pin 2 of the TSS harness connector and pin 51 of the 120-pin MCM connector. Refer to section 8.3.2.1.

8.3.2 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 8.3.2.1.
 - [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.
 - [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 8.3.1, step 5.

8.3.2.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF. Reconnect all connectors.
2. Turn ignition ON. Clear codes with diagnostic tool.
3. Start and run the engine for one minute. Stop engine.
4. 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).

8.4 SPN 103/FMI 4

This diagnosis is typically short to ground.

8.4.1 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 8.4.2.1.
 - [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 8.4.2.1.
 - [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 8.4.2.1.
 - [b] If the resistance is greater than 5 Ω , refer to section 8.4.2.1.

8.4.2 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 8.4.2.1.
 - [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 8.4.2.1.
 - [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 8.4.2.1.
 - [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.

8.4.2.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF. Reconnect all connectors.
2. Turn ignition ON. Clear codes with diagnostic tool.
3. Start and run the engine for one minute. Stop engine.
4. Check diagnostic tool for codes.
 - [a] If no codes are displayed, troubleshooting is complete.
 - [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).

8.5 SPN 103/FMI 7

There are two possible causes for this fault code:

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

8.5.1 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. See Figure 8-2.

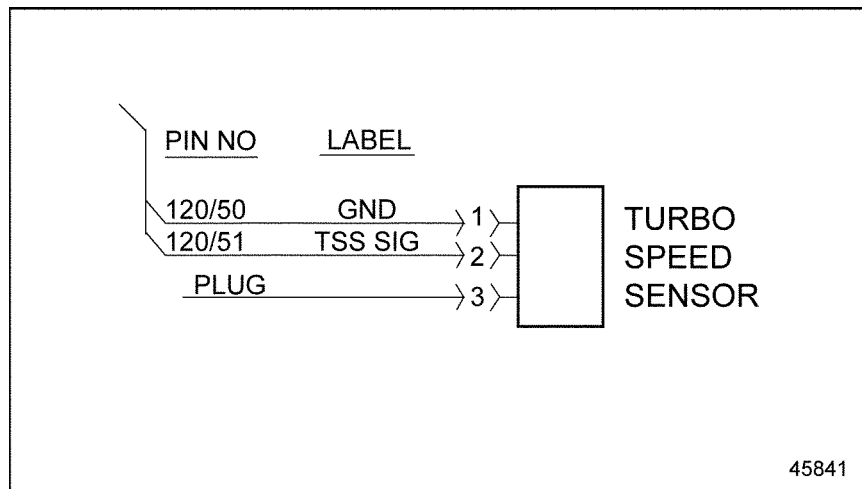


Figure 8-2 Turbo Speed Sensor Terminal and Wire Locations

- [a] If resistance is approximately 900 Ω , refer to section 8.5.2.
- [b] If resistance is zero or higher than 950 Ω , replace the sensor. Refer to section 8.5.2.1.

8.5.2 Adjust the Turbo Speed Sensor Air Gap

Adjust the TSS air gap as 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 8.5.2.1.

8.5.2.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF. Reconnect all connectors.
2. Turn ignition ON. Clear codes with diagnostic tool.
3. Start and run the engine for one minute. Stop engine.
4. Check diagnostic tool for codes.
 - [a] If no codes are displayed, troubleshooting is complete.
 - [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).

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

Section	Page
9.1 SPN 110/FMI 0	9-3
9.2 SPN 110/FMI 2	9-3
9.3 SPN 110/FMI 3	9-4
9.4 SPN 110/FMI 4	9-7
9.5 SPN 110/FMI 14	9-9

9.1 SPN 110/FMI 0

The diagnostic condition is typically engine coolant temperature high.

9.1.1 System Checks to Resolve Fault

check as follows:

1. Check for multiple codes.
 - [a] If fault 110/3 is active in addition to 110/0, refer to section 9.3.2.
 - [b] If fault 110/4 is active in addition to 110/0, refer to section 9.4.1.
 - [c] If fault 111/1 is active in addition to 110/0, refer to section 10.1.
 - [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 9.1.1.1.

9.1.1.1 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).

9.2 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.

9.2.1 Rationality Check for Temperature Drift

Check as follows:

1. Check cooling system integrity (lack of heat complaints).
2. Connect DDDL 7.0 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 9.2.1.1.
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 9.2.1.1.

9.2.1.1 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).

9.3 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.

9.3.1 Multiple Codes Check

Check for multiple codes as follows:

1. Turn the ignition the ON (key On, engine OFF).
2. Plug in the diagnostic tool.
3. Read the active codes.
 - [a] If codes 110/3, 174/3 and 175/3 are active at the same time, repair the open circuit between pin 55 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 9.3.2.1.
 - [b] If only fault 110/3 is active, refer to section 9.3.2.

9.3.2 Open Circuit Check

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

1. Disconnect the ECT Sensor.
2. Measure the resistance across pins 1 and 2 of the ECT Sensor.
 - [a] If the resistance is greater than 4 k Ω , replace the sensor. Refer to section 9.3.2.1.
 - [b] If the resistance is less than 4 k 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 ECT Sensor harness connector.
 - [a] If the voltage is between 2.75 and 3.25 volts, go to step 6.
 - [b] If the voltage is less than 2.75 volts, go to step 5.
5. Measure the voltage between pin 2 of the ECT Sensor harness connector and ground.
 - [a] If the voltage is between 2.75 and 3.25 volts, repair the open circuit between pin 1 of the ECT Sensor harness connector and pin 55 of the 120-pin MCM connector (see Figure 9-1). Refer to section 9.3.2.1.

- [b] If the voltage is less than 2.75 volts, repair the open circuit between pin 2 of the ECT Sensor harness connector and pin 110 of the 120-pin MCM connector (see Figure 9-1). Refer to section 9.3.2.1.

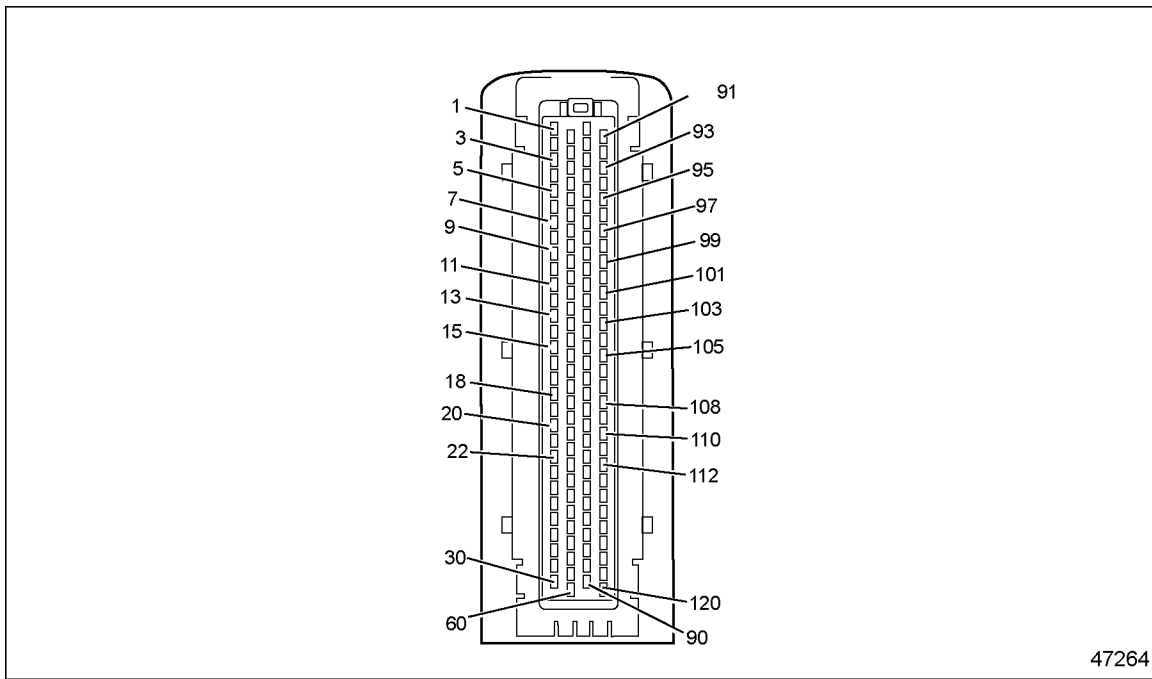


Figure 9-1 MCM Connector

- 6. Disconnect the 120-pin MCM connector. Measure the resistance between pins 1 and 2 of the ECT Sensor harness connector. See Figure 9-2.

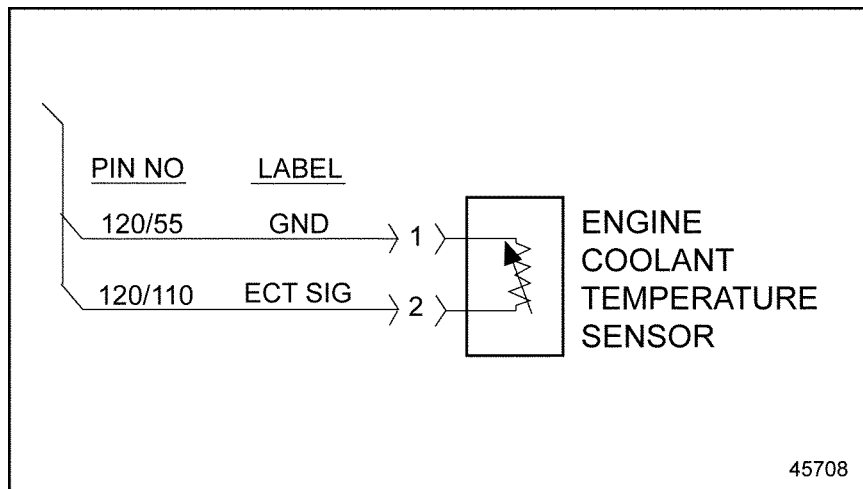


Figure 9-2 Engine Coolant Temperature Sensor Wiring

- [a] If the resistance is greater than 5 Ω, replace the ECT Sensor. Refer to section 9.3.2.1.

- [b] If the resistance is less than 5 Ω , repair the short between pins 55 and 110 of the 120-pin MCM connector. Refer to section 9.3.2.1.

9.3.2.1 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.

9.4 SPN 110/FMI 4

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

9.4.1 Short to Ground Check

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

1. Disconnect the ECT Sensor.
2. Disconnect the 120-pin MCM connector.
3. Measure the resistance across pins 1 and 2 of the ECT Sensor connector. See Figure 9-2.
 - [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 55 and 110 of the 120-pin MCM connector. Refer to section 9.4.1.1.
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 9.4.1.1.
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 9.4.1.1.

9.4.1.1 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.

9.5 SPN 110/FMI 14

The diagnostic condition is typically engine coolant temperature very high.

9.5.1 Multiple Codes Check

Perform the following steps to troubleshoot an engine coolant temperature very high fault.

1. Turn vehicle ignition switch ON (key On, engine OFF).
2. Plug in the diagnostic tool.
3. Read active codes:
 - [a] If only fault code 110/14 is active, refer to section 9.5.2.
 - [b] If fault code 110/3 is active in addition to fault code 110/14, refer to section 9.3.2.
 - [c] If fault code 110/4 is active in addition to fault code 110/14, refer to section 9.4.1.

9.5.2 System Checks to Resolve Fault

Perform the following checks and 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 9.5.2.1.

9.5.2.1 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).

10 SPN 111 – COOLANT LEVEL OUTSIDE NORMAL OPERATING RANGE

Section	Page
10.1 SPN 111/FMI 1	10-3
10.2 SPN 111/FMI 3	10-5
10.3 SPN 111/FMI 4	10-7

10.1 SPN 111/FMI 1

This diagnosis typically coolant level low.

10.1.1 Engine Coolant Level Sensor Check

Check as follows:

1. Turn the vehicle ignition switch 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 10-1.

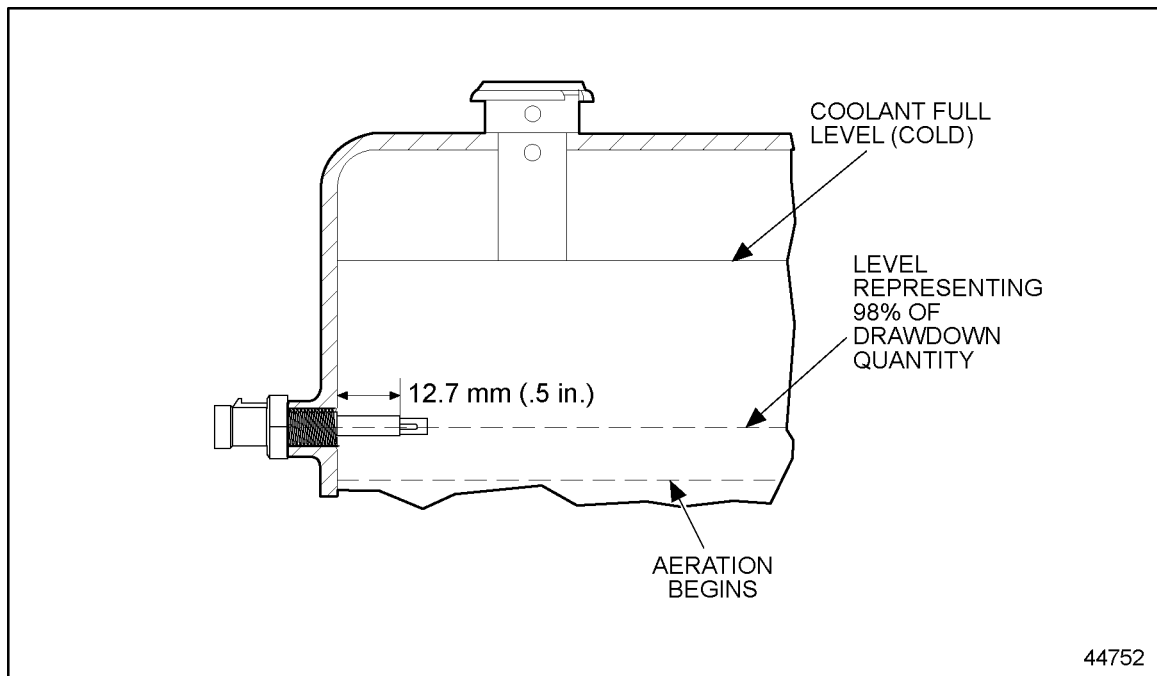


Figure 10-1 Engine Coolant Level Sensor Mounted in Radiator Top Tank

- [a] If the coolant level in the reservoir is not within limit, refer to section 10.1.2.

[b] If the coolant level in the reservoir is within limit, replace the sensor (see Figure 10-2). Refer to section 10.1.2.1.

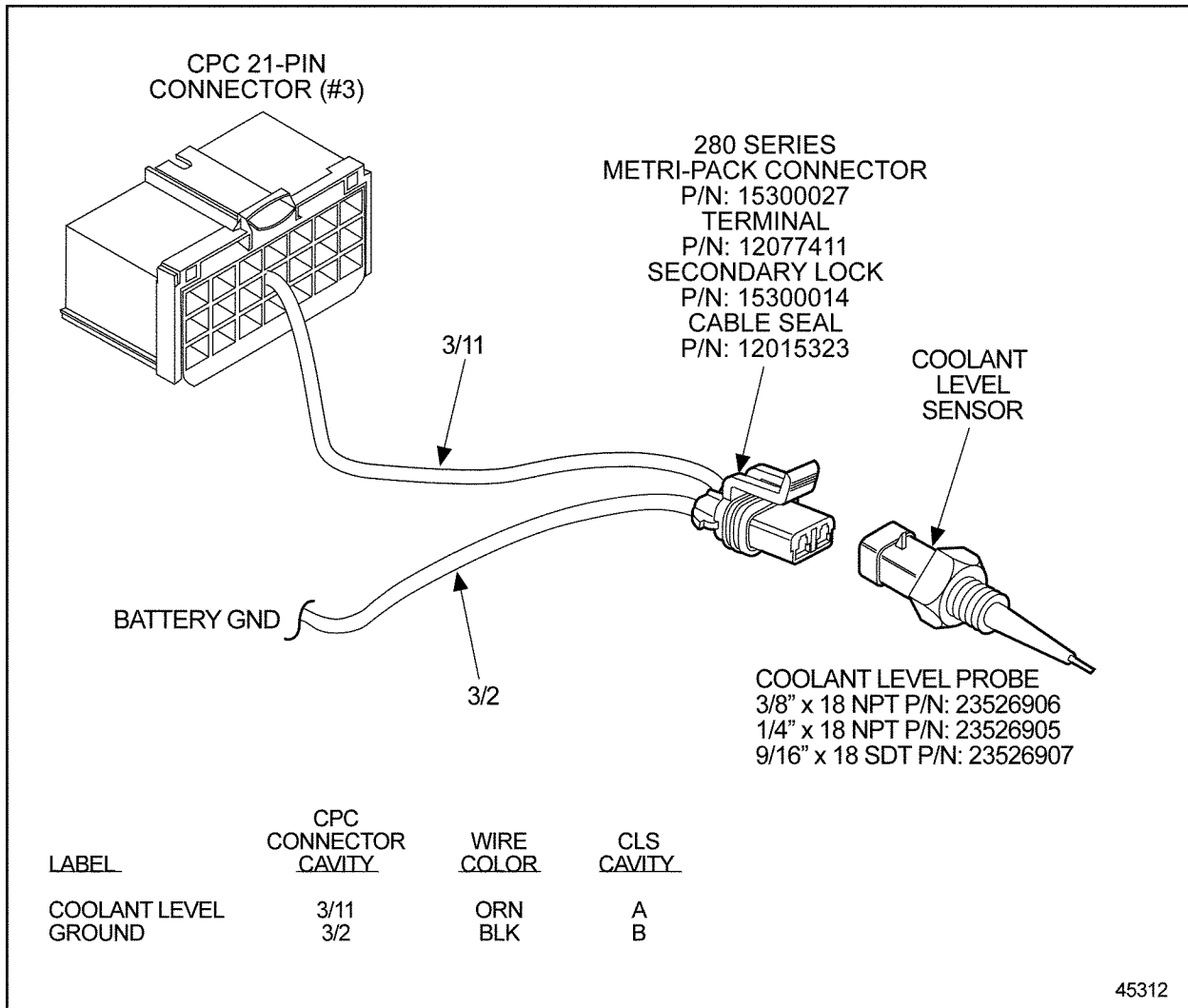


Figure 10-2 Engine Coolant Level Sensor Installation for CPC

10.1.2 Coolant Leak or Faulty Radiator Cap Check

Check as follows:

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 10.1.2.1.

10.1.2.1 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.

10.2 SPN 111/FMI 3

This condition is typically an open circuit fault.

10.2.1 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.
2. Disconnect the ECL Sensor.
3. Measure the resistance between pin 1 and 2 of the ECL Sensor.

- [a] If the resistance is greater than 1,000 Ω , replace ECL sensor. See Figure 10-3. Refer to section 10.2.1.1.

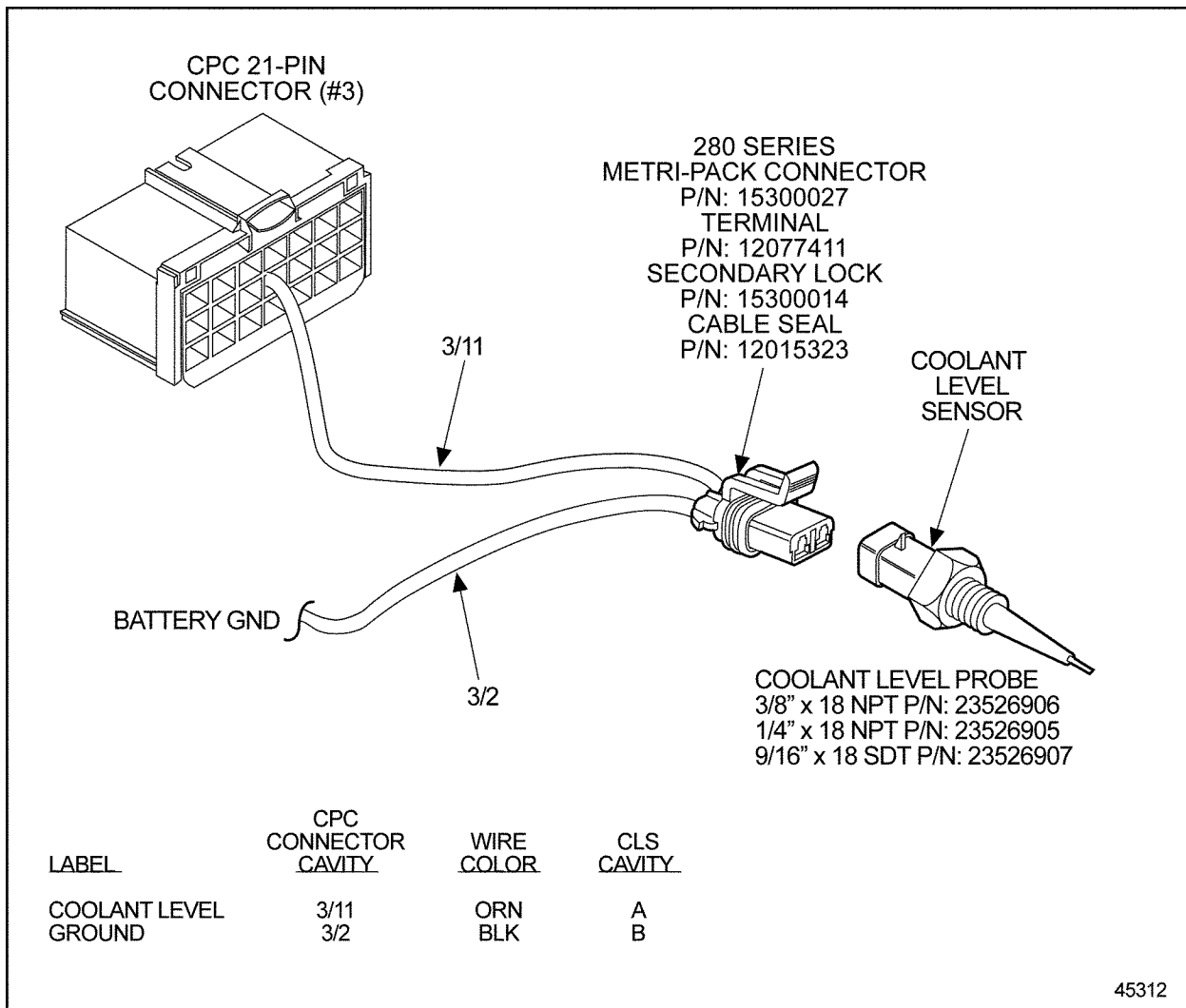


Figure 10-3 Engine Coolant Level Sensor Installation for CPC

- [b] If the resistance is less than 600 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 ECL Sensor harness connector.
 - [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 6.
 6. Measure the voltage between pin 1 of the ECL Sensor harness connector and ground.
 - [a] If the voltage is greater than 11.5 volts, repair the open between pin 2 of the CPC #3 connector and the ECL Sensor harness. Refer to section 10.2.1.1.

- [b] If the voltage is less than 11.5 volts, repair the open between pin 11 of the CPC #3 connector and the ECL Sensor harness. Refer to section 10.2.1.1.
- 7. Disconnect the CPC #3 connector.
- 8. Measure the resistance between pins 1 and 2 of the ECL Sensor harness connector.
 - [a] If the resistance is less than 5 Ω , repair the short between the ECL Sensor harness connector pins 1 and 2 and pins 2 and 11 of the CPC #3 connector. Refer to section 10.2.1.1.
 - [b] If the resistance is greater than 5 Ω , review steps 3 through 8. If the results are the same, call the Detroit Diesel Customer Support Center (313-592-5800).

10.2.1.1 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.

10.3 SPN 111/FMI 4

This fault is typically a short to ground.

10.3.1 Short to Ground Check

Check for a short to ground as follows:

1. Turn the ignition ON (key On, engine OFF).
2. Read the diagnostic codes displayed.
 - [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 3.

3. Disconnect the ECL Sensor. See Figure 10-4.

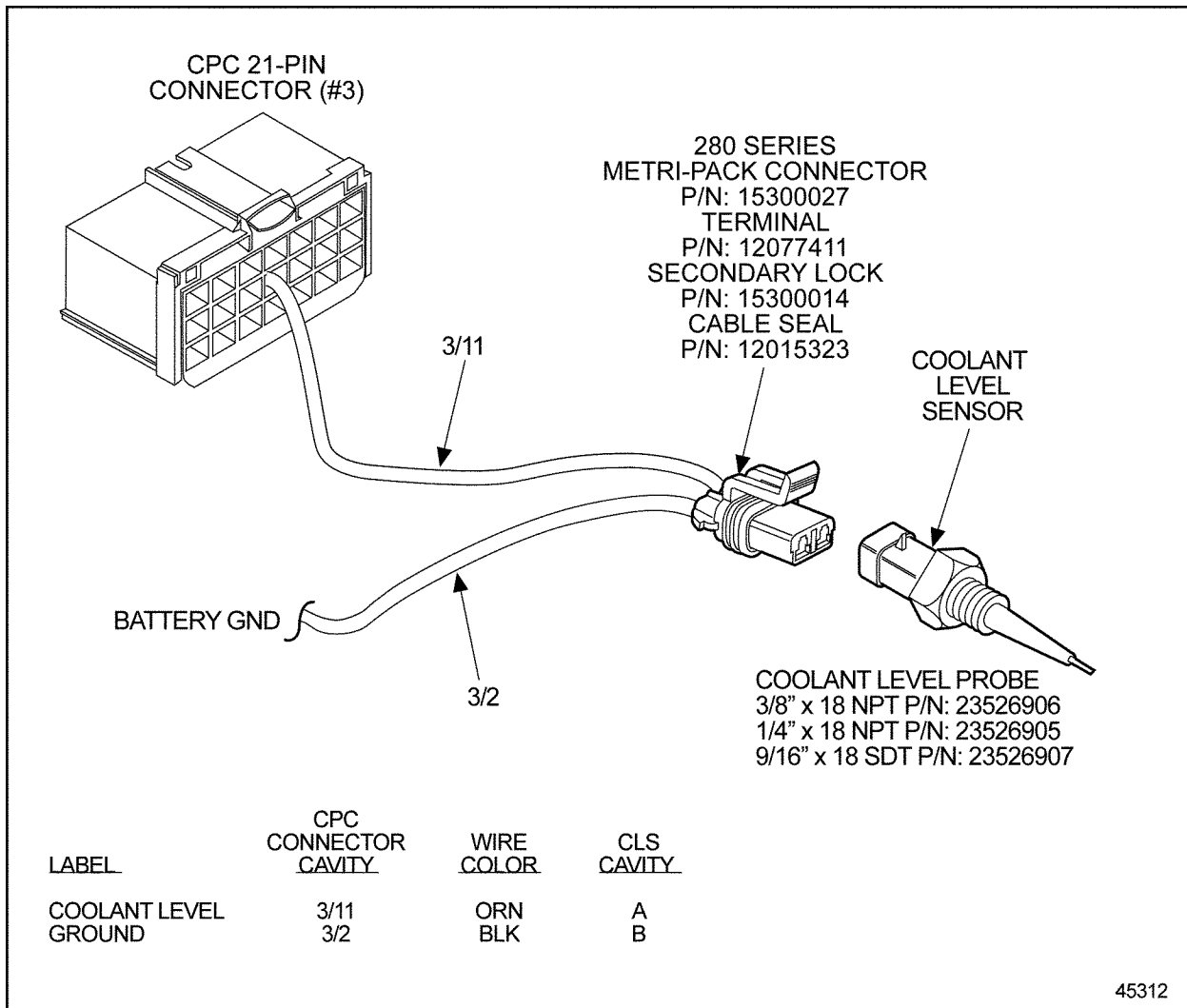


Figure 10-4 Engine Coolant Level Sensor Installation for CPC

4. Disconnect the CPC #3 connector (21-pin).
5. 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 10.3.1.1.
 - [b] If the resistance is greater than 5 Ω , go to step 6.
6. 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 10.3.1.1.
 - [b] If the resistance is greater than 5 Ω , go to step 7.
7. 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 10.3.1.1.
- [b] If the resistance is greater than 5 Ω , review steps 10.3.1.1 through 7. If the results are the same, call the Detroit Diesel Customer Support Center (313–592–5800).

10.3.1.1 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.

11 SPN 158 — BATTERY CHARGING FAULT

Section	Page
11.1 SPN 158/FMI 0	11-3
11.2 SPN 158/FMI 1	11-4
11.3 SPN 158/FMI 2	11-6

11.1 SPN 158/FMI 0

The diagnostic condition is typically high system voltage.

11.1.1 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 11.1.1.1.

11.1.1.1 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 engine.
4. 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).

11.2 SPN 158/FMI 1

The diagnostic condition is typically low system voltage.

