

# Troubleshooting Guide

**DDEC® VI  
MBE900**

**DETROIT DIESEL**  
**CORPORATION**



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


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**CALIFORNIA  
Proposition 65 Warning**

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

## ENGINE EXHAUST

Consider the following before servicing engines:

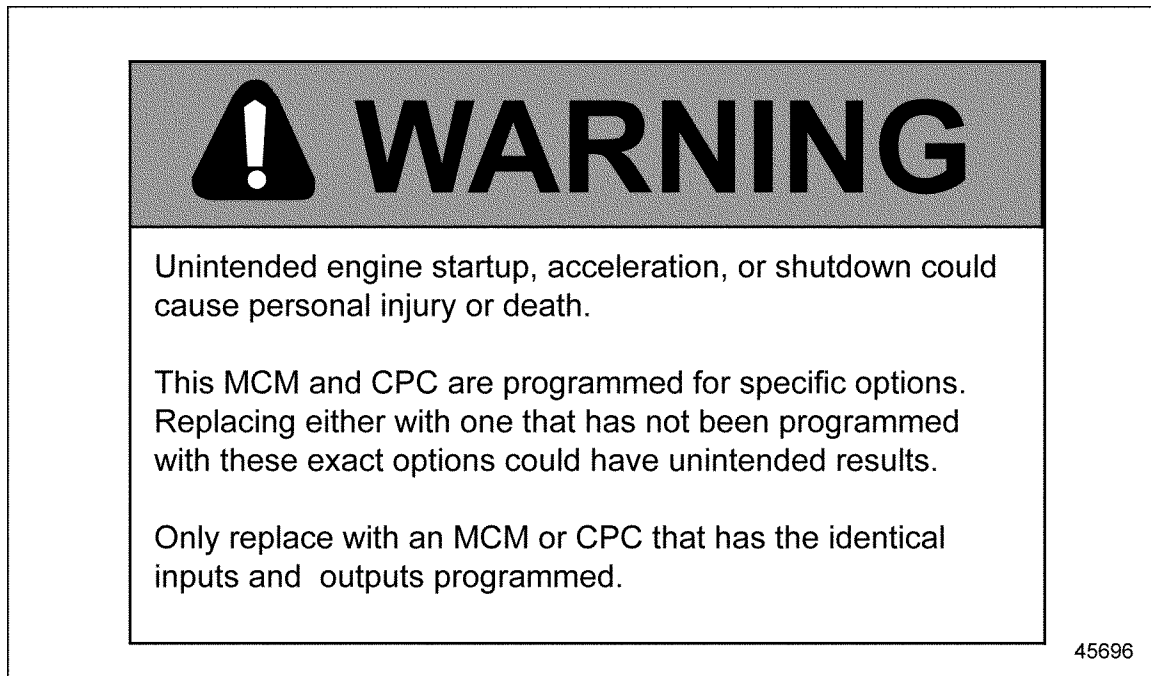
 <b>WARNING:</b> <b>PERSONAL INJURY</b>
<p><b>Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> <b>Always start and operate an engine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

 <b>WARNING:</b> <b>HOT EXHAUST</b>
<p><b>During stationary regeneration the exhaust gases will be extremely HOT and could cause a fire if directed at combustible materials. Ensure that the vehicle is in a well ventilated area and do not park where the exhaust will discharge in a manner that could create a fire.</b></p>

## TRADEMARK INFORMATION

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## MCM/CPC WARNING



**Figure 1 MCM/CPC Replacement Warning**

## SOFTWARE UPGRADES

### NOTE:

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

## ABSTRACT

This manual provides instruction for troubleshooting the 2007 Electronic Controls engines. Specifically covered in this manual are troubleshooting and repair steps that apply to DDEC VI.

## SAFETY INSTRUCTIONS

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

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

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

## **A LETTER TO THE TECHNICIANS**

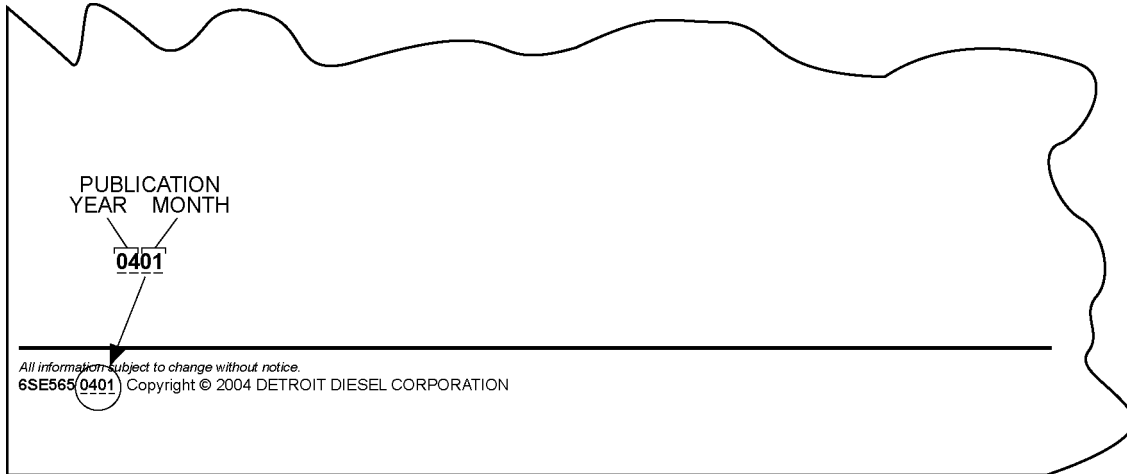
Technicians today are required to have computer skills, excellent comprehension of the written word and possess an extensive diagnostic understanding of the various technological systems and components. Technicians today must perform at a higher level of efficiency and competency than their predecessors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

As the leader in engine computer systems and technology, Detroit Diesel Corporation remains focused on providing excellence in products, service support and training. As products become more and more advanced, technicians must become specialized in multiple areas. This manual is designed with that thought in mind. The DDEC VI MBE900 and MBE 900 Troubleshooting Guide will provide you with concentrated information that will allow you to excel in DDEC VI technology.

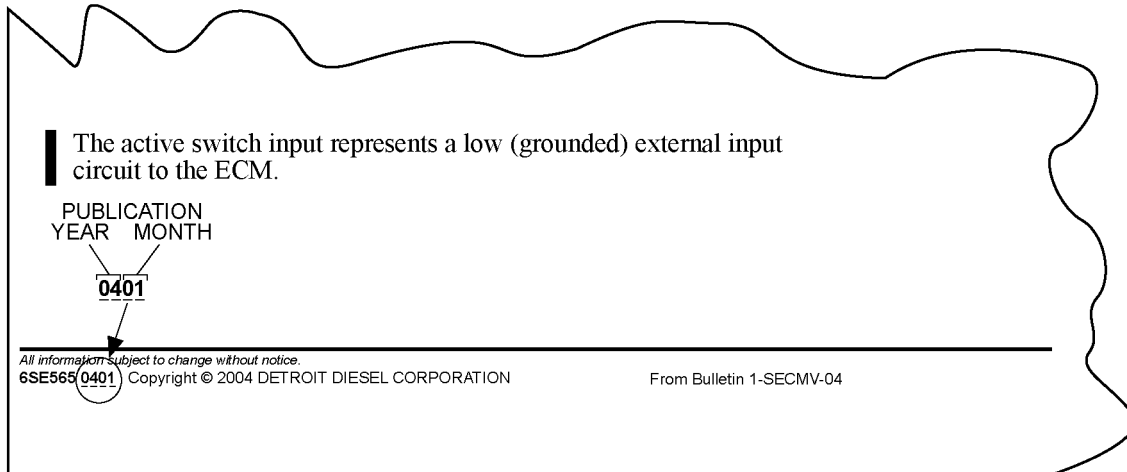
## REVISION NOTIFICATION

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

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

<b>1</b>	<b>INTRODUCTION</b>	
1.1	OVERVIEW .....	1-3
1.2	SCOPE AND USE OF THIS GUIDE .....	1-4
1.3	SAFETY PRECAUTIONS .....	1-6
<b>2</b>	<b>DDEC VI SYSTEM</b>	
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
<b>3</b>	<b>SPN 27 - EGR VALVE POSITION CIRCUIT FAULT</b>	
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
<b>4</b>	<b>SPN 84 – VEHICLE SPEED SENSOR</b>	
4.1	SPN 84/FMI 3 .....	4-3
4.2	SPN 84/FMI 4 .....	4-4
<b>5</b>	<b>SPN 86 – ADAPTIVE CRUISE CONTROL FAULT</b>	
5.1	SPN 86/FMI 14 .....	5-3
<b>6</b>	<b>SPN 91 – ACCELERATOR PEDAL SENSOR FAULT</b>	
6.1	SPN 91/FMI 2 .....	6-3
6.2	SPN 91/FMI 3 .....	6-4
6.3	SPN 91/FMI 4 .....	6-6
<b>7</b>	<b>SPN 100 — ENGINE OIL PRESSURE OUTSIDE NORMAL OPERATING RANGE</b>	
7.1	SPN 100/FMI 1 .....	7-3
7.2	SPN 100/FMI 2 .....	7-5
7.3	SPN 100/FMI 3 .....	7-6
7.4	SPN 100/FMI 4 .....	7-8
7.5	SPN 100/FMI 14 .....	7-9
<b>8</b>	<b>SPN 103 – TURBO NO REVOLUTION</b>	
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 .....	8-6
8.5	SPN 103/FMI 7 .....	8-8

<b>9</b>	<b>SPN 110 — COOLANT TEMPERATURE ABOVE OR BELOW NORMAL OPERATING RANGE</b>	
9.1	SPN 110/FMI 0 .....	9-3
9.2	SPN 110/FMI 2 .....	9-4
9.3	SPN 110/FMI 3 .....	9-5
9.4	SPN 110/FMI 4 .....	9-7
9.5	SPN 110/FMI 14 .....	9-8
<b>10</b>	<b>SPN 111 – COOLANT LEVEL OUTSIDE NORMAL OPERATING RANGE</b>	
10.1	SPN 111/FMI 1 .....	10-5
10.2	SPN 111/FMI 3 .....	10-7
10.3	SPN 111/FMI 4 .....	10-9
<b>11</b>	<b>SPN 158 — BATTERY CHARGING FAULT</b>	
11.1	SPN 158/FMI 0 .....	11-3
11.2	SPN 158/FMI 1 .....	11-4
11.3	SPN 158/FMI 2 .....	11-6
<b>12</b>	<b>SPN 168 – BATTERY VOLTAGE OUTSIDE NORMAL OPERATING RANGE</b>	
12.1	SPN 168/FMI 0 .....	12-3
12.2	SPN 168/FMI 1 .....	12-4
<b>13</b>	<b>SPN 174 – SUPPLY FUEL TEMPERATURE FAULT</b>	
13.1	SPN 174/FMI 3 .....	13-3
13.2	SPN 174/FMI 4 .....	13-5
<b>14</b>	<b>SPN 175 – ENGINE OIL TEMPERATURE OUTSIDE NORMAL RANGE</b>	
14.1	SPN 175/FMI 2 .....	14-3
14.2	SPN 175/FMI 3 .....	14-4
14.3	SPN 175/FMI 4 .....	14-5
<b>15</b>	<b>SPN 411 — EGR DIFFERENTIAL PRESSURE OR DELTA P SENSOR CIRCUIT OUTSIDE OF NORMAL OPERATING RANGE</b>	
15.1	SPN 411/FMI 0 .....	15-3
15.2	SPN 411/FMI 1 .....	15-5
15.3	SPN 411/FMI 3 .....	15-6
15.4	SPN 411/FMI 4 .....	15-7
<b>16</b>	<b>SPN 558 - IDLE VALIDATION SWITCH</b>	
16.1	SPN 558/FMI 1 .....	16-3
16.2	SPN 558/FMI 3 .....	16-3
16.3	SPN 558/FMI 4 .....	16-5
<b>17</b>	<b>SPN 599 - CRUISE CONTROL SWITCHES NOT FUNCTIONING PROPERLY</b>	
17.1	SPN 599/FMI 12 .....	17-3

<b>18</b>	<b>SPN 601 - CRUISE CONTROL SWITCHES NOT FUNCTIONING PROPERLY</b>	
18.1	SPN 601/FMI 12 .....	18-3
<b>19</b>	<b>SPN 609 - MCM FAULT (ERRONEOUS DATA)</b>	
19.1	SPN 609/FMI 12 .....	19-3
19.2	SPN 609/FMI 14 .....	19-4
<b>20</b>	<b>SPN 615 - ELECTROSTATIC OIL SEPARATOR OUTSIDE OF NORMAL OPERATING RANGE</b>	
20.1	SPN 615/FMI 3 .....	20-3
20.2	SPN 615/FMI 4 .....	20-4
<b>21</b>	<b>SPN 615 - INTAKE AIR DELTA PRESSURE OUTSIDE OF NORMAL OPERATING RANGE</b>	
21.1	SPN 615/FMI 3 .....	21-3
21.2	SPN 615/FMI 4 .....	21-5
<b>22</b>	<b>SPN 625 - CAN FAULT</b>	
22.1	SPN 625/FMI 2, 9, 10, 13, 14 .....	22-3
22.2	SPN 625/FMI 4 .....	22-5
<b>23</b>	<b>SPN 636 — CRANKSHAFT POSITION SENSOR OUTSIDE OF NORMAL OPERATING CONDITIONS</b>	
23.1	SPN 636/FMI 1 .....	23-3
23.2	SPN 636/FMI 3 .....	23-5
23.3	SPN 636/FMI 4 .....	23-7
23.4	SPN 636/FMI 7 .....	23-9
23.5	SPN 636/FMI 8 .....	23-10
<b>24</b>	<b>SPN 651 – INJECTOR #1 NOT OPERATING NORMALLY</b>	
24.1	SPN 651/FMI 5 .....	24-3
24.2	SPN 651/FMI 10 .....	24-5
<b>25</b>	<b>SPN 652 – INJECTOR #2 NOT OPERATING NORMALLY</b>	
25.1	SPN 652/FMI 5 .....	25-3
25.2	SPN 652/FMI 10 .....	25-5
<b>26</b>	<b>SPN 653 – INJECTOR #3 NOT OPERATING NORMALLY</b>	
26.1	TROUBLESHOOTING SPN 653/FMI 5 .....	26-3
26.2	TROUBLESHOOTING SPN 653/FMI 10 .....	26-5
<b>27</b>	<b>SPN 654 – INJECTOR #4 NOT OPERATING NORMALLY</b>	
27.1	TROUBLESHOOTING SPN 654/FMI 5 .....	27-3
27.2	TROUBLESHOOTING SPN 654/FMI 10 .....	27-5
<b>28</b>	<b>SPN 655 – INJECTOR #5 NOT OPERATING NORMALLY</b>	
28.1	SPN 655/FMI 5 .....	28-3
28.2	SPN 655/FMI 10 .....	28-5
<b>29</b>	<b>SPN 656 – INJECTOR #6 NOT OPERATING NORMALLY</b>	
29.1	SPN 656/FMI 5 .....	29-3

29.2	SPN 656/FMI 10 .....	29-5
<b>30</b>	<b>SPN 701 - CONSTANT THROTTLE VALVE (AUX PWM #7) NOT OPERATING NORMALLY</b>	
30.1	SPN 701/FMI 3 .....	30-3
30.2	SPN 701/FMI 4 .....	30-4
30.3	SPN 701/FMI 5 .....	30-6
<b>31</b>	<b>SPN 704 - WASTEGATE VALVE CONTROL (AUX PWM #10)</b>	
31.1	SPN 704/FMI 3 .....	31-3
31.2	SPN 704/FMI 4 .....	31-4
31.3	SPN 704/FMI 5 .....	31-6
<b>32</b>	<b>SPN 706 - ELECTRONIC PROPORTIONING VALVE CONTROL #2 NOT OPERATING NORMALLY</b>	
32.1	SPN 706/FMI 3 .....	32-3
32.2	SPN 706/FMI 4 .....	32-5
32.3	SPN 706/FMI 5 .....	32-7
<b>33</b>	<b>SPN 709 - SINGLE-SPEED FAN (LOW-SIDE DIGITAL OUTPUT #3) FAULT</b>	
33.1	SPN 709/FMI 3 .....	33-3
33.2	SPN 709/FMI 4 .....	33-5
33.3	SPN 709/FMI 5 .....	33-6
<b>34</b>	<b>SPN 710 - ELECTRONIC PROPORTIONING VALVE 1 (ENTRY SHUTOFF FLAP) NOT OPERATING NORMALLY</b>	
34.1	SPN 710/FMI 3 .....	34-3
34.2	SPN 710/FMI 4 .....	34-4
34.3	SPN 710/FMI 5 .....	34-6
<b>35</b>	<b>SPN 729 - GRID HEATER NOT OPERATING NORMALLY</b>	
35.1	SPN 729/FMI 3 .....	35-3
35.2	SPN 729/FMI 4 .....	35-5
<b>36</b>	<b>SPN 723 — CAMSHAFT POSITION SENSOR FAULT</b>	
36.1	SPN 723/FMI 3 .....	36-3
36.2	SPN 723/FMI 4 .....	36-5
36.3	SPN 723/FMI 8 .....	36-6
36.4	SPN 723/FMI 14 .....	36-7
<b>37</b>	<b>SPN 975 - TWO-SPEED FAN (AUX PWM #6) FAULT</b>	
37.1	SPN 975/FMI 3 .....	37-3
37.2	SPN 975/FMI 4 .....	37-5
37.3	SPN 975/FMI 5 .....	37-6
<b>38</b>	<b>SPN 1172 -TURBO COMPRESSOR IN TEMP HIGH OR LOW</b>	
38.1	SPN 1172/FMI 3 .....	38-3
38.2	SPN 1172/FMI 4 .....	38-5

<b>39</b>	<b>SPN 1176 - TURBO COMPRESSOR INLET PRESSURE OUTSIDE NORMAL RANGE</b>	
39.1	SPN 1176/FMI 3 .....	39-3
39.2	SPN 1176/FMI 4 .....	39-5
<b>40</b>	<b>SPN 1636 – INTAKE MANIFOLD TEMPERATURE OUTSIDE OF NORMAL OPERATING RANGE</b>	
40.1	SPN 1636 /FMI 2 .....	40-3
40.2	SPN 1636/FMI 3 .....	40-4
40.3	SPN 1636/FMI 4 .....	40-6
40.4	SPN 1636/FMI 14 .....	40-7
<b>41</b>	<b>SPN 2629 - TURBO COMPRESSOR OUT TEMP HIGH OR LOW</b>	
41.1	SPN 2629/FMI 3 .....	41-3
41.2	SPN 2629/FMI 4 .....	41-4
<b>42</b>	<b>SPN 2791 – EGR VALVE (AUX PWM #1) FAILED OR OPEN CIRCUIT</b>	
42.1	SPN 2791/FMI 3 .....	42-3
42.2	SPN 2791/FMI 4 .....	42-5
42.3	SPN 2791/FMI 5 .....	42-6
<b>43</b>	<b>SPN 3510 — ACCELERATOR PEDAL SUPPLY OUTSIDE OF NORMAL OPERATING RANGE</b>	
43.1	SPN 3510/FMI 2 .....	43-3
43.2	SPN 3510/FMI 3 .....	43-5
43.3	SPN 3510/FMI 4 .....	43-6
<b>44</b>	<b>SPN 3563 – INTAKE MANIFOLD PRESSURE OUTSIDE NORMAL RANGE</b>	
44.1	SPN 3563/FMI 0/1/2 .....	44-3
44.2	SPN 3563/FMI 3 .....	44-6
44.3	SPN 3563/FMI 4 .....	44-8
<b>45</b>	<b>SPN 3659 — ELECTRONIC UNIT PUMP #1 NOT OPERATING NORMALLY</b>	
45.1	SPN 3659/FMI 5 .....	45-3
45.2	SPN 3659/FMI 10 .....	45-5
<b>46</b>	<b>SPN 3660 - ELECTRONIC UNIT PUMP #2 NOT OPERATING NORMALLY</b>	
46.1	SPN 3660/FMI 5 .....	46-3
46.2	SPN 3660/FMI 10 .....	46-5
<b>47</b>	<b>SPN 3661 - ELECTRONIC UNIT PUMP #3 NOT OPERATING NORMALLY</b>	
47.1	SPN 3661/FMI 5 .....	47-3
47.2	SPN 3661/FMI 10 .....	47-5
<b>48</b>	<b>SPN 3662 - ELECTRONIC UNIT PUMP #4 NOT OPERATING NORMALLY</b>	
48.1	SPN 3662/FMI 5 .....	48-3

48.2	SPN 3662/FMI 10 .....	48-5
<b>49</b>	<b>SPN 3663 - ELECTRONIC UNIT PUMP #5 NOT OPERATING NORMALLY</b>	
49.1	SPN 3663/FMI 5 .....	49-3
49.2	SPN 3663/FMI 10 .....	49-5
<b>50</b>	<b>SPN 3664 - ELECTRONIC UNIT PUMP #6 NOT OPERATING NORMALLY</b>	
50.1	SPN 3664/FMI 5 .....	50-3
50.2	SPN 3664/FMI 10 .....	50-5
<b>51</b>	<b>CPC DIGITAL OUTPUTS SPN/FMI</b>	
51.1	CPC DIGITAL OUTPUT FAULT CODES .....	51-3
51.2	TROUBLESHOOTING THE CPC DIGITAL OUTPUTS .....	51-3

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# 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.

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

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

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

## 1.2 SCOPE AND USE OF THIS GUIDE

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

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

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

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

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

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

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

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

### **NOTE:**

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

### 1.2.1 Mechanical Troubleshooting

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

## 1.2.2 Electronic Troubleshooting

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

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

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


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


### **NOTE:**


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

### 1.3 SAFETY PRECAUTIONS

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

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

 <b>WARNING:</b> <b>HOT EXHAUST</b>
<p><b>During stationary regeneration the exhaust gases will be extremely HOT and could cause a fire if directed at combustible materials. Ensure that the vehicle is in a well ventilated area and do not park where the exhaust will discharge in a manner that could create a fire.</b></p>

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



**PERSONAL INJURY**

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

### 1.3.1 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:

 <b>WARNING:</b> <b>PERSONAL INJURY</b>
<p>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.</p>

 <b>WARNING:</b> <b>PERSONAL INJURY</b>
<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"> <li><input type="checkbox"/> Always start and operate an engine in a well ventilated area.</li> <li><input type="checkbox"/> If operating an engine in an enclosed area, vent the exhaust to the outside.</li> <li><input type="checkbox"/> Do not modify or tamper with the exhaust system or emission control system.</li> </ul>

 <b>WARNING:</b> <b>HOT EXHAUST</b>
<p>During stationary regeneration the exhaust gases will be extremely HOT and could cause a fire if directed at combustible materials. Ensure that the vehicle is in a well ventilated area and do not park where the exhaust will discharge in a manner that could create a fire.</p>

### 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.

 <b>WARNING:</b>
<b>FIRE</b>
<b>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.</b>

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

 <b>WARNING:</b>
<b>FIRE</b>
<b>To avoid injury from fire caused by heated diesel-fuel vapors:</b>
<ul style="list-style-type: none"><li><input type="checkbox"/> <b>Keep those people who are not directly involved in servicing away from the engine.</b></li><li><input type="checkbox"/> <b>Stop the engine immediately if a fuel leak is detected.</b></li><li><input type="checkbox"/> <b>Do not smoke or allow open flames when working on an operating engine.</b></li><li><input type="checkbox"/> <b>Wear adequate protective clothing (face shield, insulated gloves and apron, etc.).</b></li><li><input type="checkbox"/> <b>To prevent a buildup of potentially volatile vapors, keep the engine area well ventilated during operation.</b></li></ul>

**WARNING:****FIRE**

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

**1.3.7 Batteries**

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

**WARNING:****Battery Explosion and Acid Burn**

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

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


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

**WARNING:****PERSONAL INJURY**

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


### 1.3.8 Fire

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

 <b>WARNING:</b>
<b>FIRE</b>
<b>To avoid injury from fire, keep a fire extinguisher near the grinding machine in case excessive heat should ignite the oil.</b>


### 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.

 <b>WARNING:</b>
<b>PERSONAL INJURY</b>
<b>To avoid injury from harmful vapors or skin contact, do not use carbon tetrachloride as a cleaning agent.</b>

### 1.3.10 Diagnostic Equipment

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

 <b>WARNING:</b>
<b>PERSONAL INJURY</b>
<b>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.</b>

### 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.

 <b>CAUTION:</b>
<b>UNEXPECTED ENGINE START</b>
<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>

 <b>WARNING:</b>
<b>PERSONAL INJURY</b>
<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.

 <b>WARNING:</b>
<b>CHEMICAL BURNS</b>
<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).

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## 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

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## 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.).

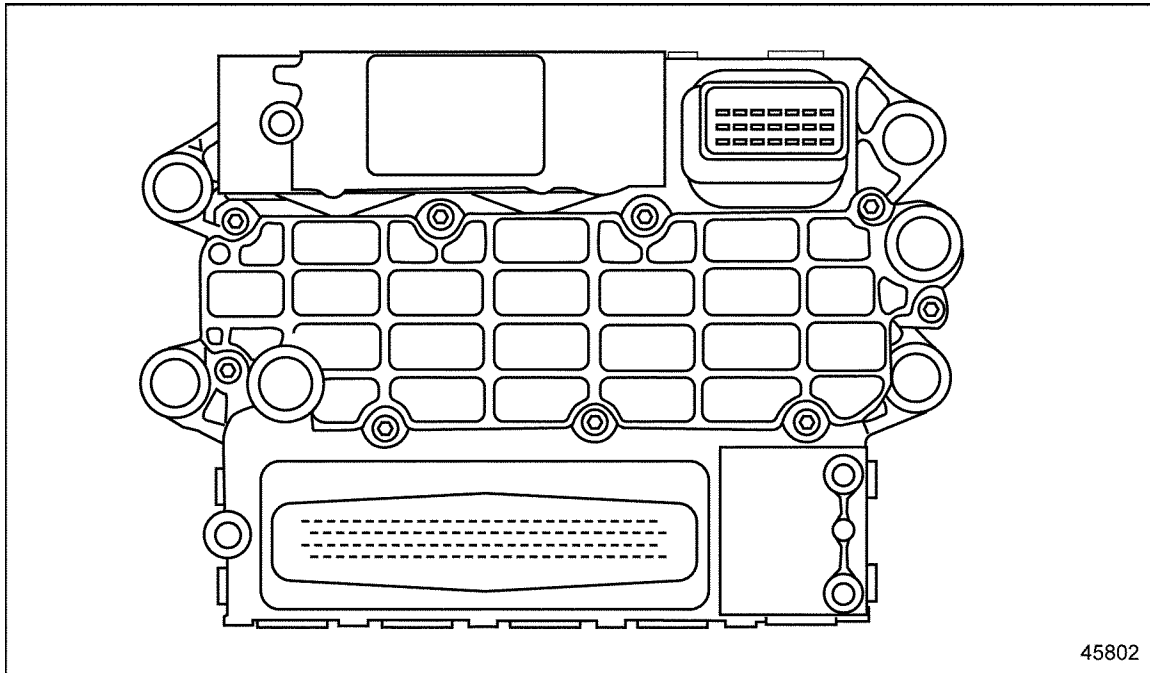
### 2.1.1 Harnesses

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 ECU 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.



**Figure 2-1** Motor Control Module

### 2.2.1 MBE 900 Engine Harness

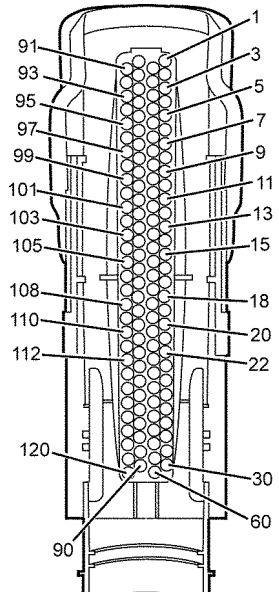
The MCM has a 120-pin connector Engine Harness which is factory installed. It also has a 21-pin connector which is the responsibility of the OEM. The pinouts for the 120-pin connector for the MBE 900 engine are listed in Table 2-1, Table 2-2, Table 2-3, and Table 2-4.

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

**Table 2-1 MCM Connector – MBE900 (1 of 4) – C Sample**

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

**Table 2-2 MCM Connector – MBE900 (2 of 4) – C Sample**

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

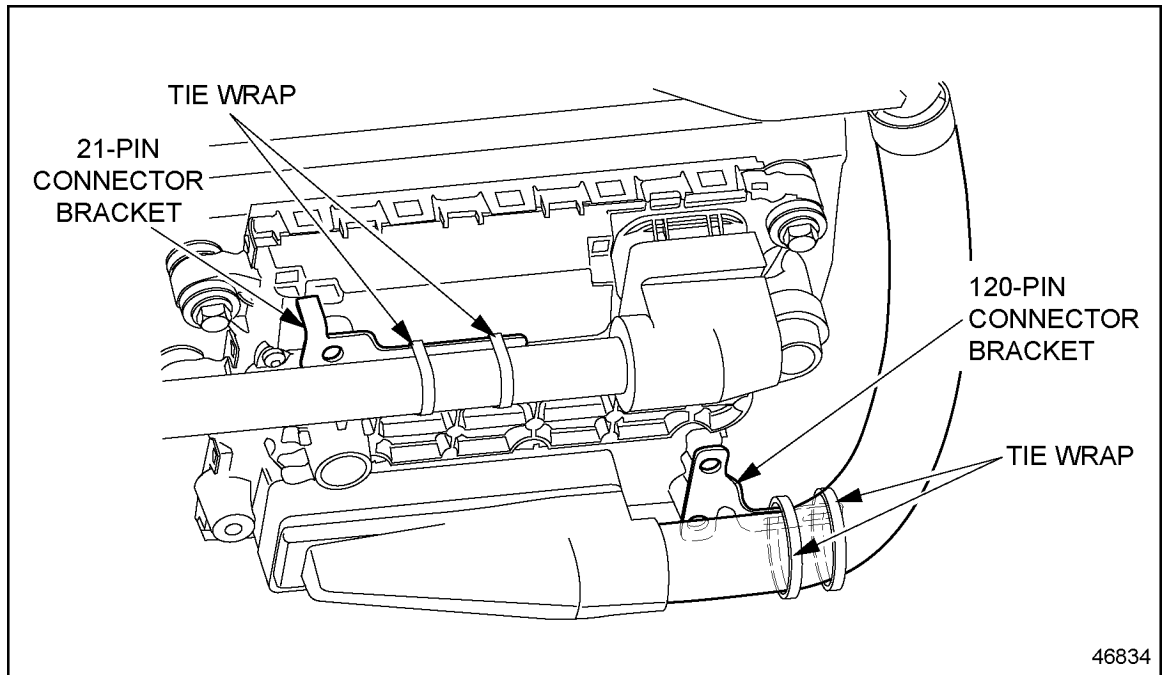
**Table 2-3 MCM Connector – MBE900 (3 of 4) – C Sample**

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

**Table 2-4 MCM Connector – MBE900 (4 of 4) – C Sample**

## 2.2.2 Connector Brackets

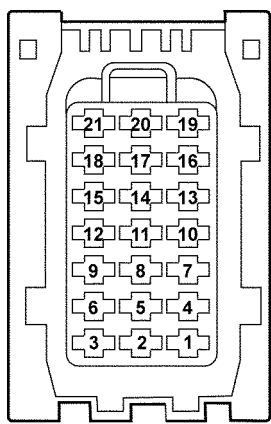
The harnesses on MCM must be bracketed and held secure. The bracket design will change for different engines as the routing is different. The 120-pin connector and the 21-pin connector must be tie-wrapped to the brackets as shown in the following drawing for the MBE engines (see Figure 2-2).



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

### 2.2.3 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
Connector	1-1534127-1
Terminal (strip form)	1-968855-1
Terminal (single)	1-968875-1
Seal	828904-2
Backshell	9-1394050-1

**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	MBE900	MBE 4000	HDE
31/1	Power Supply #1 — EGR Actuator*	—	—	X	X
31/2	Power Supply #2 — VNT*	—	—	—	X
31/3	Fuel Heater Supply #1†	—	X	-	X
31/4	AC Compressor Supply (FL)	X	X	X	X
31/5	Full Heater Supply #2†	—	X	—	X
31/6	Power Supply #1 Ground*	—	—	X	X
31/7	Power Supply #2 Ground*	—	—	—	X
31/8	Ether Start	X	—	—	—
31/9	Fan Control #2 – High of Two-speed Fan or Variable Speed Fan	X	X	X	X
31/10	Single Speed Fan or Low for Two-speed Fan	X	X	X	X
31/11	Fuel Heater Ground #1†	—	X	—	X
31/12	AC Compressor Ground (FL)	X	X	X	X
31/13	Alternator Remote Sense (FL)	X	X	X	X
31/14	Spare	—	—	—	—
31/15	Spare	—	—	—	—
31/16	Engine Brake Solenoid Control	—	X	—	—
31/17	DOC Outlet Temp Sensor (Exhaust Gas Temperature in Front of Particulate Trap)	X	X	X	X
31/18	DOC Inlet Temp Sensor	X	X	X	X
31/19	DPF Outlet Temp Sensor( Exhaust Gas Temperature After Particulate Trap)	X	X	X	X
31/20	Full Heater Ground #2†	—	X	—	X
31/21	Alternator Charge Indicator Lamp (FL)	X	X	X	X
31/22	Power Supply	X	X	X	X
31/23	Fan Speed	X	X	X	X
31/24	Sensor Ground (3V)	X	X	X	X
31/25	Spare	—	—	—	—
31/26	Spare	—	—	—	—
31/27	TCI Temp	X	—	—	—
31/28	Sensor Ground (5V)	X	X	X	X
31/29	Sensor Supply (2V)	X	X	X	X
31/30	DPF Outlet Pressure Sensor (Exhaust Gas Pressure After Particulate Filter)	X	X	X	X
31/31	DPF Inlet Pressure Sensor (Exhaust Gas Pressure Before Particulate Filter)	X	X	X	X

\*Fused at 15 amps

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

**Table 2-7 31-pin MCM Pigtail Connector**

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

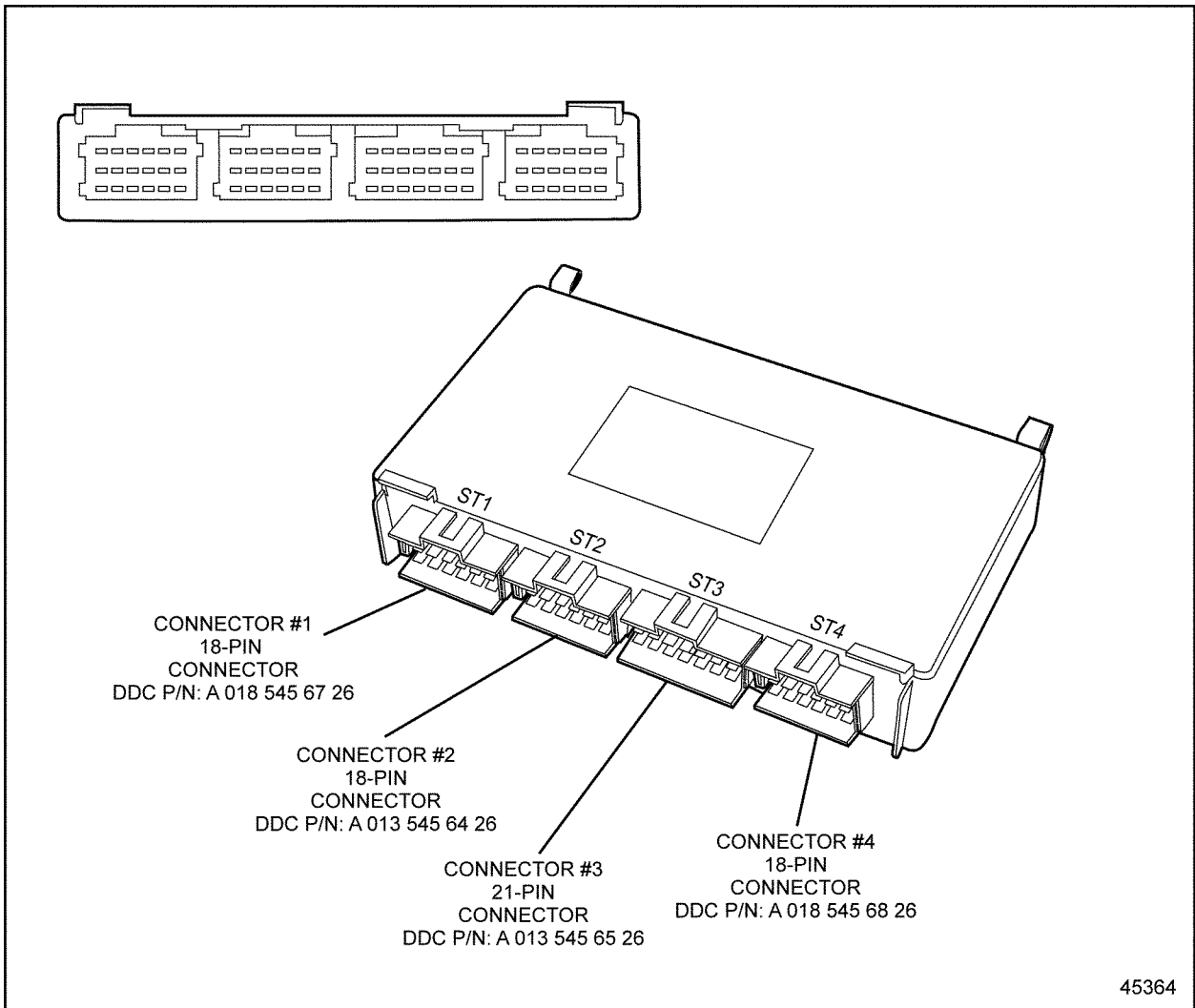
<b>Part</b>	<b>Tyco/Amp Part Number</b>
Connector	967363-1
Terminal	1-929974-4
Seals (GXL insulation)	828921-1
Cavity Plugs	828922-1
Backshell	965636-1

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

## 2.3 COMMON POWERTRAIN CONTROLLER

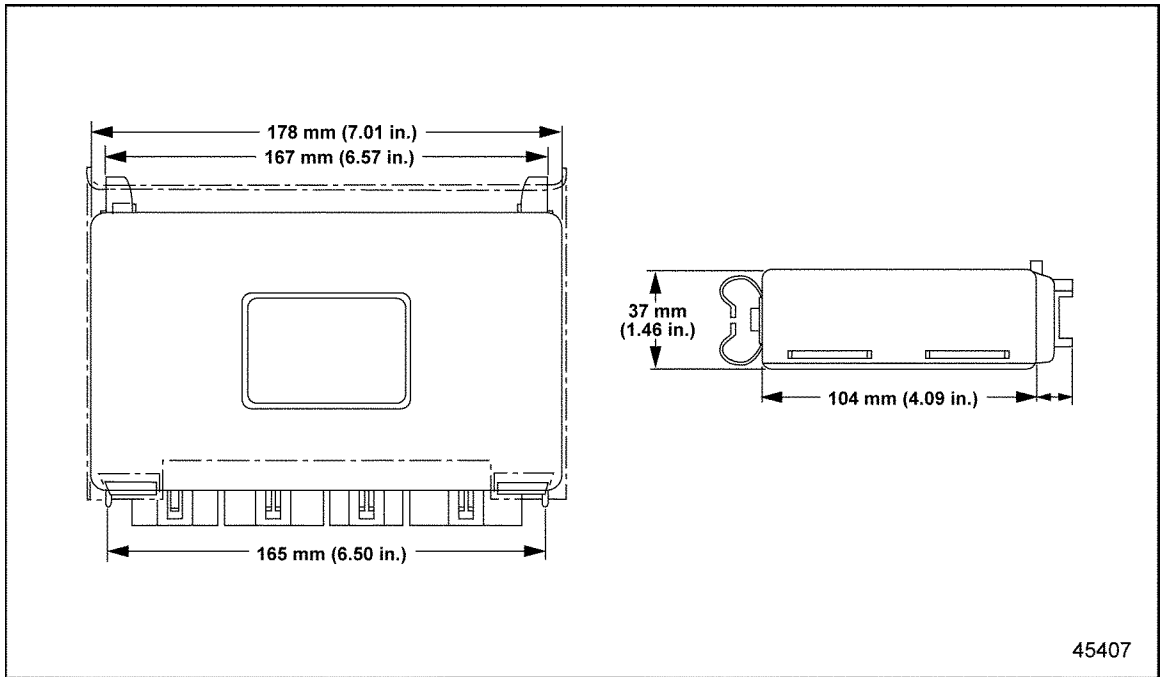
The Common Powertrain Controller (CPC) has three 18-pin connectors and one 21-pin connector. The following sections contain the connector pin-outs for truck, vocational, transit bus and crane applications.

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.

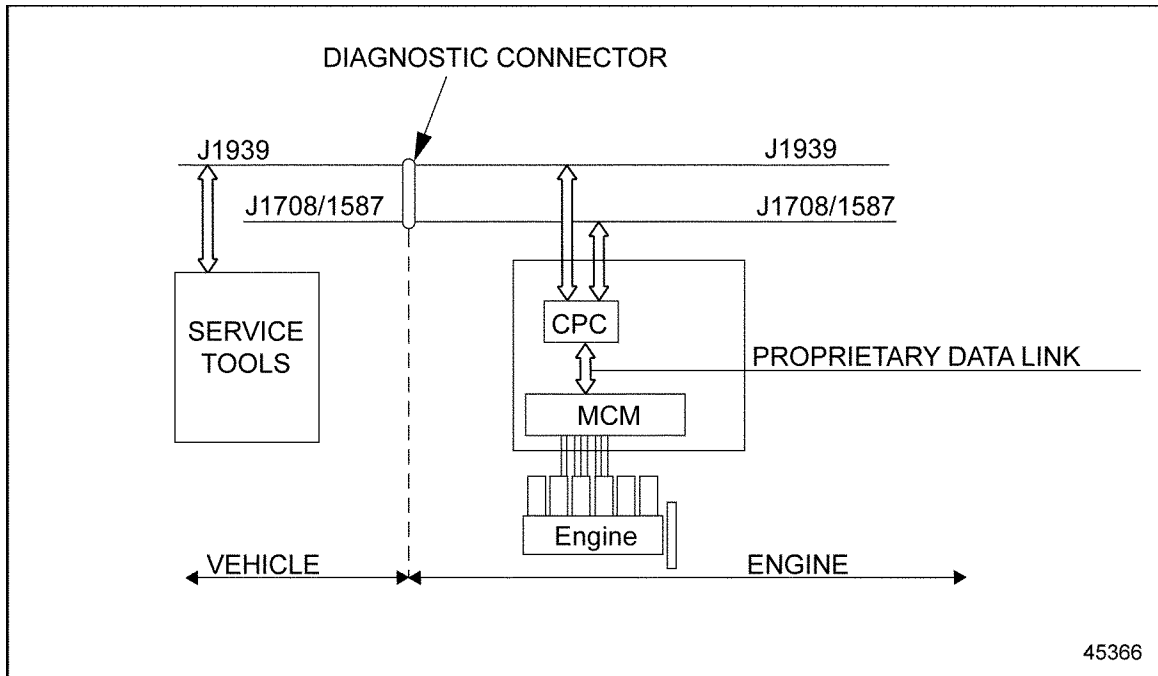


**Figure 2-4 CPC Dimensions**

**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  $-40^{\circ}\text{F}$  to  $185^{\circ}\text{F}$  ( $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ ).

#### 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).

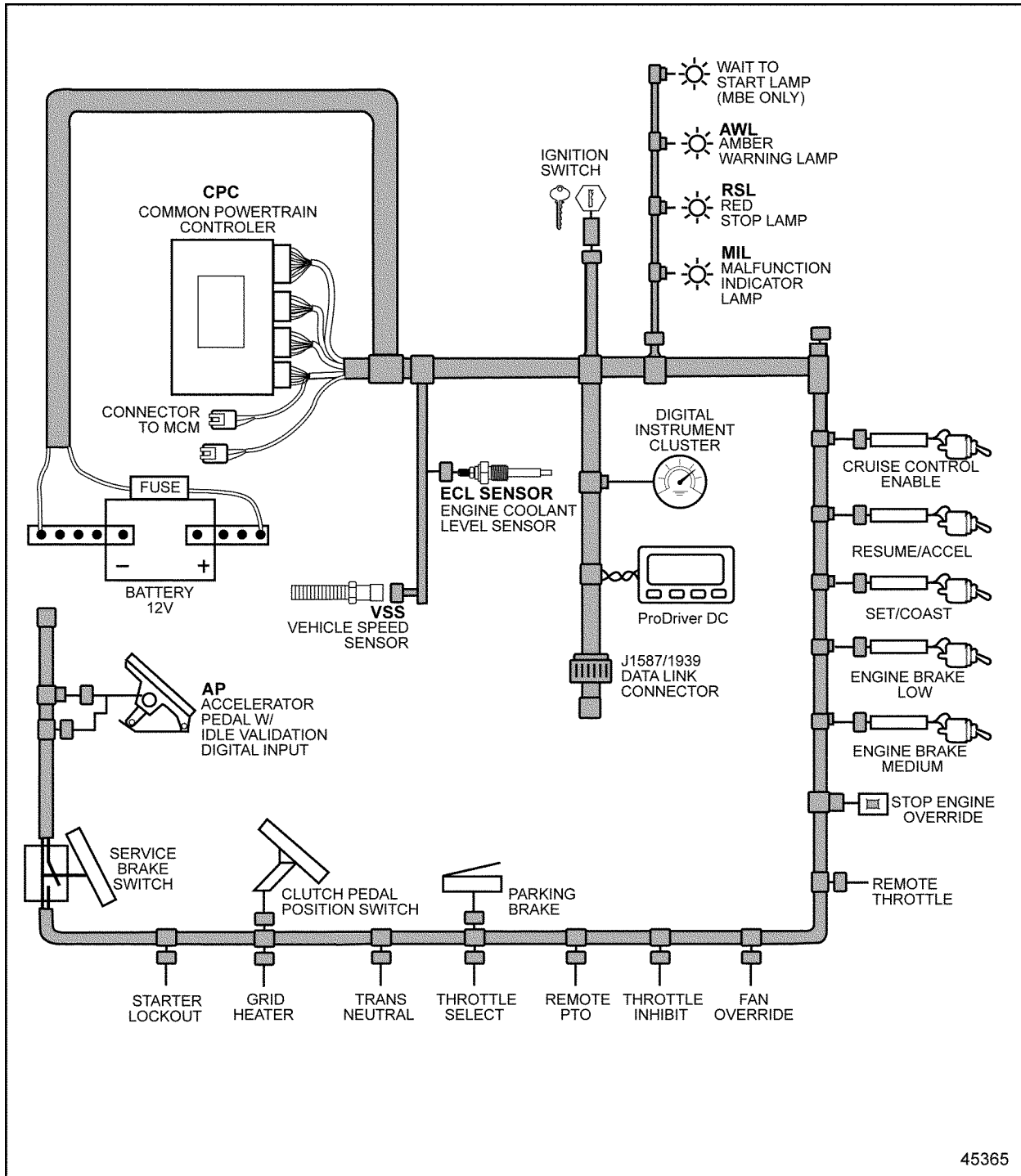


Figure 2-6 Vehicle Interface Harness

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	300 $\mu$ A
	Ignition On and Engine Stopped	175 mA

**Table 2-11 Current Draw for CPC Configuration**

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

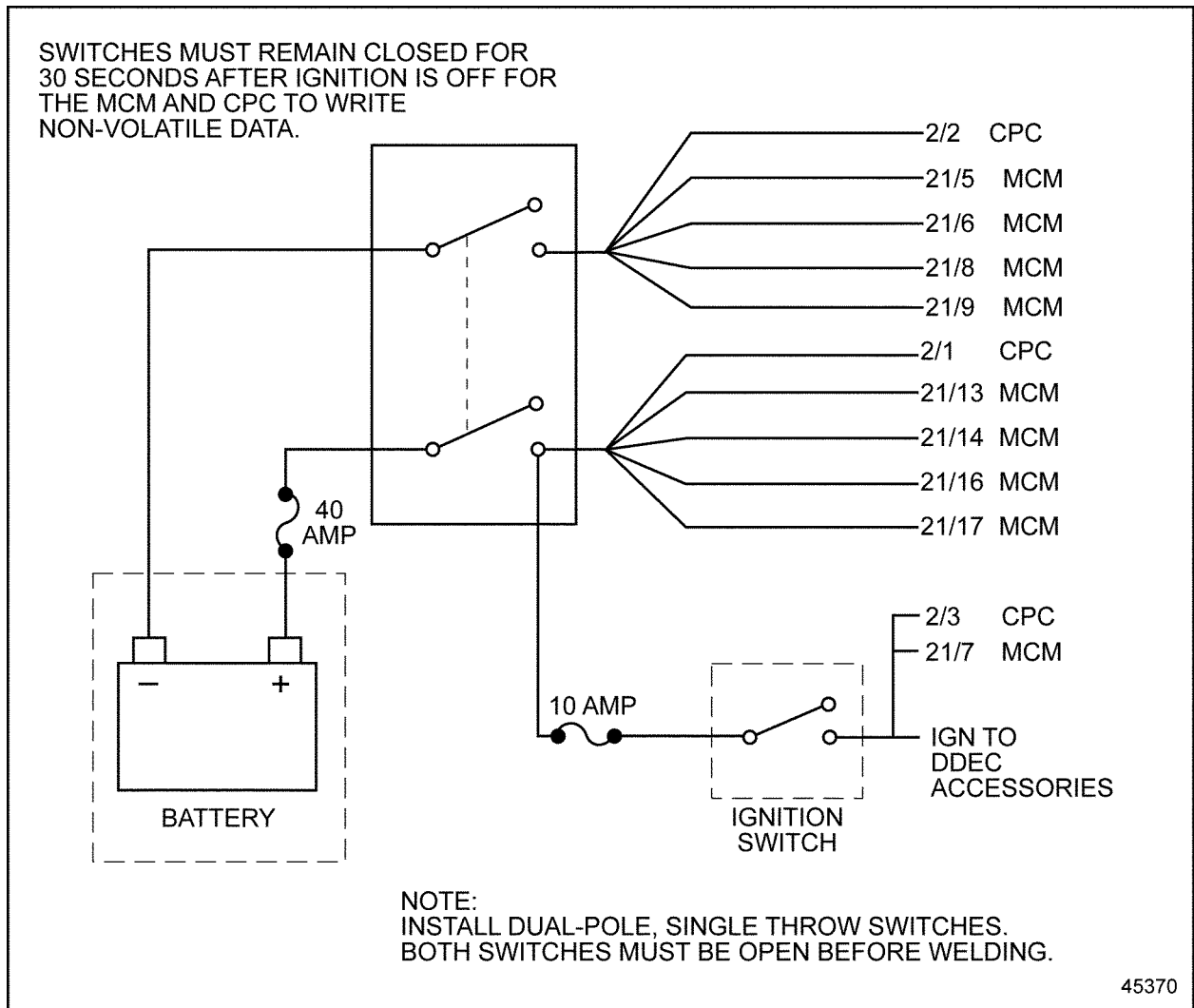
Configuration	Condition	Current
MCM	Ignition Off	<1 mA
	Ignition On and Engine Stopped	400 mA

**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
Connector	1-1534127-1
Terminal (strip form)	1-968855-1
Terminal (single)	1-968875-1
Seal	828904-2
Backshell	9-1394050-1

**Table 2-19 21-Pin Connector to the MCM**

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

**Table 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 DDDL usage (i.e., reprogramming, diagnostics, etc.).

**NOTE:**

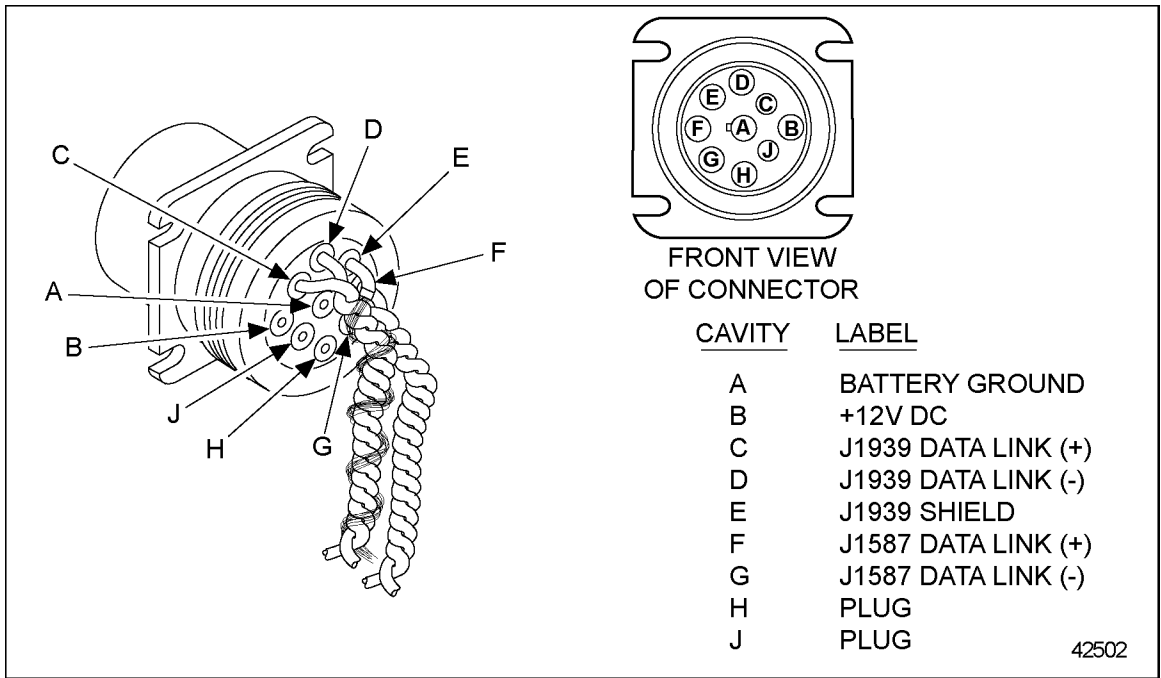
**REQUIRED: The J1939 data link must be wired to this connector.**

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:

<b>NOTICE:</b>
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.

<b>NOTICE:</b>
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.

<b>NOTICE:</b>
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.

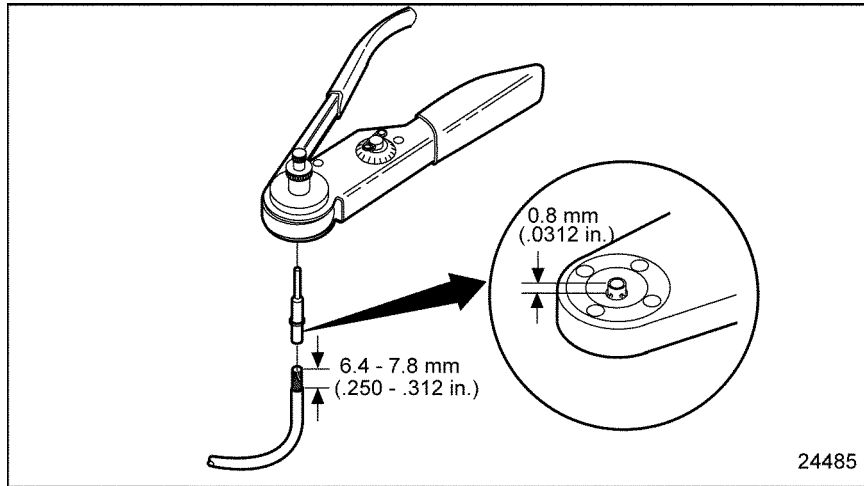
The crimp tool to use in Deutsch terminal installation is J-34182 (Kent-Moore part number).

