6SE422 JULY 2004

Troubleshooting Guide

MBE Electronic Controls

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CALIFORNIA
Proposition 65 Warning

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

ENGINE EXHAUST

Consider the following before servicing engines:

WARNING:

PERSONAL INJURY

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

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

TABLE OF CONTENTS

ABSTRACT

This manual provides instruction for troubleshooting the **MBE Electronics System**.

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.

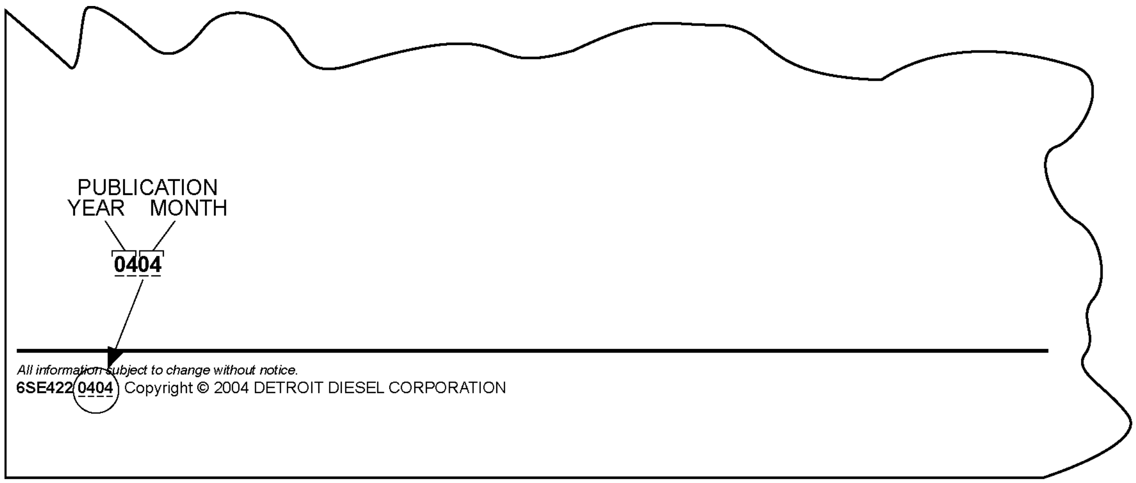
If part replacement is necessary, the part must be replaced with one of the same part number or with an equivalent part number. Do not use a replacement part of lesser quality. The service procedures recommended and described in this manual are effective methods of performing repair. Some of these procedures 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.

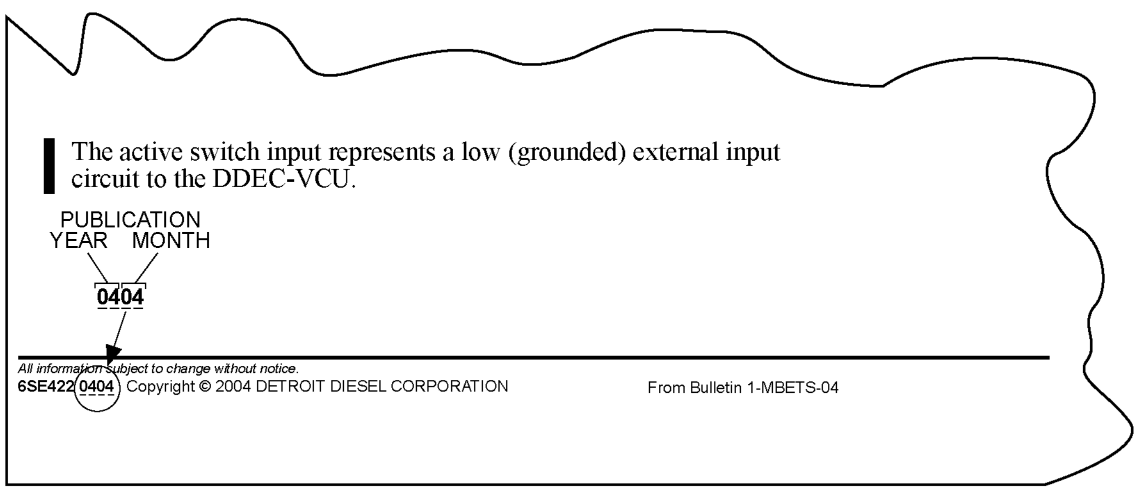
REVISION NOTIFICATION

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

Revisions to this manual will be published 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

1 INTRODUCTION

Section		Page

1.1 INTRODUCTION

Detroit Diesel Corporation (DDC) is the world leader in 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.

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

1.2 TROUBLESHOOTING INFORMATION

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 "Contact Detroit Diesel Technical Service" 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 FAX number for Detroit Diesel Technical Service is 313-592-7888.

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.

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.

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.

1.3 SAFETY PRECAUTIONS

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

1.3.1 Exhaust (Start/Run Engine)

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

WARNING:

PERSONAL INJURY

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

WARNING:

PERSONAL INJURY

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

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

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.

1.3.2 Glasses

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

CAUTION:
EYE INJURY
To avoid injury from flying debris, wear a face shield or goggles.

1.3.3 Welding

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

WARNING:

PERSONAL INJURY

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

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

WARNING:

FIRE

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

1.3.4 Pressurized Fluids

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

WARNING:

PERSONAL INJURY

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

WARNING:

PERSONAL INJURY

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

1.3.5 Fuel

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

WARNING:

FIRE

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

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

WARNING:

FIRE

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

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

WARNING:

FIRE

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

1.3.6 Batteries

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

WARNING:

BATTERY EXPLOSION AND ACID BURN

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

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

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

WARNING:

PERSONAL INJURY

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

1.3.7 Fire

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

WARNING:

FIRE

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

1.3.8 Cleaning Agent

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

WARNING:

PERSONAL INJURY

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

1.3.9 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.

1.3.10 Optimized Idle

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

CAUTION:

UNEXPECTED ENGINE START

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

WARNING:

PERSONAL INJURY

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

2 ELECTRONIC COMPONENTS AND WIRING SCHEMATICS

Section **Page**

2.1 OVERVIEW

MBE Electronic Controls require several electronic control units and their harnesses.

The engine control system monitors and determines all values which are required for the operation of the engine. The engine-resident control unit is the PLD-MR (refer to section 2.2).

The vehicle control system monitors the vehicle systems. The vehicle control system broadcasts all information on the J1587 and J1939 Data Links, where it can be read by minidiag2. The vehicle control system module is the DDEC-Vehicle Control Unit (DDEC-VCU), refer to section 2.3.

The harnesses connect the electronic control units to sensors and switches, injectors, and miscellaneous application devices like throttle controls, instrument panel gages and lights. This section describes the functionality of the harnesses and the electronic control units.

2.2 PLD-MR – ENGINE-RESIDENT CONTROL UNIT

The PLD-MR monitors and determines all values which are required for the operation of the engine.

The PLD-MR control unit (see Figure 2-1) is located on the left-hand side of the engine.

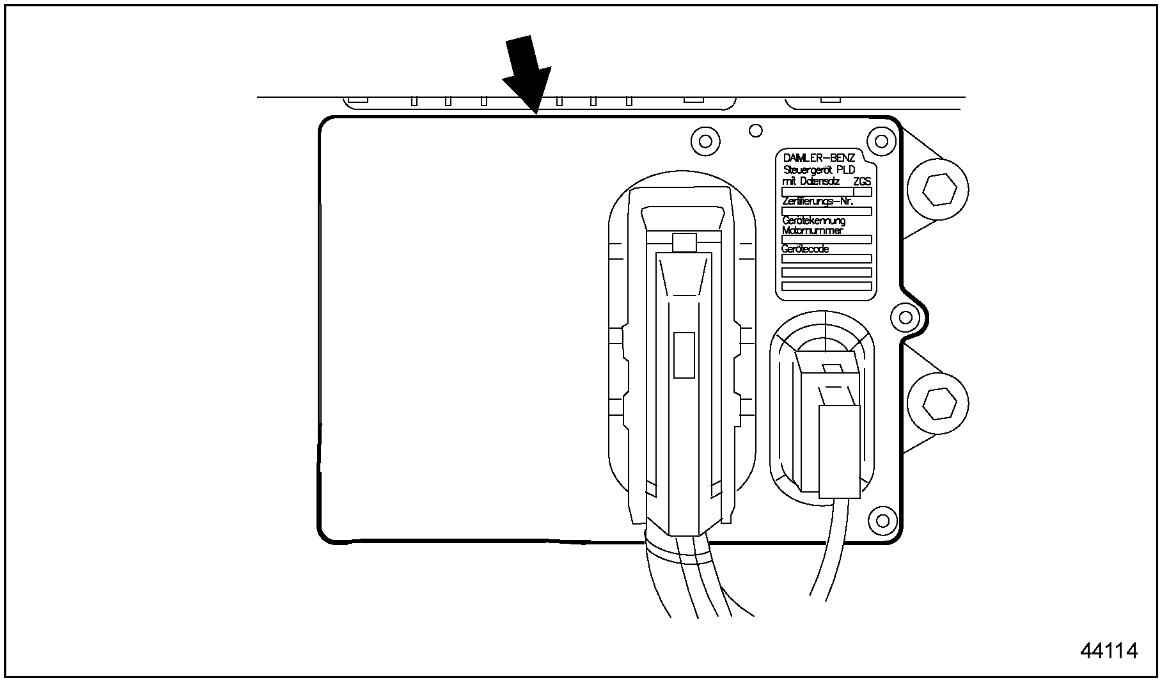


Figure 2-1 PLD-MR Control Unit on Engine

The PLD-MR processes the data received from the DDEC-VCU for engine control management.

The data is then compared to the parameters stored in the PLD-MR.

From these data, quantity and timing of injection are calculated and the unit pumps are actuated accordingly through the solenoid valves.

The part numbers for the PLD-MR versions in production in NAFTA are listed in Table 2-1.

PLD-MR	Part Number	Software Version
D21	000 446 78 40	Rel. 53 (12/24 V), 4 cylinder
D21	000 446 74 40	Rel. 53 (12/24 V), 6 cylinder
D3	000 446 85 40	Rel. 56 (12/24 V), 4 cylinder
D3	000 446 84 40	Rel. 56 (12/24 V), 6 cylinder

Table 2-1 PLD-MR Part Numbers and Software Versions

NOTE:
To obtain a replacement control unit, all the data given on the control unit data plate are required (see Figure 2-2).

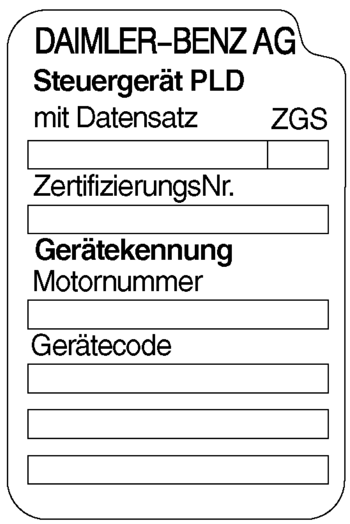


Figure 2-2 PLD-MR Control Unit Data Plate

2.2.1 Environmental Conditions

Temperature, atmospheric conditions, and vibration must be considered. The PLD-MR is resistant to all fluids and toxic gases occurring in the engine compartment.

2.2.1.1 Temperature

The ambient operating temperature range is -40 to 125°C (-40 to 257°F).

2.2.1.2 Vibration

The vibration load for the PLD-MR is maximum 3 g at 10 Hz – 1000 Hz with damping elements.

2.2.1.3 Water Intrusion

The PLD-MR can be exposed to steam cleaning and pressure washing. Care should be taken not to pressure spray the connectors.

2.2.2 Engine Sensor Harness

The Engine Sensor Harness (ESH) is factory installed and delivered connected to the engine sensors and the PLD-MR. See Figure 2-3 and Figure 2-4 for the MBE 900 ESH for non-EGR and EGR engines. See Figure 2-5 for the MBE 4000 ESH (non-EGR).

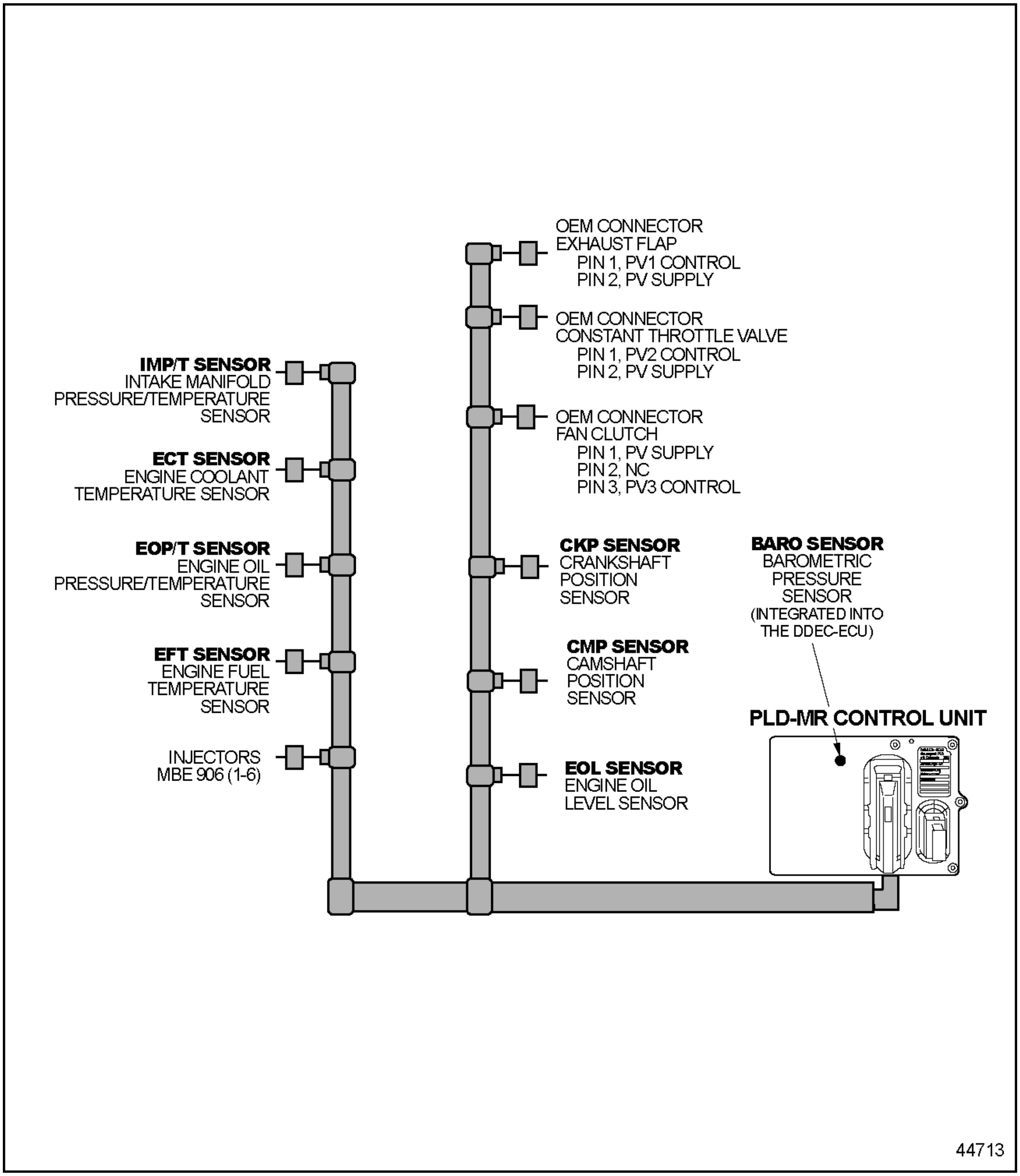


Figure 2-3 Typical On-Highway MBE 900 Engine Harness — Non-EGR Engine

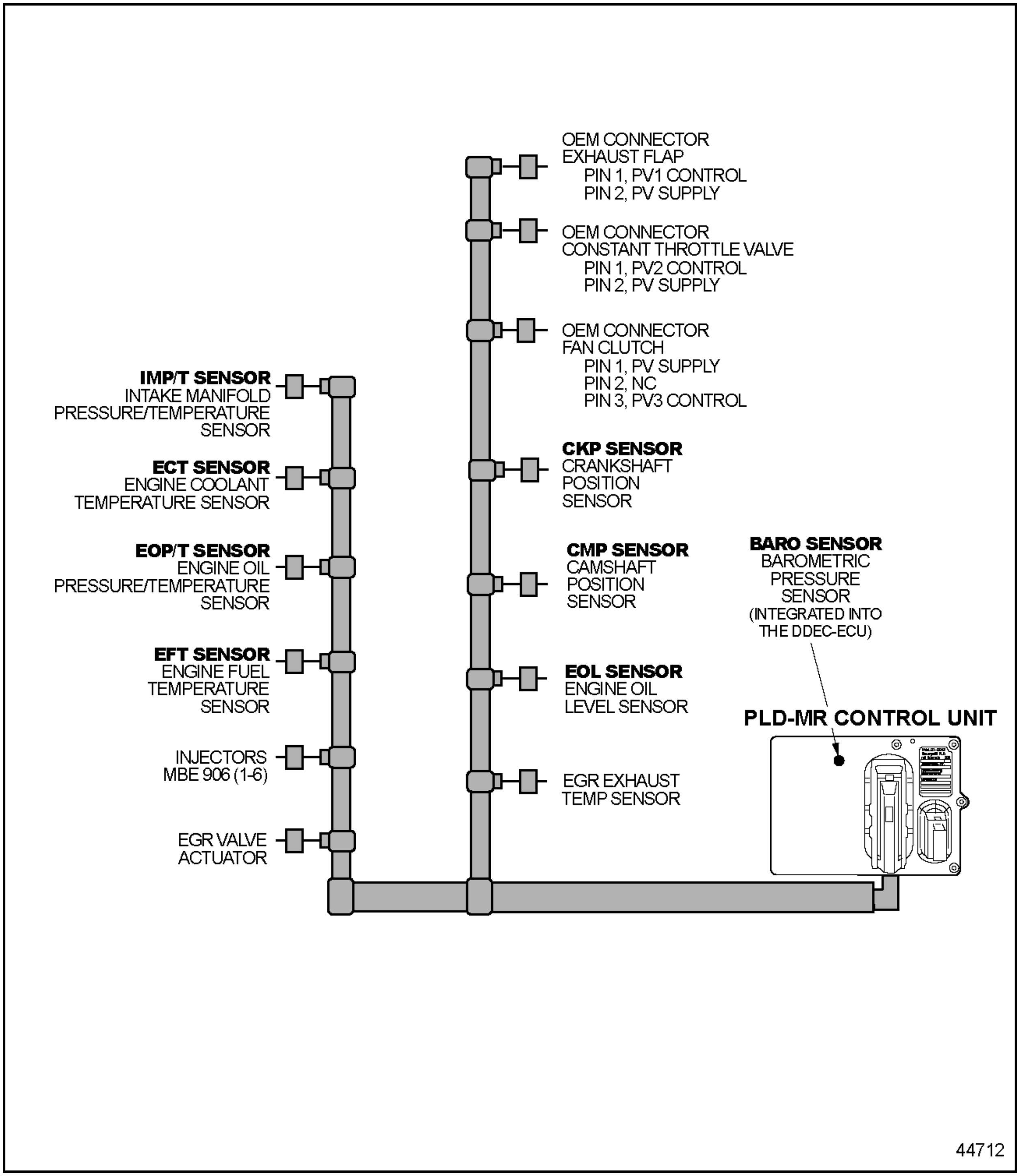


Figure 2-4 Typical On-Highway MBE 900 Six-cylinder Engine Harness — EGR Engine

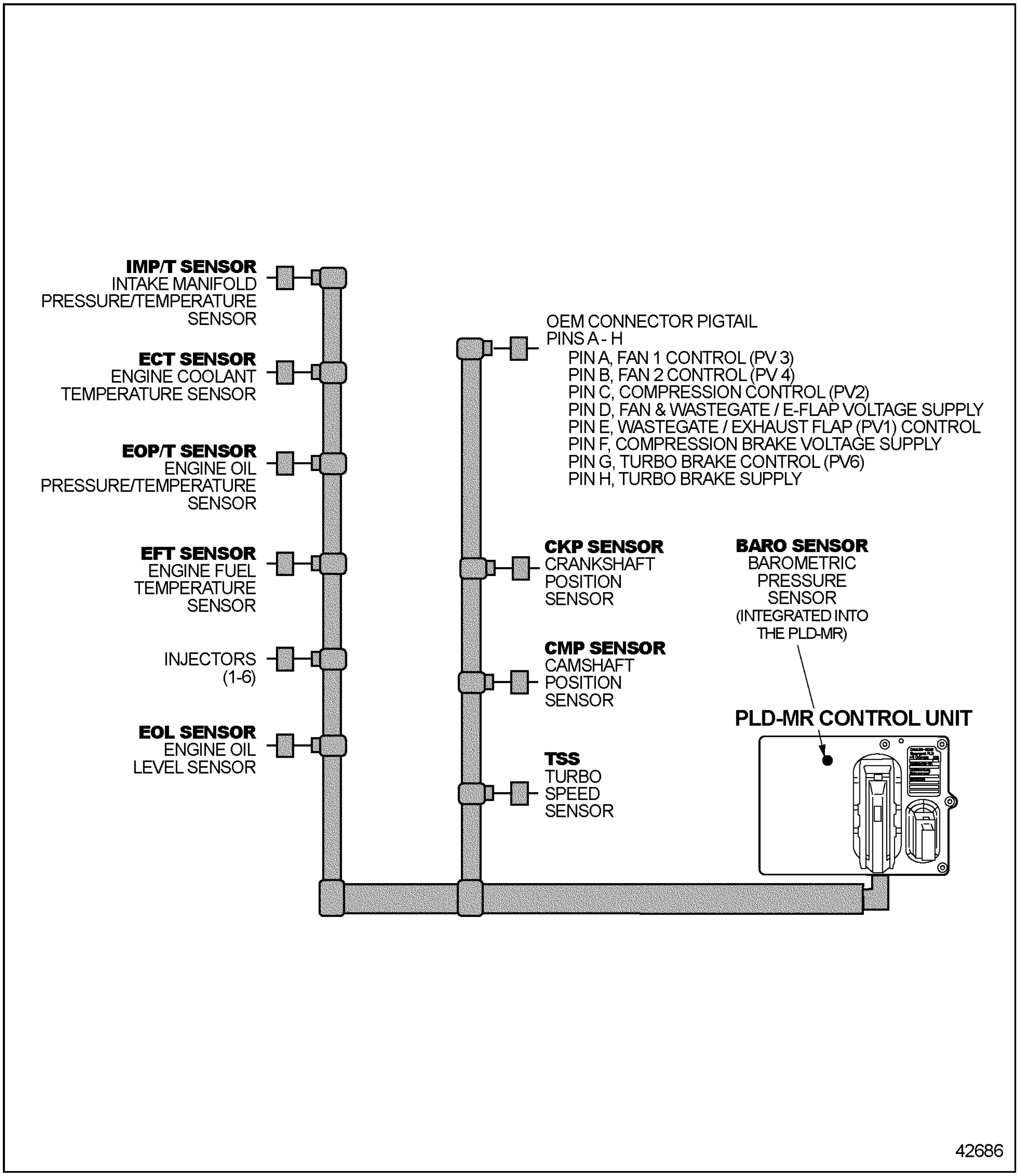


Figure 2-5 Typical MBE 4000 Engine Harness — Non-EGR Engine

The wiring for the 55-pin ESH connector to the PLD-MR is listed in Table 2-2 , Table 2-3 and Table 2-4. The side of the connector shown is looking into the pins.