11.2.1 Battery Voltage Switched – Low Check

Check as follows:

1. Turn the ignition ON (key ON, engine OFF).
2. Measure the voltage across the battery terminals. See Figure 11-1.

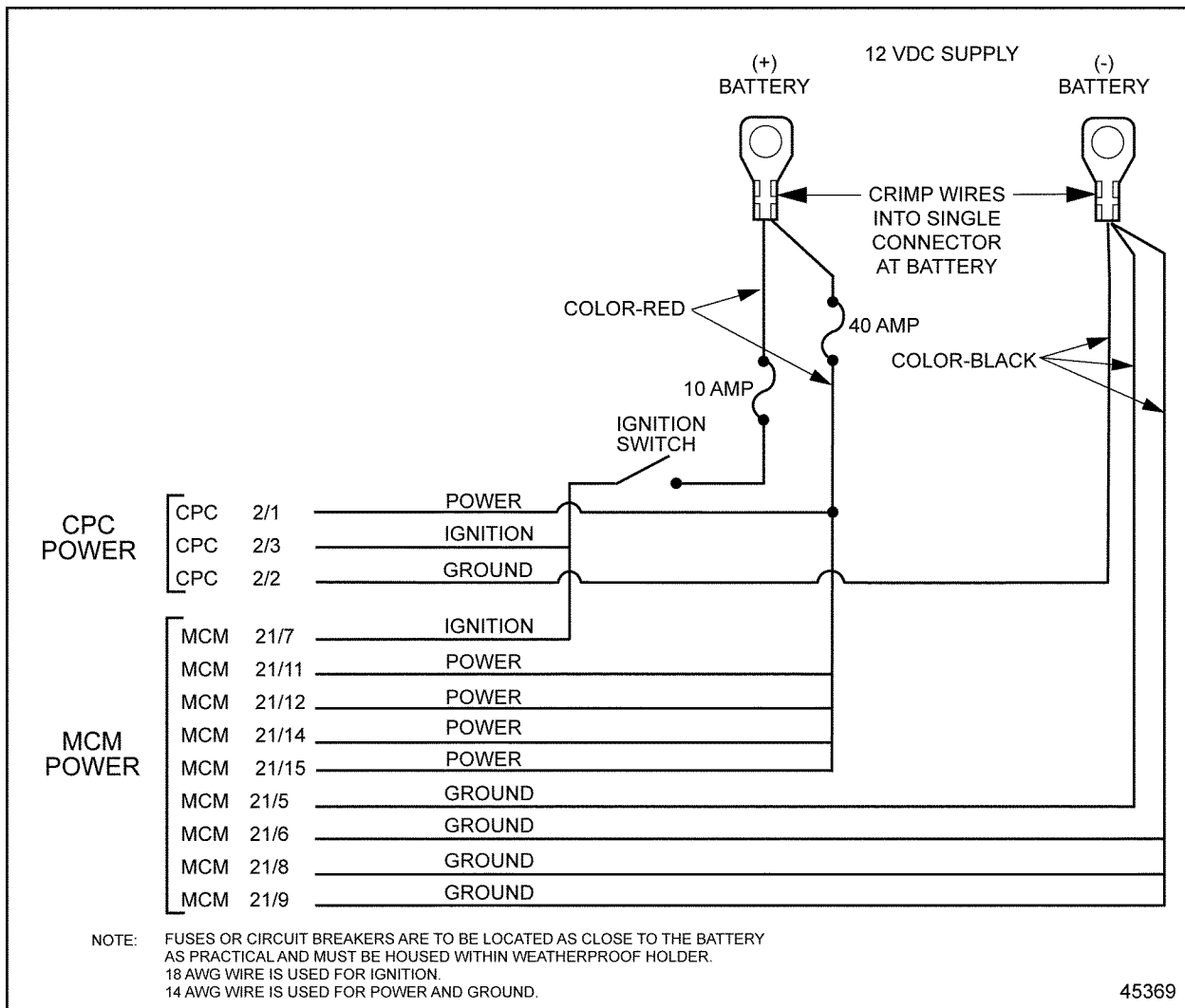


Figure 11-1 Power Wiring

- [a] If the voltage is less than 11.0 V, troubleshoot the battery, starting, and charging system for an under voltage condition. Refer to the OEM Vehicle Manual.
- [b] If the voltage is not less than 11.0 V, go to step 3.

3. Measure the voltage between pins 2/2 and 2/3 of the CPC #2 connector (18-pin). See Figure 11-1.
 - [a] If the voltage is between 11.0 and 16 V, replace the CPC. Refer to section 11.2.1.1.
 - [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 11.2.1.1.
 - [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 11.2.1.1.
 - [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).

11.2.1.1 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 engine.
4. 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).

- [a] If the voltage difference is less than 1.0 V, contact the Detroit Diesel Customer Support Center (313-592-5800).
 - [b] If the voltage difference is greater than 1.0 V with the CPC indicating the low voltage, go to step 3.
 - [c] If the voltage difference is greater than 1.0 V with the MCM indicating the low voltage, go to step 4.
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 11.3.1.1.
 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 11.3.1.1.

11.3.1.1 Verify Repairs

Verify repairs as follows:

1. Turn 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. 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).

12 SPN 168 – BATTERY VOLTAGE OUTSIDE NORMAL OPERATING RANGE

Section	Page
12.1 SPN 168/FMI 0	12-3
12.2 SPN 168/FMI 1	12-4

12.1 SPN 168/FMI 0

This diagnosis is typically battery voltage high.

12.1.1 Measure Battery Voltage

Check 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 12.1.1.1.

12.1.1.1 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 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).

12.2 SPN 168/FMI 1

This diagnosis is typically battery voltage low.

12.2.1 Alternator and Battery Check

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 12.2.2.1.
 - [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 12.2.2.1.
 - [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 12.2.2.1.
 - [b] If fault is still active, refer to section 12.2.2.

12.2.2 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 12-1.
 - [a] If resistance is greater than 0.5 Ω in any wire, repair or replace the wire and connector. Refer to section 12.2.2.1.

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

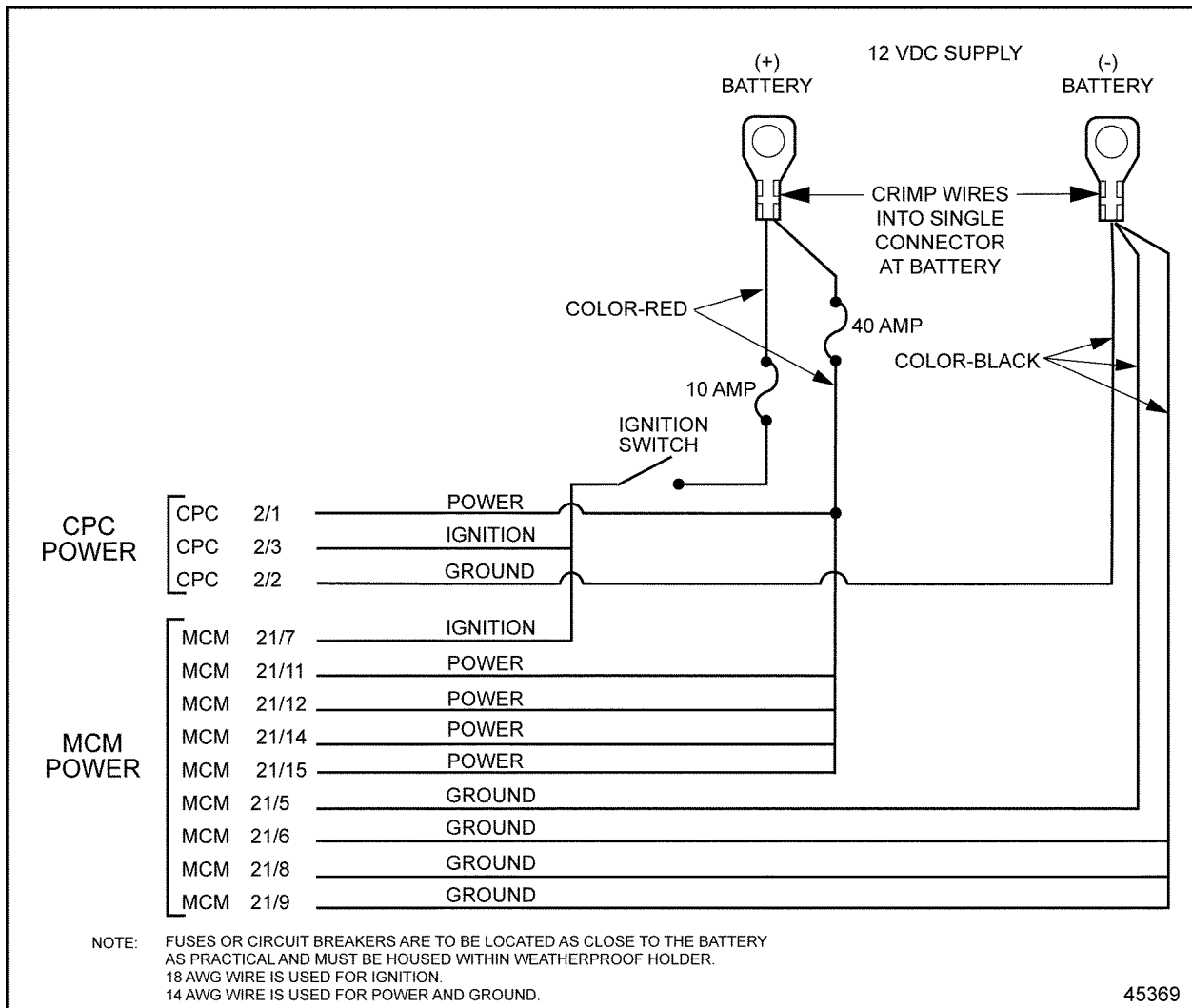


Figure 12-1 Power Wiring

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 12-1.
 - [a] If resistance is greater than 0.5Ω in any wire, repair or replace the power circuit wires and connector. Refer to section 12.2.2.1.
 - [b] If resistance is less than 0.5Ω 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 12-1.
 - [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 12.2.2.1.
 - [b] If the current drop is less than 0.2 volts in any wire, go to step 4.

4. Measure the current drop of the individual wires in the power circuit (MCM 21/11, 21/12, 21/14, 21/15 and CPC 2/1). See Figure 12-1
 - [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 12.2.2.1.
 - [b] If the current drop is more than 0.2 volts in any wire, refer to section 12.2.2.1.

12.2.2.1 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 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).

13 SPN 174 – SUPPLY FUEL TEMPERATURE FAULT

Section	Page
13.1 SPN 174/FMI 3	13-3
13.2 SPN 174/FMI 4	13-5

13.1 SPN 174/FMI 3

SPN 174/FMI 3 indicates a SFT Sensor open circuit.

13.1.1 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 55 of the 120-pin MCM Connector and pin 1 of the Engine Coolant Temperature (ECT) Sensor, the Engine Oil Temperature (EOT) Sensor and the Supply Fuel Temperature (SFT) Sensor. Refer to section 13.1.1.1.
 - [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 13-1.

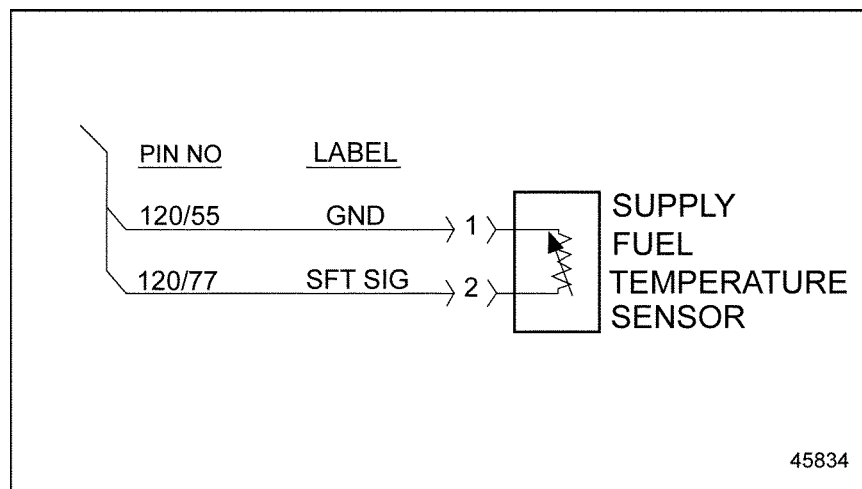


Figure 13-1 Supply Fuel Temperature Sensor

- [a] If the resistance is greater than 4k Ω , replace SFT Sensor. Refer to section 13.1.1.1.
 - [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 13-2. Refer to section 13.1.1.1.
- [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 13-2. Refer to section 13.1.1.1.

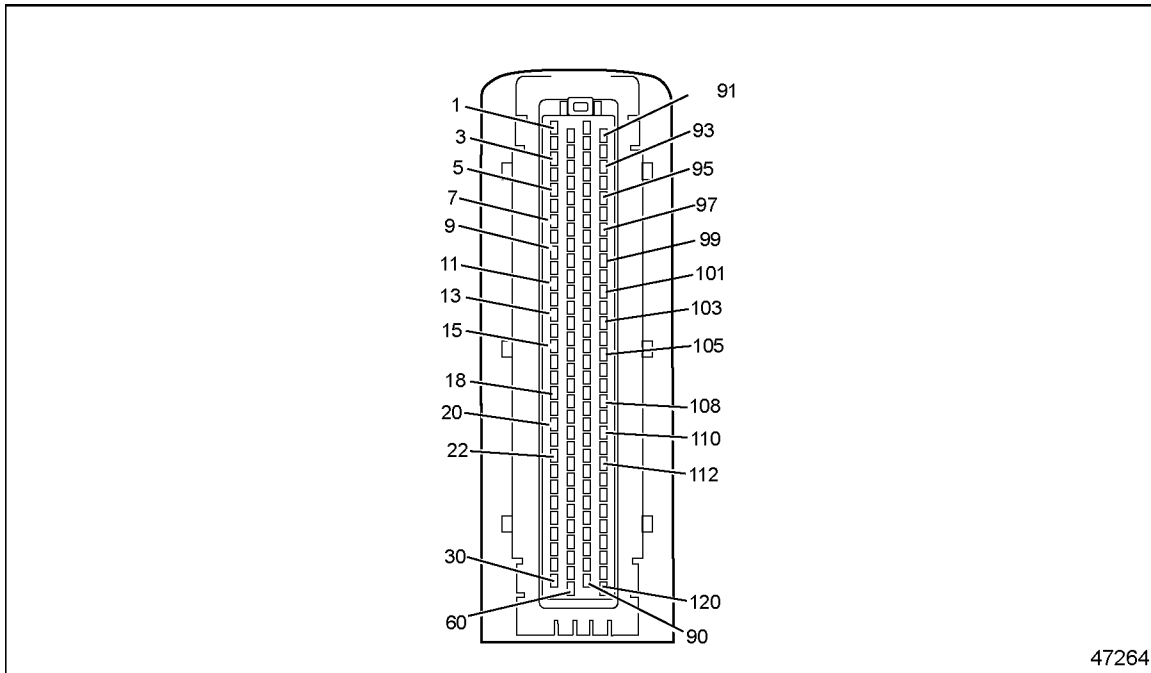


Figure 13-2 MCM 120-pin Connector

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 13.1.1.1.
 - [b] If the resistance is greater than 5 Ω , replace the sensor. Refer to section 13.1.1.1.

13.1.1.1 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.

- [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.

13.2 SPN 174/FMI 4

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

13.2.1 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 13.2.1.1.
 - [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.
 - [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 13.2.1.1.
 - [b] If resistance is greater than 5 Ω , go to step 5.
5. Measure the resistance between pin 2 of the SFT Sensor harness connector and ground.
 - [a] If resistance is less than 5 Ω , repair the short circuit between pin 2 of the SFT Sensor harness connector and ground. Refer to section 13.2.1.1.
 - [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).

13.2.1.1 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.

14 SPN 175 – ENGINE OIL TEMPERATURE OUT OF NORMAL RANGE

Section	Page
14.1 SPN 175/FMI 2	14-3
14.2 SPN 175/FMI 3	14-4
14.3 SPN 175/FMI 4	14-6

14.1 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.

14.1.1 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 DDDL 7.0. 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 EOT 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 14.1.1.1.

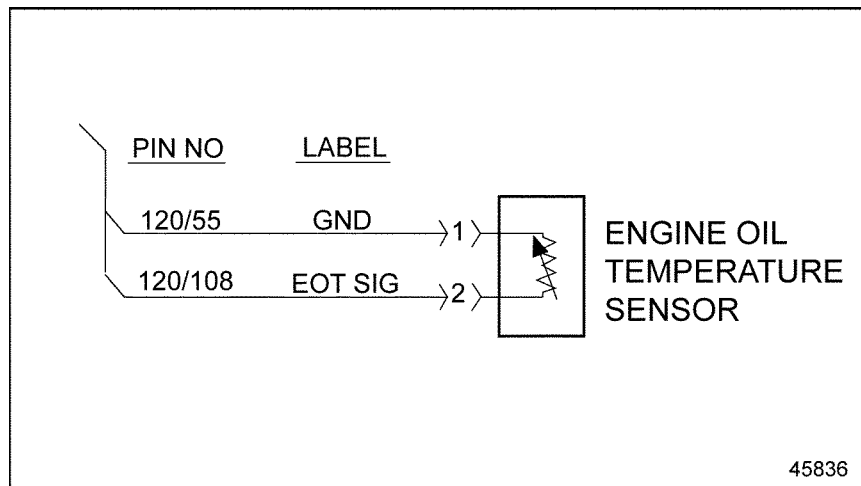


Figure 14-1 Engine Oil Temperature Sensor Wiring

NOTE:

Steps 4 and 5 are for cold start applications only.

4. Using DDDL 7.0, 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 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 14.1.1.1.

14.1.1.1 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).

14.2 SPN 175/FMI 3

This diagnosis is typically engine oil temperature open circuit.

14.2.1 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 55 of the 120–pin MCM connector and pin 1 of the Engine Coolant Temperature (ECT) Sensor, the Engine Oil Temperature Sensor (EOT) and the Supply Fuel Temperature (SFT) Sensor. Refer to section 14.2.1.1.
 - [b] If only fault 175/3 is active, go to step 2.
2. Disconnect the EOT Sensor.
3. Check the resistance across pins 1 and 2 of the EOT Sensor.
 - [a] If the resistance is greater than 4 k Ω , replace the sensor. Refer to section 14.2.1.1.
 - [b] If the resistance is less than 4 k 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 EOT Sensor harness connector.
 - [a] If the voltage is between 2.75 and 3.24 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 EOT Sensor harness connector and ground.
 - [a] If the voltage is between 2.75 and 3.24 volts, repair the open circuit between pin 1 of the EOT Sensor harness connector and pin 55 of the 120-pin MCM connector. Refer to section 14.2.1.1.
 - [b] If the voltage is less than 2.75 volts, repair the open circuit between pin 2 of the EOT Sensor harness connector and pin 108 of the 120-pin MCM connector. Refer to section 14.2.1.1.
7. Disconnect the 120-pin MCM connector. Measure the resistance between pins 1 and 2 of the EOT Sensor harness connector.
 - [a] If the resistance is greater than 5 Ω , replace the EOT Sensor. Refer to section 14.2.1.1.
 - [b] If the resistance is less than 5 Ω , repair the short between pins 55 and 108 of the 120-pin MCM connector. Refer to section 14.2.1.1.

14.2.1.1 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 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).

14.3 SPN 175/FMI 4

This diagnosis is typically oil temperature short to ground.

14.3.1 Short to Ground Check

Check as follows:

1. Disconnect the EOT Sensor.
2. Disconnect the 120-pin connector at the MCM.
3. Check the continuity between pin 1 of the connector at the sensor and ground.
 - [a] If there is no continuity, then repair the short to ground in the wire between pin 2 of the sensor connector (at the sensor) and pin 108 at the 120-pin connector. Refer to section 14.3.1.1.
 - [b] If there is continuity, then repair the short to ground in the wire between pin 1 of the sensor connector (at the sensor) and pin 52 at the 120-pin connector. refer to section 14.3.1.1.

14.3.1.1 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 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).

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

Section	Page
15.1 SPN 411/FMI 0	15-3
15.2 SPN 411/FMI 1	15-4
15.3 SPN 411/FMI 3	15-5
15.4 SPN 411/FMI 4	15-7

15.1 SPN 411/FMI 0

This diagnosis is typically EGR differential pressure failed high.

15.1.1 EGR Components Check

Check as follows:

1. Inspect to see if 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, go to step 3.
3. Connect DDDL 7.0 and monitor the coolant temperature, EGR Delta P, EGR PW, EGR valve position and EGR temperature.
4. Start the engine and increase the RPM to 1200.
5. Activate EGR PW to 60%.

NOTE:

Do not exceed three minutes.

6. Is the EGR Delta P count greater than 170 and the EGR temperature greater than 90° above coolant temperature?
 - [a] If yes, repeat steps 1 through 6 in this section. If the same results occur, contact the Detroit Diesel Customer Support Center (313-592-5800).
 - [b] If no, go to step 7.
7. Turn the engine OFF.
8. Inspect the EGR delivery pipes for damage and proper assembly.
 - [a] If damaged, repair as necessary. Refer to section 15.1.1.1.
 - [b] If OK, go to step 9.
9. Disconnect the EGR Delta P Sensor and inspect the EGR venturi tubes for blockage.
 - [a] If the tubes are blocked, clean them. Refer to section 15.1.1.1.
 - [b] If the tubes are not blocked, replace the EGR Delta P Sensor. Refer to section 15.1.1.1.

15.1.1.1 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 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).

15.2 SPN 411/FMI 1

This diagnosis is typically EGR differential pressure failed low.

15.2.1 EGR Components Check

Check as follows:

1. Check for multiple codes.
 - [a] If codes other than 411/1 are present, service them first.
 - [b] If only 411/1 is present, go to step 2.
2. Using DDDL 7.0, monitor the coolant temperature, EGR Delta P, EGR PW, EGR valve position and EGR temperature.
3. Idle the engine with the EGR PW less than 3% and the EGR position less than 5% (NO EGR FLOW COMMANDED).
4. Is the EGR Delta P greater than 130 counts and the EGR temperature greater than 40° above the coolant temperature?
 - [a] If yes, replace the EGR valve. Refer to section 15.2.1.1.
 - [b] If no, go to step 5.
5. Turn the engine OFF.
6. Disconnect the EGR Delta P Sensor and inspect the EGR tubes for blockage.
 - [a] If the tubes are blocked, clean them. Refer to section 15.2.1.1.
 - [b] If the tubes are not blocked, replace the EGR Delta P Sensor. Refer to section 15.2.1.1

15.2.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF. Reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
 - [a] If no codes are present, troubleshooting is complete.
 - [b] If code 411/1 is not logged but other codes are logged, troubleshoot the other codes.
 - [c] If code 411/1 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313-592-5800).

15.3 SPN 411/FMI 3

This diagnosis is typically EGR Delta P Sensor open or short to power circuit.

15.3.1 Open Circuit Check

Check as follows:

1. Disconnect the EGR Delta P Sensor.
2. Measure the resistance across pins 1 and 3 of the EGR Delta P Sensor.
 - [a] If the resistance is greater than 130 k Ω , replace the EGR Delta P Sensor. Refer to section 15.3.1.1.
 - [b] If the resistance is less than 130 k Ω , go to step 3.
3. Measure the resistance between pins 1 and 2 of the EGR Delta P Sensor.
 - [a] If the resistance is greater than 130 k Ω , replace the EGR Delta P Sensor. Refer to section 15.3.1.1.
 - [b] If the resistance is less than 130 k Ω , go to step 4.
4. Turn the ignition ON (key ON, engine OFF).
5. Measure the voltage between pins 1 and 3 of the EGR Delta P Sensor harness connector.
 - [a] If the voltage is between 4.5 and 5.5 volts, go to step 7.
 - [b] If the voltage is less than 4.5 volts, go to step 6.
6. Measure the voltage between pin 1 of the EGR Delta P Sensor harness connector and ground.

- [a] If the voltage is between 4.5 and 5.5 volts, repair the open circuit between pin 3 of the EGR Delta P Sensor harness connector and pin 109 of the 120-pin MCM connector. See Figure 15-1. Refer to section 15.3.1.1.

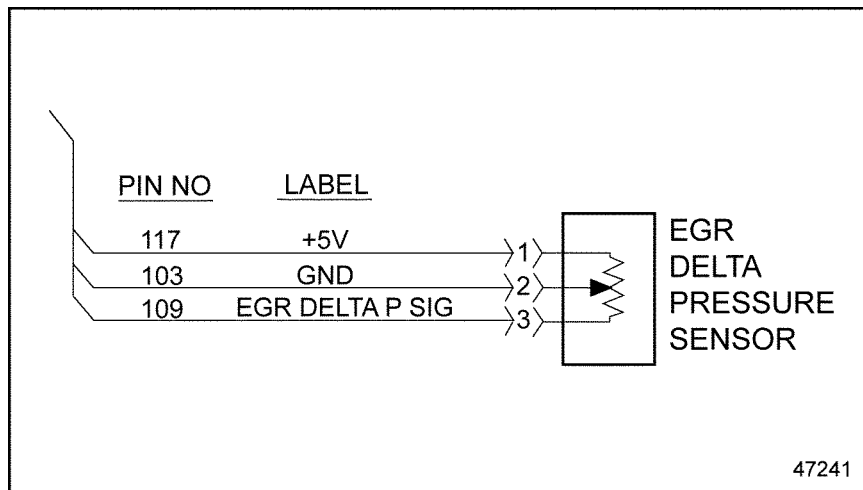


Figure 15-1 EGR Delta P Sensor

- [b] If the voltage is less than 4.5 volts, repair the open circuit between pin 1 of the EGR Delta P Sensor harness connector and pin 117 of the 120-pin MCM connector. Refer to section 15.3.1.1.
7. Turn the ignition OFF.
 8. Disconnect the 120-pin MCM connector.
 9. Measure the resistance between pins 1 and 3 of the EGR Delta P Sensor harness connector.
 - [a] If the resistance is less than 5 Ω , repair the short in wires between pins 1 and 3 of the EGR Delta P Sensor harness connector and pins 117 and 109 of the 120-pin MCM connector. Refer to section 15.4.1.1.
 - [b] If the resistance is greater than 5 Ω , go to step 10.
 10. Measure the resistance across pins 2 and 3 of the EGR Delta P Sensor harness connector.
 - [a] If the resistance is less than 5 Ω , repair the short in wires between pins 109 and 103 of the 120-pin MCM connector. Refer to section 15.4.1.1
 - [b] If the resistance is greater than 5 Ω , go to step 11.
 11. Measure the resistance between pin 1 of the EGR Delta P Sensor harness connector and ground.
 - [a] If the resistance is less than 5 Ω , repair the short circuit between pin 117 of the 120-pin MCM connector and ground. Refer to section 15.4.1.1.
 - [b] If the resistance is greater than 5 Ω , go to step 12.
 12. Measure the resistance between pin 3 of the EGR Delta P Sensor harness connector and ground..

- [a] If the resistance is less than 5 Ω , repair the short between pin 109 of the 120-pin MCM connector and ground. Refer to section 15.3.1.1.
- [b] If the resistance is greater than 5 Ω , repair the open circuit between pin 3 of the EGR Delta P Sensor harness connector and pin 109 of the 120-pin MCM connector. Refer to section 15.3.1.1.

15.3.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF. Reconnect all connectors.
2. Turn the ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
 - [a] If no codes are present, troubleshooting is complete.
 - [b] If code 411/3 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).

15.4 SPN 411/FMI 4

This diagnosis is typically EGR Delta P Sensor short to ground.

15.4.1 Short to Ground Check

Check as follows:

1. Disconnect the EGR Delta P Sensor.
2. Disconnect the 120-pin MCM connector.
3. Measure the resistance between pins 1 and 2 of the EGR Delta P Sensor.
 - [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 between pins 103 and 117 of the 120-pin MCM connector. Refer to section 15.4.1.1.
4. Measure the resistance between pins 2 and 3 of the EGR Delta P Sensor.
 - [a] If the resistance is greater than 5 Ω , go to step 5.

- [b] If the resistance is less than 5Ω , repair the short between pins 103 and 109 of the 120-pin MCM connector. See Figure 15-2. Refer to section 15.4.1.1.

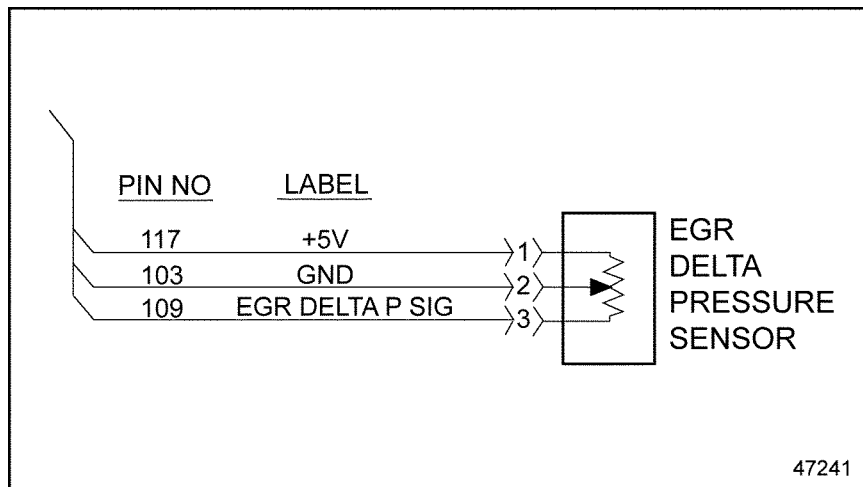


Figure 15-2 EGR Delta P Sensor

5. Measure the resistance between pin 1 of the EGR Delta P Sensor and ground.
 - [a] If the resistance is greater than 3Ω , go to step 6.
 - [b] If the resistance is less than 3Ω , repair the short circuit between pin 1 of the EGR Delta P Sensor harness connector and ground. Refer to section 15.4.1.1.
6. Measure the resistance between pin 3 of the EGR Delta P Sensor and ground.
 - [a] If the resistance is greater than 3Ω , repeat steps 3 through 6. If the results are the same, call the Detroit Diesel Customer Support Center (313-592-5800).
 - [b] If the resistance is less than 3Ω , repair the short circuit between pin 3 of the EGR Delta P Sensor harness connector and ground. Refer to section 15.4.1.1.

15.4.1.1 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).

16 SPN 412 - EGR TEMPERATURE IS OUTSIDE OF THE NORMAL RANGE

Section	Page
16.1 SPN 412/FMI 3	16-3
16.2 SPN 412/FMI 4	16-5

16.1 SPN 412/FMI 3

This diagnosis is typically EGR Temperature Sensor circuit failed high or open circuit.

16.1.1 Open Circuit Check

Check as follows:

1. Check for multiple codes.
 - [a] If codes 1636/3, 403/3 and 412/3 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 16.1.1.1.
 - [b] If only fault 412/3 is active, go to step 2.
2. Disconnect the EGR Temperature Sensor.
3. Measure the resistance across pins 1 and 2 of the EGR Temperature Sensor.
 - [a] If the resistance is greater than 4k Ω , replace the EGR Temperature Sensor. Refer to section 16.1.1.1.
 - [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 EGR Temperature 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 EGR Temperature 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 EGR Temperature Sensor harness connector and pin 52 of the 120-pin MCM connector. See Figure 16-1. Refer to section 16.1.1.1.

- [b] If the voltage is less than 2.75 volts, repair the open circuit between pin 2 of the EGR Temperature Sensor harness connector and pin 83 of the 120-pin MCM connector. See Figure 16-1. Refer to section 16.1.1.1.