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

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

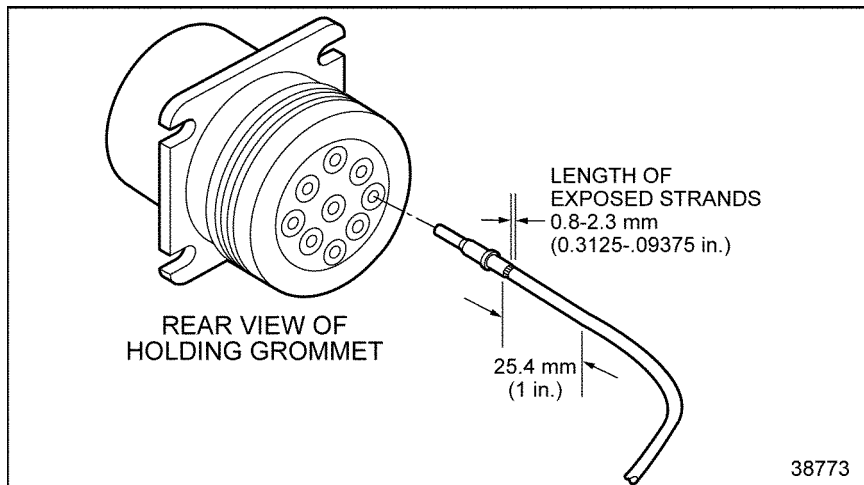
Use the following instructions for installing Deutsch terminals:

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.



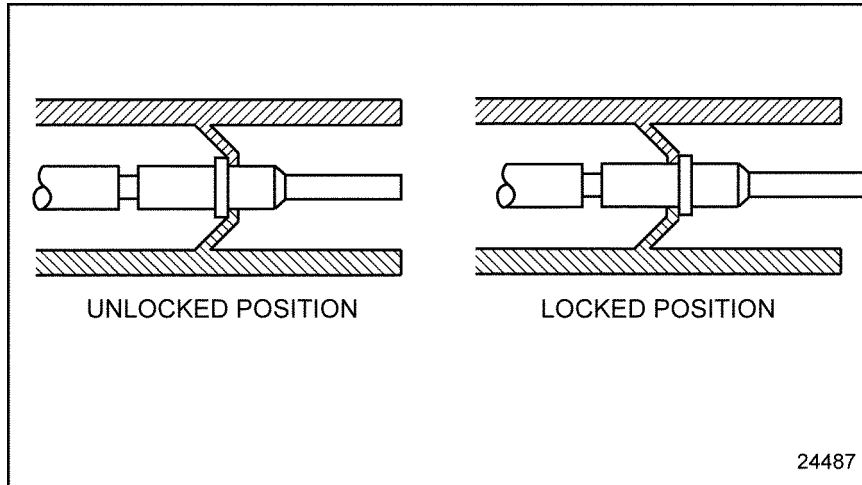
**Figure 2-9**                      **Setting Wire Gage Selector and Positioning the Contact**

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

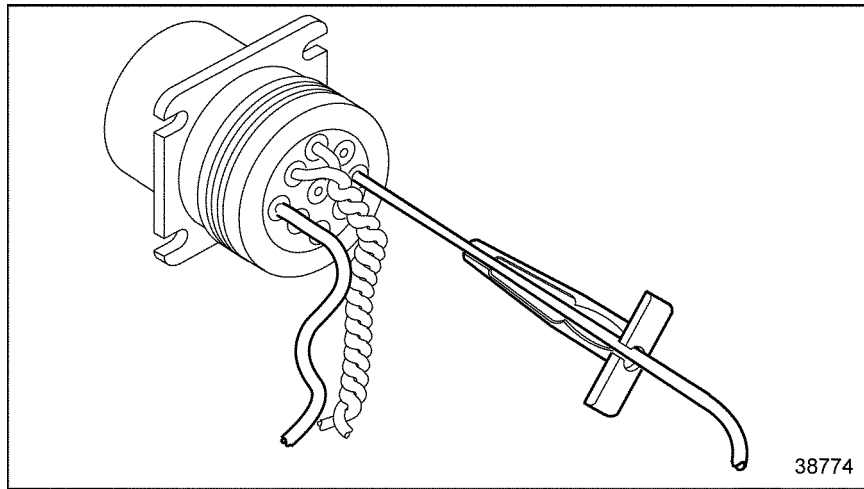
The appropriate size removal tool should be used when removing cables from connectors. The proper removal tools are listed in Table 2-24.

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**

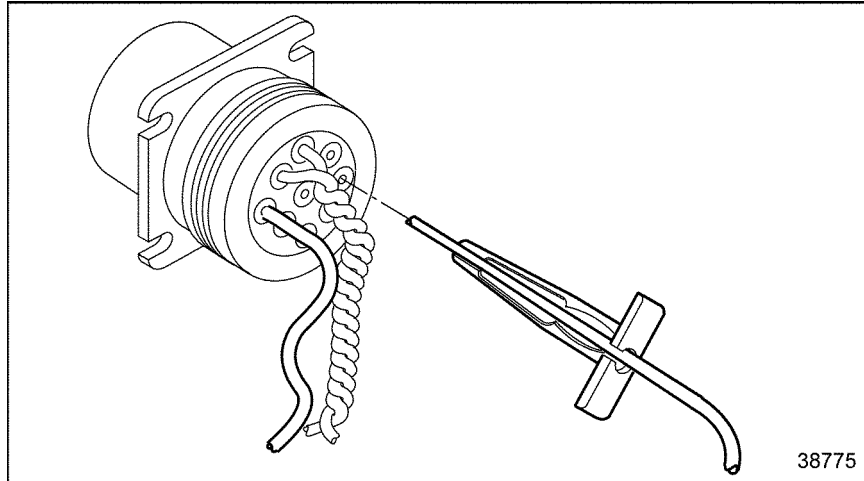
Remove Deutsch terminals as follows:

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

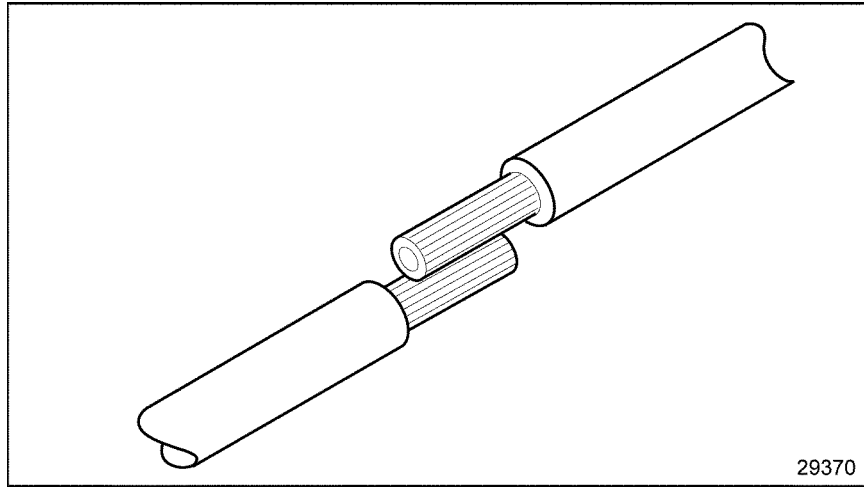
**Table 2-25 Recommended Splicing Tools**

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.

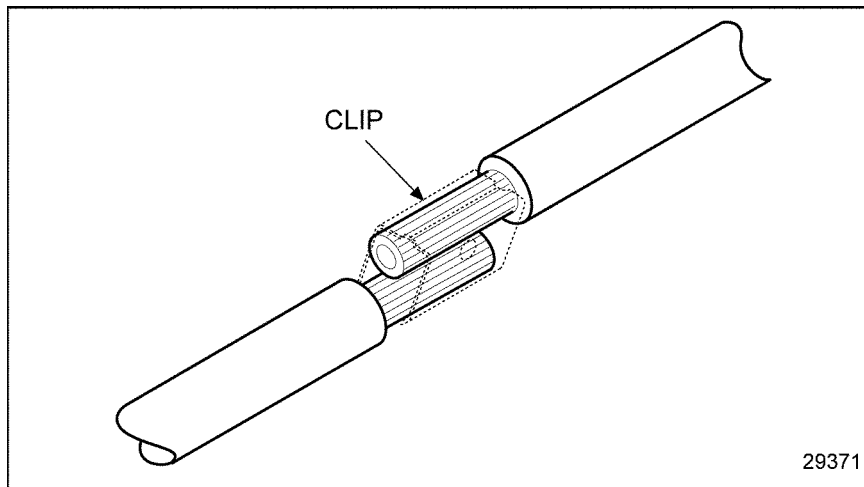
Soldering splice connectors is optional. To solder splice connectors:

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**

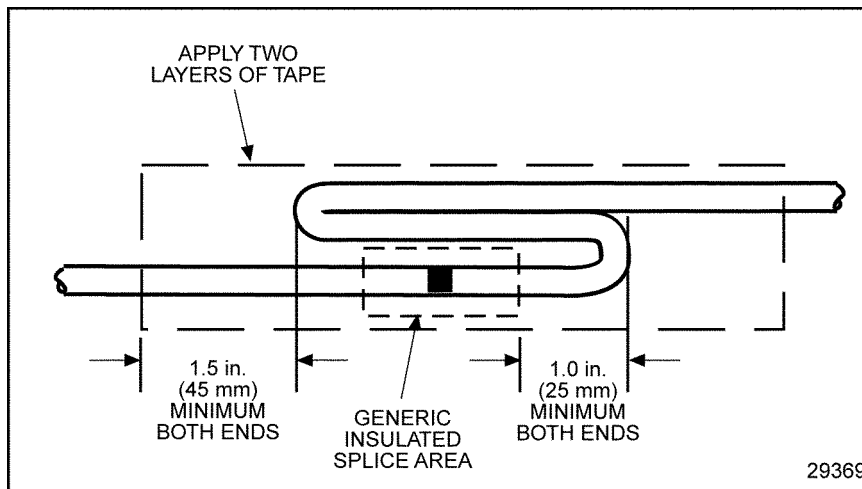
3. Use a suitable electronic soldering iron to heat the wires. Apply the solder to the heated wire and clip (not to the soldering iron) allowing sufficient solder flow into the splice joint.

- 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)

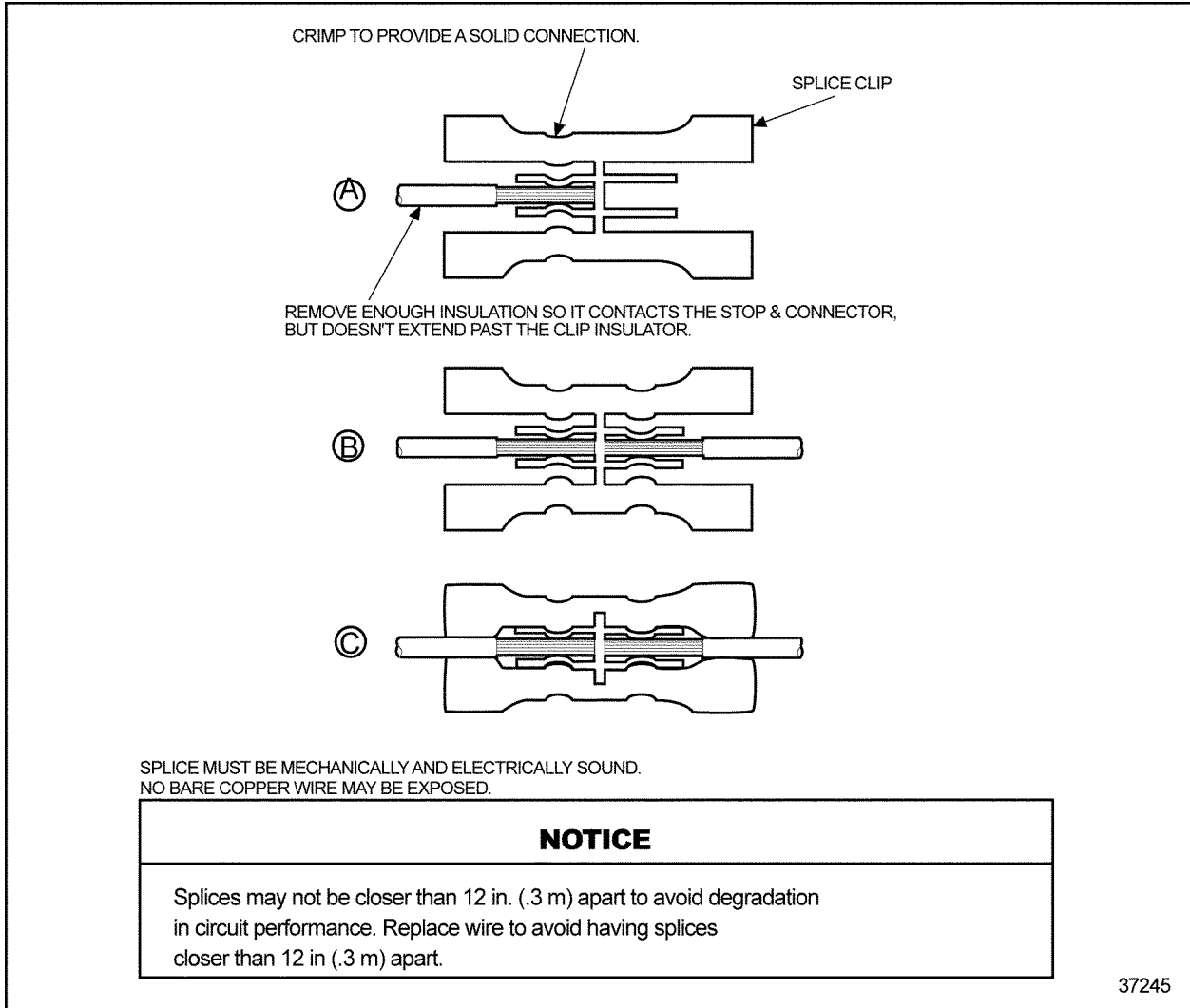
**Table 2-28 Applied Load Criteria for Terminals**

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:**

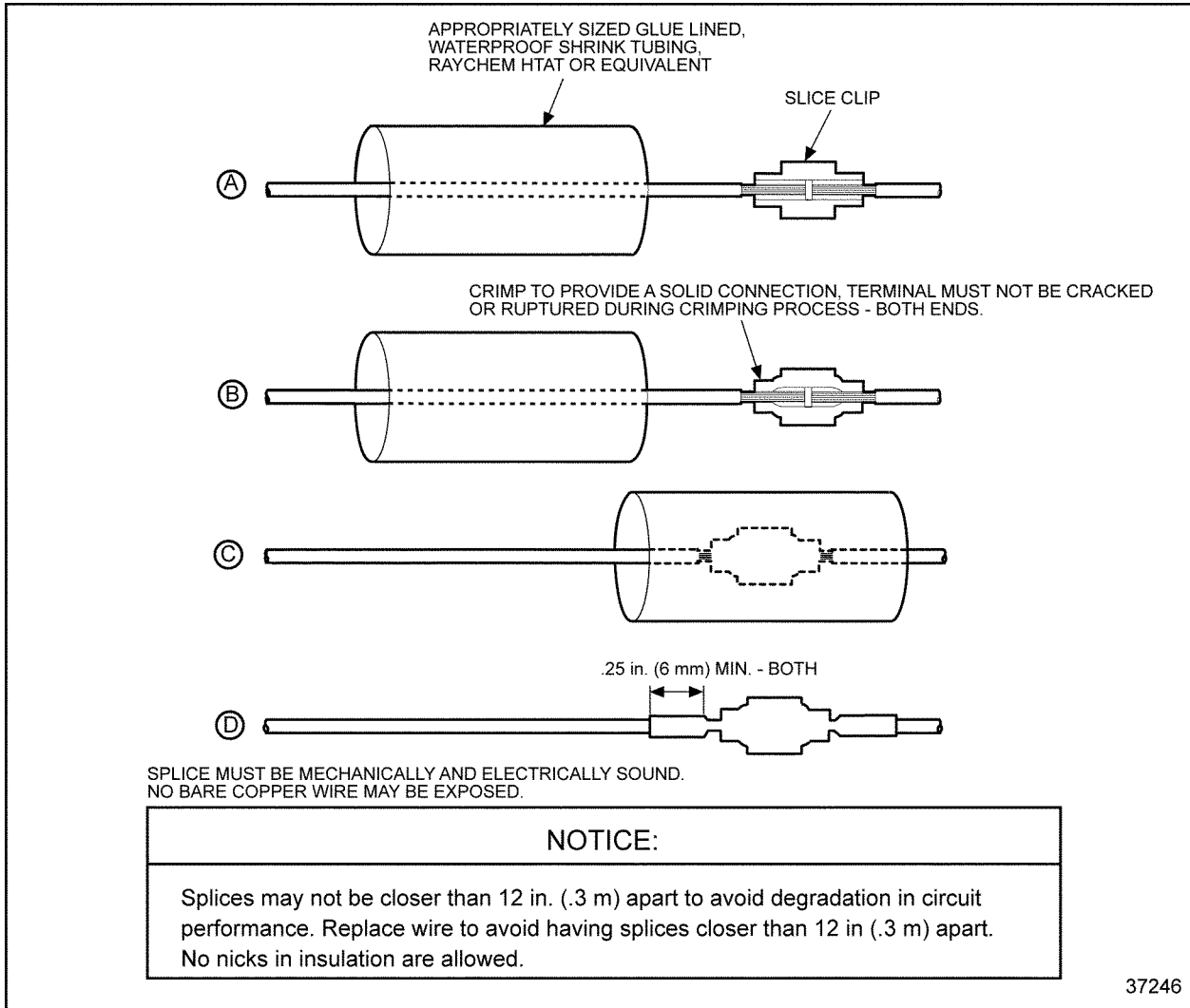
Any terminal that is cracked or ruptured is unacceptable as malfunctions may occur.

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:

<b>NOTICE:</b>
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).

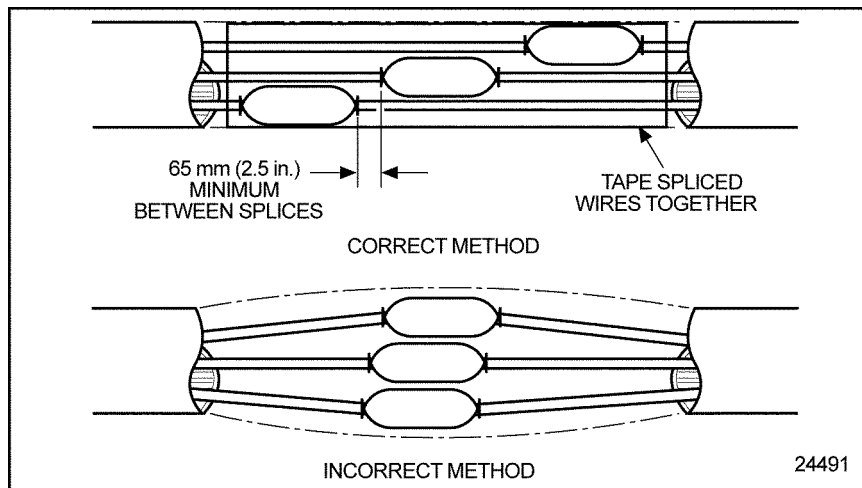
### 2.4.5.5 Staggering Wire Splices

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.

<b>NOTICE:</b>
----------------

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

The following guidelines should be used when designing a harness:

<b>NOTICE:</b>
----------------

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.

<b>NOTICE:</b>
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).

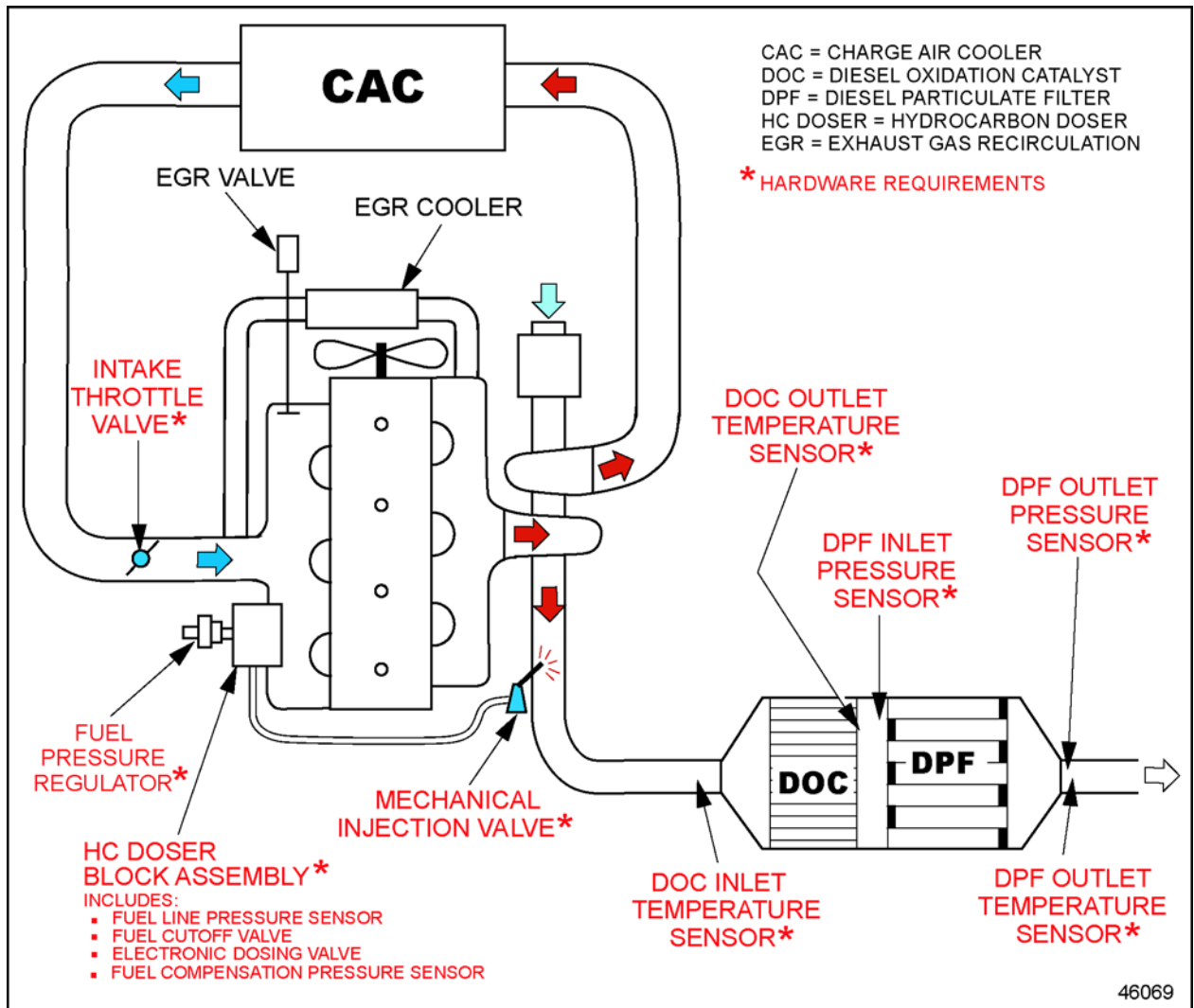
## 2.7.1 Factory-installed Sensors

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 Outlet Temperature Sensor	Temperature measured at the outlet of the after-treatment system that is installed within the exhaust system of the vehicle. It's located after the DPF that is within the after-treatment unit.
DOC Inlet Temperature	Temperature measured at the inlet of the after-treatment device in the exhaust system of the vehicle. Located before the DOC that is within the after-treatment device.
DOC Outlet Temperature	Temperature measured between the DOC and the DPF in the after-treatment assembly located in the exhaust system of the vehicle.
Engine Coolant Temperature Sensor (ECT Sensor)	Senses coolant temperature for functions such as engine protection, fan control and engine fueling.
EGR Temperature Sensor	Senses EGR exhaust temperature after EGR cooler. Used for EGR system diagnosis.
Engine Oil Pressure Sensor (EOP Sensor)	Senses gallery oil pressure for functions such as engine protection.
Engine Oil Temperature Sensor (EOT Sensor)	Senses oil temperature for functions such as reducing variation in fuel injection and fan control.
Intake Manifold Pressure Sensor (IMP Sensor)	Senses turbo boost for functions such as smoke control and engine protection.
Intake Manifold Temperature Sensor (IMT Sensor)	Senses boost temperature
Supply Fuel Temperature Sensor (SFT Sensor)	Senses fuel temperature for functions such as engine fueling.
Turbo Compressor Temperature Out Sensor	Senses turbo out air temperature.
Turbo Speed Sensor	Monitors turbo speed.

**Table 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.

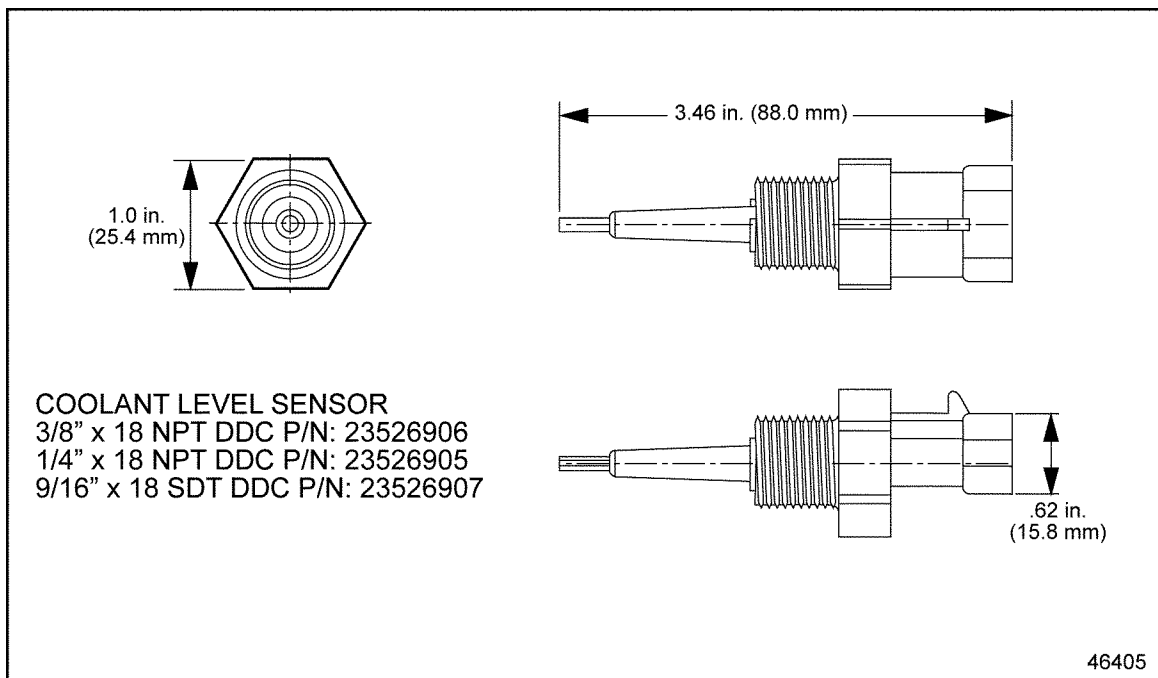
### 2.7.3 Engine Coolant Level Sensor

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.



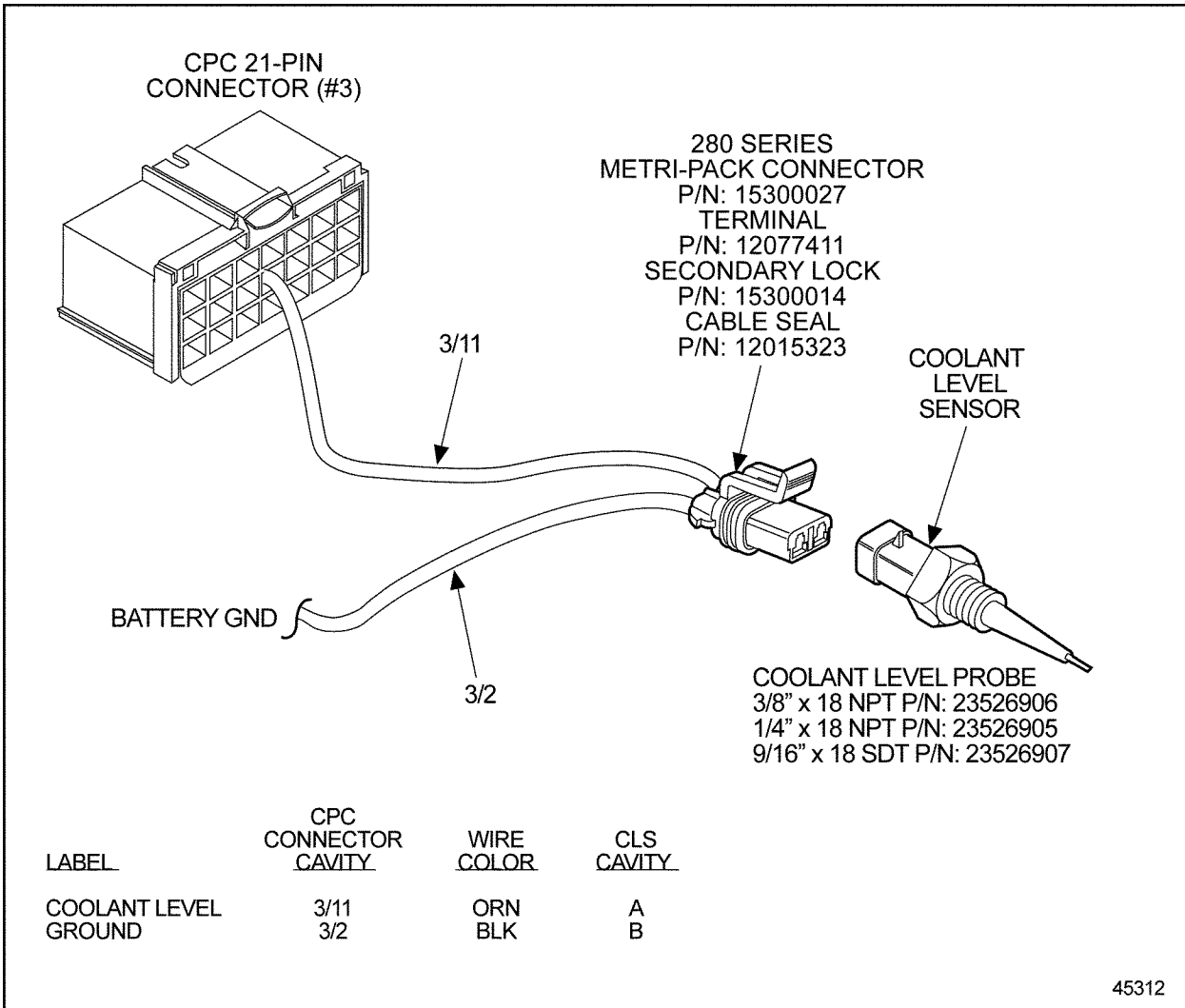
**Figure 2-21 Engine Coolant Level Sensor Specifications**

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

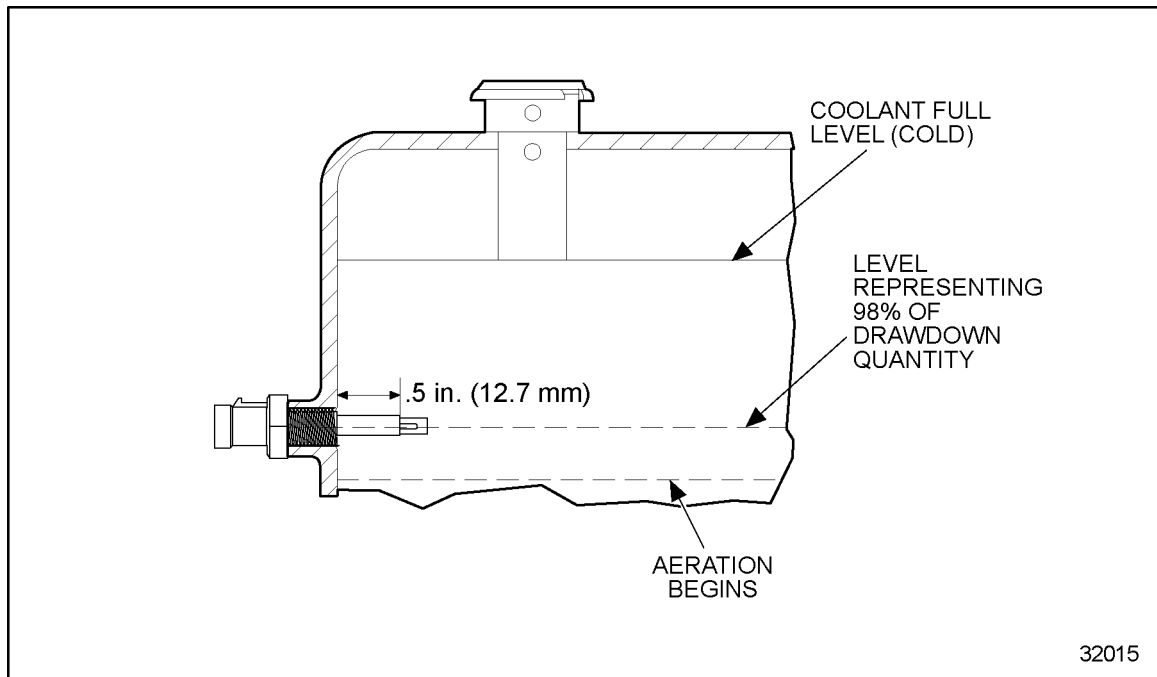
**Table 2-33 Metri-Pack 280 Connectors and Part Numbers**

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**

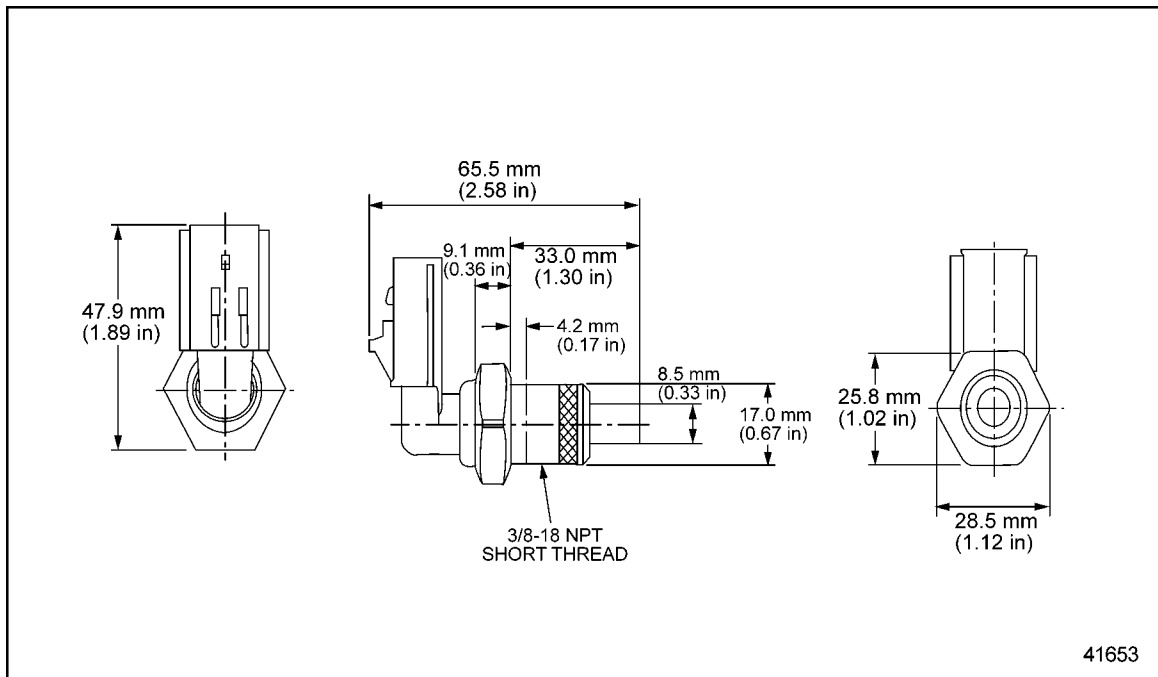
The sensor must be enabled with VEPS or the DRS as listed in Table 2-36.

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

**Table 2-36 Enabling the Engine Coolant Level Sensor**

## 2.7.4 Turbo Compressor In Temperature Sensor

The Turbo Compressor In Temperature Sensor (TCI Sensor) produces a signal representing the temperature of the turbo compressor inlet. See Figure 2-24.



**Figure 2-24 Turbo Compressor In Temperature Sensor**

This sensor is required for the Series 60.

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

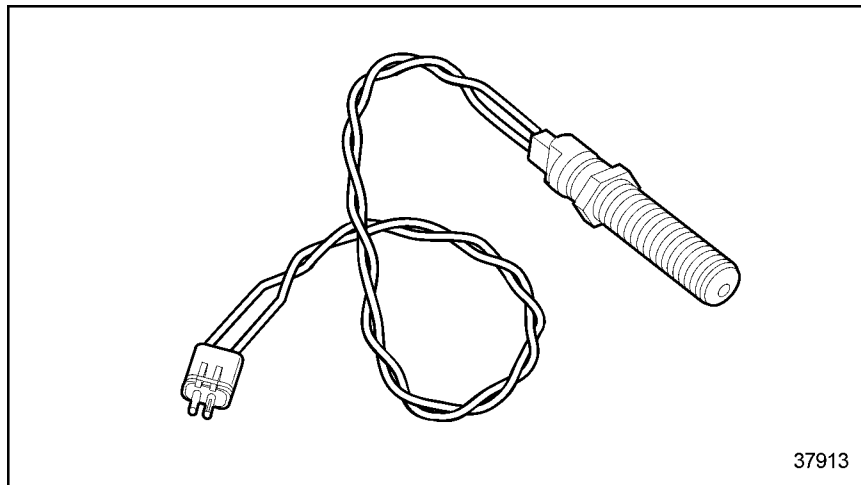
Install the Turbo Compressor In Temperature Sensor in the filtered air side of the air filter canister. Otherwise it must be mounted between the air cleaner and the turbocharger compressor inlet. This sensor has a pigtail on the Engine Harness. If it does not fit your application, this circuit is also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

## 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 2-25) provides a vehicle speed signal for use in Cruise Control and Vehicle Speed Limiting. The VSS signal type can be changed v

**NOTE:**

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



**Figure 2-25 Vehicle Speed Sensor**

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

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

**Table 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

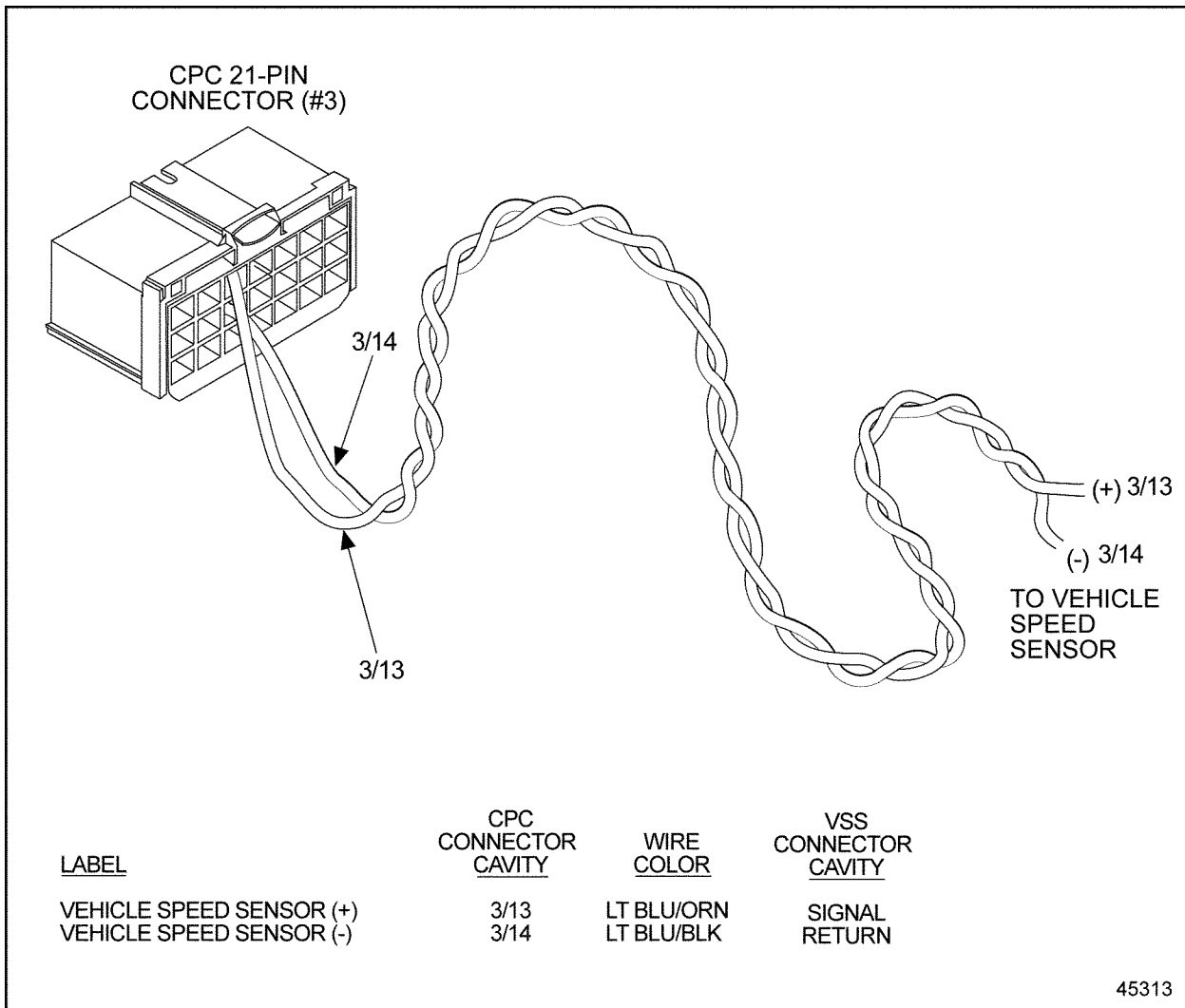
**Table 2-38 Magnetic Pickup Vehicle Speed Sensor Requirements**

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 2-26 for the installation of the Magnetic VSS.



**Figure 2-26 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	Range	Default
Vehicle Speed Sensor	0 = No Sensor 1 = C3 Sensor 2 = Square Wave (Hall Sensor) 3 = Vehicle Speed over J1939 4 = Magnetic Pickup 5 = Vehicle Speed via J1939 (TCO1, SPN 1624) 8 = Vehicle Speed via J1939 (CCVS, SPN 84)	4 = Magnetic
Axle Ratio	1 – 20.0	5.29
Tire Revs per Unit Distance	160 – 1599	312
Top Gear Ratio	0.1 – 2.55	1
Second Highest Gear Ratio	0 — 5.75	2.55
Two Spd Axle Second Axle Ratio	1 – 20.0	5.29
Anti Tamper	0 = Disable 1 = Enable VSS ABS Anti Tampering Function 2 = Enable VSS without ABS Anti Tampering Function	0 = Disable






**Table 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**

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## 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 for a short to ground 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  $\Omega$ , 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  $\Omega$ , 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

Perform the following steps to verify repairs.

1. Turn the ignition OFF.
2. Reconnect all connectors. Turn ignition ON.
3. Clear codes with diagnostic tool.
4. Start and run the engine for one minute. Stop engine.
5. Check diagnostic tool for codes.
  - [a] If no codes are displayed, troubleshooting is complete.
  - [b] If 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 for a short in the wires 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  $\Omega$ , repair the short in wires between pins 2 and 4 of the EGR valve connector and pins 60 and 62 of the 120-pin MCM connector. Refer to section 3.2.1.1.
  - [b] If the resistance is greater than 5  $\Omega$ , 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

Perform the following steps to verify repairs.

1. Turn the ignition OFF.
2. Reconnect all connectors. Turn ignition ON.
3. Clear codes with diagnostic tool.
4. Start and run the engine for one minute. Stop engine.
5. Check diagnostic tool for codes.
  - [a] If no codes are displayed, troubleshooting is complete.
  - [b] If 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. Turn the ignition ON.
2. Check for multiple codes. If other codes are present, service them first.
3. Disconnect the EGR valve electrical connector. Inspect the connector for corrosion, bent or spread pins.
  - [a] If connector damage is found, repair as necessary. Refer to section 3.3.1.1.
  - [b] If there is no connector damage, go to step 4.
4. Turn the ignition OFF.
5. Reconnect the EGR valve electrical connector.
6. Connect diagnostic tool for DDEC VI.
7. Turn the ignition ON.
8. Monitor the EGR valve actual position.
9. Does the EGR valve actual position read less than 3%?
  - [a] If yes, go to step 10.
  - [b] If no, go to step 14.
10. Command the EGR pulse width to 50%.
11. Does the EGR valve actual position read between 46% and 54%?
  - [a] If yes, go to step 12.
  - [b] If no, go to step 14.
12. Command the EGR pulse width to 100%.
13. Does the EGR valve actual position read above 95%?
  - [a] If yes, repeat steps 3 through 13. If the results are the same, call the Detroit Diesel Customer Support Center.
  - [b] If no, go to step 14.
14. Remove the EGR valve.
15. Visually inspect the EGR valve for Physical damage or excessive carbon/sludge buildup.
  - [a] If the EGR valve is damaged, replace it. Refer to section 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

Perform the following steps to verify repairs.

1. Turn the ignition OFF.
2. Reconnect all connectors. Turn ignition ON.
3. Clear codes with diagnostic tool.
4. Start and run the engine for one minute. Stop the engine.
5. Check diagnostic tool for codes.
  - [a] If no codes are displayed, troubleshooting is complete.
  - [b] If SPN 27/0/1/2/14 is not logged and other codes are logged, troubleshoot the logged codes.
  - [c] If SPN 27/0/1/2/14 and other codes are logged, review this section to find the error. If no error is found, call the Detroit Diesel Customer Support Center (313-592-5800).

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## 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 for an open as follows:

1. Disconnect the VSS.
2. Turn the ignition ON.
3. Measure the voltage between pins 1 and 2 of the VSS harness connector.
  - [a] If the voltage is between 4.5 and 5.5 volts, refer to section 4.1.2.
  - [b] If the voltage is less than 4.5 volts, go to step 4.
4. Measure the voltage between pin 1 of the VSS harness connector and a good ground..
  - [a] If the voltage is greater than 4.5 volts, repair the open wire between pin 14 of the CPC #3 connector (21-pin) and pin 2 of the VSS harness connector. Refer to section 4.1.2.1.
  - [b] If the voltage is less than 4.5 volts, repair the open wire between pin 13 of the CPC #3 connector (21-pin) and pin 1 of the VSS harness connector. Refer to section 4.1.2.1.

### 4.1.2 Short Circuit Check

Check the VSS circuit as follows:

1. Turn the ignition OFF.
2. Disconnect the CPC #3 connector (21-pin).
3. Measure the resistance between
  - [a] If the resistance measurement is less than 5  $\Omega$ , repair the short in the harness between pin 13 and pin 14 of the CPC #3 connector (21-pin). Refer to section 4.1.2.1.
  - [b] If the resistance measurement is greater than 5  $\Omega$ , replace the VSS. Refer to section 4.1.2.1.

#### 4.1.2.1 Verify Repairs

Perform the following steps to verify repairs.

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

- [a] If no codes are displayed, troubleshooting is complete.
- [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  $\Omega$ , 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  $\Omega$ , 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  $\Omega$ , 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  $\Omega$ , 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  $\Omega$ , 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  $\Omega$ , replace the VSS. Refer to section 4.2.1.1.

#### 4.2.1.1 Verify Repairs

Perform the following steps to verify repairs.

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

- [a] If no codes are displayed, troubleshooting is complete.
- [b] If code 84/4 is not logged, and other codes are logged, troubleshoot the logged codes.
- [c] If code 84/4 and other codes are logged, review this section to find the error. If no error is found, call the Detroit Diesel Customer Support Center (313-592-5800).



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## **5 SPN 86 – ADAPTIVE CRUISE CONTROL FAULT**

<b>Section</b>	<b>Page</b>
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.



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## 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 .....	6-6



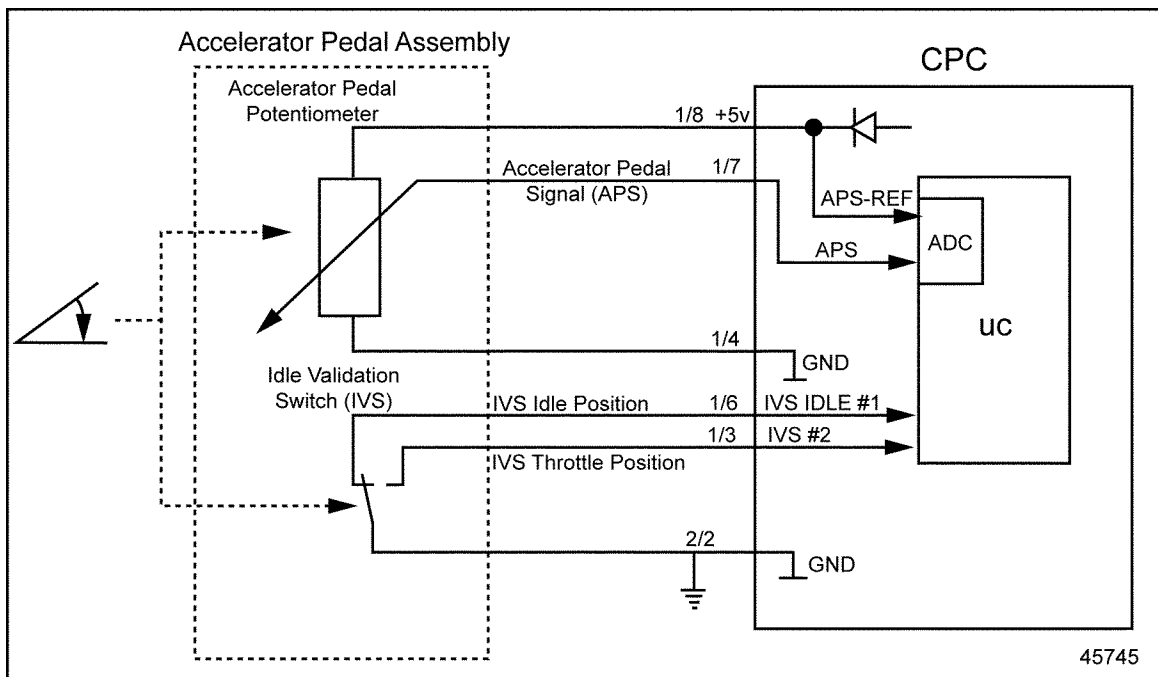
## 6.1 SPN 91/FMI 2

A typical diagnosis for the fault is erratic data.

### 6.1.1 Erratic Data Check

Check for erratic data 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.
  - [a] If the voltage is between 4.5 and 5.5 volts, go to step 5.
  - [b] If the voltage is less than 4.5, go to step 4.
4. Measure the voltage between pins 1 of the AP harness connector and ground.
  - [a] If the voltage is between 4.5 and 5.5 volts, repair the open circuit between pin 3 of the AP harness connector and pin 4 of the CPC #1 connector. See Figure 6-1. 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. See Figure 6-1. Refer to section 6.1.1.1.



**Figure 6-1 Accelerator Pedal Assembly Installation**

5. Turn the ignition switch to the OFF position.
6. Disconnect the CPC #1 connector.

7. Measure the resistance between pin 2 of the AP harness connector and pin 7 of the CPC #1 connector.
  - [a] Measure the resistance between pin 2 of the AP harness connector and pin 7 of the CPC #1 connector. Refer to section 6.1.1.1.
  - [b] If the resistance is less than 3  $\Omega$ , replace the Accelerator Pedal. Refer to section 6.1.1.1.

### 6.1.1.1 Verify Repairs

Perform the following steps to verify repairs.

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

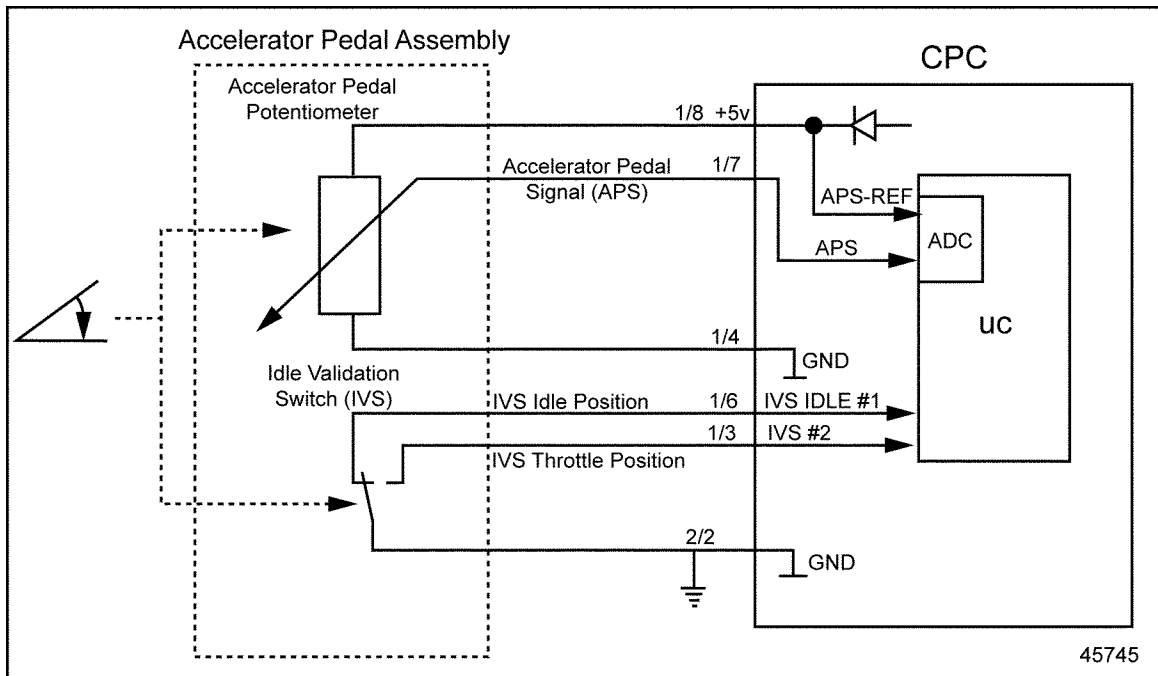
The typical diagnosis for this fault is high voltage.

### 6.2.1 High Voltage Check

Check for high voltage 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.
  - [a] If the voltage is between 4.5 and 5.5 volts, go to step 5.
  - [b] If the voltage is less than 4.5, 4.
4. Measure the voltage between pins 1 of the AP harness connector and ground.
  - [a] If the voltage is between 4.5 and 5.5 volts, repair the open circuit between pin 3 of the AP harness connector and pin 4 of the CPC #1 connector. See Figure 6-2. 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. See Figure 6-2. Refer to section 6.2.1.1.



**Figure 6-2 Accelerator Pedal Assembly Installation**

5. Turn the ignition OFF.
6. Disconnect the CPC #1 connector.
7. Measure the resistance between pin 2 of the AP harness connector and pin 7 of the CPC #1 connector.
  - [a] Measure the resistance between pin 2 of the AP harness connector and pin 7 of the CPC #1 connector. Refer to section 6.2.1.1.
  - [b] If the resistance is less than 3  $\Omega$ , replace the Accelerator Pedal. Refer to section 6.2.1.1.

### 6.2.1.1 Verify Repairs

Perform the following steps to verify repairs.

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

- [b] If code 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).