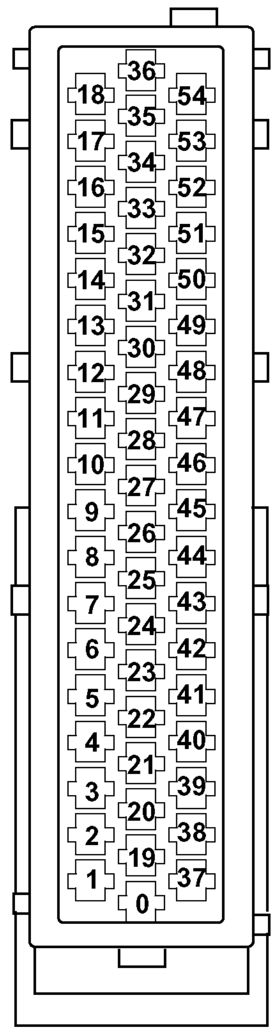
Pin	Wire Color		Signal Type	Function	Connector
	900	4000			
0	N/A	N/A	Digital Input	Oil Separator Diagnosis	 42708 Front Looking into the Pins
1	Blk/Yel	Blk/Yel	Sensor Return	Camshaft Position (CMP) Sensor (-)	
2	Blk/Viol	Blk/Viol	Sensor Return	Crankshaft Position (CKP) Sensor (-)	
3	Wht/Yel	Wht/Yel	Sensor Return	Engine Coolant Temp Sensor	
4	Brn/Grn	Brn/Grn	Sensor Return	Supply Fuel Temp Sensor	
5	N/A	Grn/Wht	Sensor Return	Passive Engine Oil Press / Booster / Fan Speed Sensor	
6	Brn/Gray	Wht/Blk	Sensor Supply	Active Engine Oil Press Sensor	
7	Grn	Grn	Sensor Supply	Intake Manifold Press Sensor	
8	N/A	N/A	Frequency Input	Turbo Speed No. 2 Sensor	
9	Red/Blu	Red/Blu	Injector Return	Injector Valves Bank 2 (B - D - F - H)	
10	Gray/Yel	N/A	Sensor Return	Active Engine Oil Press Sensor Alternative Oil Combination Sensor, each w/ Speed Sensor	
11	N/A	Brn/Wht	Output Return	Proportional Valve - Ground	
12	Red/Blk	Brn/Red	Output Supply	Proportional Valve Bank (PV 1 - 4)*	
13	N/A	N/A	Sensor Supply	Optional Fuel Press / P3	
14	N/A	N/A	Sensor Supply	Scavenging Gradient Sensor / Fan Speed Sensor	
15	Brn/Wht	Gray/Yel	Sensor Return	Engine Oil Temp / Scavenging Gradient Sensor	
16	Red/Grn	Red/Grn	Injector Return	Injector Valve Bank 1 (A - C - E - G)	
17	N/A	N/A	Frequency Input	Fan Speed Sensor	
18	N/A	N/A	High Side Control Output	Starter	
19	Brn/Viol	Brn/Viol	Frequency Input	CKP Sensor (+)	
20	Brn/Yel	Brn/Yel	Frequency Input	CMP Sensor (+)	
21	Grn/Yel	N/A	Sensor Return	Intake Manifold Temp Sensor	
22	N/A	N/A	Sensor Return	Optional Fuel Pressure	
23	N/A	Blu	Sensor Return	Intake Manifold Press Sensor	
24	N/A	Grn/Viol	Frequency Input	Turbo Speed No. 1 Sensor	
25	N/A	N/A	Digital Input	Service Engine Switch - Start	
26			Digital Input	Passive Engine Oil Press Sensor	
27	N/A	N/A	High Side Control	Proportional Valve 5	

Table 2-2 Engine Harness – Pins 0–27

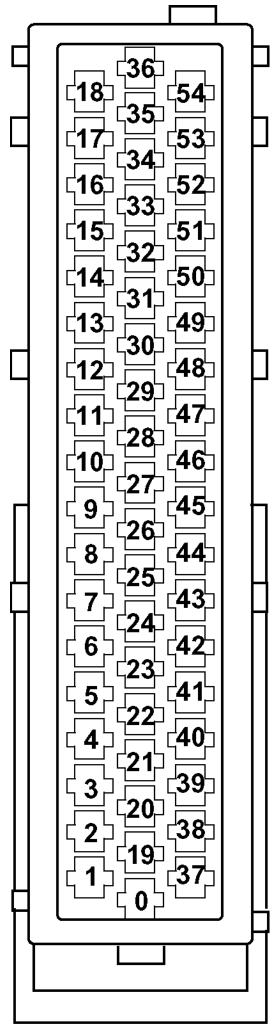
Pin	Wire Color		Signal Type	Function	Connector
	900	4000			
28	N/A	N/A	Analog Input	Optional Fuel Pressure	 42708 Front Looking into the Pins
29	Viol	Viol	Analog Input	Intake Manifold Pressure Sensor	
30	N/A	N/A	Sensor Supply	Service Engine Switch (Start/Stop)	
31	N/A	N/A	Analog Input	Optional Press Gradient (Boost/Exhaust)	
32	Grn/Blu	Brn/Gray	Analog Input	Active Engine Oil Press Sensor	
33	Wht	Wht	Analog Input	Engine Oil Level (EOL) Sensor	
34	Red/Yel	Red/Yel	Analog Input	Engine Coolant Temp Sensor	
35	N/A	N/A	Digital Input	Service Engine Switch - Stop	
36	Brn/Blu	Brn/Blu	Analog Input	Supply Fuel Temp Sensor	
37	N/A	N/A	Injector Output – High Side	Injector/Solenoid Valve H	
38	Wht/Blu	Wht/Blu	Injector Output – High Side	Injector/Solenoid Valve F	
39	Gray/Brn	Gray/Brn	Analog Input	Engine Oil Temp Sensor	
40	N/A	Brn/Blk	PWM/Digital Output – Low Side	Proportional Valve 6	
41	Blu/Wht	Red	PWM/Digital Output – Low Side	Proportional Valve 3	
42	N/A	Blu/Blk	Sensor Supply	Proportional Valve 6	
43	Blu/Red	Blk/Wht	PWM/Digital Output – Low Side	Proportional Valve 4*	
44	Gray/Yel	Wht/Blu	Injector Output – High Side	Injector/Solenoid Valve D	
45	Gray/Viol	Gray/Grn	Injector Output – High Side	Injector/Solenoid Valve B	
46	N/A	N/A	Injector Output – High Side	Injector/Solenoid Valve G	
47	Gray/Blu	Gray/Viol	Injector Output – High Side	Injector/Solenoid Valve E	
48	Brn	Brn	Analog Input	Intake Manifold Temp Sensor	
49	Yel	Yel	Sensor Return	EOL Sensor	
50	Grn/Wht	Gray/Viol	PWM/Digital Output – Low Side	Proportional Valve 2	

Table 2-3 Engine Harness – Pins 28–50

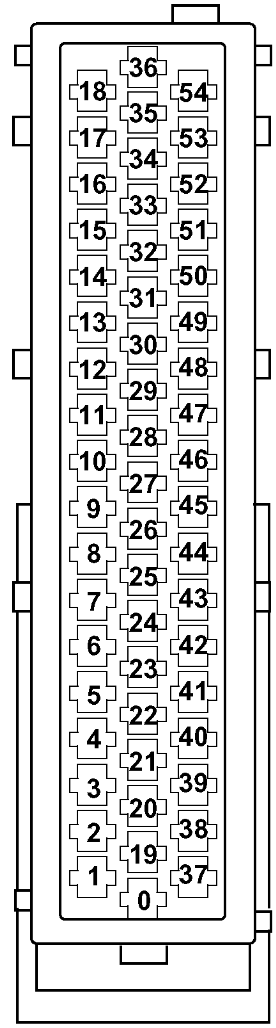
Pin	Wire Color		Signal Type	Function	Connector
	900	4000			
51	Red/Wht	Wht/Red	PWM/Digital Output – Low Side	Proportional Valve 1	 42708 Front Looking into the Pins
52	Brn/Red	Gray/Viol	Output Supply	Proportional Valve 2	
53	Gray/Grn	Gray/Blu	Injector Output – High Side	Injector/Solenoid Valve C	
54	Gray/Blk	Gray/Blk	Injector Output – High Side	Injector/Solenoid Valve A	

Table 2-4 Engine Harness – Pins 51–54

2.2.3 Power Supply

NOTE:
The PLD-MR and DDEC-VCU must be powered from the same battery voltage source.

The voltage supply for the PLD-MR is listed in Table 2-5.

Voltage Supply	Voltage Version	
	24 V	12 V
Nominal Voltage	22 V ≤ V≤ 30 V	11 V ≤ V≤ 16 V
Low Voltage	8 V ≤ V≤ 22 V Limited Operating Range	6.5 V ≤ V≤ 11 V Limited Operating Range
Overload Switch-off	V > 33 V	V > 33 V

Table 2-5 PLD-MR Voltage Supply

The polarity/overload protection for the PLD-MR is listed in Table 2-6.

Polarity/Overload Protection	Voltage Version	
	24 V	12 V
Polarity Protection	Continuous polarity of battery (+) and battery (-) without damage of system	Continuous polarity of battery (+), battery (-) and ignition without damage of system
Overload Resistance	58 V	58 V
Overload Resistance	100 V (see SAE J1455)	100 V (see SAE J1455)

Table 2-6 PLD-MR Polarity/Overload Protection

The current consumption for the PLD-MR is listed in Table 2-7.

Current Consumption	Voltage Version	
	24 V	12 V
Peak Power Consumption (without solenoid drivers)	8.0 A cyclic, depending on engine rpm and series	12.5 A cyclic, depending on engine rpm and series
Standby Voltage Supply (ignition off and after completion backup phase)	I < 1 mA	I < 1 mA

Table 2-7 PLD-MR Current Consumption

The short circuit recognition thresholds for the PLD-MR are listed in Table 2-8.

Short Circuit Recognition Thresholds	Voltage Version	
	24 V	12 V
Ground Short	20 A	20 A
Starter to Ground	2.5 A	2.5 A
Solenoid Valve to Return Line	32 A	32 A
Proportional Valve Supply to Ground	14 A	14 A
Proportional Valve to Ground *	2 A	2 A

* Open circuit fault greater than 40 kΩ resistance

Table 2-8 PLD-MR Short Circuit Recognition Thresholds

2.2.4 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 PLD-MR's maximum voltage of 32 volts.

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 PLD-MR is damaged during a reverse battery condition

Bussmann ATC-40 and Delphi Packard Electric Systems MaxiFuse 40 amp rated fuses or equivalent will satisfy these requirements. Acceptable blow times versus current and temperature derating characteristics are listed in listed in Table 2-9 and listed in Table 2-10.

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

Table 2-9 Fuse Current and Blow Time

Temperature	% of Rated Fuse Current
-40°C (-40°F)	110% max
+25°C (+77°F)	100%
+120°C (+248°F)	80% min

Table 2-10 Fuse Temperature and Current

2.2.5 Proportional Valve Control

The proportional valve control on the PLD-MR controls external setting and switching elements. The output function of the proportional valves is determined by the configuration. The outputs of the control unit can be configured as pulse width modulated (PWM) or digital outputs. The proportional valve control outputs can be enabled or disabled by minidiag2.

The output function of the proportional valves is listed in Table 2-11.

Valve	Signal	Function MBE 900 Non-EGR Engine	Function MBE 900 EGR Engine	Function MBE 4000 EGR Engine	Low Side Control Pin	Power Supply Pin (Switched V Bat)
PV1	PWM/Digital Output	Exhaust Flap or Wastegate	Exhaust Flap or Wastegate	Wastegate	55/51	55/12
PV2	PWM/Digital Output	Compression Brake	EGR Valve	EGR Valve	55/50	55/52
PV3	PWM/Digital Output	Fan 1	Fan 1	Fan 1	55/41	55/12
PV4	PWM/Digital Output	Fan 2	Fan 2	Fan 2	55/43	55/12
PV5	PWM/Digital Output	Unused	Compression Brake	Compression Brake	55/11 – Ground	55/27 — High Side Control
PV6	PWM/Digital Output	Unused	Grid Heater	Turbo Brake or Exhaust Flap	55/40	55/42

Table 2-11 Proportional Valves

2.2.6 Connectors

See Figure 2-6 for the connectors to the PLD-MR.

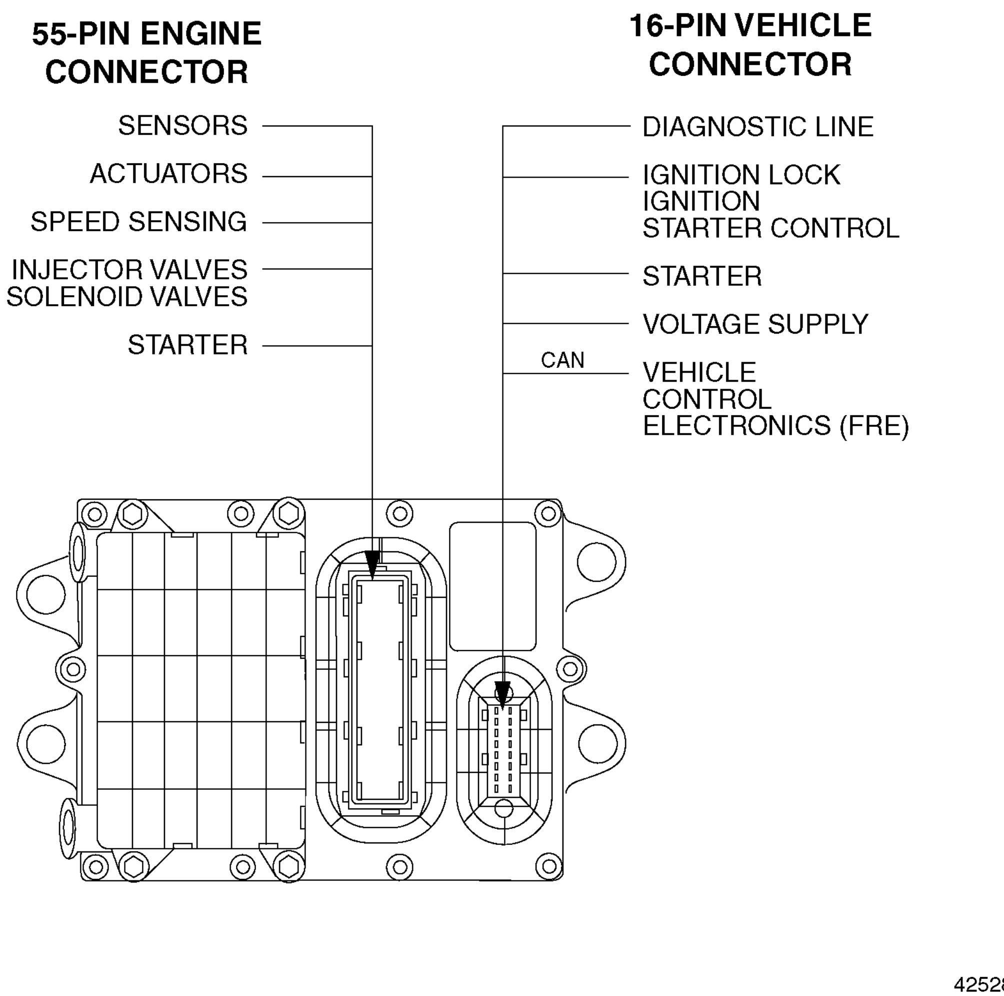


Figure 2-6 PLD-MR Connectors

2.3 VEHICLE CONTROL UNIT— ON-HIGHWAY

The DDEC-VCU is the interface between the PLD-MR and the truck for engine control and manages other vehicle functions.

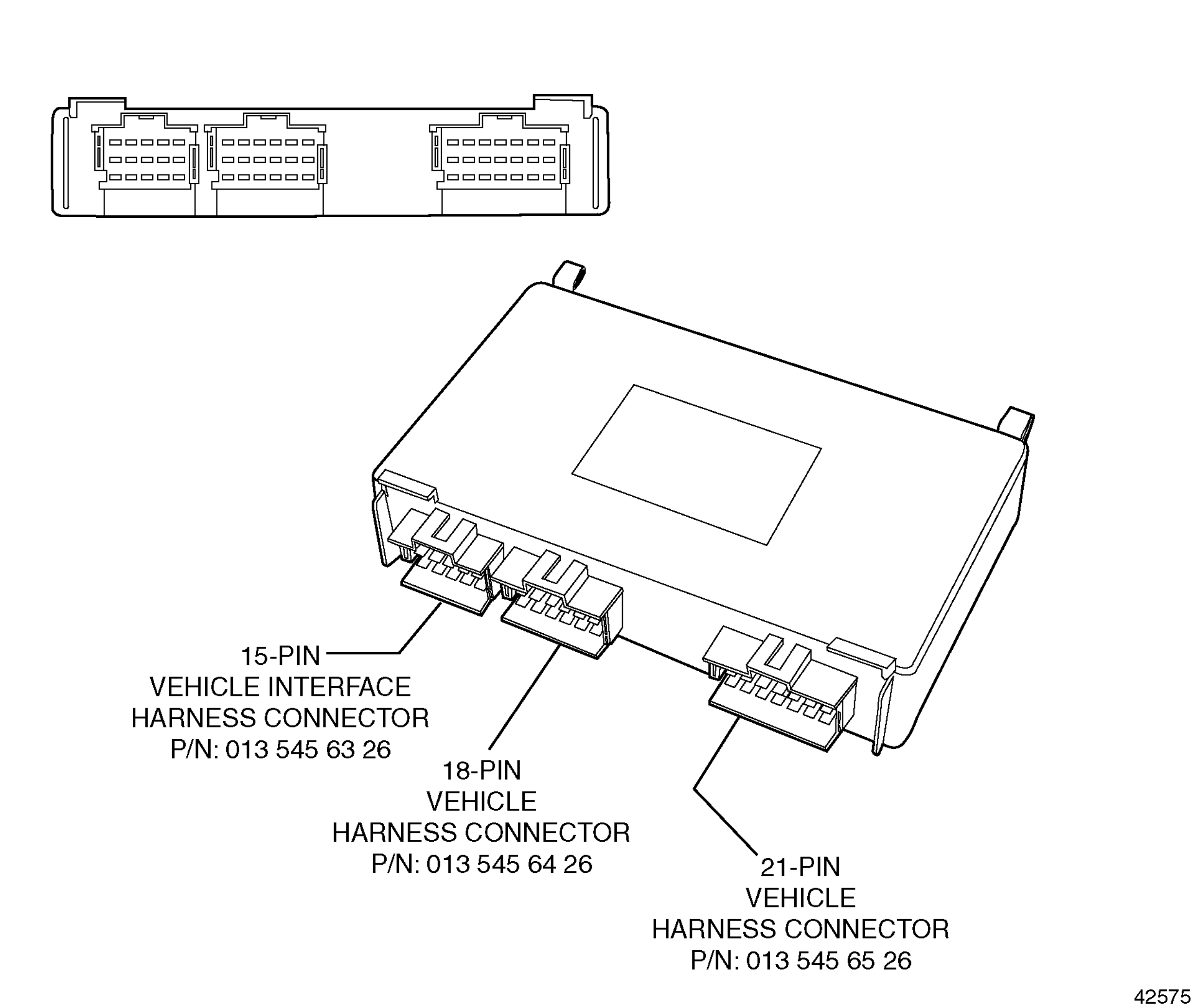


Figure 2-7 The Vehicle Control Unit

The DDEC-VCU also communicates over the J1587 and J1939 Data Links to the vehicle (see Figure 2-8).

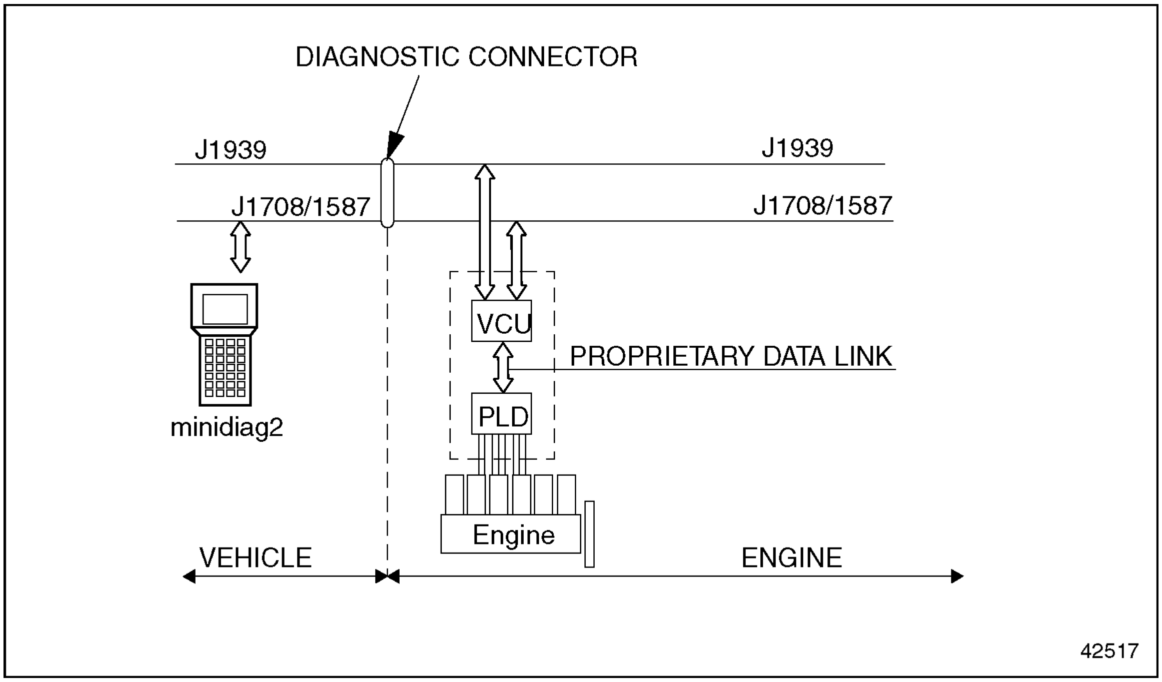


Figure 2-8 NAFTA Architecture

Within the DDEC-VCU, sets of data for specific applications are stored. These include idle speed, maximum running speed, and speed limitation.

The DDEC-VCU receives data from the operator (accelerator pedal position, switches, various sensors) and other electronic control units (for example, the anti-lock brake system, transmission controllers).

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

2.3.1 Vehicle Interface Harness Design

The OEM supplied Vehicle Interface harness (VIH) connects the DDEC-VCU to the PLD-MR and other vehicle systems (see Figure 2-9).

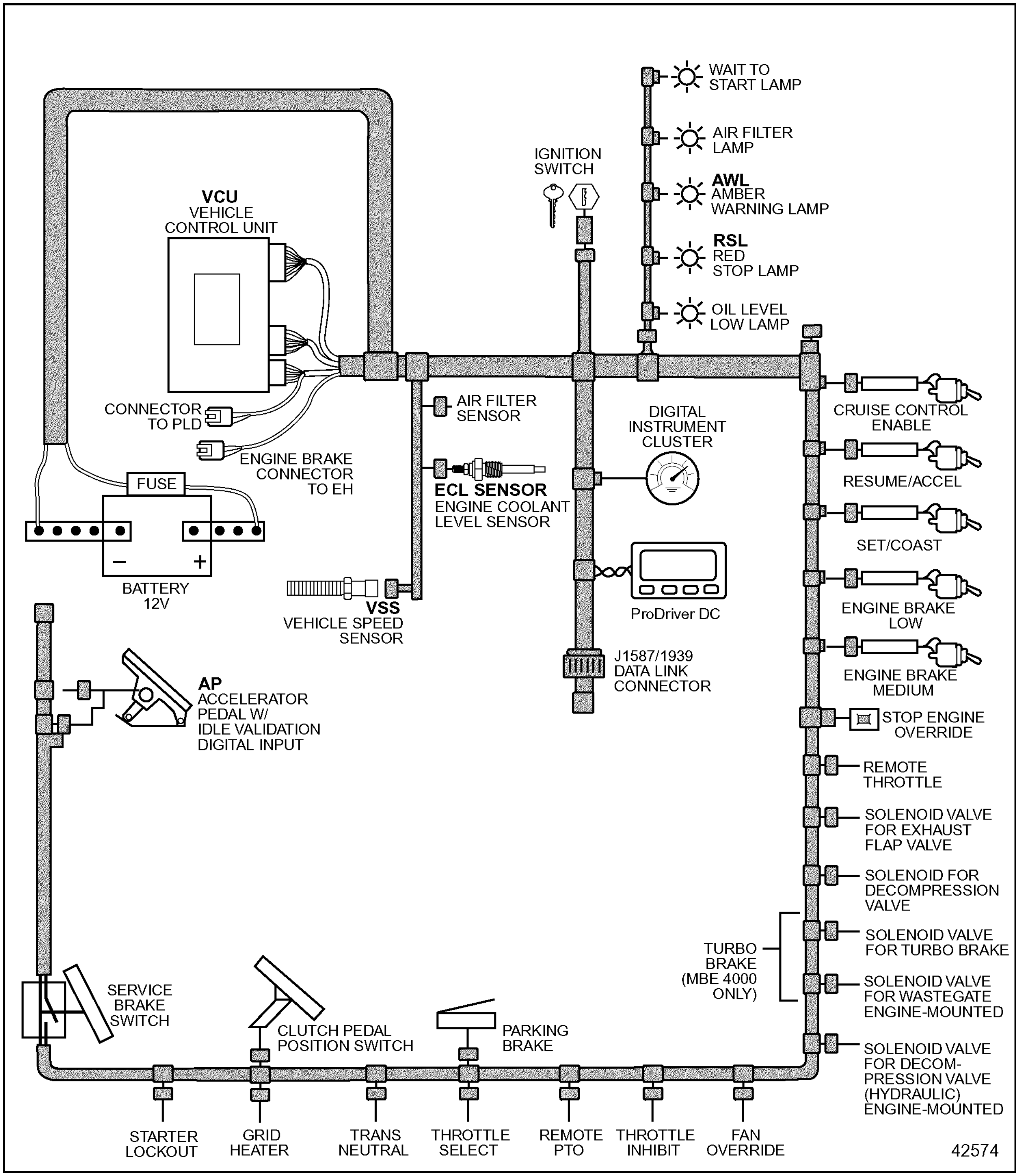


Figure 2-9 Typical On-Highway Vehicle Interface Harness with a DDEC-VCU

2.3.1.1 Digital Inputs

The DDEC-VCU has 18 digital inputs located on the VIH. These inputs are in low state by providing a connection to battery ground and placed in high state by providing an open circuit.

Digital Input Requirements:

High State:	Battery (+) $>E_{in}>$ 7.0 V
Low State:	$V_{in}<$ 3.0 V
Isink:	Capable of sinking 5–20 mA

The digital inputs are listed in Table 2-12.

Connector Pin	Description	V_{max}	V_{min}	Pull-up Resistor	Input Requirement
DDEC-VCU 15/01	Transmission Neutral	V_{Bat}	0 V	2.35 kΩ	V on<3.0 V V off>7.0 V
DDEC-VCU 15/02	Dual Road Speed Axle	V_{Bat}	0 V	5 kΩ	V on<3.0 V V off>7.0 V
DDEC-VCU 18/02	Clutch Switch	V_{Bat}	0 V	5 kΩ	V on<3.0 V V off>7.0 V
DDEC-VCU 18/04	Cruise Control Set/Coast	V_{Bat}	0 V	5 kΩ	V on<3.0 V V off>7.0 V
DDEC-VCU 18/05	Cruise Control Resume/Accel	V_{Bat}	0 V	5 kΩ	V on<3.0 V V off>7.0 V
DDEC-VCU 18/06	Cruise Control On/Off Switch	V_{Bat}	0 V	5 kΩ	V on<3.0 V V off>7.0 V
DDEC-VCU 18/07	Throttle Select	V_{Bat}	0 V	5 kΩ	V on<3.0 V V off>7.0 V
DDEC-VCU 18/08	Engine Brake Low	V_{Bat}	0 V	5 kΩ	V on<3.0 V V off>7.0 V
DDEC-VCU 18/09	Engine Brake High	V_{Bat}	0 V	5 kΩ	V on<3.0 V V off>7.0 V
DDEC-VCU 18/10	Remote PTO Switch	V_{Bat}	0 V	5 kΩ	V on<3.0 V V off>7.0 V
DDEC-VCU 18/11	Limiter 0	V_{Bat}	0 V	5 kΩ	V on<3.0 V V off>7.0 V
DDEC-VCU 18/12	Limiter 1	V_{Bat}	0 V	2.35 kΩ	V on<3.0 V V off>7.0 V
DDEC-VCU 18/13	Shutdown Override Switch	V_{Bat}	0 V	5 kΩ	V on<3.0 V V off>7.0 V
DDEC-VCU 18/14	Air Conditioner (Limiter 2)	V_{Bat}	0 V	2.35 kΩ	V on<3.0 V V off>7.0 V
DDEC-VCU 18/15	Fan Override	V_{Bat}	0 V	5 kΩ	V on<3.0 V V off>7.0 V
DDEC-VCU 18/16	Throttle Inhibit	V_{Bat}	0 V	5 kΩ	V on<3.0 V V off>7.0 V
DDEC-VCU 21/15	Service Brake Switch	V_{Bat}	0 V	2.35 kΩ	V on<3.0 V V off>7.0 V
DDEC-VCU 21/16	Park Brake Switch	V_{Bat}	0 V	2.35 kΩ	V on<3.0 V V off>7.0 V

Table 2-12 Digital Inputs

2.3.1.2 Analog Inputs

The analog inputs are listed in Table 2-13.