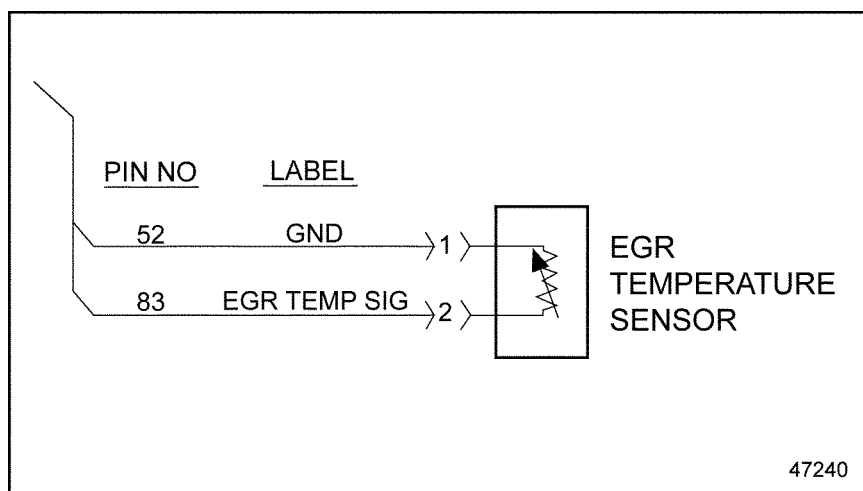


Figure 16-1 EGR Temperature Sensor

7. Disconnect the 120-pin MCM connector. Measure the resistance between pins 1 and 2 of the EGR Temperature Sensor harness connector.
 - [a] If the resistance is less than 5 Ω , repair the short between pins 52 and 83 of the 120-pin MCM connector. Refer to section 16.1.1.1.
 - [b] If the resistance is greater than 5 Ω , replace the EGR Out Temperature Sensor. Refer to section 16.1.1.1.

16.1.1.1 Verify Repairs

Verify repairs as follows:

1. 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 412/3 is not logged but other codes are logged, troubleshoot the other codes.
 - [c] If code 412/3 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313-592-5800).

16.2 SPN 412/FMI 4

This diagnosis is typically EGR Temperature Sensor circuit failed low or short circuit.

16.2.1 Short Circuit Check

Check for a short circuit as follows:

1. Disconnect the EGR Temperature Sensor.
2. Disconnect the 120-pin MCM connector.
3. Measure the resistance between pin 1 and 2 of the EGR Temperature Sensor connector.
 - [a] If the resistance is less than 5 Ω , repair the short between wires 52 and 83 of the 120-pin MCM connector. See Figure 16-2. Refer to section 16.2.1.1.

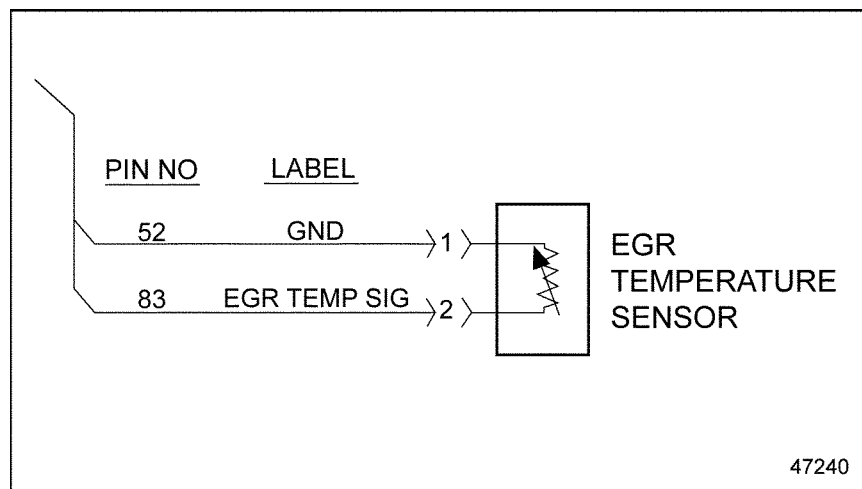


Figure 16-2 EGR Temperature Sensor

- [b] If the resistance is greater than 5 Ω , go to step 4.
4. Measure the resistance between pin 1 of the EGR Temperature Sensor and ground.
 - [a] If the resistance is less than 5 Ω , repair the short between pin 1 of the EGR Temperature Sensor and ground. Refer to section 16.2.1.1.
 - [b] If the resistance is greater than 5 Ω , go to step 5.
5. Measure the resistance between pin 2 of the EGR Temperature Sensor harness connector and ground.
 - [a] If the resistance is less than 3 Ω , repair the short circuit between pin 2 of the EGR Temperature Sensor harness connector and ground. Refer to section 16.2.1.1.
 - [b] If the resistance is greater than 5 Ω , repeat steps 3 through 5. If the results are the same, contact the Detroit Diesel Customer Support Center (313-5925044).

16.2.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF. Reconnect all connectors.
2. Turn the ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
 - [a] If no codes are present, troubleshooting is complete.
 - [b] If code 412/4 is not logged but other codes are logged, troubleshoot the other codes.
 - [c] If code 412/4 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313-592-5800).

17 SPN 558 - IDLE VALIDATION SWITCH

Section	Page
17.1 SPN 558/FMI 1	17-3
17.2 SPN 558/FMI 3	17-3
17.3 SPN 558/FMI 4	17-5

17.1 SPN 558/FMI 1

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

17.1.1 Check Idle Validation Switch Wiring

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).

17.2 SPN 558/FMI 3

This diagnostic condition is typically an open circuit.

17.2.1 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 17.2.1.1.
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 5 Ω , repair the open the wire between pin 2 of the CPC #2 connector and pin 6 of the Idle Validation Switch. Refer to section 17.2.1.1.
 - [b] If the resistance is less than 5 Ω , replace the Idle Validation Switch. Refer to section 17.2.1.1.

7. Measure the voltage between the Idle Validation Switch pins 5 and 6.
 - [a] If the voltage is greater than 11.5 volts, replace the Idle Validation Switch. Refer to section 17.2.1.1.
 - [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 17.2.1.1.

17.2.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF. Reconnect all connectors.
2. Turn the ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
 - [a] If no codes are present, troubleshooting is complete.
 - [b] If code 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).

17.3 SPN 558/FMI 4

This diagnostic condition is typically either a short to ground or an open wire.

17.3.1 Check for Short to Ground

Check for short to ground as follows:

1. Disconnect the Idle Validation Switch. See Figure 17-1.

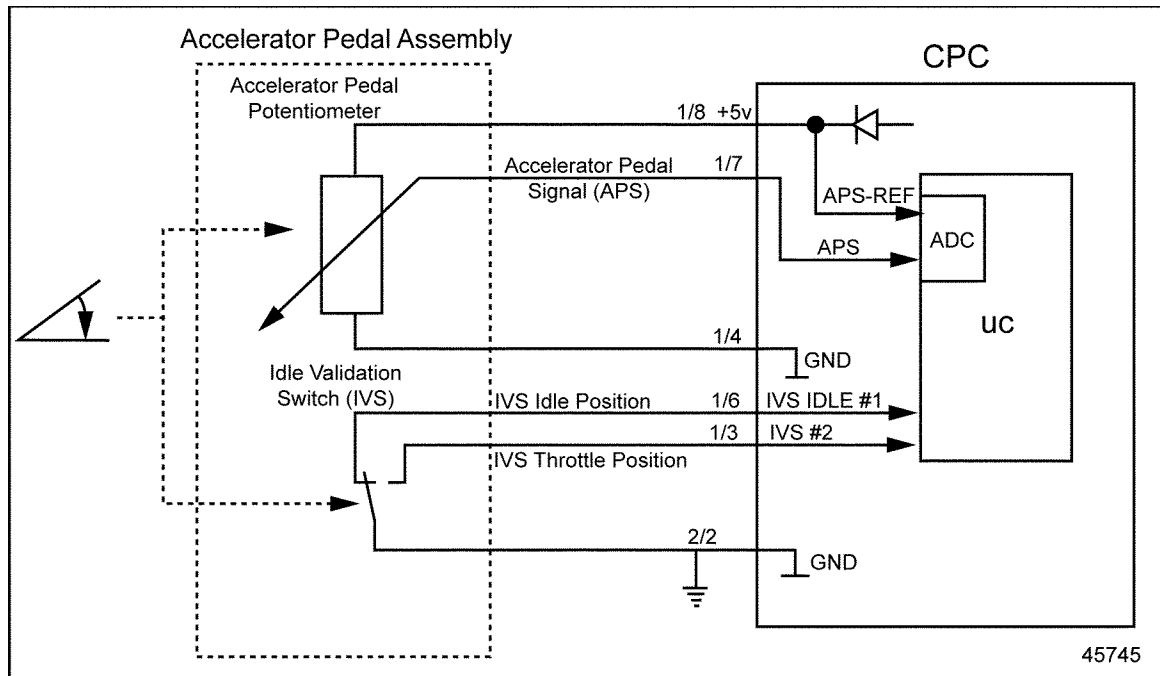


Figure 17-1 Idle Validation Switch, Part of the Accelerator Pedal Assembly

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 17.3.1.1.
 - [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 17.3.1.1.
 - [b] If the resistance is greater than 5 Ω , replace the Idle Validation Switch. Refer to section 17.3.1.1.

17.3.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF. Reconnect all connectors.
2. Turn the ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
 - [a] If no codes are present, troubleshooting is complete.
 - [b] If code 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).

18 SPN 599 - CRUISE CONTROL SWITCHES NOT FUNCTIONING PROPERLY

Section	Page
18.1 SPN 599/FMI 12	18-3

18.1 SPN 599/FMI 12

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

18.1.1 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 18.1.1.1.
 - [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 18.1.1.1.
4. Unplug the SET Cruise Control Switch.
 - [a] If SET status is no longer displayed, replace the Cruise Control SET Switch. Refer to section 18.1.1.1.
 - [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 18.1.1.1.

18.1.1.1 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.
 - [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).

19 SPN 601 - CRUISE CONTROL SWITCHES NOT FUNCTIONING PROPERLY

Section	Page
19.1 SPN 601/FMI 12	19-3

19.1 SPN 601/FMI 12

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

19.1.1 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 19.1.1.1.
 - [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 19.1.1.1.
4. Unplug the SET Cruise Control Switch.
 - [a] If SET status is no longer displayed, replace the Cruise Control SET Switch. Refer to section 19.1.1.1.
 - [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 19.1.1.1.

19.1.1.1 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.
 - [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).

20 SPN 609 - MCM FAULT (ERRONEOUS DATA)

Section	Page
20.1 SPN 609/FMI 12	20-3
20.2 SPN 609/FMI 14	20-4

20.1 SPN 609/FMI 12

This diagnostic condition is typically MCM failed or programmed incorrectly.

20.1.1 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.

20.2 SPN 609/FMI 14

This diagnostic condition is typically MCM incorrect or not programmed correctly.

20.2.1 MCM Check

Check 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.

21 SPN 625 - CAN FAULT

Section	Page
21.1 SPN 625/FMI 2,9,10,13,14	21-3
21.2 SPN 625/FMI 4	21-5

21.1 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.

21.1.1 Data Link Check

Check as follows:

1. Have the MCM and/or the CPC been recently changed or reprogrammed?
 - [a] If yes, verify 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 21.1.1.1.
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 21.1.1.1.
9. Check the resistance between pin 3 of the CPC #4 connector and ground.
 - [a] If the resistance is greater than 5 Ω , go to step 10.

- [b] If the resistance is less than 5 Ω , repair the short to ground between pin 3 of the CPC #4 connector and ground. Refer to section 21.1.1.1.
- 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 21.1.1.1.
 - [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 21.1.1.1.
 - [b] If the resistance is less than 5 Ω , call the DDC Customer Support Center (313-592-5800).

21.1.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF. Reconnect all connectors.
2. Turn the ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
 - [a] If no codes are present, troubleshooting is complete.
 - [b] If code 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).

21.2 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.

21.2.1 Short Circuit Check

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 21.2.1.1.
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 21.2.1.1.
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 21.2.1.1.
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 21.2.1.1.
 - [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 21.2.1.1.
 - [b] If the resistance is less than 5 Ω , call the DDC Customer Support Center (313-592-5800).

21.2.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF. Reconnect all connectors.
2. Turn the ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
 - [a] If no codes are present, troubleshooting is complete.
 - [b] If code 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).

22 SPN 636 — CRANKSHAFT POSITION SENSOR OUTSIDE OF NORMAL OPERATING CONDITIONS

Section	Page
22.1 SPN 636/FMI 1	22-3
22.2 SPN 636/FMI 3	22-4
22.3 SPN 636/FMI 4	22-6
22.4 SPN 636/FMI 7	22-7
22.5 SPN 636/FMI 8	22-9

22.1 SPN 636/FMI 1

The diagnostic condition is typically CKP Sensor Signal Voltage Too Low.

22.1.1 Low Signal Voltage Check

Check low signal voltage as follows:

1. If fault occurs only when cranking the engine (and engine will not start), check that the CKP and Camshaft Position (CMP) sensors are correctly wired to the MCM. See Figure 22-1.

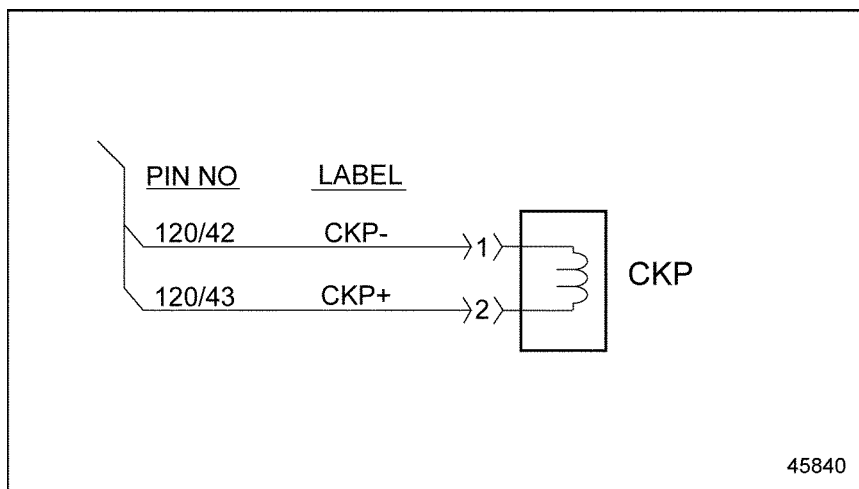


Figure 22-1 Crankshaft Position Sensor Wiring

- [a] If wires are not correctly wired, repair or replace wires as required. Refer to section 22.1.1.1.
- [b] If wires are correctly wired, go to step 2.
2. If fault occurs at other times than 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 22.1.1.1.
 - [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 22.1.1.1.
 - [b] If the flywheel is not out of position, go to step 4.
4. Check crankshaft axial play.

- [a] If axial play is not within specifications, repair or replace crankshaft thrust bearings, as required. Refer to section 22.1.1.1.
- [b] If axial play is within specifications, replace the MCM. Refer to section 22.1.1.1.

22.1.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF. Reconnect all connectors.
2. Turn ignition ON. Clear codes with diagnostic tool.
3. Start and run the engine for one minute. Stop engine.
4. 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).

22.2 SPN 636/FMI 3

The diagnostic condition is typically CKP Sensor has an open circuit.

22.2.1 Open Circuit Check

Check for a CKP Sensor open circuit as follows:

1. Disconnect the CKP Sensor.
2. Measure the resistance across pins 1 and 2 of the CKP Sensor. See Figure 22-2.
 - [a] If the resistance is greater than 140 Ω , replace CKP Sensor. Refer to section 22.2.2.1.
 - [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. See Figure 22-2. Refer to section 22.2.2.1.

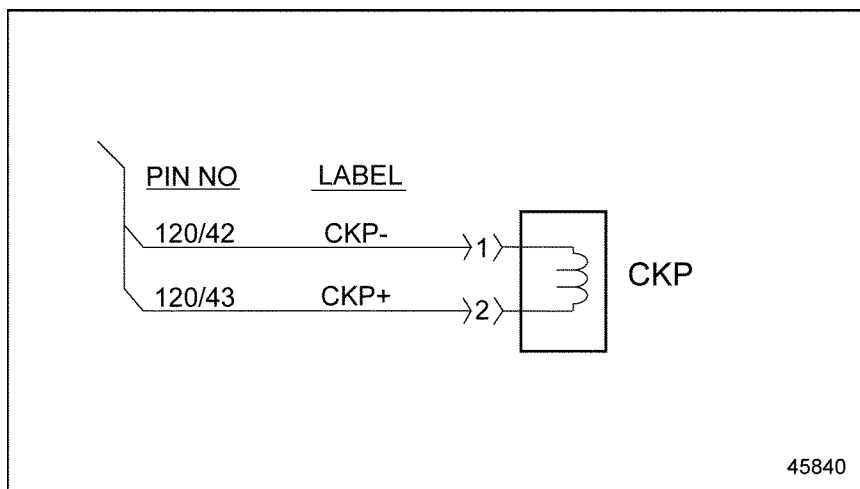


Figure 22-2 Crankshaft Position Sensor Wiring

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 22.2.2.1.
 - [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 22.2.2.1.
 - [b] If the resistance is less than 5 Ω , refer to section 22.2.2.

22.2.2 Crankshaft Position Sensor Gap Check

Check 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 22.2.2.1. If the problem returns, the pulse wheel may be loose or bad or damaged.

22.2.2.1 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 engine.
4. 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).

22.3 SPN 636/FMI 4

This diagnostic condition is typically the CKP Sensor shorted to ground.

22.3.1 Short to Ground Check

Troubleshoot 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 22.3.1.1.
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 22.3.1.1.
4. Disconnect the 120-pin MCM connector.
5. Measure the resistance across pins 1 and 2 of the CKP Sensor harness connector.
 - [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 22.3.1.1.
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 22.3.1.1.
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 22.3.1.1.

22.3.1.1 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 engine.
4. 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).

22.4 SPN 636/FMI 7

This diagnostic condition is typically camshaft and crankshaft signals not matching.

22.4.1 Camshaft and Crankshaft Signals Not Matching

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 22.4.1.1.
 - [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 22.4.1.1.
 - [b] If 636/7 is active, go to step 6.
6. Disconnect the CKP Sensor connector and measure the sensor resistance.
 - [a] If the sensor resistance is not between 1000 Ω and 1385 Ω , replace the sensor. refer to section 22.4.1.1.
 - [b] If the sensor resistance is between 1000 Ω and 1385 Ω , go to step 7.
7. Verify that all flywheel holes or slots are present by viewing through the access hole on the flywheel housing.
 - [a] If the flywheel holes or slots are missing or damaged, replace the flywheel as needed. refer to section 22.4.1.1.
 - [b] If the flywheel holes or slots are all present, go to step 8.
8. Replace the MCM. Refer to section 22.4.1.1.

22.4.1.1 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 engine.
4. 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).

22.5 SPN 636/FMI 8

The diagnostic condition is typically CKP Sensor Time Out.

22.5.1 Sensor Time Out Check

Check for a sensor time out as follows:

1. Check for multiple codes.
 - [a] If fault s 636/3 is active in addition to fault 636/8 with the engine running, refer to section 22.2.1.
 - [b] If fault s 636/4 is active in addition to fault s 636/8 with the engine running, refer to section 22.3.1.
 - [c] If only fault s 636/8 is active with the engine running, go to step 2.
2. Check the CKP Sensor position.
 - [a] If fault 636/8 is not active after checking position, replace CKP Sensor clamping sleeve. Refer to section 22.5.1.1.
 - [b] If fault 636/8 is active after checking position, go to step 3.
3. Replace the Vehicle Speed Sensor.
 - [a] If fault s 636/8 is not active, refer to section 22.5.1.1.
 - [b] If fault s 636/8 is still active, go to step 4.
4. 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 22-3.

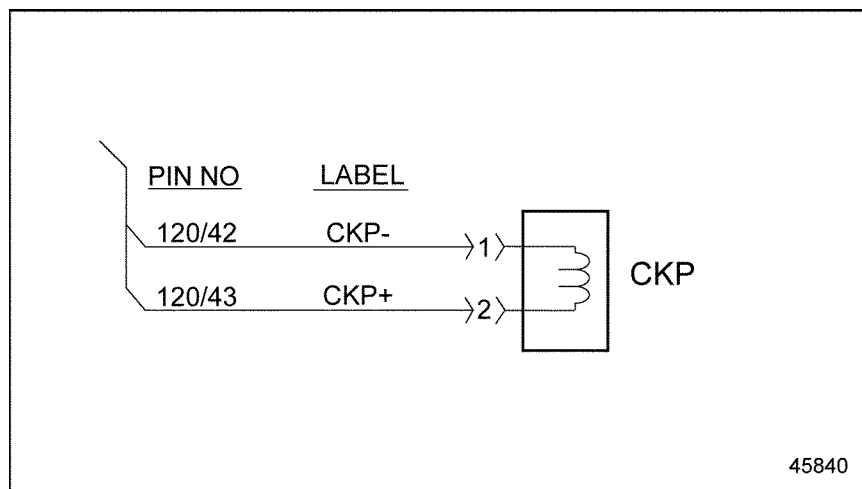


Figure 22-3 Crankshaft Position Sensor

- [b] If sensors are not out of position, go to step 5.
- 5. Check crankshaft axial play.
 - [a] If axial play is not within specifications, repair or replace crankshaft thrust bearings, as required. Refer to section 22.5.1.1.
 - [b] If axial play is within specifications, contact the Detroit Diesel Customer Support Center (313-592-5800).

22.5.1.1 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 engine.
4. 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).

23 SPN 651 – INJECTOR #1 NEEDLE VALVE NOT OPERATING NORMALLY

Section	Page
23.1 SPN 651/FMI 5	23-3
23.2 SPN 651/FMI 10	23-6

23.1 SPN 651/FMI 5

This diagnosis is typically the injector needle valve current is below normal or an open circuit fault.

23.1.1 Open Circuits with the Ignition OFF 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 12.2.
 - [b] If fault 652/5 and 653/5 are active in addition to 651/5 repair the open circuit in the harness between pin 23, 25, and 27 of the 120-pin MCM connector and terminal and pin 1 of the injector #1 connector. Refer to section 23.1.3.1.
 - [c] If only fault code 651/5 is active, go to step 2.
2. Turn the vehicle ignition switch OFF.
3. Disconnect the Injector Harness 23-pin connector.
4. Measure the resistance between pin D and pin F on the valve cover side of the connector.
 - [a] If the resistance is less than 3 Ω , refer to section 23.1.2.
 - [b] If the resistance is greater than 3 Ω , go to step 5.
5. Remove valve cover.
6. Disconnect injector #1 connector.
7. Measure the resistance between pin 1 of the injector connector and pin F of the injector harness 23-pin connector.
 - [a] If the resistance is greater than 3 Ω , repair the open between pin 1 of the injector connector and pin F of the injector harness 23-pin connector. Refer to section 23.1.3.1.
 - [b] If the resistance is less than 3 Ω , go to step 8.
8. Measure the resistance between pin 2 of the injector connector and pin D of the injector harness 23-pin connector.
 - [a] If the resistance is greater than 3 Ω , repair the open between pin 2 of the injector connector and pin D of the injector harness 23-pin connector. Refer to section 23.1.3.1.
 - [b] If the resistance is less than 3 Ω , refer to section 23.1.2.

23.1.2 Open Circuit with the Ignition ON Check

Check as follows:

1. Turn the ignition ON (key ON, engine OFF).
2. Measure the voltage between pin D and F on the engine side of the 23-pin connector.
 - [a] If the voltage is less than 11.5 volts, repair the open between pin D of the 23-pin connector and pin 26 of the MCM 120-pin connector (see Figure 23-1). Refer to section 23.1.3.1.

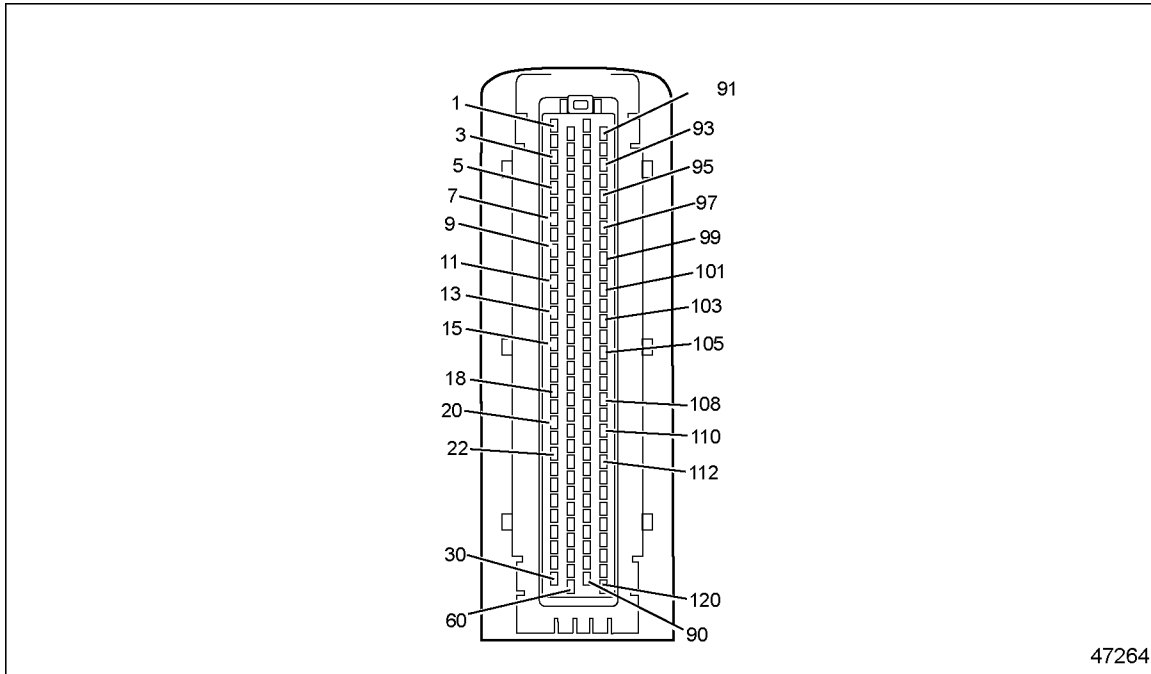


Figure 23-1 120-pin MCM Connector

- [b] If the voltage is between 11.5 and 13.5 volts, refer to section 23.1.3.
3. Swap the injector
 - [a] If fault code 651/5 is not active after swapping the injector, replace the original injector. Refer to section 23.1.3.1.
 - [b] If fault code 651/5 is still active after swapping the injector, call the Detroit Diesel Customer Service Center (313-592-5800).

23.1.3 Injector Check

Check as follows:

1. Check the resistance on pin 1 and pin 2 of injector #1.
 - [a] If the resistance is greater than 25 k Ω , replace the injector. Refer to section 23.1.3.1.
 - [b] If the resistance is less than 25 k Ω , go to step 2.
2. Swap the injectors
 - [a] If fault code 651/5 is not active after swapping injectors, replace the original injector. Refer to section 23.1.3.1.
 - [b] If fault code 651/5 is still active after swapping injectors, contact Detroit Diesel Customer Support Center (313-592-5044).

23.1.3.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF and reconnect all connectors.
2. Turn the ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
 - [a] If no codes are present, troubleshooting is complete.
 - [b] If code 651/5 is not logged but other codes are logged, troubleshoot the other codes.
 - [c] If code 651/5 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313-592-5800).

23.2 SPN 651/FMI 10

This diagnostic condition is typically a short to ground.

23.2.1 Short to Ground Check

Check as follows:

1. Turn the ignition OFF.
2. Disconnect the Injector Harness 23-pin connector.
3. Measure the resistance between pin D and ground on the valve cover side of the connector.
 - [a] If the resistance is less than 5 Ω , repair the short to ground between Pin D and pin 2 of the injector. Refer to section 23.2.1.1.
 - [b] If the resistance is greater than 5 Ω , go to step 6.
4. Disconnect the MCM 120-pin connector.
5. Measure the resistance between pin D and ground on the engine side of the connector.
 - [a] If the resistance is less than 5 Ω , repair the short to ground between Pin D and pin 26 of the MCM 120-pin connector. Refer to section 23.2.1.1.
 - [b] If the resistance is greater than 5 Ω , go to step 6.
6. Recheck the resistance using steps 3 through 5. When you have just completed the recheck, go to step 7.
7. 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. Refer to section 23.2.1.1.

23.2.1.1 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).

24 SPN 652 – INJECTOR #2 NEEDLE VALVE NOT OPERATING NORMALLY

Section	Page
24.1 SPN 652/FMI 5	24-3
24.2 SPN 652/FMI 10	24-6

24.1 SPN 652/FMI 5

This diagnosis is typically the injector current is below normal or an open circuit fault.

24.1.1 Open Circuits with the Ignition OFF 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 12.2.
 - [b] If fault 651/5 and 653/5 are active in addition to 652/5, repair the open circuit in the harness between pin 23, 25, and 27 of the 120-pin MCM connector and terminal and pin 1 of injectors #1, #2, and #3 connector. Refer to section 24.1.3.1.
 - [c] If only fault code 652/5 is active, go to step 2.
2. Turn the ignition OFF.
3. Disconnect the Injector Harness 23-pin connector.
4. Measure the resistance between pin G and pin F on the valve cover side of the connector.
 - [a] If the resistance is less than 3 Ω , refer to section 24.1.2.
 - [b] If the resistance is greater than 3 Ω , go to step 5.
5. Remove valve cover.
6. Disconnect injector #2 connector.
7. Measure the resistance between pin 1 of the injector connector and pin F of the injector harness 23-pin connector.
 - [a] If the resistance is greater than 3 Ω , repair the open between pin 1 of the injector connector and pin F of the injector harness 23-pin connector. Refer to section 24.1.3.1.
 - [b] If the resistance is less than 3 Ω , go to step 8.
8. Measure the resistance between pin 2 of the injector connector and pin G of the injector harness 23-pin connector.
 - [a] If the resistance is greater than 3 Ω , repair the open between pin 2 of the injector connector and pin G of the injector harness 23-pin connector. Refer to section 24.1.3.1.
 - [b] If the resistance is less than 3 Ω , refer to section 24.1.3.

24.1.2 Open Circuits with the Ignition ON Check

Check as follows:

1. Turn the ignition ON (key ON, engine OFF).
2. Measure the voltage between pin G and F on the engine side of the 23-pin connector.
 - [a] If the voltage is less than 11.5 volts, repair the open between pin G of the 23-pin connector and pin 22 of the MCM 120-pin connector (see Figure 24-1). Refer to section 24.1.3.1.