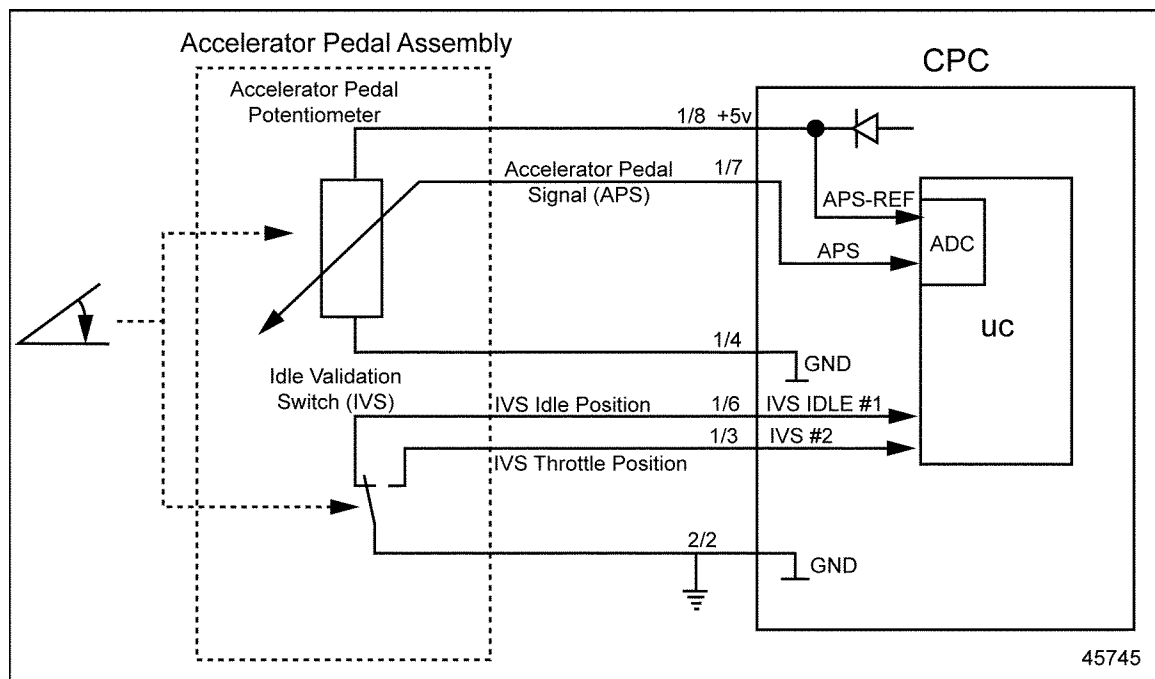
## 6.3 SPN 91/FMI 4

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 CPC #1 connector.
3. Measure the resistance between pin 1 and pin 3 of the AP connector.
  - [a] If the resistance is less than 5  $\Omega$ , repair the short between wires 8 and 4 of the CPC #1 connector. See Figure 6-3. Refer to section 6.3.1.1.
  - [b] If the resistance is greater than 5  $\Omega$ , go to step 4.



**Figure 6-3 Accelerator Pedal Assembly Installation**

4. Measure the resistance between pin 2 and 3 of the AP connector.
  - [a] If the resistance is less than 5  $\Omega$ , 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  $\Omega$ , 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  $\Omega$ , 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  $\Omega$ , 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  $\Omega$ , 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  $\Omega$ , replace the Accelerator Pedal. Refer to section 6.3.1.1.

### 6.3.1.1 Verify Repairs

Perform the following steps to verify repairs.

1. Turn the ignition OFF.
2. Reconnect all connectors. Turn ignition ON.
3. Clear codes with diagnostic tool.
4. Start and run the engine for one minute. Stop engine.
5. Check diagnostic tool for codes.
  - [a] If no codes are displayed, troubleshooting is complete.
  - [b] If code 91/4 is not logged, and other codes are logged, troubleshoot the logged codes.
  - [c] If code 91/4 and other codes are logged, review this section to find the error. If no error is found, call the Detroit Diesel Customer Support Center (313-592-5800).



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## **7 SPN 100 — ENGINE OIL PRESSURE OUTSIDE NORMAL OPERATING RANGE**

<b>Section</b>		<b>Page</b>
7.1	SPN 100/FMI 1 .....	7-3
7.2	SPN 100/FMI 2 .....	7-5
7.3	SPN 100/FMI 3 .....	7-6
7.4	SPN 100/FMI 4 .....	7-8
7.5	SPN 100/FMI 14 .....	7-9



## 7.1 SPN 100/FMI 1

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

The following procedures will troubleshoot SPN 100.

### 7.1.1 Low Oil Pressure Check

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

1. Turn the ignition ON.
2. Check for multiple codes.
  - [a] If fault codes 100/1 and 100/3 are both active, refer to section 7.4.1.
  - [b] If fault codes 100/1 and 100/4 are both active, refer to section 7.3.1
  - [c] If only fault code 100/1 is active, go to step 3.
3. Observe the stability of the oil pressure.
  - [a] If the oil pressure is in normal operating range and stable, go to step 4.
  - [b] If the oil pressure is fluctuating, go to step 5.
4. Check the oil level.

#### **NOTE:**

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

- [a] If the oil level is high, check for fuel entering into the engine oil system and repair as required. Change the engine oil. Refer to section 7.1.1.1.
  - [b] If the engine oil level is low, fill oil to proper level. Refer to section 7.1.1.1.
5. Check the operation of the oil gage.
  - [a] If the oil gage readings are erratic, repair or replace the oil gage as required. Refer to section 7.1.1.1.
  - [b] If the oil gage readings are fine, go to step 6.
6. Check the condition of the oil pump suction pipe.
  - [a] If the pipe is loose or cracked, replace a cracked pipe and reinstall a loose pipe. Refer to section 7.1.1.1.
  - [b] If there is no problem with the oil pump suction pipe, go to step 7.
7. Check the condition of the oil pump drive and driven gears.
  - [a] If either gear is loose, repair or replace loose gears as required. Refer to section 7.1.1.1.
  - [b] If neither gear is loose, go to step 8.
8. Check for a faulty oil pressure relief valve.

- [a] If the relief valve does not open at the set pressure or sticks open, repair or replace a faulty oil pressure relief valve as required. Refer to section 7.1.1.1.
- [b] If the relief valve is fine, refer to section 7.1.1.1.

### **7.1.1.1 Verify Repairs**

Perform the following steps to verify repairs.

1. Turn the ignition OFF.
2. Reconnect all connectors.
3. Turn ignition ON.
4. Clear codes with diagnostic tool.
5. Start and run the engine for one minute.
6. Stop engine.
7. Check diagnostic tool for codes.
  - [a] If no codes are displayed, troubleshooting is complete.
  - [b] If code 100/1 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 Switch.

### 7.2.1 Erratic Data From the Engine Oil Pressure Switch

Check for erratic data from the Engine Oil Pressure Switch 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 7.4.1.
  - [b] If fault code 100/4 is active in addition to code 100/2, refer to section 7.3.1.
  - [c] If only fault code 100/2 is active, check and clean switch contacts (remove any corrosion). Refer to section 7.2.1.1.

#### 7.2.1.1 Verify Repairs

Perform the following steps to verify repairs.

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

## 7.3 SPN 100/FMI 3

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

### 7.3.1 Open Short to Power Check

Check as follows:

1. Check for multiple codes.
  - [a] If 100/3, 174/3, 115/3, 110/3 and 100/3 are present, repair the open between pin 55 of the 120-pin connector and the associated switches. Refer to section 7.3.1.1.
  - [b] If only 100/3 is present, go to step 2.
2. Disconnect the Engine Oil Pressure Switch.
3. Turn the ignition ON.
4. Measure the voltage between pins 1 and 2 of the Engine Oil Pressure Switch harness connector.
  - [a] If the voltage is between 2.5 and 3 volts, replace the Engine Oil Pressure Switch. Refer to section 7.3.1.1.
  - [b] If the voltage is less than 2.5 volts, go to step 5.
5. Measure the voltage between pin 2 of the Engine Oil Pressure Switch harness connector and ground.
  - [a] If the voltage is between 2.5 and 3 volts, repair the open circuit between pin 1 of the Engine Oil Pressure Switch harness connector and pin 55 of the 120-pin MCM connector. Refer to section 7.3.1.1.
  - [b] If the voltage is less than 2.5 volts, repair the open circuit between pin 2 of the Engine Oil Pressure Switch harness connector and pin 54 of the 120-pin MCM connector. Refer to section 7.3.1.1.

#### 7.3.1.1 Verify Repairs

Perform the following steps to verify repairs.

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

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

### 7.4.1 Open Short to Ground Check

Check as follows:

1. Disconnect the Engine Oil Pressure Switch.
2. Disconnect the 120-pin MCM connector.
3. Measure the resistance between pins 1 and 2 of the Engine Oil Pressure Switch.
  - [a] If the resistance is greater than 5 $\Omega$ , go to step 4.
  - [b] If the resistance is less than 5 $\Omega$ , repair the short between wires 54 and 55 of the 120-pin MCM connector. Refer to section 7.4.1.1.
4. Measure the resistance between pins 1 of the Engine Oil Pressure Switch harness connector and ground.
  - [a] If the resistance is greater than 5 $\Omega$ , go to step 5.
  - [b] If the resistance is less than 5 $\Omega$ , repair the short circuit between pin 1 of the Engine Oil Pressure Switch harness connector and chassis ground. Refer to section 7.4.1.1.
5. Measure the resistance between pin 2 of the Engine Oil Pressure Switch harness connector and ground.
  - [a] If the resistance is greater than 5  $\Omega$ , replace the switch. Refer to section 7.4.1.1.
  - [b] If the resistance is less than 5  $\Omega$ , repair the short between pin 2 of the Engine Oil Pressure Switch harness connector and ground. Refer to section 7.4.1.1.

#### 7.4.1.1 Verify Repairs

Perform the following steps to verify repairs.

1. Turn the ignition OFF.
2. Reconnect all connectors.
3. Turn ignition ON.
4. Clear codes with diagnostic tool.
5. Start and run the engine for one minute.
6. Stop engine.
7. Check diagnostic tool for codes.
  - [a] If no codes are displayed, troubleshooting is complete.
  - [b] If code 100/4 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 Code Check

Check for multiple codes as follows:

1. Turn the ignition ON.
2. Check for additional active fault codes.
  - [a] If fault code 100/3 is active in addition to code 100/14, refer to section 7.4.1.
  - [b] If fault code 100 /4 is active in addition to code 100/14, refer to section 7.3.1.
3. If only fault code 100/14 is active, refer to section 7.5.2.

### 7.5.2 Oil Pressure, Oil Pump and Oil Gauges Check

Check as follows

1. Start engine and check oil pressure.
  - [a] If pressure is fluctuating, go to step 2.
  - [b] If pressure is low but stable, go to step 3.
2. 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 7.5.2.1
3. 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 4.
  - [b] If oil is not above maximum level, contact Detroit Diesel Customer Support Center (313–592–5800).
4. Check for possible fuel in oil.

- [a] If fuel is found, locate and repair source of fuel leak. Change the oil. Refer to section 7.5.2.1.
- [b] If fuel is not found, contact Detroit Diesel Customer Support Center (313–592–5800).

### **7.5.2.1 Verify Repairs**

Perform the following steps to verify repairs.

1. Turn the ignition OFF.
2. Reconnect all connectors.
3. Turn ignition ON.
4. Clear codes with diagnostic tool.
5. Start and run the engine for one minute.
6. Stop engine.
7. Check diagnostic tool for codes.
  - [a] If no codes are displayed, troubleshooting is complete.
  - [b] If code 100/14 is not logged, and other codes are logged, troubleshoot the logged codes.
  - [c] If code 100/14 and other codes are logged, review this section to find the error. If no error is found, call the Detroit Diesel Customer Support Center (313–592–5800).

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## 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 .....	8-6
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 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  $\Omega$ , replace the Turbo Speed Sensor. Refer to section 8.1.1.1.
  - [b] If the resistance is less than 1k  $\Omega$ , 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

Perform the following steps to verify repairs.

1. Turn the ignition OFF.
2. Reconnect all connectors. Turn ignition ON.
3. Clear codes with diagnostic tool.
4. Start and run the engine for one minute. Stop engine.
5. Check diagnostic tool for codes.
  - [a] If no codes are displayed, troubleshooting is complete.
  - [b] If code 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  $\Omega$ , replace the Turbo Speed Sensor. Refer to section 8.2.1.1.
  - [b] If the resistance is less than 1k  $\Omega$ , 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. Perform the engine oil pressure.
  - [a] If the fuel pressure is not within specifications, repair the lubrication system as necessary. When the repairs are done, refer to section 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

Perform the following steps to verify repairs.

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

1. Disconnect the Turbo Speed Sensor (TSS).
2. Measure the resistance across pins 1 and 2 of the sensor (see Figure ).
  - [a] If the resistance is greater than 1k  $\Omega$ , replace the sensor. Refer to section 8.3.2.1.
  - [b] If the resistance is less than 1k  $\Omega$ , go to step 3.
3. Turn the ignition switch to the ON position.
4. Measure the voltage between pins 1 and 2 of the TSS harness connector.
  - [a] If the voltage is between 4.5 and 5.5 volts, refer to section 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. See Figure . 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  $\Omega$ , replace the sensor. Refer to section 8.3.2.1.
  - [b] If the resistance is less than 1.1k  $\Omega$ , go to step 7.
7. Turn the ignition switch to the ON position.
8. Measure the voltage between pins 1 and 2 of the TSS harness connector.
  - [a] If the voltage is between 4.5 and 5.5 volts, contact the Detroit Diesel Customer Support Center (313–592–5800) for authorization to replace the MCM.
  - [b] If the voltage is less than 4.5 volts, refer to section 8.3.1, step 5.

#### 8.3.2.1 Verify Repairs

Perform the following steps to verify repairs.

1. Turn vehicle ignition OFF.
2. Reconnect all connectors. Turn ignition ON.
3. Clear codes with diagnostic tool.
4. Start and run the engine for one minute. Stop engine.
5. Check diagnostic tool for codes.
  - [a] If no codes are displayed, troubleshooting is complete.
  - [b] If code 103/3 is not logged, and other codes are logged, troubleshoot the logged codes.
  - [c] If code 103/3 and other codes are logged, review this section to find the error. If no error is found, call the Detroit Diesel Customer Support Center (313–592–5800).

### 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  $\Omega$ , 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  $\Omega$ , 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  $\Omega$ , 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  $\Omega$ , 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  $\Omega$ , 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  $\Omega$ , 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  $\Omega$ , 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  $\Omega$ , 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  $\Omega$ , 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  $\Omega$ , 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  $\Omega$ , 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  $\Omega$ , contact the Detroit Diesel Customer Support Center (313-592-5800) for authorization to replace the MCM.

### 8.4.2.1 Verify Repairs

Perform the following steps to verify repairs.

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

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

There are two possible causes for this fault code:

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

### 8.5.1 Turbo Speed Sensor Check

Troubleshoot a Turbo No Revolution fault as follows:

1. With the engine stopped and at ambient temperature, unplug the TSS from the TSS connector.
2. Measure the resistance between the sensor terminals.
  - [a] If resistance is approximately 900  $\Omega$ , refer to section 8.5.2.
  - [b] If resistance is zero or higher than 950  $\Omega$ , 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

Perform the following steps to verify repairs.

1. Turn the ignition OFF.
2. Reconnect all connectors. Turn ignition ON.
3. Clear codes with diagnostic tool.
4. Start and run the engine for one minute. Stop engine.
5. Check diagnostic tool for codes.
  - [a] If no codes are displayed, troubleshooting is complete.
  - [b] If code 103/7 is not logged, and other codes are logged, troubleshoot the logged codes.
  - [c] If code 103/7 and other codes are logged, review this section to find the error. If no error is found, call the Detroit Diesel Customer Support Center (313-592-5800).



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# 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 .....	9-4
9.3 SPN 110/FMI 3 .....	9-5
9.4 SPN 110/FMI 4 .....	9-7
9.5 SPN 110/FMI 14 .....	9-8



## 9.1 SPN 110/FMI 0

The diagnostic condition is typically engine coolant temperature high.

### 9.1.1 Multiple Code Check

Perform the following steps to check for multiple codes

1. Turn the ignition ON.
2. Plug in the diagnostic tool.
3. Read active codes.
  - [a] If fault 110/3 is active in addition to 110/0, refer to section 9.3.
  - [b] If fault 110/4 is active in addition to 110/0, refer to section 9.4.
  - [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, refer to section 9.1.2.

### 9.1.2 System Checks to Resolve Fault

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

1. Check for coolant loss.
2. Check for blockage in radiator and charge air cooler.
3. Check fan belt condition (slippage).
4. Check for proper location of fan shroud.
5. Check for proper radiator hose condition (no collapsed hoses).
6. Check for proper viscous fan operation.
7. Once checks and repairs are finished, refer to section 9.1.2.1.

#### 9.1.2.1 Verify Repairs

Perform the following steps to verify repairs.

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

Troubleshoot SPN 110/2 as follows:

1. Check cooling system integrity (lack of heat complaints).
2. Connect the diagnostic tool and monitor the engine oil temperature and the engine coolant temperature.
3. With the engine running at idle and the engine oil temperature above 160°, is the coolant temperature within X degrees of the oil temperature?
  - [a] If yes, go to step 4.
  - [b] If no, disconnect the ECT Sensor and the MCM connector. Bridge pins X and X of the sensor, measure the resistance at the MCM between pins X and X. If the resistance is greater than 3  $\Omega$ , repair the harness. If the resistance is less than 3  $\Omega$ , 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  $\Omega$  repair the harness. If the resistance is less than 3  $\Omega$ , replace the sensor. Refer to section 9.2.1.1.

#### 9.2.1.1 Verify Repairs

Perform the following steps to verify repairs.

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

## 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 (110/3).

### 9.3.1 Multiple Code Check

Check for multiple codes as follows:

1. Turn the ignition ON.
2. Plug in the diagnostic tool.
3. Read the active codes.
  - [a] If codes 110/3, 174/3 and 175/3 are active at the same time, repair the open circuit between pin 73 of the 120-pin MCM connector and pin 1 of the ECT Sensor, the EOT Sensor and the Supply Fuel Temperature Sensor. Refer to section 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 $\Omega$ , replace the sensor. Refer to section 9.3.2.1.
  - [b] If the resistance is less than 4 k $\Omega$ , go to step 3.
3. Turn the ignition ON.
4. Measure the voltage between pins 1 and 2 of the ECT Sensor harness connector.
  - [a] If the voltage is between 2.75 and 3.25 volts, go to step 6.
  - [b] If the voltage is less than 2.75 volts, go to step 5.
5. Measure the voltage between pin 2 of the ECT Sensor harness connector and ground.
  - [a] If the voltage is between 2.75 and 3.25 volts, repair the open circuit between pin 1 of the ECT Sensor harness connector and pin 73 of the 120-pin MCM connector (see Figure ). 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. Refer to section 9.3.2.1.
6. Disconnect the 120-pin MCM connector. Measure the resistance between pins 1 and 2 of the ECT Sensor harness connector.
  - [a] If the resistance is greater than 5  $\Omega$ , replace the ECT Sensor. Refer to section 9.3.2.1.

- [b] If the resistance is less than 5  $\Omega$ , repair the short between pins 73 and 110 of the 120-pin MCM connector. Refer to section 9.3.2.1.

### **9.3.2.1 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 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.
  - [a] If resistance is greater than 5  $\Omega$ , go to step 4.
  - [b] If resistance is less than 5  $\Omega$ , repair short to ground between pins 73 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  $\Omega$ , go to step 5.
  - [b] If resistance is less than 5  $\Omega$ , 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  $\Omega$ , 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  $\Omega$ , 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

Perform the following steps to verify repairs.

1. Turn vehicle ignition OFF and reconnect all connectors.
2. Turn vehicle ignition ON. Clear the codes.
3. Start and run the engine for eight minutes. Stop the engine.
4. Check for codes.
  - [a] If no codes are logged, troubleshooting is complete.
  - [b] If 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 Code Check

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

1. Turn the ignition switch ON.
2. Plug in the Diagnostic Data Reader (DDR).
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

Perform the following steps to verify repairs.

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

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## **10 SPN 111 – COOLANT LEVEL OUTSIDE NORMAL OPERATING RANGE**

<b>Section</b>	<b>Page</b>
10.1 SPN 111/FMI 1 .....	10-5
10.2 SPN 111/FMI 3 .....	10-7
10.3 SPN 111/FMI 4 .....	10-9





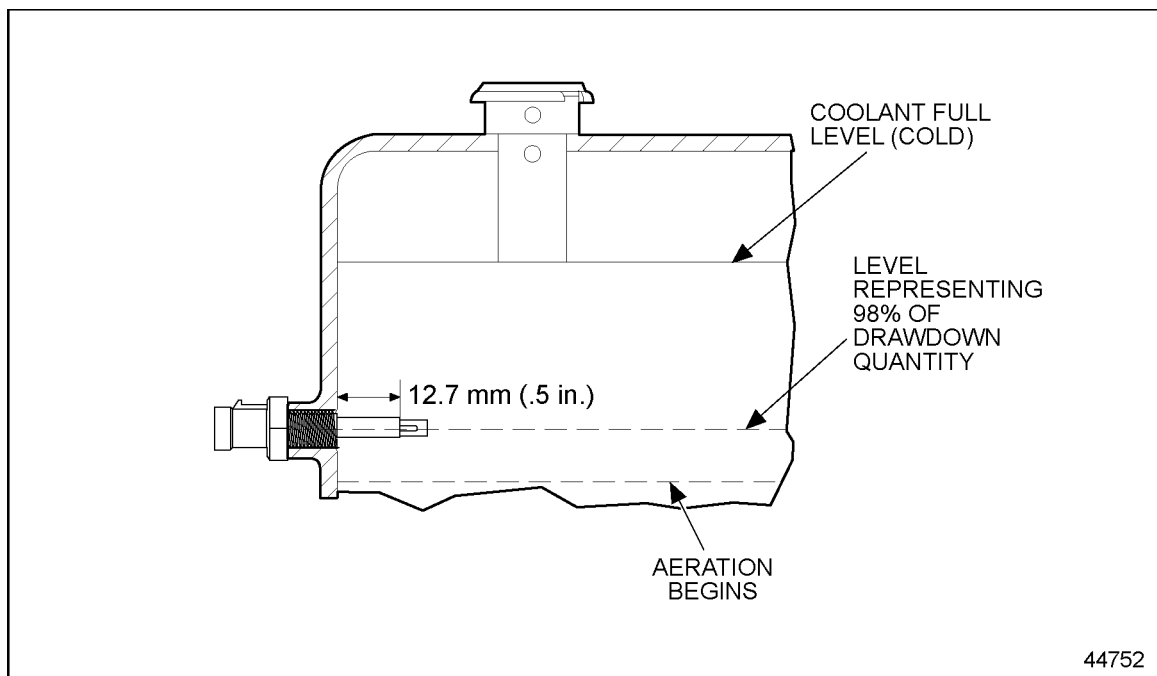


## 10.1 SPN 111/FMI 1

Perform the following steps to troubleshoot 111/1:

### 10.1.1 Coolant Level Check

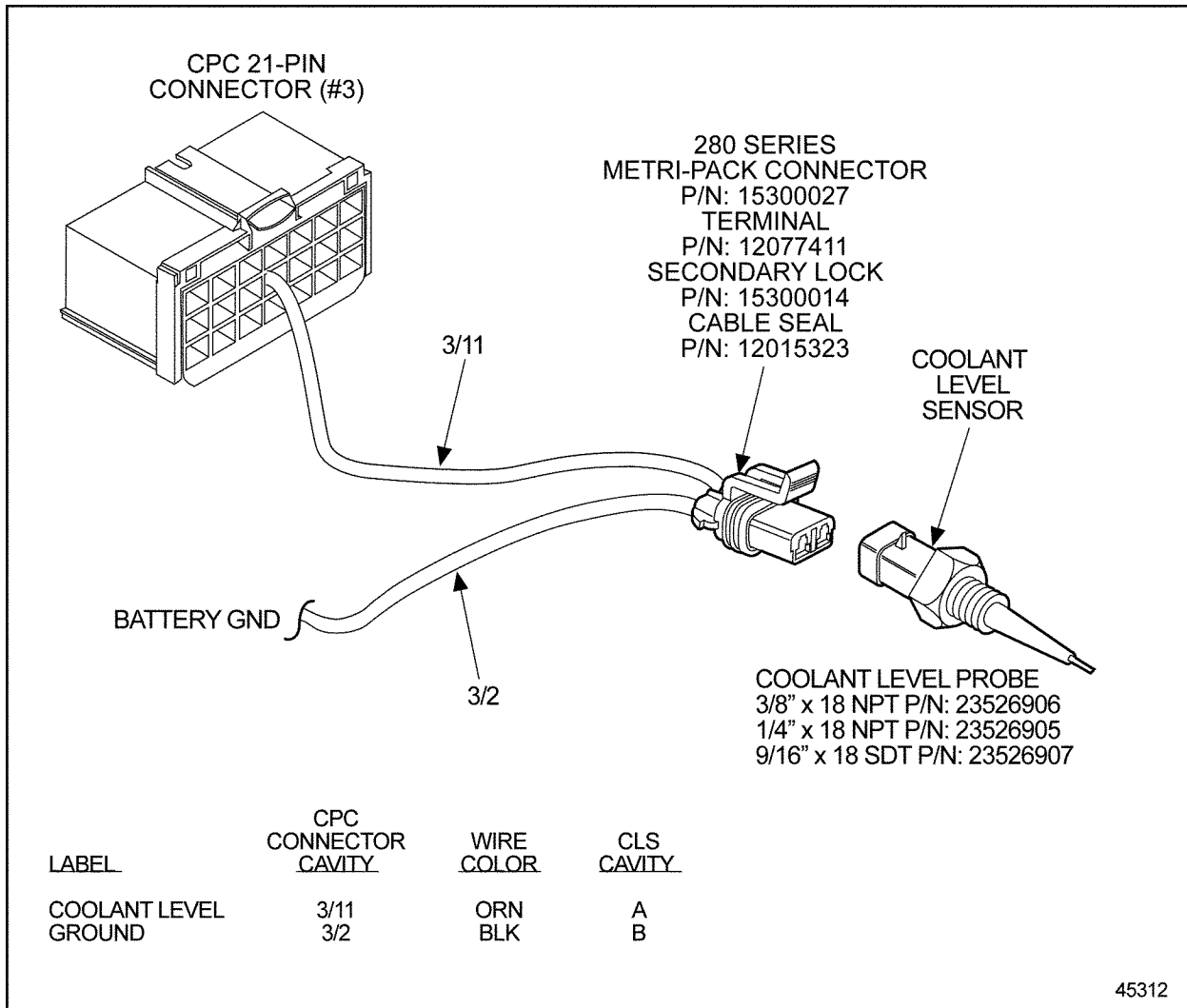
1. Turn the ignition ON.
2. Check for multiple codes.
  - [a] If other faults are active in addition to fault 111/1, troubleshoot the other faults first.
  - [b] If only fault 111/1 is active, go to step 3.
3. Check the coolant level in the reservoir. See Figure 10-1.



**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

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

1. Check for coolant leak at cylinder head gasket.
2. Check for coolant leak at air compressor head gasket.
3. Check for external coolant leak at hose connections.
4. Check for coolant in oil.
5. Check for loose or faulty radiator cap.
6. When these checks and subsequent repairs are finished, Refer to section 10.1.2.1.

### 10.1.2.1 Verify Repairs

Perform the following steps to test the repair:

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

## 10.2 SPN 111/FMI 3

This condition is typically an open circuit fault.

### 10.2.1 Multiple Codes Check

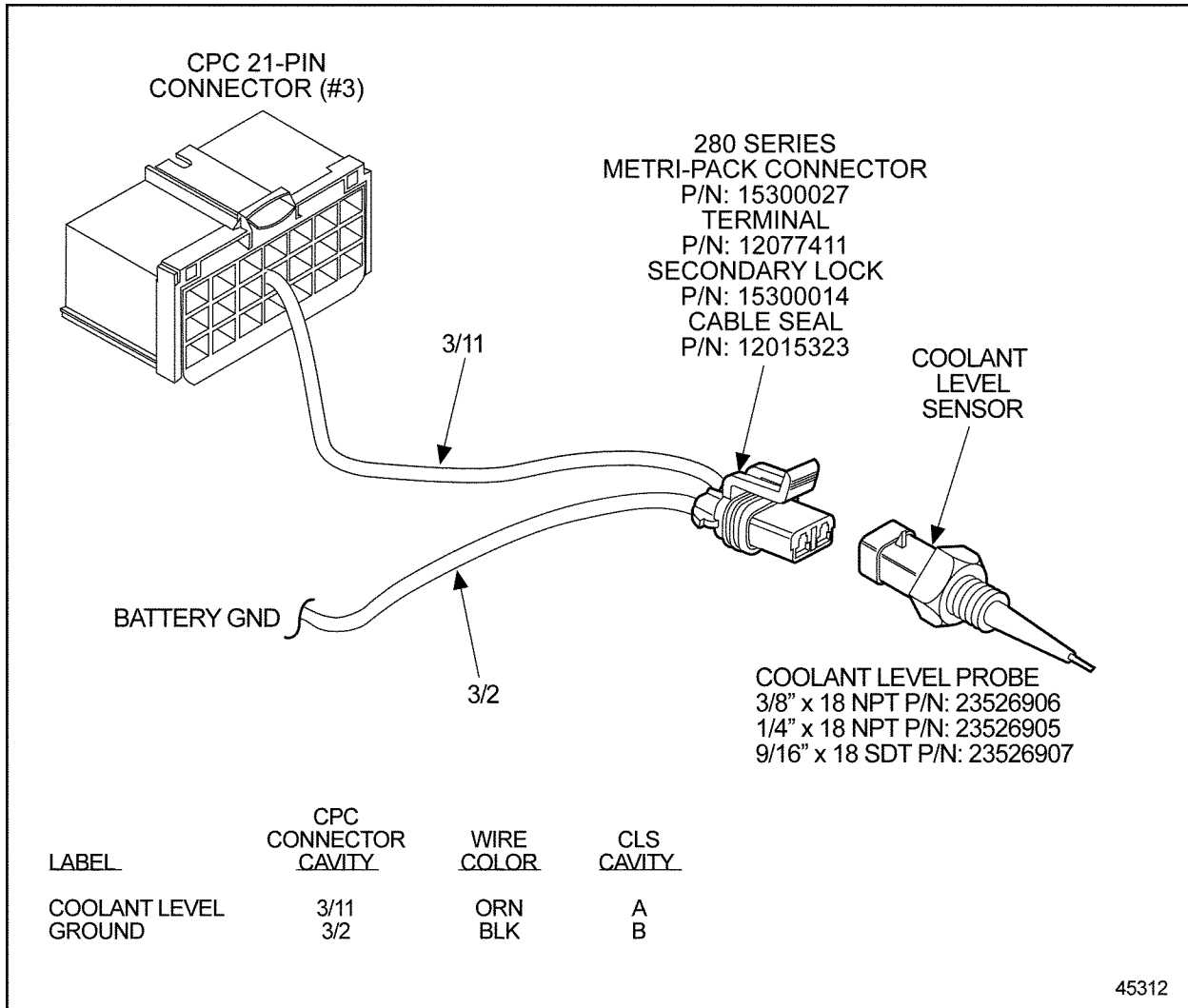
Perform the following steps to check for multiple codes:

1. Turn the ignition ON.
2. Read the diagnostic codes displayed.
  - [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, refer to section 10.2.2.

### 10.2.2 Open Circuit Check

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

1. Check the voltage between the CPC #3 connector (21-pin ) wire 3/11 on the ECL Sensor. See Figure 10-3.



**Figure 10-3 Engine Coolant Level Sensor Installation for CPC**

- [a] If voltage is about 5 volts, replace ECL sensor. Refer to section 10.2.2.1.
  - [b] If voltage is the same as battery voltage, repair short to wire in ECL Sensor wire 3/11. Refer to section 10.2.2.1.
  - [c] If voltage is 0 volts, go to step 2.
2. Bridge wire 3/11 to battery ground.
    - [a] If fault 111/3 is active, repair open circuit in ECL Sensor wire 3/11. Refer to section 10.2.2.1.
    - [b] If fault 111/4 is active, repair open circuit in ECL Sensor wire 3/2. Refer to section 10.2.2.1.

### 10.2.2.1 Verify Repairs

Perform the following steps to test the repair:

1. Connect all the removed connectors.
2. Start and run the engine for 5 minutes.
3. Plug in the diagnostic tool.
4. Read the active codes.
  - [a] If no codes display, the repairs are complete.
  - [b] If code 111/3 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. Perform the following steps to troubleshoot.

### 10.3.1 Multiple Codes Check

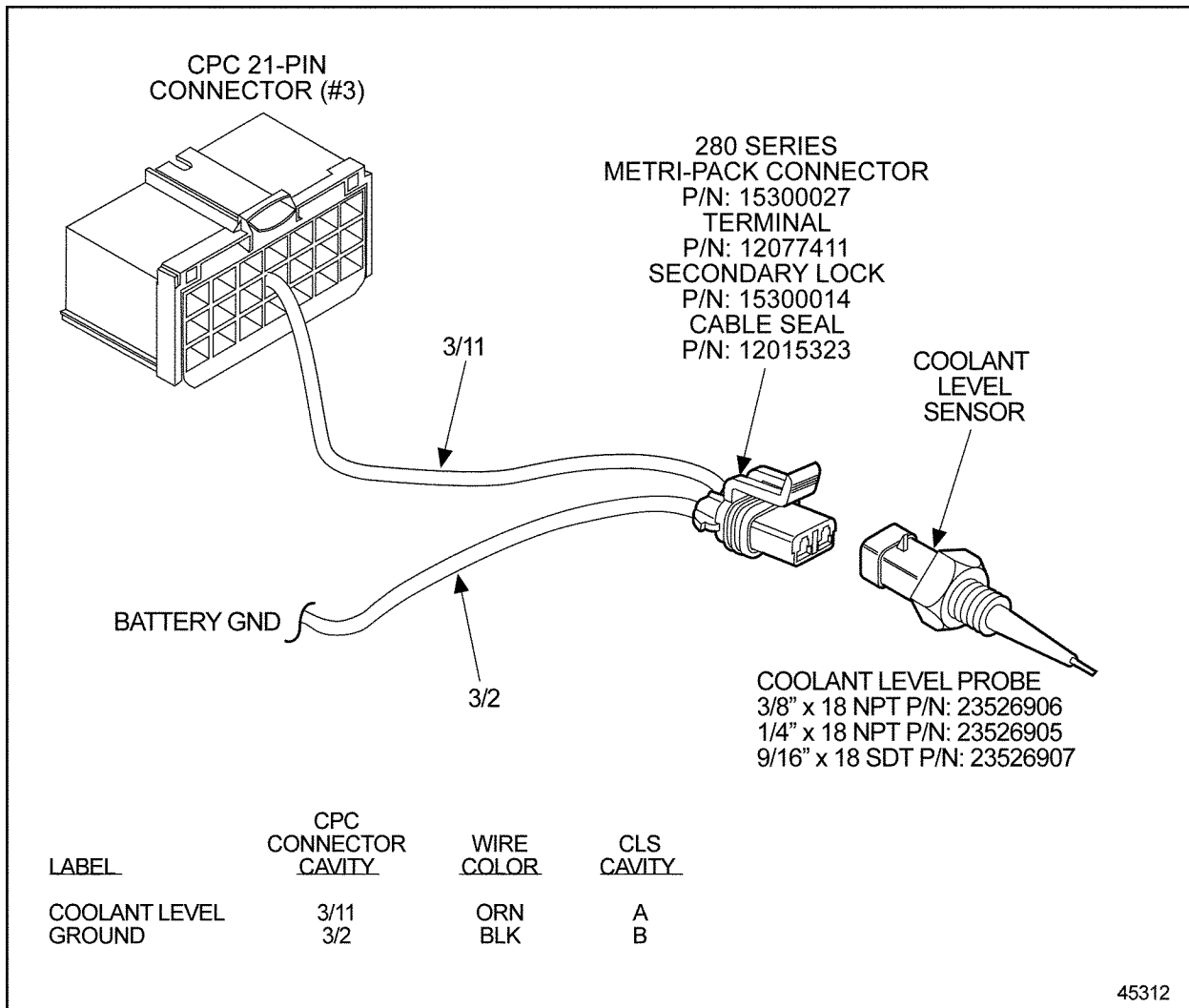
Perform the following steps to check for multiple codes:

1. Turn the ignition ON.
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, refer to section 10.3.2.

### 10.3.2 Short to Ground Check

Check for a short to ground as follows:

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



**Figure 10-4 Engine Coolant Level Sensor Installation for CPC**

- [a] If fault 111/4 is not active after disconnecting the sensor, replace the ECL Sensor.
  - [b] If fault 111/4 is active after disconnecting the sensor, go to step 2.
2. Disconnect the #3 connector (21-pin).
  3. Measure the resistance across pins 1 and 2 of the ECL Sensor connector.
    - [a] If the resistance is less than 5  $\Omega$ , repair the short between the wires 2 and 11 of the CPC #3 connector. Refer to section 10.3.2.1.
    - [b] If the resistance is greater than 5  $\Omega$ , go to step 4.
  4. Measure the resistance between pin 1 of the ECL Sensor harness connector and ground.
    - [a] If the resistance is less than 5  $\Omega$ , repair the short circuit between pin 1 of the ECL Sensor harness connector and ground. Refer to section 10.3.2.1.

- [b] If the resistance is greater than 5  $\Omega$ , go to step 5.
- 5. Measure the resistance between pin 2 of the ECL Sensor harness connector and ground.
  - [a] If the resistance is less than 5  $\Omega$ , repair the short circuit between pin 2 of the ECL Sensor harness connector and ground. Refer to section 10.3.2.1.
  - [b] If the resistance is greater than 5  $\Omega$ , review steps 10.3.2.1 through 5. If the results are the same, call the Detroit Diesel Customer Support Center (313-592-5800).

### 10.3.2.1 Verify Repairs

Perform the following steps to test the repair:

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



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# 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 for high voltage as follows:

1. Start the engine and rev at rated speed.
2. Measure the voltage across the battery terminals. .
  - [a] If the voltage is greater than 16 V, troubleshoot the charging system for an overvoltage condition. Refer to the OEM Vehicle Manual.
  - [b] If the voltage is between 16 and 11.0 V and fault code 158/0 is still active, replace the MCM. Refer to section 11.1.1.1.

#### 11.1.1.1 Verify Repairs

Perform the following steps to verify repairs.

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

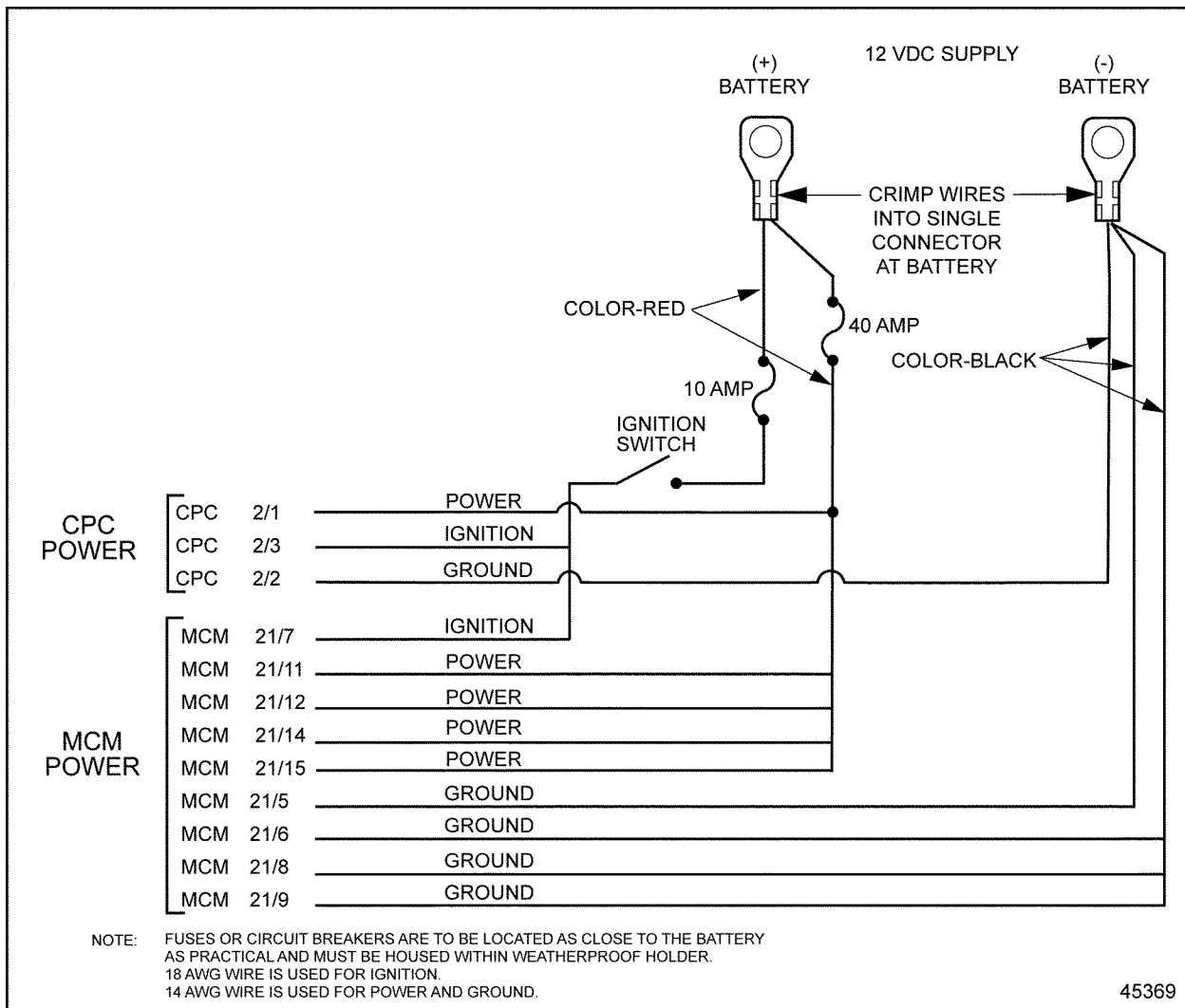
## 11.2 SPN 158/FMI 1

The diagnostic condition is typically low system voltage.

### 11.2.1 Battery Voltage Switched – Low

Check for low voltage as follows:

1. Turn the ignition ON.
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

Perform the following steps to verify repairs.

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

## 11.3 SPN 158/FMI 2

This diagnostic is typically unmatched MCM and CPC signals.

### 11.3.1 Multiple Codes Check

Check MCM and CPC signals as follows:

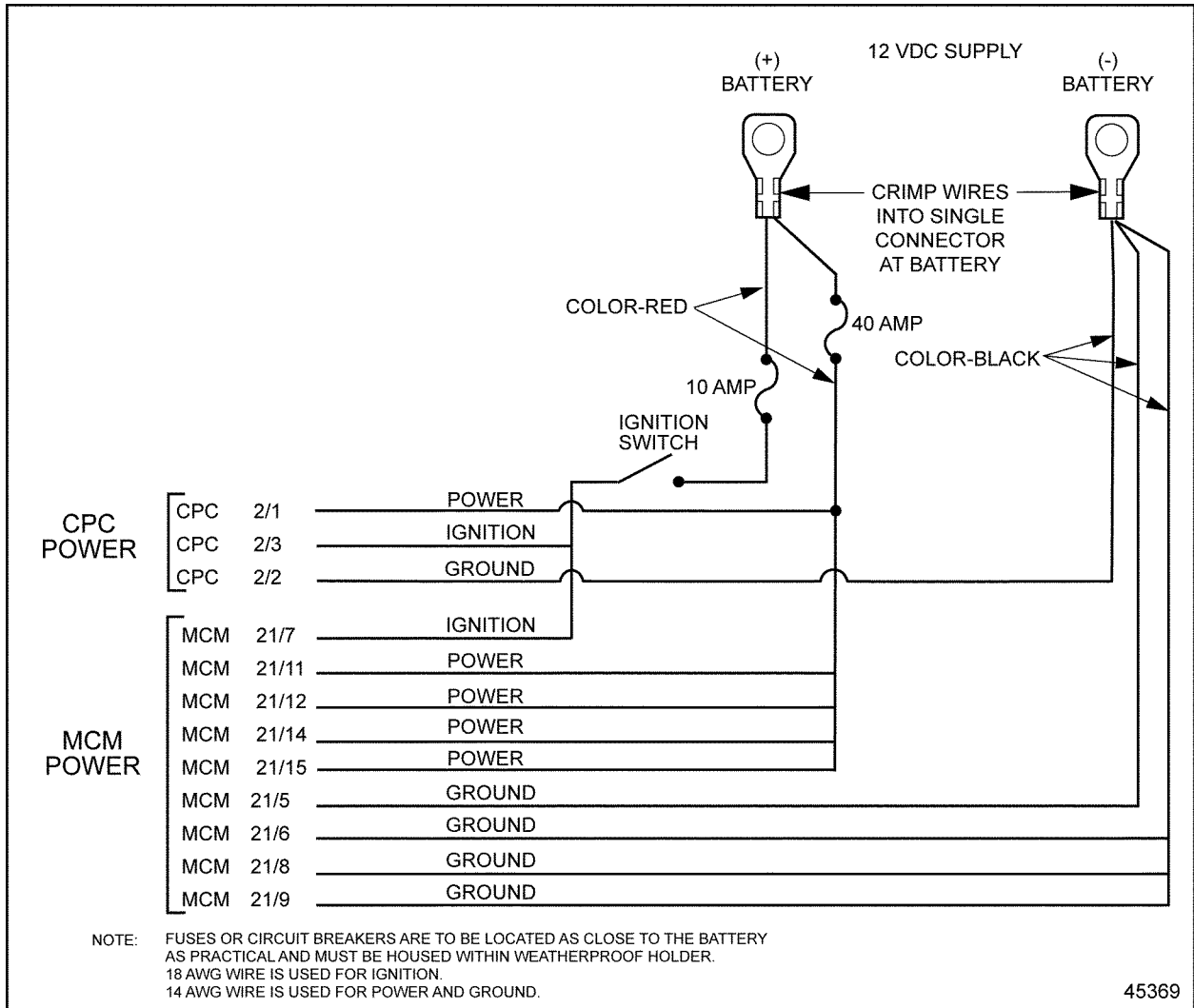
1. Turn the the switch ON.
2. Plug in your diagnostic tool.
3. Check for active codes.
  - [a] If fault codes 158/2 and 168/0 are both still active, refer to section 12.1.
  - [b] If fault codes 158/2 and 158/1 are both still active, refer to section 11.2.1
  - [c] If fault codes 158/2 and 158/0 are both still active, refer to section 11.1.1.
  - [d] If fault codes 158/2 and 168/1 are both still active, refer to section 12.2.

### 11.3.2 MCM and CPC Signals Check

Check MCM and CPC signals as follows:

1. Measure the difference in voltage inputs between the CPC and the MCM. See Figure 11-2.
  - [a] If the voltage difference is less than 1.0 V, contact the Detroit Diesel Customer Support Center (313-592-5800).
  - [b] If the voltage difference is greater than 1.0 V with the CPC indicating the low voltage, go to step 2.

- [c] If the voltage difference is greater than 1.0 V with the MCM indicating the low voltage, go to step 3.



**Figure 11-2 Power Wiring**

2. 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 11.3.2.1.
3. 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 11.3.2.1.

### 11.3.2.1 Verify Repairs

Perform the following steps to verify repairs.

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

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## **12 SPN 168 – BATTERY VOLTAGE OUTSIDE NORMAL OPERATING RANGE**

<b>Section</b>	<b>Page</b>
12.1 SPN 168/FMI 0 .....	12-3
12.2 SPN 168/FMI 1 .....	12-4



## 12.1 SPN 168/FMI 0

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

### 12.1.1 Measure Battery Voltage

Measure the battery voltage as follows:

1. Measure battery voltage with the engine running at maximum rpm.
2. If greater than 16 volts, check for proper alternator operation and repair or replace, as required. Refer to section 12.1.1.1.

#### 12.1.1.1 Verify Repairs

Verify repairs as follows:

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

## 12.2 SPN 168/FMI 1

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

### 12.2.1 Check the Alternator and the Battery

Check the alternator and battery as follows:

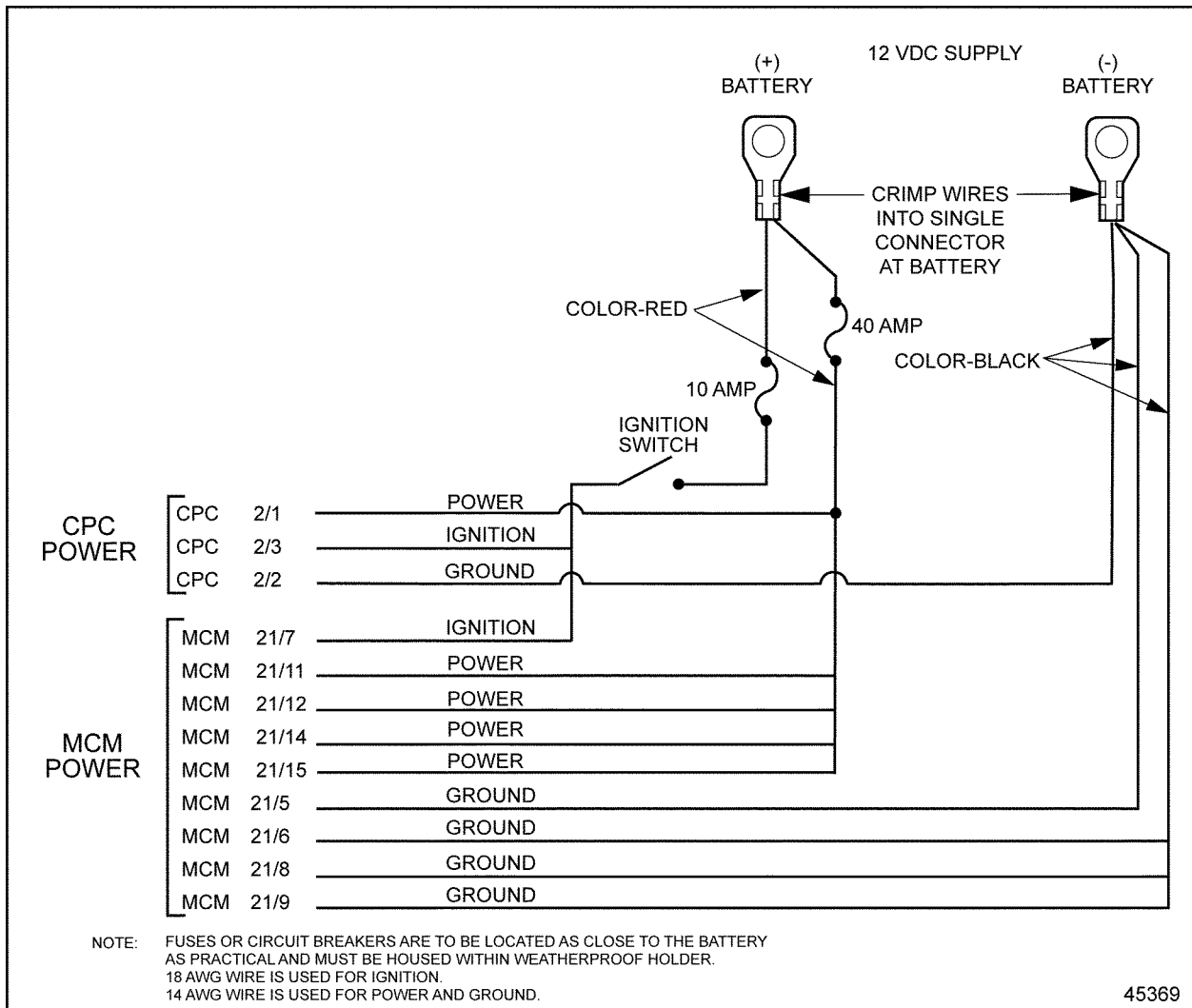
1. Check the condition of the alternator drive belt and replace, if required.
  - [a] If fault is no longer active, refer to section 12.2.2.1.
  - [b] If fault is still active, go to step 2.
2. Check for loose alternator mounting and retighten or repair, as required.
  - [a] If fault is no longer active, 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, go to step 1.

### 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  $\Omega$  in any wire, repair or replace the wire and connector. Refer to section 12.2.2.1.

[b] If resistance is less than 0.5 Ω 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 0.5 Ω 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 0.5 Ω in any wire, go to step 3.
3. Measure the current drop of the individual wires in the ground circuit (MCM 21/5, 21/6, 21/8, 21/9 and CPC 2/2). See Figure 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 ignition OFF and reconnect all connectors.
2. Turn the ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
  - [a] If no codes are present, troubleshooting is complete.
  - [b] If code 168/1 is not logged but other codes are logged, troubleshoot the other codes.
  - [c] If code 168/1 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313-592-5800).

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# 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 an Supply Fuel Temperature Sensor (SFT Sensor) open circuit.

### 13.1.1 Multiple Codes Check

Check for multiple codes as follows:

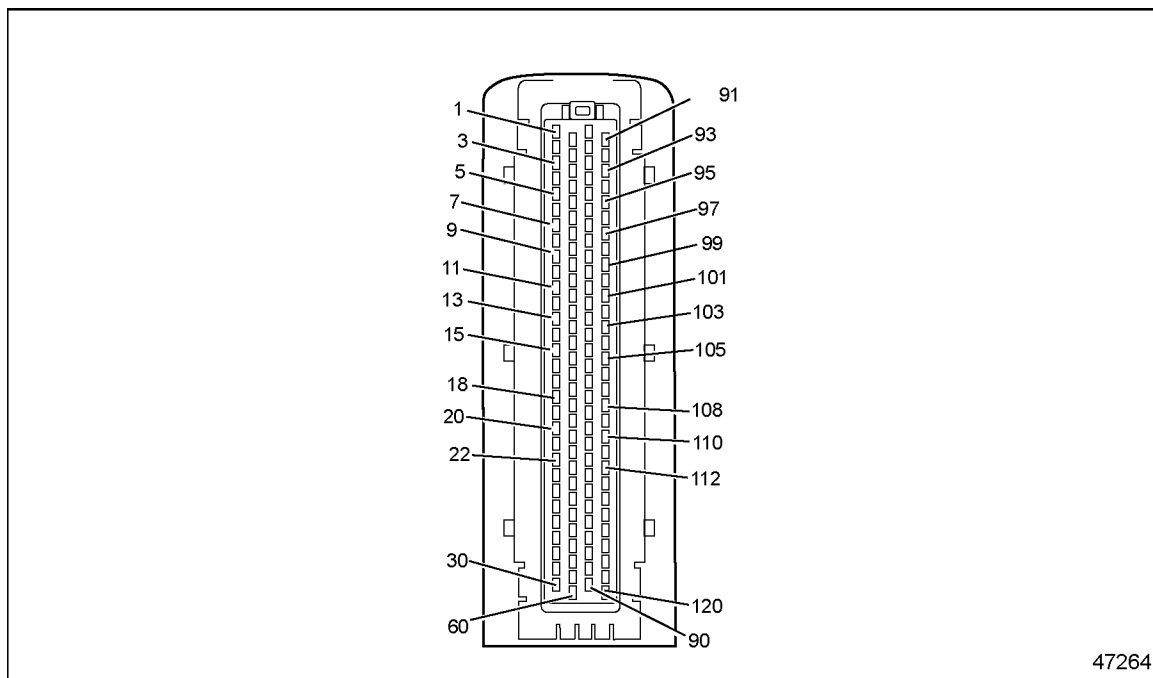
1. Turn the ignition ON.
2. Plug in the diagnostic tool.
3. Read the active codes.
  - [a] If faults 174/3 and 110/3 are active at the same time, repair the open circuit between pin 55 of the 120-pin MCM Connector and pin 1 of the Engine Oil Temperature (EOT) Sensor and the Supply Fuel Temperature (SFT) Sensor. Refer to section 13.1.2.1.
  - [b] If only fault 174/3 is active, refer to section 13.1.2.

### 13.1.2 Open Circuit Check

Check for an open circuit fault as follows:

1. Disconnect the Supply Fuel Temperature Sensor.
2. Measure the resistance across pins 1 and 2 of the SFT Sensor.
  - [a] If the resistance is greater than 4k  $\Omega$ , replace SFT Sensor. Refer to section 13.1.2.1.
  - [b] If the resistance is less than 4k  $\Omega$ , go to step 3.
3. Turn the ignition switch to the ON position.
4. 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 6.
  - [b] If the voltage is less than 2.75 volts, go to step 5.
5. 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 13-1. Refer to section 13.1.2.1.

- [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 13-1. Refer to section 13.1.2.1.



**Figure 13-1 MCM 120-pin Connector**

6. 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  $\Omega$ , repair the short between pins 55 and 77 of the 120-pin MCM connector. Refer to section 13.1.2.1.
  - [b] If the resistance is greater than 5  $\Omega$ , replace the sensor. Refer to section 13.1.2.1.