Pin	Description	V_{Bat}	V_{min}	Pull-up or Pull-down Resistor
15/07	Engine Coolant Level Sensor	5 V	0 V	440 Ω to 5 V Pull-up
15/08	Air Filter Restriction Sensor	5 V	0 V	200 kΩ to 5 V Pull-up
18/18	Remote Throttle Signal	5 V	0 V	200 kΩ to 5 V Pull-up
21/11	Accelerator Pedal Signal	5 V	0 V	Williams Pedal Terminal A, 47 kΩ to Ground Pull-down

Table 2-13 Analog Inputs

2.3.1.3 Digital Outputs

The digital outputs are listed in Table 2-14.

Pin	Description	I_{Max}	V_{Bat}	P_{Max} Lamp	Output Type
DDEC-VCU 15/05	Power Supply Accelerator Pedal PWM	2 A	V_{Bat}	—	High-side Driver
	Gear Out 1				
DDEC-VCU 15/06	Engine Brake 2, Exhaust Flap	2 A	V_{Bat}	—	High-side Relay Driver
DDEC-VCU 15/09	Relay 2	2 A	V_{Bat}	—	Low-side Relay Driver
DDEC-VCU 15/10	Engine Brake 1, Constant Throttle	1.8 A	V_{Bat}	—	High-side Relay Driver
DDEC-VCU 15/11	Relay 3	250 mA	V_{Bat}	—	Low-side Relay Driver, Short Protected
DDEC-VCU 15/12	Relay 1	1.3 A	V_{Bat}	—	Low-side Relay Driver, Short Protected
DDEC-VCU 18/01	Relay 4	1.3 A	V_{Bat}	—	Low-side Relay Driver, Short Protected
DDEC-VCU 18/03	Idle Validation Switch Ground	250 mA	0 V	—	Input for William's Pedal Terminal F
DDEC-VCU 21/04	Oil Level Lamp	250 mA	V_{Bat}	2 W at 12 V	Low-side Relay Driver, Short Protected
DDEC-VCU 21/05	Red Stop Lamp	250 mA	V_{Bat}	2 W at 12 V	Low-side Relay Driver, Short Protected
DDEC-VCU 21/06	Amber Warning Lamp	150 mA	V_{Bat}	2 W at 12 V	Low-side Relay Driver, Short Protected
DDEC-VCU 21/07	Wait to Start Lamp	250 mA	V_{Bat}	2 W at 12 V	Low-side Relay Driver, Short Protected
DDEC-VCU 21/08	Air Filter Lamp	250 mA	V_{Bat}	2 W at 12 V	Low-side Relay Driver, Short Protected

Table 2-14 Digital Outputs

2.3.1.4 Data Links

The Data Links that provide the communication interface are listed in Table 2-15.

Pin	Description	Potential	U_{Bat}	U_{min}	Further Data
15/15	Engine-CAN (Low)	—	2/3 V_{Bat}	1/3 V_{min}	ISO/DIS 11992, One Wire Capability
15/14	CAN-HF-Ground	GND	—	—	100 nF to Ground
15/13	Engine-CAN (High)	—	2/3 V_{Bat}	1/3 V_{min}	ISO/DIS 11992, One Wire Capability
21/17	SAE 1708, A	—	—	—	Only Partly Implemented
21/18	SAE 1708, A	—	—	—	Only Partly Implemented
21/19	SAE J1939 CAN (High)	5 V	—	—	—
21/20	CAN-HF-Ground	GND	—	—	100 nF to ground
21/21	SAE J1939 CAN (Low)	5 V	—	—	—

Table 2-15 Communication Interface Data Links

2.3.1.5 Ignition

The ignition source is 12 volts. The DDEC-VCU and PLD-MR ignition must be an independent input sourced directly from the battery post via a weatherproof blade type fuse, circuit breaker, or equivalent. Ignition sinks a maximum of 25 mA. The ignition fuse rating must be sized for the loads utilized in the application; however, a rating between 5 and 10 amps is usually sufficient. Fuse holders for blade type fuses may be purchased from the DDC Parts Distribution Center. The fuse holder accepts a wire diameter with an OD of 2.89 - 3.65 mm. Part numbers are listed in Table 2-16.

Part	Part Number
Fuse Holder	12033769
Cover	12033731
Terminals	12066614

Table 2-16 Fuse Holder Part Numbers

Ignition voltage must be provided in the crank and run modes.

2.3.2 Vehicle Interface Harness Wiring

The wiring for the VIH 15–pin connector to the DDEC-VCU is listed in Table 2-17. The side of the connector shown is looking into the pins.

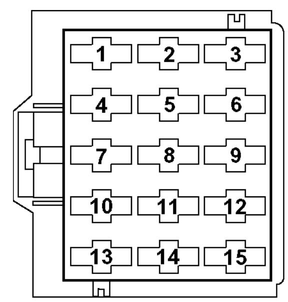
Pin	Signal Type	Function	Connector
15/01	Digital Input – Switch to Ground, Normally Open, Disables Engine Start if Closed	Transmission Neutral Switch	 42705 Front Looking into the Pins on the Harness
15/02	Digital Input – Switch to Ground, Normally Open, Sets Speed Ratio if Closed	Dual Speed Axle	
15/03	Data Link	Vehicle Speed Signal Input for Tachometer	
15/04	—	Reserved	
15/05	Configurable High Side Digital Output	Power Supply for PWM Pedal Gear Out 1, Output for Modulation Valve (e.g. Allison Automatic Transmission)	
15/06	Configurable High Side Digital Output	Engine Brake 2, Exhaust Flap	
15/07	Analog Input	Engine Coolant Level Sensor	
15/08	Analog Input	Air Filter Sensor	
15/09	Configurable High Side Digital Output	Relay 2 The configurable parameters are listed in Table 2-18.	
15/10	Configurable High Side Digital Output	Engine Brake 1, Decompression Valve	
15/11	Configurable Low Side Digital Output	Relay 3 The configurable parameters are listed in Table 2-18.	
15/12	Configurable Low Side Digital Output	Relay 1 The configurable parameters are listed in Table 2-18.	
15/13	Data Link	MBE Proprietary CAN (+) (PLD-MR)	
15/14	Data Link	MBE Proprietary CAN Shield (PLD-MR)	
15/15	Data Link	MBE Proprietary CAN (-) (PLD-MR)	

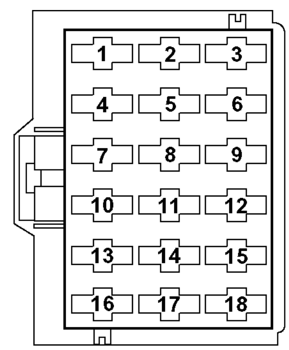
Table 2-17 DDEC-VCU 15–Pin VIH Connector Pin Assignments

Pin	Function	Parameters
15/12	Relay 1	0 = Disabled 1 = Starter Protection 2 = Acc. Pedal Kick Down position 3 = Transmission Output 1
15/09	Relay 2	0 = Disabled 1 = Grid Heater 2 = Acc. Pedal Idle Position
15/11	Relay 3	0 = Acc. Pedal Idle Position 1 = Actual Torque 2 = Vehicle Speed 3 = Engine Speed 4 = Coolant Temperature 5 = Acc. Pedal Torque 6 = Booster Temperature 7 = Oil Pressure Warning Lamp 8 = Coolant Temp Warning Lamp
18/01	Relay 4	0 = Kickdown Position 1 = Actual Torque 2 = Vehicle Speed 3 = Engine Speed 4 = Coolant Temp 5 = Pedal Torque 6 = Booster Air Temp 7 = Oil Pressure Warning Lamp 8 = Coolant Temp Warning Lamp
18/08	Engine Brake Low, Engine Brake Switches Low and High	0 = Not Active 1 = Active
18/09	Engine Brake High	High/Low 0 0 = Engine Brakes Disabled 0 1 = Engine Brake Step 1: Decompression Valve Enabled 1 0 = Engine Brake Step 2: Decompression Valve and Exhaust Flap Enabled 1 1 = Not Implemented

Table 2-18 Configurable Parameters on the DDEC-VCU 15- and 18-Pin Connectors

The wiring for the VIH 18–pin connector to the DDEC-VCU is listed in Table 2-19. The side of the connector shown is looking into the pins.

Pin	Signal Type	Function	Connector
18/01	Configurable Low Side Digital Output	Relay 4 The configurable parameters are listed in Table 2-18.	
18/02	Digital Input – Normally Closed (open if clutch is pressed)	Clutch Switch 1	
18/03	Digital Input	Idle Validation Switches	
18/04	Digital Input – Normally Open	Cruise Control, Set/Coast	
18/05	Digital Input – Normally Open	Cruise Control, Res/Accel	
18/06	Digital Input – Normally Open	Cruise Control, On/Off	
18/07	Digital Input – Normally Open	Remote Accelerator Select Switch	
18/08	Digital Input – Normally Open	Engine Brake Low, Engine Brake Switches Low and High The configurable parameters are listed in Table 2-18.	
18/09	Digital Input – Normally Open	Engine Brake High The configurable parameters are listed in Table 2-18.	
18/10	Digital Input – Normally Open	Remote PTO Switch	
18/11	Digital Input – Normally Open	Limiter 0	
18/12	Digital Input – Normally Open	Limiter 1	
18/13	Digital Input – Normally Open	Engine Shutdown Override	
18/14	Digital Input – Normally Open	Limiter 2 (Air Condition Status – Fast Idle)	
18/15	Digital Input – Normally Open	Fan Override	
18/16	Digital Input – Normally Open	Throttle Inhibit	
18/17	Sensor Supply	Remote PTO Power Supply and Air Cleaner Sensor	
18/18	Analog Input	Remote Throttle Signal	



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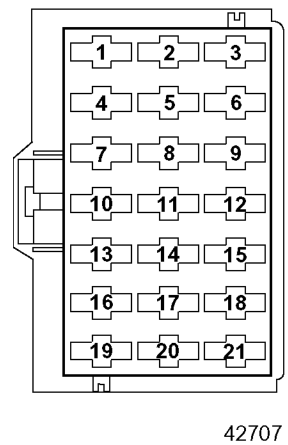
Front
Looking into the Pins on the Harness

Table 2-19 DDEC-VCU 18–Pin VIH Connector Pin Assignments

The wiring for the VIH 21–pin connector for the DDEC-VCU is listed in Table 2-20. The power and communication links are wired through this connector. The side of the connector shown is looking into the pins.

Pin	Signal Type	Function	Connector
21/01	—	Battery Voltage	
21/02	Digital Input	Ignition (+12 V)	
21/03	—	Battery Ground	
21/04	Digital Output – Low Side	Oil Level Lamp*	
21/05	Digital Output – Low Side	Red Stop Lamp*	
21/06	Digital Output – Low Side	Amber Warning Lamp*	
21/07	Digital Output – Low Side	Wait to Start Lamp	
21/08	Digital Output – Low Side	Air Filter Warning Lamp	
21/09	Sensor Supply	Accelerator Pedal Power Supply (+5 V supply)	
21/10	Digital Input – Normally Open	Plug (not used, must be plugged)	
21/11	Analog Input	Accelerator Pedal Signal	
21/12	Pulse Input	PWM Throttle Signal, Path 1	
		Idle Validation 2 (Throttle Active)	
21/13	Pulse Input	PWM Throttle Signal, Path 2	
		Idle Validation 1 (Idle Active)	
21/14	—	PWM Accelerator Pedal Ground	
		Analog Pedal Ground	
21/15	Digital Input – Normally Closed	Service Brake Switch	
21/16	Digital Input – Normally Open	Park Brake Switch	
21/17	Data Link	SAE J1708 (+)	
21/18	Data Link	SAE J1708 (-)	
21/19	Data Link	SAE J1939 (+)	
21/20	Data Link	J1939 Shield	
21/21	Data Link	SAE J1939 (-)	



Front
Looking into the Pins on the Harness

* If output is active while engine is running, shut down the engine immediately and initiate an error diagnosis.

Table 2-20 DDEC-VCU 21–Pin VIH Connector Pin Assignments

2.3.2.1 VIH to PLD-MR Connector Wiring

The wiring for the VIH 16–pin to the PLD-MR is listed in Table 2-21. The side of the connector shown is looking into the pins.

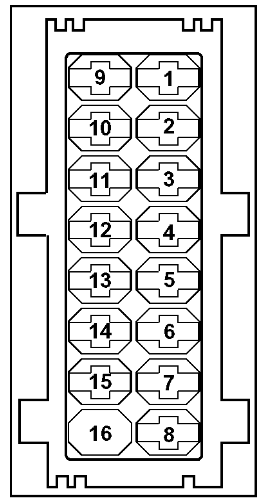
Pin	Signal Type	Function	Connector
1	Data Link	CAN Interface (High Line)	 Front Looking into the Pins on the Harness
2	Data Link	CAN Interface (Low Line)	
3	Data Link	CAN HF Ground	
4	Data Link	CAN HF Ground	
5	Power Supply	Battery Voltage (+)	
6	Power Supply	Battery Voltage (+)	
7	NC	NC	
8	Digital Output	Starter Control Signal	
9	Ground	Battery Ground (-)	
10	Digital Output	Proportional Valve 1–4 High Side Supply	
11	Ground	Battery Ground (-)	
12	Digital Output	Starter High Side Control	
13	Digital Data Link	Diagnostic Link K-line (ISO)	
14	Digital Output	Proportional Valve 3 Low Side Control	
15	Ignition Input	Ignition	
16	Digital Output	Proportional Valve 4 Low Side Control	

Table 2-21 16–Pin Connector to the PLD-MR

2.3.2.2 VIH to Engine Harness Connector Wiring

The wiring for the 8-pin connector to the Engine Harness required for engine brakes and fan control for the MBE 4000 is listed in Table 2-22.

Description	Engine Harness 8–pin Connector	PLD-MR 55–pin Connector
Fan Control —Control 31, Switch to Bat- (PV3)	A	41
Fan Control No. 2, Switch to Bat- (PV4)	B	43
Compression Brake Control, Switch to Bat- (PV2)	C	50
Fan and Wastegate/E-Flap Voltage Supply (PV1,3,4)	D	12
Exhaust Flap/Wastegate Control, Switch to Bat- (PV1)	E	51
Compression Brake Voltage Supply (PV2)	F	52
Turbo Brake Control, Switch to Bat-(PV6)	G	40
Turbo Brake Voltage Supply (PV6)	H	42

Table 2-22 Engine Harness Connector for Engines with Two Solenoid Air Valves for Engine Brakes — MBE 4000 Only

See Figure 2-10 for an engine brake schematic.

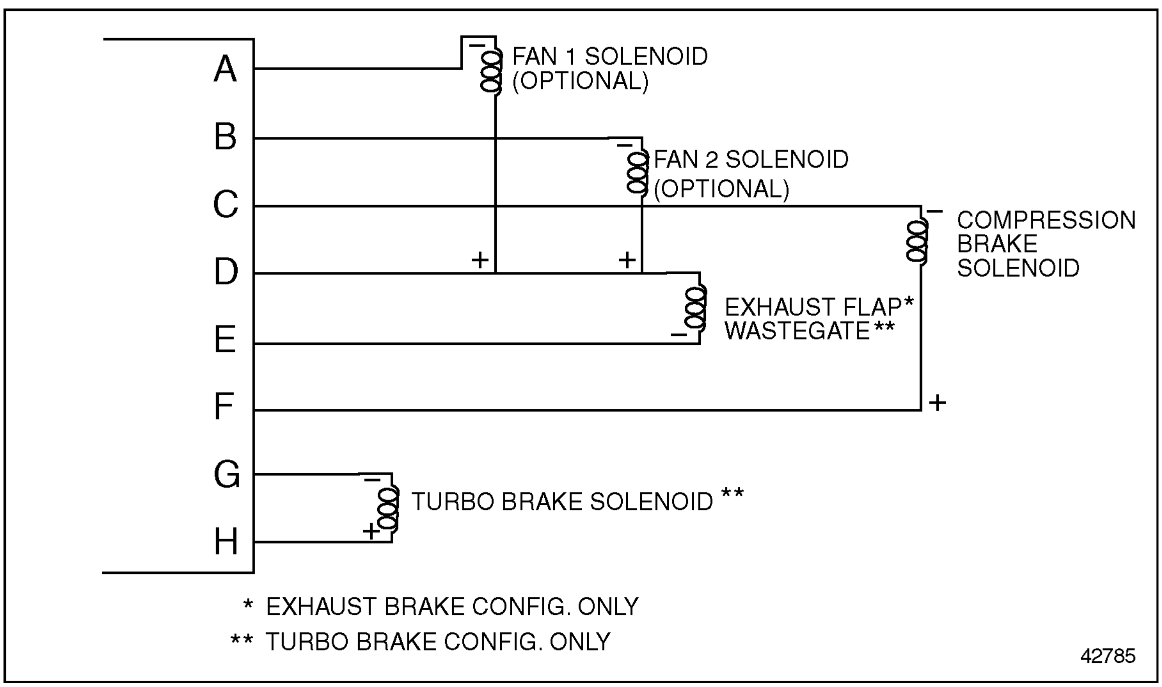


Figure 2-10 MBE 4000 Non-EGR Engine Brake

The wiring for the 8-pin connector to the Engine Harness required for Engine Brakes and Fan Control for the Non-EGR MBE 900 is listed in Table 2-23. See Figure 2-11 for a schematic.

Description	Engine Harness Connector/Pin	PLD-MR 55 Pin Connector
Fan Control, Switch to Bat- (PV3, PV4)	Y70/Pin 1	41
Fan Control Power	Y70/ Pin 2	12
Compression Brake Control, Switch to Bat- (PV2)	Y49/ Pin 1	50
Compression Brake Power	Y49/Pin 2	52
Exhaust Flap Control, Switch to Bat- (PV1)	Y91/Pin 1	51
Exhaust Flap Power	Y91/Pin 2	12

Table 2-23 Engine Harness Connector for MBE 900 Non-EGR Engine

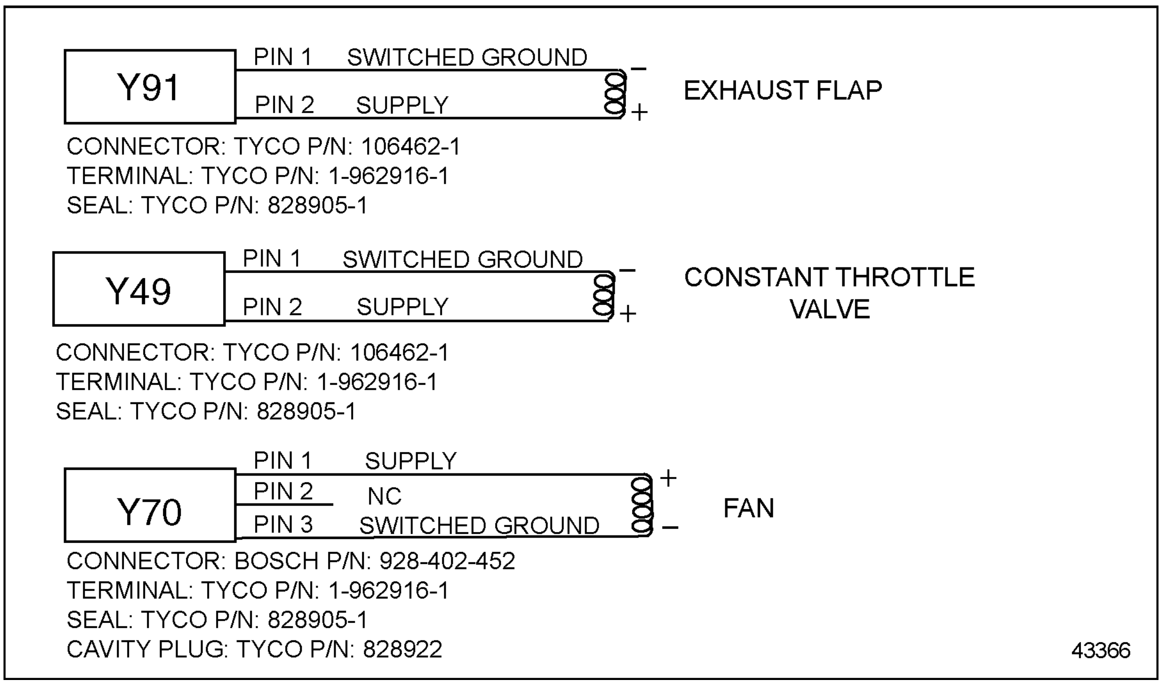


Figure 2-11 MBE 900 Non-EGR VIH to Engine Harness Wiring

The wiring for the 8-pin connector to the Engine Harness required for engine brakes and fan control for the MBE 900 EGR engine is listed in Table 2-24. See Figure 2-12 for a schematic.

Description	Engine Harness Connector/Pin	PLD-MR 55 Pin Connector
Fan Control, Switch to Bat- (PV3, PV4)	Y70/Pin 1	41
Fan Control Power	Y70/ Pin 2	12
Compression Brake Ground	Y49/ pin 1	11
Compression Brake Control, Switch to Bat+ (PV5)	Y49/Pin 2	27
Exhaust Flap Control, Switch to Bat- (PV1)	Y91/Pin 1	51
Exhaust Flap Power	Y91/Pin 2	12

Table 2-24 Engine Harness Connector for MBE 900 EGR Engine

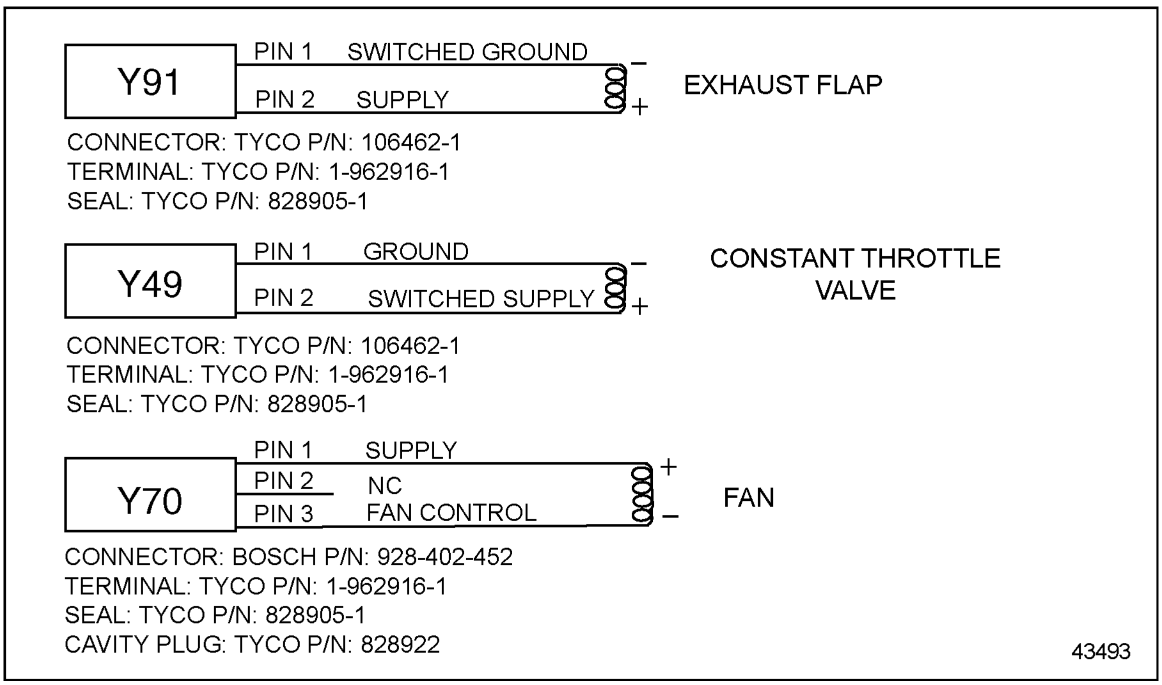


Figure 2-12 Engine Harness Connector for MBE 900 EGR Engine

2.3.2.3 VIH Power Wiring

The OEM-supplied VIH power wiring (see Figure 2-13) supplies 12 volts to the DDEC-VCU and PLD-MR. The system must be sourced directly from the battery. The terminals are designed to accept 14 AWG standard wall wire.