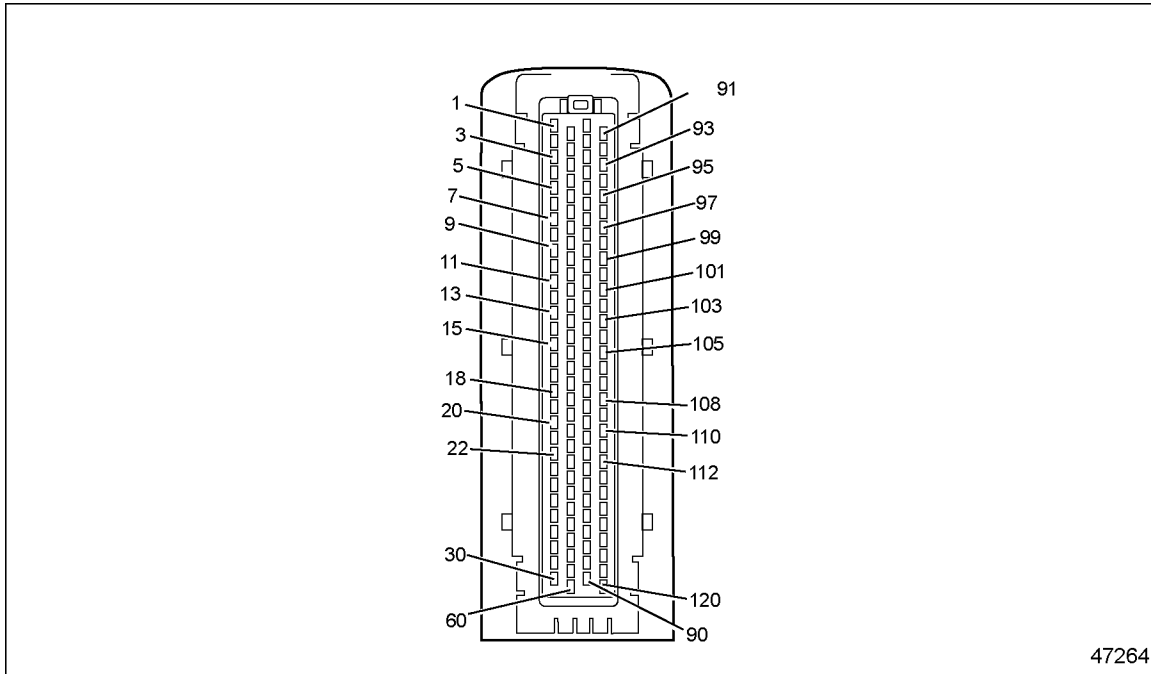


Figure 24-1 120-pin MCM Connector

- [b] If the voltage is between 11.5 and 13.5 volts, go to step 3.
3. Swap the injector.
 - [a] If fault code 652/5 is not active after swapping the injector, replace the original injector. Refer to section 24.1.3.1.
 - [b] If fault code 652/5 is still active after swapping the injector, call the Detroit Diesel Customer Service Center (313-592-5800).

24.1.3 Injector Check

Check as follows:

1. Check the resistance on pin 1 and pin 2 of injector #2.
 - [a] If the resistance is greater than 25 k Ω , replace the injector. Refer to section 24.1.3.1.
 - [b] If the resistance is less than 25 k Ω , go to step 2.
2. Swap the injectors
 - [a] If fault code 652/5 is not active after swapping injectors, replace the original injector. Refer to section 24.1.3.1.
 - [b] If fault code 652/5 is still active after swapping injectors, contact Detroit Diesel Customer Support Center (313-592-5044).

24.1.3.1 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 652/5 is not logged but other codes are logged, troubleshoot the other codes.
 - [c] If code 652/5 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313-592-5800).

24.2 SPN 652/FMI 10

This diagnostic condition is typically a short to ground.

24.2.1 Short to Ground Check

Check as follows:

1. Put the ignition switch in the OFF position.
2. Disconnect the Injector Harness 23-pin connector.
3. Measure the resistance between pin G and ground on the valve cover side of the connector.
 - [a] If the resistance is less than 5 Ω , repair the short to ground between Pin G and pin 2 of the injector. Refer to section 24.2.1.1.
 - [b] If the resistance is greater than 5 Ω , go to step 4.
4. Disconnect the MCM 120-pin connector.
5. Measure the resistance between pin G and ground on the engine side of the connector.
 - [a] If the resistance is less than 5 Ω , repair the short to ground between Pin G and pin 22 of the MCM 120-pin connector. Refer to section 24.2.1.1.
 - [b] If the resistance is greater than 5 Ω , go to step 6.
6. Recheck the resistance using steps 3 through 5. When you have completed the recheck, go to step 7.
7. 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. Refer to section 24.2.1.1.

24.2.1.1 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).

25 SPN 653 – INJECTOR #3 NEEDLE VALVE NOT OPERATING NORMALLY

Section	Page
25.1 SPN 653/FMI 5	25-3
25.2 SPN 653/FMI 10	25-6

25.1 SPN 653/FMI 5

This diagnosis is typically the injector current is below normal or an open circuit fault.

25.1.1 Open Circuits with the Ignition OFF 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 12.2.
 - [b] If fault 651/5 and 652/5 are active in addition to 653/5, repair the open circuit in the harness between pin 23, 25, and 27 of the 120-pin MCM connector and terminal and pin 1 of injectors #1, #2, and #3 connector. Refer to section 25.1.2.
 - [c] If only fault code 653/5 is active, go to step 2.
2. Turn the ignition OFF.
3. Disconnect the Injector Harness 23-pin connector.
4. Measure the resistance between pin D and pin E on the valve cover side of the connector.
 - [a] If the resistance is less than 3 Ω , refer to section 25.1.2.
 - [b] If the resistance is greater than 3 Ω , go to step 5.
5. Remove valve cover.
6. Disconnect injector #3 connector.
7. Measure the resistance between pin 1 of the injector connector and pin F of the injector harness 23-pin connector.
 - [a] If the resistance is greater than 3 Ω , repair the open between pin 1 of the injector connector and pin F of the injector harness 23-pin connector. Refer to section 25.1.3.1.
 - [b] If the resistance is less than 3 Ω , go to step 8.
8. Measure the resistance between pin 2 of the injector connector and pin E of the injector harness 23-pin connector.
 - [a] If the resistance is greater than 3 Ω , repair the open between pin 2 of the injector connector and pin E of the injector harness 23-pin connector. Refer to section 25.1.3.1.
 - [b] If the resistance is less than 3 Ω , refer to section 25.1.3.

25.1.2 Open Circuit with the Ignition ON Check

Check as follows:

1. Turn the ignition switch ON (key ON, engine OFF).
2. Measure the voltage between pin E and F on the engine side of the 23-pin connector.
 - [a] If the voltage is less than 11.5 volts, repair the open between pin E of the 23-pin connector and pin 24 of the MCM 120-pin connector (see Figure 25-1). Refer to section 25.1.3.1.

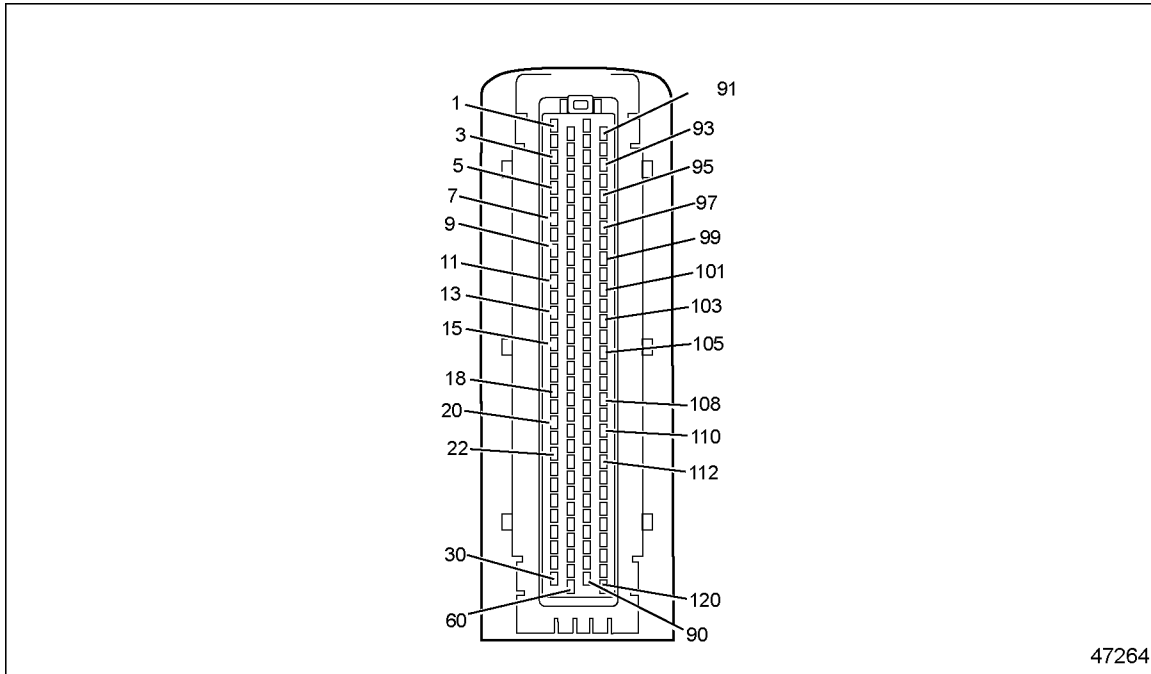


Figure 25-1 120-pin MCM Connector

- [b] If the voltage is between 11.5 and 13.5 volts, go to step 3.
3. Swap the injector.
 - [a] If fault code 653/5 is not active after swapping the injector, replace the original injector. Refer to section 25.1.3.1.
 - [b] If fault code 653/5 is still active after swapping the injector, call the Detroit Diesel Customer Service Center (313-592-5800).

25.1.3 Injector Check

Check as follows:

1. Check the resistance on pin 1 and pin 2 of injector #3.
 - [a] If the resistance is greater than 25 k Ω , replace the injector. Refer to section 25.1.3.1.
 - [b] If the resistance is less than 25 k Ω , go to step 2.
2. Swap the injectors
 - [a] If fault code 653/5 is not active after swapping injectors, replace the original injector. Refer to section 25.1.3.1.
 - [b] If fault code 653/5 is still active after swapping injectors, contact Detroit Diesel Customer Support Center (313-592-5044).

25.1.3.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF and reconnect all connectors.
2. Turn the ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
 - [a] If no codes are present, troubleshooting is complete.
 - [b] If code 653/5 is not logged but other codes are logged, troubleshoot the other codes.
 - [c] If code 653/5 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313-592-5800).

25.2 SPN 653/FMI 10

This diagnostic condition is typically a short to ground.

25.2.1 Short to Ground Check

Check as follows:

1. Put the switch in the OFF position.
2. Disconnect the Injector Harness 23-pin connector.
3. Measure the resistance between pin E and ground on the valve cover side of the connector.
 - [a] If the resistance is less than 5 Ω , repair the short to ground between Pin E and pin 2 of the injector. Refer to section 25.2.1.1.
 - [b] If the resistance is greater than 5 Ω , go to step 4.
4. Disconnect the MCM 120-pin connector.
5. Measure the resistance between pin E and ground on the engine side of the connector.
 - [a] If the resistance is less than 5 Ω , repair the short to ground between Pin E and pin 24 of the MCM 120-pin connector. Refer to section 25.2.1.1.
 - [b] If the resistance is greater than 5 Ω , go to step 6.
6. Recheck the resistance using steps 3 through 5. When you have just completed the recheck, go to step 7.
7. 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. Refer to section 25.2.1.1.

25.2.1.1 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).

26 SPN 654 – INJECTOR #4 NEEDLE VALVE NOT OPERATING NORMALLY

Section	Page
26.1 SPN 654/FMI 5	26-3
26.2 SPN 654/FMI 10	26-6

26.1 SPN 654/FMI 5

This diagnosis is typically the injector current is below normal or an open circuit fault.

26.1.1 Open Circuits with the Ignition OFF 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 12.2.
 - [b] If fault codes 655/5 and 656/5 are active in addition to 654/5, repair the open circuit in the harness between pin 17, 19, 21 of the 120-pin MCM connector and terminal and pin 1 of injectors #4, #5, and #6 connector.
 - [c] If only fault code 654/5 is active, go to step 2.
2. Turn the ignition switch OFF.
3. Disconnect the Injector Harness 23-pin connector.
4. Measure the resistance between pin L and pin K on the valve cover side of the connector.
 - [a] If the resistance is less than 3 Ω , refer to section 26.1.2.
 - [b] If the resistance is greater than 3 Ω , go to step 5.
5. Remove valve cover.
6. Disconnect injector #4 connector.
7. Measure the resistance between pin 1 of the injector connector and pin K of the injector harness 23-pin connector.
 - [a] If the resistance is greater than 3 Ω , repair the open between pin 1 of the injector connector and pin K of the injector harness 23-pin connector. Refer to section 26.1.3.1.
 - [b] If the resistance is less than 3 Ω , go to step 8.
8. Measure the resistance between pin 2 of the injector connector and pin L of the injector harness 23-pin connector.
 - [a] If the resistance is greater than 3 Ω , repair the open between pin 2 of the injector connector and pin L of the injector harness 23-pin connector. Refer to section 26.1.3.1.
 - [b] If the resistance is less than 3 Ω , refer to section 26.1.3.

26.1.2 Open Circuit with the Ignition ON Check

Check as follows:

1. Turn the ignition ON (key ON, engine OFF).
2. Measure the voltage between pin K and L on the engine side of the 23-pin connector.
 - [a] If the voltage is less than 11.5 volts, repair the open between pin K of the 23-pin connector and pin 16 of the MCM 120-pin connector (see Figure 26-1). Refer to section 26.1.3.1.

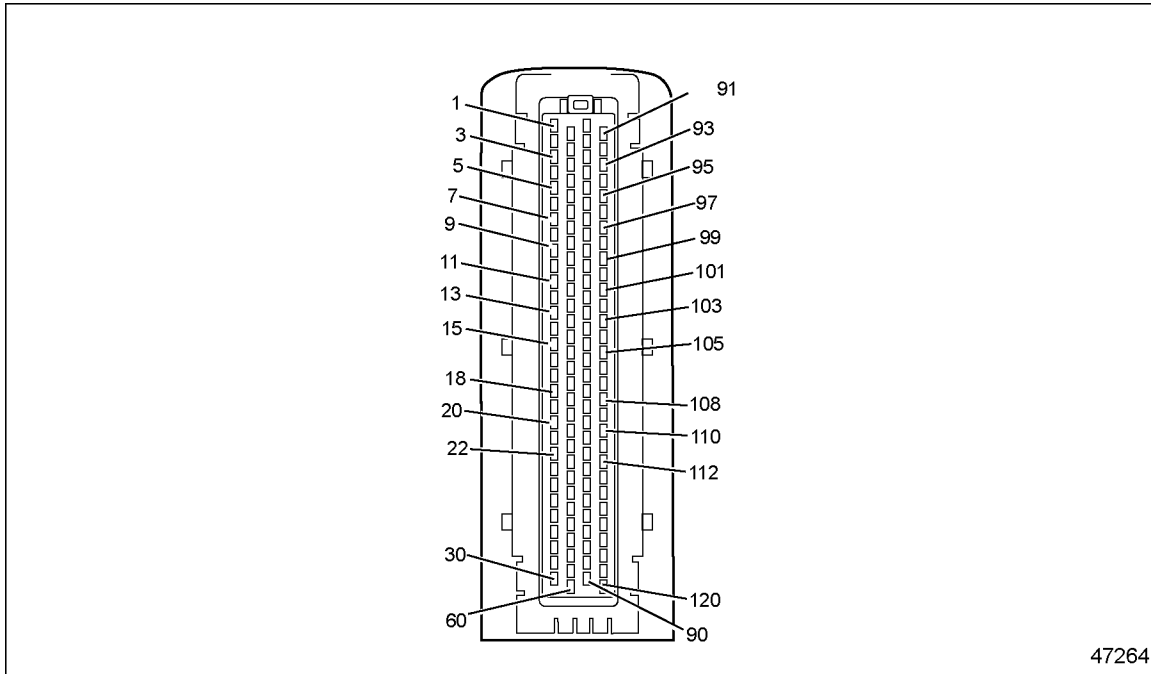


Figure 26-1 120-pin MCM Connector

- [b] If the voltage is between 11.5 and 13.5 volts, go to step 3.
3. Swap the injector
 - [a] If fault code 654/5 is not active after swapping the injector, replace the original injector. Refer to section 26.1.3.1.
 - [b] If fault code 654/5 is still active after swapping the injector, call the Detroit Diesel Customer Service Center (313-592-5800).

26.1.3 Injector Check

Check as follows:

1. Check the resistance on pin 1 and pin 2 of injector #4.
 - [a] If the resistance is greater than 25 k Ω , replace the injector. Refer to section 26.1.3.1.
 - [b] If the resistance is less than 25 k Ω , go to step 2.
2. Swap the injectors
 - [a] If fault code 654/5 is not active after swapping injectors, replace the original injector. Refer to section 26.1.3.1.
 - [b] If fault code 654/5 is still active after swapping injectors, contact Detroit Diesel Customer Support Center (313-592-5044).

26.1.3.1 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 654/5 is not logged but other codes are logged, troubleshoot the other codes.
 - [c] If code 654/5 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313-592-5800).

26.2 SPN 654/FMI 10

This diagnostic condition is typically a short to ground.

26.2.1 Short to Ground Check

Check as follows:

1. Put the ignition switch in the OFF position.
2. Disconnect the Injector Harness 23-pin connector.
3. Measure the resistance between pin L and ground on the valve cover side of the connector.
 - [a] If the resistance is less than 5 Ω , repair the short to ground between Pin L and pin 2 of the injector. Refer to section 26.2.1.1.
 - [b] If the resistance is greater than 5 Ω , go to step 4.
4. Disconnect the MCM 120-pin connector.
5. Measure the resistance between pin L and ground on the engine side of the connector.
 - [a] If the resistance is less than 5 Ω , repair the short to ground between Pin L and pin 16 of the MCM 120-pin connector. Refer to section 26.2.1.1.
 - [b] If the resistance is greater than 5 Ω , go to step 6.
6. Recheck the resistance using steps 3 through 5. When you have just completed the recheck, go to step 7.
7. 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. Refer to section 26.2.1.1.

26.2.1.1 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 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).

27 SPN 655 – INJECTOR #5 NEEDLE VALVE NOT OPERATING NORMALLY

Section	Page
27.1 SPN 655/FMI 5	27-3
27.2 SPN 655/FMI 10	27-6

27.1 SPN 655/FMI 5

This diagnosis is typically the injector current is below normal or an open circuit fault.

27.1.1 Open Circuits with the Ignition OFF 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 12.2.
 - [b] If fault codes 654/5 and 656/5 are active in addition to 655/5, repair the open circuit in the harness between pin 17, 19, 21 of the 120-pin MCM connector and terminal and pin 1 of injectors #4, #5, and #6 connector. Refer to section 27.1.3.1.
 - [c] If only fault code 655/5 is active, go to step 2.
2. Turn the vehicle ignition switch OFF.
3. Disconnect the Injector Harness 23-pin connector.
4. Measure the resistance between pin H and pin K on the valve cover side of the connector.
 - [a] If the resistance is less than 3 Ω , go to step 4.
 - [b] If the resistance is greater than 3 Ω , go to step 8.
5. Remove valve cover.
6. Disconnect injector #5 connector.
7. Measure the resistance between pin 1 of the injector connector and pin K of the injector harness 23-pin connector.
 - [a] If the resistance is greater than 3 Ω , repair the open between pin 1 of the injector connector and pin F of the injector harness 23-pin connector. Refer to section 27.1.3.1
 - [b] If the resistance is less than 3 Ω , go to step 8.
8. Measure the resistance between pin 2 of the injector connector and pin H of the injector harness 23-pin connector.
 - [a] If the resistance is greater than 3 Ω , repair the open between pin 2 of the injector connector and pin H of the injector harness 23-pin connector. Refer to section 27.1.3.1.
 - [b] If the resistance is less than 3 Ω , go to step 7.

27.1.2 Open Circuit with the Ignition ON Check

Check for an open circuit with the ignition ON as follows:

1. Turn the ignition ON.
2. Measure the voltage between pin H and K on the engine side of the 23-pin connector.
 - [a] If the voltage is less than 11.5 volts, repair the open between pin D of the 23-pin connector and pin 20 of the MCM 120-pin connector (see Figure 27-1). Refer to section 27.1.3.1.

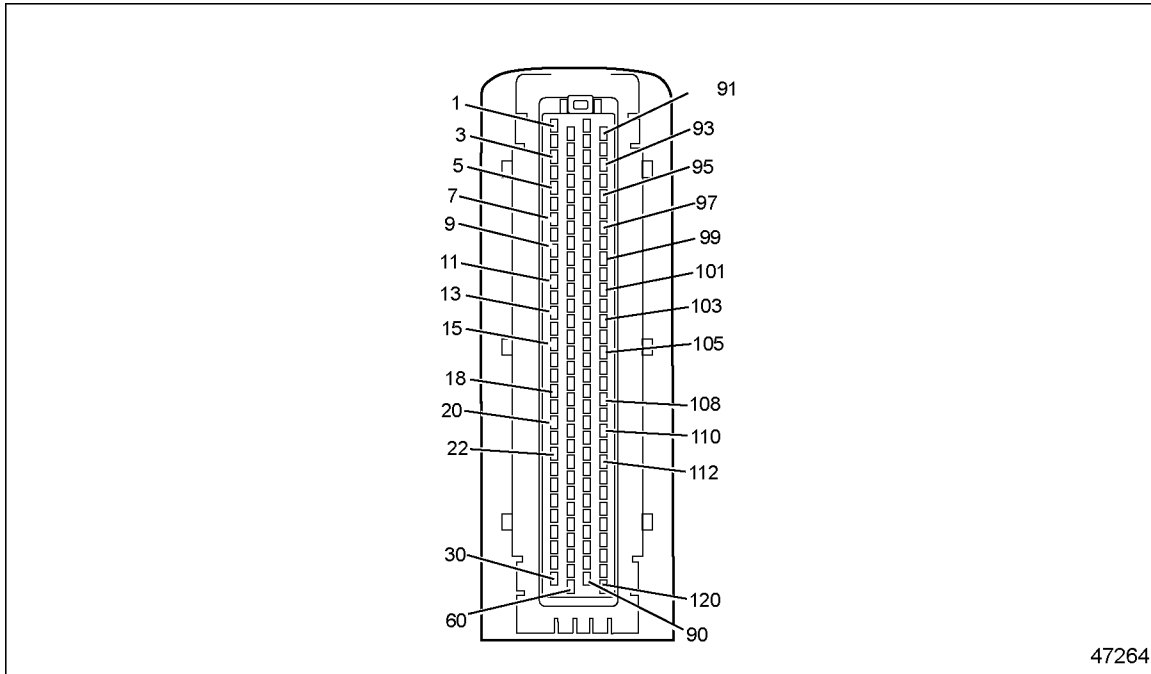


Figure 27-1 120-pin MCM Connector

- [b] If the voltage is between 11.5 and 13.5 volts, refer to section 27.1.3.
3. Swap the injector.
 - [a] If fault code 655/5 is not active after swapping the injector, replace the original injector. Refer to section 27.1.3.1.
 - [b] If fault code 655/5 is still active after swapping the injector, call the Detroit Diesel Customer Service Center (313-592-5800).

27.1.3 Injector Check

Check as follows:

1. Check the resistance on pin 1 and pin 2 of injector #5.
 - [a] If the resistance is greater than 25k Ω , replace the injector. Refer to section 27.1.3.1.
 - [b] If the resistance is less than 25k Ω , go to step 1.
2. Swap the injectors
 - [a] If fault code 655/5 is not active after swapping injectors, replace the original injector. Refer to section 27.1.3.1.
 - [b] If fault code 655/5 is still active after swapping injectors, contact Detroit Diesel Customer Support Center (313-592-5044).

27.1.3.1 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 655/5 is not logged but other codes are logged, troubleshoot the other codes.
 - [c] If code 655/5 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313-592-5800).

27.2 SPN 655/FMI 10

This diagnostic condition is typically a short to ground.

27.2.1 Short to Ground Check

Check as follows:

1. Put the ignition switch in the OFF position.
2. Disconnect the Injector Harness 23-pin connector.
3. Measure the resistance between pin H and ground on the valve cover side of the connector.
 - [a] If the resistance is less than 5 Ω , repair the short to ground between Pin H and pin 2 of the injector. Refer to section 27.2.1.1.
 - [b] If the resistance is greater than 5 Ω , go to step 4.
4. Measure the resistance between pin Q and ground on the valve cover side of the connector.
 - [a] If the resistance is less than 5 Ω , repair the short to ground between pin Q and pin 3 of the injector. Refer to section 27.2.1.1.
 - [b] If the resistance is greater than 5 Ω , go to step 5.
5. Disconnect the MCM 120-pin connector.
6. Measure the resistance between pin H and ground on the engine side of the connector.
 - [a] If the resistance is less than 5 Ω , repair the short to ground between Pin H and pin 20 of the MCM 120-pin connector. Refer to section 27.2.1.1.
 - [b] If the resistance is greater than 5 Ω , go to step 7.
7. Recheck the resistance using steps 3 through 6. When you have just completed the recheck, go to step 8.
8. 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.

27.2.1.1 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 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).

28 SPN 656 – INJECTOR #6 NEEDLE VALVE NOT OPERATING NORMALLY

Section	Page
28.1 SPN 656/FMI 5	28-3
28.2 SPN 656/FMI 10	28-6

28.1 SPN 656/FMI 5

This diagnosis is typically the injector current is below normal or an open circuit fault.

28.1.1 Open Circuits with the Ignition OFF 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 12.2.
 - [b] If fault codes 654/5 and 655/5 are active in addition to 656/5, repair the open circuit in the harness between pin 17, 19, 21 of the 120-pin MCM connector and terminal and pin 1 of injectors #4, #5, and #6 connector. Refer to section 28.1.3.1.
 - [c] If only fault code 656/5 is active, go to step 2.
2. Turn the vehicle ignition switch OFF.
3. Disconnect the Injector Harness 23-pin connector.
4. Measure the resistance between pin J and pin K on the valve cover side of the connector.
 - [a] If the resistance is less than 3 Ω , refer to section 28.1.2.
 - [b] If the resistance is greater than 3 Ω , go to step 5.
5. Remove the valve cover.
6. Disconnect injector #6 connector.
7. Measure the resistance between pin 1 of the injector connector and pin K of the injector harness 23-pin connector.
 - [a] If the resistance is greater than 3 Ω , repair the open between pin 1 of the injector connector and pin K of the injector harness 23-pin connector. Refer to section 28.1.3.1.
 - [b] If the resistance is less than 3 Ω , go to step 8.
8. Measure the resistance between pin 2 of the injector connector and pin J of the injector harness 23-pin connector.
 - [a] If the resistance is greater than 3 Ω , repair the open between pin 2 of the injector connector and pin J of the injector harness 23-pin connector. Refer to section 28.1.3.1.
 - [b] If the resistance is less than 3 Ω , refer to section 28.1.3.

28.1.2 Open Circuit with the Ignition ON Check

Check as follows:

1. Turn the ignition ON (key ON, engine OFF).
2. Measure the voltage between pin J and K on the engine side of the 23-pin connector.
 - [a] If the voltage is less than 11.5 volts, repair the open between pin J of the 23-pin connector and pin 18 of the MCM 120-pin connector (see Figure 28-1). Refer to section 28.1.3.1.

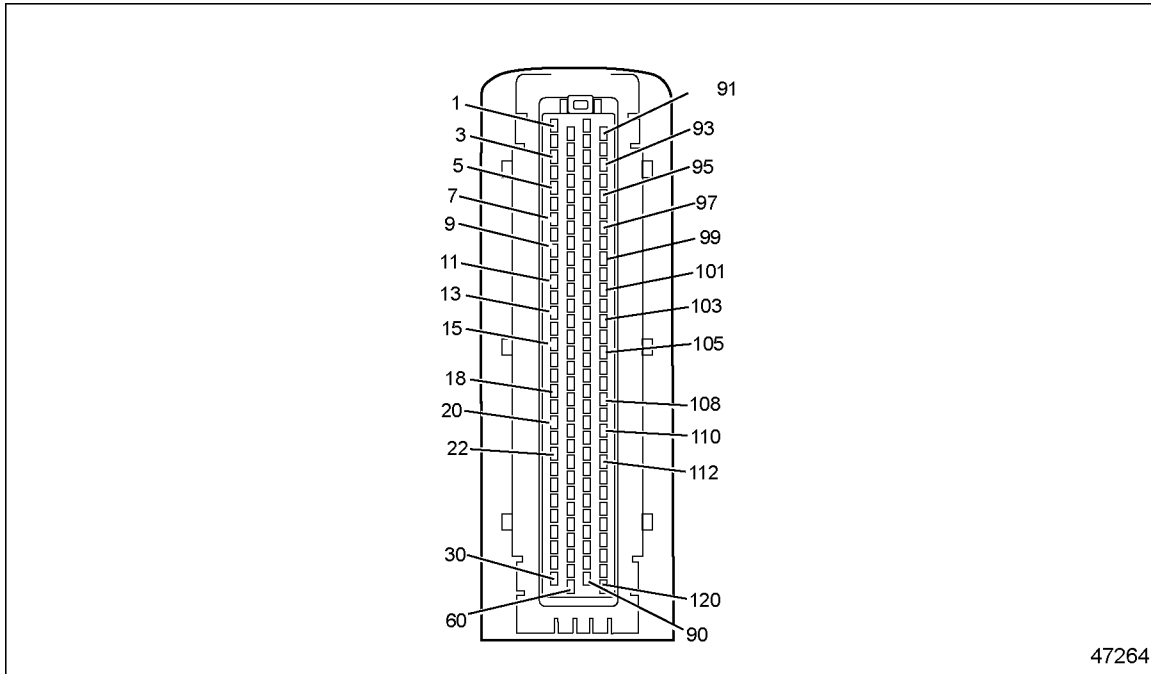


Figure 28-1 120-pin Connector

- [b] If the voltage is between 11.5 and 13.5 volts, go to step 3.
3. Swap the injector.
 - [a] If fault code 656/5 is not active after swapping the injector, replace the original injector. Refer to section 28.1.3.1.
 - [b] If fault code 656/5 is still active after swapping the injector, call the Detroit Diesel Customer Service Center (313-592-5800).