### 13.1.2.1 Verify Repairs

Perform the following steps to verify repairs.

1. Turn the ignition OFF and reconnect all connectors.
2. Turn ignition ON. Clear codes.
3. Start and run the engine for eight minutes. Stop engine.
4. Check diagnostic tool for codes.
  - [a] If no codes are logged, no further troubleshooting is required.
  - [b] If code 174/3 and any other codes are logged, review this section from the first step to find the error. If not error is found, call the Detroit Diesel Customer Support Center (313-592-5800).

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

## 13.2 SPN 174/FMI 4

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

### 13.2.1 Short to Ground Check

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

1. Disconnect the SFT Sensor.
2. Disconnect the 120-pin MCM connector.
3. Measure the resistance across pins 1 and 2 of the SFT Sensor connector.
  - [a] If resistance is less than 5  $\Omega$ , 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  $\Omega$ , 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  $\Omega$ , 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  $\Omega$ , 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  $\Omega$ , 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  $\Omega$ , 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

Perform the following steps to verify repairs.

1. Turn the ignition OFF and reconnect all connectors.
2. Turn ignition ON. Clear codes.
3. Start and run the engine for eight minutes. Stop engine.
4. Check diagnostic tool for codes.
  - [a] If no codes are logged, no further troubleshooting is required.
  - [b] If code 174/4 and any other codes are logged, review this section from the first step to find the error. If not error is found, call the Detroit Diesel Customer Support Center (313-592-5800).
  - [c] If code 174/4 is not logged but other codes are logged, troubleshoot the other codes.



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# 14 SPN 175 – ENGINE OIL TEMPERATURE OUTSIDE 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 .....	14-5



## 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 for temperature drift as follows:

1. Check engine oil level. Add oil if needed and recheck for fault codes. If SPN 175/FMI 2 is still active, go to step 2.
2. Connect the diagnostic tool. Monitor the engine oil temperature and engine coolant temperature.
3. With the engine running at idle and coolant temperature above 160°, is the oil temperature within X degrees of the coolant temperature?
  - [a] If yes, go to step 4.
  - [b] If no, disconnect the Engine Oil 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  $\Omega$ , repair the harness. If the resistance is less than 3  $\Omega$ , replace the sensor. Refer to section 14.1.1.1.

### NOTE:

Steps 4 and 5 are for cold start applications only.

4. Using the diagnostic tool, monitor the engine oil temperature and the fuel consumed.
5. With the engine running at idle, when the fuel consumed is greater than 0.X gallons is the oil temperature greater than 140°?
  - [a] If yes, contact the Detroit Diesel Customer Support Center (313-592-5800).
  - [b] If no, disconnect the Engine Oil Temperature Sensor and the 120-pin MCM connector. Bridge pins 1 and 2 of the sensor harness. Measure the resistance at the MCM between pins 55 and 108. If the resistance is greater than 3  $\Omega$ , repair the harness. If the resistance is less than 3  $\Omega$ , replace the sensor. Refer to section 14.1.1.1.

#### 14.1.1.1 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).

## 14.2 SPN 175/FMI 3

This diagnosis is typically engine oil temperature short to power.

### 14.2.1 Check for Open Short to Power

Check for a open short to power as follows:

1. Check for multiple codes..
  - [a] If codes 110/3, 174/3 and 175/3 are active at the same time, repair the open between pin 55 of the 120-pin MCM connector and associated sensors. Refer to section 14.2.1.1.
  - [b] If only fault 175/3 is active, go to step 2.
2. Disconnect the Engine Oil Temperature Sensor.
3. Measure the resistance between pins 1 and 2 of the Engine Oil Temperature Sensor.
  - [a] If the resistance is greater than 4k  $\Omega$ , replace the Engine Oil Temperature Sensor. Refer to section 14.2.1.1.
  - [b] If the resistance is less than 4k  $\Omega$ , go to step 4.
4. Turn the ignition ON.
5. Measure the voltage between pins 1 and 2 of the Engine Oil Temperature Sensor harness connector.
  - [a] If the voltage is between 2.5 and 3 volts, refer to section 14.2.1.1.
  - [b] If the voltage is less than 2.5 volts, go to step 6.
6. Measure the voltage between pin 2 of the Engine Oil Temperature Sensor harness connector and ground.
  - [a] If the voltage is between 2.5 and 3 volts, repair the open circuit between pin 55 of the 120-pin MCM connector and pin 1 of the Engine Oil Temperature Sensor harness connector. Refer to section 14.2.1.1.
  - [b] If the voltage is less than 2.5 volts, repair the open circuit between pin 108 of the 120-pin MCM connector and pin 2 of the Engine Oil Temperature Sensor harness connector. Refer to section 14.2.1.1.

#### 14.2.1.1 Verify Repairs

Perform the following steps to verify repairs.

1. Turn the ignition OFF and reconnect all connectors.

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

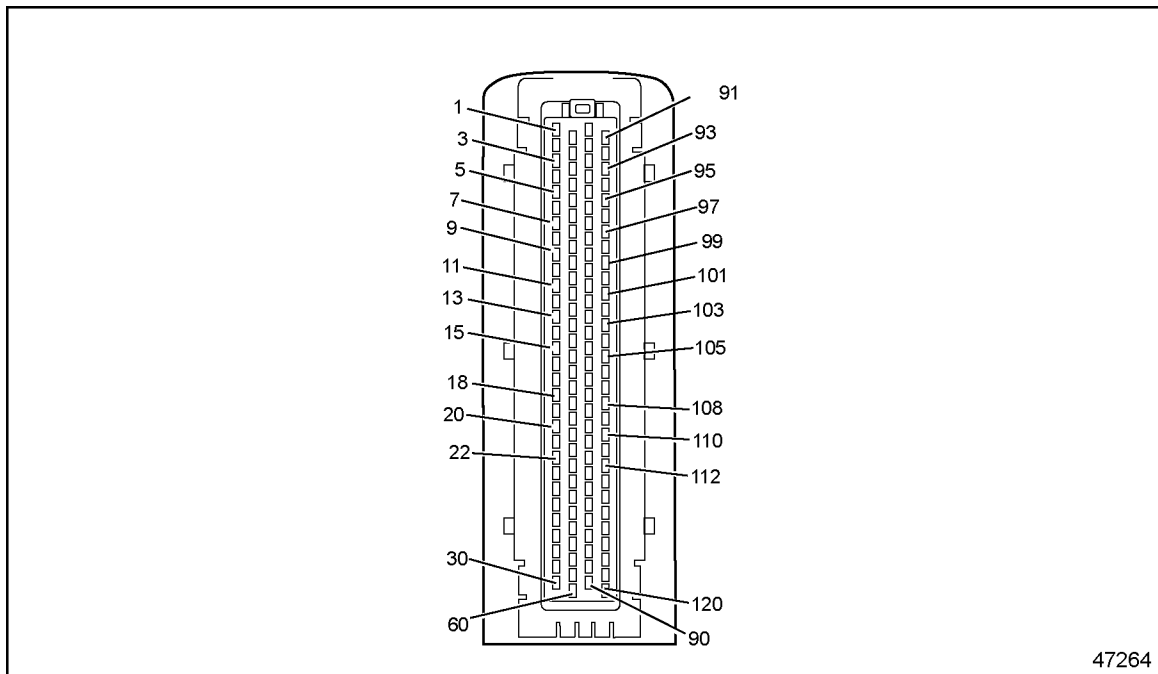
### 14.3 SPN 175/FMI 4

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

#### 14.3.1 Check for Short to Ground

Check for a short to ground as follows:

1. Disconnect the Engine Oil Temperature Sensor.
2. Disconnect the 120-pin MCM connector.
3. Measure the resistance between pins 1 and 2 of the Engine Oil Temperature Sensor connector.
  - [a] If the resistance is greater than  $5\Omega$ , go to step 4.
  - [b] If the resistance is less than  $5\Omega$ , repair the short between pins 55 and 108 of 120-pin MCM connector. See Figure 14-1. Refer to section 14.3.1.1.



**Figure 14-1** 120-pin MCM Connector

4. Measure the resistance between pin 1 of the Engine Oil Temperature Sensor connector and ground.
  - [a] If the resistance is greater than  $5\Omega$ , go to step 5.
  - [b] If the resistance is less than  $5\Omega$ , repair the short circuit between pin 1 of the Engine Oil Temperature Sensor connector and chassis ground. Refer to section 14.3.1.1.
5. Measure the resistance between pin 2 of the Engine Oil Temperature Sensor connector and ground.
  - [a] If the resistance is greater than  $5\Omega$ , repeat steps 3 through 5. If the results are the same, call the Detroit Diesel Customer Support Center (313-592-5800).
  - [b] If the resistance is less than  $5\Omega$ , repair the short circuit between pin 2 of the Engine Oil Temperature Sensor harness connector and ground. Refer to section 14.3.1.1.

### 14.3.1.1 Verify Repairs

Perform the following steps to verify repairs.

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

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# 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 .....	15-5
15.3 SPN 411/FMI 3 .....	15-6
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 Check for Coolant Loss and Multiple Codes

Begin by checking for coolant loss 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, refer to section 15.1.2.

### 15.1.2 Check EGR Components

Check the EGR components as follows:

1. Connect DDDL for DDEC VI and monitor the coolant temperature, EGR Delta P, EGR PW, EGR valve position and EGR temperature.
2. Start the engine and increase the RPM to 1200.
3. Activate EGR PW to 60%.

#### **NOTE:**

Do not exceed three minutes.

4. Is the EGR Delta P count greater than 170 and the EGR temperature greater than 90° above coolant temperature?
  - [a] If yes, repeat all the steps in section 15.1.1 and steps 1 through 4 in this section. If the same results occur, contact the Detroit Diesel Customer Support Center (313-592-5800).
  - [b] If no, go to step 5.
5. Turn the engine OFF.
6. Inspect the EGR delivery pipes for damage and proper assembly.
  - [a] If damaged, repair as necessary. Refer to section 15.1.2.1.
  - [b] If OK, go to step 7.
7. Disconnect the EGR Delta P Sensor and inspect the EGR venturi tubes for blockage.
  - [a] If the tubes are blocked, clean them. Refer to section 15.1.2.1.
  - [b] If the tubes are not blocked, replace the EGR Delta P Sensor. Refer to section 15.1.2.1.

### 15.1.2.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF. Reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
  - [a] If no codes are present, troubleshooting is complete.
  - [b] If code 411/0 is not logged but other codes are logged, troubleshoot the other codes.
  - [c] If code 411/0 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313-592-5800).

## 15.2 SPN 411/FMI 1

This diagnosis is typically EGR differential pressure failed low.

### 15.2.1 Check for Multiple Codes

Check for multiple codes as follows:

1. Connect DDDL for DDEC VI to check for codes.
2. Are codes other than 411/1 present?
  - [a] If codes other than 411/1 are present, service them first.
  - [b] If only 411/1 is present, refer to section 15.2.2.

### 15.2.2 Check EGR Components

Check the EGR components as follows:

1. Using DDDL for DDEC VI, monitor the coolant temperature, EGR Delta P, EGR PW, EGR valve position and EGR temperature.
2. Idle the engine with the EGR PW less than 3% and the EGR position less than 5% (NO EGR FLOW COMMANDED).
3. Is the 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 15.2.2.1.
  - [b] If no, go to step 4.
4. Turn the engine OFF.
5. Disconnect the EGR Delta P Sensor and inspect the EGR tubes for blockage.
  - [a] If the tubes are blocked, clean them. Refer to section 15.2.2.1.
  - [b] If the tubes are not blocked, replace the EGR Delta P Sensor. Refer to section 15.2.2.1

#### 15.2.2.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF. Reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
  - [a] If no codes are present, troubleshooting is complete.
  - [b] If code 411/1 is not logged but other codes are logged, troubleshoot the other codes.

- [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).

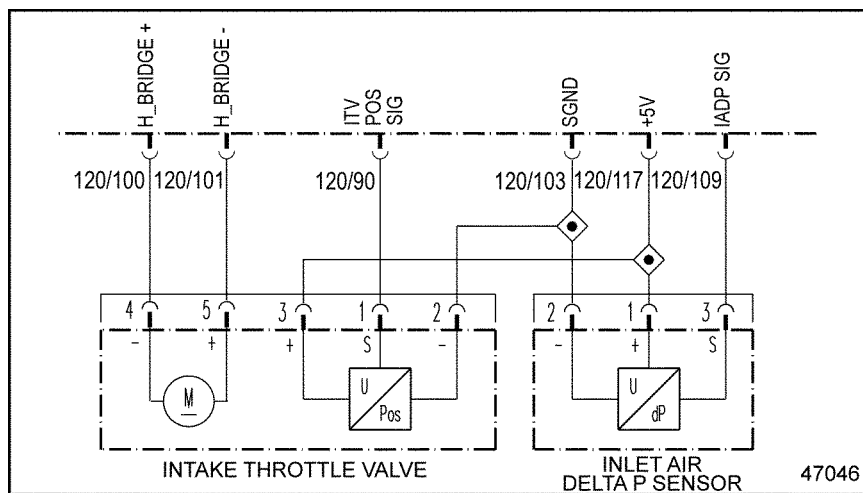
## 15.3 SPN 411/FMI 3

This diagnosis is typically EGR Delta P Sensor short circuit.

### 15.3.1 Check for Short

Check the circuit for the EGR Delta P Sensor as follows:

1. Disconnect the EGR Delta P Sensor.
2. Disconnect the 120-pin MCM connector.
3. Measure the resistance across pins 1 and 3 of the EGR Delta P Sensor. See Figure 15-1.



**Figure 15-1 EGR Delta P Sensor**

- [a] If the resistance is greater than  $5\Omega$ , repair the short to power on wire 109 of the 120-pin MCM connector. Refer to section 15.3.1.1.
- [b] If the resistance is less than  $5\Omega$ , repair the short between pins 109 and 117 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 vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes

- [a] If no codes are present, troubleshooting is complete.
- [b] If code 411/3 is not logged but other codes are logged, troubleshoot the other codes.
- [c] If code 411/3 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313-592-5800).

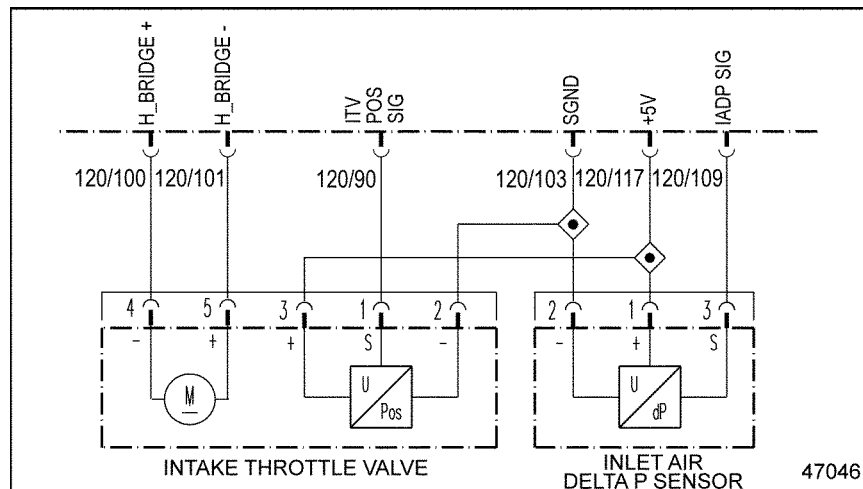
## 15.4 SPN 411/FMI 4

This diagnosis is typically EGR Delta P Sensor open circuit.

### 15.4.1 Check for Open Circuit

Check for a short as follows:

1. Disconnect the EGR Delta P Sensor.
2. Measure the resistance across pins 1 and 3 of the EGR Delta P Sensor. See Figure 15-2.



**Figure 15-2**

- [a] If the resistance is greater than 130 k $\Omega$ , replace the EGR Delta P Sensor. Refer to section 15.4.1.1.
  - [b] If the resistance is less than 130 k $\Omega$ , 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 $\Omega$ , replace the EGR Delta P Sensor. Refer to section 15.4.1.1.
    - [b] If the resistance is less than 130 k $\Omega$ , go to step 4.
  4. Turn the ignition switch to the ON position.
  5. Measure the voltage between pins 1 and 3 of the EGR Delta P Sensor harness connector.
    - [a] If the voltage is between 4.5 and 5.5 volts, go to step 7.

- [b] If the voltage is less than 4.5 volts, go to step 6.
- 6. Measure the voltage between pin 1 of the EGR Delta P Sensor harness connector and ground.
  - [a] If the voltage is between 4.5 and 5.5 volts, repair the open circuit between pin 3 of the EGR Delta P Sensor harness connector and pin 109 of the 120-pin MCM connector. Refer to section 15.4.1.1.
  - [b] If the voltage is less than 4.5 volts, repair the open circuit between pin 1 of the EGR Delta P Sensor harness connector and pin 117 of the 120-pin MCM connector. Refer to section 15.4.1.1.
- 7. Turn the ignition switch to the OFF position.
- 8. Disconnect the 120-pin MCM connector.
- 9. Measure the resistance between pins 1 and 3 of the EGR Delta P Sensor harness connector.
  - [a] If the resistance is less than 5  $\Omega$ , 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 15.3.1.1.
  - [b] If the resistance is greater than 5  $\Omega$ , 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  $\Omega$ , repair the short in wires between pins 109 and 103 of the 120-pin MCM connector. Refer to section 15.3.1.1
  - [b] If the resistance is greater than 5  $\Omega$ , 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  $\Omega$ , repair the short circuit between pin 117 of the 120-pin MCM connector and ground. Refer to section 15.3.1.1.
  - [b] If the resistance is greater than 5  $\Omega$ , 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  $\Omega$ , repair the short between pin 109 of the 120-pin MCM connector and ground. Refer to section 15.4.1.1.
  - [b] If the resistance is greater than 5  $\Omega$ , 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 15.4.1.1.

### 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).



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## 16 SPN 558 - IDLE VALIDATION SWITCH

Section	Page
16.1 SPN 558/FMI 1 .....	16-3
16.2 SPN 558/FMI 3 .....	16-3
16.3 SPN 558/FMI 4 .....	16-5



## 16.1 SPN 558/FMI 1

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

### 16.1.1 Idle Validation Switch Wiring Check

Check Idle Validation Switch (IVS) wiring as follows:

1. Connect the diagnostic tool
2. Turn ignition ON.
3. Monitor IVS #1 and IVS #2 with the throttle pedal in the idle position.
4. If IVS #1 reads OFF and IVS #2 reads ON, verify the proper wire pin outs.
  - IVS #1 should be routed from Idle Validation Switch pin 5 to pin 6 of the CPC #1 connector.
  - IVS #2 should be routed from Validation Switch pin 6 to pin 3 of the CPC #1 connector.
5. If wiring checks OK, contact the Detroit Diesel Customer Support Center (313-592-5800).

## 16.2 SPN 558/FMI 3

This diagnostic condition is typically an open circuit.

### 16.2.1 Open Circuit Check

Check for open as follows:

1. Disconnect the Idle Validation Switch.
2. Turn the ignition switch to the ON position.
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 16.2.1.1.
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  $5\Omega$ , repair the open the wire between pin 2 of the CPC #2 connector and pin 6 of the Idle Validation Switch. Refer to section 16.2.1.1.
  - [b] If the resistance is less than  $5\Omega$ , replace the Idle Validation Switch. Refer to section 16.2.1.1.

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 16.2.1.1.
  - [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 16.2.1.1.

### **16.2.1.1 Verify Repairs**

Verify repairs as follows:

1. Turn the ignition OFF. Reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
  - [a] If no codes are present, troubleshooting is complete.
  - [b] If code 558/3 is not logged but other codes are logged, troubleshoot the other codes.
  - [c] If code 558/3 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313-592-5800).

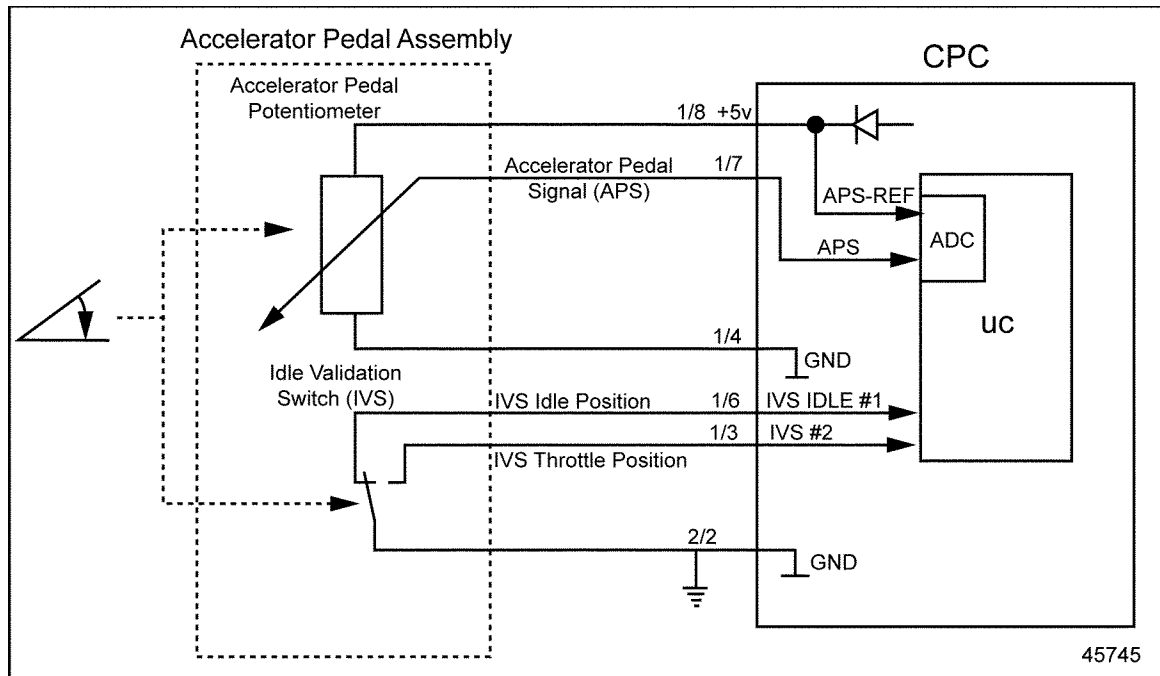
## 16.3 SPN 558/FMI 4

This diagnostic condition is typically a short to ground.

### 16.3.1 Short to Ground Check

Check for short to ground as follows:

1. Disconnect the Idle Validation Switch. See Figure 16-1.



**Figure 16-1 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  $\Omega$ , 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 16.3.1.1.
  - [b] If the resistance is greater than 5  $\Omega$ , 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  $\Omega$ , 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 16.3.1.1.
  - [b] If the resistance is greater than 5  $\Omega$ , replace the Idle Validation Switch.

### 16.3.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF. Reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
  - [a] If no codes are present, troubleshooting is complete.
  - [b] If code 558/4 is not logged but other codes are logged, troubleshoot the other codes.
  - [c] If code 558/4 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313-592-5800).

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# 17 SPN 599 - CRUISE CONTROL SWITCHES NOT FUNCTIONING PROPERLY

Section	Page
17.1 SPN 599/FMI 12 .....	17-3



## 17.1 SPN 599/FMI 12

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

### 17.1.1 Short to Ground Check

Check for a short to ground as follows:

1. Turn the ignition ON 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 17.1.1.1.
  - [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 17.1.1.1.
4. Unplug the SET Cruise Control Switch.
  - [a] If SET status is no longer displayed, replace the Cruise Control SET Switch. Refer to section 17.1.1.1.
  - [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 17.1.1.1.

#### 17.1.1.1 Verify Repairs

Perform the following steps to verify repairs.

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



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# 18 SPN 601 - CRUISE CONTROL SWITCHES NOT FUNCTIONING PROPERLY

Section	Page
18.1 SPN 601/FMI 12 .....	18-3



## 18.1 SPN 601/FMI 12

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

### 18.1.1 Short to Ground

Check for a short to ground as follows:

1. Turn the ignition ON 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

Perform the following steps to verify repairs.

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



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## 19 SPN 609 - MCM FAULT (ERRONEOUS DATA)

Section	Page
19.1 SPN 609/FMI 12 .....	19-3
19.2 SPN 609/FMI 14 .....	19-4



## 19.1 SPN 609/FMI 12

This diagnostic condition is typically MCM failed or programmed incorrectly.

### 19.1.1 MCM Parameter Check

Check the parameters as follows:

1. Using your diagnostic tool, reset the parameters on the MCM.
  - [a] If fault code 233/12 is not active after resetting parameters, troubleshooting is finished.
  - [b] If fault code 233/12 is still active after resetting parameters, go to step 2.
2. Check the MCM parameters to ensure they are correct for the vehicle configuration.
  - [a] If parameters are not correct, reset parameters on the MCM.
  - [b] If parameters are correct, contact Detroit Diesel Customer Support Center (313-592-5800) for authorization to replace the MCM. Set parameters on the new MCM.

## 19.2 SPN 609/FMI 14

This diagnostic condition is typically MCM incorrectly programmed.

### 19.2.1 MCM Check

Check the MCM as follows:

1. Check to ensure the MCM is correct for the engine.
  - [a] If MCM is correct for the engine, go to step 2.
  - [b] If MCM is not correct for the engine, contact Detroit Diesel Customer Support Center (313-592-5800) for authorization to replace the MCM. Set parameters on the new MCM.
2. Reset the MCM parameters.
  - [a] If fault code 233/14 is not active after the MCM parameters are reset, troubleshooting is complete.
  - [b] If fault code 233/14 is still active after the MCM parameters are reset, go to step 3.
3. Check the MCM parameters to ensure they are correct for the vehicle configuration.
  - [a] If the MCM parameters are not correct, reset the parameters.
  - [b] If the MCM parameters are correct, contact Detroit Diesel Customer Support Center (313-592-5800) for authorization to replace the MCM. Set the parameters on the new MCM.

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# 20 SPN 615 - ELECTROSTATIC OIL SEPARATOR OUTSIDE OF NORMAL OPERATING RANGE

Section	Page
20.1 SPN 615/FMI 3 .....	20-3
20.2 SPN 615/FMI 4 .....	20-4



## 20.1 SPN 615/FMI 3

This is typically a short to power.

### 20.1.1 Multiple Codes Check

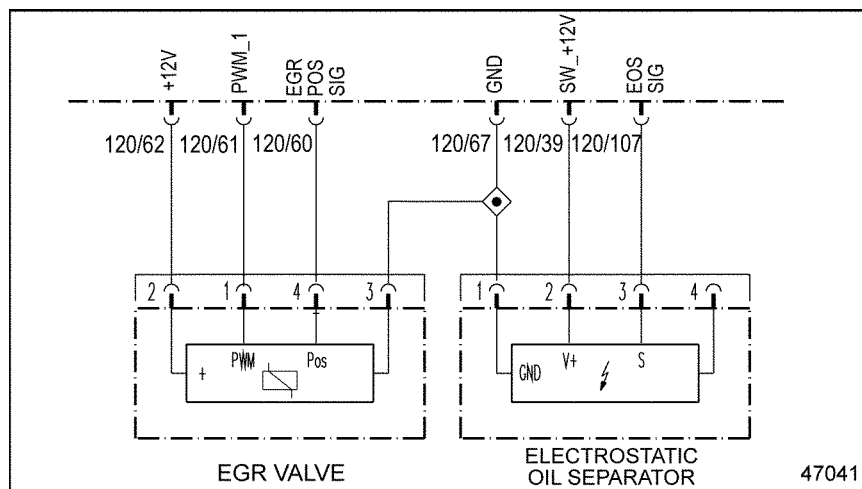
Check as follows:

1. Plug in diagnostic tool.
2. Turn ignition ON.
3. Check for multiple codes.
  - [a] If 615/3 and 2791/3 are present, repair the open between pin 67 of the 120-pin MCM connector and pin 1 of the Electrostatic Oil Separator connector and pin 3 of the EGR valve connector. Refer to section 20.1.2.1.
  - [b] If only 615/3 is present, turn the ignition OFF and refer to section 20.1.2.
4. Turn ignition OFF.

### 20.1.2 Short to Power Check

Check as follows:

1. Disconnect the Electrostatic Oil Separator connector.
2. Turn ignition ON.
3. Measure the voltage between pins 1 and 2 of the Electrostatic Oil Separator connector.
  - [a] If the voltage is greater than 11.5 volts, go to step 4.
  - [b] If the voltage is less than 11.5 volts, repair the open between pin 1 of the Electrostatic Oil Separator connector and pin 67 of the 120-pin MCM connector. See Figure 20-1. Refer to section 20.1.2.1.



**Figure 20-1 Electrostatic Oil Separator Wiring**

4. Turn the ignition OFF.
5. Disconnect the 120-pin MCM connector.
6. Measure the resistance between pins 2 and 3 of the Electrostatic Oil Separator connector.
  - [a] If the resistance is greater than 5  $\Omega$ , repair the open between pin 2 of the Electrostatic Oil Separator connector and pin 39 of the 120-pin MCM connector. Refer to section 20.1.2.1.
  - [b] If the resistance is less than 5  $\Omega$ , repair the short between pin 2 and 3 of the Electrostatic Oil Separator connector and pins 39 and 107 of the 120-pin MCM connector. Refer to section 20.1.2.1.

### **20.1.2.1 Verify Repairs**

Perform the following steps to verify repairs.

1. Turn vehicle ignition OFF and reconnect all connectors.
2. Turn vehicle ignition ON. 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).

## **20.2 SPN 615/FMI 4**

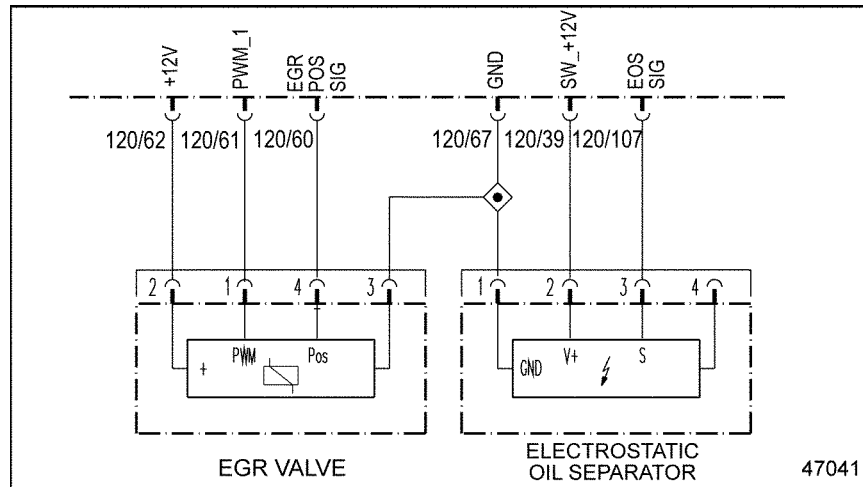
This is typically an open/short to ground.

### **20.2.1 Open/Short to Ground Check**

Check as follows:

1. Disconnect the Electrostatic Oil Separator connector.
2. Measure the resistance between pins 1 and 2 of the Electrostatic Oil Separator.

- [a] If the resistance is greater than 150  $\Omega$ , replace the Electrostatic Oil Separator. See Figure 20-2. Refer to section 20.2.1.1.



**Figure 20-2 Electrostatic Oil Separator Wiring**

- [b] If the resistance is less than 150  $\Omega$ , go to step 3.
- Measure the resistance between pins 1 and 3 of the Electrostatic Oil Separator.
    - If the resistance is greater than 150  $\Omega$ , replace the Electrostatic Oil Separator. Refer to section 20.2.1.1.
    - If the resistance is less than 150  $\Omega$ , go to step 4.
  - Turn the ignition OFF.
  - Disconnect the 120-pin MCM connector.
  - Measure the resistance between pin 3 of the Electrostatic Oil Separator connector and ground.
    - If the resistance is greater than 5  $\Omega$ , repair the open between pin 3 of the Electrostatic Oil Separator connector and pin 107 of the 120-pin MCM connector. Refer to section 20.2.1.1.
    - If the resistance is less than 5  $\Omega$ , repair the short to ground between pin 3 of the Electrostatic Oil Separator connector and pin 107 of the 120-pin MCM connector. Refer to section 20.2.1.1.

### 20.2.1.1 Verify Repairs

Perform the following steps to verify repairs.

- Turn vehicle ignition OFF and reconnect all connectors.
- Turn vehicle ignition ON. Clear the codes.
- Start and run the engine for eight minutes. Stop the engine.

4. Check for codes.

- [a] If no codes are logged, troubleshooting is complete.
- [b] If other codes are logged, review this section to find the error. If no error is found, contact Detroit Diesel Customer Support Center (313-592-5800).

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## **21 SPN 615 - INTAKE AIR DELTA PRESSURE OUTSIDE OF NORMAL OPERATING RANGE**

<b>Section</b>	<b>Page</b>
21.1 SPN 615/FMI 3 .....	21-3
21.2 SPN 615/FMI 4 .....	21-5



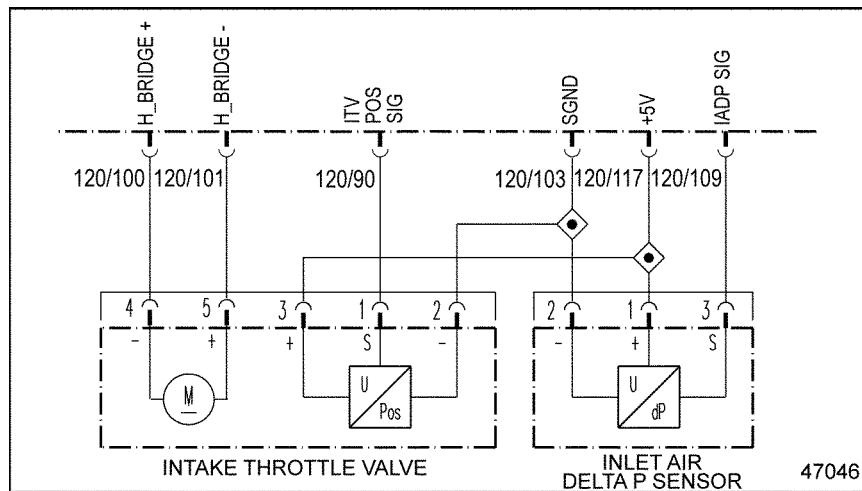
## 21.1 SPN 615/FMI 3

This diagnosis is typically an open circuit.

### 21.1.1 Open Circuit Check

Check as follows:

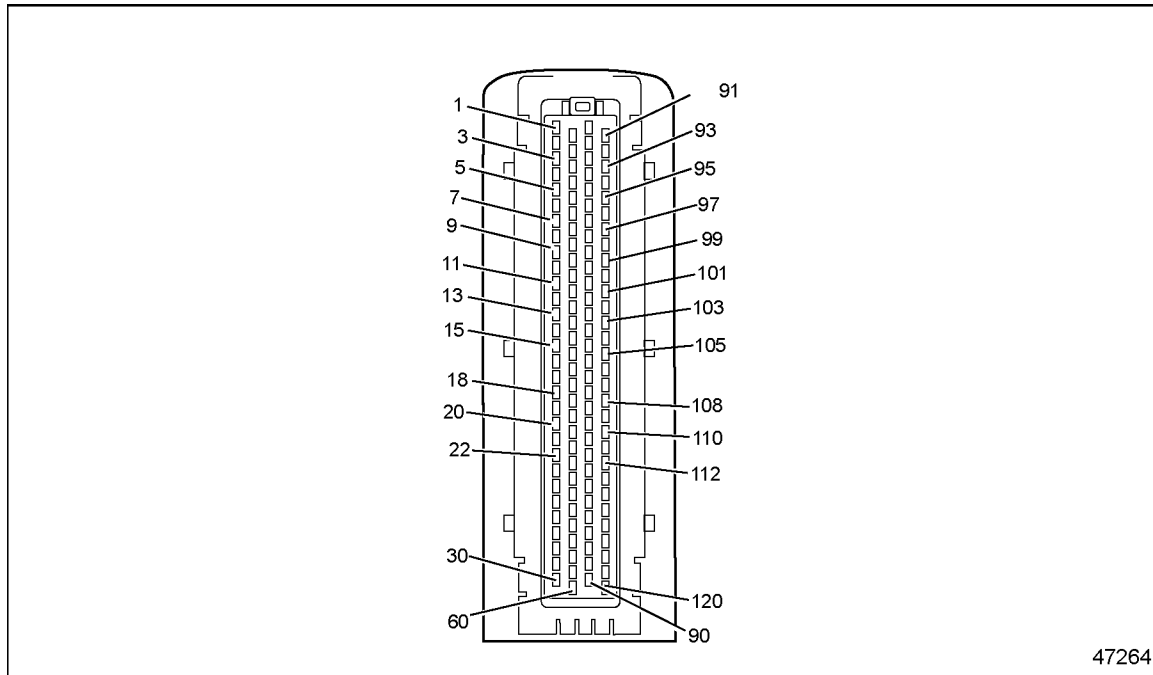
1. Check for multiple codes.
  - [a] If 51/3 and 615/3 are present, repair the open between pin 103 of the 120-pin MCM connector and pin 2 of the Intake Air Delta P Sensor and the Intake Throttle Valve. See Figure 21-1. Refer to section 21.1.1.1.



**Figure 21-1 Intake Air Delta P Sensor**

- [b] If only 615/3 is present, go to step 2.
2. Disconnect the Intake Air Delta P Sensor.
3. Measure the resistance across pins 1 and 2 of the Intake Air Delta P Sensor.
  - [a] If the resistance is greater than 200k  $\Omega$ , replace the Intake Air Delta P Sensor.
  - [b] If the resistance is less than 200k  $\Omega$ , go to step 4.
4. Measure the resistance across pins 1 and 3 of the Intake Air Delta P Sensor.
  - [a] If the resistance is greater than 50k  $\Omega$ , replace the Intake Air Delta P Sensor.
  - [b] If the resistance is less than 50k  $\Omega$ , go to step 5.
5. Turn the ignition ON.
6. Measure the voltage between pins 1 and 2 of the Intake Air Delta P Sensor harness connector.
  - [a] If the voltage is between 4.5 and 5.5 volts, go to step 8.
  - [b] If the voltage is less than 4.5 volts, go to step 7.

7. Measure the voltage between pin 1 of the Intake Air Delta P Sensor harness connector and ground.
  - [a] If the voltage is between 4.5 and 5.5 volts, repair the open circuit between pin 2 of the Intake Air Delta P Sensor harness connector and pin 103 of the 120-pin MCM connector. See Figure 21-2. Refer to section 21.1.1.1.



**Figure 21-2 120-pin MCM Connector**

- [b] If the voltage is less than 4.5 volts, repair the open circuit between pin 1 of the Intake Air Delta P Sensor harness connector and pin 117 of the 120-pin MCM connector. Refer to section 21.1.1.1.
8. Turn the ignition OFF.
9. Disconnect the 120-pin MCM connector.
10. Measure the resistance between pins 1 and 3 of the Intake Air Delta P Sensor harness connector.
  - [a] If the resistance is greater than 5  $\Omega$ , go to step 11.
  - [b] If the resistance is less than 5  $\Omega$ , repair the short in wires between pins 1 and 3 of the Intake Air Delta P Sensor harness connector and pin 109 of the 120-pin MCM connector. Refer to section 21.1.1.1.
11. Measure the resistance between pin 3 of the Intake Air Delta P Sensor harness connector and pin 109 of the 120-pin MCM connector.
  - [a] If the resistance is greater than 3  $\Omega$ , repair the open between pin 3 of the Intake Air Delta P Sensor harness connector and pin 109 of the 120-pin MCM connector. Refer to section 21.1.1.1.

- [b] If the resistance is less than 3  $\Omega$ , repeat steps 2 through 11. If the results are the same, contact the Detroit Diesel 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 vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes

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

[b] If code 615/3 is not logged but other codes are logged, troubleshoot the other codes.

[c] If code 615/3 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313-592-5800).

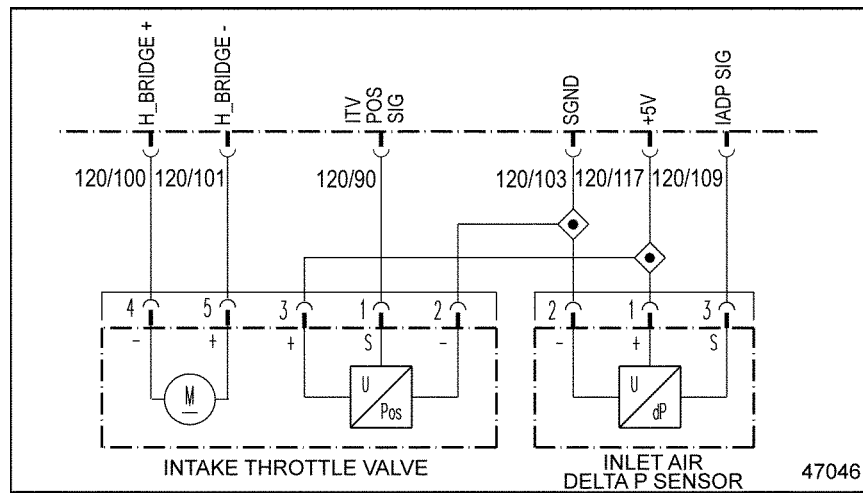
## 21.2 SPN 615/FMI 4

This diagnosis is typically a short to ground.

### 21.2.1 Short to Ground Check

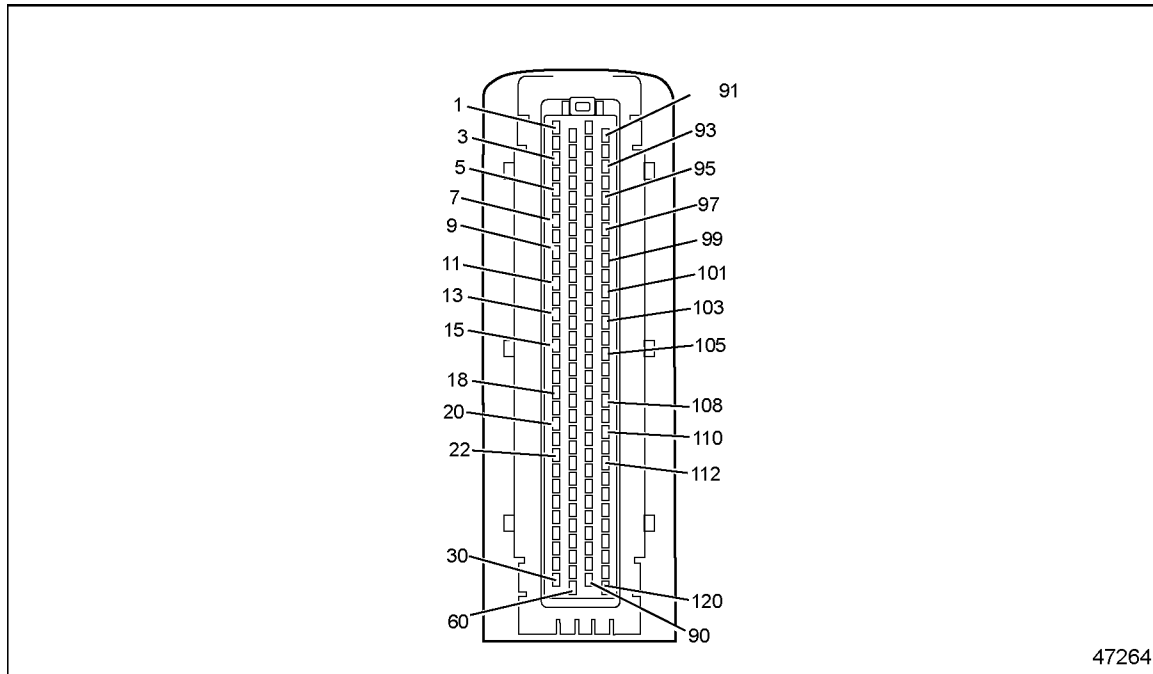
Check as follows:

1. Disconnect the Intake Air Delta P Sensor.
2. Disconnect the 120-pin MCM connector.
3. Measure the resistance between pins 1 and 2 of the Intake Air Delta P Sensor. See Figure 21-3.



**Figure 21-3 Intake Air Delta P Sensor**

- [a] If the resistance is less than  $5\Omega$ , repair the short between pins 117 and 103 of the 120-pin MCM connector. See Figure 21-4. Refer to section 21.2.1.1.



**Figure 21-4 120-pin MCM Connector**

- [b] If the resistance is greater than  $5\Omega$ , go to step 4.
4. Measure the resistance between pins 2 and 3 of the Intake Air Delta P Sensor.
- [a] If the resistance is less than  $5\Omega$ , repair the short between pins 109 and 103 of the 120-pin MCM connector. Refer to section 21.2.1.1.
- [b] If the resistance is greater than  $5\Omega$ , go to step 5.
5. Measure the resistance between pin 1 of the Intake Air Delta P Sensor harness connector and ground.
- [a] If the resistance is less than  $3\Omega$ , repair the short circuit between pin 1 of the Intake Air Delta P Sensor harness connector and ground. Refer to section 21.2.1.1.
- [b] If the resistance is greater than  $3\Omega$ , go to step 6.
6. Measure the resistance between pin 3 of the Intake Air Delta P Sensor harness connector and ground.
- [a] If the resistance is less than  $3\Omega$ , repair the short circuit between pin 3 of the Intake Air Delta P Sensor harness connector and ground. Refer to section 21.2.1.1.
- [b] If the resistance is greater than  $3\Omega$ , repeat steps 3 through 6. If the results are the same, contact the Detroit Diesel 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 vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
  - [a] If no codes are present, troubleshooting is complete.
  - [b] If code 615/3 is not logged but other codes are logged, troubleshoot the other codes.
  - [c] If code 615/3 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313-592-5800).



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## 22 SPN 625 - CAN FAULT

Section	Page
22.1 SPN 625/FMI 2, 9, 10, 13, 14 .....	22-3
22.2 SPN 625/FMI 4 .....	22-5



## 22.1 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.

### 22.1.1 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.
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  $\Omega$ , go to step 8.
  - [b] If the resistance is less than 5  $\Omega$ , 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 22.1.1.1.
8. Measure the resistance between pin 1 of the CPC #4 connector and ground.
  - [a] If the resistance is greater than 5  $\Omega$ , go to step 9.
  - [b] If the resistance is less than 5  $\Omega$ , repair the short to ground between pin 1 of the CPC #4 connector and ground. Refer to section 22.1.1.1.
9. Measure the resistance between pin 3 of the CPC #4 connector and ground.
  - [a] If the resistance is greater than 5  $\Omega$ , go to step 10.

- [b] If the resistance is less than 5  $\Omega$ , repair the short to ground between pin 3 of the CPC #4 connector and ground. Refer to section 22.1.1.1.
- 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  $\Omega$ , repair the open between pin 1 of the CPC #4 connector and pin 19 of the 21-pin MCM connector. Refer to section 22.1.1.1.
  - [b] If the resistance is less than 5  $\Omega$ , 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  $\Omega$ , repair the open between pin 3 of the CPC #4 connector and pin 13 of the 21-pin MCM connector. Refer to section 22.1.1.1.
  - [b] If the resistance is less than 5  $\Omega$ , call the DDC Customer Support Center (313-592-5800).

### 22.1.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF. Reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
  - [a] If no codes are present, troubleshooting is complete.
  - [b] If code 625/2,9,10,13,14 is not logged but other codes are logged, troubleshoot the other codes.
  - [c] If code 625/2,9,10,13,14 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313-592-5800).

## 22.2 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.

### 22.2.1 Check for Short Circuit

Check as follows:

1. Turn ignition OFF, disconnect the 21-pin MCM connector.
2. Disconnect the CPC #4 connector.
3. Measure the resistance between pins 1 and 3 of the CPC #4 connector.
  - [a] If the resistance is greater than 5  $\Omega$ , go to step 4.
  - [b] If the resistance is less than 5  $\Omega$ , 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 22.2.1.1.
4. Measure the resistance between pin 1 of the CPC #4 connector and ground.
  - [a] If the resistance is greater than 5  $\Omega$ , go to step 5.
  - [b] If the resistance is less than 5  $\Omega$ , repair the short to ground between pin 1 of the CPC #4 connector and ground. Refer to section 22.2.1.1.
5. Measure the resistance between pin 3 of the CPC #4 connector and ground.
  - [a] If the resistance is greater than 5  $\Omega$ , go to step 6.
  - [b] If the resistance is less than 5  $\Omega$ , repair the short to ground between pin 3 of the CPC #4 connector and ground. Refer to section 22.2.1.1.
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  $\Omega$ , repair the open between pin 1 of the CPC #4 connector and pin 19 of the 21-pin MCM connector. Refer to section 22.2.1.1.
  - [b] If the resistance is less than 5  $\Omega$ , 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  $\Omega$ , repair the open between pin 3 of the CPC #4 connector and pin 13 of the 21-pin MCM connector. Refer to section 22.2.1.1.
  - [b] If the resistance is less than 5  $\Omega$ , call the DDC Customer Support Center (313-592-5800).

### 22.2.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF. Reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
  - [a] If no codes are present, troubleshooting is complete.
  - [b] If code 625/4 is not logged but other codes are logged, troubleshoot the other codes.
  - [c] If code 625/4 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313-592-5800).

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# 23 SPN 636 — CRANKSHAFT POSITION SENSOR OUTSIDE OF NORMAL OPERATING CONDITIONS

Section	Page
23.1 SPN 636/FMI 1 .....	23-3
23.2 SPN 636/FMI 3 .....	23-5
23.3 SPN 636/FMI 4 .....	23-7
23.4 SPN 636/FMI 7 .....	23-9
23.5 SPN 636/FMI 8 .....	23-10



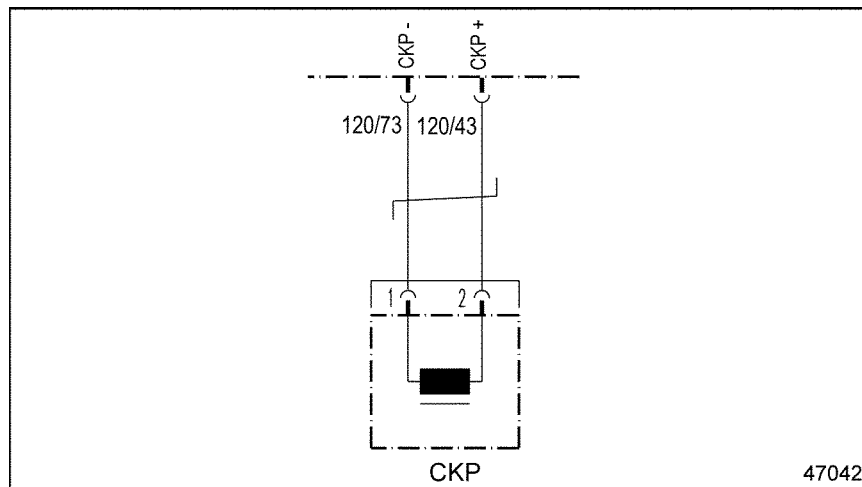
## 23.1 SPN 636/FMI 1

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

### 23.1.1 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 23-1.



**Figure 23-1 Crankshaft Position Sensor Wiring**

- [a] If wires are not correctly wired, repair or replace wires as required. Refer to section 23.1.1.1.
- [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 23.1.1.1.
  - [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 23.1.1.1.
  - [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 23.1.1.1.
- [b] If axial play is within specifications, replace the MCM. Refer to section 23.1.1.1.

### **23.1.1.1 Verify Repairs**

Perform the following steps to verify repairs.

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

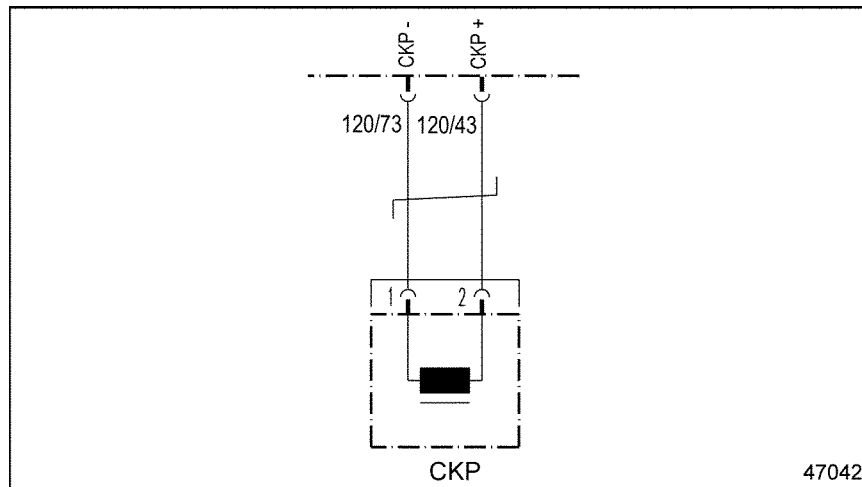
## 23.2 SPN 636/FMI 3

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

### 23.2.1 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 23-2.



**Figure 23-2 Crankshaft Position Sensor Wiring**

- [a] If the resistance is greater than  $140\ \Omega$ , replace CKP Sensor. Refer to section 23.2.2.1.
- [b] If the resistance is less than  $140\ \Omega$ , 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  $5\ \Omega$ , go to step 5.
  - [b] If the resistance is less than  $5\ \Omega$ , repair the short between pins 1 and 2 of the CKP Sensor harness connector and pins 42 and 43 of the 120-pin MCM connector. Refer to section 23.2.2.1.
5. Measure the resistance between pin 1 of the CKP Sensor harness connector and pin 42 of the 120-pin MCM connector.
  - [a] If the resistance is greater than  $5\ \Omega$ , repair the open between pin 1 of the CKP Sensor harness connector and pin 42 of the 120-pin MCM connector. Refer to section 23.2.2.1.
  - [b] If the resistance is less than  $5\ \Omega$ , 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  $\Omega$ , repair the open between pin 2 of the CKP Sensor harness connector and pin 43 of the 120-pin MCM connector. Refer to section 23.2.2.1.
  - [b] If the resistance is less than 5  $\Omega$ , refer to section 23.2.2.

## 23.2.2 Crankshaft Position Sensor Gap Check

Check the crankshaft position sensor gap as follows:

1. Bar the engine until the CKP Sensor is over a CKP tooth of the pulse wheel.
2. Check the gap between the CKP Sensor and the tooth of the pulse wheel (0.020 to 0.040 in.). A depth micrometer can be used.
  - [a] If the gap setting is correct, repeat steps 1 and 2. If the results are the same, call the Detroit Diesel Customer Support Center (313-592-5800).
  - [b] If the gap setting is not correct, adjust the CKP Sensor until the gap setting is correct and refer to section 23.2.2.1. If the problem returns, the pulse wheel may be loose or bad or damaged.

### 23.2.2.1 Verify Repairs

Perform the following steps to verify repairs.

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

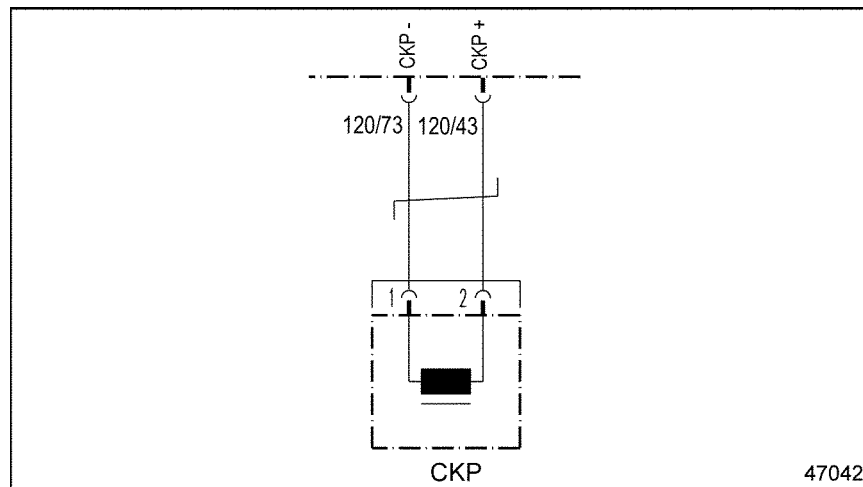
## 23.3 SPN 636/FMI 4

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

### 23.3.1 Short to Ground Check

Troubleshoot a CKP Sensor short to ground fault as follows:

1. Disconnect the CKP Sensor.
2. Measure the resistance between pin 1 of the CKP Sensor and ground.
  - [a] If the resistance is greater than 5  $\Omega$ , go to step 3.
  - [b] If the resistance is less than 5  $\Omega$ , replace the sensor. Refer to section 23.3.1.1.
3. Measure the resistance between pin 2 of the CKP Sensor and ground.
  - [a] If the resistance is greater than 5  $\Omega$ , go to step 4.
  - [b] If the resistance is less than 5  $\Omega$ , replace the sensor. Refer to section 23.3.1.1.
4. Disconnect the 120-pin MCM connector.
5. Measure the resistance across pins 1 and 2 of the CKP Sensor harness connector. See Figure 23-3.