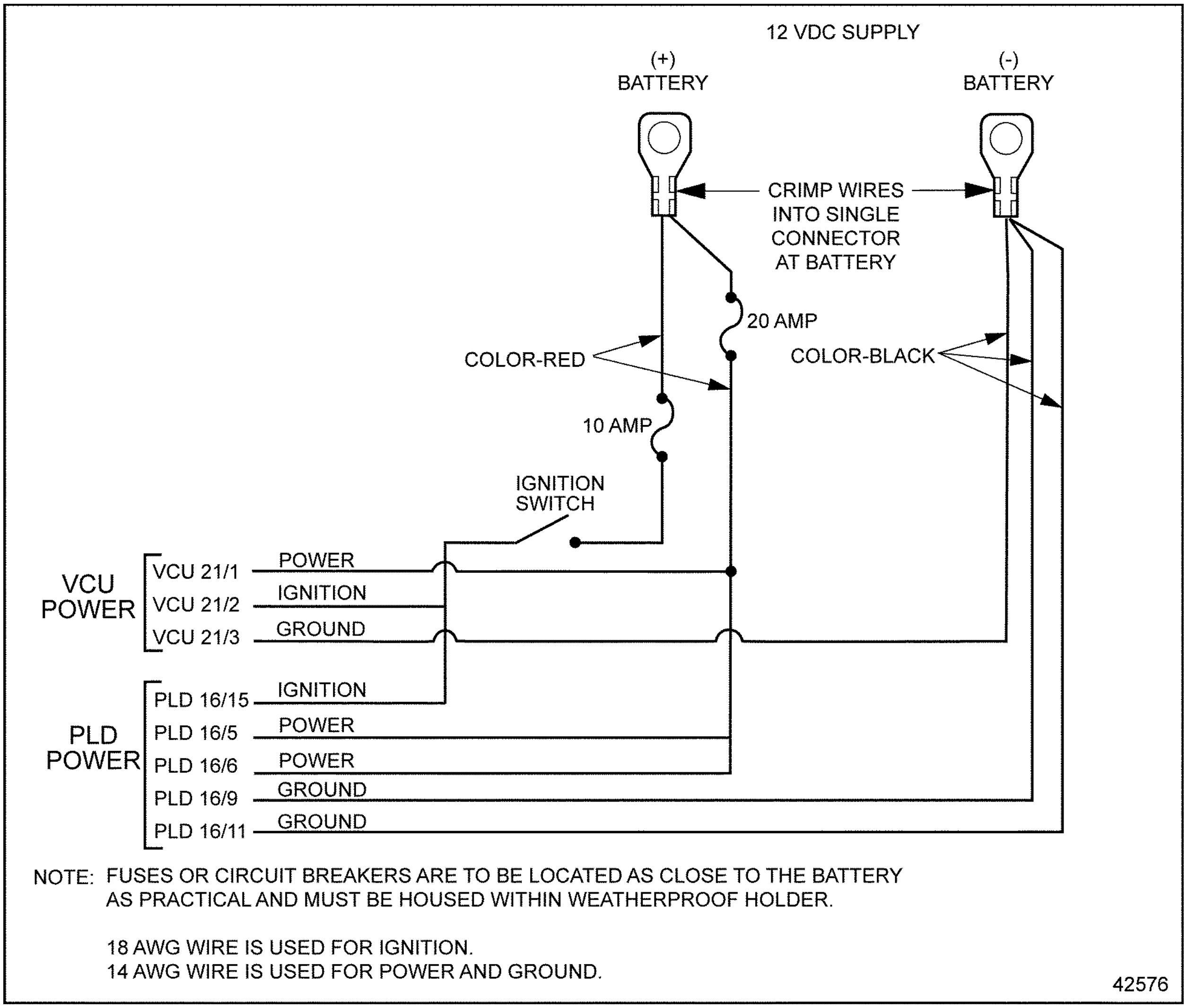


Figure 2-13 Power Wiring

Power must be sourced directly from the battery. An electrically solid connection to the battery or bus bar is required so the battery can filter electrical noise from the power lines. Power for other vehicle systems must not be sourced from the VIH power wires. ***Do not*** use chassis ground.

NOTE:
The ground wire must be electrically separate from chassis ground.

Power and ground bus bars may be used. The bus bar must be connected to the battery posts with 0 AWG or larger wire depending upon the total vehicle current requirement. The connecting wires must be as short as possible to minimize circuit resistance. ***Do not*** connect the ground wire to the chassis ground.

2.3.2.4 Communications – SAE J1939 Data Link

SAE J1939 Data Link (+), SAE J1939 Data Link (-), and SAE J1939 Data Link Shield are used as the J1939 communication link. J1939 cable is required for the J1939 data link. Termination resistors are required per the SAE specification. Refer to SAE J1939–11 for specific requirements.

The DDEC-VCU connector pin assignments for SAE J1939 are listed in Table 2-25.

Pin	Signal Type	Function
21/19	Data Link	SAE J1939 (+)
21/20	Data Link	J1939 Shield
21/21	Data Link	SAE J1939 (-)

Table 2-25 J1939 DDEC-VCU to VIH Connector Pin Assignments

The following SAE documents cover the SAE J1939 Data Link. Contact the Society of Automotive Engineers to obtain documents.

SAE J1939	**Top Layer (Overview)**
SAE J1939/11	Physical Layer
SAE J1939/21	Data Link Layer
SAE J1939/71	Vehicle Application Layer
SAE J1939/01	Truck and Bus Applications
SAE J1939/73	Application Layer — Diagnostics

J1939 cable is available from the following sources:

Belden Electronics Division	**Tyco Electronics Corporation**
2200 U.S. 27 South	Raychem Wire & Harnessing
Richmond, IN 47374	300 Constitution Drive
Phone: 1–800–235–3361	Menlo Park, CA 94025
www.belden.com	www.raychem.com

2.3.2.5 Communications – SAE J1587/J1708 Data Link

SAE J1587 Data Link+ and SAE J1587 Data Link- are used for the SAE J1708/J1587 communication link.

The DDEC-VCU connector pin assignments for SAE J1708/J1587 are listed in Table 2-26.

Pin	Signal Type	Function
21/17	Data Link	SAE J1708 (+)
21/18	Data Link	SAE J1708 (-)

Table 2-26 J1708/1587 DDEC-VCU to VIH Connector Pin Assignments

The following SAE documents cover the SAE J1587/J1708 Data Link. Contact the Society of Automotive Engineers to obtain documents.

SAE J1587	**Electronic Data Interchange Between Microcomputer Systems in Heavy-Duty Vehicle Applications**
SAE J1708	Serial Data Communications Between Microcomputer Systems in Heavy-duty Vehicle Applications

2.3.2.6 Communications – Propriety IES-CAN Data Link

The low speed propriety IES-CAN link between the PLD-MR and the DDEC-VCU 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 (221°F). Termination resistors for the IES-CAN link are located in the DDEC-VCU and PLD-MR. The wiring for the PLD-MR 16–pin connector and the DDEC-VCU 15–pin connector are listed in Table 2-27.

DDEC-VCU 15–Pin	Function	PLD-MR 16–Pin
15/13	IES-CAN Data Link (+)	16/1
15/14	IES-CAN Data Link (Shield)	16/2
15/15	IES-CAN Data Link (-)	16/3

Table 2-27 Propriety IES-CAN Data Link

NOTE:
A special cable must be used for the propriety IEC-CAN data link.

2.3.3 Power Supply – 12 Volt System

Normal operating voltage for the DDEC-VCU and PLD-MR is 11-16 VDC.

NOTICE:
Operating the DDEC-VCU or PLD-MR over the voltage limits of 16 volts will cause damage to the DDEC-VCU or PLD-MR.

Operating the DDEC-VCU and/or PLD-MR 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 DDEC-VCU and/or PLD-MR if the Power Harness is not properly fused.

NOTE:
All output loads, ignition and DDEC-VCU 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 2-28. This information should be used to size the alternator.

System	Maximum Average Current Draw (12 V Nominal Supply)	
	Idle	Full Load/Rated Speed
PLD-MR – Engine Loads	1–2 A total	12.5 A total
DDEC-VCU – Vehicle Loads*	350 mA total	5.4 A total

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

Table 2-28 Maximum Average Current Draw

The current draw for a DDEC-VCU configuration is listed in Table 2-29.

Configuration	Condition	Current
DDEC-VCU	Ignition Off	100 µA
	Ignition On and Engine Stopped	200 mA

Table 2-29 Current Draw for DDEC-VCU Configuration

The current draw for a PLD-MR is listed in Table 2-30.

Configuration	Condition	Current
PLD-MR	Ignition Off	1 mA
	Ignition On and Engine Stopped	400 mA

Table 2-30 Current Draw for PLD-MR Configuration

2.3.3.2 Battery Isolator

MBE electronic controls do not require a battery isolators. 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 2-14.

NOTE:
Switches must remain closed for 30 seconds after ignition is off for the PLD-MR and DDEC-VCU to write non-volatile data.

NOTE:
Disconnecting positive power is not sufficient to isolate the DDEC-VCU 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.

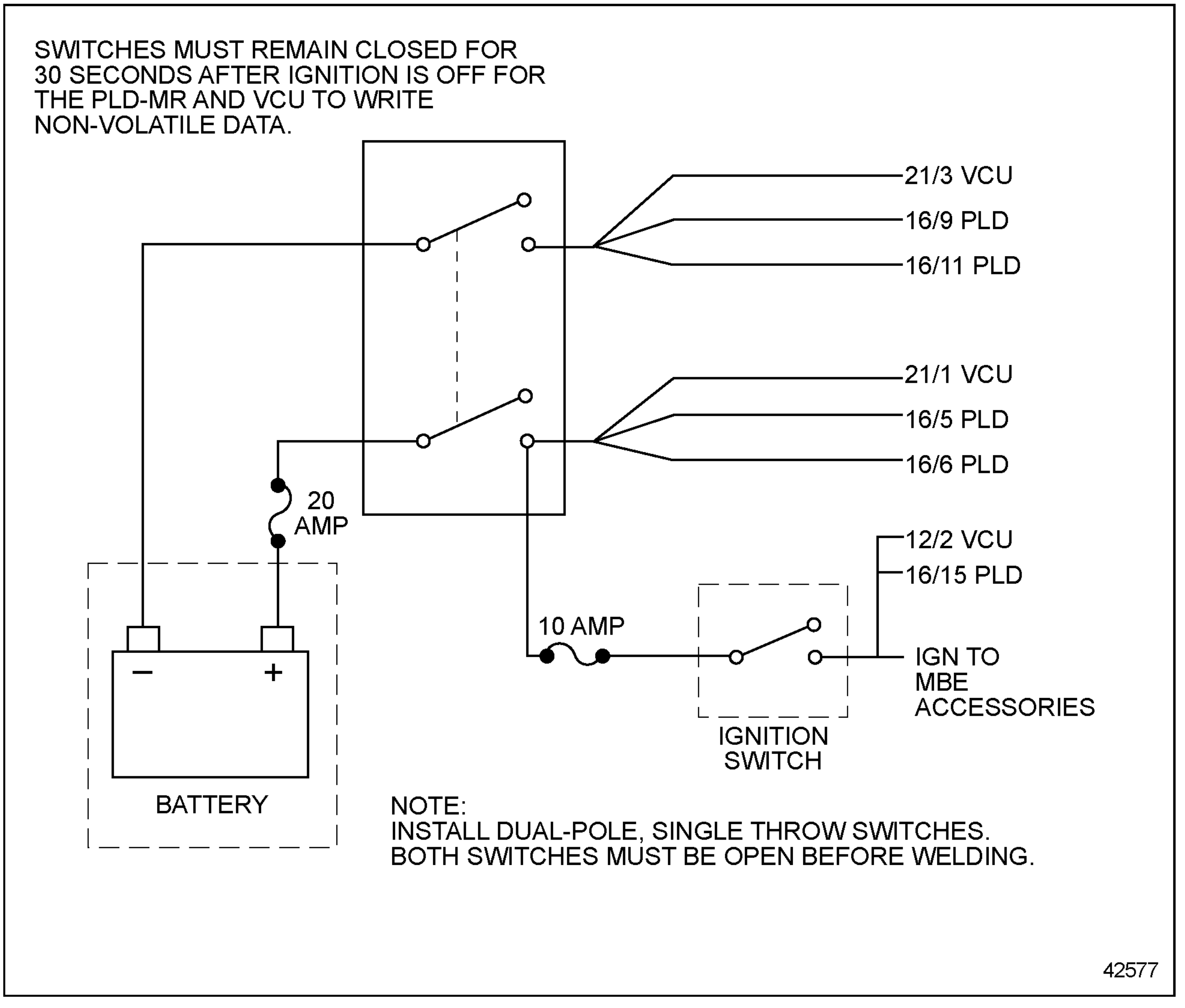


Figure 2-14 Main Power Supply Shutdown 12 or 24 Volt Systems

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 DDEC-VCU – PLD-MR's maximum operating voltage of 16 volts.

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.

2.3.5 Connectors

There are three connectors to the DDEC-VCU, a 21-pin connector, an 18-pin connector and a 15-pin connector. The OEM is responsible for the three connectors at the DDEC-VCU and the one connector at the PLD-MR.

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

The part numbers for the DDEC-VCU 21–pin connector are listed in Table 2-31.

Part	DDC Part Number
DDEC-VCU 21–pin connector	013 545 65 26
Terminal (Vehicle) 0.5–1.0 mm wire	013 545 76 26
Terminal (Power) 1.5–2.5 mm wire	013 545 78 26
Seals — 1.0 mm wire	000 545 28 39
Seals — 1.5 — 2.5 mm wire	000 545 29 39
Plug	000 545 62 80

Table 2-31 DDEC-VCU 21–pin Connector Part Numbers

The part numbers for the DDEC-VCU 18–pin connector are listed in Table 2-32.

Part	DDC Part Number
DDEC-VCU 18–pin connector	013 545 64 26
Terminal (Vehicle) 0.5–1.0 mm wire	013 545 76 26
Terminal (Power) 1.5–2.5 mm wire	013 545 78 26
Seals — 1.0 mm wire	000 545 28 39
Seals — 1.5 — 2.5 mm wire	000 545 29 39
Plug	000 545 62 80

Table 2-32 DDEC-VCU 18–pin Connector Part Numbers

The part numbers for the DDEC-VCU 15–pin connector are listed in Table 2-33.

Part	DDC Part Number
DDEC-VCU 15–pin connector	013 545 63 26
Terminal (Vehicle) 0.5–1.0 mm wire	013 545 76 26
Terminal (Power) 1.5–2.5 mm wire	013 545 78 26
Seals — 1.0 mm wire	000 545 28 39
Seals — 1.5 — 2.5 mm wire	000 545 29 39
Plug	000 545 62 80

Table 2-33 DDEC-VCU 15–pin Connector Part Numbers

The part numbers for the DDEC-VCU-to-PLD-MR connector is listed in Table 2-34.

Part	DDC Part Number
PLD-MR 16–pin connector	000 153 00 22
Terminal (DDEC-VCU) 0.5–1.0 mm wire	011 545 77 26
Terminal (power) 1.0–2.5 mm wire	011 545 76 26
Seals — 1.0 mm	000 545 28 39
Seals — 1.5–2.5 mm	000 545 29 39
Plug	000 545 62 80
Cover	000 153 00 82

Table 2-34 DDEC-VCU–to–PLD-MR 16–pin Connector Part Numbers

The part numbers for the OEM connectors (see Figure 2-11 and Figure 2-12) for Engine Brakes and Fan Control and constant throttle valve/exhaust flap for the MBE 900 Non-EGR and EGR engine are listed in Table 2-23.

Part	Part Number
Constant Throttle/Exhaust Flap 2–pin Connector	Tyco 106462 1
Terminal	Tyco 1 962916 1
Seal	Tyco 828905 1
Fan 3–Pin Connector	Bosch 928 402 452
Terminal	Tyco 1 962916 1
Seal	Tyco 828905 1
Cavity Plug	Tyco 828922

Table 2-35 OEM Connectors for Constant Throttle Valve/Exhaust Flap and Fan on MBE 900 EGR and Non-EGR Engines

The part numbers for the OEM 8–pin connector for the MBE 4000 non-EGR engine are listed in Table 2-36.

Part	DDC Part Number
8–pin Delphi Connector, 8WM M/P 150 Blk	030 545 8828
8–pin Delphi Connector, TPA	000 545 4073
Terminal, M/P 150M 0.35–0.50 mm	034 545 0028
Terminal, M/P 150M 0.75–1.00 mm	665 545 9026
Terminal, M/P 150M 0.50–1.00 mm	030 545 4128
Terminal, M/P 150M 1.00–1.50 mm	030 545 9026
Seal, 1.29–1.70	001 5545 1280
Seal, 1.60–2.15	001 5545 1380
Seal, 2.03–2.85	001 5545 1480

Table 2-36 OEM 8–Pin Connector for MBE 4000 Non-EGR Engine

2.3.5.1 Data Link Connector

The connector used to connect the data links is a 9-pin Deutsch connector for the SAE J1939 Data Link and the SAE J1708/J1587 Data Link.

The components listed in Table 2-37 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
9-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 2-37 Required Components to Incorporate an SAE J1939/J1587 Data Link in the VIH with the 9-Pin Connector

The following illustration shows the wiring for the 9-pin connector (see Figure 2-15).

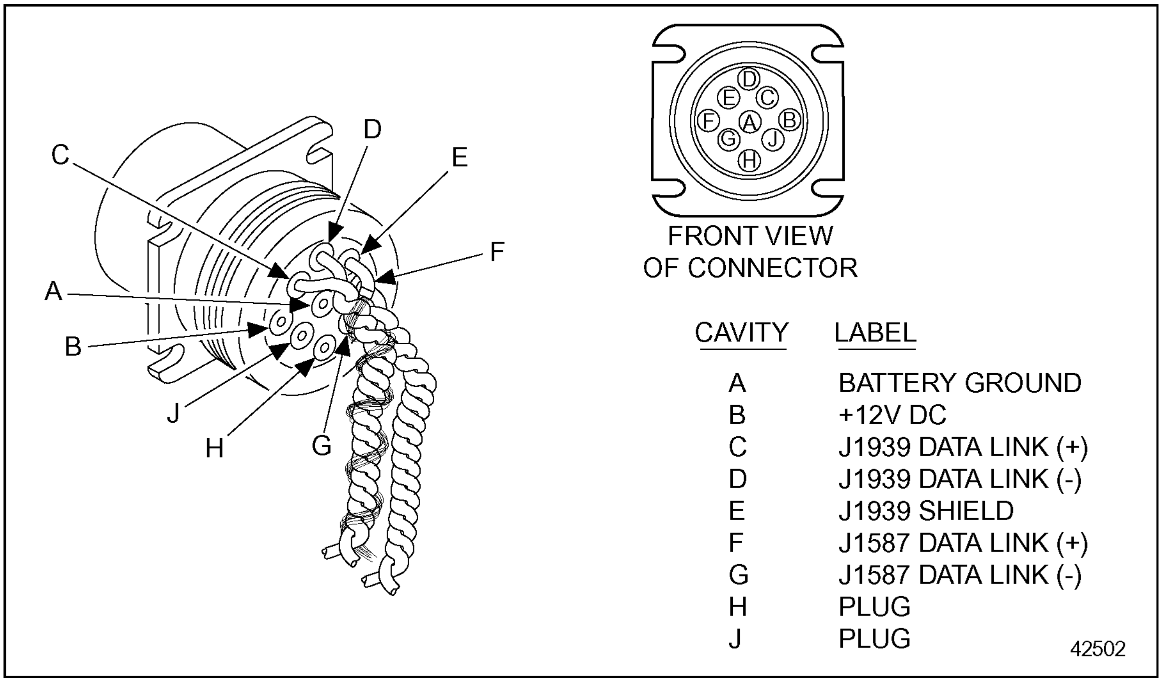


Figure 2-15 Wiring for 9-Pin Data Link Connector

The maximum length for the SAE J1939 Data Link is 40 m (130 ft).

The SAE J1587/J1708 Data Link must be twisted pairs. The twists are a minimum of 12 turns per 305 mm (1 ft). The maximum length for the SAE J1587/J1708 Data Link is 40 m (130 ft).

2.3.5.2 SAE J1708/J1587 Data Link 6-Pin Connector

The components are required to incorporate a SAE J1708/J1587 Data Link in a VIH so a diagnostic devices can be attached without a unique jumper are listed in Table 2-38.

Component	DDC Part Number	Deutsch Part Number
6-Pin Deutsch Connector	23513052	HD10-6-12P
Connector Cover	23507154	HDC 16–6
Two (2) Cavity Plugs	23507136	114017
Four (4) Terminals	23513053	0460-220-1231

Table 2-38 Required Components to Incorporate an SAE J1939/J1587 Data Link in the VIH with the 6-Pin Connector

The following illustration shows the wiring for the 6-pin connector (see Figure 2-16).

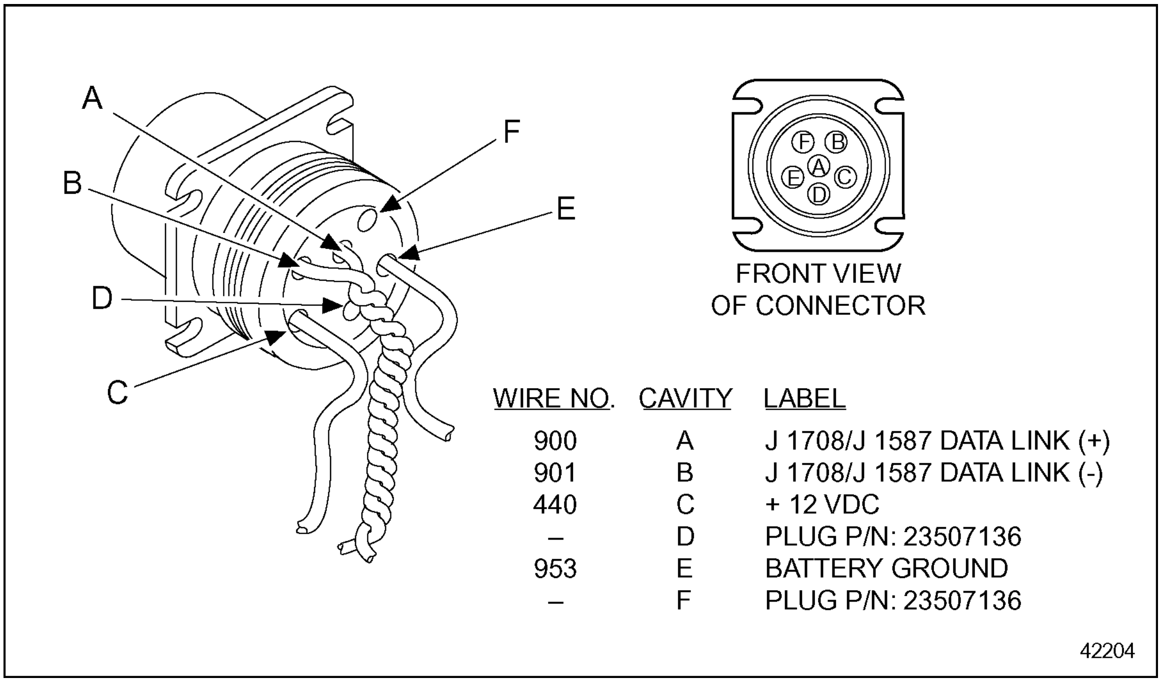


Figure 2-16 Wiring for 6-Pin Data Link Connector

2.4 WIRES AND WIRING

Detroit Diesel Corporation recommends color coding and hot stamping wire numbers in contrasting colors at intervals of 100 mm (4 in.) 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 the MBE Electronic Controls must meet the following criteria:

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

NOTICE:
Insulation must be free of nicks.

Criteria: Wires
Tape, conduit, loom or a combination thereof must be used to protect the wires. Refer to sections 2.5 and 2.6.
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 Deutsch Terminal Installation and Removal

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

2.4.3.1 Deutsch Terminal Installation Guidelines

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

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

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

NOTICE:
Terminal crimps must be made with the crimp tool J 34182 to assure gas tight connections.

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

Use the following instructions for installing Deutsch terminals:

1. Strip approximately 6 mm (0.25 in.) 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 0.8 mm (0.03 in.) above the four indenters. See Figure 2-17. Crimp the cable.

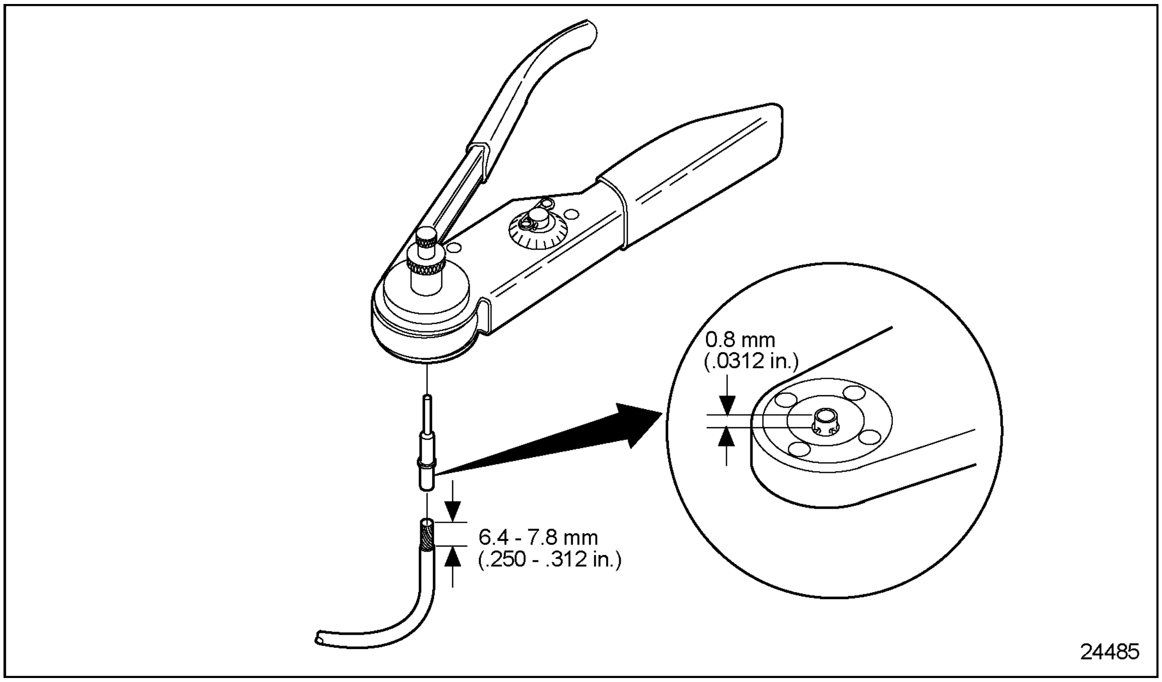


Figure 2-17 Setting Wire Gage Selector and Positioning the Contact

5. Grasp the contact approximately 25 mm (1 in.) behind the contact crimp barrel. Hold the connector with the rear grommet facing you. See Figure 2-18.