28.1.3 Injector Check

Check as follows:

1. Check the resistance on pin 1 and pin 2 of injector #6.
 - [a] If the resistance is greater than 25k Ω , replace the injector. Refer to section 28.1.3.1.
 - [b] If the resistance is less than 25k Ω , go to step 2.
2. Swap the injectors
 - [a] If fault code 656/5 is not active after swapping injectors, replace the original injector. Refer to section 28.1.3.1.
 - [b] If fault code 656/5 is still active after swapping injectors, contact Detroit Diesel Customer Support Center (313-592-5044).

28.1.3.1 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 656/5 is not logged but other codes are logged, troubleshoot the other codes.
 - [c] If code 656/5 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313-592-5800).

28.2 SPN 656/FMI 10

This diagnostic condition is typically a short to ground.

28.2.1 Short to Ground Check

Check as follows:

1. Put the ignition switch in the OFF position.
2. Disconnect the Injector Harness 23-pin connector.
3. Measure the resistance between pin J and ground on the valve cover side of the connector.
 - [a] If the resistance is less than 5 Ω , repair the short to ground between Pin J and pin 2 of the injector. Refer to section 28.2.1.1.
 - [b] If the resistance is greater than 5 Ω , go to step 4.
4. Disconnect the MCM 120-pin connector.
5. Measure the resistance between pin J and ground on the engine side of the connector.
 - [a] If the resistance is less than 5 Ω , repair the short to ground between Pin J and pin 18 of the MCM 120-pin connector. Refer to section 28.2.1.1.
 - [b] If the resistance is greater than 5 Ω , go to step 6.
6. Recheck the resistance using steps 3 through 5. When you have just completed the recheck, go to step 7.
7. 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.

28.2.1.1 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 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).

29 SPN 701 – JAKE BRAKES LOW (AUX PWM #7) OPEN OR SHORT

Section	Page
29.1 SPN 701/FMI 3	29-3
29.2 SPN 701/FMI 4	29-5
29.3 SPN 701/FMI 5	29-6

29.1 SPN 701/FMI 3

This fault code indicates that there is a short to power.

29.1.1 Short to Power Check

Check as follows:

1. Turn the ignition OFF.
2. Disconnect the injector harness 23-pin connector.
3. Measure the resistance between pin A and pin C on the valve cover side of the connector.
 - [a] If the resistance is less than 5 Ω , repair the short in the harness on the valve cover side between circuits 32 and 91 on pins A and C. Refer to section 29.1.2.1.
 - [b] If the resistance is greater than 9 Ω , go to step 4.
4. Turn the ignition ON (key ON, engine OFF).
5. Measure the voltage between pin C and ground on the engine side of the connector.
 - [a] If the voltage is greater than 11.5 volts, repair the short to power between pin C and pin 32 of the MCM. Refer to section 29.1.2.1.
 - [b] If the voltage is less than 11.5 volts, refer to section 29.1.2.

29.1.2 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 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 injector harness 23-pin connector.
6. Measure the resistance between pin A and pin C on the valve cover side of the connector.
 - [a] If the resistance is less than 5 Ω , repair the short in the harness on the valve cover side between circuits 32 and 91 on pins A and C. Refer to section 29.1.2.1.
 - [b] If the resistance is greater than 9 Ω , go to step 7.
7. Turn the ignition ON (key ON, engine OFF).
8. Measure the voltage between pin C and ground on the engine side of the connector.
 - [a] If the voltage is greater than 11.5 volts, repair the short to power between pin C and pin 32 of the MCM. Refer to section 29.1.2.1.

- [b] If the voltage is less than 11.5 volts, contact the Detroit Diesel Customer Support Center (313-592-5800) for authorization to replace the MCM.

29.1.2.1 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 701/3 is not logged but other codes are logged, troubleshoot the other codes.
 - [c] If code 701/3 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313-592-5800).

29.2 SPN 701/FMI 4

This fault code indicates that there is a short to ground.

29.2.1 Short to Ground Check

Check as follows:

1. Turn the ignition OFF.
2. Disconnect the injector harness 23-pin connector.
3. Measure resistance between pin C and ground on the valve cover side of the connector.
 - [a] If the resistance is less than 5 Ω , repair short to ground between pin C and pin 2 of the Jake Brake solenoid. Refer to section 29.2.2.1.
 - [b] If the resistance is greater than 5 Ω , go to step 4.
4. Disconnect 120-pin MCM connector
5. Measure resistance between pin C and ground on the engine side of the connector.
 - [a] If the resistance is less than 5 ohms, repair short to ground between pin C and pin 32 of the MCM. Refer to section 29.2.2.1.
 - [b] If the resistance is greater than 5 Ω , refer to section 29.2.2.

29.2.2 Resistance Check

The resistance 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 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 injector harness 23-pin connector.
6. Measure resistance between pin C and ground on the valve cover side of the connector.
 - [a] If the resistance is less than 5 Ω , repair short to ground between pin C and pin 2 of the Jake Brake solenoid. Refer to section 29.2.2.1.
 - [b] If the resistance is greater than 5 Ω , go to step 7.
7. Disconnect 120-pin MCM connector
8. Measure resistance between pin C and ground on the engine side of the connector.
 - [a] If the resistance is less than 5 ohms, repair short to ground between pin C and pin 32 of the MCM. Refer to section 29.2.2.1.

- [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.

29.2.2.1 Verify Repairs

Verify repairs as follows:

1. 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 701/4 is not logged but other codes are logged, troubleshoot the other codes.
 - [c] If code 701/4 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313-592-5800).

29.3 SPN 701/FMI 5

This fault code indicates that there is an open circuit.

29.3.1 Open Circuit Check

Check as follows:

1. Check for multiple codes.
 - [a] If SPN 701/5 and SPN 706/5 are active repair the open in between the pin 91 of the 120-pin MCM connector and the Jake Brake solenoids.
 - [b] If only SPN 701/5 is active, go to step 2.
2. Put the ignition switch in the OFF position.
3. Disconnect the injector harness 23-pin connector.
4. Measure the resistance between pin A and pin C on the valve cover side of the connector.
 - [a] If the resistance is less than 10 Ω , go to step 10.
 - [b] If the resistance is greater than 10 Ω , go to step 5.
5. Remove the valve cover.
6. Disconnect the Jake Brake solenoid 1, 2, 3.
7. Measure the resistance between pin 1 of the Jake Brake solenoid and pin A of the injector harness 23-pin connector.
 - [a] If the resistance is greater than 3 Ω , repair the open between pin 1 of the Jake Brake solenoid and pin A. Refer to section 29.3.1.1.

- [b] If the resistance is less than 3 Ω , go to step 8.
- 8. Measure resistance between pin 2 of the Jake Brake solenoid and pin C of the injector harness 23-pin connector.
 - [a] If the resistance is greater than 3 Ω , repair the open between pin 2 of the Jake Brake solenoid and pin C. Refer to section 29.3.1.1.
 - [b] If the resistance is less than 3 Ω , go to step 9.
- 9. Measure resistance between pin 1 and pin 2 of the Jake Brake solenoid.
 - [a] If the resistance is greater than 5 Ω , replace the solenoid. Refer to section 29.3.1.1.
 - [b] If the resistance is less than 5 Ω , go to step 12.
- 10. Turn the ignition ON (key ON, engine OFF).
- 11. Measure the voltage between pins A and C on the engine side of the 23-pin connector.
 - [a] If the voltage is less than 11.5 volts, repair the open between pin C of the injector connector and pin 32 of the 120-pin MCM connector.
 - [b] If the voltage is between 11.5 and 13.5 volts, go to step 12.
- 12. Check for codes. If the code is still present, contact Detroit Diesel Customer Support Center (313-592-5800) for MCM replacement authorization.

29.3.1.1 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 701/5 is not logged but other codes are logged, troubleshoot the other codes.
 - [c] If code 701/5 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313-592-5800).

30 SPN 704 - TURBO ACTUATOR CONTROL (AUX PWM #10)

Section	Page
30.1 SPN 704/FMI 3	30-3
30.2 SPN 704/FMI 4	30-4
30.3 SPN 704/FMI 5	30-5

30.1 SPN 704/FMI 3

This diagnosis is typically a short to power.

30.1.1 Short to Power Check

Check as follows:

1. Disconnect the turbo actuator connector.
2. Turn the ignition ON (key ON, engine OFF).
3. Measure the voltage between pin 3 of the turbo actuator connector and chassis ground.
 - [a] If the voltage is greater than 4.5 volts, repair the short to power between pin 3 of the turbo actuator connector and pin 35 of the 120-pin MCM connector. Refer to section 30.1.1.1.
 - [b] If the voltage is less than 4.5 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 3 of the turbo actuator connector.
 - [a] If the resistance is less than 5 Ω , repair the short between pins 1 and 3 of the turbo actuator connector and pins 35 and 93 of the 120-pin MCM connector. Refer to section 30.1.1.1.
 - [b] If the resistance is greater than 5 Ω , refer to section 30.1.1.1.

30.1.1.1 Verify Repairs

Verify repairs as follows:

1. Turn 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. 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).

30.2 SPN 704/FMI 4

This diagnosis is typically a short to ground.

30.2.1 Short Circuit Check

Check as follows:

1. Disconnect the turbo actuator connector.
2. Disconnect the 120-pin MCM connector.
3. Measure the resistance between pins 1 and 3 of the turbo actuator connector.
 - [a] If the resistance is less than 5 Ω , repair the short between pins 35 and 93 of the 120-pin MCM connector. Refer to section 30.2.1.1.
 - [b] If the resistance is greater than 5 Ω , go to step 4.
4. Measure the resistance between pins 2 and 3 of the turbo actuator connector.
 - [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 30.2.1.1.
 - [b] If the resistance is greater than 5 Ω , go to step 5.
5. Measure the resistance between pin 3 of the turbo actuator connector and ground.
 - [a] If the resistance is less than 5 Ω , repair the short between pin 3 of the turbo actuator connector and ground. Refer to section 30.2.1.1.
 - [b] If the resistance is greater than 5 Ω , go to step 6.
6. Measure the resistance between pin 1 of the turbo actuator connector and ground.
 - [a] If the resistance is less than 5 Ω , repair the short between pin 1 of the turbo actuator connector and ground. Refer to section 30.2.1.1.
 - [b] If the resistance is greater than 5 Ω , refer to section 30.2.1.1.

30.2.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF. Reconnect all connectors.
2. Turn ignition ON. Clear codes with diagnostic tool.
3. Start and run the engine for one minute. Stop engine.
4. 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).

30.3 SPN 704/FMI 5

This diagnosis is typically an open circuit.

30.3.1 Open Circuit Check

Check as follows:

1. Perform the Turbo Actuator Hysteresis Test using Artesian software and a turbo interface cable.
 - [a] If the hysteresis test fails, replace the turbo actuator.
 - [b] If the hysteresis test result is pass or unable to perform hysteresis test, go to step 2.
2. Disconnect the turbo actuator connector.
3. Turn the ignition ON (key ON, engine OFF).
4. Measure the voltage between pins 1 and 2 of the turbo actuator connector.
 - [a] If the voltage is greater than 11.5 volts, go to step 6.
 - [b] If the voltage is less than 11.5 volts, go to step 5.
5. Measure the voltage between pin 1 of the turbo actuator connector and chassis ground.
 - [a] If the voltage is between 11 and 13 volts, repair the open in the wire between pin 38 of the 120-pin MCM connector and pin 2 of the turbo actuator connector. Refer to section 30.1.1.1.
 - [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 1 of the turbo actuator connector. Refer to section 30.1.1.1.
6. Turn the ignition OFF.
7. Disconnect the 120-pin MCM connector.
8. Measure the resistance between pin 3 of the turbo actuator connector and pin 35 of the 120-pin MCM connector.
 - [a] If the resistance is less than 3 Ω , re-verify this procedure. If the results are the same contact the Detroit Diesel Customer Support Center (313-5925800).
 - [b] If the resistance is greater than 3 Ω , repair the open circuit in the wire between pin 3 of the turbo actuator connector and pin 35 of the MCM 120-pin connector. Refer to section 30.1.1.1.

30.3.1.1 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 engine.
4. 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).

31 SPN 706 – JAKE BRAKE MEDIUM (AUX PWM #13) OPEN OR SHORT

Section	Page
31.1 SPN 706/FMI 3	31-3
31.2 SPN 706/FMI 4	31-5
31.3 SPN 706/FMI 5	31-6

31.1 SPN 706/FMI 3

This fault code indicates that there is a short to power.

31.1.1 Short to Power Check

Check as follows:

1. Turn the ignition OFF.
2. Disconnect the injector harness 23-pin connector.
3. Measure the resistance between pin A and pin B on the valve cover side of the connector.
 - [a] If the resistance is less than 5 Ω , repair the short in the harness on the valve cover side between circuits 36 and 91 on pins A and B. Refer to section 31.1.2.1.
 - [b] If the resistance is greater than 9 Ω , go to step 4.
4. Turn the ignition ON (key ON, engine OFF).
5. Measure the voltage between pin B and ground on the engine side of the connector.
 - [a] If the voltage is greater than 11.5 volts, repair the short to power between pin B and pin 36 of the MCM. Refer to section 31.1.2.1.
 - [b] If the voltage is less than 11.5 volts, refer to section 31.1.2.

31.1.2 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. Reconnect all connectors.
2. Turn ignition ON. Clear codes with diagnostic tool.
3. Start and run the engine for one minute. Stop engine.
4. Turn the ignition OFF.
5. Disconnect the injector harness 23-pin connector.
6. Measure the resistance between pin A and pin B on the valve cover side of the connector.
 - [a] If the resistance is less than 5 Ω , repair the short in the harness on the valve cover side between circuits 36 and 91 on pins A and B. Refer to section 31.1.2.1.
 - [b] If the resistance is greater than 9 Ω , go to step 7.
7. Turn the ignition ON (key ON, engine OFF).
8. Measure the voltage between pin B and ground on the engine side of the connector.
 - [a] If the voltage is greater than 11.5 volts, repair the short to power between pin B and pin 36 of the MCM. Refer to section 31.1.2.1.

- [b] If the voltage is less than 11.5 volts, contact the Detroit Diesel Customer Support Center (313-592-5800) for authorization to replace the MCM.

31.1.2.1 Verify Repairs

Verify repairs as follows:

1. Turn the vehicle ignition OFF and reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
 - [a] If no codes are present, troubleshooting is complete.
 - [b] If code 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).

31.2 SPN 706/FMI 4

This fault code indicates that there is a short to ground.

31.2.1 Short to Ground Check

Check as follows:

1. Turn the ignition OFF.
2. Disconnect the injector harness 23-pin connector.
3. Measure resistance between pin B and ground on the valve cover side of the connector.
 - [a] If the resistance is less than 5 Ω , repair short to ground between pin B and pin 2 of the Jake Brake solenoid. Refer to section 31.2.2.1.
 - [b] If the resistance is greater than 5 Ω , go to step 4.
4. Disconnect 120-pin MCM connector
5. Measure resistance between pin B and ground on the engine side of the connector.
 - [a] If the resistance is less than 5 ohms, repair short to ground between pin B and pin 36 of the MCM. Refer to section 31.2.2.1.
 - [b] If the resistance is greater than 5 Ω , refer to section 31.2.2.

31.2.2 Resistance Check

The resistance 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 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 injector harness 23-pin connector.
6. Measure resistance between pin B and ground on the valve cover side of the connector.
 - [a] If the resistance is less than 5 Ω , repair short to ground between pin B and pin 2 of the Jake Brake solenoid. Refer to section 31.2.2.1.
 - [b] If the resistance is greater than 5 Ω , go to step 7.
7. Disconnect 120-pin MCM connector
8. Measure resistance between pin B and ground on the engine side of the connector.
 - [a] If the resistance is less than 5 ohms, repair short to ground between pin B and pin 36 of the MCM. Refer to section 31.2.2.1.

- [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.

31.2.2.1 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 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).

31.3 SPN 706/FMI 5

This fault code indicates that there is an open circuit.

31.3.1 Open Circuit Check

Check as follows:

1. Check for multiple codes.
 - [a] If SPN 706/5 and SPN 704/5 are active repair the open in between the pin 91 of the 120-pin MCM connector and the Jake Brake solenoids.
 - [b] If only SPN 706/5 is active, go to step 2.
2. Turn the ignition OFF.
3. Disconnect the injector harness 23-pin connector.
4. Measure the resistance between pin A and pin B on the valve cover side of the connector.
 - [a] If the resistance is less than 10 Ω , go to step 5.
 - [b] If the resistance is greater than 10 Ω , go to step 10.
5. Remove the valve cover.
6. Disconnect the Jake Brake solenoid 4, 5, 6.
7. Measure the resistance between pin 1 of the Jake Brake solenoid and pin A of the injector harness 23-pin connector.
 - [a] If the resistance is greater than 3 Ω , repair the open between pin 1 of the Jake Brake solenoid and pin A. Refer to section 31.3.1.1.

- [b] If the resistance is less than 3 Ω , 8.
- 8. Measure resistance between pin 2 of the Jake Brake solenoid and pin B of the injector harness 23-pin connector.
 - [a] If the resistance is greater than 3 Ω , repair the open between pin 2 of the Jake Brake solenoid and pin B. Refer to section 31.3.1.1.
 - [b] If the resistance is less than 3 Ω , 9.
- 9. Measure resistance between pin 1 and pin 2 of the Jake Brake solenoid.
 - [a] If the resistance is greater than 5 Ω , replace the solenoid. Refer to section 31.3.1.1.
 - [b] If the resistance is less than 5 Ω , 12.
- 10. Turn the ignition ON (key ON, engine OFF).
- 11. Measure the voltage between pins A and B on the engine side of the 23-pin connector.
 - [a] If the voltage is less than 11.5 volts, repair the open between pin B of the injector connector and pin 66 of the 120-pin MCM connector.
 - [b] If the voltage is between 11.5 and 13.5 volts, go to step 12.
- 12. Check for codes. If the code is still present, contact Detroit Diesel Customer Support Center (313-592-5800) for MCM replacement authorization.

31.3.1.1 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 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).

32 SPN 709 - SINGLE-SPEED FAN (LOW-SIDE DIGITAL OUTPUT #3) FAULT

Section	Page
32.1 SPN 709/FMI 3	32-3
32.2 SPN 709/FMI 4	32-5
32.3 SPN 709/FMI 5	32-6

32.1 SPN 709/FMI 3

This fault code indicates that there is a short to power.

32.1.1 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 32.1.2.1.
 - [b] If the voltage is less than 11.5 volts, refer to section 32.1.2.

32.1.2 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 the ignition OFF. Reconnect all connectors.
2. Turn ignition ON. Clear codes with diagnostic tool.
3. Start and run the engine for one minute. Stop engine.
4. Turn the ignition OFF.
5. Disconnect the fan control solenoid connector.
6. Turn the ignition ON (key On, engine OFF).
7. Measure the voltage between pin 1 of the fan control solenoid connector and ground.
 - [a] If the voltage is greater than 11.5 volts, repair the short to power between pin 1 of the fan control solenoid connector and pin 98 of the 120-pin MCM connector. Refer to section 32.1.2.1.
 - [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.

32.1.2.1 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 711/3 is not logged but other codes are logged, troubleshoot the other codes.
 - [c] If code 711/3 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313-592-5800).

32.2 SPN 709/FMI 4

This fault code indicates that there is a short to ground.

32.2.1 Short to Ground Check

Check as follows:

1. Turn the ignition OFF.
2. Disconnect the fan control solenoid connector.
3. Disconnect the 120-pin MCM connector.
4. Measure the resistance between pin 1 of the fan control solenoid connector and ground.
 - [a] If the resistance is less than 5 Ω , repair the short to ground between pin 1 of the fan control solenoid connector and pin 98 of the 120-pin MCM connector. Refer to section 32.2.1.1.
 - [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 32.2.1.1.

32.2.1.1 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 711/4 is not logged but other codes are logged, troubleshoot the other codes.
 - [c] If code 711/4 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313-592-5800).

32.3 SPN 709/FMI 5

This fault code indicates that there is an open circuit.

32.3.1 Open Circuit Check

Check 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 32.3.1.1.
 - [b] If only SPN 709/5 is active, go to step 2.
2. Disconnect the fan control solenoid connector.
3. Turn the ignition ON (key On, engine OFF).
4. Measure the voltage between pin 1 and 2 of the fan control solenoid connector.
 - [a] If the voltage is less than 11.5 volts, go to step 5.
 - [b] If the voltage is between 11.5 and 13.5 volts, replace the fan control solenoid. Refer to section 32.3.1.1.
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 32.3.1.1.
 - [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 32.3.1.1.
 - [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 32.3.1.1.

32.3.1.1 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 711/5 is not logged but other codes are logged, troubleshoot the other codes.
 - [c] If code 711/5 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313-592-5800).

33 SPN 714 - ETHER START (LOW-SIDE DIGITAL OUTPUT #8) FAULT

Section	Page
33.1 SPN 714/FMI 3	33-3
33.2 SPN 714/FMI 4	33-4
33.3 SPN 714/FMI 5	33-5

33.1 SPN 714/FMI 3

SPN 714/FMI 3 is typically a short to power.

33.1.1 Short to Power Check

Check as follows:

1. Turn the ignition OFF.
2. Disconnect the Ether Start connector.
3. Turn the ignition ON (key On, engine OFF).
4. Measure the voltage between pin C of the Ether Start connector and ground.
 - [a] If the voltage is greater than 4.5 volts, repair the short to power between pin C and pin 70 of the 120-pin MCM connector. Refer to section 33.1.1.1.
 - [b] If the voltage is less than 4.5 volts, go to step 5.
5. Review steps 1 through 4. If the results are the same, contact the Detroit Diesel Customer Support Center (313-592-5800).

33.1.1.1 Verify Repairs

Perform the following steps to verify repairs.

1. Turn the ignition OFF and reconnect all connectors.
2. Turn the ignition ON. Clear the codes.
3. Start and run the engine for eight minutes. Stop the engine.
4. Check for codes.
 - [a] If no codes are logged, troubleshooting is complete.
 - [b] If other codes are logged, review this section to find the error. If no error is found, contact Detroit Diesel Customer Support Center (313-592-5800).

33.2 SPN 714/FMI 4

The diagnosis for SPN 714/FMI 4 is typically a short to ground.

33.2.1 Short Circuit Check

Check as follows:

1. Disconnect the Ether Start connector at the Ether Injection Relay.
2. Disconnect the 120-pin MCM connector.
3. Measure the resistance between pin C of the Ether Start connector and ground.
 - [a] If the resistance is less than 5 Ω , repair the short circuit between pin C of the Ether Start connector and ground. Refer to section 33.2.1.1.
 - [b] If the resistance is greater than 5 Ω , contact the Detroit Diesel Customer Support Center (313-592-5800).

33.2.1.1 Verify Repairs

Perform the following steps to verify repairs.

1. 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).

33.3 SPN 714/FMI 5

This diagnosis for SPN 714/FMI 5 is typically an open circuit.

33.3.1 Open Circuit Check

Check as follows:

1. Disconnect the Ether Start connector at the Ether Injection Relay.
2. Disconnect the 120-pin MCM connector.
3. Measure the resistance between pin C of the Ether Start connector and pin 70 of the 120-pin MCM connector.
 - [a] If the resistance is greater than repair the open circuit between pin C of the Ether Start connector and pin 70 of the 120-pin MCM connector. Refer to section 33.3.1.1.
 - [b] If the resistance is less than 5 Ω , contact the Detroit Diesel Customer Support Center (313-592-5800).

33.3.1.1 Verify Repairs

Perform the following steps to verify repairs.

1. Reconnect all connectors.
2. Turn the ignition ON. Clear the codes.
3. Start and run the engine for eight minutes. Stop the engine.
4. Check for codes.
 - [a] If no codes are logged, troubleshooting is complete.
 - [b] If other codes are logged, review this section to find the error. If no error is found, contact Detroit Diesel Customer Support Center (313-592-5800).

34 SPN 723 — CAMSHAFT POSITION SENSOR FAULT

Section	Page
34.1 SPN 723/FMI 3	34-3
34.2 SPN 723/FMI 4	34-5
34.3 SPN 723/FMI 8	34-6
34.4 SPN 723/FMI 14	34-7

34.1 SPN 723/FMI 3

The diagnostic condition is typically an open circuit.

34.1.1 Open Circuit Check

Perform the following steps to troubleshoot an open circuit.

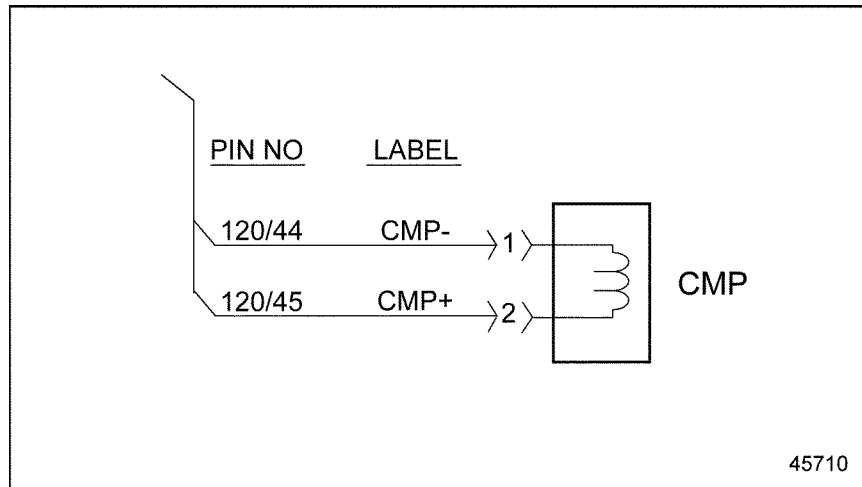


Figure 34-1 MCM — Camshaft Position Sensor Schematic

1. Disconnect CMP Sensor
2. Measure the resistance across pins 1 and 2 of the CMP Sensor. See Figure 34-1.
 - [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 34.1.1.1.
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 34.1.1.1.
 - [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 than 5 ohms, repair open between pin 1 of the CMP harness connector and pin 44 of the MCM 120 pin connector. Refer to section 34.1.1.1.
 - [b] If the resistance is less than 5 Ω , go to step 6.

6. Measure the resistance between pin 2 of the CMP harness connector and pin 45 of the MCM 120 pin connector.
 - [a] If the resistance is greater than 5 ohms, repair open between pin 2 of the CMP harness connector and pin 45 of the MCM 120 pin connector. Refer to section 34.1.1.1.
 - [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).

34.1.1.1 Verify Repairs

Perform the following steps to verify repairs.

1. Turn the ignition OFF and reconnect all connectors.
2. Turn the ignition ON.
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.

34.2 SPN 723/FMI 4

A typical diagnosis is a short to ground.

34.2.1 Short to Ground Check

Perform the following step to troubleshoot a short to ground.

1. Disconnect the CMP Sensor.
2. Measure the resistance between pin 1 of the CMP Sensor and ground. See Figure 34-2.

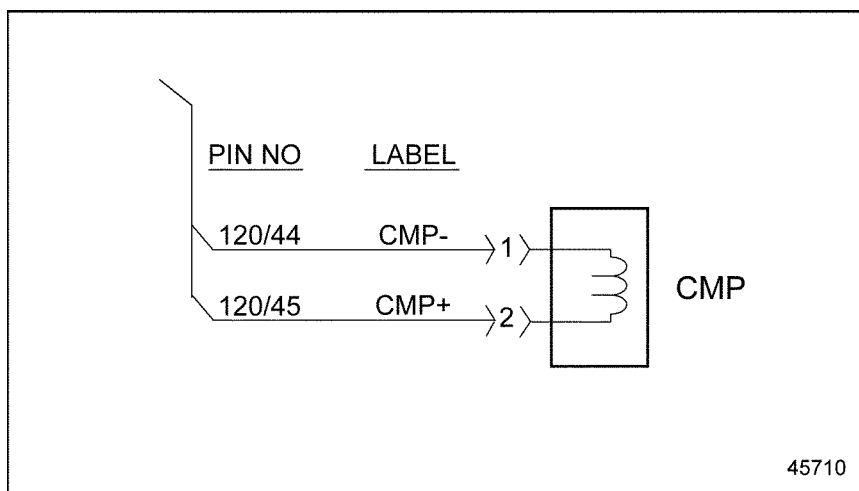


Figure 34-2 MCM — Camshaft Position Sensor Schematic

- [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 34.2.1.1.
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 34.2.1.1.
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 34.2.1.1.
6. Measure the resistance between pin 1 of the CMP harness connector and ground.
 - [a] If the resistance is greater than 5 Ω , go to step 7.

- [b] If the resistance is less than 5 Ω , repair the short to ground between pin 1 of the CMP harness connector and pin 44 of the 120-pin MCM connector. Refer to section 34.2.1.1.
- 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 34.2.1.1.

34.2.1.1 Verify Repairs

Perform the following steps to verify repairs.

1. Turn the ignition OFF and reconnect all connectors.
2. Turn the ignition ON.
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.

34.3 SPN 723/FMI 8

A typical diagnosis is time out.

34.3.1 Time Out Check

Perform the following steps to troubleshoot a time out.

1. Start and run the engine.
2. Check for active fault codes.
 - [a] If fault codes 64/3 and 64/8 are active, troubleshoot active fault code 64/3. Refer to section 34.1.1.
 - [b] If fault codes 64/4 and 64/8 are not active, go to step 3.
 - [c] If fault codes 64/4 and 64/8 are active, refer to section 34.3.2.
3. Shutdown the engine.
4. Ensure that the sensor is correctly positioned and check for active codes.

- [a] If the sensor position is correct and fault code 64/8 is active, refer to section 34.3.2.
- [b] If the sensor position is incorrect and fault code 64/8 is not active, remove and replace the camshaft sensor sleeve. Refer to section 34.3.2.1.

34.3.2 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 34.3.2.1.
2. Check the Camshaft Position Sensor for proper axial play. Repair as necessary if the axial play is incorrect. Refer to section 34.3.2.1.

34.3.2.1 Verify Repairs

Perform the following steps to verify repairs.

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 723/8 are logged, troubleshoot those codes.

34.4 SPN 723/FMI 14

A typical diagnosis is swapped pins.

34.4.1 Pins Swapped Check

Perform the following step to troubleshoot pins swapped.

1. If fault code 64/14 is active, check the Camshaft Position Sensor for reversed polarity.
2. Reseat the camshaft and crankshaft sensors.