**Figure 23-3 Crankshaft Position Sensor Wiring**

- [a] If the resistance is greater than 5  $\Omega$ , go to step 6.
  - [b] If the resistance is less than 5  $\Omega$ , 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 23.3.1.1.
6. Measure the resistance between pin 1 of the CKP Sensor harness connector and ground.
  - [a] If the resistance is greater than 5  $\Omega$ , go to step 7.

- [b] If the resistance is less than 5  $\Omega$ , 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 23.3.1.1.
- 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  $\Omega$ , 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  $\Omega$ , 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 23.3.1.1.

### 23.3.1.1 Verify Repairs

Perform the following steps to verify repairs.

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

## 23.4 SPN 636/FMI 7

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

### 23.4.1 Camshaft and Crankshaft Signals Not Matching Check

Troubleshoot a no match of camshaft and crankshaft signals fault as follows:

1. Remove CKP and CMP sensors.
2. Reseat the CKP Sensor until it touches the flywheel and reseat the CMP Sensor until it touches the cam gear. Check codes.
  - [a] If 636/7 is not active, refer to section 23.4.1.1.
  - [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 23.4.1.1.
  - [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  $\Omega$  and 1385  $\Omega$ , replace the sensor. refer to section 23.4.1.1.
  - [b] If the sensor resistance is between 1000  $\Omega$  and 1385  $\Omega$ , 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 23.4.1.1.
  - [b] If the flywheel holes or slots are all present, go to step 8.
8. Replace the MCM. Refer to section 23.4.1.1.

### 23.4.1.1 Verify Repairs

Perform the following steps to verify repairs.

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

## 23.5 SPN 636/FMI 8

The diagnostic condition is typically CKP Sensor Time Out.

### 23.5.1 Check for Multiple Codes

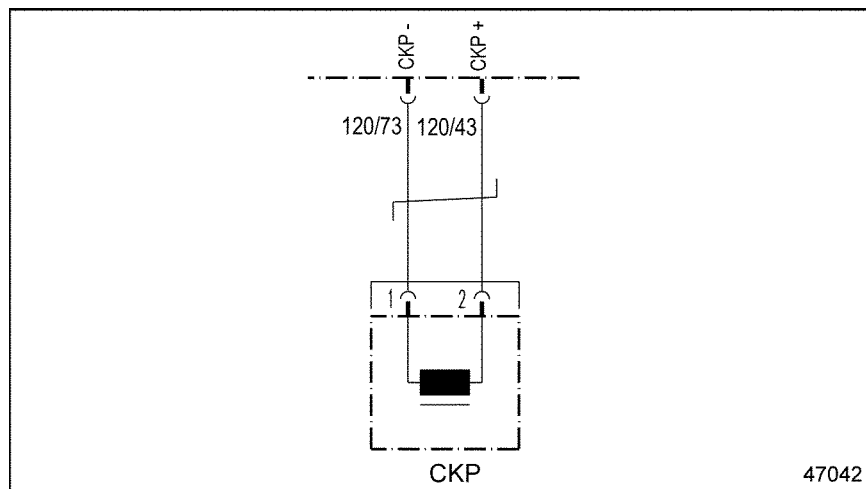
Check for multiple codes as follows:

1. Turn ON ignition and engine.
2. Plug in your diagnostic tool.
3. Read active codes.
  - [a] If fault 636/3 is active in addition to fault 636/8 with the engine running, refer to section 23.2.1.
  - [b] If fault 636/4 is active in addition to fault s 636/8 with the engine running, refer to section 23.3.1.
  - [c] If only fault s 636/8 is active with the engine running, refer to section 23.5.2.

## 23.5.2 Sensor Time Out Check

Check for a sensor time out as follows:

1. Check the CKP Sensor position.
  - [a] If fault 636/8 is not active after checking position, replace CKP Sensor clamping sleeve. Refer to section 23.5.2.1.
  - [b] If fault 636/8 is active after checking position, go to step 2.
2. Replace the Vehicle Speed Sensor.
  - [a] If fault s 636/8 is not active, refer to section 23.5.2.1.
  - [b] If fault s 636/8 is still active, go to step 3.
3. Check the flywheel position in the timing case through the inspection window using the turning tool.
  - [a] If sensors are out of position, repair or replace the spring bushing, as required. Erase fault code memory. See Figure 23-4.



**Figure 23-4 Crankshaft Position Sensor**

- [b] If sensors are not out of position, go to step 4.
4. Check crankshaft axial play.
  - [a] If axial play is not within specifications, repair or replace crankshaft thrust bearings, as required. Refer to section 23.5.2.1.
  - [b] If axial play is within specifications, contact the Detroit Diesel Customer Support Center (313-592-5800).

### 23.5.2.1 Verify Repairs

Perform the following steps to verify repairs.

1. Turn vehicle ignition OFF.
2. Reconnect all connectors. Turn ignition ON.
3. Clear codes with diagnostic tool.
4. Start and run the engine for one minute. Stop engine.
5. Check diagnostic tool for codes.
  - [a] If no codes are displayed, troubleshooting is complete.
  - [b] If code 636/8 is not logged, and other codes are logged, troubleshoot the logged codes.
  - [c] If code 636/8 and other codes are logged, review this section to find the error. If no error is found, call the Detroit Diesel Customer Support Center (313-592-5800).

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# 24 SPN 651 – INJECTOR #1 NOT OPERATING NORMALLY

Section	Page
24.1 SPN 651/FMI 5 .....	24-3
24.2 SPN 651/FMI 10 .....	24-5



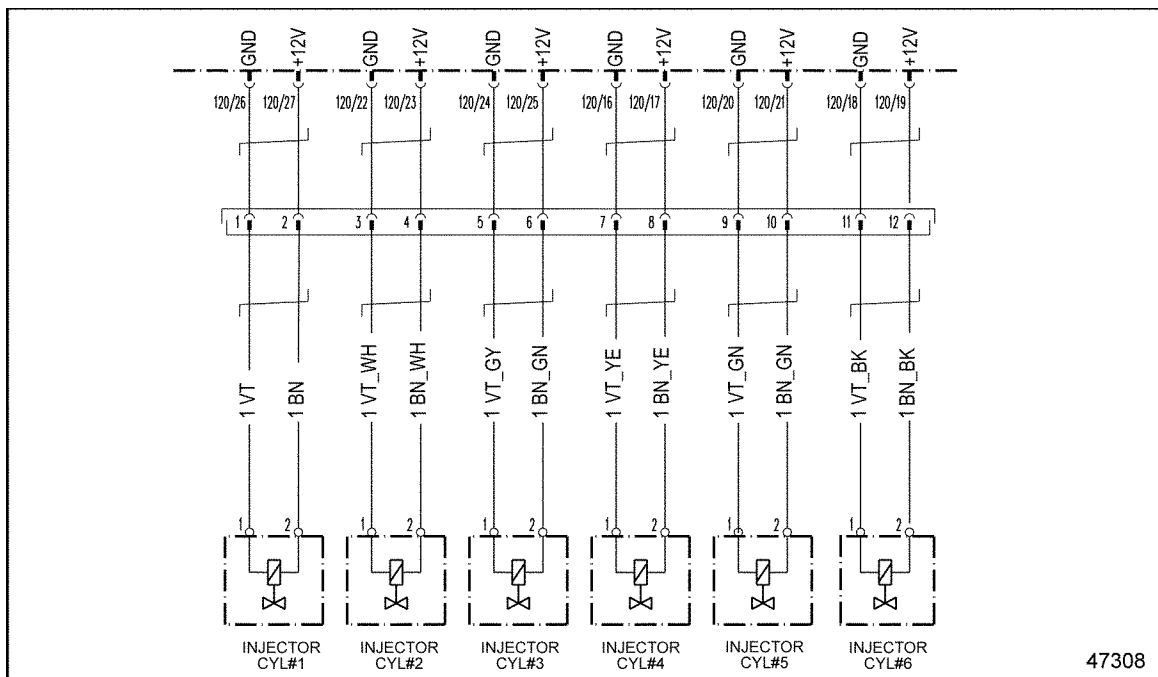
## 24.1 SPN 651/FMI 5

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

### 24.1.1 Open Circuit Check

Check as follows:

1. Check for multiple codes.
  - [a] If fault code 168/1 is active in addition to 651/5, service 168/1 first. Refer to section 12.2.
  - [b] If fault 652/5 and 653/5 are active in addition to 651/5, call the Detroit Diesel Customer Support Center (313-592-5800) for MCM replacement authorization.
  - [c] If only fault code 651/5 is active, go to step 2.
2. Turn the ignition OFF.
3. Disconnect the Injector Harness 12-pin connector.
4. Measure the resistance between pins 1 and 2 on the valve cover side of the connector. See Figure 24-1.



**Figure 24-1 MBE 900 Injectors**

- [a] If the resistance is less than  $9\Omega$ , go to step 9.
  - [b] If the resistance is greater than  $9\Omega$ , go to step 5.
5. Remove valve cover

6. Disconnect the injector #1 connector.
7. Measure the resistance between pin 1 of the injector connector and pin 1 of the Injector Harness 12-pin connector.
  - [a] If the resistance is less than  $3\Omega$ , go to step 8.
  - [b] If the resistance is greater than  $3\Omega$ , repair the open between pin 1 of the injector connector and pin 1 of the Injector Harness 12-pin connector. Refer to section 24.1.1.1.
8. Measure the resistance between pin 2 of the injector connector and pin 2 of the Injector Harness 12-pin connector.
  - [a] If the resistance is less than  $3\Omega$ , replace the #1 injector.
  - [b] If the resistance is greater than  $3\Omega$ , repair the open between pin 2 of the injector connector and pin 2 of the Injector Harness 12-pin connector. Refer to section 24.1.1.1.
9. Turn the ignition On.
10. Measure the voltage between pins 1 and 2 on the engine side of the Injector Harness 12-pin connector.
  - [a] If the voltage is less than 11.5 volts, go to step 11.
  - [b] If the voltage is between 11.5 and 13.5 volts, repeat steps 2 through 10. If the results are the same, contact the Detroit Diesel Customer Support Center (313-592-5800).
11. Measure the voltage between pin 2 on the engine side of the Injector Harness 12-pin connector and ground.
  - [a] If the voltage is less than 11.5 volts, repair the open between pin 2 on the engine side of the Injector Harness 12-pin connector and pin 27 of the 120-pin MCM connector. Refer to section 24.1.1.1.
  - [b] If the voltage is between 11.5 and 13.5 volts, repair the open between pin 1 on the engine side of the Injector Harness 12-pin connector and pin 26 of the 120-pin MCM connector. Refer to section 24.1.1.1.

### 24.1.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF and reconnect all connectors.
2. Turn the ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
  - [a] If no codes are present, troubleshooting is complete.
  - [b] If code 651/5 is not logged but other codes are logged, troubleshoot the other codes.

- [c] If code 651/5 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313-592-5800).

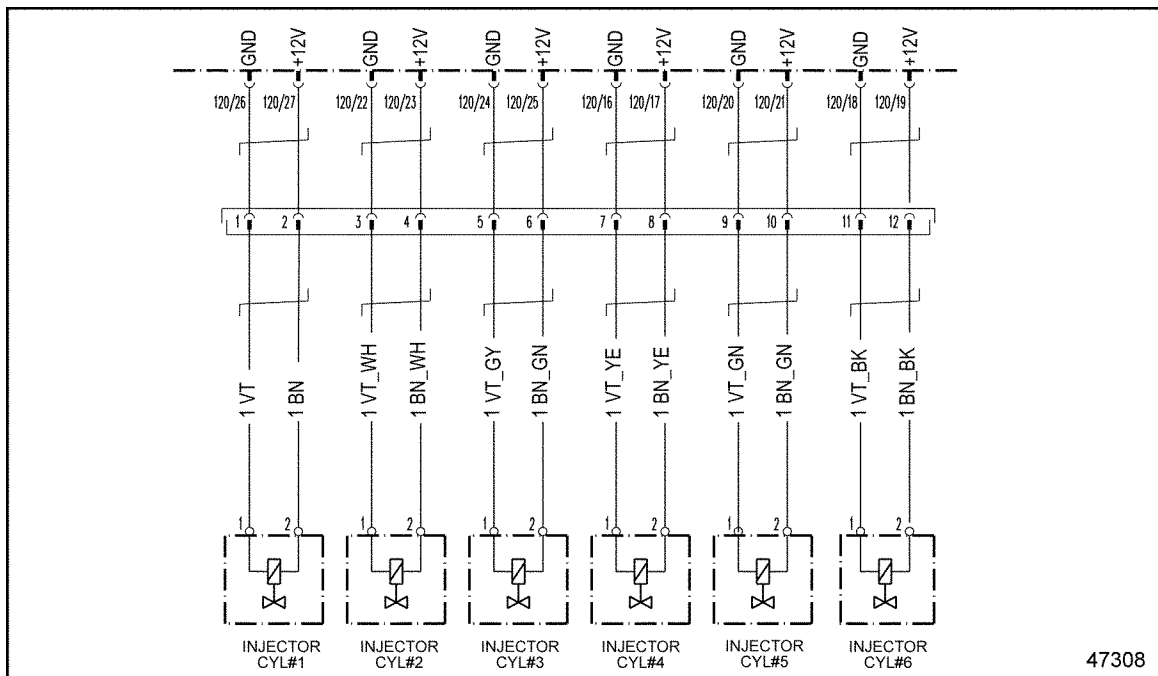
## 24.2 SPN 651/FMI 10

This diagnostic condition is typically a short to ground.

### 24.2.1 Short to Ground Check

Check as follows:

1. Turn the ignition OFF.
2. Disconnect the Injector Harness 12-pin connector.
3. Measure the resistance between pin 1 of injector #1 and ground on the valve cover side of the Injector Harness 12-pin connector. See Figure 24-2.



**Figure 24-2 MBE 900 Injectors**

- [a] If the resistance is less than 5  $\Omega$ , go to step 4..
- [b] If the resistance is greater than 5  $\Omega$ , go to step 8.
4. Remove the valve cover.
  5. Disconnect the Injector Harness from the injector.
  6. Measure the resistance between pin 1 and ground on the valve cover side of the Injector Harness 12-pin connector.

- [a] If the resistance is less than 5  $\Omega$ , repair the short to ground between pin 1 of the Injector Harness 12-pin connector and pin 1 of injector #1. Refer to section 24.2.1.1.
  - [b] If the resistance is greater than 5  $\Omega$ , go to step 7.
7. Measure the resistance between pin 1 of injector #1 and ground.
- [a] If the resistance is less than 5  $\Omega$ , replace the injector.
  - [b] If the resistance is greater than 5  $\Omega$ , repair the short to ground between pin 2 of the Injector Harness 12-pin connector and pin 2 of injector #1. Refer to section 24.2.1.1.
8. Disconnect the 120-pin MCM connector.
9. Measure the resistance between pin 1 and ground on the engine side of the Injector Harness 12-pin connector.
- [a] If the resistance is less than 5  $\Omega$ , repair the short to ground between pin 1 of the Injector Harness 12-pin connector and pin 26 of the 120-pin MCM connector. Refer to section 24.2.1.1.
  - [b] If the resistance is greater than 5  $\Omega$ , go to step 10.
10. Measure the resistance between pin 2 and ground on the engine side of the Injector Harness 12-pin connector.
- [a] If the resistance is less than 5  $\Omega$ , repair the short to ground between pin 2 of the Injector Harness 12-pin connector and pin 27 of the 120-pin MCM connector. Refer to section 24.2.1.1.
  - [b] If the resistance is greater than 5  $\Omega$ , go to step 11
11. Clear the codes. Check for active codes.
- [a] If code 651/10 is still active, call the Detroit Diesel Customer Support Center (313-592-5800) for authorization to replace the MCM.
  - [b] If there are no active codes, troubleshooting is finished.

### 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 651/10 is not logged but other codes are logged, troubleshoot the other codes.
  - [c] If code 651/10 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313-592-5800).

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# 25 SPN 652 – INJECTOR #2 NOT OPERATING NORMALLY

Section	Page
25.1 SPN 652/FMI 5 .....	25-3
25.2 SPN 652/FMI 10 .....	25-5



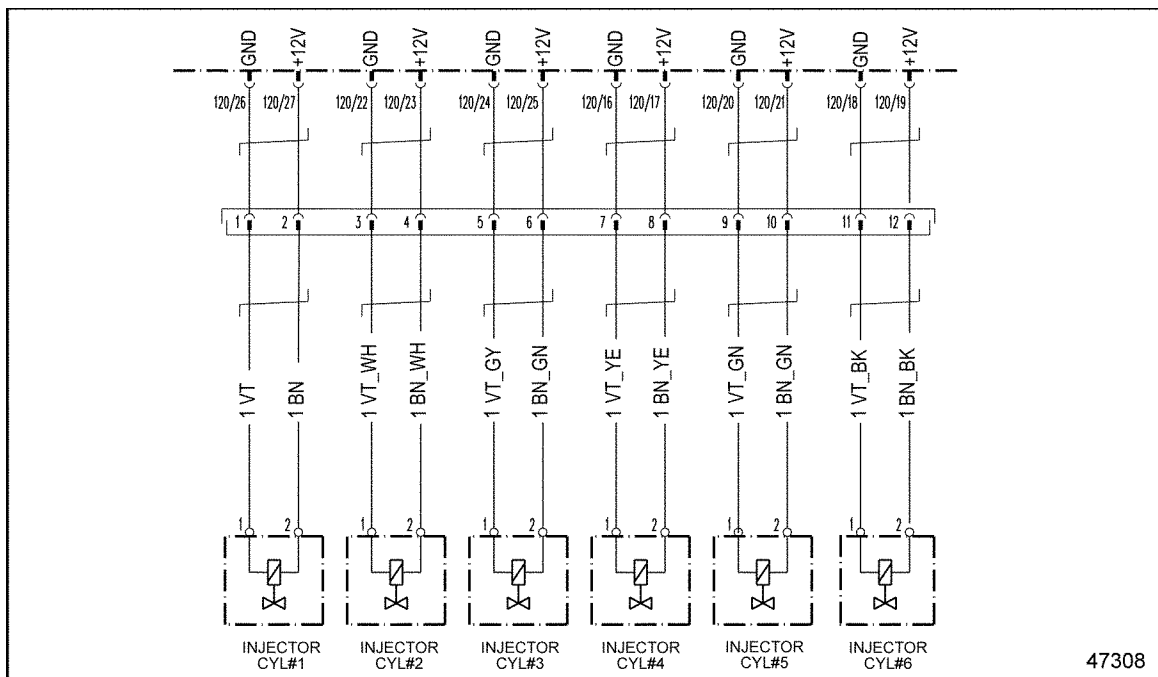
## 25.1 SPN 652/FMI 5

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

### 25.1.1 Open Circuit Check

Check as follows:

1. Check for multiple codes.
  - [a] If fault code 168/1 is active in addition to 652/5, service 168/1 first. Refer to section 12.2.
  - [b] If fault 651/5 and 653/5 are active in addition to 652/5, call the Detroit Diesel Customer Support Center (313-592-5800) for MCM replacement authorization.
  - [c] If only fault code 652/5 is active, go to step 2.
2. Turn the ignition OFF.
3. Disconnect the Injector Harness 12-pin connector.
4. Measure the resistance between pins 3 and 4 on the valve cover side of the connector. See Figure 25-1.



**Figure 25-1 MBE 900 Injectors**

- [a] If the resistance is less than  $9\Omega$ , go to step 9.
  - [b] If the resistance is greater than  $9\Omega$ , go to step 5.
5. Remove valve cover

6. Disconnect the injector #2 connector.
7. Measure the resistance between pin 1 of the injector connector and pin 3 of the Injector Harness 12-pin connector.
  - [a] If the resistance is less than  $3\Omega$ , go to step 8.
  - [b] If the resistance is greater than  $3\Omega$ , repair the open between pin 1 of the injector connector and pin 3 of the Injector Harness 12-pin connector. Refer to section 25.1.1.1.
8. Measure the resistance between pin 2 of the injector connector and pin 4 of the Injector Harness 12-pin connector.
  - [a] If the resistance is less than  $3\Omega$ , replace the #2 injector.
  - [b] If the resistance is greater than  $3\Omega$ , repair the open between pin 2 of the injector connector and pin 4 of the Injector Harness 12-pin connector. Refer to section 25.1.1.1.
9. Turn the ignition On.
10. Measure the voltage between pins 3 and 4 on the engine side of the Injector Harness 12-pin connector.
  - [a] If the voltage is less than 11.5 volts, go to step 11.
  - [b] If the voltage is between 11.5 and 13.5 volts, repeat steps 2 through 10. If the results are the same, contact the Detroit Diesel Customer Support Center (313-592-5800).
11. Measure the voltage between pin 4 on the engine side of the Injector Harness 12-pin connector and ground.
  - [a] If the voltage is less than 11.5 volts, repair the open between pin 4 on the engine side of the Injector Harness 12-pin connector and pin 23 of the 120-pin MCM connector. Refer to section 25.1.1.1.
  - [b] If the voltage is between 11.5 and 13.5 volts, repair the open between pin 3 on the engine side of the Injector Harness 12-pin connector and pin 22 of the 120-pin MCM connector. Refer to section 25.1.1.1.

### 25.1.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF and reconnect all connectors.
2. Turn the ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
  - [a] If no codes are present, troubleshooting is complete.
  - [b] If code 652/5 is not logged but other codes are logged, troubleshoot the other codes.

- [c] If code 652/5 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313-592-5800).

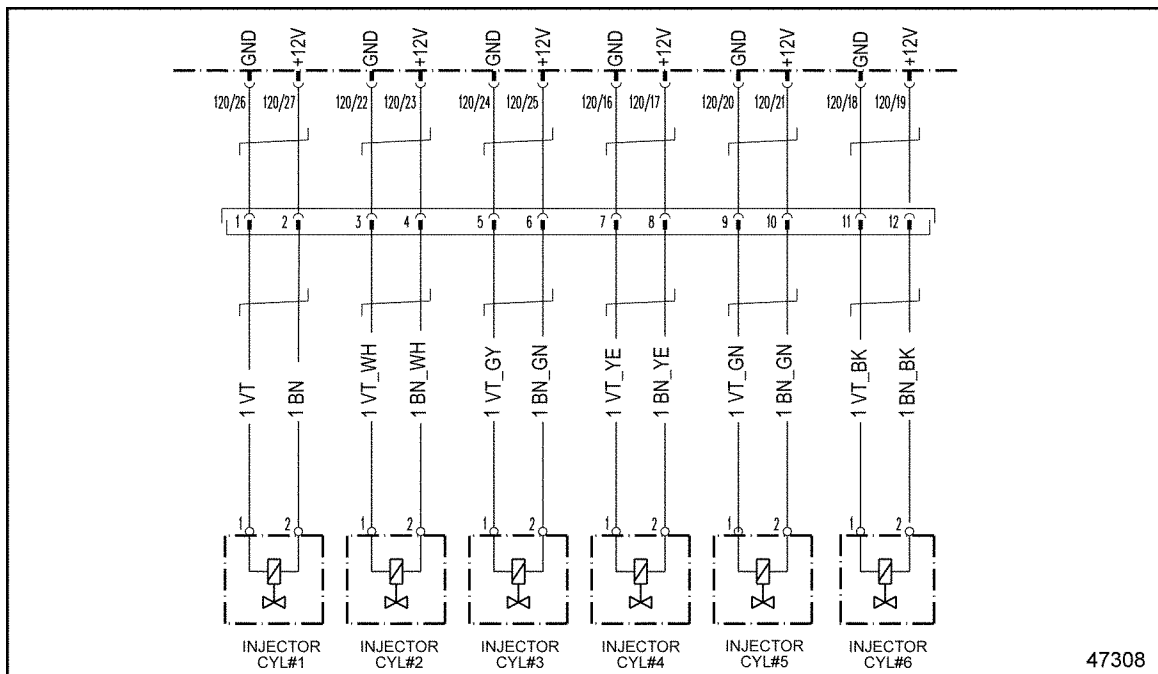
## 25.2 SPN 652/FMI 10

This diagnostic condition is typically a short to ground.

### 25.2.1 Short to Ground Check

Check as follows:

1. Turn the ignition OFF.
2. Disconnect the Injector Harness 12-pin connector.
3. Measure the resistance between pin 3 of injector #2 and ground on the valve cover side of the Injector Harness 12-pin connector. See Figure 25-2.



**Figure 25-2 MBE 900 Injectors**

- [a] If the resistance is less than 5  $\Omega$ , go to step 4.
- [b] If the resistance is greater than 5  $\Omega$ , go to step 8.
4. Remove the valve cover.
  5. Disconnect the Injector Harness from the injector.
  6. Measure the resistance between pin 3 and ground on the valve cover side of the Injector Harness 12-pin connector.

- [a] If the resistance is less than 5  $\Omega$ , repair the short to ground between pin 3 of the Injector Harness 12-pin connector and pin 1 of injector #2. Refer to section 25.2.1.1.
- [b] If the resistance is greater than 5  $\Omega$ , go to step 7.
- 7. Measure the resistance between pin 1 of injector #2 and ground.
  - [a] If the resistance is less than 5  $\Omega$ , replace the injector.
  - [b] If the resistance is greater than 5  $\Omega$ , repair the short to ground between pin 4 of the Injector Harness 12-pin connector and pin 2 of injector #2. Refer to section 25.2.1.1.
- 8. Disconnect the 120-pin MCM connector.
- 9. Measure the resistance between pin 3 and ground on the engine side of the Injector Harness 12-pin connector.
  - [a] If the resistance is less than 5  $\Omega$ , repair the short to ground between pin 3 of the Injector Harness 12-pin connector and pin 22 of the 120-pin MCM connector. Refer to section 25.2.1.1.
  - [b] If the resistance is greater than 5  $\Omega$ , go to step 10.
- 10. Measure the resistance between pin 4 and ground on the engine side of the Injector Harness 12-pin connector.
  - [a] If the resistance is less than 5  $\Omega$ , repair the short to ground between pin 4 of the Injector Harness 12-pin connector and pin 23 of the 120-pin MCM connector. Refer to section 25.2.1.1.
  - [b] If the resistance is greater than 5  $\Omega$ , go to step 11.
- 11. Clear the codes. Check for active codes.
  - [a] If code 651/10 is still active, call the Detroit Diesel Customer Support Center (313-592-5800) for authorization to replace the MCM.
  - [b] If there are no active codes, troubleshooting is finished.

### 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 652/10 is not logged but other codes are logged, troubleshoot the other codes.
  - [c] If code 652/10 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313-592-5800).

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## **26 SPN 653 – INJECTOR #3 NOT OPERATING NORMALLY**

<b>Section</b>	<b>Page</b>
26.1 TROUBLESHOOTING SPN 653/FMI 5 .....	26-3
26.2 TROUBLESHOOTING SPN 653/FMI 10 .....	26-5



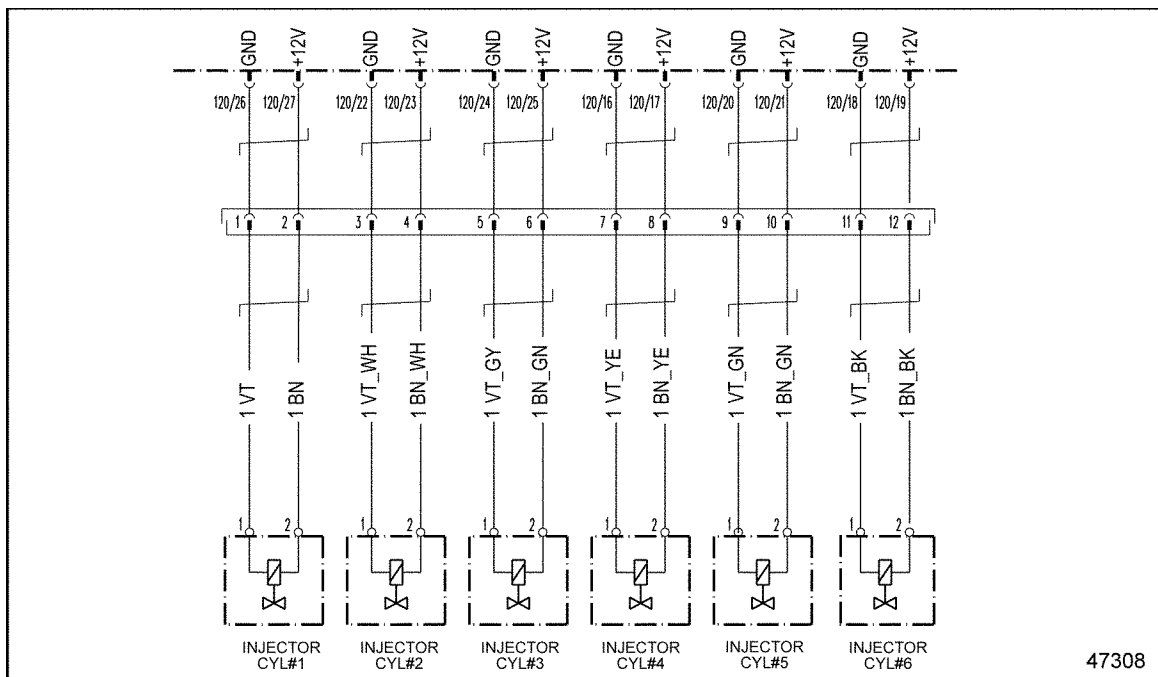
## 26.1 TROUBLESHOOTING SPN 653/FMI 5

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

### 26.1.1 Open Circuit Check

Check as follows:

1. Check for multiple codes.
  - [a] If fault code 168/1 is active in addition to 653/5, service 168/1 first. Refer to section 12.2.
  - [b] If fault 652/5 and 651/5 are active in addition to 653/5, call the Detroit Diesel Customer Support Center (313-592-5800) for MCM replacement authorization.
  - [c] If only fault code 653/5 is active, go to step 2.
2. Turn the ignition OFF.
3. Disconnect the Injector Harness 12-pin connector.
4. Measure the resistance between pins 5 and 6 on the valve cover side of the connector. See Figure 26-1.



**Figure 26-1 MBE 900 Injectors**

- [a] If the resistance is less than  $9\Omega$ , go to step 9.
  - [b] If the resistance is greater than  $9\Omega$ , go to step 5.
5. Remove valve cover.

6. Disconnect the injector #3 connector.
7. Measure the resistance between pin 1 of the injector connector and pin 5 of the Injector Harness 12-pin connector.
  - [a] If the resistance is less than  $3\Omega$ , go to step 8.
  - [b] If the resistance is greater than  $3\Omega$ , repair the open between pin 1 of the injector connector and pin 5 of the Injector Harness 12-pin connector. Refer to section 26.1.1.1.
8. Measure the resistance between pin 2 of the injector connector and pin 6 of the Injector Harness 12-pin connector.
  - [a] If the resistance is less than  $3\Omega$ , replace the #3 injector.
  - [b] If the resistance is greater than  $3\Omega$ , repair the open between pin 2 of the injector connector and pin 6 of the Injector Harness 12-pin connector. Refer to section 26.1.1.1.
9. Turn the ignition On.
10. Measure the voltage between pins 5 and 6 on the engine side of the Injector Harness 12-pin connector.
  - [a] If the voltage is less than 11.5 volts, go to step 11.
  - [b] If the voltage is between 11.5 and 13.5 volts, repeat steps 2 through 10. If the results are the same, contact the Detroit Diesel Customer Support Center (313-592-5800).
11. Measure the voltage between pin 6 on the engine side of the Injector Harness 12-pin connector and ground.
  - [a] If the voltage is less than 11.5 volts, repair the open between pin 6 on the engine side of the Injector Harness 12-pin connector and pin 24 of the 120-pin MCM connector. Refer to section 26.1.1.1.
  - [b] If the voltage is between 11.5 and 13.5 volts, repair the open between pin 5 on the engine side of the Injector Harness 12-pin connector and pin 26 of the 120-pin MCM connector. Refer to section 26.1.1.1.

### 26.1.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF and reconnect all connectors.
2. Turn the ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
  - [a] If no codes are present, troubleshooting is complete.
  - [b] If code 653/5 is not logged but other codes are logged, troubleshoot the other codes.

- [c] If code 653/5 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313-592-5800).

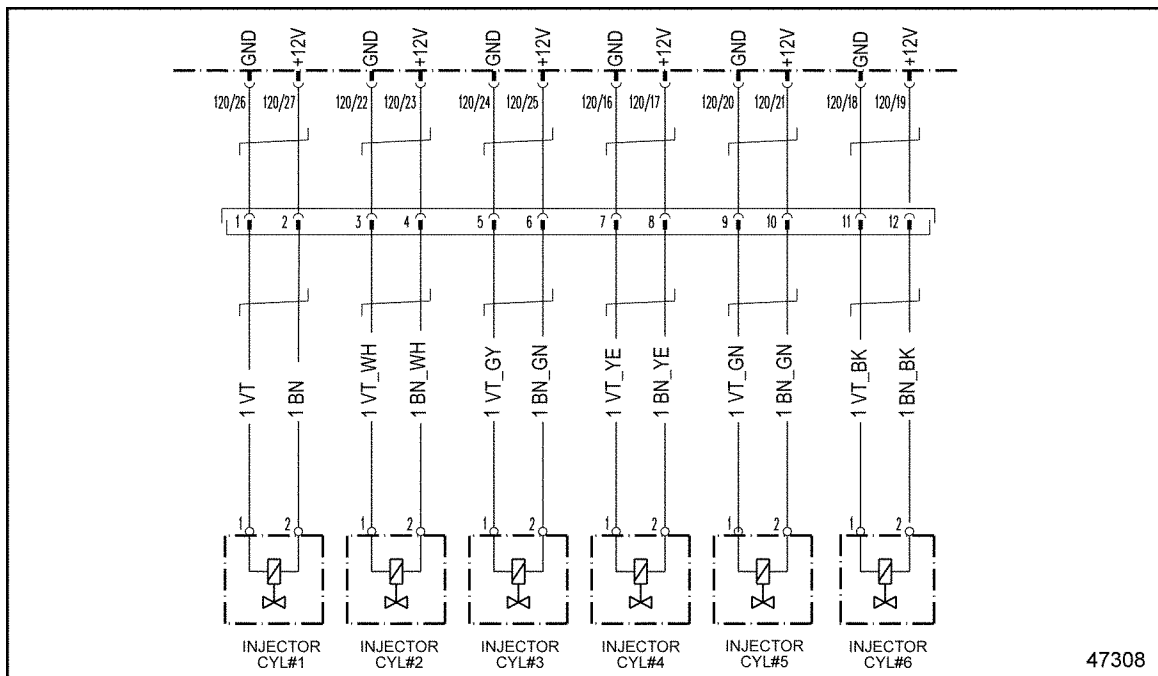
## 26.2 TROUBLESHOOTING SPN 653/FMI 10

This diagnostic condition is typically a short to ground.

### 26.2.1 Short to Ground Check

Check as follows:

1. Turn the ignition OFF.
2. Disconnect the Injector Harness 12-pin connector.
3. Measure the resistance between pin 5 of injector #3 and ground on the valve cover side of the Injector Harness 12-pin connector. See Figure 26-2.



**Figure 26-2 MBE 900 Injectors**

- [a] If the resistance is less than 5  $\Omega$ , go to step 4.
- [b] If the resistance is greater than 5  $\Omega$ , go to step 8.
4. Remove the valve cover.
  5. Disconnect the Injector Harness from the injector.
  6. Measure the resistance between pin 5 and ground on the valve cover side of the Injector Harness 12-pin connector.

- [a] If the resistance is less than 5  $\Omega$ , repair the short to ground between pin 5 of the Injector Harness 12-pin connector and pin 1 of injector #3. Refer to section 26.2.1.1.
  - [b] If the resistance is greater than 5  $\Omega$ , go to step 7.
7. Measure the resistance between pin 1 of injector #3 and ground.
- [a] If the resistance is less than 5  $\Omega$ , replace the injector.
  - [b] If the resistance is greater than 5  $\Omega$ , repair the short to ground between pin 6 of the Injector Harness 12-pin connector and pin 2 of injector #3. Refer to section 26.2.1.1.
8. Disconnect the 120-pin MCM connector.
9. Measure the resistance between pin 5 and ground on the engine side of the Injector Harness 12-pin connector.
- [a] If the resistance is less than 5  $\Omega$ , repair the short to ground between pin 5 of the Injector Harness 12-pin connector and pin 24 of the 120-pin MCM connector. Refer to section 26.2.1.1.
  - [b] If the resistance is greater than 5  $\Omega$ , go to step 10.
10. Measure the resistance between pin 6 and ground on the engine side of the Injector Harness 12-pin connector.
- [a] If the resistance is less than 5  $\Omega$ , repair the short to ground between pin 6 of the Injector Harness 12-pin connector and pin 25 of the 120-pin MCM connector. Refer to section 26.2.1.1.
  - [b] If the resistance is greater than 5  $\Omega$ , go to step 11.
11. Clear the codes. Check for active codes
- [a] If code 653/10 is still active, call the Detroit Diesel Customer Support Center (313-592-5800) for authorization to replace the MCM.
  - [b] If there are no active codes, troubleshooting is finished.

### 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 653/10 is not logged but other codes are logged, troubleshoot the other codes.
  - [c] If code 653/10 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313-592-5800).

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## **27 SPN 654 – INJECTOR #4 NOT OPERATING NORMALLY**

<b>Section</b>	<b>Page</b>
27.1 TROUBLESHOOTING SPN 654/FMI 5 .....	27-3
27.2 TROUBLESHOOTING SPN 654/FMI 10 .....	27-5



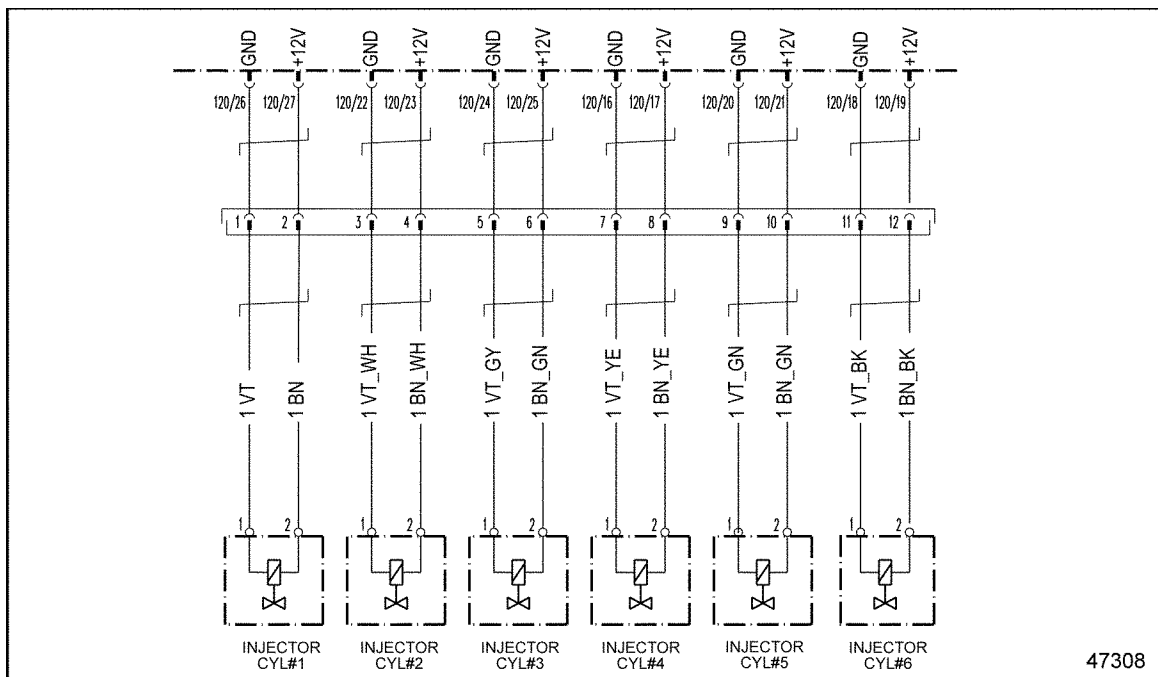
## 27.1 TROUBLESHOOTING SPN 654/FMI 5

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

### 27.1.1 Open Circuit Check

Check as follows:

1. Check for multiple codes.
  - [a] If fault code 168/1 is active in addition to 654/5, service 168/1 first. Refer to section 12.2.
  - [b] If fault 655/5 and 656/5 are active in addition to 654/5, call the Detroit Diesel Customer Support Center (313-592-5800) for MCM replacement.
  - [c] If only fault code 654/5 is active, go to step 2.
2. Turn the ignition OFF.
3. Disconnect the Injector Harness 12-pin connector.
4. Measure the resistance between pins 7 and 8 on the valve cover side of the connector. See Figure 27-1.



**Figure 27-1 MBE 900 Injectors**

- [a] If the resistance is less than  $9\Omega$ , go to step 9.
  - [b] If the resistance is greater than  $9\Omega$ , go to step 5.
5. Remove valve cover.

6. Disconnect the injector #4 connector.
7. Measure the resistance between pin 1 of the injector connector and pin 7 of the Injector Harness 12-pin connector.
  - [a] If the resistance is less than  $3\Omega$ , go to step 8.
  - [b] If the resistance is greater than  $3\Omega$ , repair the open between pin 1 of the injector connector and pin 7 of the Injector Harness 12-pin connector. Refer to section 27.1.1.1.
8. Measure the resistance between pin 2 of the injector connector and pin 8 of the Injector Harness 12-pin connector.
  - [a] If the resistance is less than  $3\Omega$ , replace the #4 injector.
  - [b] If the resistance is greater than  $3\Omega$ , repair the open between pin 2 of the injector connector and pin 8 of the Injector Harness 12-pin connector. Refer to section 27.1.1.1.
9. Turn the ignition ON
10. Measure the voltage between pins 7 and 8 on the engine side of the Injector Harness 12-pin connector.
  - [a] If the voltage is less than 11.5 volts, go to step 11.
  - [b] If the voltage is between 11.5 and 13.5 volts, repeat steps 2 through 10. If the results are the same, contact the Detroit Diesel Customer Support Center (313-592-5800).
11. Measure the voltage between pin 8 on the engine side of the Injector Harness 12-pin connector and ground.
  - [a] If the voltage is less than 11.5 volts, repair the open between pin 7 on the engine side of the Injector Harness 12-pin connector and pin 16 of the 120-pin MCM connector. Refer to section 27.1.1.1.
  - [b] If the voltage is between 11.5 and 13.5 volts, repair the open between pin 8 on the engine side of the Injector Harness 12-pin connector and pin 17 of the 120-pin MCM connector. Refer to section 27.1.1.1.

### 27.1.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the vehicle ignition OFF and reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
  - [a] If no codes are present, troubleshooting is complete.
  - [b] If code 654/5 is not logged but other codes are logged, troubleshoot the other codes.

- [c] If code 654/5 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313-592-5800).

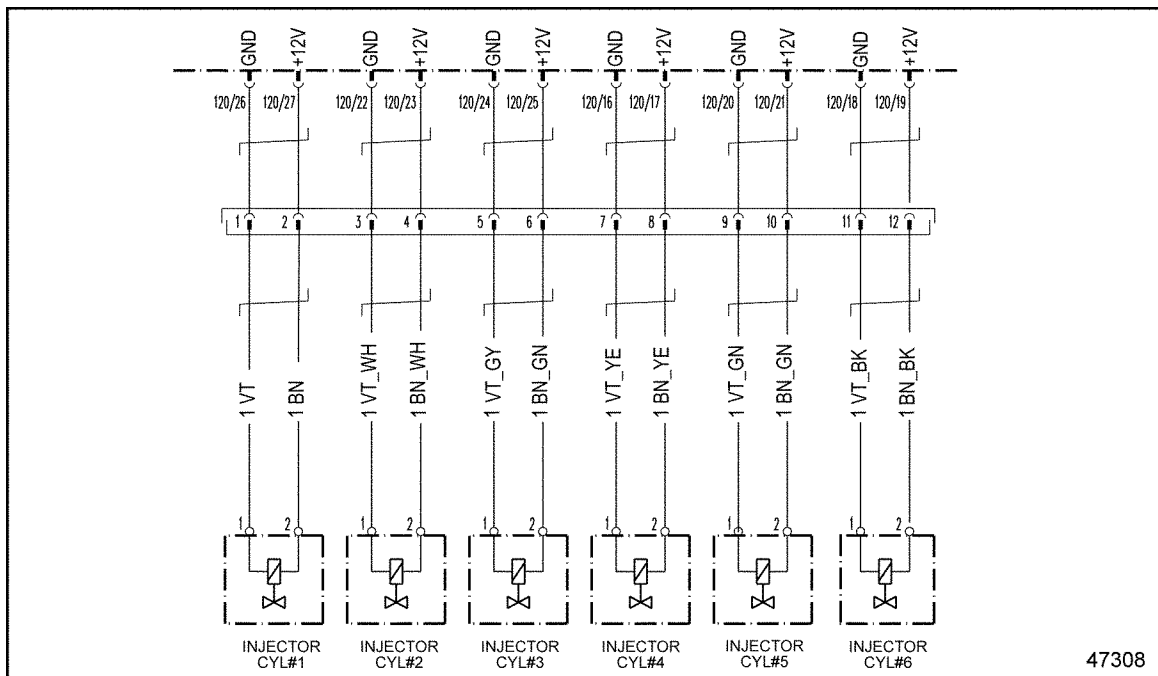
## 27.2 TROUBLESHOOTING SPN 654/FMI 10

This diagnostic condition is typically a short to ground.

### 27.2.1 Check for Short to Ground

Check as follows:

1. Turn the ignition OFF.
2. Disconnect the Injector Harness 12-pin connector.
3. Measure the resistance between pin 1 of injector #4 and ground on the valve cover side of the Injector Harness 12-pin connector. See Figure 27-2.



**Figure 27-2 MBE 900 Injectors**

- [a] If the resistance is less than 5  $\Omega$ , go to step 4.
- [b] If the resistance is greater than 5  $\Omega$ , go to step 8.
4. Remove the valve cover.
  5. Disconnect the Injector Harness from the injector.
  6. Measure the resistance between pin 7 and ground on the valve cover side of the Injector Harness 12-pin connector.

- [a] If the resistance is less than 5  $\Omega$ , repair the short to ground between pin 7 of the Injector Harness 12-pin connector and pin 1 of injector #4. Refer to section 27.2.1.1.
  - [b] If the resistance is greater than 5  $\Omega$ , go to step 7.
7. Measure the resistance between pin 1 of injector #4 and ground.
- [a] If the resistance is less than 5  $\Omega$ , replace the injector.
  - [b] If the resistance is greater than 5  $\Omega$ , repair the short to ground between pin 8 of the Injector Harness 12-pin connector and pin 2 of injector #4. Refer to section 27.2.1.1.
8. Disconnect the 120-pin MCM connector.
9. Measure the resistance between pin 7 and ground on the engine side of the Injector Harness 12-pin connector.
- [a] If the resistance is less than 5  $\Omega$ , repair the short to ground between pin 7 of the Injector Harness 12-pin connector and pin 16 of the 120-pin MCM connector. Refer to section 27.2.1.1.
  - [b] If the resistance is greater than 5  $\Omega$ , go to step 10.
10. Measure the resistance between pin 8 and ground on the engine side of the Injector Harness 12-pin connector.
- [a] If the resistance is less than 5  $\Omega$ , repair the short to ground between pin 2 of the Injector Harness 12-pin connector and pin 17 of the 120-pin MCM connector. Refer to section 27.2.1.1.
  - [b] If the resistance is greater than 5  $\Omega$ , go to step 11.
11. Clear the codes. Check for active codes.
- [a] If code 654/10 is still active, call the Detroit Diesel Customer Support Center (313-592-5800) for authorization to replace the MCM.
  - [b] If there are no active codes, troubleshooting is finished.

### 27.2.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the vehicle ignition OFF and reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
  - [a] If no codes are present, troubleshooting is complete.
  - [b] If code 654/10 is not logged but other codes are logged, troubleshoot the other codes.
  - [c] If code 654/10 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313-592-5800).

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# 28 SPN 655 – INJECTOR #5 NOT OPERATING NORMALLY

Section	Page
28.1 SPN 655/FMI 5 .....	28-3
28.2 SPN 655/FMI 10 .....	28-5



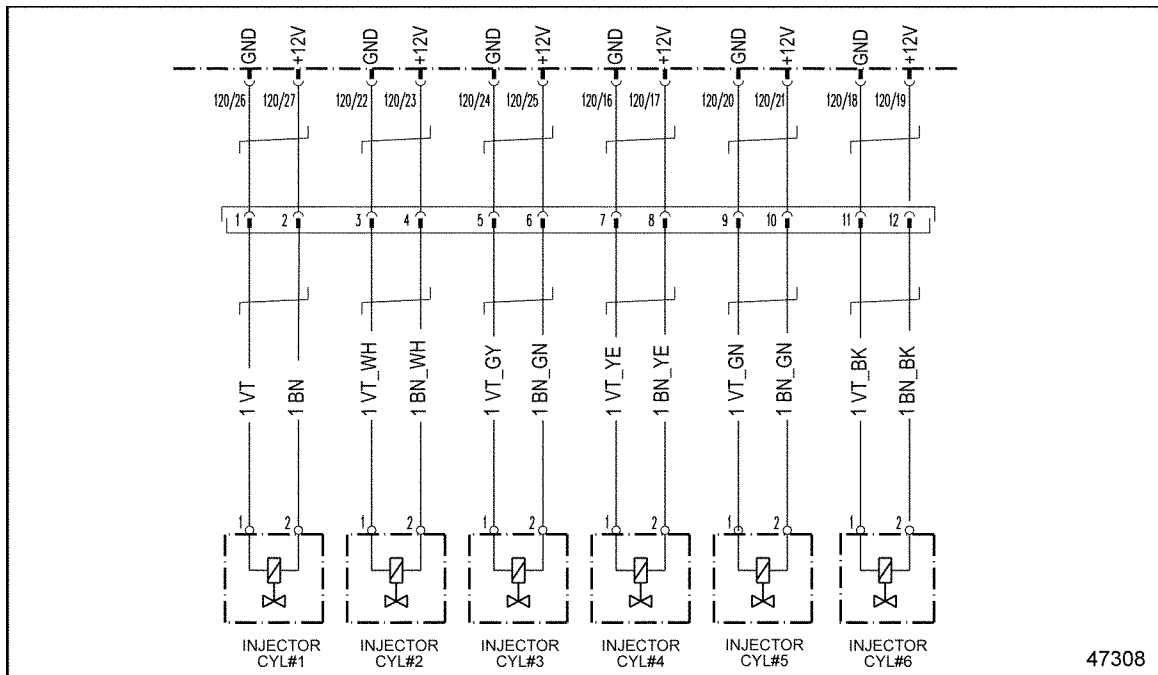
## 28.1 SPN 655/FMI 5

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

### 28.1.1 Open Circuit Check

Check as follows:

1. Check for multiple codes.
  - [a] If fault code 168/1 is active in addition to 655/5, service 168/1 first. Refer to section 12.2.
  - [b] If fault 654/5 and 656/5 are active in addition to 655/5, call the Detroit Diesel Customer Support Center (313-592-5800) for MCM replacement.
  - [c] If only fault code 655/5 is active, refer to section 28.1.1.
2. Turn the ignition OFF.
3. Disconnect the Injector Harness 12-pin connector.
4. Measure the resistance between pins 9 and 10 on the valve cover side of the connector. See Figure 28-1.



**Figure 28-1 MBE 900 Injectors**

- [a] If the resistance is less than 5  $\Omega$ , go to step 9.
  - [b] If the resistance is greater than 5  $\Omega$ , go to step 5.
5. Remove valve cover.

6. Disconnect the injector #5 connector.
7. Measure the resistance between pin 1 of the injector connector and pin 9 of the Injector Harness 12-pin connector.
  - [a] If the resistance is less than  $3\Omega$ , go to step 8.
  - [b] If the resistance is greater than  $3\Omega$ , repair the open between pin 2 of the injector connector and pin 9 of the Injector Harness 12-pin connector. Refer to section 28.1.1.1.
8. Measure the resistance between pin 2 of the injector connector and pin 10 of the Injector Harness 12-pin connector.
  - [a] If the resistance is less than  $3\Omega$ , replace the #5 injector.
  - [b] If the resistance is greater than  $3\Omega$ , repair the open between pin 2 of the injector connector and pin 10 of the Injector Harness 12-pin connector. Refer to section 28.1.1.1.
9. Turn the ignition On..
10. Measure the voltage between pins 9 and 10 on the engine side of the Injector Harness 12-pin connector.
  - [a] If the voltage is less than 11.5 volts, go to step 11.
  - [b] If the voltage is between 11.5 and 13.5 volts, repeat steps 2 through 10. If the results are the same, contact the Detroit Diesel Customer Support Center (313-592-5800).
11. Measure the voltage between pin 10 on the engine side of the Injector Harness 12-pin connector and ground.
  - [a] If the voltage is less than 11.5 volts, repair the open between pin 10 on the engine side of the Injector Harness 12-pin connector and pin 21 of the 120-pin MCM connector. Refer to section 28.1.1.1.
  - [b] If the voltage is between 11.5 and 13.5 volts, repair the open between pin 9 on the engine side of the Injector Harness 12-pin connector and pin 20 of the 120-pin MCM connector. Refer to section 28.1.1.1.

### 28.1.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the vehicle ignition OFF and reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
  - [a] If no codes are present, troubleshooting is complete.
  - [b] If code 655/5 is not logged but other codes are logged, troubleshoot the other codes.

- [c] If code 655/5 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313-592-5800).

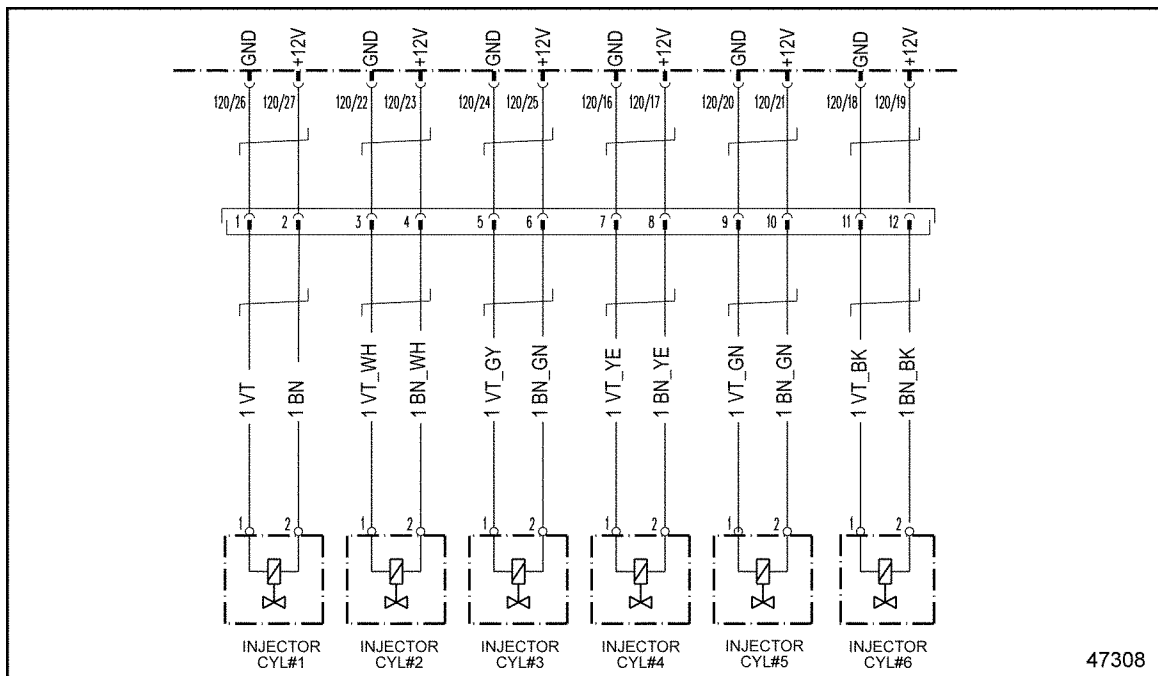
## 28.2 SPN 655/FMI 10

This diagnostic condition is typically a short to ground.