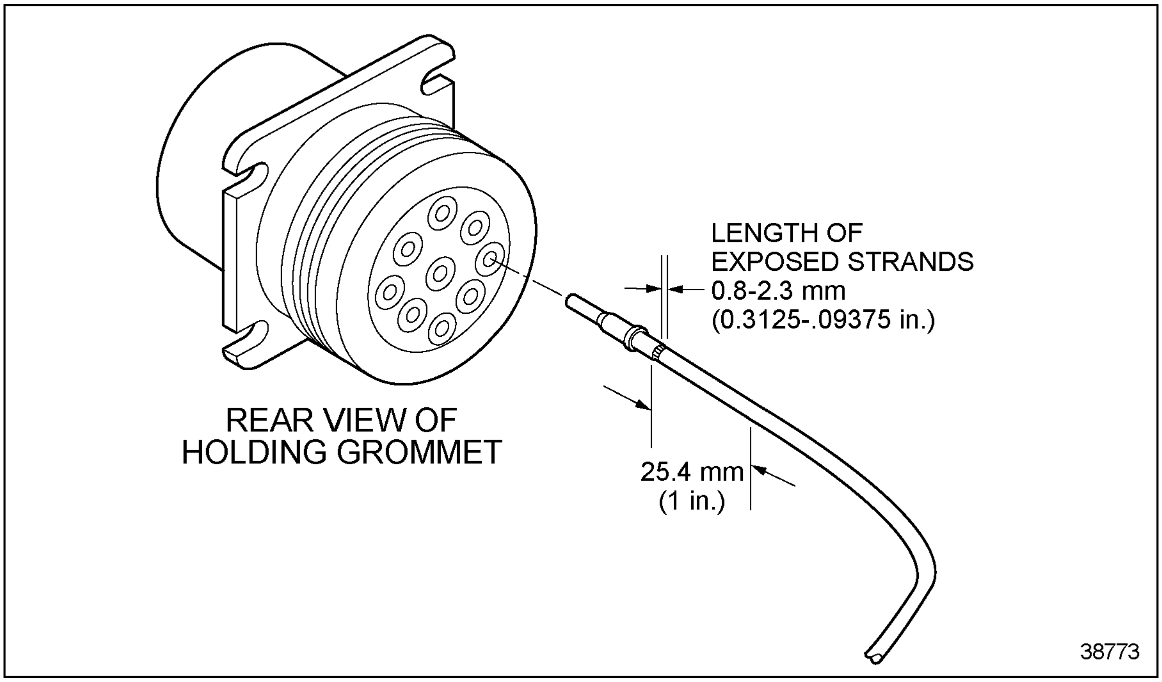


Figure 2-18 Pushing Contact into Grommet

6. Push the contact into the grommet until a positive stop is felt. See Figure 2-18. A slight tug will confirm that it is properly locked into place. See Figure 2-19.

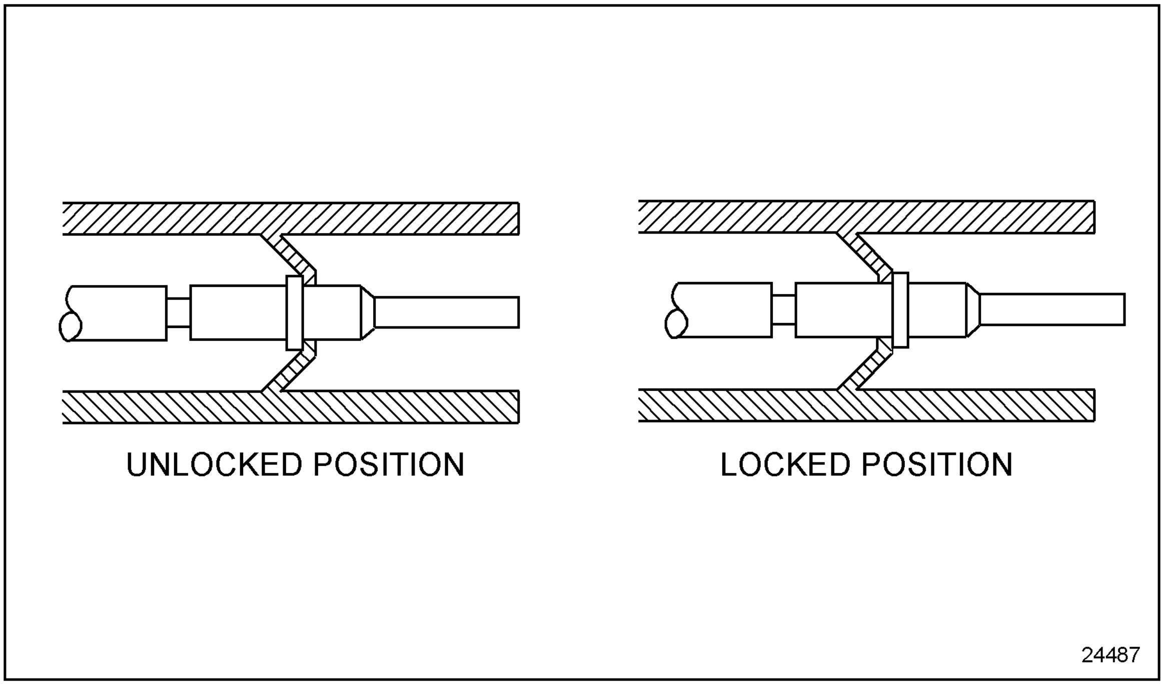


Figure 2-19 Locking Terminal into Connector

2.4.3.2 Deutsch Terminal Removal

The appropriate size removal tool should be used when removing cables from connectors. The proper removal tools are listed in Table 2-39.

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

Table 2-39 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 2-20.

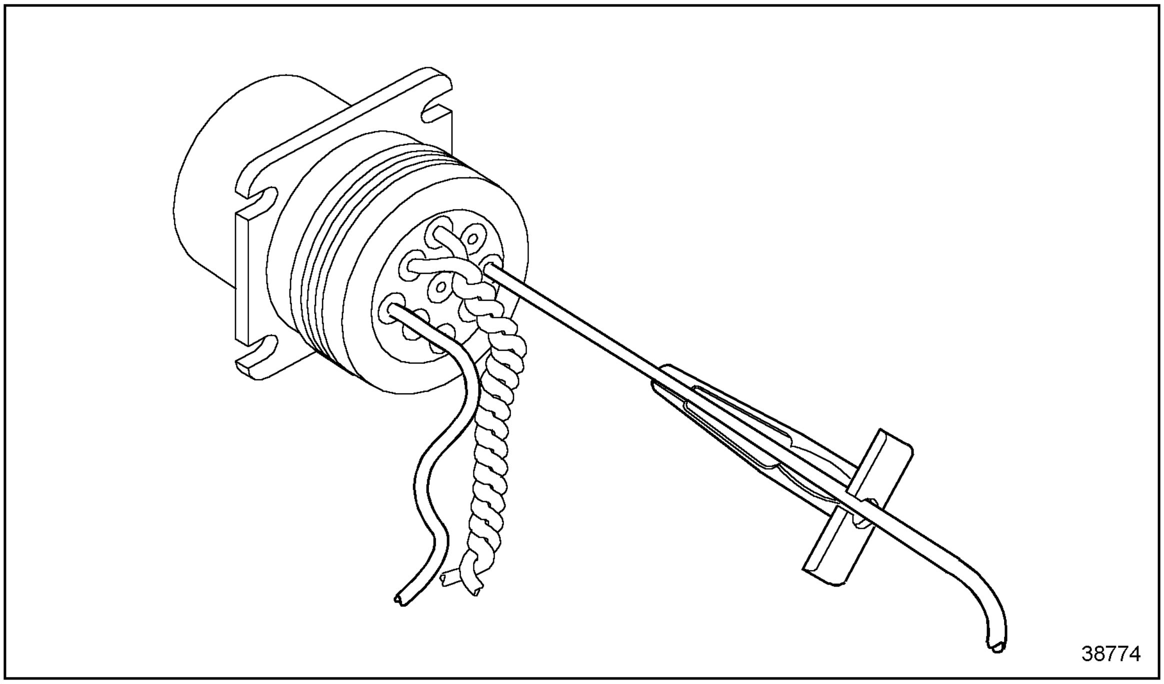


Figure 2-20 Removal Tool Position

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 2-21.

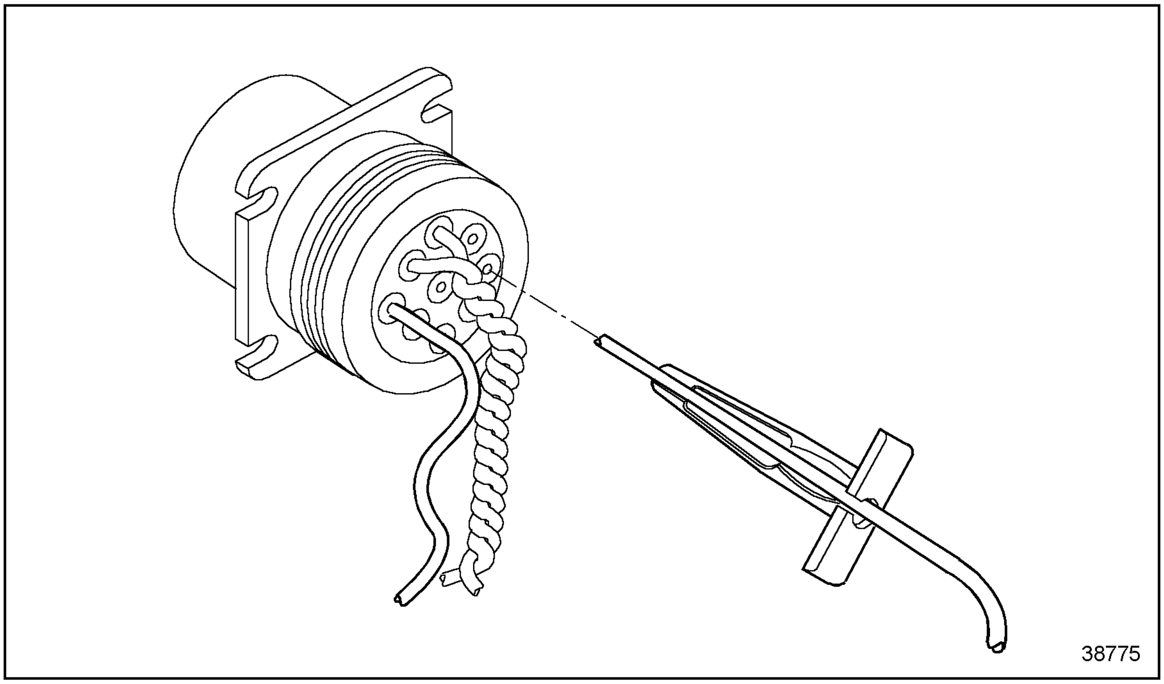


Figure 2-21 Removal Tool Insertion

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

2.4.4 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.

2.4.4.1 Clipped and Soldered Splicing Method

The tools required are listed in Table 2-40.

Tool	Part Number
Heat Gun	--
Sn 60 Solder with Rosin Core Flux	--
Wire Stripper	--
Splice Clips (commercially available)	Wire size dependent
Heat Shrink Tubing	Raychem HTAT or equivalent

Table 2-40 Recommended Splicing Tools

Criteria: Splicing Straight Leads

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 2-22.

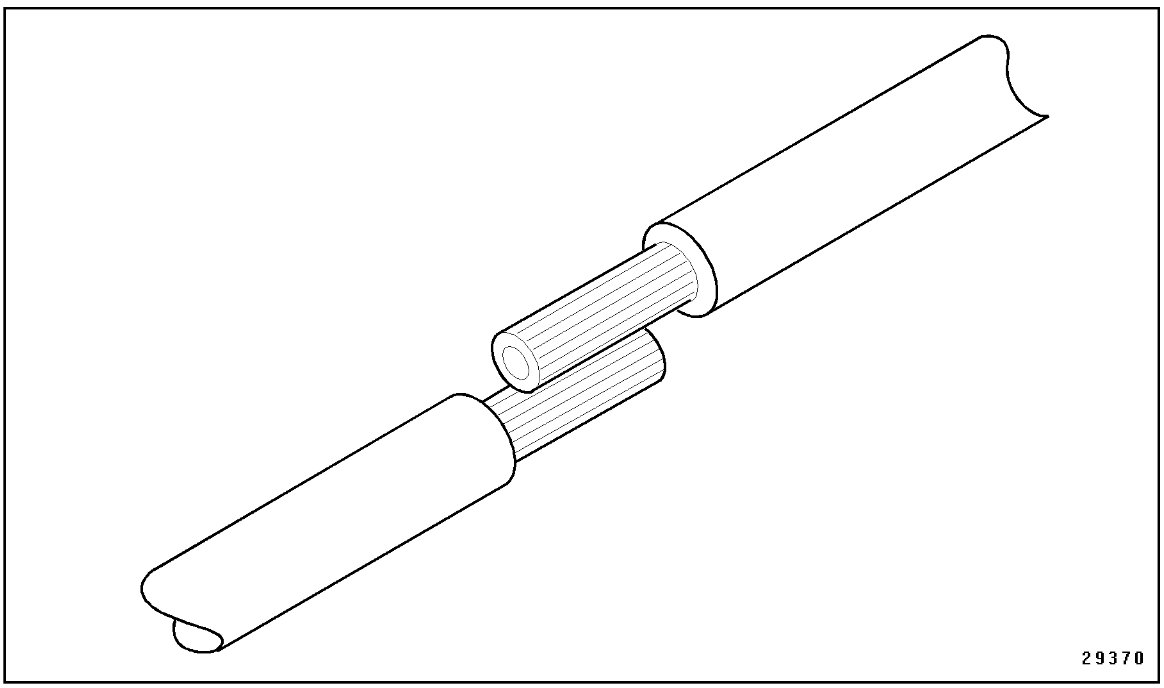


Figure 2-22 Positioning the Leads

2. Secure the leads with a commercially available clip and hand tool. See Figure 2-23.

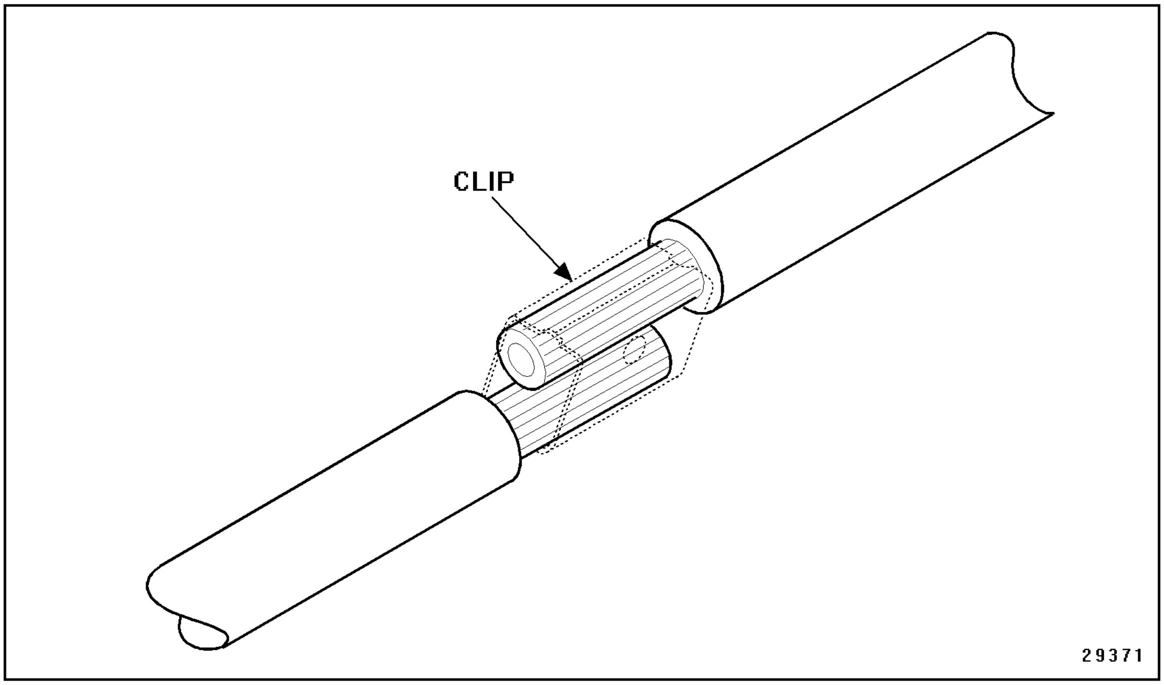


Figure 2-23 Securing the Leads With a Clip

3. Use a suitable electric soldering iron to heat the wires. Apply the solder to the heated wire and clip (not to the soldering iron) allowing sufficient solder flow into the splice joint.
4. Pull on wire to assure crimping and soldering integrity. The criteria listed in Table 2-41 must be met.

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

Table 2-41 Applied Load Criteria for Terminals

5. Loop the lead back over the spliced joint and tape. See Figure 2-24.

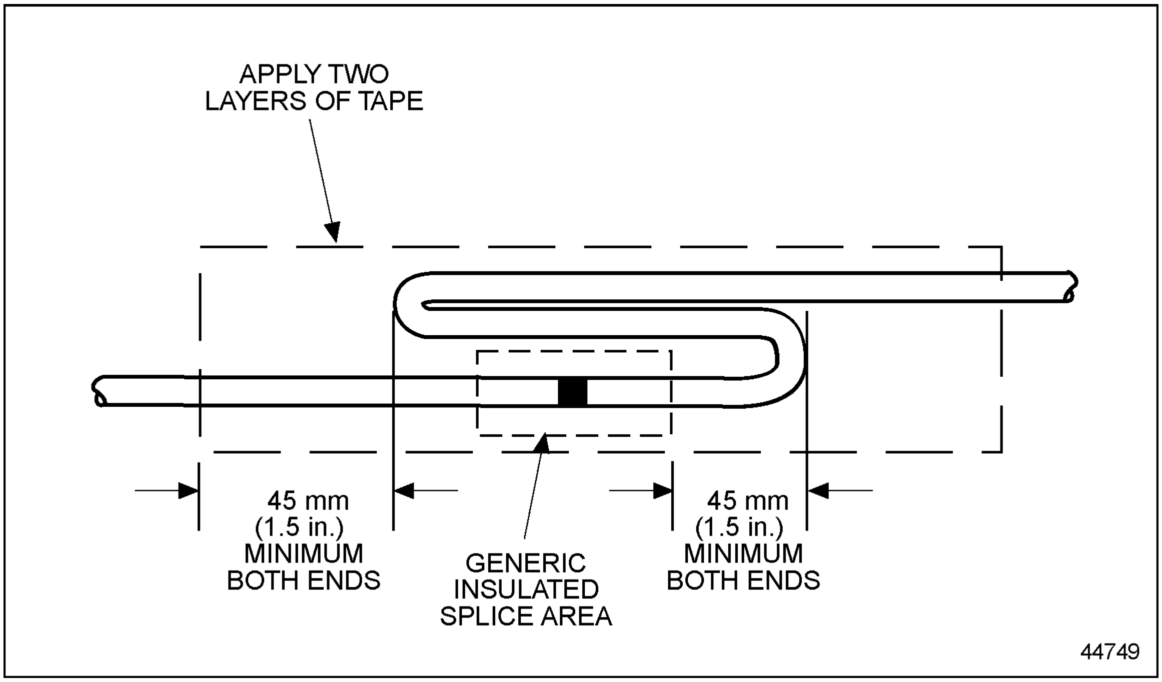


Figure 2-24 Recommended Strain Relief of Spliced Joint

2.4.4.2 Splicing and Repairing Straight Leads — Alternate Method 1

The tools required are listed in Table 2-42.

Tool	Part Number
Heat Gun	--
Wire Stripper	--
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 2-42 Recommended Splicing Tools

Criteria: 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 2-25, A).
4. Insert the other wire into the splice clip until it butts against the clip stop (see Figure 2-25, 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 2-43 must be met.

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

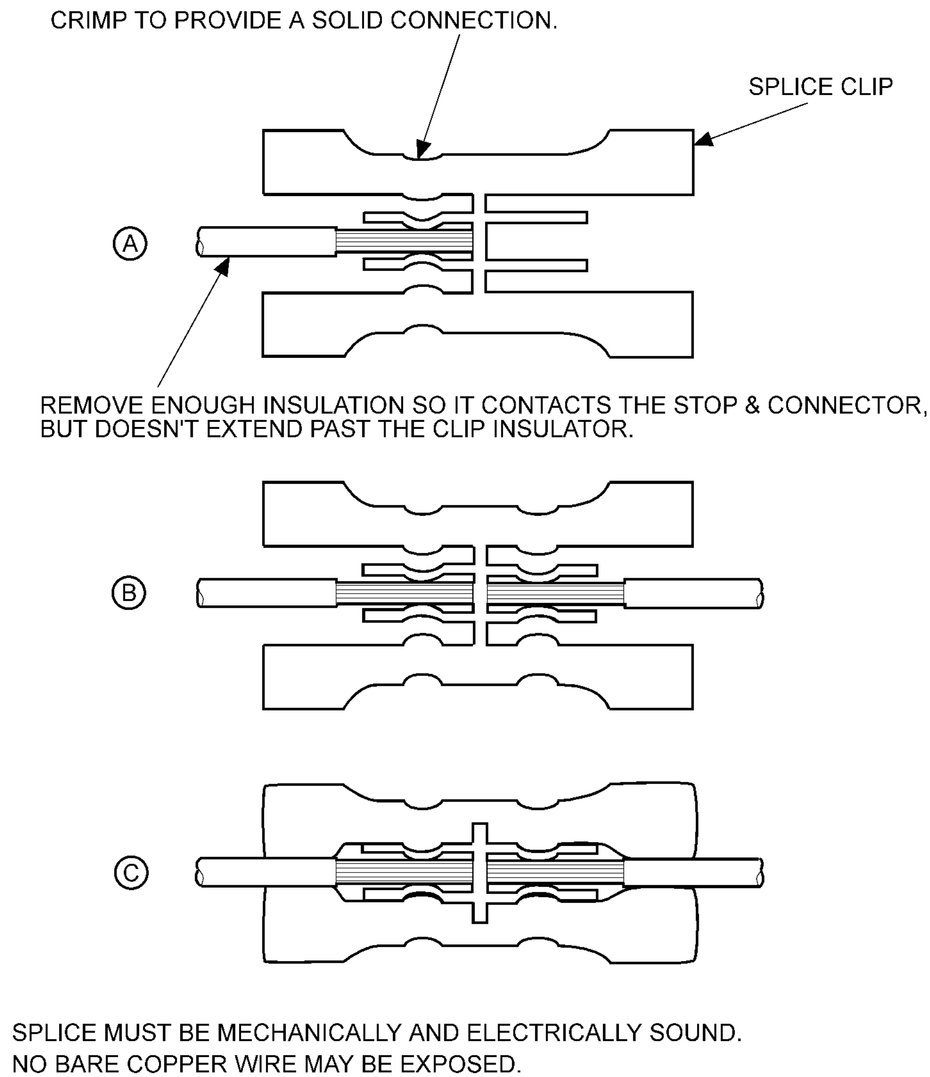
Table 2-43 Applied Load Criteria for Terminals

7. Shrink the splice clip insulative casing with a heat gun to seal the splice (see Figure 2-25, C).

NOTICE:

Splices may not be closer than 305 mm (12 in.) apart to avoid degradation in circuit performance. Replace wire to avoid having splices closer than 305 mm (12 in.) apart.

8. Loop the lead back over the spliced joint and tape. See Figure 2-24.



NOTICE:

Splices may not be closer than 30 mm (12 in.) apart to avoid degradation in circuit performance. Replace wire to avoid having splices closer than 30 mm (12 in.) apart.

44750

Figure 2-25 Splicing Straight Leads - Alternate Method 1

2.4.4.3 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 2-44.

Tool	Part Number
Heat Gun	--
Wire Stripper	--
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 2-44 Recommended Splicing Tools

Criteria: 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 6 mm (0.25 in.) on both sides (see Figure 2-26, A).
4. Insert one wire into splice clip until it butts against the splice clip. Stop and crimp (see Figure 2-26, 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 2-26, 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 2-26, C).
8. Shrink tubing with a heat gun to seal the splice (see Figure 2-26, 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 2-24.