3. Ensure that the 120-pin connector wires are not crossed. If crossed, repair as necessary. See Figure 34-3. Refer to section 34.4.1.1.

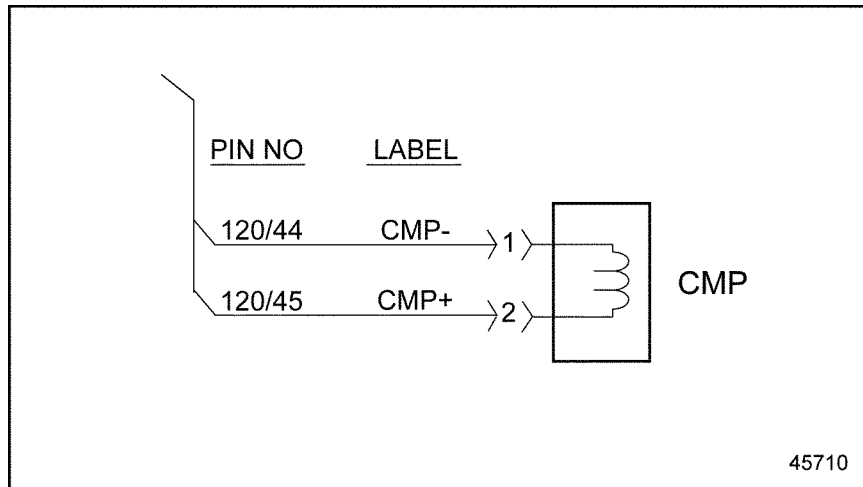


Figure 34-3 Camshaft Position Sensor

34.4.1.1 Verify Repairs

Perform the following steps to verify repairs.

1. Turn vehicle ignition OFF and reconnect all connectors.
2. Turn vehicle ignition ON.
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 723/14 are logged, troubleshoot those codes.

35 SPN 975 - TWO-SPEED FAN (AUX PWM #6) FAULT

Section	Page
35.1 SPN 975/FMI 3	35-3
35.2 SPN 975/FMI 4	35-5
35.3 SPN 975/FMI 5	35-6

35.1 SPN 975/FMI 3

This fault code indicates that there is a short to power.

35.1.1 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 35.1.2.1.
 - [b] If the voltage is less than 11.5 volts, refer to section 35.1.2.

35.1.2 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 the ignition OFF. Reconnect all connectors.
2. Turn ignition ON. Clear codes with diagnostic tool.
3. Start and run the engine for one minute. Stop engine.
4. Turn the ignition OFF.
5. Disconnect the fan control solenoid connector.
6. Turn the ignition ON (key On, engine OFF).
7. Measure the voltage between pin 1 of the fan control solenoid connector and ground.
 - [a] If the voltage is greater than 11.5 volts, repair the short to power between pin 1 of the fan control solenoid connector and pin 33 of the 120-pin MCM connector. Refer to section 35.1.2.1.
 - [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.

35.1.2.1 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 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).

35.2 SPN 975/FMI 4

This fault indicates that there is a short to ground.

35.2.1 Short to Ground Check

Check as follows:

1. Turn the ignition OFF.
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 35.2.1.1.
 - [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 35.2.1.1.

35.2.1.1 Verify Repairs

Verify repairs as follows:

1. 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 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).

35.3 SPN 975/FMI 5

This fault code indicates that there is an open circuit.

35.3.1 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 35.3.1.1.
 - [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 35.3.1.1.
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 35.3.1.1.
 - [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 35.3.1.1.

35.3.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF. Reconnect all connectors.
2. Turn the ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
 - [a] If no codes are present, troubleshooting is complete.
 - [b] If code 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).

36 SPN 1172 -TURBO COMPRESSOR IN TEMP HIGH OR LOW

Section	Page
36.1 SPN 1172/FMI 3	36-3
36.2 SPN 1172/FMI 4	36-5

36.1 SPN 1172/FMI 3

This code is typically sensor or circuit failed high.

36.1.1 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 36.1.2.1.
 - [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 36.1.2.1.
 - [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 36.1.2.1.
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 36.1.2.
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 36.1.2.1.
 - [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 36.1.2.1.

36.1.2 Resistance and Voltage Check

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

1. Turn the ignition OFF. Reconnect all connectors.
2. Turn the ignition ON (key On, engine OFF). 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 36.1.1, 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.

36.1.2.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF. Reconnect all connectors.
2. Turn ignition ON. Clear codes with diagnostic tool.
3. Start and run the engine for one minute. Stop engine.
4. 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).

36.2 SPN 1172/FMI 4

This code is typically sensor or circuit failed low.

36.2.1 Short Circuit Check

Check as follows:

1. Turn the ignition OFF.
2. Disconnect the 31-pin connector.
3. Disconnect the TCI Sensor.
4. Measure resistance between pin 27 and pin 28 of the 31-pin connector on the vehicle side.
 - [a] If the resistance is less than 10 Ω , repair the short between pin 27 and pin 28 of the 31-pin connector. Refer to section 36.2.1.1.
 - [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 36.2.1.1.
 - [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 36.2.1.1.
 - [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 36.2.1.1.
 - [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 36.2.1.1.
 - [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 36.2.1.1.
 - [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.

36.2.1.1 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 engine.
4. 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).

37 SPN 1636 – INTAKE AIR TEMPERATURE OUTSIDE OF NORMAL OPERATING RANGE

Section	Page
37.1 SPN 1636 /FMI 2	37-3
37.2 SPN 1636/FMI 3	37-4
37.3 SPN 1636/FMI 4	37-6
37.4 SPN 1636/FMI 14	37-7

37.1 SPN 1636 /FMI 2

This diagnostic condition is typically erratic data.

37.1.1 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 DDDL 7.0.
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 Air Temperature Sensor and the 120-pin MCM connector.
6. Bridge pins 1 and 2 of the IAT 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 37.1.1.1.
 - [b] If the resistance is less than 3 Ω, replace the sensor. Refer to section 37.1.1.1.
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 37.1.1.1.

37.1.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF. Reconnect all connectors.
2. Turn ignition ON. Clear codes with diagnostic tool.
3. Start and run the engine for one minute. Stop the engine.
4. Check diagnostic tool for codes.

- [a] If no codes are displayed, troubleshooting is complete.
- [b] If code 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).

37.2 SPN 1636/FMI 3

This diagnostic condition is typically Intake Air Temperature Sensor Open Circuit.

37.2.1 Intake Air Temperature Sensor Open Circuit Check

Check as follows:

1. Disconnect the IAT Sensor.
2. Measure the resistance across pins 1 and 2 of the sensor (see Figure 37-1).
 - [a] If the resistance is greater than 4k Ω , replace the sensor. Refer to section 37.2.2.1.

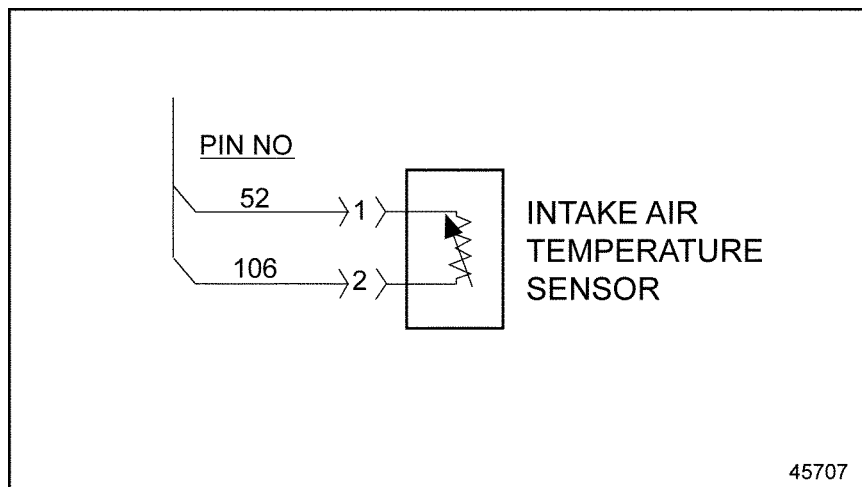


Figure 37-1 Intake Air Temperature Sensor Wiring

- [b] If the resistance is less than 4k Ω , go to step 3.
3. Turn the ignition switch to the ON position.
 4. Measure the voltage between pins 1 and 2 of the IAT Sensor harness connector.
 - [a] If the voltage is between 2.75 and 3.25 volts, refer to section 37.2.2.
 - [b] If the voltage is less than 2.75 volts, go to step 5.
 5. Measure the voltage between pin 2 of the IAT 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 IAT Sensor harness connector and pin 52 of the MCM 120-pin connector. Refer to section 37.2.2.1.
- [b] If the voltage is less than 2.75 volts, repair the open circuit between pin 2 of the IAT Sensor harness connector and pin 106 of the MCM 120-pin connector. Refer to section 37.2.2.1.

37.2.2 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. 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. Disconnect the IAT Sensor.
5. Measure the resistance across pins 1 and 2 of the sensor.
 - [a] If the resistance is greater than 4k Ω , replace the sensor. Refer to section 37.2.2.1.
 - [b] If the resistance is less than 4k Ω , go to step 6.
6. Turn the ignition ON (key On, engine OFF).
7. Measure the voltage between pins 1 and 2 of the IAT Sensor harness connector.
 - [a] If the voltage is between 2.75 and 3.25 volts, contact the Detroit Diesel Customer Support Center (313-592-5800) for authorization to replace the MCM.
 - [b] If the voltage is less than 2.75 volts, refer to section 37.2.1, step 5.

37.2.2.1 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 1636/3 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).

37.3 SPN 1636/FMI 4

A typical diagnosis is IAT Sensor Short to Ground.

37.3.1 Intake Air Temperature Sensor Short to Ground Check

Perform the following steps to troubleshoot an IAT Sensor short to ground fault:

1. Disconnect the IAT Sensor.
2. Disconnect the 120-pin MCM connector.
3. Measure the resistance across pins 1 and 2 of the IAT Sensor connector.
 - [a] If the resistance is less than 5k Ω , repair the short between wires 52 and 106 of the 120-pin MCM Connector. Refer to section 37.3.1.1.
 - [b] If the resistance is greater than 5k Ω , go to step 4.
4. Measure the resistance between pin 1 of the sensor harness connector and ground.
 - [a] If resistance is less than 5 Ω , repair short circuit between pin 1 of the sensor harness connector and ground. Refer to section 37.3.1.1.
 - [b] If resistance is greater than 5 Ω , go to step 5.
5. Measure the resistance between pin 2 of the sensor harness connector and ground.
 - [a] If the resistance is less than 5 Ω , repair the short circuit between pin 2 of the sensor harness connector and ground. Refer to section 37.3.1.1.
 - [b] If the resistance is greater than 5 Ω , refer to section 37.3.1.1.

37.3.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF. Reconnect all connectors.
2. Turn 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 1636/4 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).

37.4 SPN 1636/FMI 14

This code indicates that the Intake Air Temperature Sensor has failed a self test.

37.4.1 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 the diagnostic tool.
2. Turn the ignition ON (key On, engine OFF).
3. Monitor the intake manifold, engine oil, engine coolant, EGR and turbo outlet temperature parameters.
4. Are any of the temperature readings 15°F greater or less than that of the other sensors?
 - [a] If yes, inspect the suspect temperature sensors electrical connector for corrosion, bent or spread pins, repair as necessary. If there are no repairs, replace suspect temperature sensor. Refer to section 37.4.1.1.
 - [b] If no, go to step 5.
5. Prepare DDDL 7.0 for a snapshot.
6. Start the engine, idle for 30 seconds, then TURN THE ENGINE OFF.
7. Review the intake manifold, engine oil, engine coolant, EGR and turbo outlet temperature parameters on snapshot.
8. Are any of the temperature readings 20°F greater or less than that of the other sensors?
 - [a] If yes, inspect the suspect temperature sensors electrical connector for corrosion, bent or spread pins, repair as necessary. If there are no repairs, replace suspect temperature sensor. Refer to section 37.4.1.1.
 - [b] If no, review steps 3 through 8. If the results are the same, contact the Detroit Diesel Customer Support Center (313-592-5800).

37.4.1.1 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).

38 SPN 2629 - TURBO COMPRESSOR OUT TEMP HIGH OR LOW

Section	Page
38.1 SPN 2629/FMI 3	38-3
38.2 SPN 2629/FMI 4	38-5
38.3 SPN 2629/FMI 20	38-7
38.4 SPN 2629/FMI 21	38-8

38.1 SPN 2629/FMI 3

This condition is typically open circuit.

38.1.1 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 38.1.1.1.
 - [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 500k Ω , replace the TCO Sensor. Refer to section 38.1.1.1
 - [b] If the resistance is less than 300k 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. See Figure 38-1. Refer to section 38.1.1.1.

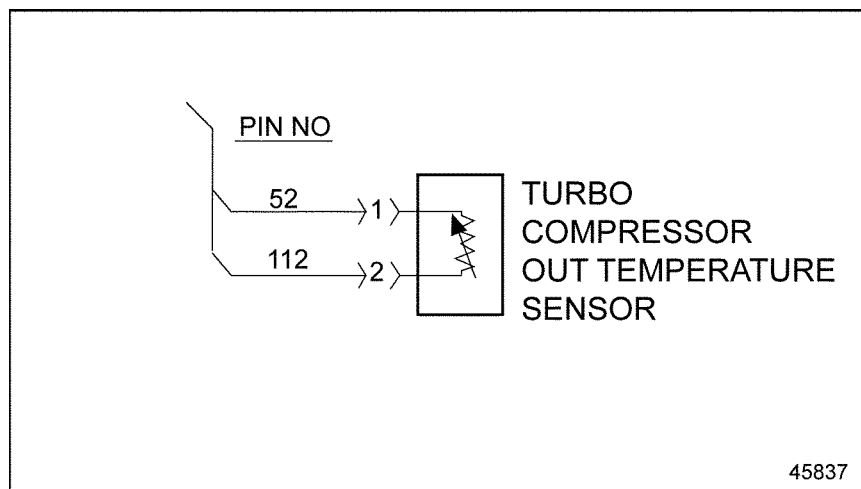


Figure 38-1 Turbo Compressor Outlet Temperature Sensor

- [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 38.1.1.1.
- 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 38.1.1.1.
 - [b] If the resistance is greater than 5 Ω , replace the TCO Sensor. Refer to section 38.1.1.1.

38.1.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the 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.
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).

38.2 SPN 2629/FMI 4

This condition is typically a short circuit.

38.2.1 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. See Figure 38-2. Refer to section 38.2.1.1.

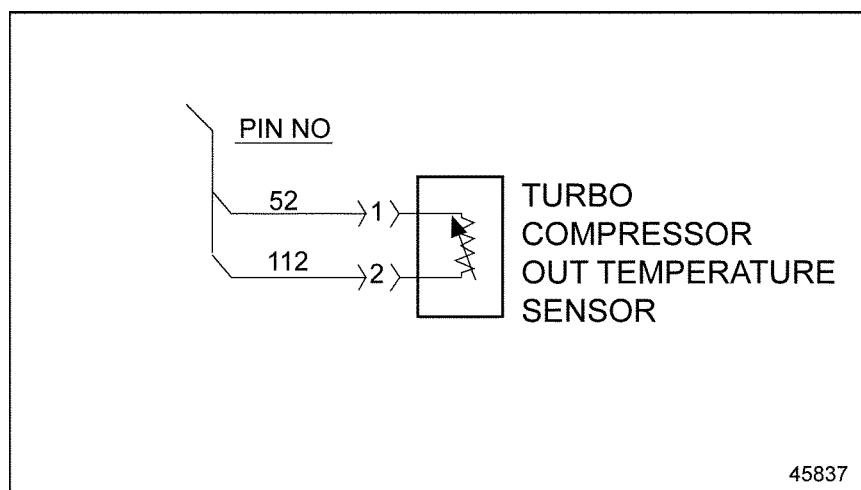


Figure 38-2 Turbo Compressor Outlet Temperature Sensor

- [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 38.2.1.1.
 - [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 38.2.1.1.
 - [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.

38.2.1.1 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.
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).

38.3 SPN 2629/FMI 20

This condition is typically temperature too high from the turbo outlet.

38.3.1 Turbocharger Check

Check as follows:

1. Inspect the turbocharger outlet plumbing and charge air cleaner for blockage, leaks or cracks. Repair as necessary
2. Turn the ignition ON (key On, engine OFF).
3. Perform the turbo hysteresis test.
 - [a] If the test fails, replace the turbo actuator. Refer to section 38.3.1.1.
 - [b] If the test is a pass, go to step 4.
4. Disconnect the Turbo Out Temperature Sensor.
 - [a] Inspect the connectors for damage, corrosion, spread or bent pins. Repair as necessary. Refer to section 38.3.1.1.
 - [b] If the connectors are OK, replace the Turbo Out Temperature Sensor. Refer to section 38.3.1.1.

38.3.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the 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.
4. Check diagnostic tool for codes.
 - [a] If no codes are displayed, troubleshooting is complete.
 - [b] If code 2629/20 is not logged, and other codes are logged, troubleshoot the logged codes.
 - [c] If code 2629/20 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 2629/FMI 21

This condition is typically temperature too low from the turbo outlet.

38.4.1 Turbocharger Check

Check as follows:

1. Disconnect the TCO Sensor.
2. Measure the resistance across pins 1 and 2 of the TCO Sensor.
 - [a] If the resistance is greater than 500k Ω , replace the TCO Sensor. Refer to section 38.4.1.1.
 - [b] If the resistance is less than 300k 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 TCO Sensor harness connector.
 - [a] If the voltage is between 2.75 and 3.25 volts, go to step 6.
 - [b] If the voltage is less than 2.75 volts, go to step 5.
5. Measure the voltage between pin 2 of the 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 38.4.1.1.
 - [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 38.4.1.1.
6. Inspect the intake air and turbocharger outlet plumbing for leaks or cracks. Repair if necessary.
7. Perform the turbo hysteresis test
 - [a] If the test fails, replace the turbo actuator. Refer to section 38.4.1.1.
 - [b] If the test is a pass, go to step 8.
8. Disconnect the Turbo Out Temperature Sensor.
 - [a] Inspect the connectors for damage, corrosion, spread or bent pins. Repair if necessary. Refer to section 38.4.1.1.
 - [b] If the connectors are OK, replace the Turbo Out Temperature Sensor. Refer to section 38.4.1.1.

38.4.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the 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.
4. Check diagnostic tool for codes.
 - [a] If no codes are displayed, troubleshooting is complete.
 - [b] If code 2629/21 is not logged, and other codes are logged, troubleshoot the logged codes.
 - [c] If code 2629/21 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).

39 SPN 2791 – EGR VALVE (AUX PWM #1) FAILED OR OPEN CIRCUIT

Section	Page
39.1 SPN 2791/FMI 3	39-3
39.2 SPN 2791/FMI 4	39-5
39.3 SPN 2791/FMI 5	39-6

39.1 SPN 2791/FMI 3

This diagnostic condition is typically a short to power fault.

39.1.1 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 39.1.2.1.
 - [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 39.1.2.1
 - [b] If the resistance is less than 5 Ω , refer to section 39.1.2.

39.1.2 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 (key On, engine OFF). 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 39.1.2.1.
 - [b] If the voltage is less than 11.5 volts, go to step 5.
5. Turn the ignition switch to the OFF position.
6. Disconnect the 120-pin MCM connector.
7. Measure the resistance between pin 1 and pin 2 of the EGR valve connector.

- [a] If the resistance is less than 5 Ω , repair the short between pin 1 and pin 2 of the EGR valve connector and pin 61 and 62 of the 120-pin MCM connector. Refer to section 39.1.2.1.
- [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.

39.1.2.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF. Reconnect all connectors.
2. Turn the ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
 - [a] If no codes are present, troubleshooting is complete.
 - [b] If code 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).

39.2 SPN 2791/FMI 4

This diagnosis is typically short to ground.

39.2.1 Check for Short

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 39.2.2.1.
 - [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 39.2.2.1.
 - [b] If the resistance is greater than 5 Ω , Refer to section 39.2.2.1.

39.2.2 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 39.2.2.1.
 - [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 39.2.2.1.
 - [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.

39.2.2.1 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 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).

39.3 SPN 2791/FMI 5

This diagnostic condition is typically an open circuit fault.

39.3.1 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 39.3.1.1.
 - [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 39.3.1.1.
 - [b] If the resistance is less than 3 Ω , replace the MCM.
6. Turn the ignition OFF and measure the resistance between pin 1 of the EGR valve connector and pin 61 of the 120-pin MCM connector.

- [a] If the resistance is greater than 3 Ω , repair the open circuit in the wire between pin 61 of the 120-pin MCM connector and pin 1 of EGR valve connector. Refer to section 39.3.1.1.
- [b] If the resistance is less than 3 Ω , replace the EGR valve.

39.3.1.1 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).

40 SPN 3510 – ACCELERATOR PEDAL SUPPLY OUTSIDE OF NORMAL OPERATING RANGE

Section	Page
40.1 SPN 3510/FMI 2	40-3
40.2 SPN 3510/FMI 3	40-5
40.3 SPN 3510/FMI 4	40-6

40.1 SPN 3510/FMI 2

This fault indicates that the throttle pedal supply is receiving erratic data.

40.1.1 Erratic Data Check

Check as follows:

1. Disconnect the Accelerator Pedal (AP).
2. Turn the ignition ON.
3. Measure the voltage between pins 1 and 3 of the AP harness connector. See Figure 40-1.

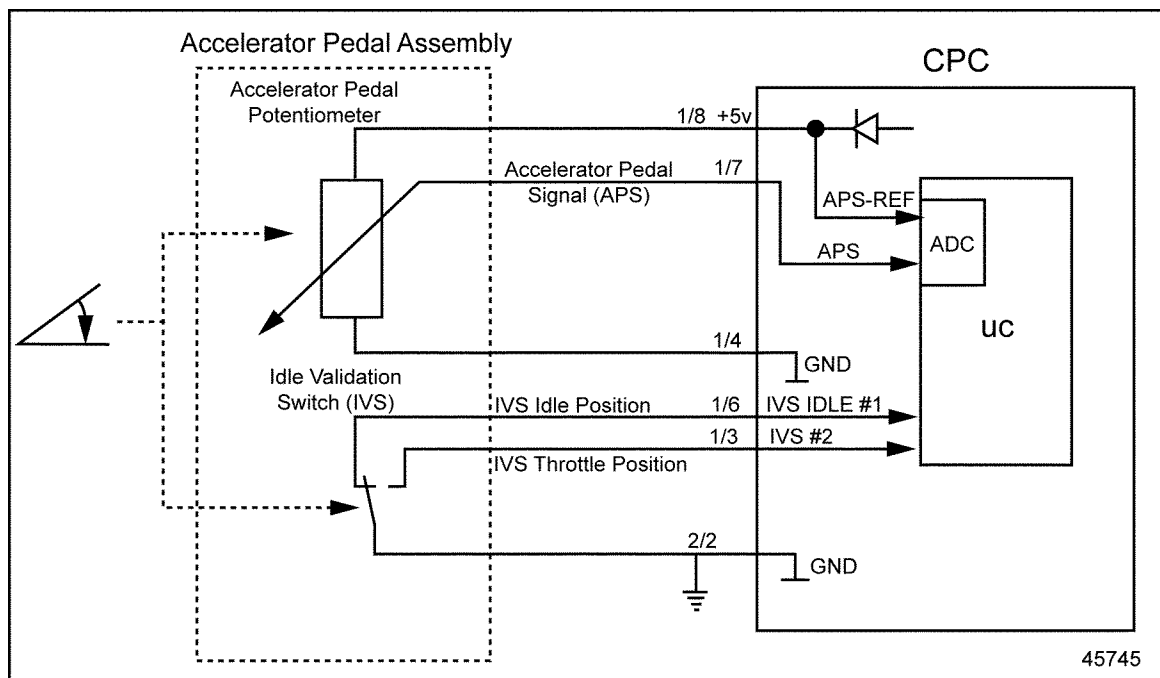


Figure 40-1 Accelerator Pedal Assembly Installation

- [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 40.1.1.1.
 - [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 40.1.1.1.
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 40.1.1.1.
 - [b] If the resistance is less than 3 Ω , replace the Accelerator Pedal. Refer to section 40.1.1.1.

40.1.1.1 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 engine.
4. 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).

40.2 SPN 3510/FMI 3

The typical diagnosis for this fault is high voltage.

40.2.1 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 40.2.1.1.
 - [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 40.2.1.1.
5. Turn the ignition OFF.
6. Disconnect the CPC #1 connector.
7. Measure the resistance between pin 2 of the AP harness connector and pin 7 of the CPC #1 connector.
 - [a] Measure the resistance between pin 2 of the AP harness connector and pin 7 of the CPC #1 connector. Refer to section 40.2.1.1.
 - [b] If the resistance is less than 3 Ω , replace the Accelerator Pedal. Refer to section 40.2.1.1.

40.2.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF. Reconnect all connectors.
2. Turn ignition ON. Clear codes with diagnostic tool.
3. Start and run the engine for one minute. Stop engine.
4. Check diagnostic tool for codes.
 - [a] If no codes are displayed, troubleshooting is complete.
 - [b] If code 3510/3 is not logged, and other codes are logged, troubleshoot the logged codes.
 - [c] If code 3510/3 and other codes are logged, review this section to find the error. If no error is found, call the Detroit Diesel Customer Support Center (313-592-5800).

40.3 SPN 3510/FMI 4

The typical diagnosis for this fault is voltage low.

40.3.1 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 40.3.1.1.
 - [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 #1 connector. Refer to section 40.3.1.1.
 - [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 40.3.1.1.
 - [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 40.3.1.1.
 - [b] If the resistance is greater than 5 Ω , replace the Accelerator Pedal. Refer to section 40.3.1.1.

40.3.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF. Reconnect all connectors.
2. Turn ignition ON. Clear codes with diagnostic tool.
3. Start and run the engine for one minute. Stop engine.
4. 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).

41 SPN 3563– INTAKE MANIFOLD PRESSURE OUTSIDE NORMAL RANGE

Section	Page
41.1 SPN 3563/FMI 0/1/2	41-3
41.2 SPN 3563/FMI 3	41-6
41.3 SPN 3563/FMI 4	41-7

41.1 SPN 3563/FMI 0/1/2

The typical diagnosis for this fault is the intake manifold pressure high or low or erratic data.

41.1.1 Low (Boost) Pressure Check

Check as follows:

1. 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 2.
2. 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 41.1.2.1.
 - [b] If the air filter or air intake system is not restricted, go to step 3.
3. Check the condition of the boost air sensor.
 - [a] If sensor is not in good condition, replace sensor. Refer to section 41.1.2.1.
 - [b] If sensor is in good condition, go to step 4.
4. 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 41.1.2.1.
 - [b] If no leaks are found, go to step 5.
5. 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 41.1.2.1.
 - [b] If the turbocharger is not faulty, go to step 6.
6. 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 41.1.2.1.
 - [b] If fuel delivery is within specifications, check for erratic data. Refer to section 41.1.2.

41.1.2 Erratic Data Check

Perform the following steps to check for erratic data:

1. Turn the ignition ON (key On, engine OFF).
2. Find the altitude for your local area and use Table 1 to determine the kPa value for the local altitude.
3. Open DDDL 7.0 and change the units to metric. (Tool menu > Options > Metric).

4. Using DDDL 7.0, read the value of the Barometric Pressure Sensor. The value should be within X kPa of the value in Table 1.
 - [a] If the value is greater than X kPa, replace the Intake Manifold Pressure/Temp Sensor. Refer to section 41.1.2.1.
 - [b] If the value is less than X kPa,, go to step 5.
5. Using DDDL 7.0, read the value of the Barometric Pressure Sensor. The value should be within X kPa of the value in Table 1.
 - [a] If the value is greater than X kPa, replace the Barometric Pressure Sensor. Due to its location in the MCM, replacing the Barometric Pressure Sensor means replacing the MCM.Refer to section 41.1.2.1.
 - [b] If the value is less than X kPa,, go to step 6.
6. Start the engine and run at idle.
7. Using DDDL 7.0, read the value of the Intake Manifold Pressure/Temp Sensor (boost pressure). The value should be within X kPa of 0.00.
 - [a] If the value is not within X kPa, replace the Intake Manifold Pressure/Temp Sensor. Refer to section 41.1.2.1.
 - [b] If the value is within X kPa, go to step 8.
8. Using DDDL 7.0, read the value of the Barometric Pressure Sensor.
 - [a] If the value is not within X kPa, replace the Barometric Pressure Sensor. Due to its location in the MCM, replacing the Barometric Pressure Sensor means replacing the MCM.Refer to section 41.1.2.1.
 - [b] If the value is within X kPa,, go to step 9.
9. Run the engine to 1500 rpm.
10. Using DDDL 7.0, read the value of the Intake Manifold Pressure/Temp Sensor (boost pressure). The value should be X kPa at 1500 rpm.
 - [a] If the value is not within 2 kPa, replace the sensor.
 - [b] If the value is within 2 kPa, go to step 11.
11. Using DDDL 7.0, read the value of the Barometric Pressure Sensor.
 - [a] If the value is not within X kPa, replace the Barometric Pressure Sensor. Due to its location in the MCM, replacing the Barometric Pressure Sensor means replacing the MCM.Refer to section 41.1.2.1.
 - [b] If the value is within X kPa, contact Detroit Diesel Customer Support Center (313-592-5800).

41.1.2.1 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 engine.
4. 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).

41.2 SPN 3563/FMI 3

The typical diagnosis for this fault is an Intake Manifold Pressure Sensor short circuit.

41.2.1 Short Circuit Check

Check as follows:

1. Disconnect the Intake Manifold Pressure Sensor (IMP Sensor).
2. Disconnect the 120-pin MCM connector.
3. Measure the resistance between pin 2 and 3 of the IMP Sensor connector. See Figure 41-1.
 - [a] If the resistance is less than 5 Ω , repair the short between pins 87 and 102 of the 120-pin MCM connector. Refer to section 41.2.1.1.