### 28.2.1 Short to Ground Check

Check as follows:

1. Turn the ignition OFF.
2. Disconnect the 120-pin MCM connector.
3. Measure the resistance between pin 9 of injector #5 and ground on the valve cover side of the Injector Harness 12-pin connector. See Figure 28-2.



**Figure 28-2 MBE 900 Injectors**

- [a] If the resistance is less than 5  $\Omega$ , go to step 4.
- [b] If the resistance is greater than 5  $\Omega$ , go to step 8.
4. Remove the valve cover.
  5. Disconnect the Injector Harness from the injector.
  6. Measure the resistance between pin 9 and ground on the valve cover side of the Injector Harness 12-pin connector.

- [a] If the resistance is less than 5  $\Omega$ , repair the short to ground between pin 9 of the Injector Harness 12-pin connector and pin 1 of injector #5. Refer to section 28.2.1.1.
- [b] If the resistance is greater than 5  $\Omega$ , go to step 7.
7. Measure the resistance between pin 1 of injector #5 and ground.
  - [a] If the resistance is less than 5  $\Omega$ , replace the injector.
  - [b] If the resistance is greater than 5  $\Omega$ , repair the short to ground between pin 10 of the Injector Harness 12-pin connector and pin 2 of injector #5. Refer to section 28.2.1.1.
8. Disconnect the 120-pin MCM connector
9. Measure the resistance between pin 9 and ground on the engine side of the Injector Harness 12-pin connector.
  - [a] If the resistance is less than 5  $\Omega$ , repair the short to ground between pin 9 of the Injector Harness 12-pin connector and pin 20 of the 120-pin MCM connector. Refer to section 28.2.1.1.
  - [b] If the resistance is greater than 5  $\Omega$ , go to step 10.
10. Measure the resistance between pin 10 and ground on the engine side of the Injector Harness 12-pin connector.
  - [a] If the resistance is less than 5  $\Omega$ , repair the short to ground between pin 10 of the Injector Harness 12-pin connector and pin 21 of the 120-pin MCM connector. Refer to section 28.2.1.1.
  - [b] If the resistance is greater than 5  $\Omega$ , go to step 11.
11. Clear the codes. Check for active codes.
  - [a] If code 655/10 is still active, call the Detroit Diesel Customer Support Center (313-592-5800) for authorization to replace the MCM.
  - [b] If there are no active codes, troubleshooting is finished.

### 28.2.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the vehicle ignition OFF and reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
  - [a] If no codes are present, troubleshooting is complete.
  - [b] If code 655/10 is not logged but other codes are logged, troubleshoot the other codes.
  - [c] If code 655/10 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313-592-5800).

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# 29 SPN 656 – INJECTOR #6 NOT OPERATING NORMALLY

Section	Page
29.1 SPN 656/FMI 5 .....	29-3
29.2 SPN 656/FMI 10 .....	29-5



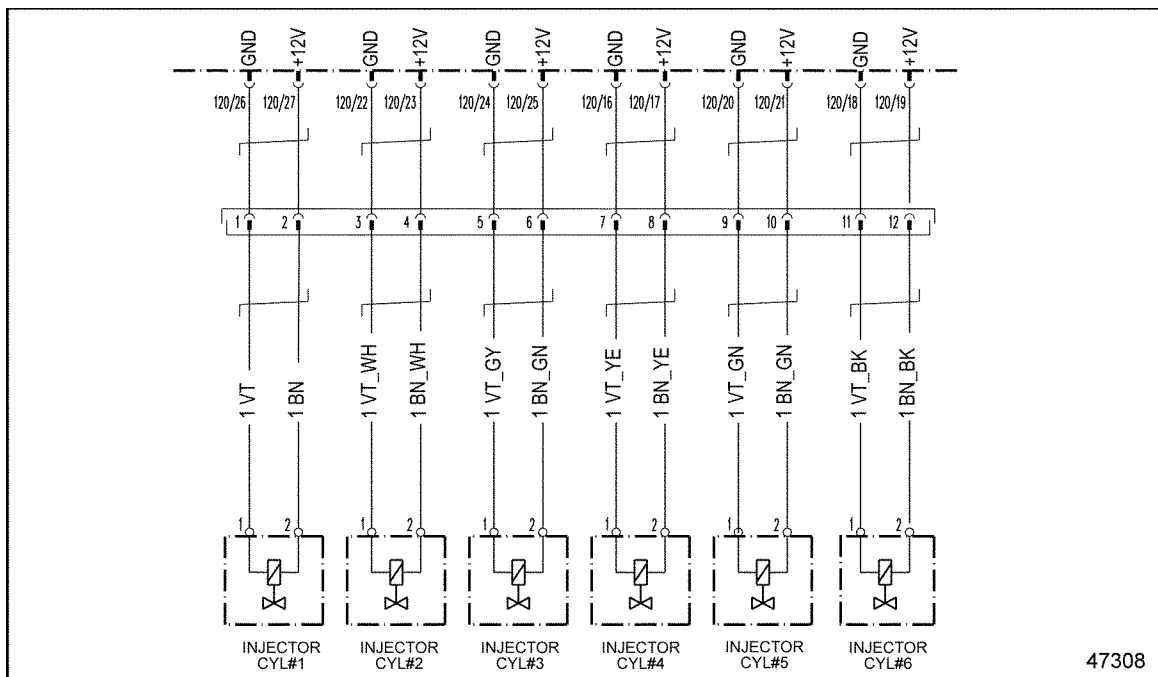
## 29.1 SPN 656/FMI 5

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

### 29.1.1 Open Circuit Check

Check as follows:

1. Check for multiple codes.
  - [a] If fault code 168/1 is active in addition to 656/5, service 168/1 first. Refer to section 12.2.
  - [b] If fault 654/5 and 655/5 are active in addition to 656/5, call the Detroit Diesel Customer Support Center (313-592-5800) for MCM replacement.
  - [c] If only fault code 656/5 is active, refer to section 29.1.1.
2. Turn the ignition OFF.
3. Disconnect the Injector Harness 12-pin connector.
4. Measure the resistance between pins 1 and 2 on the valve cover side of the connector. See Figure 29-1.



**Figure 29-1 MBE 900 Injectors**

- [a] If the resistance is less than  $9\Omega$ , go to step 9.
  - [b] If the resistance is greater than  $9\Omega$ , go to step 5.
5. Remove valve cover.

6. Disconnect the injector #6 connector.
7. Measure the resistance between pin 1 of the injector connector and pin 11 of the Injector Harness 12-pin connector.
  - [a] If the resistance is less than  $3\Omega$ , go to step 8.
  - [b] If the resistance is greater than  $3\Omega$ , repair the open between pin 1 of the injector connector and pin 11 of the Injector Harness 12-pin connector. Refer to section 29.1.1.1.
8. Measure the resistance between pin 2 of the injector connector and pin 12 of the Injector Harness 12-pin connector.
  - [a] If the resistance is less than  $3\Omega$ , replace the #6 injector.
  - [b] If the resistance is greater than  $3\Omega$ , repair the open between pin 2 of the injector connector and pin 12 of the Injector Harness 12-pin connector. Refer to section 29.1.1.1.
9. Turn the ignition ON
10. Measure the voltage between pins 11 and 12 on the engine side of the Injector Harness 12-pin connector.
  - [a] If the voltage is less than 11.5 volts, go to step 11.
  - [b] If the voltage is between 11.5 and 13.5 volts, repeat steps 2 through 10. If the results are the same, contact the Detroit Diesel Customer Support Center (313-592-5800).
11. Measure the voltage between pin 12 on the engine side of the Injector Harness 12-pin connector and ground.
  - [a] If the voltage is less than 11.5 volts, repair the open between pin 12 on the engine side of the Injector Harness 12-pin connector and pin 19 of the 120-pin MCM connector. Refer to section 29.1.1.1.
  - [b] If the voltage is between 11.5 and 13.5 volts, repair the open between pin 11 on the engine side of the Injector Harness 12-pin connector and pin 18 of the 120-pin MCM connector. Refer to section 29.1.1.1.

### 29.1.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the vehicle ignition OFF and reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
  - [a] If no codes are present, troubleshooting is complete.
  - [b] If code 656/5 is not logged but other codes are logged, troubleshoot the other codes.

- [c] If code 656/5 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313-592-5800).

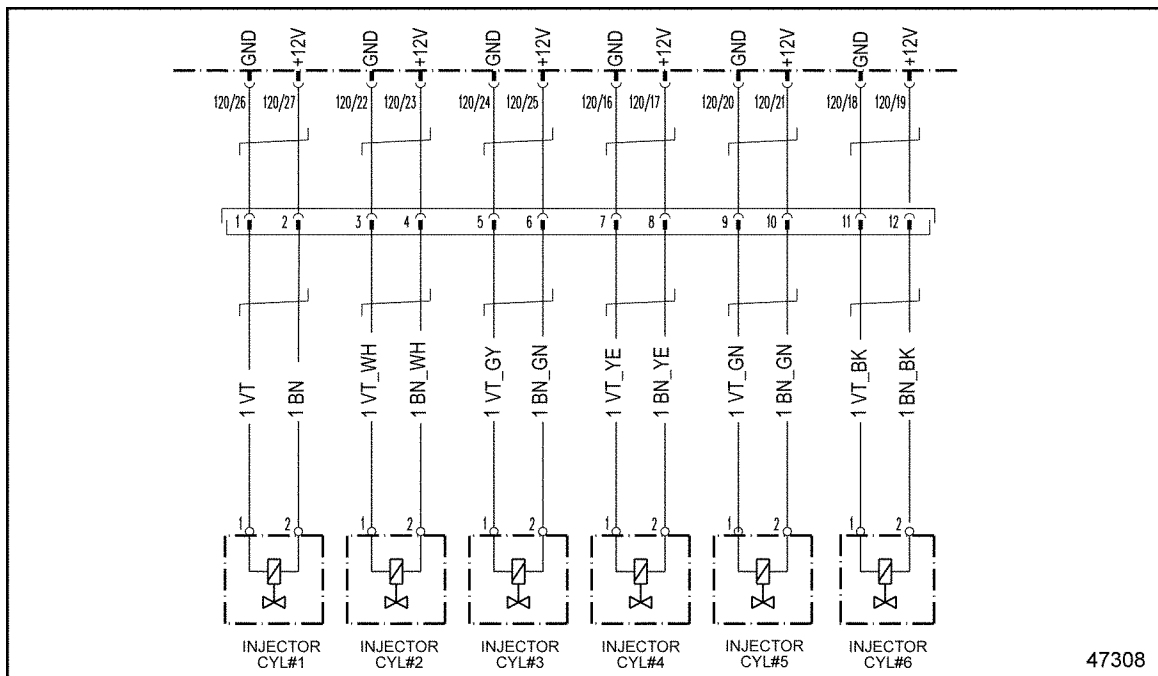
## 29.2 SPN 656/FMI 10

This diagnostic condition is typically a short to ground.

### 29.2.1 Short to Ground Check

Check as follows:

1. Turn the ignition OFF.
2. Disconnect the Injector Harness 12-pin connector.
3. Measure the resistance between pin 11 of injector #6 and ground on the valve cover side of the Injector Harness 12-pin connector. See Figure 29-2.



**Figure 29-2 MBE 900 Injectors**

- [a] If the resistance is less than 5  $\Omega$ , go to step 4.
- [b] If the resistance is greater than 5  $\Omega$ , go to step 8.
4. Remove the valve cover.
  5. Disconnect the Injector Harness from the injector.
  6. Measure the resistance between pin 11 and ground on the valve cover side of the Injector Harness 12-pin connector.

- [a] If the resistance is less than 5  $\Omega$ , repair the short to ground between pin 11 of the Injector Harness 12-pin connector and pin 1 of injector #6. Refer to section 29.2.1.1.
- [b] If the resistance is greater than 5  $\Omega$ , go to step 7.
7. Measure the resistance between pin 1 of injector #6 and ground.
  - [a] If the resistance is less than 5  $\Omega$ , replace the injector.
  - [b] If the resistance is greater than 5  $\Omega$ , repair the short to ground between pin 12 of the Injector Harness 12-pin connector and pin 2 of injector #6. Refer to section 29.2.1.1.
8. Disconnect the 120-pin MCM connector.
9. Measure the resistance between pin 11 and ground on the engine side of the Injector Harness 12-pin connector.
  - [a] If the resistance is less than 5  $\Omega$ , repair the short to ground between pin 11 of the Injector Harness 12-pin connector and pin 18 of the 120-pin MCM connector. Refer to section 29.2.1.1.
  - [b] If the resistance is greater than 5  $\Omega$ , go to step 10.
10. Measure the resistance between pin 12 and ground on the engine side of the Injector Harness 12-pin connector.
  - [a] If the resistance is less than 5  $\Omega$ , repair the short to ground between pin 12 of the Injector Harness 12-pin connector and pin 19 of the 120-pin MCM connector. Refer to section 29.2.1.1.
  - [b] If the resistance is greater than 5  $\Omega$ , go to step 11.
11. Clear the codes. Check for active codes.
  - [a] If code 656/10 is still active, call the Detroit Diesel Customer Support Center (313-592-5800) for authorization to replace the MCM.
  - [b] If there are no active codes, troubleshooting is finished.

### 29.2.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the vehicle ignition OFF and reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
  - [a] If no codes are present, troubleshooting is complete.
  - [b] If code 656/10 is not logged but other codes are logged, troubleshoot the other codes.
  - [c] If code 656/10 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313-592-5800).

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# 30 SPN 701 - CONSTANT THROTTLE VALVE (AUX PWM #7) NOT OPERATING NORMALLY

Section	Page
30.1 SPN 701/FMI 3 .....	30-3
30.2 SPN 701/FMI 4 .....	30-4
30.3 SPN 701/FMI 5 .....	30-6



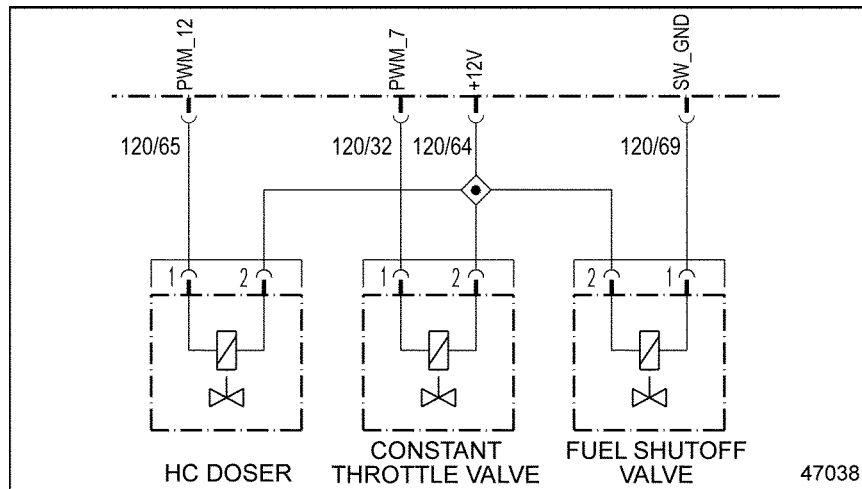
## 30.1 SPN 701/FMI 3

This diagnosis is typically a short to power.

### 30.1.1 Short to Power Check

Check as follows:

1. Disconnect the Constant Throttle Valve connector.
2. Turn the ignition ON.
3. Measure the voltage between pin 1 of the Constant Throttle Valve connector and ground.
  - [a] If the voltage is greater than 11.5 volts, repair the short to power between pin 1 of the Constant Throttle Valve connector and pin 32 of the 120-pin MCM connector. See Figure 30-1. Refer to section 30.1.1.1.



**Figure 30-1 Constant Throttle Valve**

- [b] If the voltage is less than 11.5 volts, go to step 4.
4. Turn the ignition OFF.
5. Disconnect the 120-pin MCM connector.
6. Measure the resistance between pins 1 and 2 of the Constant Throttle Valve connector.
  - [a] If the resistance is greater than  $5\Omega$ , repeat steps 2 through 6. If the results are the same, contact the Detroit Diesel Customer Support Center (313-592-5800).
  - [b] If the resistance is less than  $5\Omega$ , repair the short between pins 1 and 2 of the Constant Throttle Valve and pins 32 and 64 of the 120-pin MCM connector. Refer to section 30.1.1.1.

### 30.1.1.1 Verify Repairs

Perform the following steps to verify repairs.

1. Turn vehicle ignition OFF.
2. Reconnect all connectors. Turn ignition ON.
3. Clear codes with diagnostic tool.
4. Start and run the engine for one minute. Stop engine.
5. Check diagnostic tool for codes.
  - [a] If no codes are displayed, troubleshooting is complete.
  - [b] If code 701/3 is not logged and other codes are logged, troubleshoot the logged codes.
  - [c] If code 701/3 and other codes are logged, review this section to find the error. If no error is found, call the Detroit Diesel Customer Support Center (313-592-5800).

## 30.2 SPN 701/FMI 4

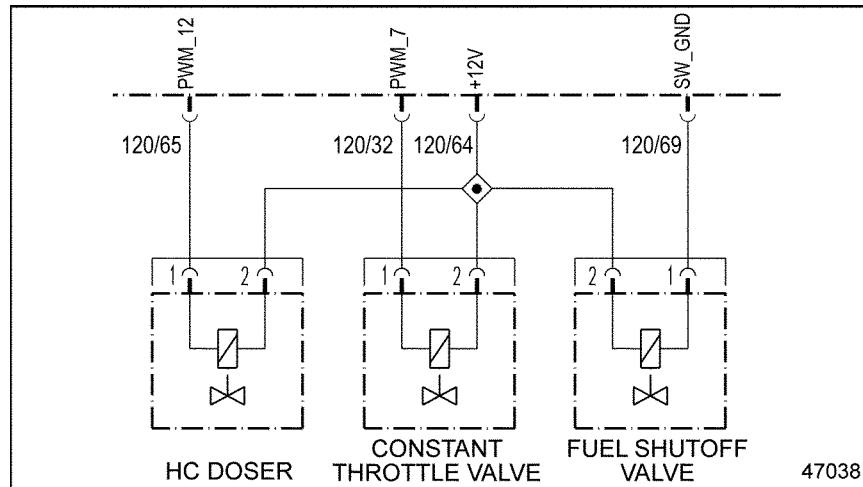
This diagnosis is typically a short to ground.

### 30.2.1 Short to Ground Check

Check as follows:

1. Check for multiple codes.
  - [a] If 3471/4 and 3482/4 are active with 701/4, repair the short to ground on pin 64 of the 120-pin MCM connector and pin 2 of the Constant Throttle Valve and pin 2 of the Electronic Dosing Valve connector and pin 2 of the Fuel Shutoff Valve. See Figure 30-2. Refer to section 30.2.1.1.
  - [b] If only 701/4 is active, go to step 2.
2. Disconnect the Constant Throttle Valve connector.
3. Disconnect the 120-pin MCM connector.
4. Measure the resistance between pins 1 and 2 of the Constant Throttle Valve connector.
  - [a] If the resistance is greater than 5 $\Omega$ , go to step 5.

- [b] If the resistance is less than  $5\Omega$ , repair the short between wires 32 and 64 of the 120-pin MCM connector. See Figure 30-2. Refer to section 30.2.1.1.



**Figure 30-2 Constant Throttle Valve**

5. Measure the resistance between pin 1 of the Constant Throttle Valve connector and ground.
  - [a] If the resistance is greater than  $5\Omega$ , repeat steps 4 and 5. If the results are the same, contact the Detroit Diesel Customer Support Center (313-592-5800).
  - [b] If the resistance is less than  $5\Omega$ , repair the short between pin 1 of the Constant Throttle Valve connector and ground. Refer to section 30.2.1.1.

### 30.2.1.1 Verify Repairs

Perform the following steps to verify repairs.

1. Turn vehicle ignition OFF.
2. Reconnect all connectors. Turn ignition ON.
3. Clear codes with diagnostic tool.
4. Start and run the engine for one minute. Stop engine.
5. Check diagnostic tool for codes.
  - [a] If no codes are displayed, troubleshooting is complete.
  - [b] If code 701/4 is not logged and other codes are logged, troubleshoot the logged codes.
  - [c] If code 701/4 and other codes are logged, review this section to find the error. If no error is found, call the Detroit Diesel Customer Support Center (313-592-5800).

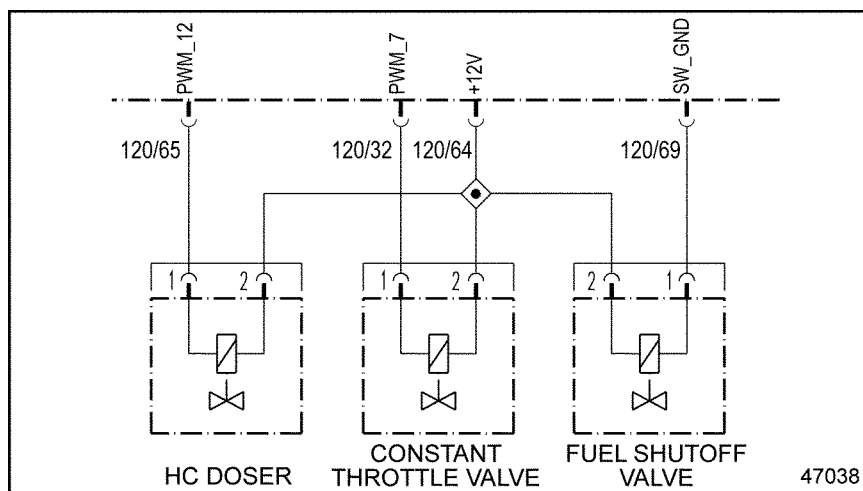
### 30.3 SPN 701/FMI 5

This diagnosis is typically an open circuit

#### 30.3.1 Open Circuit Check

Check as follows:

1. Check for multiple codes.
  - [a] If 3471/5 and 3482/5 are active with 701/5, repair the open between pin 64 of the 120-pin MCM connector and pin 2 of the Constant Throttle Valve and pin 2 of the Electronic Dosing Valve connector and pin 2 of the Fuel Shutoff Valve. See Figure 30-3. Refer to section 30.2.1.1.



**Figure 30-3 Constant Throttle Valve**

- [b] If only 701/4 is active, go to step 2.
2. Disconnect the Constant Throttle Valve connector.
3. Turn the ignition ON.
4. Measure the voltage between pins 1 and 2 of the Constant Throttle Valve connector.
  - [a] If the voltage is between 11 and 13 volts, replace the Constant Throttle Valve.
  - [b] If the voltage is less than 11 volts, go to step 5.
5. Measure the voltage between pin 2 of the Constant Throttle Valve connector and ground.
  - [a] If the voltage is between 11 and 13 volts, repair the open in the wire between pin 32 of the 120-pin MCM connector and pin 1 of the Constant Throttle Valve connector. See Figure 30-3. Refer to section 30.3.1.1.
  - [b] If the voltage is less than 11 volts, repair the open in the wire between pin 64 of the 120-pin MCM connector and pin 2 of the Constant Throttle Valve connector. See Figure 30-3. Refer to section 30.3.1.1.

### 30.3.1.1 Verify Repairs

Perform the following steps to verify repairs.

1. Turn vehicle ignition OFF.
2. Reconnect all connectors. Turn ignition ON.
3. Clear codes with diagnostic tool.
4. Start and run the engine for one minute. Stop engine.
5. Check diagnostic tool for codes.
  - [a] If no codes are displayed, troubleshooting is complete.
  - [b] If code 701/5 is not logged and other codes are logged, troubleshoot the logged codes.
  - [c] If code 701/5 and other codes are logged, review this section to find the error. If no error is found, call the Detroit Diesel Customer Support Center (313-592-5800).



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# 31 SPN 704 - WASTEGATE VALVE CONTROL (AUX PWM #10)

Section	Page
31.1 SPN 704/FMI 3 .....	31-3
31.2 SPN 704/FMI 4 .....	31-4
31.3 SPN 704/FMI 5 .....	31-6



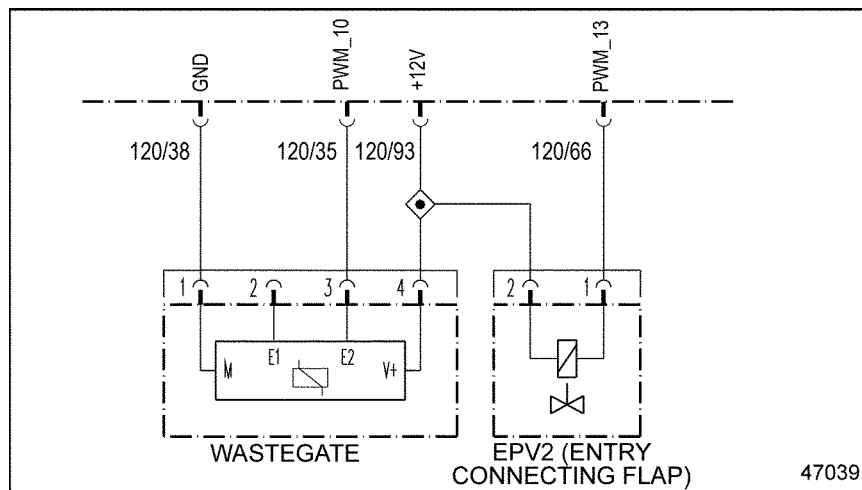
## 31.1 SPN 704/FMI 3

This diagnosis is typically a short to power.

### 31.1.1 Short to Power Check

Check for short to power as follows:

1. Disconnect the wastegate valve connector.
2. Turn the ignition switch to the ON position.
3. Measure the voltage between pin 3 of the wastegate valve connector and ground.
  - [a] If the voltage is greater than 11.5 volts, repair the short to power between pin 3 of the wastegate valve connector and pin 35 of the 120-pin MCM connector.
  - [b] If the voltage is less than 11.5 volts, go to step 4. See Figure 31-1.



**Figure 31-1 Wastegate**

4. Turn the ignition switch to the OFF position.
5. Disconnect the 120-pin MCM connector.
6. Measure the resistance between pins 3 and 4 of the wastegate valve connector.
  - [a] If the resistance is less than 5  $\Omega$ , repair the short between pins 3 and 4 of the wastegate valve connector and pins 35 and 93 of the 120-pin MCM connector.
  - [b] If the resistance is greater than 5  $\Omega$ , review steps 1 through 6. If the results are the same, contact the Detroit Diesel Customer Support Center (313-592-5800).

#### 31.1.1.1 Verify Repairs

Perform the following steps to verify repairs.

1. Turn vehicle ignition OFF.

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

## **31.2 SPN 704/FMI 4**

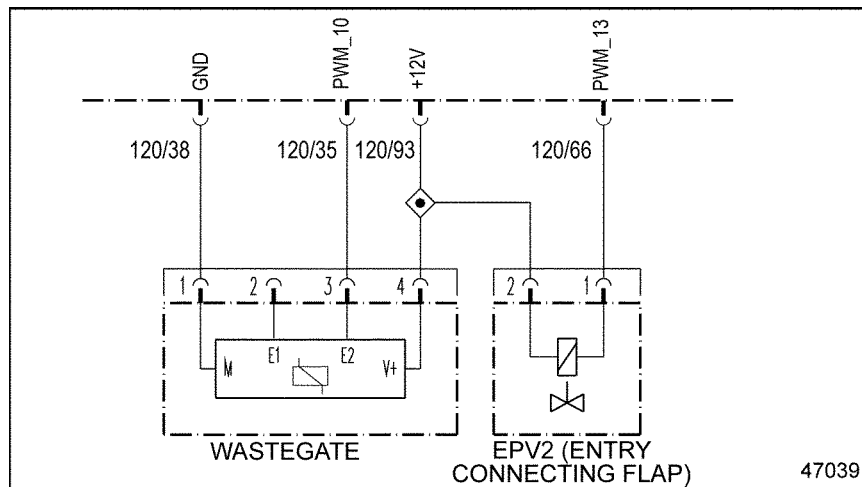
This diagnosis is typically a short to ground.

### **31.2.1 Short to Ground Check**

Check for short as follows:

1. Check for multiple codes.
  - [a] If 706/4 is active with 704/4, repair the short to ground on pin 93 of the MCM 120–pin connector and pin 4 of the wastegate valve and pin 2 of the EPV2 solenoid. Refer to section 31.2.1.1.
  - [b] If only 704/4 is active, go to step 2.
2. Disconnect the wastegate valve connector.
3. Disconnect the 120–pin MCM connector.

4. Measure the resistance between pins 1 and 3 of the wastegate valve connector. See Figure 31-2.



**Figure 31-2 Wastegate**

- [a] If the resistance is less than 5  $\Omega$ , repair the short between pins 35 and 38 of the 120-pin MCM connector. Refer to section 31.2.1.1.
- [b] If the resistance is greater than 5  $\Omega$ , go to step 5.
5. Measure the resistance between pin 3 of the wastegate valve connector and ground.
  - [a] If the resistance is less than 5  $\Omega$ , repair the short between pin 3 of the wastegate valve connector and ground. Refer to section 31.2.1.1.
  - [b] If the resistance is greater than 5  $\Omega$ , repeat steps 4 and 5. If the results are the same, contact the Detroit Diesel Customer Support Center (313-592-5800).

### 31.2.1.1 Verify Repairs

Perform the following steps to verify repairs.

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

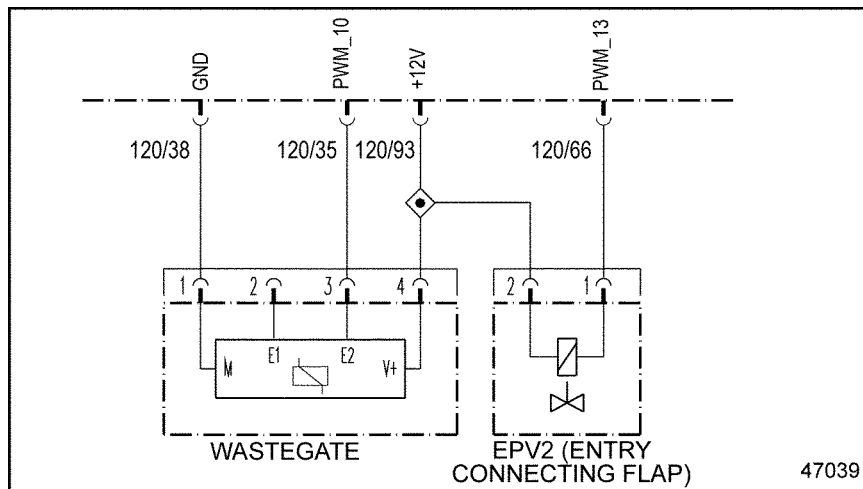
### 31.3 SPN 704/FMI 5

This diagnosis is typically an open circuit.

#### 31.3.1 Open Circuit Check

Check for an open circuit as follows:

1. Check for multiple codes.
  - [a] If 706/5 is active with 704/5, repair the open circuit between pin 93 of the MCM 120-pin connector and pin 4 of the wastegate valve and pin 2 of the EPV2 solenoid. See Figure 31-3. Refer to section 31.3.1.1.



**Figure 31-3 Wastegate**

- [b] If only 704/4 is active, go to step 2.
2. Disconnect the wastegate valve connector.
3. Turn the ignition ON.
4. Measure the voltage between pins 1 and 4 of the wastegate valve connector.
  - [a] If the voltage is between 11 and 13 volts, go to step 6.
  - [b] If the voltage is less than 11 volts, go to step 5.
5. Measure the voltage between pin 4 of the wastegate valve connector and ground.
  - [a] If the voltage is between 11 and 13 volts, then repair the open in the wire between pin 38 of the 120-pin MCM connector and pin 1 of the wastegate valve connector. Refer to section 31.3.1.1.
  - [b] If the voltage is less than 11 volts, Repair the open in the wire between pin 93 of the 120-pin MCM connector and pin 4 of the wastegate valve connector.
6. Turn the ignition OFF.

7. Disconnect the 120-pin MCM connector.
8. Measure the resistance between pin 3 of the wastegate valve connector and pin 35 of the 120-pin MCM connector.
  - [a] If the resistance is less than 3  $\Omega$ , repair the open circuit in the wire between pin 3 of the wastegate valve connector and pin 35 of the 120-pin MCM connector. Refer to section 31.3.1.1.
  - [b] If the resistance is greater than 5 $\Omega$ , replace the EPV3 solenoid.

### 31.3.1.1 Verify Repairs

Perform the following steps to verify repairs.

1. Turn vehicle ignition OFF.
2. Reconnect all connectors. Turn ignition ON.
3. Clear codes with diagnostic tool.
4. Start and run the engine for one minute. Stop engine.
5. Check diagnostic tool for codes.
  - [a] If no codes are displayed, troubleshooting is complete.
  - [b] If code SPN 704/5 is not logged and other codes are logged, troubleshoot the logged codes.
  - [c] If SPN 704/5 and other codes are logged, review this section to find the error. If no error is found, call the Detroit Diesel Customer Support Center (313-592-5800).



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# **32 SPN 706 - ELECTRONIC PROPORTIONING VALVE CONTROL #2 NOT OPERATING NORMALLY**

<b>Section</b>	<b>Page</b>
32.1 SPN 706/FMI 3 .....	32-3
32.2 SPN 706/FMI 4 .....	32-5
32.3 SPN 706/FMI 5 .....	32-7



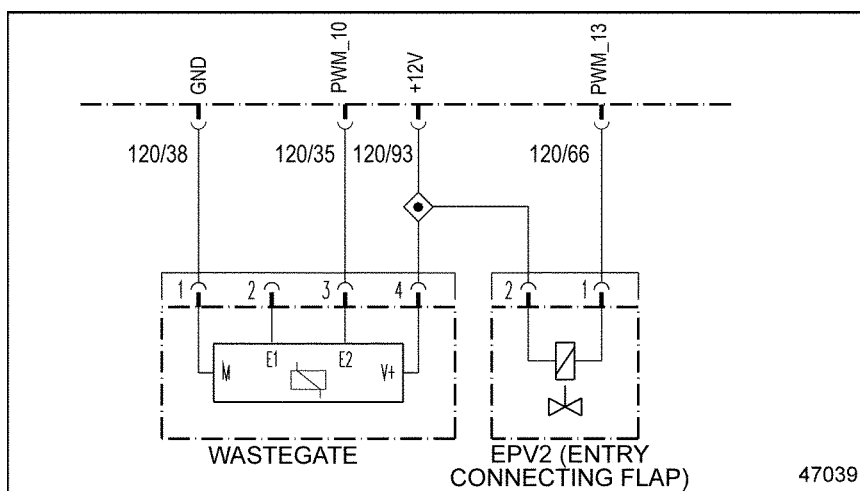
## 32.1 SPN 706/FMI 3

This diagnosis is typically a short to power.

### 32.1.1 Short to Power Check

Check as follows:

1. Disconnect the Electronic Proportioning Valve #2 (EPV2) connector.
2. Turn the ignition ON.
3. Measure the voltage between pin 1 of the EPV2 connector for the volute valve and ground. See Figure 32-1.



**Figure 32-1 EPV2 (Volute) and Wastegate**

- [a] If the voltage is greater than 11.5 volts, repair the short to power between pin 1 of the EPV2 connector and pin 66 of the 120-pin MCM connector. Refer to section 32.1.1.1.
  - [b] If the voltage is less than 11.5 volts, go to step 4.
4. Turn the ignition OFF.
  5. Disconnect the 120-pin MCM connector.
  6. Measure the resistance between pins 1 and 2 of the EPV2 connector.
    - [a] If the resistance is greater than 5  $\Omega$ , refer to section 32.1.1.1.
    - [b] If the resistance is less than 5  $\Omega$ , repair the short between pins 1 and 2 of the EPV2 connector and pins 66 and 93 of the 120-pin MCM connector. Refer to section 32.1.1.1.

### 32.1.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the vehicle ignition OFF and reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
  - [a] If no codes are present, troubleshooting is complete.
  - [b] If code 706/3 is not logged but other codes are logged, troubleshoot the other codes.
  - [c] If code 706/3 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313-592-5800).

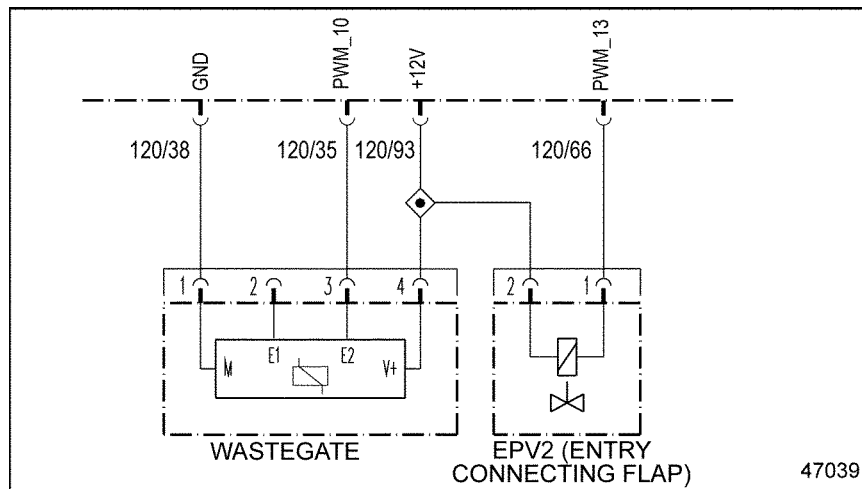
## 32.2 SPN 706/FMI 4

This diagnosis is typically a short to ground.

### 32.2.1 Short to Ground Check

Check as follows:

1. Check for multiple codes.
  - [a] If 704/4 is active with 706/4, repair the short to ground between pin 93 of the 120-pin MCM connector and pin 2 of the EPV2 connector and pin 4 of the wastegate connector. See Figure 32-2. Refer to section 32.2.1.1.



**Figure 32-2 EPV2 (Volute) and Wastegate**

- [b] If only 706/4 is active, go to step 2.
2. Disconnect the EPV2 connector.
3. Disconnect the 120-pin MCM connector.
4. Measure the resistance between pins 1 and 2 of the EPV2 connector.
  - [a] If the resistance is less than 5  $\Omega$ , repair the short between wires 66 and 93 of the 120-pin MCM connector. Refer to section 32.2.1.1.
  - [b] If the resistance is greater than 5  $\Omega$ , go to step 5.
5. Measure the resistance between pin 1 of the EPV2 connector and ground.
  - [a] If the resistance is less than 5  $\Omega$ , repair the short circuit between pin 1 of the EPV2 connector and ground. Refer to section 32.2.1.1.
  - [b] If the resistance is greater than 5  $\Omega$ , refer to section 32.2.1.1.

### 32.2.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the vehicle ignition OFF and reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
  - [a] If no codes are present, troubleshooting is complete.
  - [b] If code 706/4 is not logged but other codes are logged, troubleshoot the other codes.
  - [c] If code 706/4 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313-592-5800).

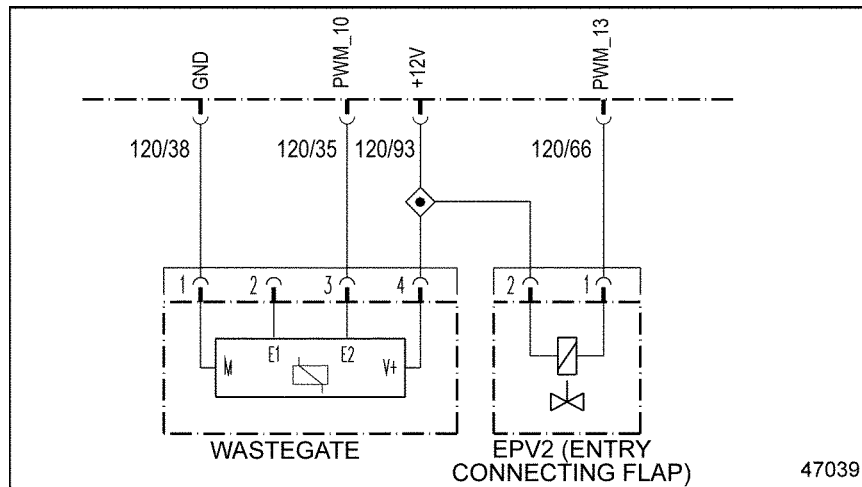
### 32.3 SPN 706/FMI 5

This diagnosis is typically an open circuit.

#### 32.3.1 Open Circuit Check

Check as follows:

1. Disconnect the EPV2 connector.
2. Turn the ignition ON.
3. Measure the voltage between pins 1 and 2 of the EPV2 connector.
  - [a] If the voltage is between 11 and 13 volts, replace the EPV2. Refer to section 32.3.1.1.
  - [b] If the voltage is less than 11 volts, go to step 4.
4. Measure the voltage between pin two of the EPV2 connector and ground.
  - [a] If the voltage is between 11 and 13 volts, repair the open in the wire between pin 66 of the 120-pin MCM connector and pin 1 of the EPV2 connector. See Figure 32-3. Refer to section 32.3.1.1.



**Figure 32-3 EPV2 (Volute) and Wastegate**

- [b] If the voltage is less than 11 volts, repair the open in the wire between pin 93 of the 120-pin MCM connector and pin 1 of EPV2 connector. Refer to section 32.3.1.1.

### 32.3.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the vehicle ignition OFF and reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
  - [a] If no codes are present, troubleshooting is complete.
  - [b] If code 706/5 is not logged but other codes are logged, troubleshoot the other codes.
  - [c] If code 706/5 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313-592-5800).

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

Section	Page
33.1 SPN 709/FMI 3 .....	33-3
33.2 SPN 709/FMI 4 .....	33-5
33.3 SPN 709/FMI 5 .....	33-6



## 33.1 SPN 709/FMI 3

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

### 33.1.1 Short to Power Check

Check for short to power as follows:

1. Put the ignition switch in the OFF position
2. Disconnect the fan control solenoid connector.
3. Turn the ignition switch to the ON position.
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 33.1.2.1.
  - [b] If the voltage is less than 11.5 volts, refer to section 33.1.2.

### 33.1.2 Voltage Check

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

1. Turn vehicle ignition OFF. Reconnect all connectors.
2. Turn ignition ON. Clear codes with diagnostic tool.
3. Start and run the engine for one minute. Stop engine.
4. Put the ignition switch in the OFF position
5. Disconnect the fan control solenoid connector.
6. Turn the ignition switch to the ON position.
7. Measure the voltage between pin 1 of the fan control solenoid connector and ground.
  - [a] If the voltage is greater than 11.5 volts, repair the short to power between pin 1 of the fan control solenoid connector and pin 98 of the 120-pin MCM connector. Refer to section 33.1.2.1.
  - [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.

#### 33.1.2.1 Verify Repairs

Verify repairs as follows:

1. Turn the vehicle ignition OFF and reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.

3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
  - [a] If no codes are present, troubleshooting is complete.
  - [b] If code 709/3 is not logged but other codes are logged, troubleshoot the other codes.
  - [c] If code 709/3 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313-592-5800).

## 33.2 SPN 709/FMI 4

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

### 33.2.1 Short to Ground Check

Check for short to ground as follows:

1. Put the ignition switch in the OFF position
2. Disconnect the fan control solenoid connector.
3. Disconnect the 120-pin MCM connector.
4. Measure the resistance between pin 1 of the fan control solenoid connector and ground.
  - [a] If the resistance is less than 5  $\Omega$ , 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 33.2.1.1.
  - [b] If the resistance is greater than 5  $\Omega$ , 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 33.2.1.1.

#### 33.2.1.1 Verify Repairs

Verify repairs as follows:

1. Reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
  - [a] If no codes are present, troubleshooting is complete.
  - [b] If code 709/4 is not logged but other codes are logged, troubleshoot the other codes.
  - [c] If code 709/4 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313-592-5800).

## 33.3 SPN 709/FMI 5

This fault code indicates that there is an open circuit.

### 33.3.1 Open Circuit Check

Check for open as follows:

1. Check for multiple codes.
  - [a] If SPN 704/5, SPN 708/5, and SPN 709/5 are active, repair the open in between pin 91 of the 120-pin MCM connector and the fan and the Jake Brake solenoids. Refer to section 33.3.1.1.
  - [b] If only SPN 709/5 is active, go to step 2.
2. Disconnect the fan control solenoid connector.
3. Turn the ignition to the ON position.
4. Measure the voltage between pin 1 and 2 of the fan control solenoid connector.
  - [a] If the voltage is less than 11.5 volts, go to step 5.
  - [b] If the voltage is between 11.5 and 13.5 volts, replace the fan control solenoid. Refer to section 33.3.1.1.
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 33.3.1.1.
  - [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 33.3.1.1.
  - [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 33.3.1.1.

#### 33.3.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF. Reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
  - [a] If no codes are present, troubleshooting is complete.
  - [b] If code 709/5 is not logged but other codes are logged, troubleshoot the other codes.
  - [c] If code 709/5 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313-592-5800).

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## **34 SPN 710 - ELECTRONIC PROPORTIONING VALVE 1 (ENTRY SHUTOFF FLAP) NOT OPERATING NORMALLY**

<b>Section</b>	<b>Page</b>
34.1 SPN 710/FMI 3 .....	34-3
34.2 SPN 710/FMI 4 .....	34-4
34.3 SPN 710/FMI 5 .....	34-6



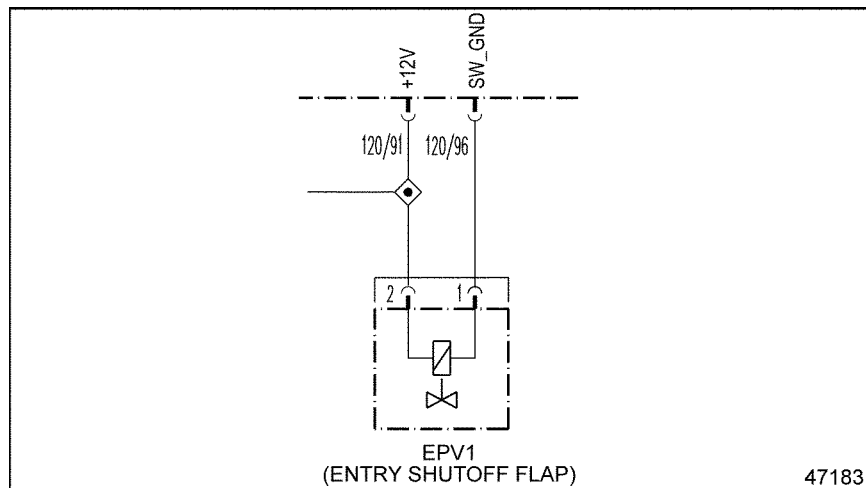
### 34.1 SPN 710/FMI 3

This diagnosis is typically a short to power.

#### 34.1.1 Short to Power Check

Check as follows:

1. Disconnect the EPV1 connector for the Entry Shutoff Flap.
2. Turn the ignition ON.
3. Measure the voltage between pin 1 of the EPV1 connector for the Entry Shutoff Flap and ground.
  - [a] If the voltage is greater than 11.5 volts, repair the short to power between pin 1 of the EPV1 connector for the Entry Shutoff Flap and pin 96 of the 120-pin MCM connector. See Figure 34-1. Refer to section 34.1.1.1.



**Figure 34-1 EPV1 (Entry Shutoff Flap)**

- [b] If the voltage is less than 11.5 volts, go to step 4.
4. Turn the ignition OFF.
5. Disconnect the 120-pin MCM connector.
6. Measure the resistance between pins 1 and 2 of the EPV1 connector for the Entry Shutoff Flap.
  - [a] If the resistance is greater than  $5\Omega$ , reconnect the 120-pin MCM connector and repeat steps 2 through 6. If the results are the same, contact the Detroit Diesel Customer Support Center (313-592-5800).
  - [b] If the resistance is less than  $5\Omega$ , repair the short between pins 1 and 2 of the EPV1 connector for the Entry Shutoff Flap and pins 91 and 96 of the 120-pin MCM connector. Refer to section 34.1.1.1.

### 34.1.1.1 Verify Repairs

Verify repairs as follows:

1. Turn vehicle ignition OFF.
2. Reconnect all connectors. Turn ignition ON.
3. Clear codes with diagnostic tool.
4. Start and run the engine for one minute. Stop engine.
5. Check diagnostic tool for codes.
  - [a] If no codes are displayed, troubleshooting is complete.
  - [b] If code 710/3 is not logged and other codes are logged, troubleshoot the logged codes.
  - [c] If code 710/3 and other codes are logged, review this section to find the error. If no error is found, call the Detroit Diesel Customer Support Center (313-592-5800).

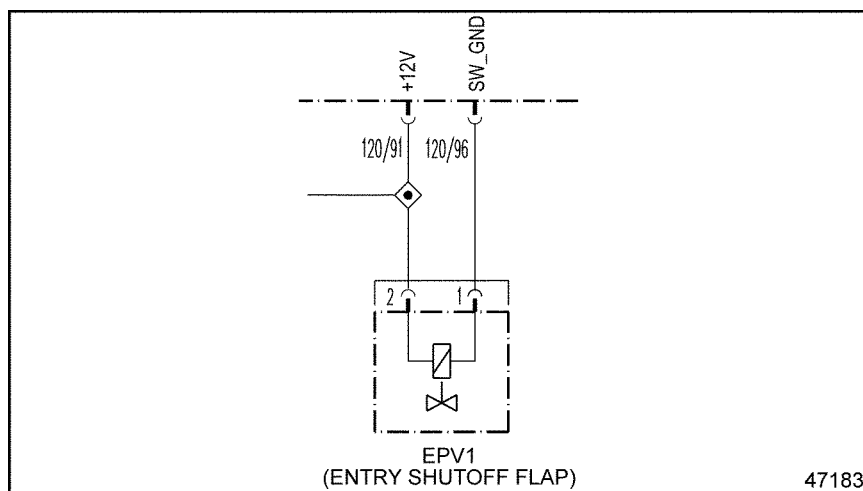
## 34.2 SPN 710/FMI 4

This diagnosis is typically a short to ground.

### 34.2.1 Check for Short to Ground

Check as follows:

1. Check for multiple codes.
  - [a] If 716/4 is active with 716/4, repair the short to ground between pin 91 of the 120-pin MCM connector and pin 2 of the EPV1 connector for the Entry Shutoff Flap and pin 21 of the 31-pin connector. See Figure 34-2. Refer to section 34.2.1.1.



**Figure 34-2 EPV1 (Entry Shutoff Flap)**

- [b] If only 710/4 is active, go to step 2.

2. Disconnect the EPV1 connector for the Entry Shutoff Flap.
3. Disconnect the 120-pin MCM connector.
4. Measure the resistance between pins 1 and 2 of the EPV1 connector for the Entry Shutoff Flap.
  - [a] If the resistance is less than 5  $\Omega$ , repair the short between wires 91 and 96 of the 120-pin connector. Refer to section 34.2.1.1.
  - [b] If the resistance is greater than 5  $\Omega$ , go to step 5.
5. Measure the resistance between pin 1 of the EPV1 connector for the Entry Shutoff Flap and ground.
  - [a] If the resistance is less than 5  $\Omega$ , repair the short between pin 1 of the EPV1 connector for the Entry Shutoff Flap and ground. Refer to section 34.2.1.1.
  - [b] If the resistance is greater than 5  $\Omega$ , repeat steps 4 and 5. If the results are the same, contact the Detroit Diesel Customer Support Center (313-592-5800).

### 34.2.1.1 Verify Repairs

Verify repairs as follows:

1. Turn vehicle ignition OFF.
2. Reconnect all connectors. Turn ignition ON.
3. Clear codes with diagnostic tool.
4. Start and run the engine for one minute. Stop engine.
5. Check diagnostic tool for codes.
  - [a] If no codes are displayed, troubleshooting is complete.
  - [b] If code 710/4 is not logged and other codes are logged, troubleshoot the logged codes.
  - [c] If code 710/4 and other codes are logged, review this section to find the error. If no error is found, call the Detroit Diesel Customer Support Center (313-592-5800).

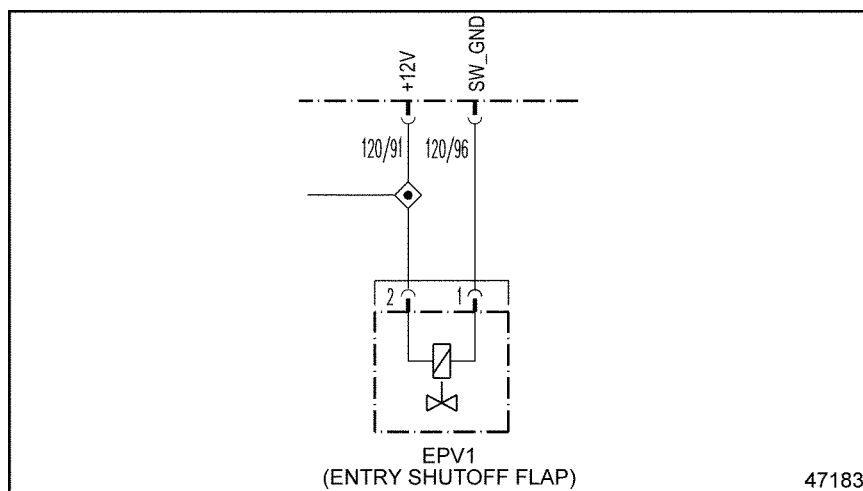
### 34.3 SPN 710/FMI 5

This diagnosis is typically an open circuit.

#### 34.3.1 Open Circuit Check

Check as follows:

1. Check for multiple codes.
  - [a] If 716/3 is active with 716/3, repair the short to ground between pin 91 of the 120-pin MCM connector and pin 2 of the EPV1 connector for the Entry Shutoff Flap and pin 22 of the 31-pin connector. Refer to section 34.3.1.1.
  - [b] If only code 710/5 is present, go to step 2.
2. Disconnect the EPV1 connector for the Entry Shutoff Flap.
3. Measure the resistance across pins 1 and 2 of the EPV1 connector for the Entry Shutoff Flap.
  - [a] If the resistance is greater than  $5\Omega$ , replace the EPV1 for the Entry Shutoff Flap. See Figure 34-3. Refer to section 34.3.1.1.



**Figure 34-3 EPV1 (Entry Shutoff Flap)**

- [b] If the resistance is greater than  $5\Omega$ , go to step 4.
4. Turn the ignition ON.
5. Measure the voltage between pins 1 and 2 of the EPV1 connector for the Entry Shutoff Flap.
  - [a] If the voltage is between 11.5 and 12.5, check the resistance again and then verify the results. Refer to section 34.3.1.1.
  - [b] the EPV1 connector for the Entry Shutoff Fla go to step 6.

6. Measure the voltage between pin 2 of the EPV1 connector for the Entry Shutoff Flap and ground.
  - [a] If the voltage is between 11.5 and 12.5, repair the open circuit between pin 1 of the EPV1 connector for the Entry Shutoff Flap and pin 96 of the 120-pin MCM connector. Refer to section 34.3.1.1.
  - [b] If the voltage is less than 11.5 volts, repair the open circuit between pin 2 of the EPV1 connector for the Entry Shutoff Flap and pin 91 of the 120-pin MCM connector. Refer to section 34.3.1.1.

### 34.3.1.1 Verify Repairs

Verify repairs as follows:

1. Turn vehicle ignition OFF.
2. Reconnect all connectors. Turn ignition ON.
3. Clear codes with diagnostic tool.
4. Start and run the engine for one minute. Stop engine.
5. Check diagnostic tool for codes.
  - [a] If no codes are displayed, troubleshooting is complete.
  - [b] If code 710/5 is not logged and other codes are logged, troubleshoot the logged codes.
  - [c] If code 710/5 and other codes are logged, review this section to find the error. If no error is found, call the Detroit Diesel Customer Support Center (313-592-5800).