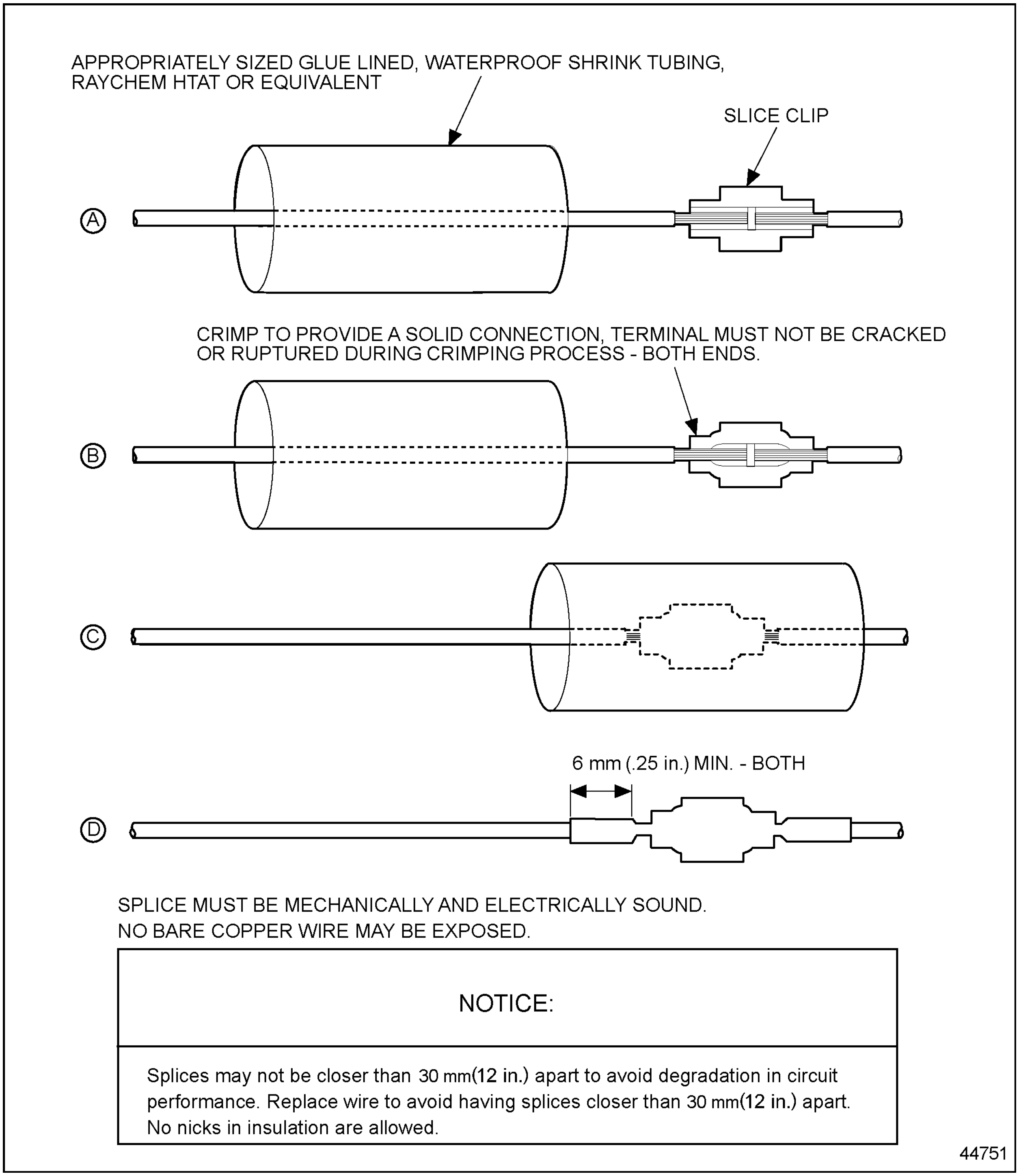


Figure 2-26 Splicing Straight Leads - Alternate Method 2

2.4.4.4 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 6 mm (0.25 in.) over wire insulation past splice in both directions.

Alpha Wire Corporation	Tyco Electronics Corporation
711 Lidgerwood Ave	Raychem Cable Identification and Protection
P.O. Box 711	300 Constitution Drive
Elizabeth, New Jersey 07207-0711	Menlo Park, CA 94025
1-800-52ALPHA	Phone: 1–800–926–2425
www.alphawire.com	www.raychem.com

To heat shrink wrap a splice:

NOTICE:
The heat shrink wrap must overlap the wire insulation about 6 mm (0.25 in.) 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).

2.4.4.5 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 2-27) so there is at least a 65 mm (2.5 in.) separation between splices.

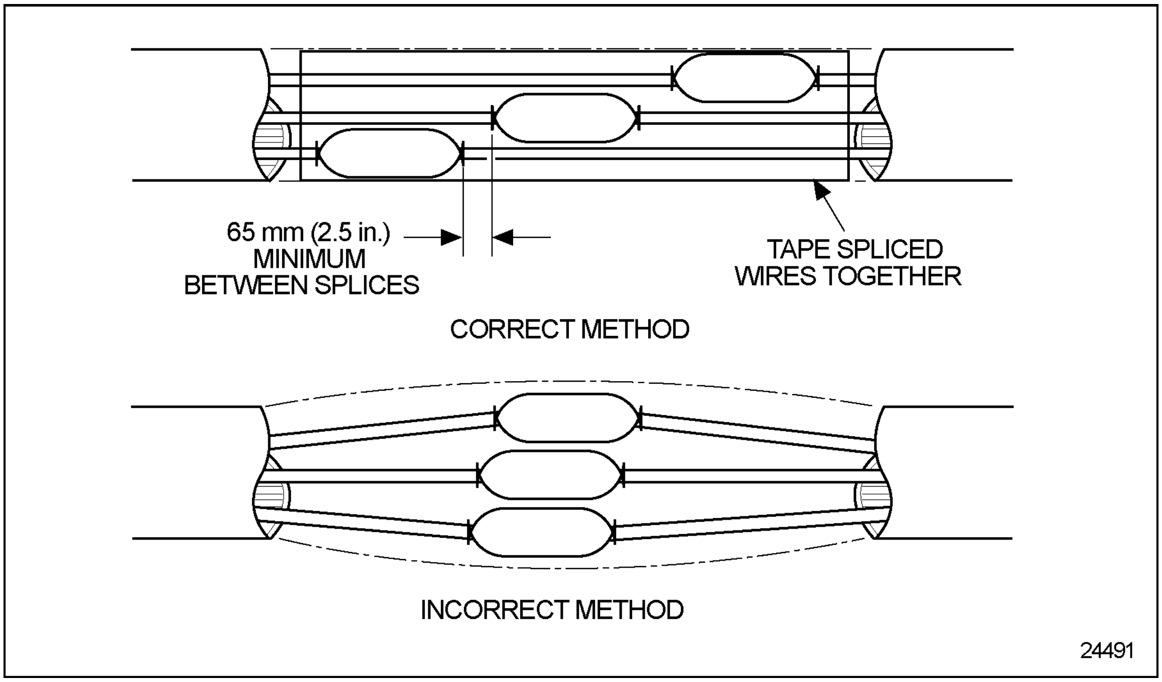


Figure 2-27 The Correct and Incorrect Method of Staggering Multiple Splices

NOTICE:
A minimum of two layers of heat shrink tubing extending 6 mm (0.25 in.) past the splice must be used to complete the splice.

2. Heat shrink a minimum of two layers of heat shrink tubing.
3. Tape the spliced wires to each other. Refer to section 2.5.

2.5 CONDUIT AND LOOM

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

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

The following guidelines should be used when designing a harness:

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

- □ The distance between the back of the connector or other listed devices to the end of the conduit should not exceed:
  - □ 25 mm (1.0 in.) for a single connector/device
  - □ 75 mm (3.0 in.) for multiple connectors/devices
- □ All cable breakouts and conduit ends must be secured in place with conduit outlet rings or tape.

Criteria: 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 (refer to section 2.5). Be sure to firmly secure the start and finish ends of tape.

Criteria: Tape

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

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

In applications where temperature exceeds 80°C (176°F), vinyl electrical tape should not be used. For these applications, adhesive cloth backed, flame retardant polyethylene or fiber glass tape (Delphi No. PM-2203, Polikan No. 165 or equivalent) is recommended.

Criteria: Taping

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

The tape must be crossed over butted conduit ends.

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

2.7 SENSORS

The MBE Electronic Controls system is designed to operate with several types of sensors as listed in Table 2-45.

Sensor Type	Description
Variable Reluctance/Magnetic Pick-up	Used to monitor the crankshaft position, engine speed, turbo speed (MBE 4000 only), 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, inlet air restriction, and oil level.

Table 2-45 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 2-46.

Sensor	Function
Camshaft Position Sensor	Senses camshaft position and engine speed for functions such as fuel control strategy.
Crankshaft Position Sensor	Indicates specific cylinder positions and engine speed.
Engine Coolant Temperature Sensor (ECT Sensor)	Senses coolant temperature for functions such as engine protection, fan control and engine fueling.
Engine Oil Level Sensor	Senses oil level for functions such as engine protection.
Engine Oil Pressure Sensor (EOP Sensor)	Senses gallery oil pressure for functions such as engine protection.
Engine Oil Temperature Sensor (EOT Sensor)	Senses oil temperature for functions such as reducing variation in fuel injection and fan control.
Intake Manifold Pressure Sensor (IMP Sensor)	Senses turbo boost for functions such as smoke control and engine protection.
Intake Manifold Temperature Sensor (IMT Sensor)(IMT Sensor)	Senses boost temperature
Supply Fuel Temperature Sensor (SFT Sensor)	Senses fuel temperature for functions such as engine fueling.
Turbo Speed Sensor (MBE 4000 only)	Monitors turbo speed.

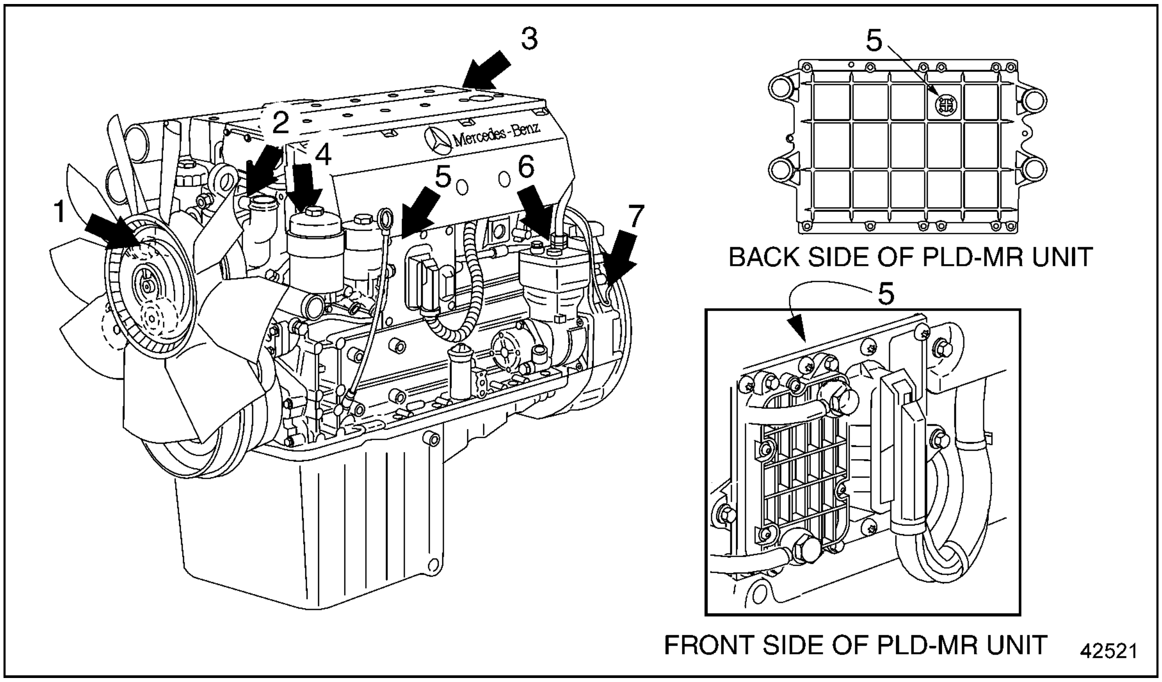
Table 2-46 Function of Factory-Installed Sensors

See Figure 2-28 for sensor locations on the MBE 900 engine

NOTE:
The 6–cylinder engine is shown; sensor locations are similar on the 4–cylinder engine.

NOTE:
The Barometric Pressure Sensor (BARO Sensor) is integrated into the PLD-MR control unit.

NOTE:
The EOL Sensor, if used, is located at the bottom of the oil pan.

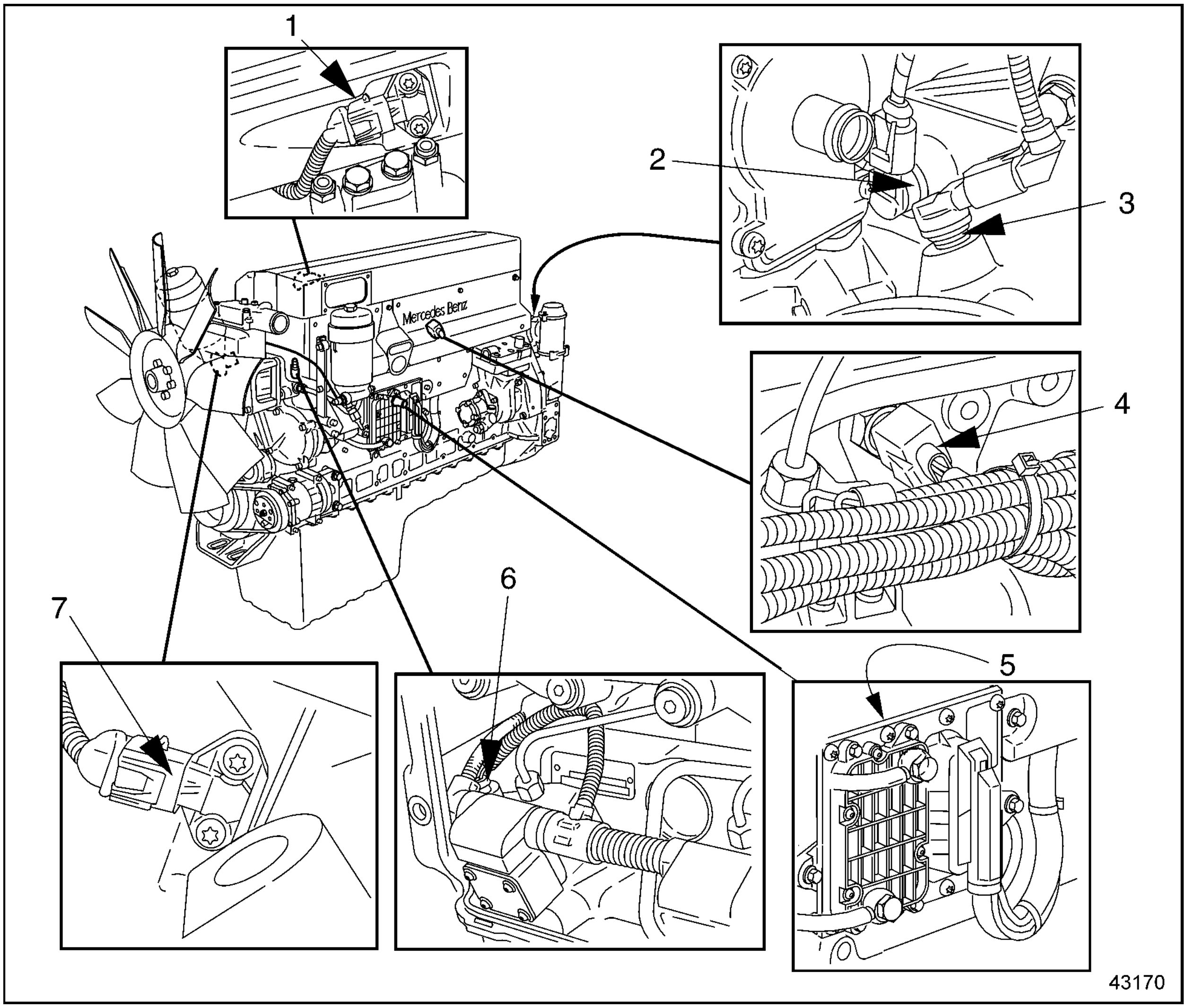


1. Oil Combination Sensor
2. Engine Coolant Temperature Sensor
3. Boost Air Combination Sensor
4. Supply Fuel Temperature Sensor
5. Barometric Pressure Sensor (integrated into PLD-MR)
6. Camshaft Position Sensor (on camshaft)
7. Crankshaft Position Sensor (on timing case)

Figure 2-28 Sensor Location on the MBE 900 Engine

Two sensors are not easily visible from the left-hand side of the MBE 4000 engine. The Boost Air Combination Sensor is located on the right-hand side of the charge air manifold, behind the No. 2 cylinder head. The Oil Combination Sensor is located at the base of the oil filter. See Figure 2-29 for sensor locations on the MBE 4000 engine.

NOTE:
The EOL Sensor, if used, is located at the bottom of the oil pan.



1. Boost Air Combination Sensor
2. Camshaft Position Sensor (on camshaft)
3. Crankshaft Position Sensor
4. Engine Coolant Temperature Sensor
5. Barometric Pressure Sensor (integrated into PLD-MR)
6. Supply Fuel Temperature Sensor
7. Oil Combination Sensor

Figure 2-29 Sensor Location on the MBE 4000 Engine

2.7.2 OEM Installed Sensors

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

The OEM is responsible for installing the sensors listed in Table 2-47.

Sensor	Part Number	Function
Engine Coolant Level Sensor (ECL Sensor)	23522855 23520380 23520381	Senses coolant level for engine protection. Refer to section 2.7.3.
Vehicle Speed Sensor (VSS)	--	Senses vehicle speed for Cruise Control and Vehicle Speed Limiting. Refer to section 2.7.4.

* Available in some applications

Table 2-47 Function and Guidelines for OEM-installed Sensors

NOTE:
The OEM harness must be securely fastened every 150 mm (6 in.). It is required that the harness be fastened within 150 mm (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. Other non-DDC supplied engine coolant level sensors may be used but may require the use of a signal interface.

The main component of the ECL Sensor consists of a conductivity probe, which connects to the DDEC-VCU (see Figure 2-30).

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

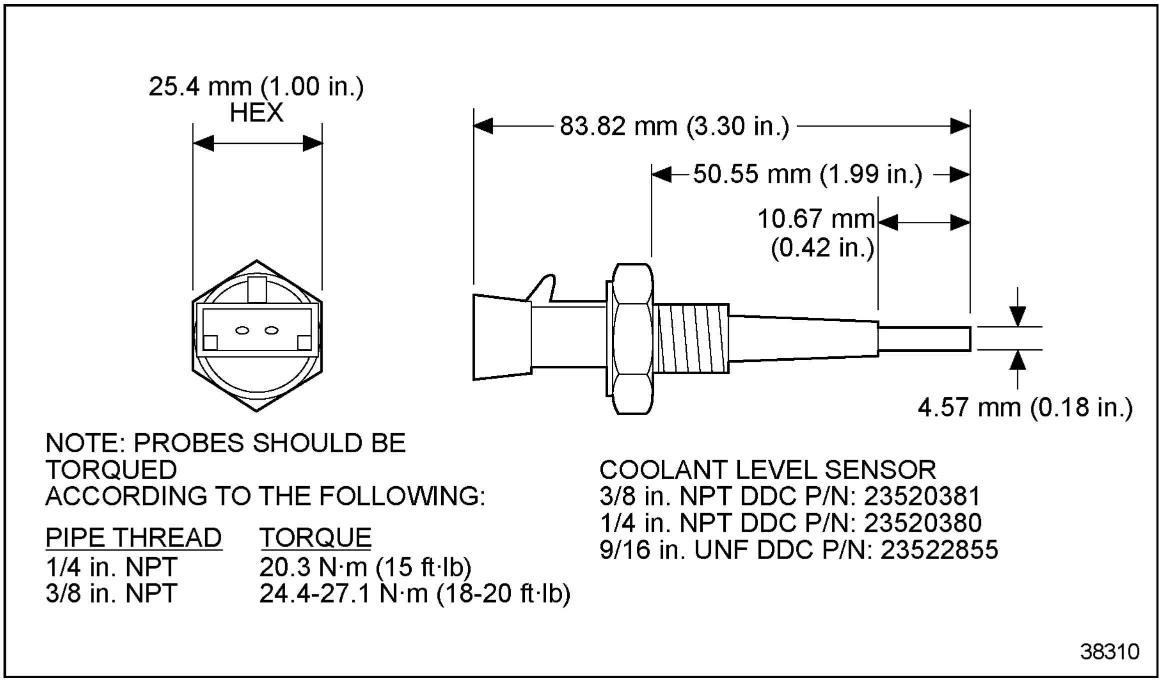


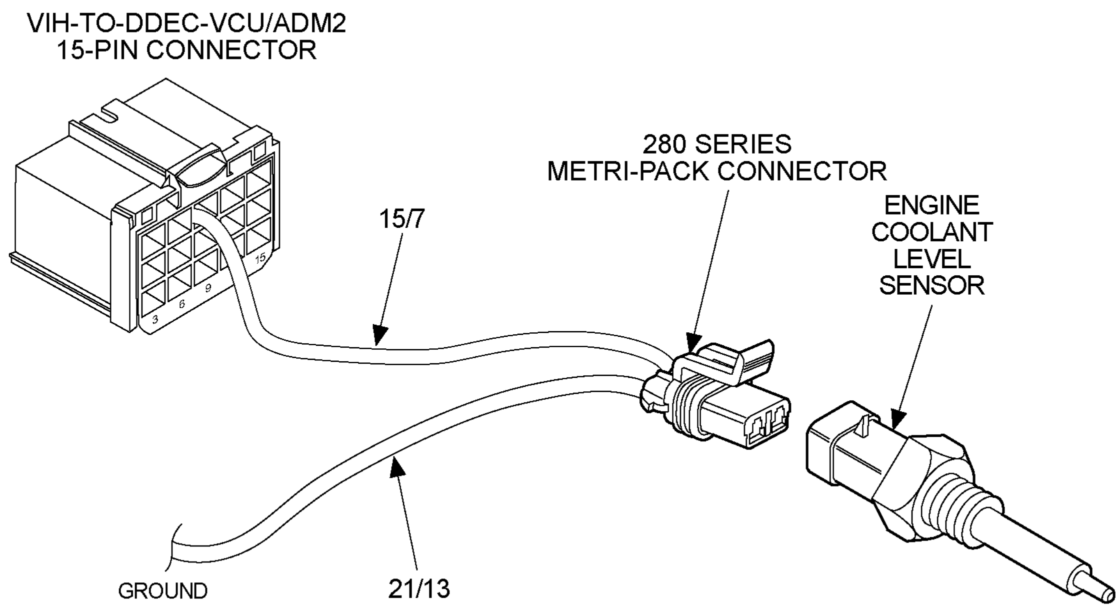
Figure 2-30 Engine Coolant Level Sensor Specifications

The connector listed in Table 2-48 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 2-48 Metri-Pack 280 Connectors and Part Numbers

The OEM must connect the ECL Sensor probe as shown in the next illustration (see Figure 2-31). Polarity of the ground and signal must be correct for proper operation.



LABEL	VIH-TO-DDEC-VCU/ADM2 CONNECTOR CAVITY	WIRE COLOR	CLS CAVITY
COOLANT LEVEL	15/7	ORN	A
GROUND	21/13	BLK/WHT	B

44437

Figure 2-31 Engine Coolant Level Sensor Installation

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 15 mm (0.5 in.) or more past the inside wall of the tank. See Figure 2-32.

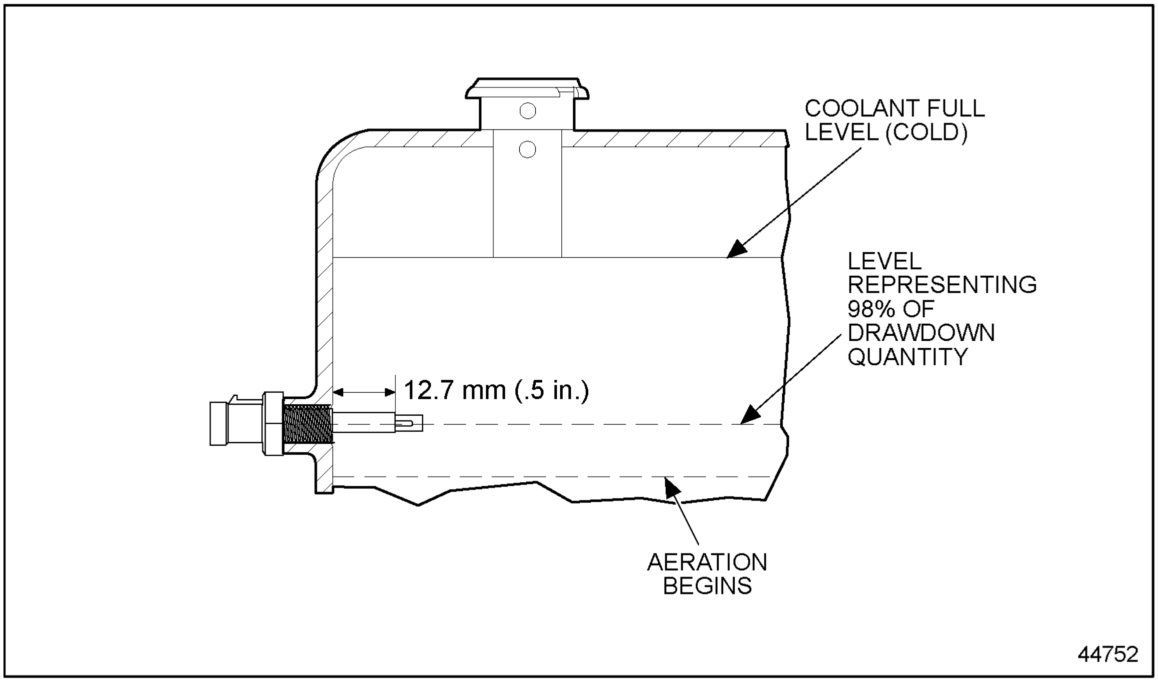


Figure 2-32 Engine Coolant Level Sensor Location - Top of Radiator Tank

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 2-49 and Table 2-50 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	23520380
Metri-Pack Connector Kit	15300027
Metri-Pack Terminals	12077411
Secondary Lock	15300014
Wire Seal	12015323
Terminal	12103881

Table 2-49 Engine Coolant Level Sensor Installation Kit P/N 23515397 (1/4 in. NPTF)

Component	Part Number
ECL Sensor	23520381
Metri-Pack Connector Kit	15300027
Metri-Pack Terminals	12077411
Secondary Lock	15300014
Wire Seal	12015323
Terminal	12103881

Table 2-50 Engine Coolant Level Sensor Installation Kit P/N 23515398 (3/8 in. NPTF)

The sensor must be enabled with VEPS or the minidiag2 as listed in Table 2-51.

Parameter	Range	Default	Parameter ID
Enable ECL Sensor Input	0 = Disabled 1 = Enabled	1	1 13 02

Table 2-51 Enabling the Engine Coolant Level Sensor

2.7.4 Vehicle Speed Sensor

The DDEC-VCU can calculate vehicle speed, providing that it is properly programmed and interfaced with a Vehicle Speed Sensor (VSS) that meets MBE requirements. The VSS (see Figure 2-33) provides a vehicle speed signal for use in Cruise Control and Vehicle Speed Limiting. The VSS signal type can be changed with the VEPS, or minidiag2.