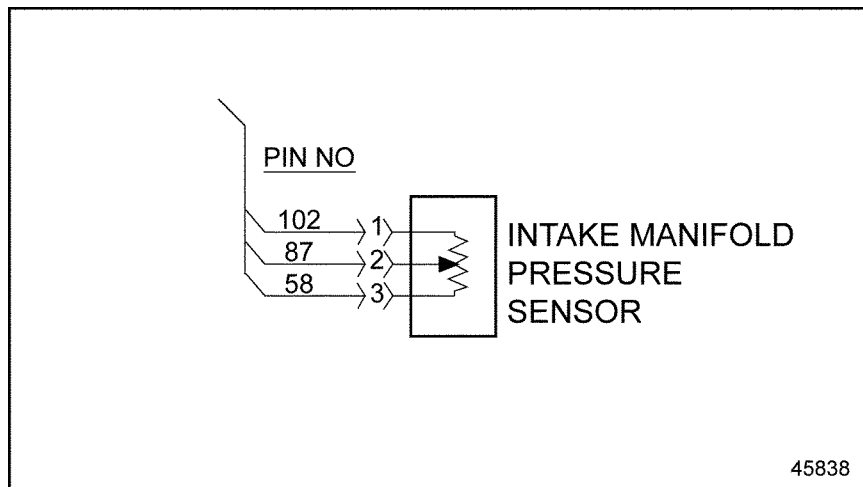


Figure 41-1 Intake Manifold Pressure Sensor

- [b] If the resistance is greater than 5 Ω , repair the short to power on pin 87 of the 120-pin MCM connector. Refer to section 41.2.1.1.

41.2.1.1 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 engine.
4. 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).

41.3 SPN 3563/FMI 4

The typical diagnosis for this fault is an Intake Manifold Pressure Sensor open circuit.

41.3.1 Open Circuit Check

Check as follows:

1. Disconnect the Intake Manifold Pressure Sensor (IMP Sensor).
2. Measure the resistance between pin 1 and 3 of the IMP Sensor.
 - [a] If resistance is greater than 130 k Ω , replace the IMP Sensor. Refer to section 41.3.1.1.
 - [b] If resistance is less than 130 k Ω , go to step 3.
3. Measure the resistance between pins 1 and 2 of the sensor. See Figure 41-2.

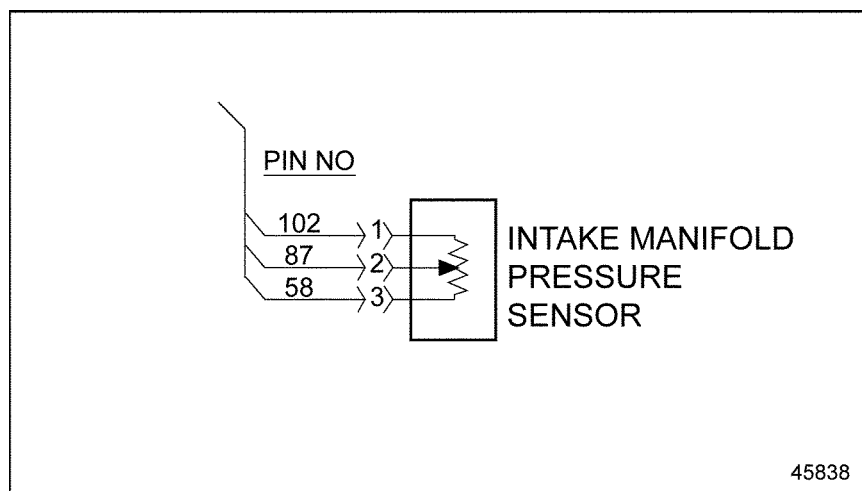


Figure 41-2 Intake Manifold Pressure Sensor

- [a] If resistance is greater than 130 k Ω , replace the IMP Sensor. Refer to section 41.3.1.1.
 - [b] If resistance is less than 130 k Ω , go to step 4.
4. Turn the ignition switch to the ON position.
5. Measure the voltage between pins 1 and 3 of the IMP 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 3 of the IMP Sensor 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 IMP Sensor harness connector and pin 105 of the 120-pin MCM connector. Refer to section 41.3.1.1.
 - [b] If the voltage is less than 4.5 volts, repair the open circuit between pin 3 of the IMP Sensor harness connector and pin 82 of the 120-pin MCM connector. Refer to section 41.3.1.1.
7. Turn the ignition OFF.
 8. Disconnect the 120-pin MCM connector.
 9. Measure the resistance between pins 1 and 3 of the IMP Sensor harness connector.
 - [a] If the resistance is greater than 5 Ω , go to step 10.
 - [b] If the resistance is less than 5 Ω , repair the short between pins 105 and 82 of the 120-pin MCM connector. Refer to section 41.3.1.1.
 10. Measure the resistance between pins 1 and 2 of the IMP 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 between pins 105 and 54 of the 120-pin MCM connector. Refer to section 41.3.1.1.
 11. Measure the resistance between pin 3 of the IMP Sensor harness connector and ground.
 - [a] If the resistance is greater than 5 Ω , go to step 12.
 - [b] If the resistance is less than 5 Ω , repair the short between pin 82 of the 120-pin MCM connector and ground. Refer to section 41.3.1.1.
 12. Measure the resistance between pin 2 of the IMP Sensor harness connector and ground.
 - [a] If the resistance is greater than 5 Ω , repair the open circuit between pin 2 of the IMP Sensor harness connector and pin 54 of the 120-pin MCM connector. Refer to section 41.3.1.1.
 - [b] If the resistance is less than 5 Ω , repair the short between pin 54 of the 120-pin MCM connector. Refer to section 41.3.1.1.

41.3.1.1 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 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).

42 SPN 3659 – INJECTOR #1 SPILL VALVE NOT OPERATING NORMALLY

Section	Page
42.1 SPN 3659/FMI 5	42-3
42.2 SPN 3659/FMI 10	42-6

42.1 SPN 3659/FMI 5

This diagnosis is typically the injector spill valve current is below normal or an open circuit fault.

42.1.1 Open Circuits with the Ignition OFF Check

Check as follows:

1. Check for multiple codes.
 - [a] If fault code 168/1 is active in addition to 3659/5, service 168/1 first. Refer to section 12.2.
 - [b] If fault 3660/5 and 3661/5 are active in addition to 3659/5, repair the open circuit in the harness between pin 11, 13, and 15 of the 120-pin MCM connector and terminal and pin 3 of injectors #1, #2, and #3 connector. Refer to section 42.1.3.1.
 - [c] If only fault code 3659/5 is active, go to step 2.
2. Turn the ignition OFF.
3. Disconnect the Injector Harness 23-pin connector.
4. Measure the resistance between pin O and pin M on the valve cover side of the connector.
 - [a] If the resistance is less than 3 Ω , refer to section 42.1.2.
 - [b] If the resistance is greater than 3 Ω , go to step 5.
5. Remove valve cover.
6. Disconnect injector #1 connector.
7. Measure the resistance between pin 3 of the injector connector and pin O of the injector harness 23-pin connector.
 - [a] If the resistance is greater than 3 Ω , repair the open between pin 3 of the injector connector and pin O of the injector harness 23-pin connector. Refer to section 42.1.3.1.
 - [b] If the resistance is less than 3 Ω , go to step 8.
8. Measure the resistance between pin 4 of the injector connector and pin M of the injector harness 23-pin connector.
 - [a] If the resistance is greater than 3 Ω , repair the open between pin 4 of the injector connector and pin M of the injector harness 23-pin connector. Refer to section 42.1.3.1.
 - [b] If the resistance is less than 3 Ω , refer to section 42.1.3.

42.1.2 Open Circuit with the Ignition ON Check

Check for an open circuit with the ignition ON as follows:

1. Turn the ignition ON (key On, engine OFF).
2. Measure the voltage between pin M and O on the engine side of the 23-pin connector.
 - [a] If the voltage is less than 11.5 volts, repair the open between pin M of the 23-pin connector and pin 14 of the MCM 120-pin connector (see Figure 42-1). Refer to section 42.1.3.1.

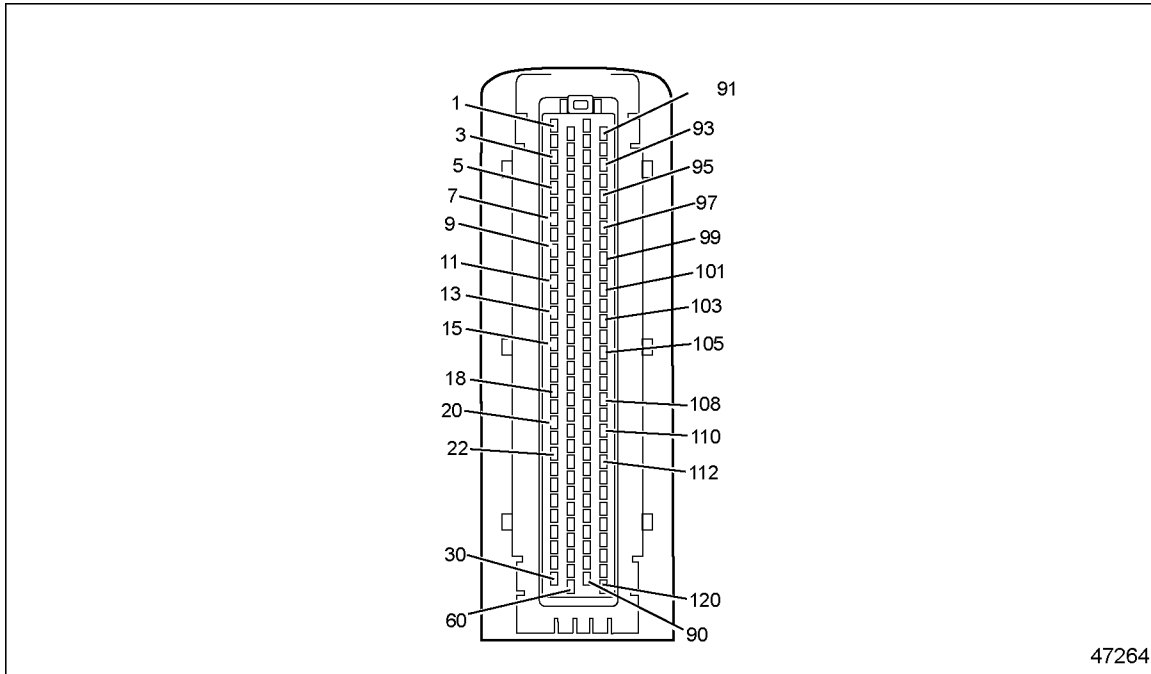


Figure 42-1 120-pin MCM Connector

- [b] If the voltage is between 11.5 and 13.5 volts, go to step 3.
3. Swap the injectors
 - [a] If fault code 3659/5 is not active after swapping injectors, replace the original injector. Refer to section 42.1.3.1.
 - [b] If fault code 3659/5 is still active after swapping injectors, contact Detroit Diesel Customer Support Center (313-592-5044).

42.1.3 Check the Injectors

Check the injectors as follows:

1. Check the resistance on pin 3 and pin 4 of injector #1.
 - [a] If the resistance is greater than 10 Ω , replace the injector. Refer to section 42.1.3.1.
 - [b] If the resistance is less than 10 Ω , go to step 2.
2. Swap the injectors
 - [a] If fault code 3659/5 is not active after swapping injectors, replace the original injector. Refer to section 42.1.3.1.
 - [b] If fault code 3659/5 is still active after swapping injectors, contact Detroit Diesel Customer Support Center (313-592-5044).

42.1.3.1 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 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).

42.2 SPN 3659/FMI 10

This diagnostic condition is typically a short to ground.

42.2.1 Short to Ground Check

Check for short to ground as follows:

1. Turn the ignition OFF.
2. Disconnect the Injector Harness 23-pin connector.
3. Measure the resistance between pin M and ground on the valve cover side of the connector.
 - [a] If the resistance is less than 5 Ω , repair the short to ground between pin M and pin 4 of the injector. Refer to section 42.2.1.1.
 - [b] If the resistance is greater than 5 Ω , go to step 5.
4. Disconnect the 120-pin MCM connector.
5. Measure the resistance between pin M and ground on the engine side of the connector.
 - [a] If the resistance is less than 5 Ω , repair the short to ground between Pin M and pin 14 of the MCM 120-pin connector. Refer to section 42.2.1.1.
 - [b] If the resistance is greater than 5 Ω , go to step 6.
6. Recheck the resistance using steps 3 through 5. When you have just completed the recheck, go to step 7.
7. Clear the codes. Check for active codes.
 - [a] If code 3659/10 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. Refer to section 42.2.1.1.

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 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).

43 SPN 3660 - INJECTOR #2 SPILL VALVE NOT OPERATING NORMALLY

Section	Page
43.1 SPN 3660/FMI 5	43-3
43.2 SPN 3660/FMI 10	43-5

43.1 SPN 3660/FMI 5

This diagnosis is typically the injector spill valve current is below normal or an open circuit fault.

43.1.1 Open Circuits with the Ignition OFF Check

Check as follows:

1. Check for multiple codes.
 - [a] If fault code 168/1 is active in addition to 3659/5, service 168/1 first. Refer to section 12.2.
 - [b] If fault 3659/5 and 3661/5 are active in addition to 3660/5, repair the open circuit in the harness between pin 11, 13, and 15 of the 120-pin MCM connector and terminal and pin 3 of injectors #1, #2, and #3 connector. Refer to section 43.1.3.1.
 - [c] If only fault code 3660/5 is active, go to step 2.
2. Turn the ignition OFF.
3. Disconnect the Injector Harness 23-pin connector.
4. Measure the resistance between pin O and pin P on the valve cover side of the connector.
 - [a] If the resistance is less than 3 Ω , refer to section 43.1.2.
 - [b] If the resistance is greater than 3 Ω , go to step 7.
5. Remove the valve cover.
6. Disconnect the #2 injector.
7. Measure the resistance between pin 3 of the injector connector and pin O of the injector harness 23-pin connector.
 - [a] If the resistance is greater than 3 Ω , repair the open between pin 3 of the injector connector and pin O of the injector harness 23-pin connector. Refer to section 43.1.3.1.
 - [b] If the resistance is less than 3 Ω , go to step 8.
8. Measure the resistance between pin 4 of the injector connector and pin P of the injector harness 23-pin connector.
 - [a] If the resistance is greater than 3 Ω , repair the open between pin 4 of the injector connector and pin P of the injector harness 23-pin connector. Refer to section 43.1.3.1.
 - [b] If the resistance is less than 3 Ω , refer to section 43.1.3.

43.1.2 Open Circuits with the Ignition ON Check

Check as follows:

1. Turn the ignition ON (key On, engine OFF).
2. Measure the voltage between pins P and O on the engine side of the 23-pin connector.
 - [a] If the voltage is less than 11.5 volts, repair the open between pin P of the 23-pin connector and pin 10 of the MCM 120-pin connector (see Figure 43-1) Refer to section 43.1.3.1.
 - [b] If the voltage is between 11.5 and 13.5 volts, go to step 3.

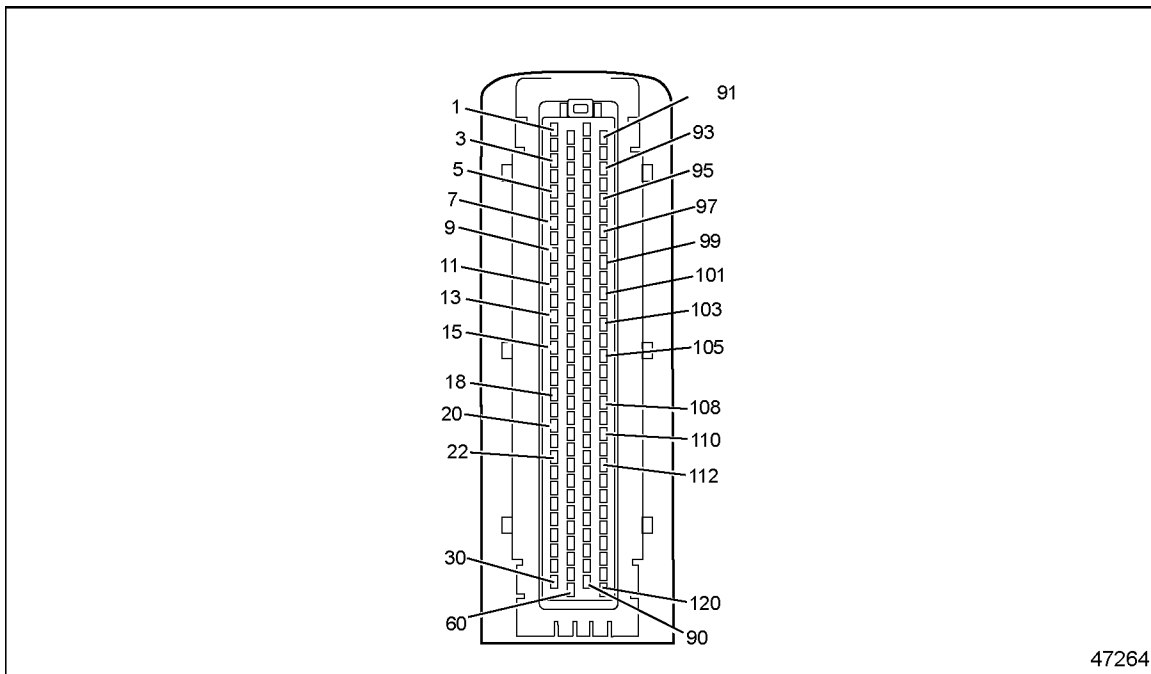


Figure 43-1 120-pin MCM Connector

3. Swap the injector.
 - [a] If fault code 3660/5 is not active after swapping the injector, replace the original injector. Refer to section 43.1.3.1.
 - [b] If fault code 3660/5 is still active after swapping the injector, call the Detroit Diesel Customer Service Center (313-592-5800).

43.1.3 Injector Check

Check the injectors as follows:

1. Check the resistance on pin 3 and pin 4 of injector #2.
 - [a] If the resistance is greater than 25 Ω , replace the injector. Refer to section 43.1.3.1.
 - [b] If the resistance is less than 25 Ω , go to step 2.
2. Swap the injectors
 - [a] If fault code 3660/5 is not active after swapping injectors, replace the original injector. Refer to section 43.1.3.1.
 - [b] If fault code 3660/5 is still active after swapping injectors, contact Detroit Diesel Customer Support Center (313-592-5044).

43.1.3.1 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).

43.2 SPN 3660/FMI 10

This diagnostic condition is typically a short to ground.

43.2.1 Short to Ground Check

Check for short to ground as follows:

1. Turn the ignition OFF.
2. Disconnect the Injector Harness 23-pin connector.
3. Measure the resistance between pin P and ground on the valve cover side of the connector.
 - [a] If the resistance is less than 5 Ω , repair the short to ground between pin P and pin 4 of the injector. Refer to section 43.2.1.1.
 - [b] If the resistance is greater than 5 Ω , go to step 4.
4. Disconnect the MCM 120-pin connector.

5. Measure the resistance between pin P and ground on the engine side of the connector.
 - [a] If the resistance is less than 5 Ω , repair the short to ground between Pin P and pin 10 of the MCM 120-pin connector. Refer to section 43.2.1.1.
 - [b] If the resistance is greater than 5 Ω , go to step 6.
6. Recheck the resistance using steps 3 through 5. When you have completed the recheck, go to step 7.
7. Clear the codes. Check for active codes.
 - [a] If code 3660/10 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. Refer to section 43.2.1.1.

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 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).

44 SPN 3661 - INJECTOR #3 SPILL VALVE NOT OPERATING NORMALLY

Section	Page
44.1 SPN 3661/FMI 5	44-3
44.2 SPN 3661/FMI 10	44-5

44.1 SPN 3661/FMI 5

This diagnosis is typically the injector spill valve current is below normal or an open circuit fault.

44.1.1 Open Circuit with the Ignition OFF Check

Check as follows:

1. Check for multiple codes.
 - [a] If fault code 168/1 is active in addition to 3661/5, service 168/1 first. Refer to section 12.2.
 - [b] If fault 3659/5 and 3660/5 are active in addition to 3661/5, repair the open circuit in the harness between pin 11, 13, and 15 of the 120-pin MCM connector and terminal and pin 3 of injectors #1, #2, and #3 connector. Refer to section 44.1.3.1.
 - [c] If only fault code 3661/5 is active, go to step 2.
2. Turn the ignition OFF.
3. Disconnect the Injector Harness 23-pin connector.
4. Measure the resistance between pin O and pin N on the valve cover side of the connector.
 - [a] If the resistance is less than 3 Ω , refer to section 44.1.2.
 - [b] If the resistance is greater than 3 Ω , go to step 5.
5. Remove valve cover.
6. Disconnect injector #3 connector.
7. Measure the resistance between pin 3 of the injector connector and pin O of the injector harness 23-pin connector.
 - [a] If the resistance is greater than 3 Ω , repair the open between pin 3 of the injector connector and pin O of the injector harness 23-pin connector. Refer to section 44.1.3.1.
 - [b] If the resistance is less than 3 Ω , go to step 8.
8. Measure the resistance between pin 4 of the injector connector and pin N of the injector harness 23-pin connector.
 - [a] If the resistance is greater than 3 Ω , repair the open between pin 4 of the injector connector and pin M of the injector harness 23-pin connector. Refer to section 44.1.3.1.
 - [b] If the resistance is less than 3 Ω , refer to section 44.1.3.

44.1.2 Open Circuit with the Ignition ON Check

Check as follows:

1. Turn the ignition ON (key On, engine OFF).
2. Measure the voltage between pins N and O on the engine side of the 23-pin connector.
 - [a] If the voltage is less than 11.5 volts, repair the open between pin N of the 23-pin connector and pin 12 of the MCM 120-pin connector (see Figure 44-1) . Refer to section 44.1.3.1.
 - [b] If the voltage is between 11.5 and 13.5 volts, go to step 3.

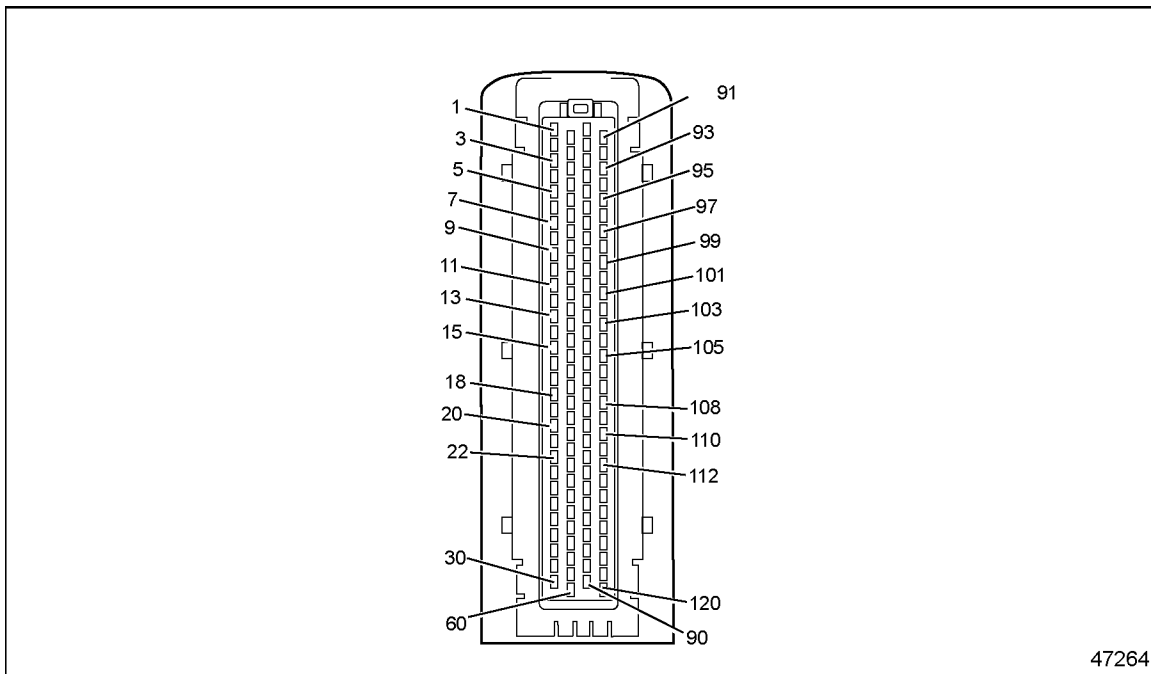


Figure 44-1 120-pin MCM Connector

3. Swap the injector.
 - [a] If fault code 3661/5 is not active after swapping the injector, replace the original injector. Refer to section 44.1.3.1.
 - [b] If fault code 3661/5 is still active after swapping the injector, call the Detroit Diesel Customer Service Center (313-592-5800).

44.1.3 Injector Check

Check the injectors as follows:

1. Check the resistance on pin 3 and pin 4 of injector #3.
 - [a] If the resistance is greater than 25 k Ω , replace the injector. Refer to section 44.1.3.1.
 - [b] If the resistance is less than 25 k Ω , go to step 2.
2. Swap the injectors
 - [a] If fault code 3661/5 is not active after swapping injectors, replace the original injector. Refer to section 44.1.3.1.
 - [b] If fault code 3661/5 is still active after swapping injectors, contact Detroit Diesel Customer Support Center (313-592-5044).

44.1.3.1 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).

44.2 SPN 3661/FMI 10

This diagnostic condition is typically a short to ground.

44.2.1 Short to Ground Check

Check for short to ground as follows:

1. Turn the ignition OFF.
2. Disconnect the Injector Harness 23-pin connector.
3. Measure the resistance between pin N and ground on the valve cover side of the connector.
 - [a] If the resistance is less than 5 Ω , repair the short to ground between pin N and pin 4 of the injector. Refer to section 44.2.1.1.
 - [b] If the resistance is greater than 5 Ω , go to step 4.
4. Disconnect the MCM 120-pin connector.

5. Measure the resistance between pin N and ground on the engine side of the connector.
 - [a] If the resistance is less than 5 Ω , repair the short to ground between Pin N and pin 12 of the MCM 120-pin connector. Refer to section 44.2.1.1.
 - [b] If the resistance is greater than 5 Ω , go to step 6.
6. Recheck the resistance using steps 3 through 5. When you have just completed the recheck, go to step 7.
7. Clear the codes. Check for active codes.
 - [a] If code 3661/10 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. Refer to section 44.2.1.1.

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 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).

45 SPN 3662 - INJECTOR #4 SPILL VALVE NOT OPERATING NORMALLY

Section	Page
45.1 SPN 3662/FMI 5	45-3
45.2 SPN 3662/FMI 10	45-5

45.1 SPN 3662/FMI 5

This diagnosis is typically the injector spill valve current is below normal or an open circuit fault.

45.1.1 Open Circuit with the Ignition OFF Check

Check as follows:

1. Check for multiple codes.
 - [a] If fault code 168/1 is active in addition to 3662/5, service 168/1 first. Refer to section 12.2.
 - [b] If fault 3663/5 and 3664/5 are active in addition to 3662/5, repair the open circuit in the harness between pin 5, 7, and 9 of the 120-pin MCM connector and terminal and pin 3 of injectors #4, #5, and #6 connector. Refer to section 45.1.2.
 - [c] If only fault code 3662/5 is active, go to step 2.
2. Turn the ignition OFF.
3. Disconnect the Injector Harness 23-pin connector.
4. Measure the resistance between pin S and pin T on the valve cover side of the connector.
 - [a] If the resistance is less than 3 Ω , refer to section 45.1.2.
 - [b] If the resistance is greater than 3 Ω , go to step 5.
5. Remove valve cover.
6. Disconnect injector #4 connector.
7. Measure the resistance between pin 3 of the injector connector and pin S of the injector harness 23-pin connector.
 - [a] If the resistance is greater than 3 Ω , repair the open between pin 3 of the injector connector and pin S of the injector harness 23-pin connector. Refer to section 45.1.3.1.
 - [b] If the resistance is less than 3 Ω , go to step 8.
8. Measure the resistance between pin 4 of the injector connector and pin T of the injector harness 23-pin connector.
 - [a] If the resistance is greater than 3 Ω , repair the open between pin 4 of the injector connector and pin T of the injector harness 23-pin connector. Refer to section 45.1.3.1.
 - [b] If the resistance is less than 3 Ω , refer to section 45.1.3.

45.1.2 Open Circuit with the Ignition ON Check

Check as follows:

1. Turn the ignition ON (key On, engine OFF).
2. Measure the voltage between pins T and S on the engine side of the 23-pin connector.
 - [a] If the voltage is less than 11.5 volts, repair the open between pin T of the 23-pin connector and pin 4 of the MCM 120-pin connector (see Figure 45-1). Refer to section 45.1.3.1.

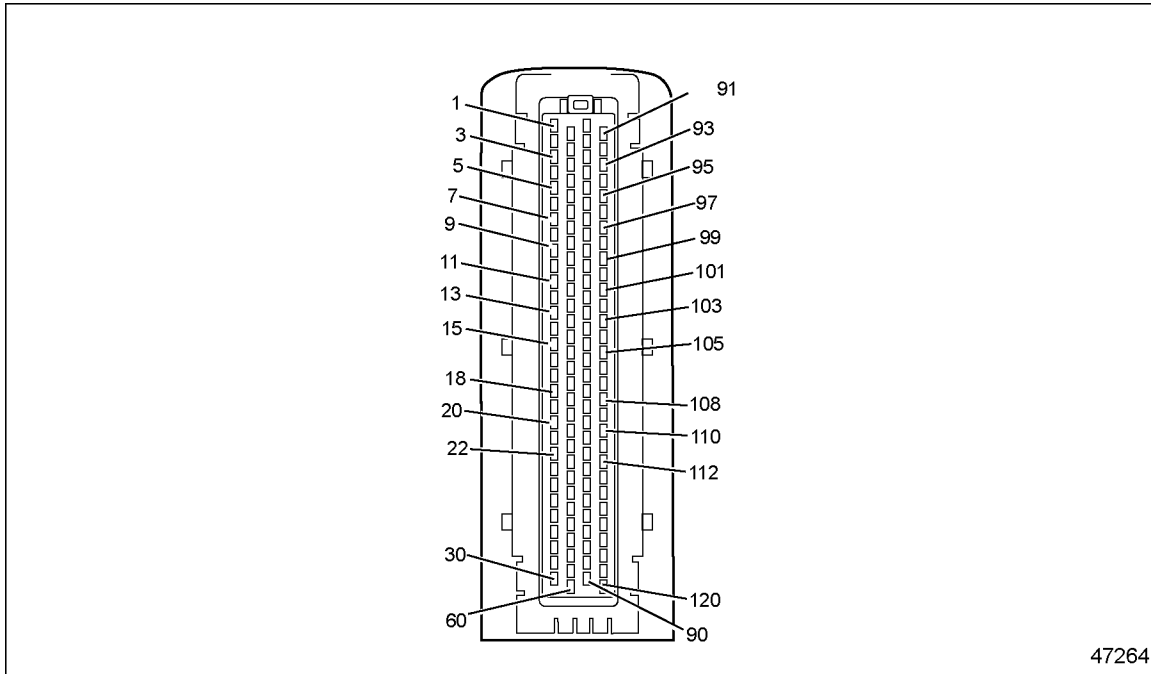


Figure 45-1 120-pin MCM Connector

- [b] If the voltage is between 11.5 and 13.5 volts, go to step 3.
3. Swap the injector
 - [a] If fault code 3662/5 is not active after swapping the injector, replace the original injector. Refer to section 45.1.3.1.
 - [b] If fault code 3662/5 is still active after swapping the injector, call the Detroit Diesel Customer Service Center (313-592-5800).