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## **35 SPN 729 - GRID HEATER NOT OPERATING NORMALLY**

<b>Section</b>	<b>Page</b>
35.1 SPN 729/FMI 3 .....	35-3
35.2 SPN 729/FMI 4 .....	35-5



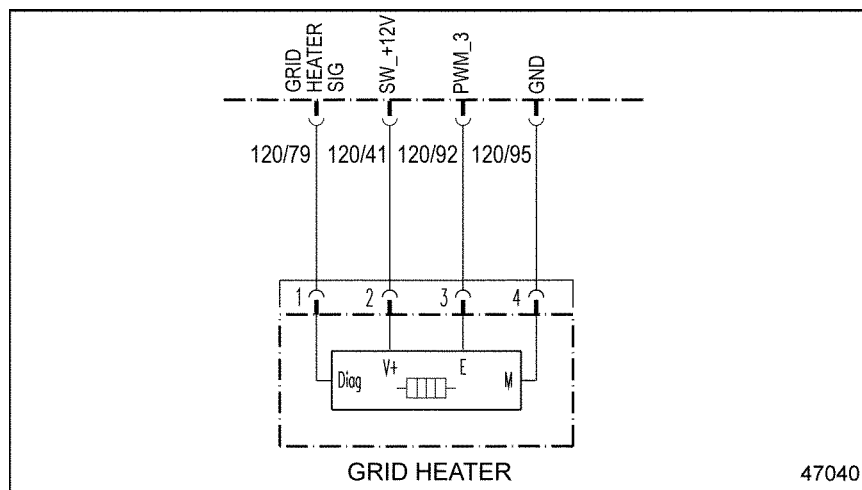
## 35.1 SPN 729/FMI 3

This diagnosis is typically a short to power/open.

### 35.1.1 Short to Power/Open Check

Check as follows:

1. Disconnect the Grid Heater connector.
2. Turn the ignition ON.
3. Measure the voltage between pins 2 and 4 of the Grid Heater connector. See Figure 35-1.



**Figure 35-1**      **Grid Heater Wiring**

- [a] If the voltage is greater than 11.5 volts, go to step 5.
- [b] If the voltage is less than 11.5 volts, go to step 4.
4. Measure the voltage between pin 2 of the Grid Heater connector and ground.
  - [a] If the voltage is greater than 11.5 volts, repair the open between pin 4 of the Grid Heater connector and pin 95 of the 120-pin MCM connector. Refer to section 35.1.1.1.
  - [b] If the voltage is less than 11.5 volts, repair the open between pin 2 of the Grid Heater connector and pin 41 of the 120-pin MCM connector. Refer to section 35.1.1.1.
5. Turn the ignition OFF.
6. Disconnect the 120-pin MCM connector.
7. Measure the resistance between pins 2 and 3 of the Grid Heater connector.
  - [a] If the resistance is greater than 5  $\Omega$ , go to step 8.
  - [b] If the resistance is less than 5  $\Omega$ , repair the short between Grid Heater pins 2 and 3 and pins 41 and 92 of the 120-pin MCM connector. Refer to section 35.1.1.1.

8. Measure the resistance between pin 3 of the Grid Heater connector and pin 92 of the 120-pin MCM connector.
  - [a] If the resistance is greater than 5  $\Omega$ , repair the open between pin 3 of the Grid Heater connector and pin 92 of the 120-pin MCM connector. Refer to section 35.1.1.1.
  - [b] If the resistance is less than 5  $\Omega$ , replace the Grid Heater.

### **35.1.1.1 Verify Repairs**

Perform the following steps to verify repairs.

1. Turn vehicle ignition OFF. Reconnect all connectors.
2. Turn ignition ON. Clear codes with diagnostic tool.
3. Start and run the engine for one minute. Stop the engine.
4. Check diagnostic tool for codes.
  - [a] If no codes are displayed, troubleshooting is complete.
  - [b] If code 729/3 is not logged, and other codes are logged, troubleshoot the logged codes.
  - [c] If code 729/3 and other codes are logged, review this section to find the error. If no error is found, call the Detroit Diesel Customer Support Center (313-592-5800).

## 35.2 SPN 729/FMI 4

This diagnosis is typically a short to ground.

### 35.2.1 Short to Ground Check

Check as follows:

1. Disconnect the Grid Heater connector.
2. Disconnect the 120-pin MCM connector.
3. Measure the resistance between pins 3 and 4 of the Grid Heater connector.
  - [a] If the resistance is less than 5  $\Omega$ , repair the short between pins 3 and 4 of the Grid Heater connector and pins 92 and 95 of the 120-pin MCM connector. Refer to section 35.2.1.1.
  - [b] If the resistance is greater than 5  $\Omega$ , go to step 4.
4. Measure the resistance between pin 3 of the Grid Heater connector and ground.
  - [a] If the resistance is less than 5  $\Omega$ , repair the short between pin 3 of the Grid Heater connector and ground. Refer to section 35.2.1.1.
  - [b] If the resistance is greater than 5  $\Omega$ , replace the Grid Heater.

#### 35.2.1.1 Verify Repairs

Perform the following steps to verify repairs.

1. Turn vehicle ignition OFF. Reconnect all connectors.
2. Turn ignition ON. Clear codes with diagnostic tool.
3. Start and run the engine for one minute. Stop the engine.
4. Check diagnostic tool for codes.
  - [a] If no codes are displayed, troubleshooting is complete.
  - [b] If code 729/4 is not logged, and other codes are logged, troubleshoot the logged codes.
  - [c] If code 729/4 and other codes are logged, review this section to find the error. If no error is found, call the Detroit Diesel Customer Support Center (313-592-5800).



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# 36 SPN 723 — CAMSHAFT POSITION SENSOR FAULT

Section	Page
36.1 SPN 723/FMI 3 .....	36-3
36.2 SPN 723/FMI 4 .....	36-5
36.3 SPN 723/FMI 8 .....	36-6
36.4 SPN 723/FMI 14 .....	36-7

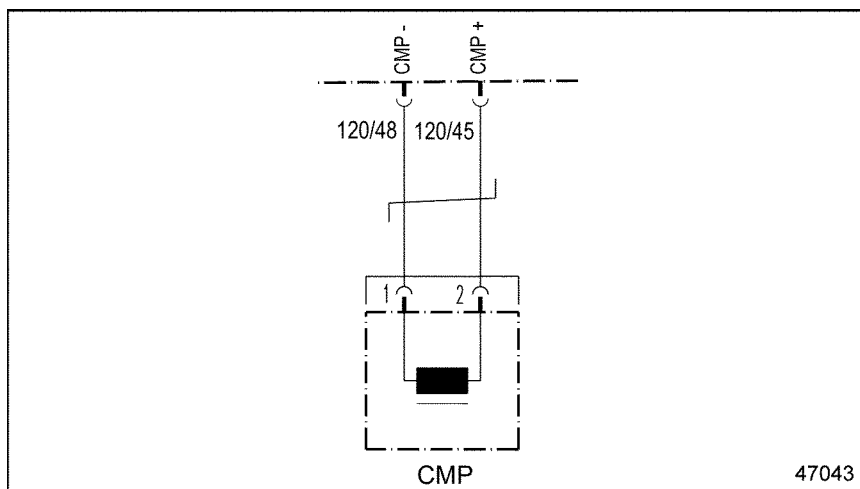


## 36.1 SPN 723/FMI 3

The diagnostic condition is typically an open circuit.

### 36.1.1 Open Circuit Check

Perform the following steps to troubleshoot an open circuit.



**Figure 36-1 MCM — Camshaft Position Sensor Schematic**

1. Disconnect CMP Sensor
2. Measure the resistance across pins 1 and 2 of the CMP Sensor. See Figure 36-1.
  - [a] If the resistance is less than 140  $\Omega$ , go to step 3.
  - [b] If the resistance is greater than 140  $\Omega$ , replace the CMP Sensor. Refer to section 36.1.1.1.
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  $\Omega$ , 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 36.1.1.1.
  - [b] If the resistance is greater than 5  $\Omega$ , 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  $\Omega$ , repair open between pin 1 of the CMP harness connector and pin 44 of the MCM 120 pin connector. Refer to section 36.1.1.1.
  - [b] If the resistance is less than 5  $\Omega$ , 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 36.1.1.1.
  - [b] If the resistance is less than 5  $\Omega$ , review steps 2 through 6. If the results are the same, contact the Detroit Diesel Customer Support Center (313-592-5800).

### 36.1.1.1 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 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.

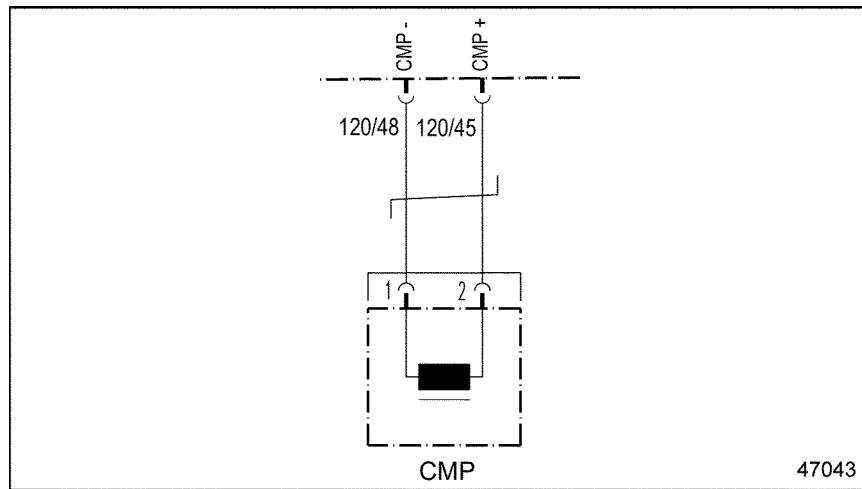
## 36.2 SPN 723/FMI 4

A typical diagnosis is a short to ground.

### 36.2.1 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 36-2.



**Figure 36-2 MCM — Camshaft Position Sensor Schematic**

- [a] If the resistance is greater than 5  $\Omega$ , go to step 3.
- [b] If the resistance is less than 5  $\Omega$ , replace the CMP Sensor. Refer to section 36.2.1.1.
3. Measure the resistance between pin 2 of the CMP Sensor and ground.
  - [a] If the resistance is greater than 5  $\Omega$ , go to step 4.
  - [b] If the resistance is less than 5  $\Omega$ , replace the CMP Sensor. Refer to section 36.2.1.1.
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  $\Omega$ , go to step 6.
  - [b] If the resistance is less than 5  $\Omega$ , 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 36.2.1.1.
6. Measure the resistance between pin 1 of the CMP harness connector and ground.
  - [a] If the resistance is greater than 5  $\Omega$ , go to step 7.

- [b] If the resistance is less than 5  $\Omega$ , 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 36.2.1.1.
- 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  $\Omega$ , 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  $\Omega$ , 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 36.2.1.1.

### 36.2.1.1 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 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.

## 36.3 SPN 723/FMI 8

A typical diagnosis is time out.

### 36.3.1 Time Out Check

Perform the following steps to troubleshoot a time out.

1. Start and run the engine.
2. Check for active fault codes.
  - [a] If fault codes 723/3 and 723/8 are active, troubleshoot active fault code 723/3. Refer to section 36.1.
  - [b] If fault codes 723/4 and 723/8 are not active, go to step 3.
  - [c] If fault codes 723/4 and 723/8 are active, refer to section 36.3.2.
3. Shutdown the engine.
4. Ensure that the sensor is correctly positioned and check for active codes.

- [a] If the sensor position is correct and fault code 723/8 is active, refer to section 36.3.2.
- [b] If the sensor position is incorrect and fault code 723/8 is not active, remove and replace the camshaft sensor sleeve. Refer to section 36.3.2.1.

### **36.3.2 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 36.3.2.1.
2. Check the Camshaft Position Sensor for proper axial play. Repair as necessary if the axial play is incorrect. Refer to section 36.3.2.1.

#### **36.3.2.1 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 s 723/8 are logged, troubleshoot those codes.

### **36.4 SPN 723/FMI 14**

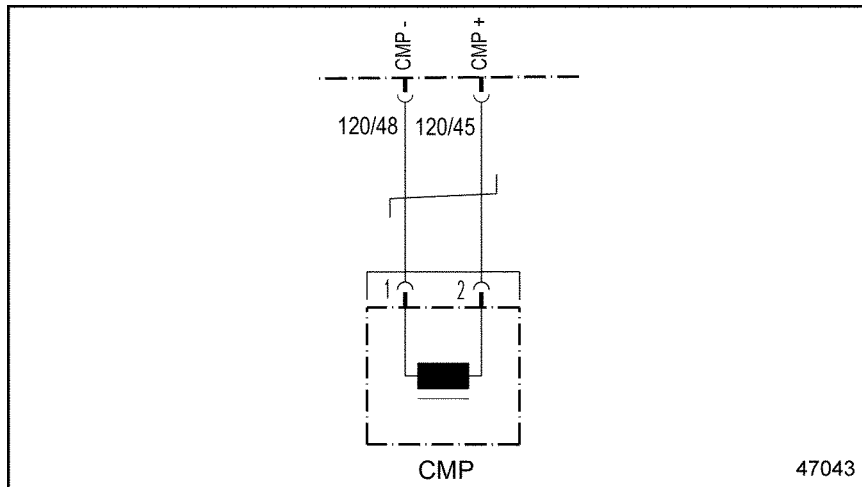
A typical diagnosis is swapped pins.

#### **36.4.1 Swapped Pins Check**

Perform the following step to troubleshoot pins swapped.

1. If fault code 723/14 is active, check the engine speed sensor for reversed polarity.
2. Reseat the camshaft and crankshaft sensors.

3. Ensure that the 120-pin connector wires are not crossed. If crossed, repair as necessary. See Figure 36-3. Refer to section 36.4.1.1.



**Figure 36-3 Camshaft Position Sensor**

### 36.4.1.1 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 s 723/14 are logged, troubleshoot those codes.

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

Section	Page
37.1 SPN 975/FMI 3 .....	37-3
37.2 SPN 975/FMI 4 .....	37-5
37.3 SPN 975/FMI 5 .....	37-6



## 37.1 SPN 975/FMI 3

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

### 37.1.1 Short to Power Check

Check for short to power as follows:

1. Put the ignition switch in the OFF position
2. Disconnect the fan control solenoid connector.
3. Turn the ignition switch to the ON position.
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 37.1.2.1.
  - [b] If the voltage is less than 11.5 volts, refer to section 37.1.2.

### 37.1.2 Voltage Check

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

1. Turn vehicle ignition OFF. Reconnect all connectors.
2. Turn ignition ON. Clear codes with diagnostic tool.
3. Start and run the engine for one minute. Stop engine.
4. Put the ignition switch in the OFF position
5. Disconnect the fan control solenoid connector.
6. Turn the ignition switch to the ON position.
7. Measure the voltage between pin 1 of the fan control solenoid connector and ground.
  - [a] If the voltage is greater than 11.5 volts, repair the short to power between pin 1 of the fan control solenoid connector and pin 33 of the 120-pin MCM connector. Refer to section 37.1.2.1.
  - [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.

#### 37.1.2.1 Verify Repairs

Verify repairs as follows:

1. Turn the vehicle ignition OFF and reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.

3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
  - [a] If no codes are present, troubleshooting is complete.
  - [b] If code 975/3 is not logged but other codes are logged, troubleshoot the other codes.
  - [c] If code 975/3 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313-592-5800).

## 37.2 SPN 975/FMI 4

This fault indicates that there is a short to ground.

### 37.2.1 Check for Short to Ground

Check for a short to ground as follows:

1. Turn the vehicle ignition switch to the OFF position.
2. Disconnect the fan control solenoid.
3. Disconnect the 120-pin MCM connector.
4. Measure the resistance between pin 1 of the fan control solenoid and ground.
  - [a] If the resistance is less than 5  $\Omega$ , 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 37.2.1.1.
  - [b] If the resistance is greater than 5  $\Omega$ , 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 37.2.1.1.

#### 37.2.1.1 Verify Repairs

Verify repairs as follows:

1. Reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
  - [a] If no codes are present, troubleshooting is complete.
  - [b] If code 975/4 is not logged but other codes are logged, troubleshoot the other codes.
  - [c] If code 975/4 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313-592-5800).

## 37.3 SPN 975/FMI 5

This fault code indicates that there is an open circuit.

### 37.3.1 Open Circuit Check

Check for open as follows:

1. Check for multiple codes.
  - [a] If SPN 704/5, SPN 708/5, SPN 711/5 and SPN 975/5 are active repair the open in between the pin 91 of the 120-pin MCM connector and the fan and the Jake Brake solenoids. Refer to section 37.3.1.1.
  - [b] If only SPN 711/5 is active, go to step 2.
2. Disconnect the fan control solenoid connector.
3. Turn the ignition to the ON position.
4. Measure the voltage between pin 1 and 2 of the fan control solenoid connector.
  - [a] If the voltage is less than 11.5 volts, go to step 5.
  - [b] If the voltage is between 11.5 and 13.5 volts, replace the fan control solenoid. Refer to section 37.3.1.1.
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 37.3.1.1.
  - [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 37.3.1.1.

#### 37.3.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF. Reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
  - [a] If no codes are present, troubleshooting is complete.
  - [b] If code 975/5 is not logged but other codes are logged, troubleshoot the other codes.
  - [c] If code 975/5 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313-592-5800).

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# 38 SPN 1172 -TURBO COMPRESSOR IN TEMP HIGH OR LOW

Section	Page
38.1 SPN 1172/FMI 3 .....	38-3
38.2 SPN 1172/FMI 4 .....	38-5



## 38.1 SPN 1172/FMI 3

This code is typically sensor or circuit failed high.

### 38.1.1 Open Circuit Check

Check for an open as follows:

1. Place ignition switch in the OFF position.
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  $\Omega$ , go to step 7.
  - [b] If the resistance is greater than 55  $\Omega$ , 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  $\Omega$ , replace the sensor. Refer to section 38.1.2.1.
  - [b] If the resistance is less than 50  $\Omega$ , 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  $\Omega$ , repair the open between pin 1 of the TCI Sensor connector and pin 27 of the 31-pin connector. Refer to section 38.1.2.1.
  - [b] If the resistance is less than 3  $\Omega$ , repair the open between pin 2 of the TCI Sensor connector and pin 28 of the 31-pin connector. Refer to section 38.1.2.1.
7. Turn the ignition switch to the ON position.
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 38.1.2.
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 38.1.2.1.
  - [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 38.1.2.1.

### 38.1.2 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 vehicle ignition OFF. Reconnect all connectors.
2. Turn ignition ON. Clear codes with diagnostic tool.
3. Measure the voltage between pin 27 and pin 28 of the 31-pin connector on the engine side.
  - [a] If the voltage is less than 4.5 volts, refer to section 38.1.1, 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.

### 38.1.2.1 Verify Repairs

Perform the following steps to verify repairs.

1. Turn vehicle ignition OFF.
2. Reconnect all connectors. Turn ignition ON.
3. Clear codes with diagnostic tool.
4. Start and run the engine for one minute. Stop engine.
5. Check diagnostic tool for codes.
  - [a] If no codes are displayed, troubleshooting is complete.
  - [b] If code 1172/3 is not logged, and other codes are logged, troubleshoot the logged codes.
  - [c] If code 1172/3 and other codes are logged, review this section to find the error. If no error is found, call the Detroit Diesel Customer Support Center (313-592-5800).

## 38.2 SPN 1172/FMI 4

This code is typically sensor or circuit failed low.

### 38.2.1 Short Circuit Check

Check for short as follows:

1. Place ignition switch in the OFF position.
2. Disconnect the 31-pin connector.
3. Disconnect the TCI Sensor.
4. Measure resistance between pin 27 and pin 28 of the 31-pin connector on the vehicle side.
  - [a] If the resistance is less than 10  $\Omega$ , repair the short between pin 27 and pin 28 of the 31-pin connector. Refer to section 38.2.1.1.
  - [b] If the resistance is greater than 10  $\Omega$ , 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  $\Omega$ , repair the short to ground between pin 27 of the 31-pin connector and pin 1 of the TCI Sensor. Refer to section 38.2.1.1.
  - [b] If the resistance is greater than 5  $\Omega$ , go to step 6.
6. Measure resistance between pin 28 and ground on the vehicle side.
  - [a] If the resistance is less than 5  $\Omega$ , repair the short to ground between pin 28 of the 31-pin connector and pin 2 of the TCI Sensor. Refer to section 38.2.1.1.
  - [b] If the resistance is greater than 5  $\Omega$ , 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  $\Omega$ , repair the short between pin 27 and pin 28 between the 31-pin connector and the 120-pin MCM connector. Refer to section 38.2.1.1.
  - [b] If the resistance is greater than 10  $\Omega$ , 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  $\Omega$ , repair the short to ground between pin 27 of the 31-pin connector and ground. Refer to section 38.2.1.1.
  - [b] If the resistance is greater than 5  $\Omega$ , 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  $\Omega$ , repair the short to ground between pin 28 of the 31-pin connector and ground. Refer to section 38.2.1.1.
  - [b] If the resistance is greater than 5  $\Omega$ , contact the Detroit Diesel Customer Support Center (313-592-5800) for authorization to replace the MCM.

### 38.2.1.1 Verify Repairs

Perform the following steps to verify repairs.

1. Turn vehicle ignition OFF.
2. Reconnect all connectors. Turn ignition ON.
3. Clear codes with diagnostic tool.
4. Start and run the engine for one minute. Stop engine.
5. Check diagnostic tool for codes.
  - [a] If no codes are displayed, troubleshooting is complete.
  - [b] If code 1172/4 is not logged, and other codes are logged, troubleshoot the logged codes.
  - [c] If code 1172/4 and other codes are logged, review this section to find the error. If no error is found, call the Detroit Diesel Customer Support Center (313-592-5800).

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# 39 SPN 1176 - TURBO COMPRESSOR INLET PRESSURE OUTSIDE NORMAL RANGE

Section	Page
39.1 SPN 1176/FMI 3 .....	39-3
39.2 SPN 1176/FMI 4 .....	39-5



## 39.1 SPN 1176/FMI 3

This diagnosis is typically a short to power.

### 39.1.1 Short to Power Check

Check for a short to power as follows:

1. Turn the ignition switch to the ON position.
2. Check for multiple codes.
  - [a] If 1176/3, 1172/3, 100/3 and 175/3 are present, repair the open between pin 105 on the 120-pin MCM connector and the associated sensors. Refer to section 39.1.1.1.
  - [b] If 1176/3 and 1172/3 are present, go to step 7.
  - [c] If only 1176/2 is present, go to step 4.
3. Turn the ignition switch OFF.
4. Disconnect the Turbo Pressure/Temp Sensor.
5. Disconnect the 120-pin MCM connector.
6. Measure the resistance between pins 1 and 2 of the Turbo Pressure/Temp Sensor harness connector.
  - [a] If the resistance is greater than 5  $\Omega$ , repair the short to power on the circuit between pin 120 of the 120-pin MCM connector and pin 1 of the Turbo Pressure/Temp Sensor harness connector. Refer to section 39.1.1.1.
  - [b] If the resistance is less than 5  $\Omega$ , repair the short between pins 120 and 85 of the 120-pin MCM connector. Refer to section 39.1.1.1.
7. Disconnect the Turbo Pressure/Temp Sensor.
8. Measure the resistance between pins 2 and 4 of the Turbo Pressure/Temp Sensor.
  - [a] If the resistance is greater than 140  $\Omega$ , replace the Turbo Pressure/Temp Sensor. Refer to section 39.1.1.1.
  - [b] If the resistance is less than 140  $\Omega$ , go to step 9.
9. Turn the ignition switch to the ON position.
10. Measure the voltage between pin 2 of the Turbo Pressure/Temp Sensor and ground.
  - [a] If the voltage is greater than 2.75 volts, repair the open circuit between pin 105 of the 120-pin MCM connector and pin 4 of the Turbo Pressure/Temp Sensor. Refer to section 39.1.1.1.
  - [b] If the voltage is less than 2.75 volts, repair the open circuit between pin 85 of the 120-pin MCM connector and pin 2 of the Turbo Pressure/Temp Sensor. Refer to section 39.1.1.1.

### 39.1.1.1 Verify Repairs

Perform the following steps to verify repairs.

1. Turn vehicle ignition OFF.
2. Reconnect all connectors.
3. Turn ignition ON.
4. Clear codes with diagnostic tool.
5. Start and run the engine for one minute.
6. Stop engine.
7. Check diagnostic tool for codes.
  - [a] If no codes are displayed, troubleshooting is complete.
  - [b] If code 1176/3 is not logged, and other codes are logged, troubleshoot the logged codes.
  - [c] If code 1176/3 and other codes are logged, review this section to find the error. If no error is found, call the Detroit Diesel Customer Support Center (313-592-5800).

## 39.2 SPN 1176/FMI 4

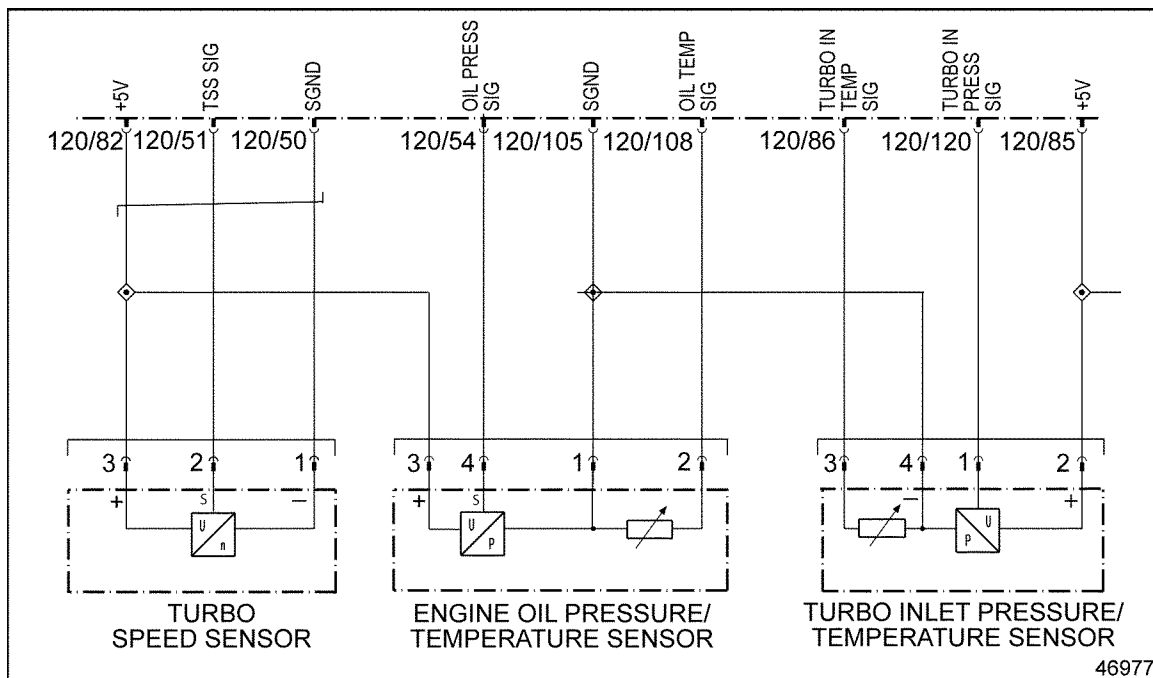
This diagnosis is typically an open short to ground.

### 39.2.1 Open or Short Circuit Check

Check for an open short to ground as follows:

1. Turn the ignition switch to the ON position.
2. Check for multiple codes.
  - [a] If 1176/4, 1172/4, 3610/4, 3609/4, 3250/4, 3242/4 and 3246/4 are present, repair the open between pin 85 on the 120-pin MCM connector and the associated sensors. Refer to section 39.2.1.1.
  - [b] If 1176/4 and 1172/4 are present, repair the open between pin 85 on the 120-pin MCM connector and pin 2 on the Turbo Pressure/Temp Sensor. Refer to section 39.2.1.1.
  - [c] If only 1176/4 is present, go to step 4.
3. Turn the ignition switch OFF.
4. Disconnect the Turbo Pressure/Temp Sensor.
5. Measure the resistance between pins 1 and 2 of the Turbo Pressure/Temp Sensor.
  - [a] If the resistance is greater than 130k  $\Omega$ , replace the Turbo Pressure/Temp Sensor. Refer to section 39.2.1.1.
  - [b] If the resistance is less than 130k  $\Omega$ , go to step 6.
6. Measure the resistance between pins 1 and 4 of the Turbo Pressure/Temp Sensor.
  - [a] If the resistance is greater than 130k  $\Omega$ , replace the Turbo Pressure/Temp Sensor. Refer to section 39.2.1.1.
  - [b] If the resistance is less than 130k  $\Omega$ , go to step 7.
7. Disconnect the 120-pin MCM connector.
8. Measure the resistance between pins 1 and 4 of the Turbo Pressure/Temp Sensor harness connector.
  - [a] If the resistance is greater than 5  $\Omega$ , go to step 9.
  - [b] If the resistance is less than 5  $\Omega$ , repair the short between wires 120 and 105 of the 120-pin MCM connector. See Figure 39-1. Refer to section 39.2.1.1.
9. Measure the voltage between pin 1 of the Turbo Pressure/Temp Sensor and ground.

- [a] If the resistance is greater than 5  $\Omega$ , repair the open between pin 1 of the Turbo Pressure/Temp Sensor and pin 120 of the 120-pin MCM connector. See Figure 39-1. Refer to section 39.2.1.1.



**Figure 39-1 Turbo Pressure/Temp Sensor Wiring**

- [b] If the resistance is less than 5  $\Omega$ , repair the short to ground circuit between pin 120 of the 120-pin MCM connector and ground. See Figure 39-1. Refer to section 39.2.1.1.

### 39.2.1.1 Verify Repairs

Perform the following steps to verify repairs.

1. Turn vehicle ignition OFF.
2. Reconnect all connectors. Turn ignition ON.
3. Clear codes with diagnostic tool.
4. Start and run the engine for one minute. Stop engine.
5. Check diagnostic tool for codes.
  - [a] If no codes are displayed, troubleshooting is complete.
  - [b] If code 1176/4 is not logged, and other codes are logged, troubleshoot the logged codes.
  - [c] If code 1176/4 and other codes are logged, review this section to find the error. If no error is found, call the Detroit Diesel Customer Support Center (313-592-5800).

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# 40 SPN 1636 – INTAKE MANIFOLD TEMPERATURE OUTSIDE OF NORMAL OPERATING RANGE

Section	Page
40.1 SPN 1636 /FMI 2 .....	40-3
40.2 SPN 1636/FMI 3 .....	40-4
40.3 SPN 1636/FMI 4 .....	40-6
40.4 SPN 1636/FMI 14 .....	40-7



## 40.1 SPN 1636 /FMI 2

This diagnostic condition is typically erratic data.

### 40.1.1 Erratic Data Source Check

Check for the source of erratic data as follows:

#### NOTE:

When diagnosing rationality erratic data faults always refer to any SIBs first for any known issues.

1. Check the air intake, CAC EGR system integrity and the intake throttle system integrity.
2. Connect the diagnostic tool.
3. Monitor the engine RPM, engine coolant temperature, intake manifold temperature, EGR temperature, EGR PW and EGR Delta P counts.
4. With the engine at idle and the coolant temperature above 160°, are the EGR PW less than 7% and the EGR Delta P counts less than 135 (NO EGR FLOW)? Is the intake manifold temperature within \_\_\_ ° of the EGR temperature?
  - [a] If yes, go to step 7.
  - [b] If no, go to step 5.
5. Disconnect the Intake Manifold Pressure/Temp Sensor and the 120-pin MCM connector.
6. Bridge pins 1 and 2 of the Intake Manifold Pressure/Temp Sensor, measure the resistance at pins 52 and 106 of the 120-pin MCM connector.
  - [a] If the resistance is greater than 3 Ω, repair the harness. Refer to section 40.1.1.1.
  - [b] If the resistance is less than 3 Ω, replace the sensor. Refer to section 40.1.1.1.
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 40.1.1.1.

#### 40.1.1.1 Verify Repairs

Perform the following steps to verify repairs.

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

- [a] If no codes are displayed, troubleshooting is complete.
- [b] If code 1636/2 is not logged, and other codes are logged, troubleshoot the logged codes.
- [c] If code 1636/2 and other codes are logged, review this section to find the error. If no error is found, call the Detroit Diesel Customer Support Center (313-592-5800).

## **40.2 SPN 1636/FMI 3**

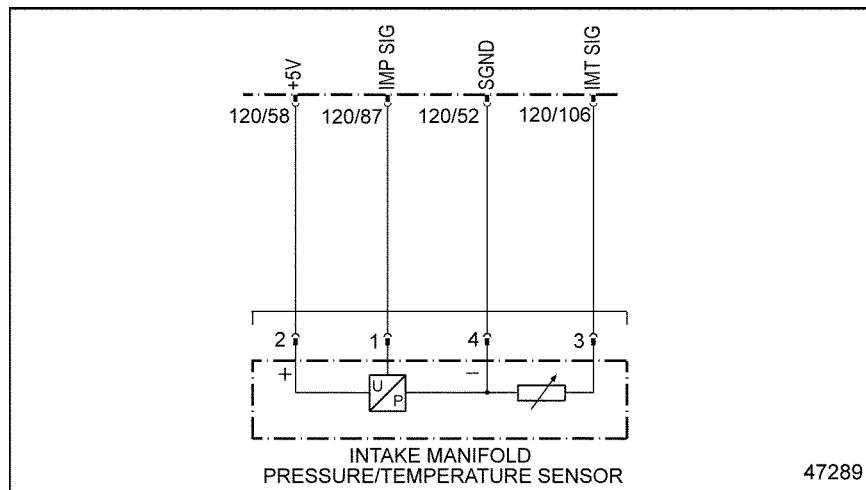
The diagnostic condition is typically Intake Manifold Temperature Sensor Open Circuit. The following procedures will troubleshoot SPN 1636/3.

### **40.2.1 Short to Power Check**

Perform the following steps to troubleshoot a short to power fault:

1. With the Intake Manifold Pressure/Temperature Sensor connected, check for multiple codes.
  - [a] If fault codes 1636/3 and 3563/3 are active, repair open circuit between pin 52 of the 120-pin MCM connector and pin 4 of the sensor. Refer to section 40.2.1.1.
  - [b] If only fault code 1636/3 is active, go to step 2.
2. Disconnect the Intake Manifold Pressure/Temperature Sensor.
3. Disconnect the 120-pin MCM connector.
4. Measure the resistance between pins 3 and 4 of the Intake Manifold Pressure/Temperature Sensor harness connector.
  - [a] If the resistance is less than 5  $\Omega$ , repair the short between pins 52 and 106 of the 120-pin MCM connector. See Figure 40-1. Refer to section 40.2.1.1.

- [b] If the resistance is more than 5  $\Omega$ , repair the short to power on the circuit between pin 106 of the 120-pin MCM connector and pin 3 of the Intake Manifold Pressure/Temperature Sensor. See Figure 40-1. Refer to section 40.2.1.1.



**Figure 40-1 Intake Manifold Pressure/Temp Sensor Wiring**

### 40.2.1.1 Verify Repairs

Perform the following steps to verify repairs.

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

- [a] If no codes are displayed, troubleshooting is complete.
- [b] If code 1636/3 is not logged, and other codes are logged, troubleshoot the logged codes.
- [c] If code 1636/3 and other codes are logged, review this section to find the error. If no error is found, call the Detroit Diesel Customer Support Center (313-592-5800).

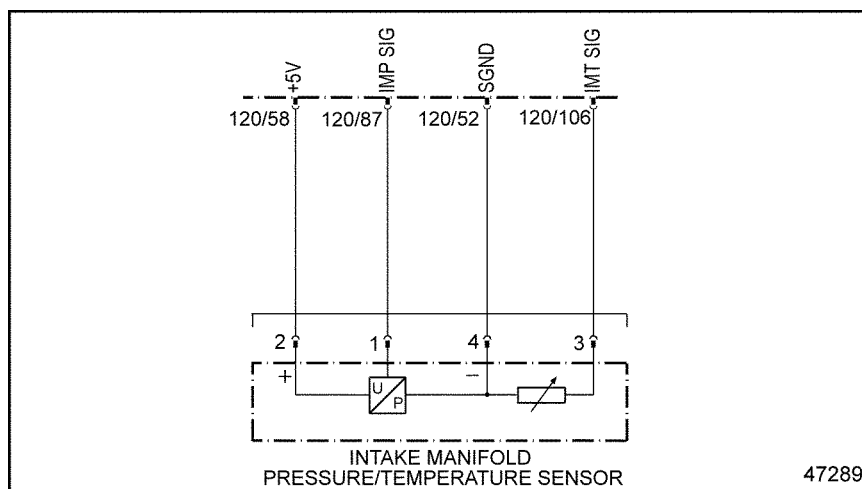
## 40.3 SPN 1636/FMI 4

A typical diagnosis is Intake Manifold Pressure/Temp Sensor Open Short to Ground.

### 40.3.1 Intake Manifold Pressure/Temp Sensor Open or Short to Ground Check

Perform the following steps to troubleshoot an Intake Manifold Pressure/Temp Sensor open or short to ground fault:

1. Check for multiple codes.
  - [a] If fault code 1636/4 and 3563 are both active, repair the open between pin 58 of the 120-pin MCM connector and pin 2 of the Intake Manifold Pressure/Temp Sensor. Refer to section 40.3.1.1.
  - [b] If only 1636/4 is active, go to step 2.
2. Disconnect the Intake Manifold Pressure/Temp Sensor.
3. Measure the resistance between pins 3 and 4 of the Intake Manifold Pressure/Temp Sensor.
  - [a] If resistance is greater than 130k  $\Omega$ , replace the sensor. Refer to section 40.3.1.1.
  - [b] If resistance is less than 130k  $\Omega$ , go to step 5.
4. Turn the ignition switch to the ON position.
5. Measure the voltage between pin 3 of the Intake Manifold Pressure/Temp Sensor and ground.
  - [a] If the voltage is greater than 2.75 volts, go to step 6.
  - [b] If the voltage is less than 2.75 volts, repair the open between pin 3 of the Intake Manifold Pressure/Temp Sensor and pin 106 of the 120-pin MCM connector. See Figure 40-2. Refer to section 40.3.1.1.



**Figure 40-2 Intake Manifold Pressure/Temp Sensor Wiring**

6. Turn the ignition switch to the OFF position.
7. Disconnect the 120-pin MCM connector.
8. Measure the resistance between pins 3 and 4 of the Intake Manifold Pressure/Temp Sensor harness connector.
  - [a] If resistance is greater than 5  $\Omega$ , repair the short to power on the circuit between pin 106 of the 120-pin MCM connector and pin 3 of the Intake Manifold Pressure/Temp Sensor harness connector. Refer to section 40.3.1.1.
  - [b] If resistance is less than 5  $\Omega$ , repair the short between wires 52 and '106 of the 120-pin MCM connector. Refer to section 40.3.1.1.

### 40.3.1.1 Verify Repairs

Perform the following steps to verify repairs.

1. Turn vehicle ignition OFF.
2. Reconnect all connectors.
3. Turn ignition ON.
4. Clear codes with diagnostic tool.
5. Start and run the engine for one minute.
6. Stop engine.
7. Check diagnostic tool for codes.
  - [a] If no codes are displayed, troubleshooting is complete.
  - [b] If code 1636/4 is not logged, and other codes are logged, troubleshoot the logged codes.
  - [c] If code 1636/4 and other codes are logged, review this section to find the error. If no error is found, call the Detroit Diesel Customer Support Center (313-592-5800).

## 40.4 SPN 1636/FMI 14

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

### 40.4.1 Temperature Check

Check the temperature as follows:

**NOTE:**

Prior to performing this diagnostic procedure the engine must have a minimum of a three hour soak (cool down).

1. Connect DDDL.
2. Turn the ignition switch to the ON position.

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 40.4.1.1.
  - [b] If no, go to step 5.
5. Prepare DDDL for a snapshot.
6. Start the engine, idle for 30 seconds, then TURN THE ENGINE OFF.
7. Review the the intake manifold, engine oil, engine coolant, EGR and turbo outlet temperature parameters on snapshot.
8. Are any of the temperature readings 20°F greater or less than that of the other sensors?
  - [a] If yes, inspect the suspect temperature sensors electrical connector for corrosion, bent or spread pins, repair as necessary. If there are no repairs, replace suspect temperature sensor. Refer to section 40.4.1.1.
  - [b] If no, review steps 3 through 8. If the results are the same, contact the Detroit Diesel Customer Support Center (313–592–5800).

#### 40.4.1.1 Verify Repairs

Perform the following steps to verify repairs.

1. Turn vehicle ignition OFF. Reconnect all connectors.
2. Turn ignition ON. Clear codes with diagnostic tool.
3. Start and run the engine for one minute. Stop the engine.
4. Check diagnostic tool for codes.
  - [a] If no codes are displayed, troubleshooting is complete.
  - [b] If code 1636/14 is not logged, and other codes are logged, troubleshoot the logged codes.
  - [c] If code 1636/14 and other codes are logged, review this section to find the error. If no error is found, call the Detroit Diesel Customer Support Center (313–592–5800).

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# 41 SPN 2629 - TURBO COMPRESSOR OUT TEMP HIGH OR LOW

Section	Page
41.1 SPN 2629/FMI 3 .....	41-3
41.2 SPN 2629/FMI 4 .....	41-4



## 41.1 SPN 2629/FMI 3

This condition is typically open circuit.

### 41.1.1 Check for Multiple Codes

Check for multiple codes as follows:

1. Plug in the diagnostic tool.
2. Read the active 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 41.1.2.1.
  - [b] If only fault 2629/3 is active, refer to section 41.1.2.

### 41.1.2 Open Circuit Check

Check for open 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 4k  $\Omega$ , replace the TCO Sensor. Refer to section 41.1.2.1
  - [b] If the resistance is less than 4k  $\Omega$ , go to step 3.
3. Turn the ignition switch to the ON position.
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 41.1.2.1.
  - [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 41.1.2.1.
6. 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  $\Omega$ , repair the short between pins 52 and 112 of the 120-pin MCM connector. Refer to section 41.1.2.1.
  - [b] If the resistance is greater than 5  $\Omega$ , replace the TCO Sensor. Refer to section 41.1.2.1.

### 41.1.2.1 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 2629/3 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).

## 41.2 SPN 2629/FMI 4

This condition is typically a short circuit.

### 41.2.1 Short Circuit Check

Check for short 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  $\Omega$ , repair the short between the 120-pin MCM connector wire 50 and 112. Refer to section 41.2.1.1.
  - [b] If the resistance is greater than 5k  $\Omega$ , 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  $\Omega$ , repair the short circuit between pin 1 of the TCO Sensor connector and ground. Refer to section 41.2.1.1.
  - [b] If the resistance is greater than 5k  $\Omega$ , 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  $\Omega$ , repair the short circuit between pin 2 of the TCO Sensor connector and ground. Refer to section 41.2.1.1.
  - [b] If the resistance is greater than 5k  $\Omega$ , contact the Detroit Diesel Customer Support Center (313-592-5800) for authorization to replace the MCM.

### 41.2.1.1 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).



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

<b>Section</b>	<b>Page</b>
42.1 SPN 2791/FMI 3 .....	42-3
42.2 SPN 2791/FMI 4 .....	42-5
42.3 SPN 2791/FMI 5 .....	42-6



## 42.1 SPN 2791/FMI 3

This diagnostic condition is typically a short to power fault.

### 42.1.1 Short Circuit Check

Check for short as follows:

1. Disconnect the EGR valve connector.
2. Turn the ignition switch to the ON position.
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 42.1.2.1.
  - [b] If the voltage is less than 11.5 volts, go to step 4.
4. Turn the ignition switch to the OFF position.
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  $\Omega$ , 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 42.1.2.1
  - [b] If the resistance is less than 5  $\Omega$ , refer to section 42.1.2.

### 42.1.2 Resistance and Voltage Check

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

1. Turn ignition ON. Reconnect all connectors.
2. Clear codes with diagnostic tool.
3. Start and run the engine for one minute. Stop engine.
4. Measure the voltage between pin 1 of the EGR valve connector and ground.
  - [a] If the voltage is greater than 11.5 volts, repair the short to power between pin 1 of the EGR valve connector and pin 61 of the 120-pin MCM connector. Refer to section 42.1.2.1.
  - [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  $\Omega$ , 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 42.1.2.1.
- [b] If the resistance is less than 5  $\Omega$ , call the Detroit Diesel Customer Support Center (313-592-5800) for authorization to replace the MCM.

### **42.1.2.1 Verify Repairs**

Verify repairs as follows:

1. Turn the vehicle OFF. Reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
  - [a] If no codes are present, troubleshooting is complete.
  - [b] If code 2791/3 is not logged but other codes are logged, troubleshoot the other codes.
  - [c] If code 2791/3 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313-592-5800).

## 42.2 SPN 2791/FMI 4

This diagnosis is typically short to ground.

### 42.2.1 Short Circuit Check

Check for a short as follows:

1. Disconnect EGR valve connector.
2. Disconnect 120-pin MCM connector.
3. Measure the resistance between pin 1 of the EGR valve connector and ground.
  - [a] If the resistance is less than 5  $\Omega$ , repair the short circuit between pin 1 of the EGR valve connector and ground. Refer to section 42.2.2.1.
  - [b] If the resistance is greater than 5  $\Omega$ , 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  $\Omega$ , repair the short circuit between pin 2 of the EGR valve connector and ground. Refer to section 42.2.2.1.
  - [b] If the resistance is greater than 5  $\Omega$ , Refer to section 42.2.2.1.

### 42.2.2 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, 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  $\Omega$ , repair the short circuit between pin 1 of the EGR valve connector and ground. Refer to section 42.2.2.1.
  - [b] If the resistance is greater than 5  $\Omega$ , 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  $\Omega$ , repair the short circuit between pin 2 of the EGR valve connector and ground. Refer to section 42.2.2.1.
  - [b] If the resistance is greater than 5  $\Omega$ , call the Detroit Diesel Customer Support Center (313-592-5800) for authorization to replace the MCM.

### 42.2.2.1 Verify Repairs

Verify repairs as follows:

1. Turn the vehicle ignition OFF and reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
  - [a] If no codes are present, troubleshooting is complete.
  - [b] If code 2791/4 is not logged but other codes are logged, troubleshoot the other codes.
  - [c] If code 2791/4 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313-592-5800).

## 42.3 SPN 2791/FMI 5

This diagnostic condition is typically an open circuit fault.

### 42.3.1 Open Circuit Check

Check for open as follows:

1. Disconnect the EGR valve connector.
2. Turn the ignition switch to the ON position.
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 42.3.1.1.
  - [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  $\Omega$ , 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 42.3.1.1.
  - [b] If the resistance is less than 3  $\Omega$ , 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  $\Omega$ , 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 42.3.1.1.
- [b] If the resistance is less than 3  $\Omega$ , replace the EGR valve.

### 42.3.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the vehicle ignition OFF and reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
  - [a] If no codes are present, troubleshooting is complete.
  - [b] If code 2791/5 is not logged but other codes are logged, troubleshoot the other codes.
  - [c] If code 2791/5 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313-592-5800).



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## **43 SPN 3510 — ACCELERATOR PEDAL SUPPLY OUTSIDE OF NORMAL OPERATING RANGE**

<b>Section</b>	<b>Page</b>
43.1 SPN 3510/FMI 2 .....	43-3
43.2 SPN 3510/FMI 3 .....	43-5
43.3 SPN 3510/FMI 4 .....	43-6



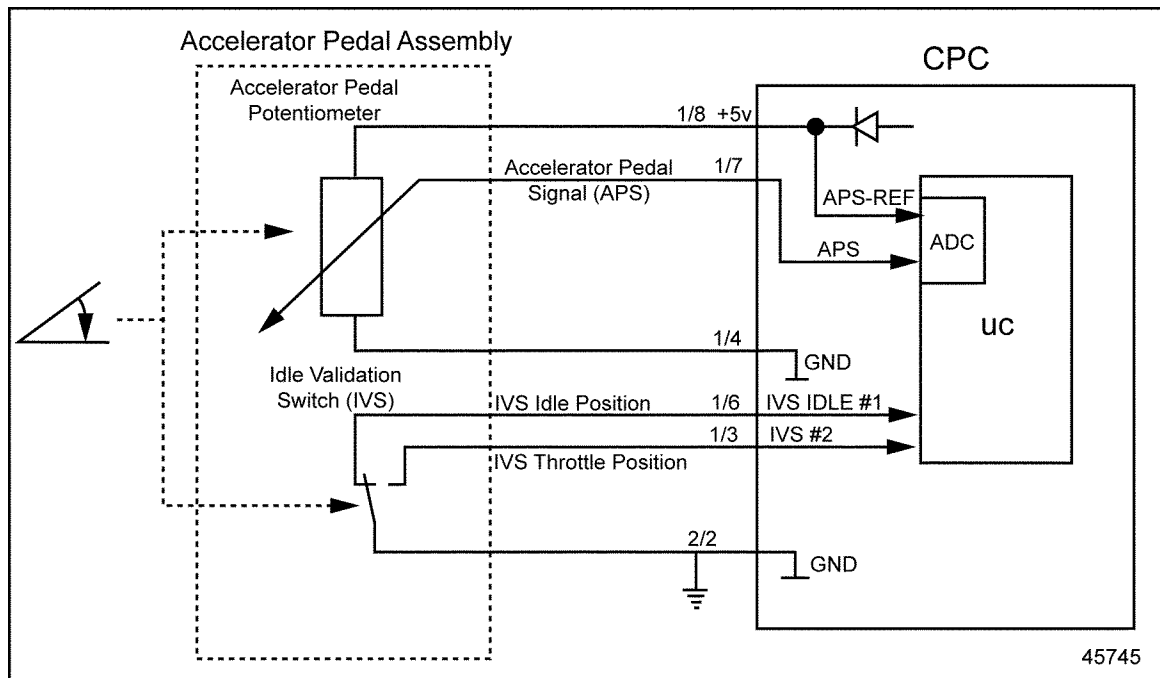
## 43.1 SPN 3510/FMI 2

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

### 43.1.1 Erratic Data Check

Check for erratic data as follows:

1. Disconnect the Accelerator Pedal (AP).
2. Turn the ignition switch to the ON position.
3. Measure the voltage between pins 1 and 3 of the AP harness connector. See Figure 43-1.



**Figure 43-1 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 43.1.1.1.
  - [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 43.1.1.1.
5. Turn the ignition switch to the OFF position.
6. Disconnect the CPC #1 connector.

7. Measure the resistance between pin 2 of the AP harness connector and pin 7 of the CPC #1 connector.
  - [a] If the resistance is greater than 3  $\Omega$ , repair the open between pin 2 of the AP harness connector and pin 7 of the CPC #1 connector. Refer to section 43.1.1.1.
  - [b] If the resistance is less than 3  $\Omega$ , replace the Accelerator Pedal. Refer to section 43.1.1.1.

#### **43.1.1.1 Verify Repairs**

Perform the following steps to verify repairs.

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

## 43.2 SPN 3510/FMI 3

The typical diagnosis for this fault is high voltage.

### 43.2.1 High Voltage Check

Check for high voltage as follows:

1. Disconnect the Accelerator Pedal (AP).
2. Turn the ignition switch to the ON position.
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 43.2.1.1.
  - [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 43.2.1.1.
5. Turn the ignition switch to the OFF position.
6. Disconnect the CPC #1 connector.
7. Measure the resistance between pin 2 of the AP harness connector and pin 7 of the CPC #1 connector.
  - [a] Measure the resistance between pin 2 of the AP harness connector and pin 7 of the CPC #1 connector. Refer to section 43.2.1.1.
  - [b] If the resistance is less than 3  $\Omega$ , replace the Accelerator Pedal. Refer to section 43.2.1.1.

#### 43.2.1.1 Verify Repairs

Perform the following steps to verify repairs.

1. Turn vehicle ignition OFF.
2. Reconnect all connectors. Turn ignition ON.
3. Clear codes with diagnostic tool.
4. Start and run the engine for one minute. Stop engine.
5. Check diagnostic tool for codes.
  - [a] If no codes are displayed, troubleshooting is complete.
  - [b] If code 3510/3 is not logged, and other codes are logged, troubleshoot the logged codes.

- [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).

### 43.3 SPN 3510/FMI 4

The typical diagnosis for this fault is voltage low.

#### 43.3.1 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  $\Omega$ , repair the short between wires 8 and 4 of the CPC #1 connector. Refer to section 43.3.1.1.
  - [b] If the resistance is greater than 5  $\Omega$ , 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  $\Omega$ , repair the short between wires 7 and 14 of the CPC #1 connector. Refer to section 43.3.1.1.
  - [b] If the resistance is greater than 5  $\Omega$ , 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  $\Omega$ , repair the short circuit between pin 1 of the AP connector and ground. Refer to section 43.3.1.1.
  - [b] If the resistance is greater than 5  $\Omega$ , 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  $\Omega$ , repair the short circuit between pin 2 of the AP connector and ground. Refer to section 43.3.1.1.
  - [b] If the resistance is greater than 5  $\Omega$ , replace the Accelerator Pedal. Refer to section 43.3.1.1.

### 43.3.1.1 Verify Repairs

Perform the following steps to verify repairs.

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



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## **44 SPN 3563 – INTAKE MANIFOLD PRESSURE OUTSIDE NORMAL RANGE**

<b>Section</b>	<b>Page</b>
44.1 SPN 3563/FMI 0/1/2 .....	44-3
44.2 SPN 3563/FMI 3 .....	44-6
44.3 SPN 3563/FMI 4 .....	44-8



## 44.1 SPN 3563/FMI 0/1/2

The following procedures will troubleshoot SPN 3563/FMI 0/1/2, intake manifold pressure high or low or erratic data.

### 44.1.1 Code Check

Perform the following steps to check for codes:

1. Turn the vehicle ON.
2. Using the diagnostic tool, check for codes
3. Check for historic fault codes in addition to 3563/0/1/2.
  - [a] If other historic fault codes are present, troubleshoot other fault codes first.
  - [b] If only fault code 3563/0 or 3563/1 or 3563/2 is present, refer to section 44.1.2.

### 44.1.2 Low (Boost) Pressure Check

Perform the following steps to troubleshoot an intake manifold (boost) pressure low fault:

1. Check for a restricted air filter or air intake system.
  - [a] If the air filter or air intake system is restricted, replace the air filter and/or eliminate the restriction in the air intake system. Refer to section 44.1.3.1.
  - [b] If the air filter or air intake system is not restricted, go to step 2.
2. Check the condition of the boost air sensor.
  - [a] If sensor is not in good condition, replace sensor. Refer to section 44.1.3.1.
  - [b] If sensor is in good condition, go to step 3.
3. Visually inspect the CAC (charge air cooler) and the CAC hoses for leaks.
  - [a] If leaks are found, repair or replace the CAC and/or CAC hoses. Refer to section 44.1.3.1.
  - [b] If no leaks are found, go to step 4.
4. Check for a faulty turbocharger (compressor wheel does not spin freely or is rubbing on side walls).
  - [a] If the turbocharger is faulty, replace it. Refer to section 44.1.3.1.
  - [b] If the turbocharger is not faulty, go to step 5.
5. Verify that fuel delivery is within specifications (no restrictions to fuel flow).
  - [a] If fuel delivery is not within specifications, eliminate restrictions in fuel delivery system. Refer to section 44.1.3.1.
  - [b] If fuel delivery is within specifications, check for erratic data. Refer to section 44.1.3.