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

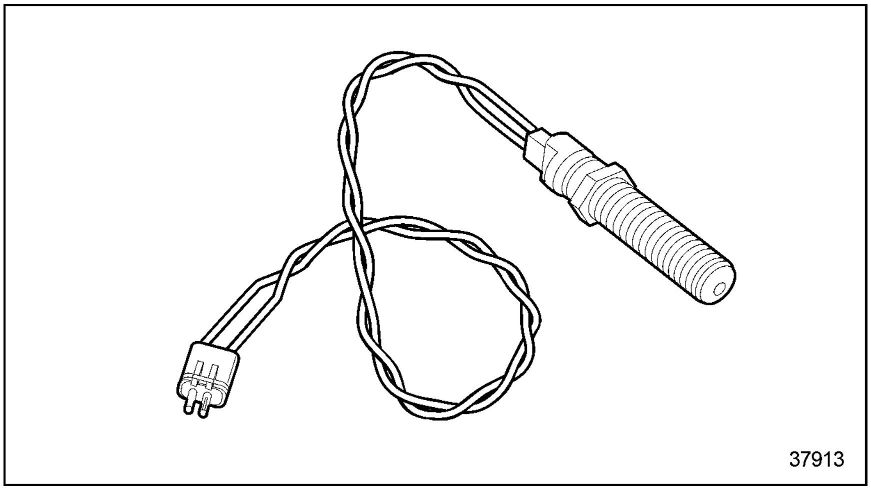


Figure 2-33 Vehicle Speed Sensor

2.7.4.1 SAE J1939 Data Link

A VSS wired to the DDEC-VCU is not required if the transmission output shaft message is being transferred over the SAE J1939 data link. To obtain accurate vehicle mileage, the parameters listed in Table 2-52 must be programmed with VEPS or the minidiag2.

Parameter	Range	Default	Parameter ID
VSS Input Configuration	3 = Transmission output shaft on the SAE J1939 Data Link*	0 = No VSS	1 13 08
Axle Ratio	1 – 20.0	5.29	1 13 09
Number of Output Shaft Teeth	0 – 250	16	1 13 10
Tire Revs/Kilometer	160 – 1599	312	1 13 11
Top Gear Ratio	0.1 – 2.55	1	1 13 12
Two Speed Axle — Second Axle Ratio	1 – 20.0	5.29	1 13 13

* Range must be set to 1.

Table 2-52 Vehicle Speed Sensor Parameters

2.7.4.2 Magnetic Pickup

The magnetic pickup requirements are listed in Table 2-53. Magnetic Pickup size is determined by installation requirements.

Parameters	Range
Frequency Range	1 - 3000 Hz
Low Threshold Voltage	>1.7 Volts

Table 2-53 Magnetic Pickup Vehicle Speed Sensor Requirements

The VSS is wired to the 15-pin connector of the DDEC-VCU. The VSS pin wiring is listed in Table 2-54.

Connector/Pin	Function
15/3	VSS (+)
15/4	VSS (-)

Table 2-54 Vehicle Speed Sensor Wiring

Magnetic Vehicle Speed Sensors can be obtained from the following sources:

Wabash Technologies	Airpax Instruments	Invensys Electro Corporation
1375 Swan Street Huntington, Indiana 46750-0829 Tel: 260-356-8300 www.wabashtech.com	Phillips Technologies 150 Knotter Drive Chesire, Connecticut 06410 Tel: 800-643-0643	1845 57th Street Sarasota, Florida 34231 Tel: 1–800–446–5762 Fax: 941-355-3120 www.electrocorp.com

2.7.4.3 SAE J1939 Data Link

A VSS wired to the DDEC-VCU 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 2-55 must be programmed with VEPS or the minidiag2.

Parameter	Range	Default	Parameter ID
VSS Input Configuration	3 = Transmission output shaft speed on the SAE J1939 Data Link*	0 = No VSS	1 13 08
Axle Ratio	1 – 20.0	5.29	1 13 09
Tire Revs/Kilometer	160 – 1599	312	1 13 11
Top Gear Ratio	0.1 – 2.55	1	1 13 12
Two Speed Axle — Second Axle Ratio	1 – 20.0	5.29	1 13 13

* Range must be set to 3.

Table 2-55 Vehicle Speed Sensor Parameters

2.8 GRID HEATER

The grid heater (see Figure 2-34) is driven by a load relay switched to supply voltage.

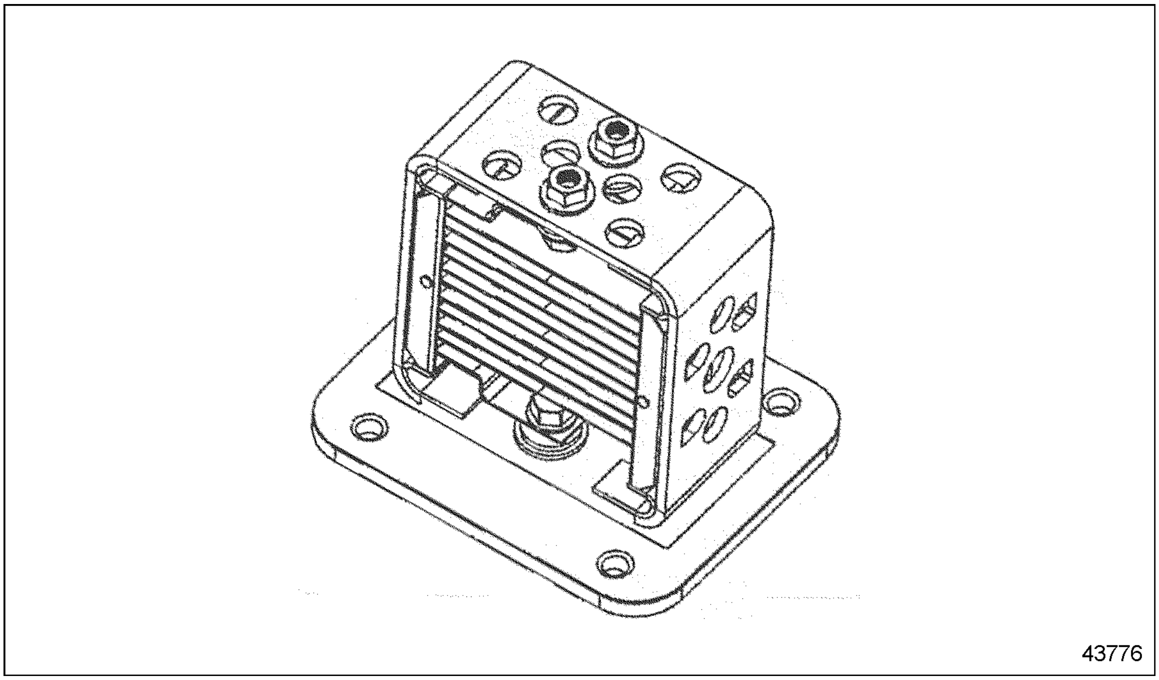


Figure 2-34 Grid Heater

Nominal power and resistance for the 12 V.

2.9 CRUISE CONTROL CIRCUIT

The following is a list of switches and DDEC-VCU sensors that are required for Cruise Control operation:

- ☐ Cruise Control ON/OFF (Switch or J1939)
- ☐ Service Brake (Switch or J1939)
- ☐ Clutch Released for Manual Transmission (Switch or J1939)
- ☐ Set/Coast (Switch or J1939)
- ☐ Resume/Accel (Switch or J1939)
- ☐ Vehicle Speed Sensor (or J1939)

See Figure 2-35 for a diagram of the cruise control circuit.

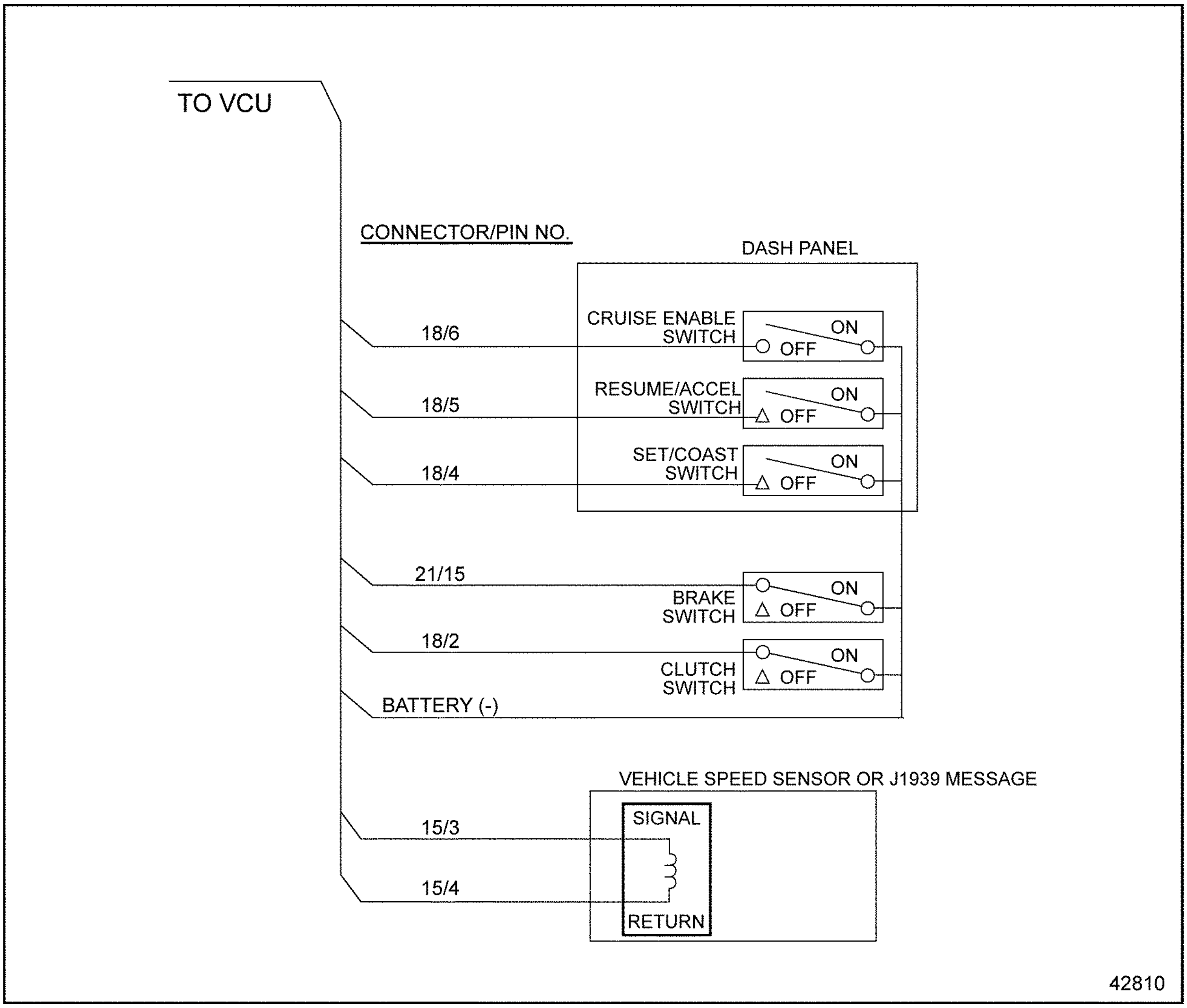


Figure 2-35 Cruise Control Circuit

2.10 ENGINE FAN

Engine Brakes and Fan Control

- ☐ Single Fan (refer to section 2.10.1)
- ☐ Dual Fans (refer to section 2.10.2)
- ☐ Two-Speed Fan (refer to section 2.10.3)
- ☐ Variable-Speed Single Fan (PWM) (refer to section 2.10.4)

2.10.1 SINGLE-SPEED FAN (FAN TYPE 4)

This section provides a schematic of the specific connection from the PLD-MR to the single-speed fan (fan type 4). See Figure 2-36 for an MBE 4000 engine or Figure 2-37 for an MBE 900 engine.

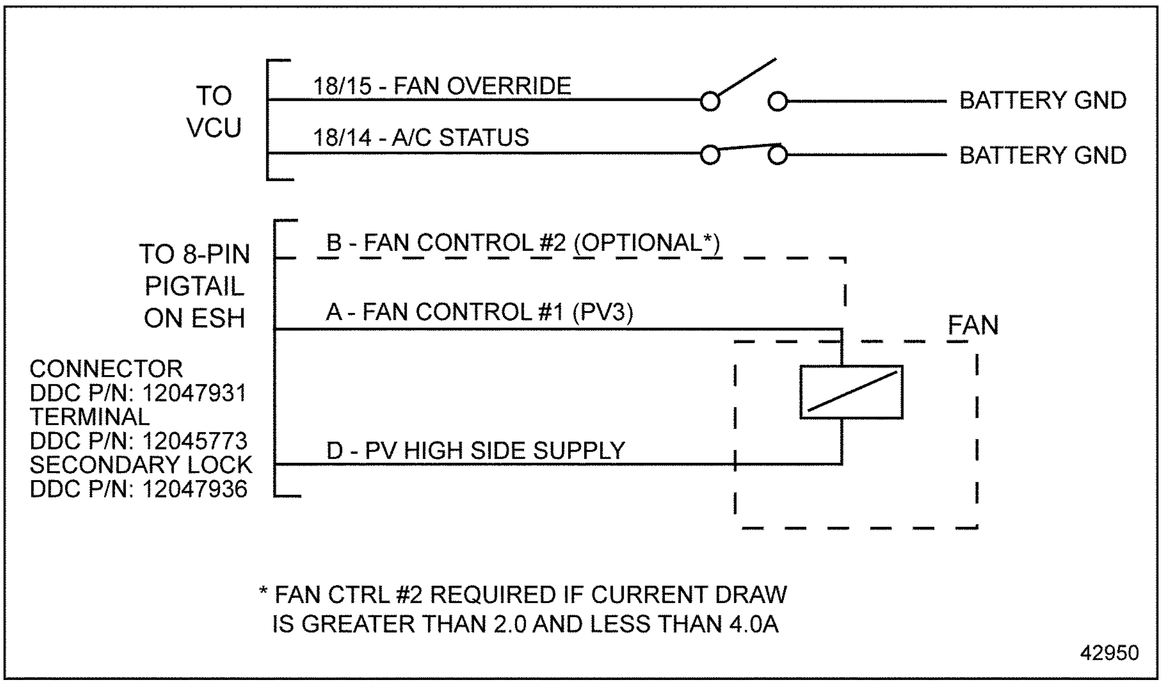


Figure 2-36 Single-Speed Fan on an MBE 4000 Engine

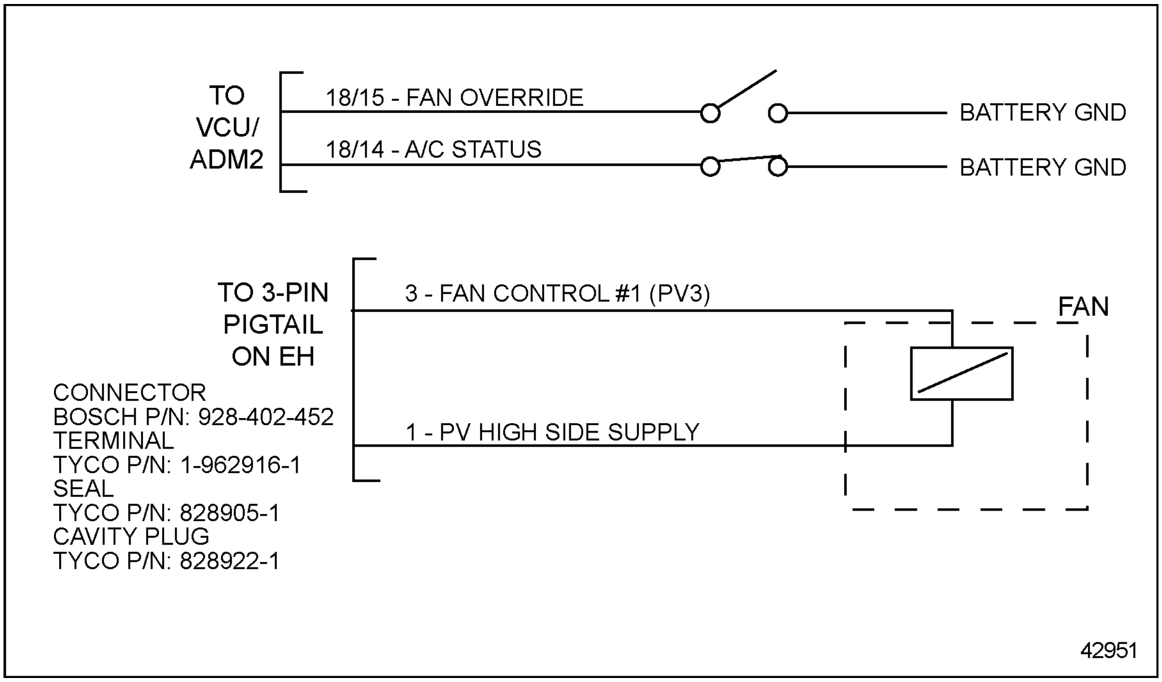


Figure 2-37 Single-Speed Fan on an MBE 900 Engine

2.10.2 DUAL FAN (FAN TYPE 6) – MBE 4000 ENGINE

See Figure 2-38 for the schematic showing a dual fan (fan type 6) on an MBE 4000 engine.

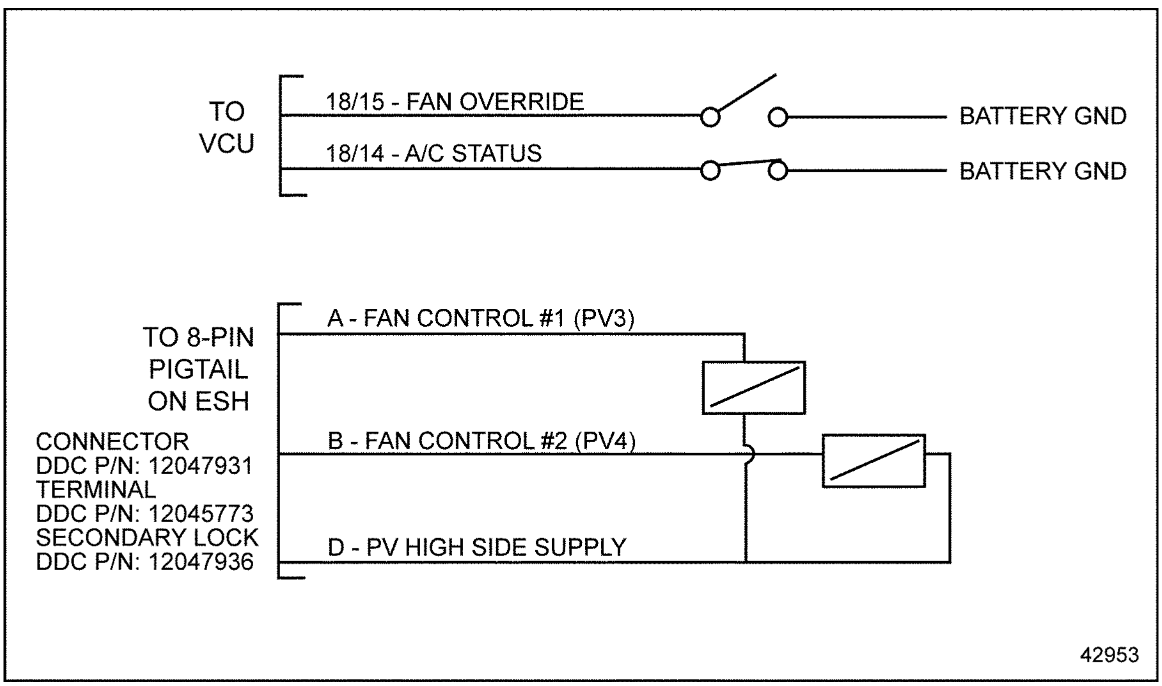


Figure 2-38 Dual Fan on an MBE 4000 Engine

2.10.3 TWO-SPEED FAN (FAN TYPE 0 OR 1) – MBE 4000 ENGINE

See Figure 2-39 for the schematic showing a two-speed fan (fan type 0 or 1) on an MBE 4000 engine.

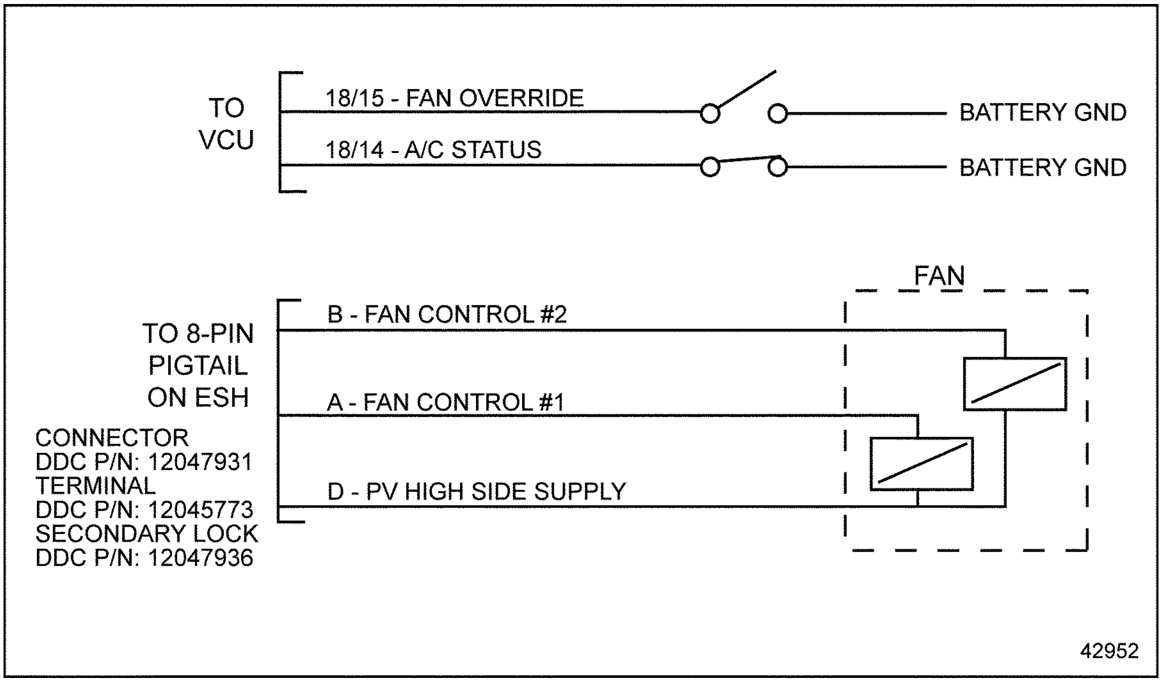


Figure 2-39 Two-Speed Fan on an MBE 4000 Engine

2.10.4 VARIABLE-SPEED FAN (FAN TYPE 5)

See Figure 2-40 for an MBE 4000 engine or Figure 2-41 for an MBE 900 engine of the schematic showing a variable-speed fan (fan type 5) installation.

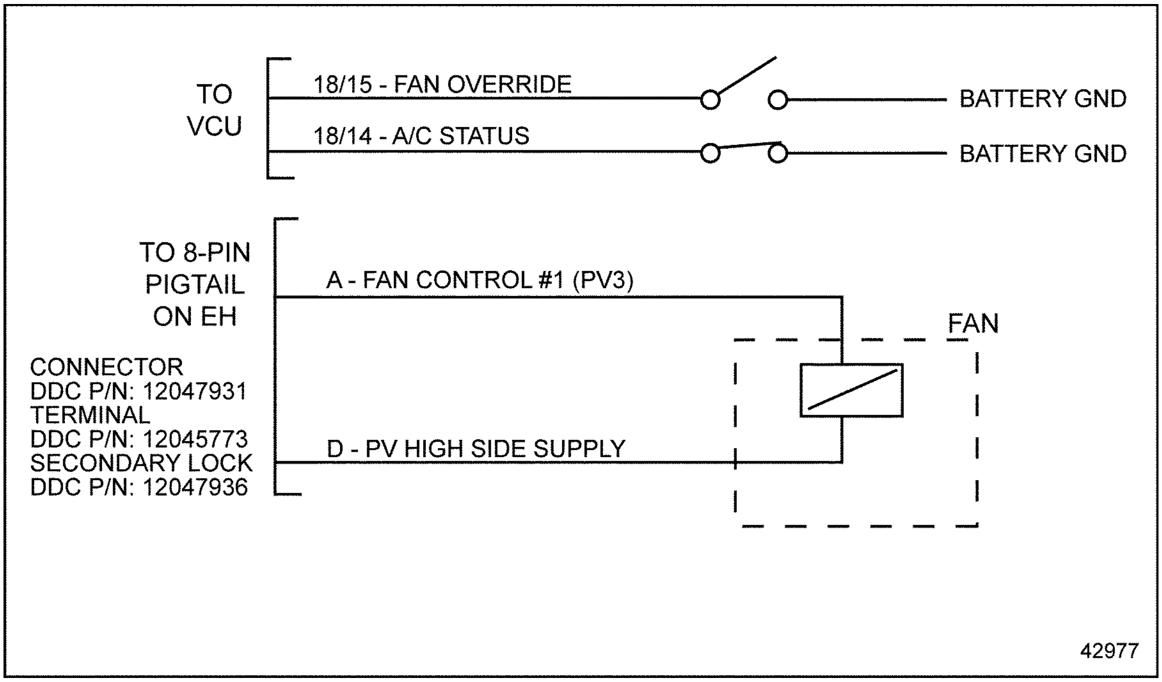


Figure 2-40 Variable-Speed Fan on an MBE 4000 Engine

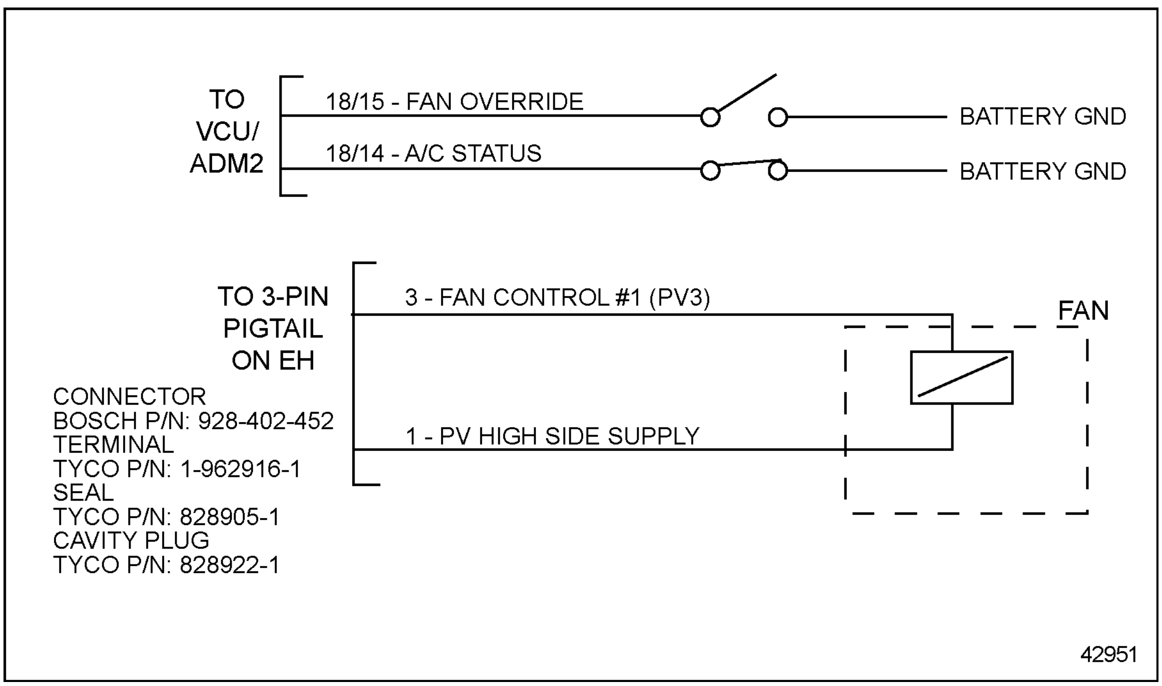


Figure 2-41 Variable-Speed Fan on an MBE 900 Engine

2.11 PARKING BRAKE SWITCH

A Park Brake Switch may be installed (see Figure 2-42). Idle Shutdown Timer operates with a digital input configured as a park brake and switched to battery ground. The time can range from 1 to 5000 seconds (approximately 1 hr and 38 minutes).