45.1.3 Injector Check

Check the injectors as follows:

1. Check the resistance on pin 3 and pin 4 of injector #4.
 - [a] If the resistance is greater than 25 Ω , replace the injector. Refer to section 45.1.3.1.
 - [b] If the resistance is less than 25 Ω , go to step 2.
2. Swap the injectors
 - [a] If fault code 3662/5 is not active after swapping injectors, replace the original injector. Refer to section 45.1.3.1.
 - [b] If fault code 3662/5 is still active after swapping injectors, contact Detroit Diesel Customer Support Center (313-592-5044).

45.1.3.1 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).

45.2 SPN 3662/FMI 10

This diagnostic condition is typically a short to ground.

45.2.1 Short to Ground Check

Check for short to ground as follows:

1. Turn the ignition OFF.
2. Disconnect the Injector Harness 23-pin connector.
3. Measure the resistance between pin T and ground on the valve cover side of the connector.
 - [a] If the resistance is less than 5 Ω , repair the short to ground between pin T and pin 3 of the injector. Refer to section 45.2.1.1.
 - [b] If the resistance is greater than 5 Ω , go to step 4.
4. Measure the resistance between pin T and ground on the engine side of the connector.

- [a] If the resistance is less than 5 Ω , repair the short to ground between Pin T and pin 4 of the MCM 120-pin connector. Refer to section 45.2.1.1.
 - [b] If the resistance is greater than 5 Ω , go to step 5.
5. Recheck the resistance using steps 3 through 4. When you have just completed the recheck, go to step 6.
 6. Clear the codes. Check for active codes.
 - [a] If code 3662/10 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. Refer to section 45.2.1.1.

45.2.1.1 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).

46 SPN 3663 - INJECTOR #5 SPILL VALVE NOT OPERATING NORMALLY

Section	Page
46.1 SPN 3663/FMI 5	46-3
46.2 SPN 3663/FMI 10	46-6

46.1 SPN 3663/FMI 5

This diagnosis is typically the injector spill valve current is below normal or an open circuit fault.

46.1.1 Open Circuit with the Ignition OFF Check

Check as follows:

1. Check for multiple codes.
 - [a] If fault code 168/1 is active in addition to 3662/5, service 168/1 first. Refer to section 12.2.
 - [b] If fault 3662/5 and 3664/5 are active in addition to 3663/5, repair the open circuit in the harness between pin 5, 7, and 9 of the 120-pin MCM connector and terminal and pin 3 of injectors #4, #5, and #6 connector. Refer to section 46.1.3.1.
 - [c] If only fault code 3663/5 is active, go to step 2.
2. Turn the ignition OFF.
3. Disconnect the Injector Harness 23-pin connector.
4. Measure the resistance between pin S and pin Q on the valve cover side of the connector.
 - [a] If the resistance is less than 3 Ω , refer to section 46.1.2.
 - [b] If the resistance is greater than 3 Ω , go to step 5.
5. Remove valve cover.
6. Disconnect injector #5 connector.
7. Measure the resistance between pin 3 of the injector connector and pin S of the injector harness 23-pin connector.
 - [a] If the resistance is greater than 3 Ω , repair the open between pin 3 of the injector connector and pin S of the injector harness 23-pin connector. Refer to section 46.1.3.1.
 - [b] If the resistance is less than 3 Ω , go to step 8.
8. Measure the resistance between pin 4 of the injector connector and pin Q of the injector harness 23-pin connector.
 - [a] If the resistance is greater than 3 Ω , repair the open between pin 4 of the injector connector and pin Q of the injector harness 23-pin connector. Refer to section 46.1.3.1.
 - [b] If the resistance is less than 3 Ω , refer to section 46.1.3.

46.1.2 Open Circuit with the Ignition ON Check

Check for an open circuit with the ignition ON as follows:

1. Turn the ignition ON (key On, engine OFF).
2. Measure the voltage between pins Q and S on the engine side of the 23-pin connector.
 - [a] If the voltage is less than 11.5 volts, repair the open between pin Q of the 23-pin connector and pin 8 of the MCM 120-pin connector (see Figure 46-1). Refer to section 46.1.3.1.

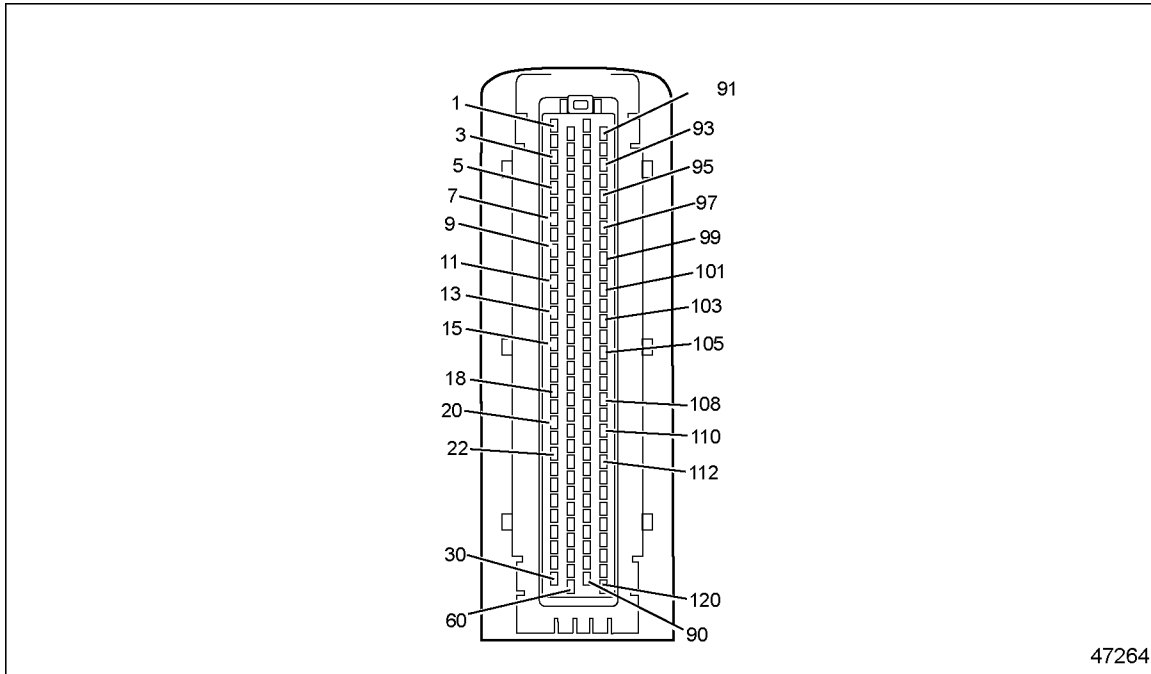


Figure 46-1 120-pin MCM Connector

- [b] If the voltage is between 11.5 and 13.5 volts, go to step 3.
3. Swap the injector.
 - [a] If fault code 3663/5 is not active after swapping the injector, replace the original injector. Refer to section 46.1.3.1.
 - [b] If fault code 3663/5 is still active after swapping the injector, call the Detroit Diesel Customer Service Center (313-592-5800).

46.1.3 Injector Check

Check the injectors as follows:

1. Check the resistance on pin 3 and pin 4 of injector #5.
 - [a] If the resistance is greater than 25 Ω , replace the injector. Refer to section 46.1.3.1.
 - [b] If the resistance is less than 25 Ω , go to step 2.
2. Swap the injectors
 - [a] If fault code 3663/5 is not active after swapping injectors, replace the original injector. Refer to section 46.1.3.1.
 - [b] If fault code 3663/5 is still active after swapping injectors, contact Detroit Diesel Customer Support Center (313-592-5044).

46.1.3.1 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).

46.2 SPN 3663/FMI 10

This diagnostic condition is typically a short to ground.

46.2.1 Short to Ground Check

Check as follows:

1. Turn the ignition OFF.
2. Disconnect the Injector Harness 23-pin connector.
3. Measure the resistance between pin Q and ground on the valve cover side of the connector.
 - [a] If the resistance is less than 5 Ω , repair the short to ground between pin Q and pin 4 of the injector. Refer to section 46.2.1.1.
 - [b] If the resistance is greater than 5 Ω , go to step 4.
4. Disconnect the MCM 120-pin connector.
5. Measure the resistance between pin Q and ground on the engine side of the connector.
 - [a] If the resistance is less than 5 Ω , repair the short to ground between Pin Q and pin 8 of the MCM 120-pin connector. Refer to section 46.2.1.1.
 - [b] If the resistance is greater than 5 Ω , go to step 6.
6. Recheck the resistance using steps 3 through 5. When you have just completed the recheck, go to step 7.
7. Clear the codes. Check for active codes.
 - [a] If code 3663/10 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. Refer to section 46.2.1.1.

46.2.1.1 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).

47 SPN 3664 - INJECTOR #6 SPILL VALVE NOT OPERATING NORMALLY

Section	Page
47.1 SPN 3664/FMI 5	47-3
47.2 SPN 3664/FMI 10	47-6

47.1 SPN 3664/FMI 5

This diagnosis is typically the injector spill valve current is below normal or an open circuit fault.

47.1.1 Open Circuit with the Ignition OFF Check

Check as follows:

1. Check for multiple codes.
 - [a] If fault code 168/1 is active in addition to 3662/5, service 168/1 first. Refer to section 12.2.
 - [b] If fault 3662/5 and 3663/5 are active in addition to 3664/5, repair the open circuit in the harness between pin 5, 7, and 9 of the 120-pin MCM connector and terminal and pin 3 of injectors #4, #5, and #6 connector. Refer to section 47.1.3.1.
 - [c] If only fault code 3664/5 is active, go to step 2.
2. Turn the ignition OFF.
3. Disconnect the Injector Harness 23-pin connector.
4. Measure the resistance between pin S and pin R on the valve cover side of the connector.
 - [a] If the resistance is less than 3 Ω , refer to section 47.1.2.
 - [b] If the resistance is greater than 3 Ω , go to step 5.
5. Measure the resistance between pin 3 of the injector connector and pin S of the injector harness 23-pin connector.
 - [a] If the resistance is greater than 3 Ω , repair the open between pin 3 of the injector connector and pin S of the injector harness 23-pin connector. Refer to section 47.1.3.1.
 - [b] If the resistance is less than 3 Ω , go to step 6.
6. Measure the resistance between pin 4 of the injector connector and pin R of the injector harness 23-pin connector.
 - [a] If the resistance is greater than 3 Ω , repair the open between pin 4 of the injector connector and pin R of the injector harness 23-pin connector. Refer to section 47.1.3.1.
 - [b] If the resistance is less than 3 Ω , refer to section 47.1.3.

47.1.2 Open Circuit with the Ignition ON Check

Check as follows:

1. Turn the ignition ON (key On, engine OFF).
2. Measure the voltage between pins R and S on the engine side of the 23-pin connector.

- [a] If the voltage is less than 11.5 volts, repair the open between pin R of the 23-pin connector and pin 6 of the 120-pin MCM connector (see Figure 47-1). Refer to section 47.1.3.1.

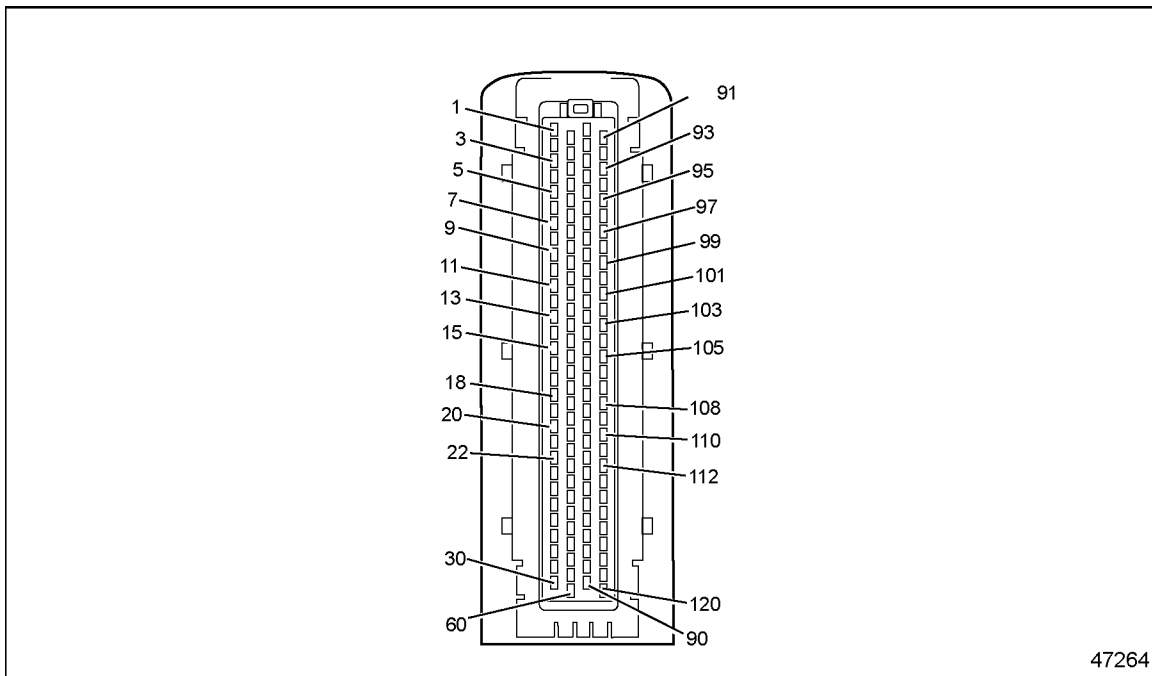


Figure 47-1 120-pin MCM Connector

- [b] If the voltage is between 11.5 and 13.5 volts, go to step 3.
3. Swap the injector.
- [a] If fault code 3664/5 is not active after swapping the injector, replace the original injector. Refer to section 47.1.3.1.
- [b] If fault code 3664/5 is still active after swapping the injector, call the Detroit Diesel Customer Service Center (313-592-5800).

47.1.3 Injector Check

Check the injectors as follows:

1. Check the resistance on pin 3 and pin 4 of injector #6.
 - [a] If the resistance is greater than 25 k Ω , replace the injector. Refer to section 47.1.3.1.
 - [b] If the resistance is less than 25 k Ω , go to step 2.
2. Swap the injectors
 - [a] If fault code 3664/5 is not active after swapping injectors, replace the original injector. Refer to section 47.1.3.1.
 - [b] If fault code 3664/5 is still active after swapping injectors, contact Detroit Diesel Customer Support Center (313-592-5044).

47.1.3.1 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).

47.2 SPN 3664/FMI 10

This diagnostic condition is typically a short to ground.

47.2.1 Short to Ground Check

Check for short to ground as follows:

1. Turn the ignition OFF.
2. Disconnect the Injector Harness 23-pin connector.
3. Measure the resistance between pin R and ground on the valve cover side of the connector.
 - [a] If the resistance is less than 5 Ω , repair the short to ground between pin R and pin 3 of the injector. Refer to section 47.2.1.1.
 - [b] If the resistance is greater than 5 Ω , go to step 4.
4. Disconnect the MCM 120-pin connector.
5. Measure the resistance between pin R and ground on the engine side of the connector.
 - [a] If the resistance is less than 5 Ω , repair the short to ground between Pin R and pin 6 of the MCM 120-pin connector. Refer to section 47.2.1.1.
 - [b] If the resistance is greater than 5 Ω , go to step 6.
6. Recheck the resistance using steps 3 through 5. When you have just completed the recheck, go to step 7.
7. Clear the codes. Check for active codes.
 - [a] If code 3664/10 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. Refer to section 47.2.1.1.

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 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).

48 CPC DIGITAL OUTPUTS SPN/FMI

Section	Page
48.1 CPC DIGITAL OUTPUT FAULT CODES	48-3
48.2 TROUBLESHOOTING THE CPC DIGITAL OUTPUTS	48-3

48.1 CPC DIGITAL OUTPUT FAULT CODES

These CPC digital outputs have the same SPN as some MCM faults. DDDL 7.0 makes the distinction between the MCM and CPC when diagnosing a fault.

48.2 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 48-1.

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 13 of 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.

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 48-1 CPC Digital Output Faults

INDEX

C

Common Powertrain Controller (CPC), 2-13

Connectors, 2-21

Environmental conditions, 2-15

Vehicle Interface Harness (VIH), 2-16

Conduit and Loom, 2-39

Criteria, 2-39

Connectors

CPC connectors, 2-21

Deutsch connector, 2-23

D

DDEC VI System--How It Works, 2-3

Harnesses, 2-3

Deutsch Connectors, 2-26

Deutsch Terminals

Installation, 2-26

Removal, 2-28

G

Guide Scope and Use, 1-4

Electronic Troubleshooting, 1-5

Mechanical Troubleshooting, 1-4

M

Motor Control Module (MCM), 2-4

120-pin connector, Series 60, 2-5–2-8

21-pin connector, 2-10

31-pin connector, 2-11

Connector Brackets, 2-9

Engine Harness, 2-4

S

Safety Precautions, 1-6

Batteries, 1-12

Cleaning Agent, 1-13

- Diagnostic Equipment, 1-13
- Ether Start, 1-7
- Exhaust (Start/Run Engine), 1-8
- Fire, 1-13
- Fluoroelastomer, 1-15
- Fuel, 1-11
- Glasses, 1-8
- Optimized Idle, 1-15
- Pressurized Fluids, 1-10
- Welding, 1-9
- Working on a Running Engine, 1-14
- Sensors, 2-41
 - Factory-installed Sensors, 2-42
 - OEM-installed Sensors, 2-44
- SPN 100/FMI 1, 7-3
 - Check Low Oil Pressure, 7-3
- SPN 100/FMI 14, 7-9
 - Check for Multiple Codes, 7-9
- SPN 100/FMI 2, 7-4
 - Check for Erratic Data From the Engine Oil Pressure Sensor, 7-4
- SPN 100/FMI 3, 7-5
 - Check, 7-5
- SPN 100/FMI 4, 7-7
 - Check for Open, 7-7
- SPN 103/FMI 0, 8-3
 - Check Equipment, 8-3
- SPN 103/FMI 1, 8-4
 - Check Equipment, 8-4
- SPN 103/FMI 3, 8-5
 - Check for Open, 8-5
 - Resistance and Voltage Check, 8-6
- SPN 103/FMI 4, 8-7
 - Check for Short, 8-7
 - Resistance Check, 8-7
- SPN 103/FMI 7, 8-8
 - Adjust the Turbo Speed Sensor Air Gap, 8-9

- Check the Turbo Speed Sensor, 8-9
- SPN 110/FMI 0, 9-3
 - System Checks to Resolve Fault, 9-3
- SPN 110/FMI 14, 9-9
 - Check for Multiple Codes, 9-9
 - System Checks to Resolve Fault, 9-9
- SPN 110/FMI 2, 9-3
 - Rationality Check, 9-4
- SPN 110/FMI 3, 9-4
 - Check for Multiple Codes, 9-5
 - Check for Open Circuit, 9-5
- SPN 110/FMI 4, 9-7
 - Check for Short to Ground, 9-7
- SPN 111/FMI 1, 10-3
 - Check, 10-4
 - Check Coolant Level Sensor, 10-3
- SPN 111/FMI 3, 10-5
 - Check for Open Circuit, 10-5
- SPN 111/FMI 4, 10-7
 - Check for Short to Ground, 10-7
- SPN 1172/FMI 3, 36-3
 - Check for Open, 36-3
 - Resistance and Voltage Check, 36-4
- SPN 1172/FMI 4, 36-5
 - Check for Short, 36-5
- SPN 158/FMI 0, 11-3
 - Check for Battery High Voltage, 11-3
- SPN 158/FMI 1, 11-4
 - Check for Battery Voltage Switched – Low, 11-4
- SPN 158/FMI 2, 11-6
 - Check MCM and CPC Signals, 11-6
- SPN 1636 /FMI 2, 37-3
 - Check for Erratic Data Source, 37-3
- SPN 1636 /FMI 3, 37-4
 - Check Intake Air Temperature Sensor, 37-4

- Resistance and Voltage Check, 37-5
- SPN 1636 /FMI 4, 37-6
 - Check for Intake Air Temperature Sensor Short to Ground, 37-6
- SPN 1636/FMI 14, 37-7
 - Check the Temperature, 37-7
- SPN 168/FMI 0, 12-3
 - Measure Battery Voltage, 12-3
- SPN 168/FMI 1, 12-4
 - Check the Alternator and the Battery, 12-4
 - Measure the Resistance, 12-4
- SPN 174/FMI 3, 13-3
 - Check for Open Circuit, 13-3
- SPN 174/FMI 4, 13-5
 - Check for Short to Ground, 13-5
- SPN 175/FMI 2, 14-3
 - Rationality Check, 14-3
- SPN 175/FMI 3, 14-4
 - Check for Open Circuit, 14-4
- SPN 175/FMI 4, 14-6
 - Check for Short to Ground, 14-6
- SPN 2629/FMI 3, 38-3
 - Check for Open, 38-3
- SPN 2629/FMI 4, 38-5
 - Short Circuit Check, 38-5
- SPN 27/FMI 0/1/2/14, 3-5
 - Check Valve Function, 3-5
- SPN 27/FMI 3, 3-3
 - Check for a Short, 3-3
- SPN 27/FMI 4, 3-4
 - Check for Short, 3-4
- SPN 2791/FMI 3, 39-3
 - Check for Short, 39-3
 - Resistance and Voltage Check, 39-3
- SPN 2791/FMI 4, 39-5
 - Check for Short, 39-5

- Resistance and Voltage Check, 39-5
- SPN 2791/FMI 5, 39-6
 - Check for Open, 39-6
- SPN 3510/FMI 2, 40-3
 - Check for Erratic Data, 40-3
- SPN 3510/FMI 3, 40-5
 - Check for High Voltage, 40-5
- SPN 3510/FMI 4, 40-6
 - Check for Low Voltage, 40-6
- SPN 3563/FMI 0/1/2, 41-3
 - Check for Erratic Data, 41-3
 - Check Low (Boost) Pressure, 41-3
- SPN 3563/FMI 3, 41-6
 - Check for a Short Circuit, 41-6
- SPN 3563/FMI 4, 41-7
 - Check for Open, 41-7
- SPN 3659/FMI 10, 42-6
 - Check for Short to Ground, 42-6
- SPN 3659/FMI 5, 42-3
 - Check for Open Circuit with the Ignition ON, 42-4
 - Check for Open Circuits, 42-3
 - Check the Injectors, 42-5
- SPN 3660/FMI 10, 43-5
 - Check for Short to Ground, 43-5
- SPN 3660/FMI 5, 43-3
 - Check for Open Circuits with the Ignition OFF, 43-3
 - Check for Open Circuits with the Ignition ON, 43-4
 - Check the Injectors, 43-5
- SPN 3661/FMI 10, 44-5
 - Check for Short to Ground, 44-5
- SPN 3661/FMI 5, 44-3
 - Check for Open Circuits with the Ignition OFF, 44-3
 - Check for Open Circuits with the Ignition ON, 44-4
 - Check the Injectors, 44-5
- SPN 3662/FMI 10, 45-5

- Check for Short to Ground, 45-5
- SPN 3662/FMI 5, 45-3
 - Check for Open Circuits with the Ignition OFF, 45-3
 - Check for Open Circuits with the Ignition ON, 45-4
 - Check the Injectors, 45-5
- SPN 3663/FMI 10, 46-6
 - Check for Short to Ground, 46-6
- SPN 3663/FMI 5, 46-3
 - Check for Open Circuits with the Ignition OFF, 46-3
 - Check for Open Circuits with the Ignition ON, 46-4
 - Check the Injectors, 46-5
- SPN 3664/FMI 10, 47-6
 - Check for Short to Ground, 47-6
- SPN 3664/FMI 5, 47-3
 - Check for Open Circuits with the Ignition OFF, 47-3
 - Check for Open Circuits with the Ignition ON, 47-3
 - Check the Injectors, 47-5
- SPN 411/FMI 0, 15-3
 - Check EGR Components, 15-3
- SPN 411/FMI 1, 15-4
 - Check EGR Components, 15-4
- SPN 411/FMI 3, 15-5
 - Check for Open Circuit, 15-5
- SPN 411/FMI 4, 15-7
 - Check for Short, 15-7
- SPN 412/FMI 3, 16-3
 - Check for Open, 16-3
- SPN 412/FMI 4, 16-5
 - Check for Short, 16-5
- SPN 558/FMI 1
 - Check IVS Wiring, 17-3
- SPN 558/FMI 3, 17-3
 - Check for Open, 17-3
- SPN 558/FMI 4, 17-5
 - Check for Short to Ground, 17-5

- SPN 599/FMI 12, 18-3
 - Check for Short, 18-3
- SPN 601/FMI 12, 19-3
 - Check for Short, 19-3
- SPN 609/FMI 12, 20-3
 - Check MCM Parameters, 20-3
- SPN 609/FMI 14, 20-4
 - Check MCM, 20-4
- SPN 625/FMI 2,9,10,13,14, 21-3
 - Check the Data Link, 21-3
- SPN 625/FMI 4, 21-5
 - Check for Short, 21-5
- SPN 636/FMI 1, 22-3
 - Check Low Signal Voltage, 22-3
- SPN 636/FMI 3, 22-4
 - Check Crankshaft Position Sensor Gap, 22-5
 - Check for Open Circuit, 22-4
- SPN 636/FMI 4, 22-6
 - Check for Short to Ground, 22-6
- SPN 636/FMI 7, 22-7
 - Check for Camshaft and Crankshaft Signals Not Matching, 22-7
- SPN 636/FMI 8, 22-9
 - Check Sensor Time Out, 22-9
- SPN 651/FMI 10, 23-6
 - Check for Short to Ground, 23-6
- SPN 651/FMI 5, 23-3
 - Check for Open Circuit with the Ignition ON, 23-4
 - Check for Open Circuits with the Ignition OFF, 23-3
 - Check the Injectors, 23-5
- SPN 652/FMI 10, 24-6
 - Check for Short to Ground, 24-6
- SPN 652/FMI 5, 24-3
 - Check for Open Circuits with the Ignition OFF, 24-3
 - Check for Open Circuits with the Ignition ON, 24-4
 - Check the Injectors, 24-5

SPN 653/FMI 10, 25-6

Check for Short to Ground, 25-6

SPN 653/FMI 5, 25-3

Check for Open Circuit with the Ignition ON, 25-4

Check for Open Circuits with the Ignition OFF, 25-3

Check the Injectors, 25-5

SPN 654/FMI 5, 26-3

Check for Open Circuit with the Ignition ON, 26-4

Check for Open Circuits with the Ignition OFF, 26-3

Check the Injectors, 26-5

SPN 654/FMI 6, 26-6

Check for Short to Ground, 26-6

SPN 655/FMI 10, 27-6

Check for Short to Ground, 27-6

SPN 655/FMI 5, 27-3

Check for Open Circuit with the Ignition ON, 27-4

Check for Open Circuits with the Ignition OFF, 27-3

Check the Injectors, 27-5

SPN 656/FMI 10, 28-6

Check for Short to Ground, 28-6

SPN 656/FMI 5, 28-3

Check for Open Circuit with the Ignition ON, 28-4

Check for Open Circuits with the Ignition OFF, 28-3

Check the Injectors, 28-5

SPN 701/FMI 3, 29-3

Check for Short to Power, 29-3

Resistance and Voltage Check, 29-3

SPN 701/FMI 4, 29-5

Check for Short to Ground, 29-5

Resistance Check, 29-5

SPN 701/FMI 5, 29-6

Check for Open, 29-6

SPN 704/FMI 3, 30-3

Check for Short to Power, 30-3

SPN 704/FMI 4, 30-4

Check for Short, 30-4

SPN 704/FMI 5, 30-5

Check for Open Circuit, 30-5

SPN 706/FMI 3, 31-3

Check for Short to Power, 31-3

Resistance and Voltage Check, 31-3

SPN 706/FMI 4, 31-5

Check for Short to Ground, 31-5

Resistance Check, 31-5

SPN 706/FMI 5, 31-6

Check for Open, 31-6

SPN 709/FMI 3, 32-3

Check for Short to Power, 32-3

Voltage Check, 32-3

SPN 709/FMI 4, 32-5

Check for Short to Ground, 32-5

SPN 709/FMI 5, 32-6

Check for Open, 32-6

SPN 714/FMI 3, 33-3

Check for Short to Power, 33-3

SPN 714/FMI 4, 33-4

Check for Short, 33-4

SPN 714/FMI 5, 33-5

Check for Open, 33-5

SPN 723/FMI 14, 34-7

Check for Pins Swapped, 34-7

SPN 723/FMI 3, 34-3

Check for Open Circuit, 34-3

SPN 723/FMI 4, 34-5

Check for Short to Ground, 34-5

SPN 723/FMI 8, 34-6

Check for Time Out, 34-6

Check the Camshaft Position Sensor, 34-7

SPN 84/FMI 3, 4-3

Check for Open, 4-3

SPN 84/FMI 4, 4-4

Check for Short, 4-4

SPN 86/FMI 14, 5-3

SPN 91/FMI 2, 6-3

Check for Erratic Data, 6-3

SPN 91/FMI 3, 6-4

Check for High Voltage, 6-4

SPN 91/FMI 4, 6-5

Check for Low Voltage, 6-5

SPN 975/FMI 3, 35-3

Check for Short to Power, 35-3

Voltage Check, 35-3

SPN 975/FMI 4, 35-5

Check for Short to Ground, 35-5

SPN 975/FMI 5, 35-6

Check for Open, 35-6

T

Tape and Taping, 2-40

Tape Criteria, 2-40

Taping Criteria, 2-40

Terminal Installation

Deutsch connectors, 2-26

Terminal Removal

Deutsch terminals, 2-28

W

Wires

Recommendations, 2-25

Requirements, 2-25