### 44.1.3 Erratic Data Check

Perform the following steps to check for erratic data:

1. Turn the vehicle ignition switch ON with the 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 and change the units to metric. (Tool menu > Options > Metric).
4. Using DDDL, read the value of the Barometric Pressure Sensor. The value should be within X kPa of the value in Table 1.
  - [a] If the value is greater than X kPa, replace the Intake Manifold Pressure/Temp Sensor. Refer to section 44.1.3.1.
  - [b] If the value is less than X kPa,, go to step 5.
5. Using DDDL, read the value of the Barometric Pressure Sensor. The value should be within X kPa of the value in Table 1.
  - [a] If the value is greater than X kPa, replace the Barometric Pressure Sensor. Due to its location in the MCM, replacing the Barometric Pressure Sensor means replacing the MCM.Refer to section 44.1.3.1.
  - [b] If the value is less than X kPa,, go to step 6.
6. Start the engine and run at idle.
7. Using DDDL, 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 44.1.3.1.
  - [b] If the value is within X kPa, go to step 8.
8. Using DDDL, read the value of the Barometric Pressure Sensor.
  - [a] If the value is not within X kPa, replace the Barometric Pressure Sensor. Due to its location in the MCM, replacing the Barometric Pressure Sensor means replacing the MCM.Refer to section 44.1.3.1.
  - [b] If the value is within X kPa,, go to step 9.
9. Run the engine to 1500 rpm.
10. Using DDDL, read the value of the Intake Manifold Pressure/Temp Sensor (boost pressure). The value should be X kPa at 1500 rpm.
  - [a] If the value is not within 2 kPa, replace the sensor.
  - [b] If the value is within 2 kPa, go to step 11.
11. Using DDDL, read the value of the Barometric Pressure Sensor.

- [a] If the value is not within X kPa, replace the Barometric Pressure Sensor. Due to its location in the MCM, replacing the Barometric Pressure Sensor means replacing the MCM. Refer to section 44.1.3.1.
- [b] If the value is within X kPa, contact Detroit Diesel Customer Support Center (313-592-5800).

#### **44.1.3.1 Verify Repairs**

Perform the following steps to verify repairs.

1. Turn vehicle ignition OFF.
2. Reconnect all connectors. Turn ignition ON.
3. Clear codes with diagnostic tool.
4. Start and run the engine for one minute. Stop engine.
5. Check diagnostic tool for codes.
  - [a] If no codes are displayed, troubleshooting is complete.
  - [b] If code 3563/0/1/2 is not logged, and other codes are logged, troubleshoot the logged codes.
  - [c] If code 3563/0/21 and other codes are logged, review this section to find the error. If no error is found, call the Detroit Diesel Customer Support Center (313-592-5800).

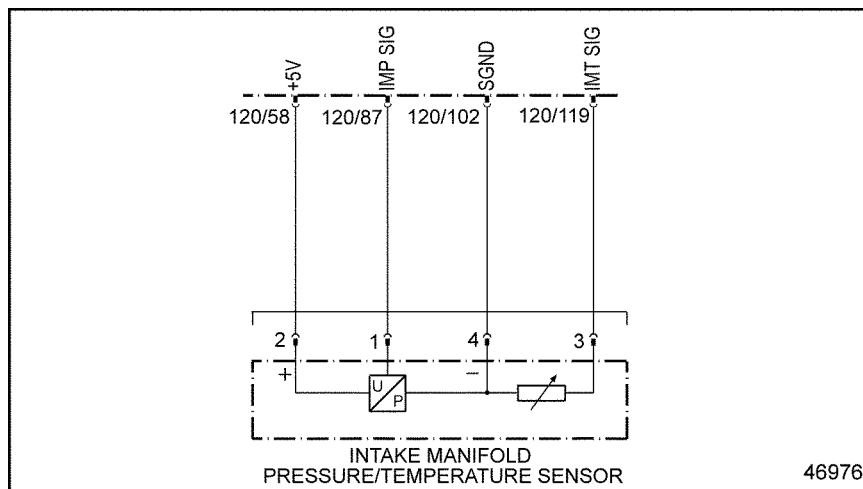
## 44.2 SPN 3563/FMI 3

The following procedures will troubleshoot SPN 3563/FMI 3, Intake Manifold Pressure/Temp Sensor short to power.

### 44.2.1 Short to Power Check

Perform the following steps to check for a short to power:

1. Check for multiple codes.
  - [a] If fault code 3563/3 and 1636/3 are present, repair open circuit between pin 102 of the 120-pin MCM connector and pin 4 of the Intake Manifold Pressure/Temp Sensor. See Figure 44-1. Refer to section 44.2.1.1.
  - [b] If only fault code 3563/3 is present, go to step 2.
2. Disconnect the Intake Manifold Pressure/Temp Sensor.
3. Disconnect the 120-pin MCM connector.
4. Measure the resistance between pins 1 and 4 of the Intake Manifold Pressure/Temp Sensor harness connector. See Figure 44-1.



**Figure 44-1 Intake Manifold Pressure/Temp Sensor**

- [a] If the resistance is greater than 5  $\Omega$ , repair short to power in the circuit between pin 87 of the 120-pin MCM connector and pin 1 of the Intake Manifold Pressure/Temp Sensor. See Figure 44-1. Refer to section 44.2.1.1.
- [b] If the resistance is less than 5  $\Omega$ , repair the short between wire 58 and 87 of the 120-pin MCM connector. See Figure 44-1. Refer to section 44.2.1.1.

#### 44.2.1.1 Verify Repairs

Perform the following steps to verify repairs.

1. Turn vehicle ignition OFF.
2. Reconnect all connectors. Turn ignition ON.
3. Clear codes with diagnostic tool.
4. Start and run the engine for one minute. Stop engine.
5. Check diagnostic tool for codes.
  - [a] If no codes are displayed, troubleshooting is complete.
  - [b] If code 3563/3 is not logged, and other codes are logged, troubleshoot the logged codes.
  - [c] If code 3563/3 and other codes are logged, review this section to find the error. If no error is found, call the Detroit Diesel Customer Support Center (313-592-5800).

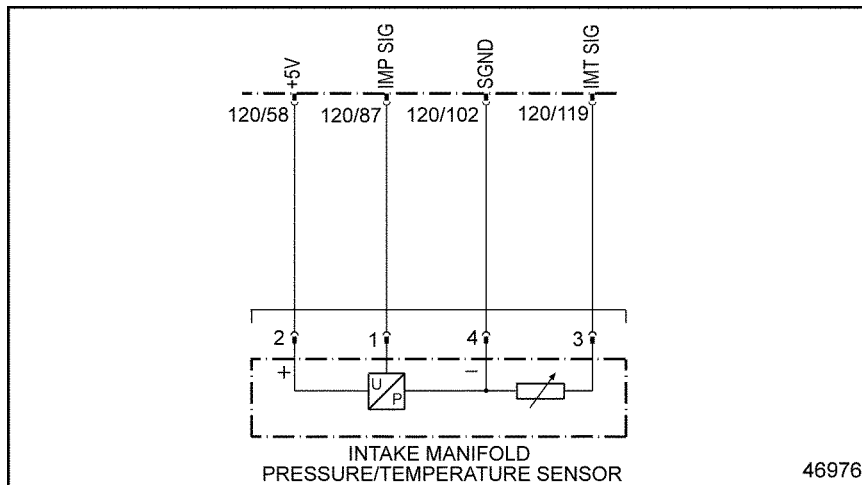
## 44.3 SPN 3563/FMI 4

The following procedures will troubleshoot SPN 3563/FMI 4, Intake Manifold Pressure/Temp Sensor short to ground.

### 44.3.1 Open or Short to Ground Check

Perform the following steps to check for an open short to ground:

1. Check for multiple codes.
  - [a] If faults 3563/4 and 1636/4 are present, go to step 2.
  - [b] If only 3563/4 is present, go to step 7.
2. Disconnect the Intake Manifold Pressure/Temp Sensor.
3. Measure the resistance between pins 1 and 2 of the Intake Manifold Pressure/Temp Sensor. See Figure 44-2.



**Figure 44-2 Intake Manifold Pressure/Temp Sensor**

- [a] If resistance is greater than 130k  $\Omega$ , replace the sensor. Refer to section 44.3.1.1.
- [b] If resistance is less than 130k  $\Omega$ , go to step 4.
4. Measure the resistance between pins 2 and 4 of the Intake Manifold Pressure/Temp Sensor. See Figure 44-2.
  - [a] If resistance is greater than 130k  $\Omega$ , replace the sensor. Refer to section 44.3.1.1.
  - [b] If resistance is less than 130k  $\Omega$ , go to step 5.
5. Turn the ignition switch to the ON position.
6. Measure the voltage between pin 2 of the Intake Manifold Pressure/Temp Sensor and ground.

- [a] If the voltage is greater than 2.75 volts, repair the open between pin 4 of the Intake Manifold Pressure/Temp Sensor and pin 102 of the 120-pin MCM connector. Refer to section 44.3.1.1.
  - [b] If the voltage is less than 2.75 volts, repair the open between pin 2 of the Intake Manifold Pressure/Temp Sensor and pin 108 of the 120-pin MCM connector. Refer to section 44.3.1.1.
7. Turn the ignition switch to the OFF position.
  8. Disconnect the Intake manifold Pressure/Temp Sensor.
  9. Disconnect the 120-pin MCM connector.
  10. Measure the resistance between pins 1 and 2 of the Intake Manifold Pressure/Temp Sensor harness connector.
    - [a] If the resistance is greater than 5  $\Omega$ , repair the short to power on the circuit between pin 87 of the 120-pin MCM connector and pin 1 of the Intake Manifold Pressure/Temp Sensor harness connector. Refer to section 44.3.1.1.
    - [b] If the resistance is less than 5  $\Omega$ , repair the short between wires 58 and 87 of the 120-pin MCM connector. Refer to section 44.3.1.1.

#### **44.3.1.1 Verify Repairs**

Perform the following steps to verify repairs.

1. Turn vehicle ignition OFF.
2. Reconnect all connectors. Turn ignition ON.
3. Clear codes with diagnostic tool.
4. Start and run the engine for one minute. Stop engine.
5. Check diagnostic tool for codes.
  - [a] If no codes are displayed, troubleshooting is complete.
  - [b] If code 3563/4 is not logged, and other codes are logged, troubleshoot the logged codes.
  - [c] If code 3563/4 and other codes are logged, review this section to find the error. If no error is found, call the Detroit Diesel Customer Support Center (313-592-5800).



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## **45 SPN 3659 — ELECTRONIC UNIT PUMP #1 NOT OPERATING NORMALLY**

<b>Section</b>	<b>Page</b>
45.1 SPN 3659/FMI 5 .....	45-3
45.2 SPN 3659/FMI 10 .....	45-5



## 45.1 SPN 3659/FMI 5

This diagnosis is typically the Electronic Unit Pump current is below normal or an open circuit fault.

### 45.1.1 Multiple Codes Check

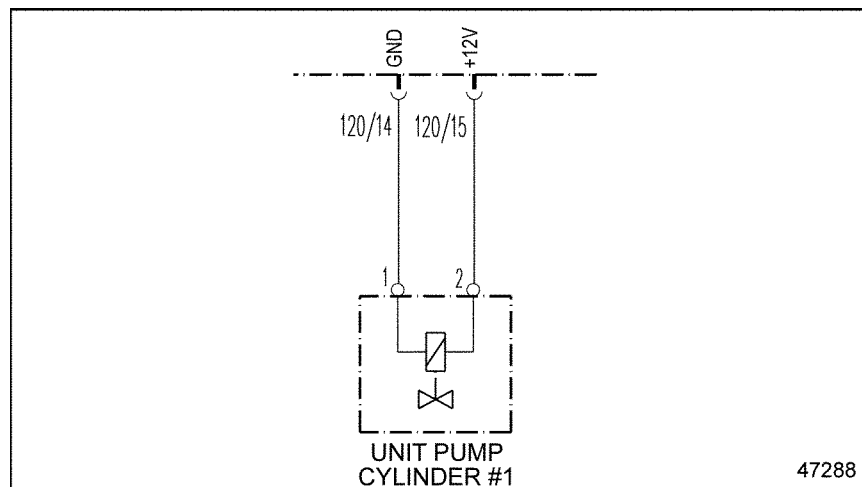
Check for multiple codes as follows:

1. Turn the ignition ON.
2. Plug in the diagnostic tool.
3. Read the active 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, contact the Detroit Diesel Customer Support Center (313-592-5800) for MCM replacement.
  - [c] If only fault code 3659/5 is active, refer to section 45.1.2.

### 45.1.2 Open Circuit Check

Check as follows:

1. The ignition should still be ON.
2. Measure the voltage between pins 1 and 2 of Electronic Unit Pump #1. See Figure 45-1.



**Figure 45-1 Electronic Unit Pump #1**

- [a] If the voltage is greater than 11.5 volts, replace Electronic Unit Pump #1.
- [b] If the voltage is less than 11.5 volts, go to step 3.
3. Measure the voltage between pin 2 of Electronic Unit Pump #1 and ground.

- [a] If the voltage is greater than 11.5 volts, repair the open between pin 14 of the 120-pin MCM connector and pin 1 of Electronic Unit Pump #1. Refer to section 45.1.2.1.
- [b] If the voltage is less than 11.5 volts, repair the open between pin 15 of the 120-pin MCM connector and pin 2 of Electronic Unit Pump #1. Refer to section 45.1.2.1.

### **45.1.2.1 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 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).

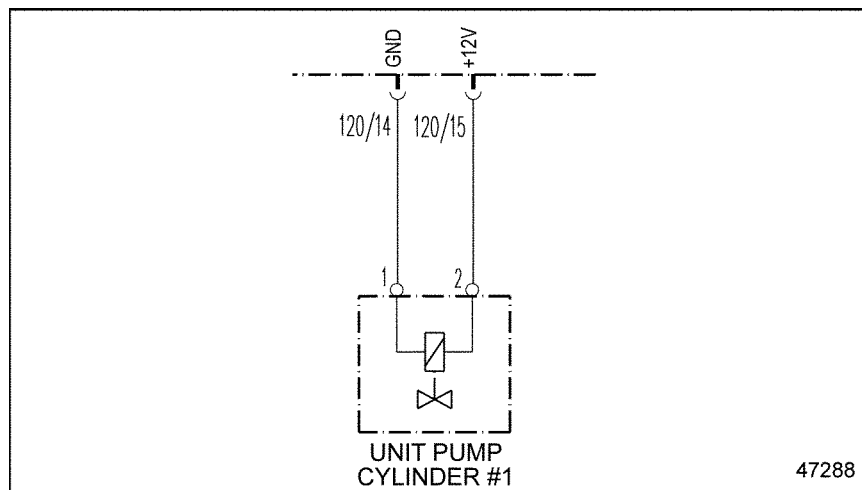
## 45.2 SPN 3659/FMI 10

This diagnostic condition is typically a short to ground.

### 45.2.1 Short to Ground Check

Check as follows:

1. Turn the ignition OFF.
2. Disconnect the 120-pin MCM connector.
3. Disconnect pins 1 and 2 of Electronic Unit Pump #1.
4. Measure the resistance between pins 1 and 2 of the Electronic Unit Pump #1 harness. See Figure 45-2.
  - [a] If the resistance is less than 5  $\Omega$ , repair the short between pins 1 and 2 of the Electronic Unit Pump #1 harness and pins 14 and 15 of the 120-pin MCM connector. Refer to section 45.2.1.1.
  - [b] If the resistance is greater than 5  $\Omega$ , go to step 5.



**Figure 45-2 Electronic Unit Pump #1**

5. Measure the resistance between pin 2 of the Electronic Unit Pump #1 harness and ground.
  - [a] If the resistance is less than 5  $\Omega$ , repair the short to ground between pin 2 of the Electronic Unit Pump #1 harness and pin 15 of the MCM 120-pin connector. Refer to section 45.2.1.1.
  - [b] If the resistance is greater than 5  $\Omega$ , repair the short to ground between pin 1 of the Electronic Unit Pump #1 harness and pin 14 of the MCM 120-pin connector. Refer to section 45.2.1.1.

### 45.2.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the ignition OFF and reconnect all connectors.
2. Turn the ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
  - [a] If no codes are present, troubleshooting is complete.
  - [b] If code 3659/10 is not logged but other codes are logged, troubleshoot the other codes.
  - [c] If code 3659/10 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313-592-5800).

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## **46 SPN 3660 - ELECTRONIC UNIT PUMP #2 NOT OPERATING NORMALLY**

<b>Section</b>	<b>Page</b>
46.1 SPN 3660/FMI 5 .....	46-3
46.2 SPN 3660/FMI 10 .....	46-5



## 46.1 SPN 3660/FMI 5

This diagnosis is typically the Electronic Unit Pump current is below normal or an open circuit fault.

### 46.1.1 Multiple Codes Check

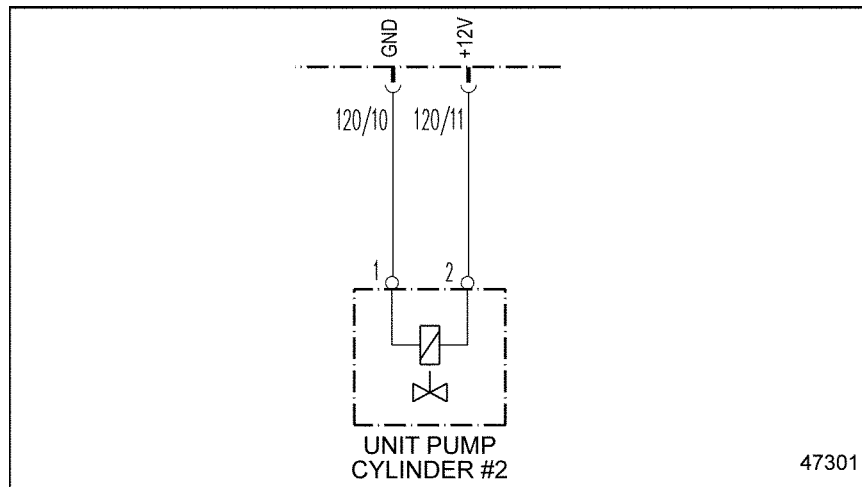
Check for multiple codes as follows:

1. Turn the vehicle ignition switch ON.
2. Plug in the diagnostic tool.
3. Read the active codes.
  - [a] If fault code 168/1 is active in addition to 3660/5, service 168/1 first. Refer to section 12.2.
  - [b] If fault 3659/5 and 3661/5 are active in addition to 3660/5, contact the Detroit Diesel Customer Support Center (313-592-5800) for MCM replacement.
  - [c] If only fault code 3660/5 is active, refer to section 46.1.2.

### 46.1.2 Open Circuit Check

Check as follows:

1. The ignition should still be ON.
2. Measure the voltage between pins 1 and 2 of Electronic Unit Pump #2. See Figure 46-1.



**Figure 46-1 Electronic Unit Pump #2**

- [a] If the voltage is greater than 11.5 volts, replace Electronic Unit Pump #2.
- [b] If the voltage is less than 11.5 volts, go to step 3.
3. Measure the voltage between pin 2 of the Electronic Unit Pump #2 and ground.

- [a] If the voltage is greater than 11.5 volts, repair the open between pin 10 of the 120-pin MCM connector and pin 1 of Electronic Unit Pump #2. Refer to section 46.1.2.1.
- [b] If the voltage is less than 11.5 volts, repair the open between pin 11 of the 120-pin MCM connector and pin 2 of Electronic Unit Pump #2. Refer to section 46.1.2.1.

### **46.1.2.1 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 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).

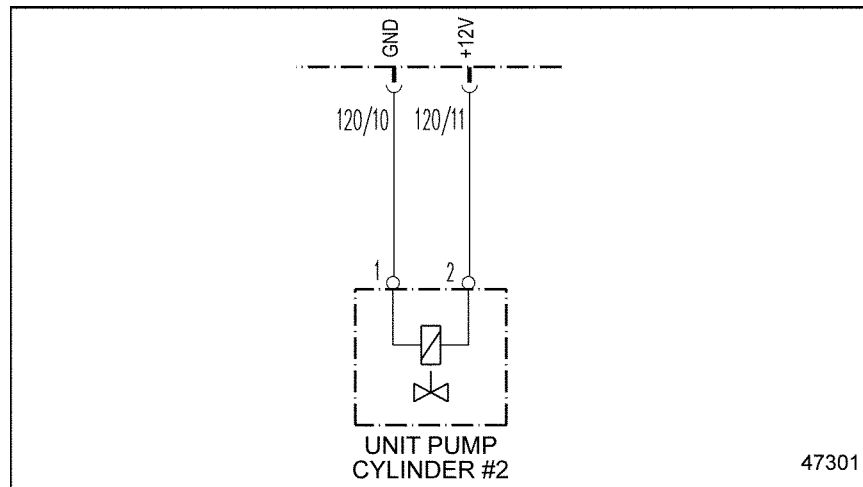
## 46.2 SPN 3660/FMI 10

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 120-pin MCM connector.
3. Disconnect pins 1 and 2 of Electronic Unit Pump #2. See Figure 46-2.



**Figure 46-2 Electronic Unit Pump #2**

4. Measure the resistance between pins 1 and 2 of the Electronic Unit Pump #2 harness.
  - [a] If the resistance is less than 5  $\Omega$ , repair the short between pins 1 and 2 of the Electronic Unit Pump #2 harness and pins 10 and 11 of the 120-pin MCM connector. Refer to section 46.2.1.1.
  - [b] If the resistance is greater than 5  $\Omega$ , go to step 5.
5. Measure the resistance between pin 2 of the Electronic Unit Pump #2 harness and ground.
  - [a] If the resistance is less than 5  $\Omega$ , repair the short to ground between pin 2 of the Electronic Unit Pump #2 harness and pin 11 of the MCM 120-pin connector. Refer to section 46.2.1.1.
  - [b] If the resistance is greater than 5  $\Omega$ , repair the short to ground between pin 1 of the Electronic Unit Pump #2 harness and pin 10 of the MCM 120-pin connector. Refer to section 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 3660/10 is not logged but other codes are logged, troubleshoot the other codes.
  - [c] If code 3660/10 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313-592-5800).

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## **47 SPN 3661 - ELECTRONIC UNIT PUMP #3 NOT OPERATING NORMALLY**

<b>Section</b>	<b>Page</b>
47.1 SPN 3661/FMI 5 .....	47-3
47.2 SPN 3661/FMI 10 .....	47-5



## 47.1 SPN 3661/FMI 5

This diagnosis is typically the Electronic Unit Pump current is below normal or an open circuit fault.

### 47.1.1 Check for Multiple Codes

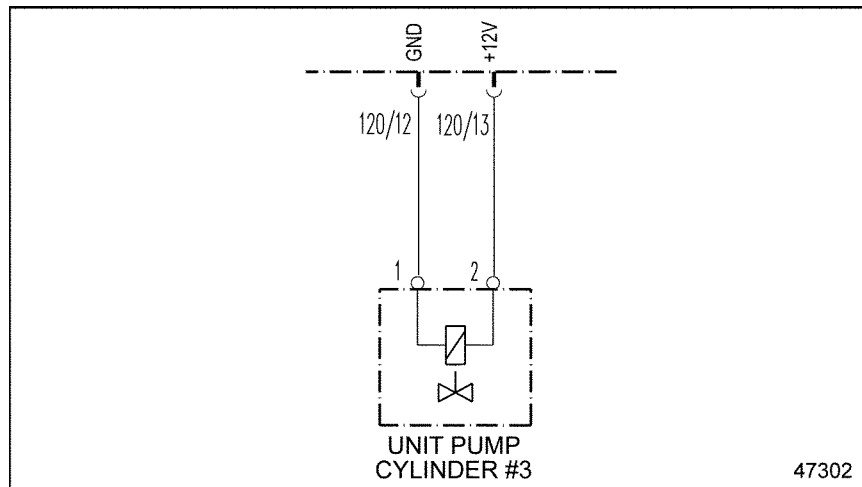
Check for multiple codes as follows:

1. Turn the ignition ON.
2. Plug in the diagnostic tool.
3. Read the active 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, contact the Detroit Diesel Customer Support Center (313-592-5800) for MCM replacement.
  - [c] If only fault code 3661/5 is active, refer to section 47.1.2.

### 47.1.2 Check for Open Circuits

Check as follows:

1. The ignition should still be ON.
2. Measure the voltage between pins 1 and 2 of Electronic Unit Pump #3. See Figure 47-1.



**Figure 47-1 Electronic Unit Pump #3**

- [a] If the voltage is greater than 11.5 volts, replace Electronic Unit Pump # 3.
- [b] If the voltage is less than 11.5 volts, go to step 3.
3. Measure the voltage between pin 2 of the Electronic Unit Pump #3 and ground.

- [a] If the voltage is greater than 11.5 volts, repair the open between pin 12 of the 120-pin MCM connector and pin 1 of Electronic Unit Pump #3. Refer to section 47.1.2.1.
- [b] If the voltage is less than 11.5 volts, repair the open between pin 13 of the 120-pin MCM connector and pin 2 of Electronic Unit Pump #3. Refer to section 47.1.2.1.

### **47.1.2.1 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 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).

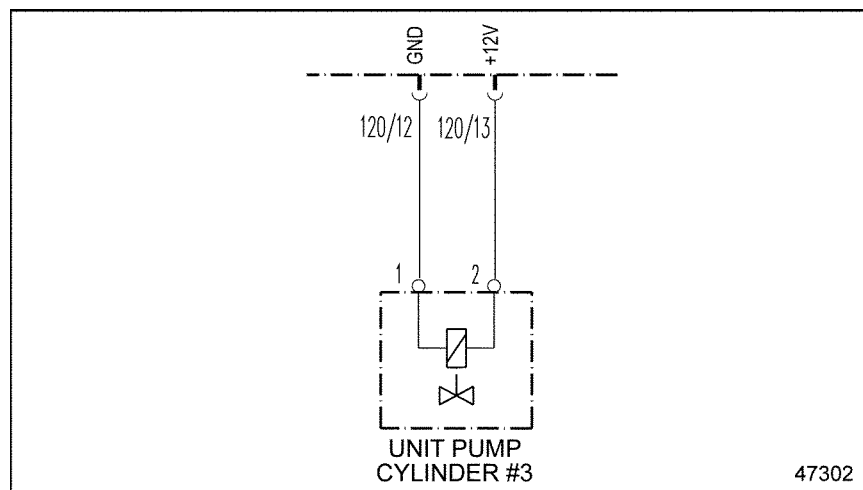
## 47.2 SPN 3661/FMI 10

This diagnostic condition is typically a short.

### 47.2.1 Check for Short

Check as follows:

1. Turn the ignition OFF.
2. Disconnect the 120-pin MCM connector.
3. Disconnect pins 1 and 2 of Electronic Unit Pump #3. See Figure 47-2.



**Figure 47-2 Electronic Unit Pump #3**

4. Measure the resistance between pins 1 and 2 of the Electronic Unit Pump #3 harness.
  - [a] If the resistance is less than 5  $\Omega$ , repair the short between pins 1 and 2 of the Electronic Unit Pump #3 harness and pins 12 and 13 of the 120-pin MCM connector. Refer to section 47.2.1.1.
  - [b] If the resistance is greater than 5  $\Omega$ , go to step 5.
5. Measure the resistance between pin 2 of the Electronic Unit Pump #3 harness and ground.
  - [a] If the resistance is less than 5  $\Omega$ , repair the short to ground between pin 2 of the Electronic Unit Pump #3 harness and pin 13 of the MCM 120-pin connector. Refer to section 47.2.1.1.
  - [b] If the resistance is greater than 5  $\Omega$ , repair the short to ground between pin 1 of the Electronic Unit Pump #3 harness and pin 12 of the MCM 120-pin connector. Refer to section 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 3661/10 is not logged but other codes are logged, troubleshoot the other codes.
  - [c] If code 3661/10 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313-592-5800).

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## **48 SPN 3662 - ELECTRONIC UNIT PUMP #4 NOT OPERATING NORMALLY**

<b>Section</b>	<b>Page</b>
48.1 SPN 3662/FMI 5 .....	48-3
48.2 SPN 3662/FMI 10 .....	48-5



## 48.1 SPN 3662/FMI 5

This diagnosis is typically the Electronic Unit Pump current is below normal or an open circuit fault.

### 48.1.1 Multiple Codes Check

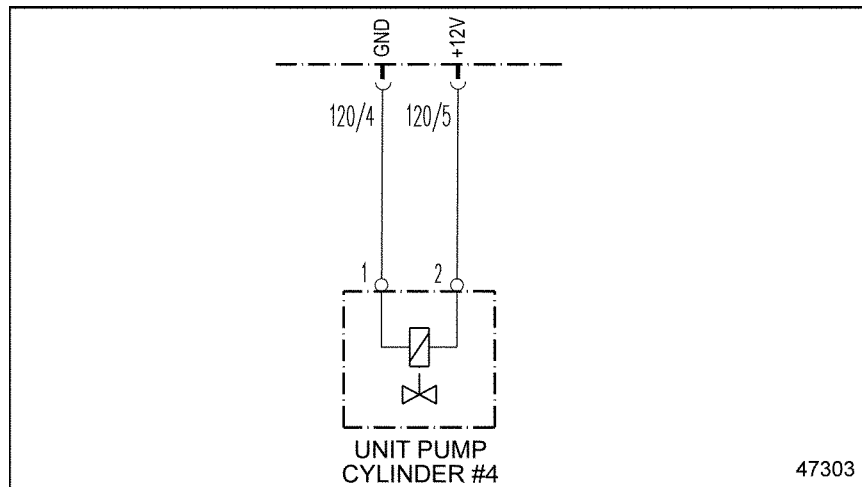
Check for multiple codes as follows:

1. Turn the vehicle ignition switch ON.
2. Plug in the diagnostic tool.
3. Read the active 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, contact the Detroit Diesel Customer Support Center (313-592-5800) for MCM replacement.
  - [c] If only fault code 3662/5 is active, refer to section 48.1.2.

### 48.1.2 Open Circuit Check

Check as follows:

1. The ignition should still be ON.
2. Measure the voltage between pins 1 and 2 of Electronic Unit Pump #4. See Figure 48-1.



**Figure 48-1 Electronic Unit Pump #4**

- [a] If the voltage is greater than 11.5 volts, replace Electronic Unit Pump #4.
- [b] If the voltage is less than 11.5 volts, go to step 3.
3. Measure the voltage between pin 2 of the Electronic Unit Pump #4 and ground.

- [a] If the voltage is greater than 11.5 volts, repair the open between pin 4 of the 120-pin MCM connector and pin 1 of Electronic Unit Pump #4. Refer to section 48.1.2.1.
- [b] If the voltage is less than 11.5 volts, repair the open between pin 5 of the 120-pin MCM connector and pin 2 of Electronic Unit Pump #4. Refer to section 48.1.2.1.

### **48.1.2.1 Verify Repairs**

Verify repairs as follows:

1. Turn the vehicle ignition OFF and reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
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).

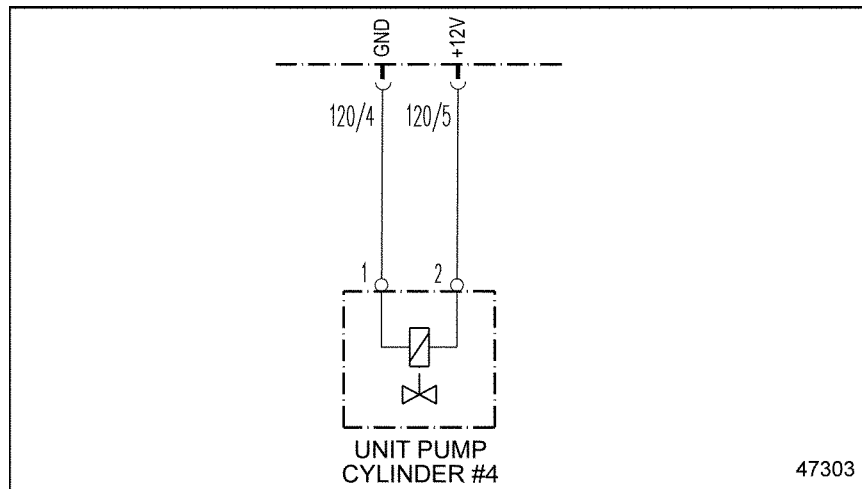
## 48.2 SPN 3662/FMI 10

This diagnostic condition is typically a short to ground.

### 48.2.1 Short to Ground Check

Check as follows:

1. Turn the ignition OFF.
2. Disconnect the 120-pin MCM connector.
3. Disconnect pins 1 and 2 of Electronic Unit Pump #4. See Figure 48-2.



**Figure 48-2 Electronic Unit Pump #4**

4. Measure the resistance between pins 1 and 2 of the Electronic Unit Pump #4 harness.
  - [a] If the resistance is less than 5  $\Omega$ , repair the short between pins 1 and 2 of the Electronic Unit Pump #4 harness and pins 4 and 5 of the 120-pin MCM connector. Refer to section 48.2.1.1.
  - [b] If the resistance is greater than 5  $\Omega$ , go to step 5.
5. Measure the resistance between pin 2 of the Electronic Unit Pump #4 harness and ground.
  - [a] If the resistance is less than 5  $\Omega$ , repair the short to ground between pin 2 of the Electronic Unit Pump #4 harness and pin 5 of the MCM 120-pin connector. Refer to section 48.2.1.1.
  - [b] If the resistance is greater than 5  $\Omega$ , repair the short to ground between pin 1 of the Electronic Unit Pump #4 harness and pin 4 of the MCM 120-pin connector. Refer to section 48.2.1.1.

### 48.2.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the vehicle ignition OFF and reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
  - [a] If no codes are present, troubleshooting is complete.
  - [b] If code 3662/10 is not logged but other codes are logged, troubleshoot the other codes.
  - [c] If code 3662/10 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313-592-5800).

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## **49 SPN 3663 - ELECTRONIC UNIT PUMP #5 NOT OPERATING NORMALLY**

<b>Section</b>	<b>Page</b>
49.1 SPN 3663/FMI 5 .....	49-3
49.2 SPN 3663/FMI 10 .....	49-5



## 49.1 SPN 3663/FMI 5

This diagnosis is typically the Electronic Unit Pump current is below normal or an open circuit fault.

### 49.1.1 Multiple Codes Check

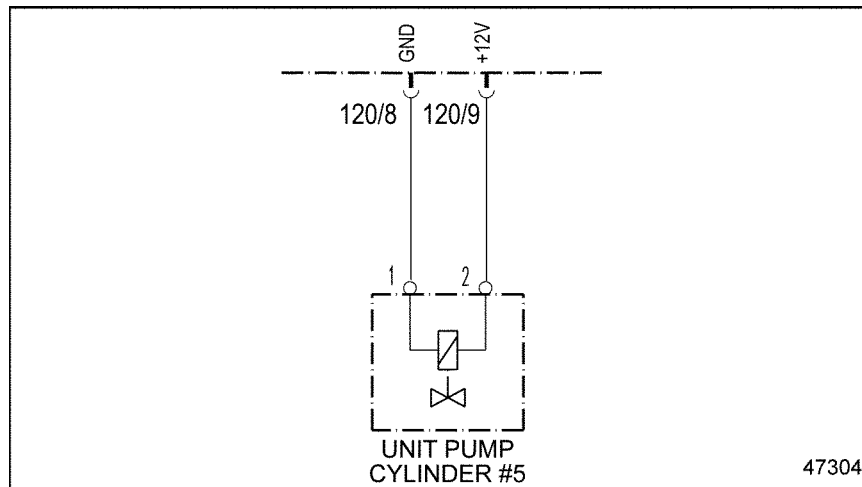
Check for multiple codes as follows:

1. Turn the ignition ON.
2. Plug in the diagnostic tool.
3. Read the active codes.
  - [a] If fault code 168/1 is active in addition to 3663/5, service 168/1 first. Refer to section 12.2.
  - [b] If fault 3662/5 and 3664/5 are active in addition to 3663/5, contact the Detroit Diesel Customer Support Center (313-592-5800) for MCM replacement.
  - [c] If only fault code 3663/5 is active, refer to section 49.1.2.

### 49.1.2 Open Circuit Check

Check as follows:

1. The ignition should still be ON.
2. Measure the voltage between pins 1 and 2 of Electronic Unit Pump #5. See Figure 49-1.



**Figure 49-1 Electronic Unit Pump #5**

- [a] If the voltage is greater than 11.5 volts, replace Electronic Unit Pump #5.
- [b] If the voltage is less than 11.5 volts, go to step 3.
3. Measure the voltage between pin 2 of the Electronic Unit Pump #5 and ground.

- [a] If the voltage is greater than 11.5 volts, repair the open between pin 8 of the 120-pin MCM connector and pin 1 of Electronic Unit Pump #5. Refer to section 49.1.2.1.
- [b] If the voltage is less than 11.5 volts, repair the open between pin 9 of the 120-pin MCM connector and pin 2 of Electronic Unit Pump #5. Refer to section 49.1.2.1.

### **49.1.2.1 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 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).

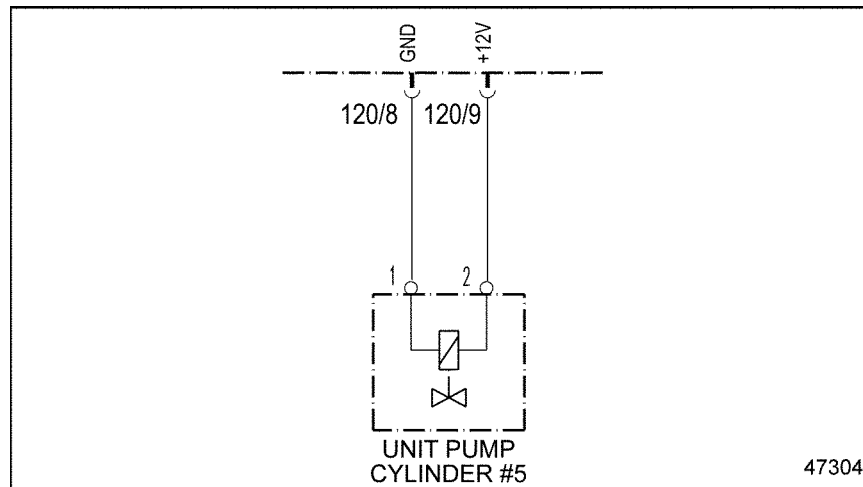
## 49.2 SPN 3663/FMI 10

This diagnostic condition is typically a short to ground.

### 49.2.1 Short to Ground Check

Check as follows:

1. Turn the ignition OFF.
2. Disconnect the 120-pin MCM connector.
3. Disconnect pins 1 and 2 of Electronic Unit Pump #5. See Figure 49-2.



**Figure 49-2 Electronic Unit Pump #5**

4. Measure the resistance between pins 1 and 2 of the Electronic Unit Pump #5 harness.
  - [a] If the resistance is less than 5  $\Omega$ , repair the short between pins 1 and 2 of the Electronic Unit Pump #5 harness and pins 8 and 9 of the 120-pin MCM connector. Refer to section 49.2.1.1.
  - [b] If the resistance is greater than 5  $\Omega$ , go to step 5.
5. Measure the resistance between pin 2 of the Electronic Unit Pump #5 harness and ground.
  - [a] If the resistance is less than 5  $\Omega$ , repair the short to ground between pin 2 of the Electronic Unit Pump #5 harness and pin 9 of the MCM 120-pin connector. Refer to section 49.2.1.1.
  - [b] If the resistance is greater than 5  $\Omega$ , repair the short to ground between pin 1 of the Electronic Unit Pump #5 harness and pin 8 of the MCM 120-pin connector. Refer to section 49.2.1.1.

### 49.2.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the vehicle ignition OFF and reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
  - [a] If no codes are present, troubleshooting is complete.
  - [b] If code 3663/10 is not logged but other codes are logged, troubleshoot the other codes.
  - [c] If code 3663/10 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313-592-5800).

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# 50 SPN 3664 - ELECTRONIC UNIT PUMP #6 NOT OPERATING NORMALLY

Section	Page
50.1 SPN 3664/FMI 5 .....	50-3
50.2 SPN 3664/FMI 10 .....	50-5



## 50.1 SPN 3664/FMI 5

This diagnosis is typically the Electronic Unit Pump current is below normal or an open circuit fault.

### 50.1.1 Multiple Codes Check

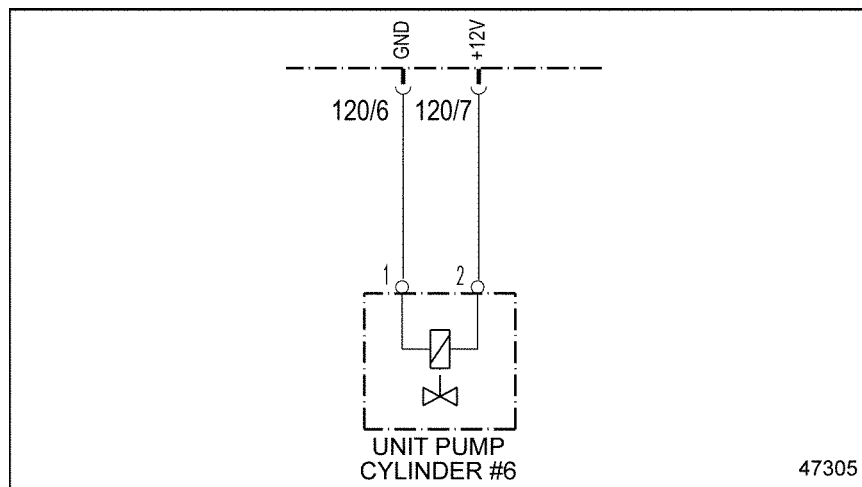
Check for multiple codes as follows:

1. Turn the ignition ON.
2. Plug in the diagnostic tool.
3. Read the active codes.
  - [a] If fault code 168/1 is active in addition to 3664/5, service 168/1 first. Refer to section 12.2.
  - [b] If fault 3662/5 and 3663/5 are active in addition to 3664/5, contact the Detroit Diesel Customer Support Center (313-592-5800) for MCM replacement. Refer to section 50.1.2.1.
  - [c] If only fault code 3664/5 is active, refer to section 50.1.2.

### 50.1.2 Open Circuit Check

Check as follows:

1. The ignition should still be ON.
2. Measure the voltage between pins 1 and 2 of Electronic Unit Pump #6. See Figure 50-1.



**Figure 50-1 Electronic Unit Pump #6**

- [a] If the voltage is greater than 11.5 volts, replace Electronic Unit Pump #6.
- [b] If the voltage is less than 11.5 volts, go to step 3.

3. Measure the voltage between pin 2 of the Electronic Unit Pump #6 and ground.
  - [a] If the voltage is greater than 11.5 volts, repair the open between pin 6 of the 120-pin MCM connector and pin 1 of Electronic Unit Pump #6. Refer to section 50.1.2.1.
  - [b] If the voltage is less than 11.5 volts, repair the open between pin 7 of the 120-pin MCM connector and pin 2 of Electronic Unit Pump #6. Refer to section 50.1.2.1.

### **50.1.2.1 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 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).

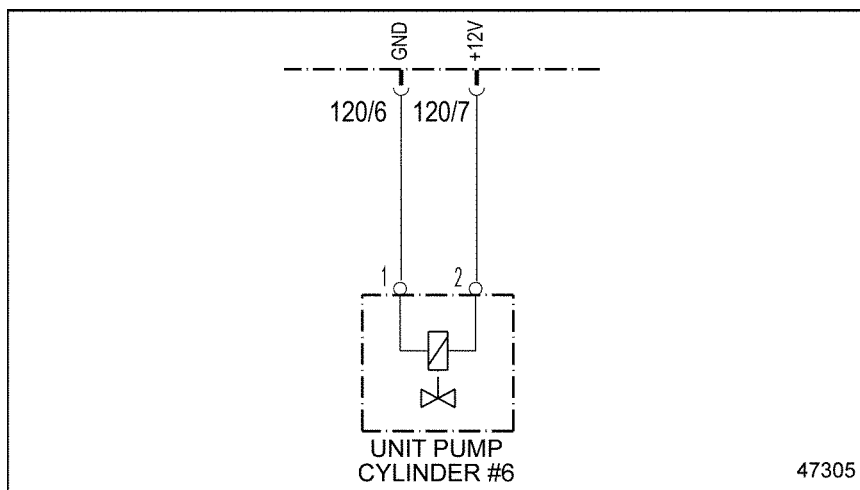
## 50.2 SPN 3664/FMI 10

This diagnostic condition is typically a short to ground.

### 50.2.1 Check for Short

Check as follows:

1. Turn the ignition OFF.
2. Disconnect the 120-pin MCM connector.
3. Disconnect pins 1 and 2 of Electronic Unit Pump #6. See Figure 50-2.



**Figure 50-2 Electronic Unit Pump #6**

4. Measure the resistance between pins 1 and 2 of the Electronic Unit Pump #6 harness.
  - [a] If the resistance is less than 5  $\Omega$ , repair the short between pins 1 and 2 of the Electronic Unit Pump #6 harness and pins 6 and 7 of the 120-pin MCM connector. Refer to section 50.2.1.1.
  - [b] If the resistance is greater than 5  $\Omega$ , go to step 5.
5. Measure the resistance between pin 2 of the Electronic Unit Pump #6 harness and ground.
  - [a] If the resistance is less than 5  $\Omega$ , repair the short to ground between pin 2 of the Electronic Unit Pump #6 harness and pin 7 of the MCM 120-pin connector. Refer to section 50.2.1.1.
  - [b] If the resistance is greater than 5  $\Omega$ , repair the short to ground between pin 1 of the Electronic Unit Pump #6 harness and pin 6 of the MCM 120-pin connector. Refer to section 50.2.1.1.

### 50.2.1.1 Verify Repairs

Verify repairs as follows:

1. Turn the vehicle ignition OFF and reconnect all connectors.
2. Turn the vehicle ignition ON, and clear codes.
3. Start and run the engine for one minute. Stop the engine.
4. Check for codes
  - [a] If no codes are present, troubleshooting is complete.
  - [b] If code 3664/10 is not logged but other codes are logged, troubleshoot the other codes.
  - [c] If code 3664/10 and other codes are logged repeat troubleshooting procedure. If no error is found, contact the Detroit Diesel Customer Support Center (313-592-5800).

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# 51 CPC DIGITAL OUTPUTS SPN/FMI

Section	Page
51.1 CPC DIGITAL OUTPUT FAULT CODES .....	51-3
51.2 TROUBLESHOOTING THE CPC DIGITAL OUTPUTS .....	51-3



## 51.1 CPC DIGITAL OUTPUT FAULT CODES

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

## 51.2 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 51-1.

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 51-1 CPC Digital Output Faults**

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# INDEX

## C

- Common Powertrain Controller, 2-13
  - Connectors, 2-21
- Common Powertrain Controller (CPC)
  - environmental conditions, 2-15
- Conduit and Loom, 2-39
  - Criteria, 2-39
- Connectors
  - deutsch connector, 2-23

## D

- Deutsch Connectors, 2-26
- Deutsch Terminals
  - installation, 2-26
  - removal, 2-28

## E

- Engine Harness (EH)
  - 120-pin connector, MBE 900, 2-5

## I

- Introduction, 1-3

## M

- Motor Control Module (MCM)
  - 120-pin connector, MBE 900, 2-5
  - 120-pin connector, mbe900, 2-5-2-8
  - 21-pin connector, 2-10

## S

- Safety Precautions, 1-6
  - Batteries, 1-13
  - Cleaning Agent, 1-14
  - Detroit Diesel Diagnostic Link, 1-14
  - Ether Start, 1-8
  - Exhaust (Start/Run Engine), 1-9

- Fire, 1-14
- Fuel, 1-12
- Glasses, 1-9
- Optimized Idle, 1-16
- Pressurized Fluids, 1-11
- Welding, 1-10
- Working on a Running Engine, 1-15
- SPN 100/FMI 1, 7-3
  - Check Low Oil Pressure, 7-3
- SPN 100/FMI 14, 7-9
  - Check for Multiple Codes, 7-9
  - Check Oil Pressure, Oil Pump and Oil Gauges, 7-9
- SPN 100/FMI 2, 7-5
  - Check for Erratic Data From the Engine Oil Pressure Switch, 7-5
- SPN 100/FMI 3, 7-6
  - Check for Open Short to Ground, 7-6
- SPN 100/FMI 4, 7-8
  - Check for an Open Short to Ground, 7-8
- 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, 8-6
  - 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, 8-8
- SPN 110, 9-3
  - Multiple Code Check, 9-3
- SPN 110/FMI 14, 9-8
  - Check for Multiple Codes, 9-8
  - System Checks to Resolve Fault, 9-8

- SPN 110/FMI 3
  - Open Circuit Check, 9-5
- SPN 110/FMI 4, 9-7
  - Check for Short to Ground, 9-7
- SPN 1172/FMI 3, 38-3
  - Check for Open, 38-3
  - Resistance and Voltage Check, 38-3
- SPN 1172/FMI 4, 38-5
  - Short Circuit Check, 38-5
- SPN 1176/FMI 3, 39-3
  - Check for a Short to Power, 39-3
- SPN 1176/FMI 4, 39-5
  - Open or Short Circuit Check, 39-5
- SPN 1636 /FMI 2, 40-3
  - Erratic Data Source Check, 40-3
- SPN 1636/FMI 14, 40-7
  - Temperature Check, 40-7
- SPN 1636/FMI 3, 40-4
  - Short to Power Check, 40-4
- SPN 1636/FMI 4, 40-6
  - Intake Manifold Pressure/Temp Sensor Short to Ground, 40-6
- SPN 168/FMI 0, 12-3
  - Measure Battery Voltage, 12-3
- SPN 174/FMI 3, 13-3
  - Check for Multiple Codes, 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 Short to Power, 14-4
- SPN 175/FMI 4, 14-5
  - Check for Short to Ground, 14-5
- SPN 2629/FMI 3, 41-3

- Open Circuit Check, 41-3
- SPN 2629/FMI 4, 41-4
  - Short Circuit Check, 41-4
- SPN 27/FMI 0/1/2/14, 3-5
  - Valve Function Check, 3-5
- SPN 27/FMI 3, 3-3
  - Short to Ground Check, 3-3
- SPN 27/FMI 4, 3-4
  - Short Circuit Check, 3-4
- SPN 2791/FMI 3, 42-3
  - Resistance and Voltage Check, 42-3
  - Short Circuit Check, 42-3
- SPN 2791/FMI 4, 42-5
  - Resistance and Voltage Check, 42-5
  - Short Circuit Check, 42-5
- SPN 2791/FMI 5, 42-6
  - Open Circuit Check, 42-6
- SPN 3510/FMI 2, 43-3
  - Erratic Data Check, 43-3
- SPN 3510/FMI 3, 43-5
  - High Voltage Check, 43-5
- SPN 3510/FMI 4, 43-6
  - Low Voltage Check, 43-6
- SPN 3563/FMI 0/1/2, 44-3
  - Code Check, 44-3
  - Erratic Data Check, 44-4
  - Low (Boost) Pressure Check, 44-3
- SPN 3563/FMI 3, 44-6
  - Short to Power Check, 44-6
- SPN 3563/FMI 4, 44-8
  - Open or Short to Ground Check, 44-8
- SPN 3659/FMI 10
  - Check for Short to Ground, 45-5
- SPN 3659/FMI 5, 45-3
  - Check for Multiple Codes, 45-3

- Check for Open Circuits, 45-3
- SPN 3660/FMI 10, 46-5
  - Check for Short, 46-5
- SPN 3660/FMI 5
  - Check for Multiple Codes, 46-3
  - Check for Open Circuits, 46-3
- SPN 3661/FMI 10, 47-5
  - Check for Short to Ground, 47-5
- SPN 3661/FMI 5, 47-3
  - Check for Multiple Codes, 47-3
  - Check for Open Circuits, 47-3
- SPN 3662/FMI 10, 48-5
  - Check for Short, 48-5
- SPN 3662/FMI 5, 48-3
  - Check for Multiple Codes, 48-3
  - Check for Open Circuits, 48-3
- SPN 3663/FMI 10, 49-5
  - Check for Short, 49-5
- SPN 3663/FMI 5, 49-3
  - Check for Multiple Codes, 49-3
  - Check for Open Circuits, 49-3
- SPN 3664/FMI 10, 50-5
  - Check for Short to Ground, 50-5
- SPN 3664/FMI 5, 50-3
  - Check for Multiple Codes, 50-3
  - Check for Open Circuits, 50-3
- SPN 558/FMI 12
  - Short to Ground Check, 16-5
- SPN 558/FMI 3, 16-3
  - Open Circuit Check, 16-3
- SPN 558/FMI 4, 16-5
- SPN 599/FMI 12, 17-3
  - Short to Ground Check, 17-3
- SPN 601/FMI 12, 18-3
  - Short to Ground Check, 18-3

- SPN 609/FMI 12, 19-3
  - MCM Parameter Check, 19-3
- SPN 609/FMI 14, 19-4
  - MCM Check, 19-4
- SPN 615/FMI 3, 20-3
  - Multiple Codes Check, 20-3
  - Short to Power Check, 20-3
- SPN 615/FMI 4, 20-4
  - Open/Short to Ground Check, 20-4
- SPN 625/FMI 2,9,10,13,14, 22-3
  - Data Link Check, 22-3
- SPN 625/FMI 4, 22-5
  - Short Circuit Check, 22-5
- SPN 636/FMI 1, 23-3
  - Low Signal Voltage Check, 23-3
- SPN 636/FMI 3, 23-5
  - Crankshaft Position Sensor Gap Check, 23-6
  - Open Circuit Check, 23-5
- SPN 636/FMI 4, 23-7
  - Short to Ground Check, 23-7
- SPN 636/FMI 7, 23-9
  - Signal Check, 23-9
- SPN 636/FMI 8, 23-10
  - Multiple Code Check, 23-10
  - Sensor Time Out Check, 23-11
- SPN 651/FMI 10, 24-5
  - Short to Ground Check, 24-5
- SPN 651/FMI 5, 24-3
  - Open Circuit Check, 24-3
- SPN 652/FMI 10, 25-5
  - Short to Ground Check, 25-5
- SPN 652/FMI 5, 25-3
  - Check for Open Circuits with the Ignition OFF, 25-3
- SPN 653/FMI 10, 26-5
  - Short to Ground Check, 26-5

- SPN 653/FMI 5, 26-3
  - Open Circuit Check, 26-3
- SPN 654/FMI 10, 27-5
  - Check for Short to Ground, 27-5
- SPN 654/FMI 5, 27-3
  - Open Circuit Check, 27-3
- SPN 655/FMI 10, 28-5
  - Short to Ground Check, 28-5
- SPN 655/FMI 5, 28-3
  - Open Circuit Check, 28-3
- SPN 656/FMI 10, 29-5
  - Short to Ground Check, 29-5
- SPN 656/FMI 5, 29-3
  - Open Circuit Check, 29-3
- SPN 704/FMI 3, 31-3
  - Short to Power Check, 31-3
- SPN 704/FMI 4, 31-4
  - Short Circuit Check, 31-4
- SPN 704/FMI 5, 31-6
  - Open Circuit Check, 31-6
- SPN 709/FMI 3, 33-3
  - Short to Power Check, 33-3
  - Voltage Check, 33-3
- SPN 709/FMI 4, 33-5
  - Short to Ground Check, 33-5
- SPN 709/FMI 5, 33-6
  - Open Circuit Check, 33-6
- SPN 723
  - Swapped Pins Check, 36-7
  - Time Out Check, 36-6
- SPN 723/FMI 3
  - Open Circuit Check, 36-3
- SPN 723/FMI 4
  - Short to Ground Check, 36-5
- SPN 729/FMI 3, 35-3

Short to Power/Open Check, 35-3

SPN 729/FMI 4, 35-5

Short to Ground Check, 35-5

SPN 84/FMI 3, 4-3

Check for Open, 4-3

Check for Short, 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, 6-6

Check for Low Voltage, 6-6

SPN 975/FMI 3, 37-3

Short to Power Check, 37-3

Voltage Check, 37-3

SPN 975/FMI 5, 37-6

Open Circuit Check, 37-6

## 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

Troubleshooting Add Engine Coolant Level Sensor

Test Repair, 10-9

Troubleshooting SPN 110/FMI 2, 9-4

Rationality Check, 9-4

Troubleshooting SPN 158

158 01 – Battery Voltage Switched — Low, 11-4

Troubleshooting SPN 3660/FMI 5, 46-3

Troubleshooting SPN 588/FMI 1

IVS Wiring Check, 16-3

Troubleshooting SPN 601/FMI 12

Check

Verify Repairs, 18-3

Troubleshooting SPN 723, 36-3

Troubleshooting SPN 84/FMI 3

Check

Verify Repairs, 4-3

## **W**

Wires

recommendations, 2-25

requirements, 2-25