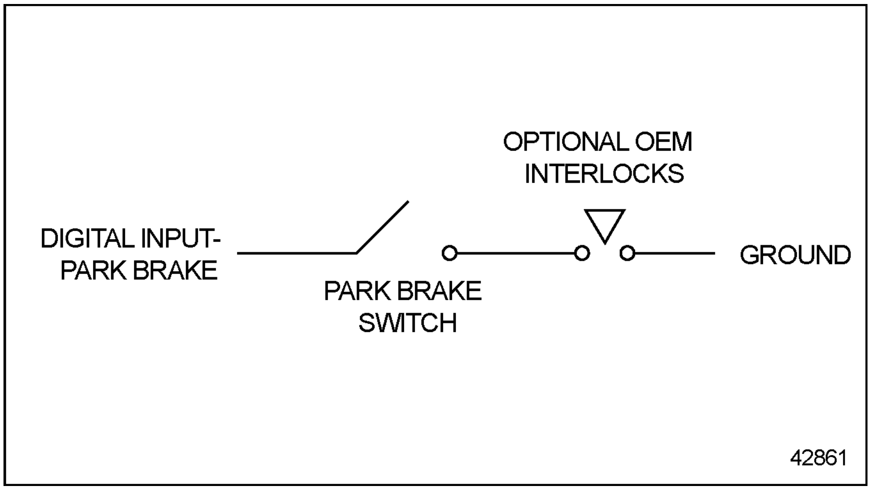


Figure 2-42 Parking Brake Digital Input

2.12 VEHICLE POWER SHUTDOWN — OPTIONAL

Vehicle Power Shutdown is used with Idle Timer Shutdown or Engine Protection Shutdown. After the idle timer times out or engine protection shuts the engine down, the Vehicle Power Shutdown relay shuts down the rest of the electrical power to the vehicle.

A Vehicle Power Shutdown relay can be installed to shutdown all electrical loads when the engine is shutdown (See Figure 2-43). The engine will shutdown after the specified idle time and will reset the relay (ignition circuit).

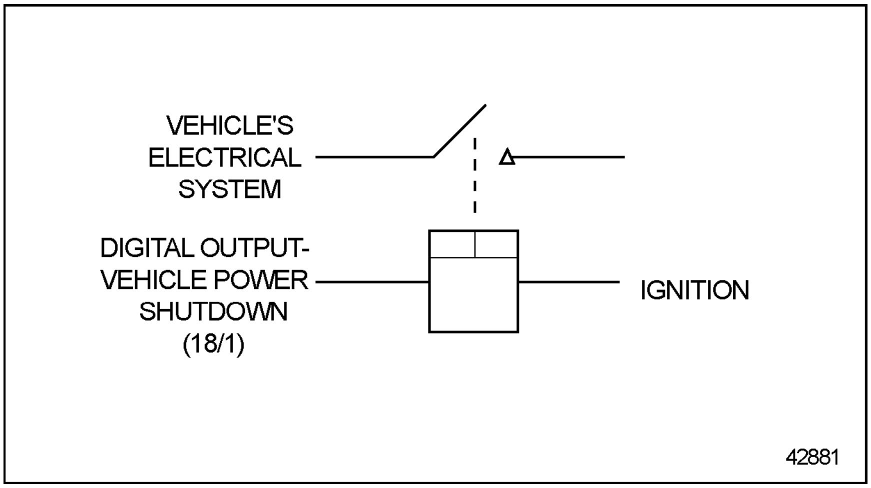


Figure 2-43 Vehicle Power Shutdown Relay

2.13 STARTER LOCKOUT

The starter lockout output circuit drives a normally closed relay, which interrupts the starting signal when the output has been activated. See Figure 2-44.

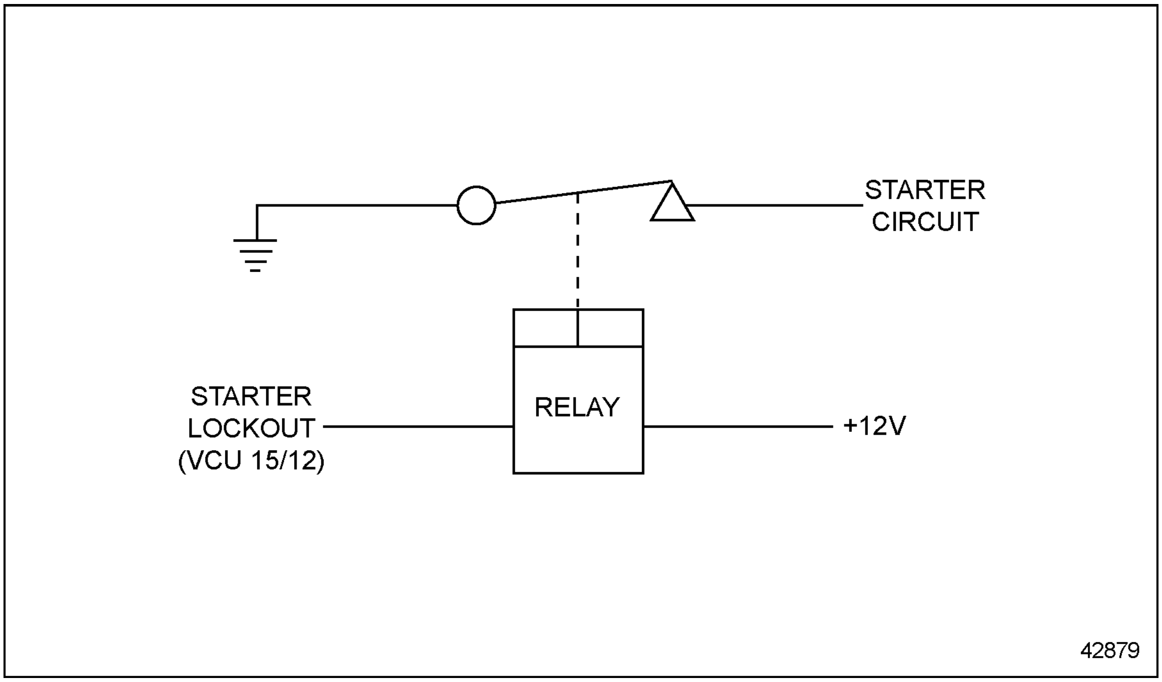


Figure 2-44 Starter Lockout

2.14 ACCELERATOR PEDAL INSTALLATION

The Accelerator Pedal (AP) sends an input signal which the DDEC-VCU uses to calculate engine power proportional to the foot pedal position. This assembly is also referred to as the Accelerator Pedal Sensor (AP Sensor) assembly.

See Figure 2-45 for installation requirements.

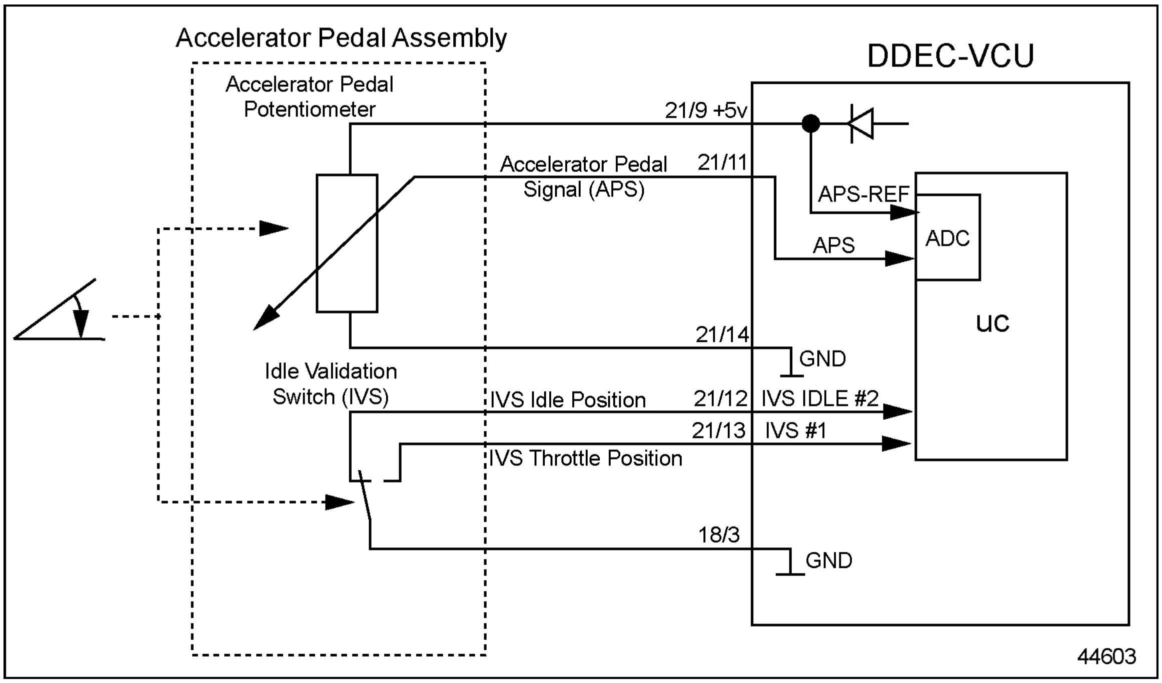


Figure 2-45 Accelerator Pedal Installation

3 OPERATION

The MBE Electronics system is an electronic control system that monitors and determines all values required for the operation of the engine. A diagnostic interface is provided to connect an external diagnosis tester.

Besides the engine related sensors and the engine-resident control unit (PLD-MR), this system has a cab-mounted control unit for vehicle engine management. There are several different modules used for vehicle engine management such as the DDEC-Vehicle Control Unit (DDEC-VCU) and the FMR. The specific DDEC-VCU used is application dependent. 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.). There are five different architectures used for the different vehicle engine management modules and the PLD-MR.

The engine control system monitors both the engine and the datalink connecting the electronic control units. The DDEC-VCU then broadcasts all information on the J1587 and J1939 datalinks, where it can be read by Minidiag2 and the other vehicle systems. When a malfunction or other problem is detected, the system selects an appropriate response; for example, the emergency running mode may be activated.

3.1 FEATURES

The operating advantages offered by the MBE Electronic Engine Control are:

- ☐ Has effective protection of engine from overloading.
- ☐ Engine parameters are easily set for particular applications.
- ☐ Integrated backup computer keeps engine operational if main computer fails.
- ☐ Engine continues to operate if CAN connection is interrupted.
- ☐ Warning signals are issued in critical states.
- ☐ Electronic fault store reduces costs of service.

4 PID 45

Section **Page**

4.1 DESCRIPTION OF PID 45 – COLD START (GRID HEATER) FAULT

The digital output for the grid heater relay is monitored for high/low state conformity. At the start of the preheating state and the starting state, and during the first two seconds of the preheating state, the intake air manifold temperature is measured to check if the cold start device (grid heater) works.

PID 45 indicates that a fault occurred during operation of the grid heater.

The diagnostic condition is typically:

- ☐ Open Circuit (045 03).
- ☐ Short to Ground (045 04).

4.1.1 DDEC-VCU

The Vehicle Control Unit (DDEC-VCU) is the interface between the DDEC-VCU and the vehicle/equipment for engine control and manages the vehicle/equipment functions. See Figure 4-1.

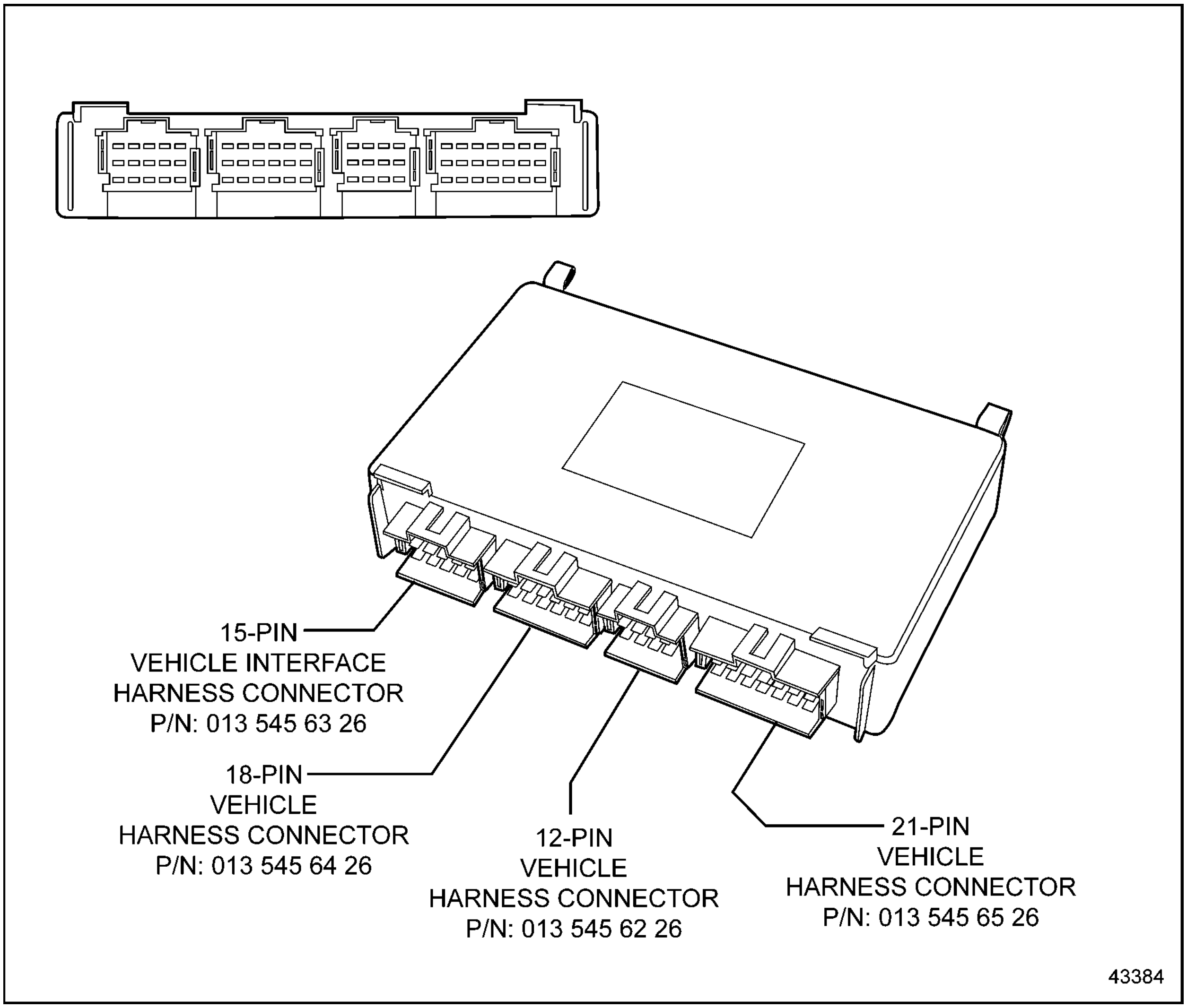


Figure 4-1 The DDEC-VCU

4.1.2 Wiring the Grid Heater

The output (pin 7 of the 21-pin connector) activates the grid heater control lamp. The output (pin 10 – of the 15-pin connector) activates the load relay for the grid heater. The digital input (pin 10 of the 12-pin connector) can be used for monitoring the load contacts of the load relay. If the output is shut off, the relay is switched to the supply voltage or to ground. See Figure 4-2.

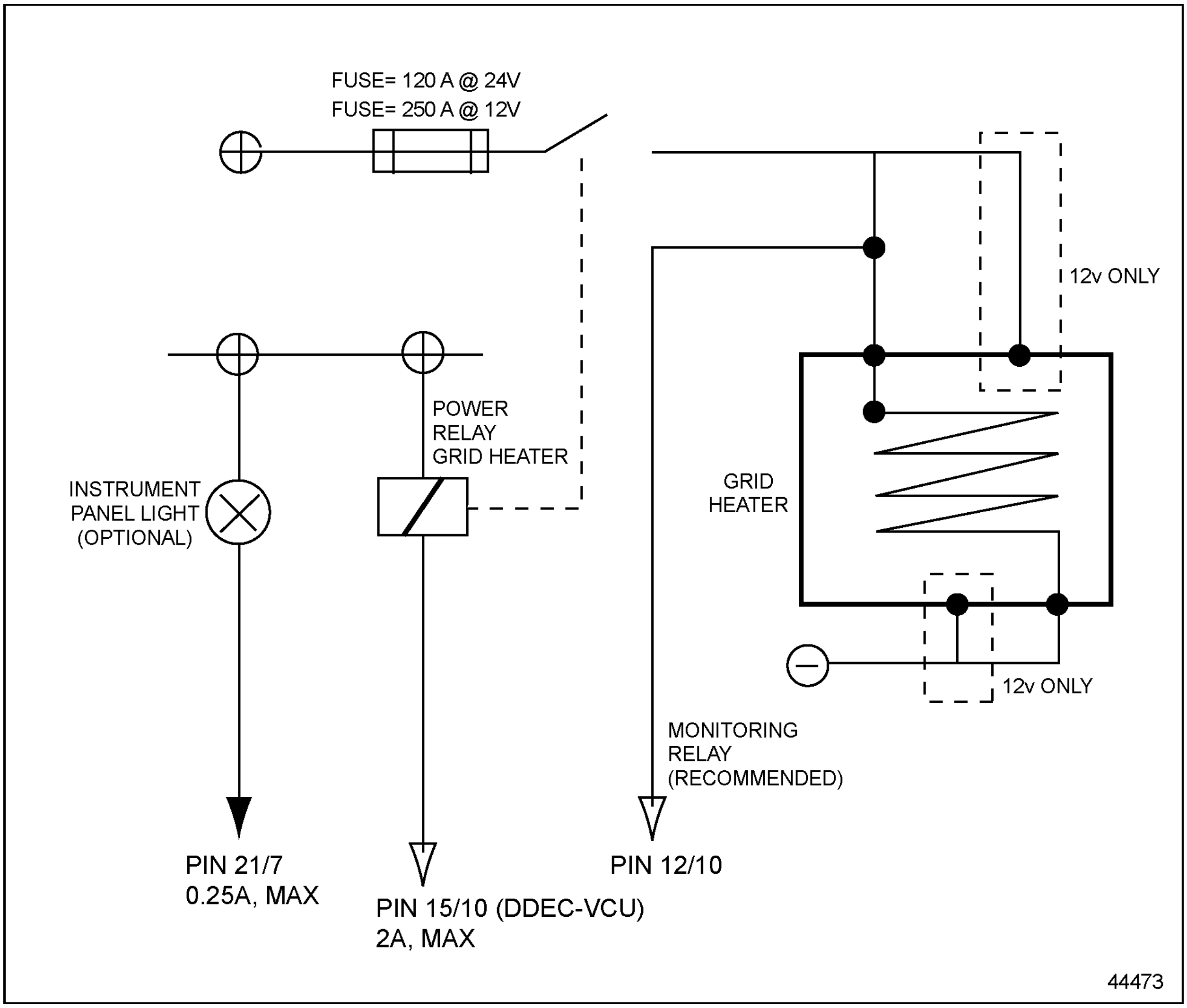


Figure 4-2 DDEC-VCU Grid Heater Wiring

4.1.3 Grid Heater

The grid heater, see Figure 4-3, is driven by the load relay switched to supply voltage. The installation of a fused high current, as well as the recommended monitoring of the load contact of the load relay, is the responsibility of the vehicle manufacturer.

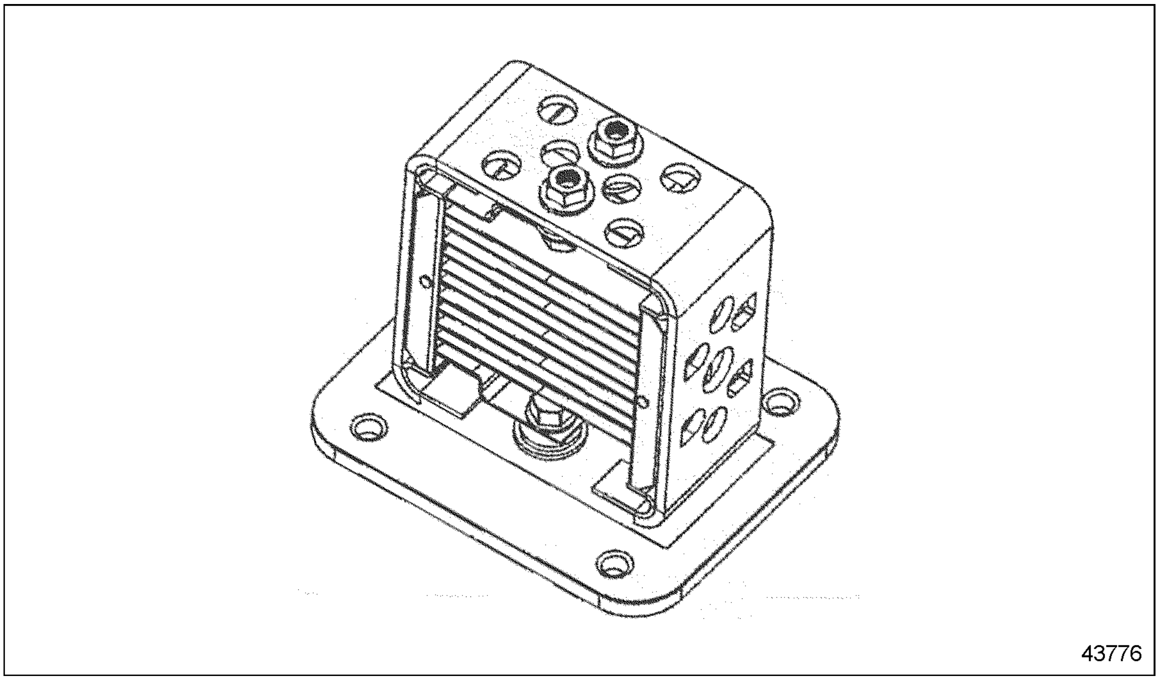


Figure 4-3 Grid Heater

A sticking contact on the load relay can be monitored via input pin 10 of the 12-pin connector, but there is no automatic power cut off. If a load contact sticks, the grid heater control lamp will flash and the grid heater load circuit must be switched off manually.

Nominal power and resistance for the 12-volt grid heater is listed in Table 4-1.

Data	12 Volt
Nominal Power at 1000 °C (1832 °F)	1.9 kw ± 10%
Resistance at Rated Temperature	62 mΩ ± 10%

Table 4-1 Nominal Power and Resistance

NOTE:
The grid heater requires a 250 amp relay for 12-volt systems.

4.2 TROUBLESHOOTING PID 45

The following procedures will troubleshoot PID 45.

4.2.1 045 03 – Open Circuit Fault

Perform the following step to troubleshoot an open circuit fault.

1. Measure the resistance between wire 10 on the 12-pin connector and the grid heater ground.
   - [a] If resistance is greater than 70 mΩ for a 12-volt system, replace the grid heater. Erase fault code memory.
   - [b] If resistance is less than 70 mΩ for a 12-volt system, contact Detroit Diesel Technical Service.

4.2.2 045 04 – Short to Ground Fault

Perform the following step to troubleshoot a short to ground fault.

1. Measure the resistance between wire 10 on the 12-pin connector and the grid heater ground.
   - [a] If resistance is 0 Ω, replace the grid heater. Erase fault code memory.
   - [b] If resistance is greater than 0 Ω, contact Detroit Diesel Technical Service.

5 PID 84

Section **Page**

5.1 DESCRIPTION OF PID 84 — VEHICLE SPEED SENSOR FAULT

PID 84 indicates that during engine operation the vehicle speed that is measured by the Vehicle Speed Sensor (VSS) is less than the expected value for the current engine speed/conditions. See Figure 5-1. The road speed limiter (if equipped) will use top gear ratio and limit engine speed.

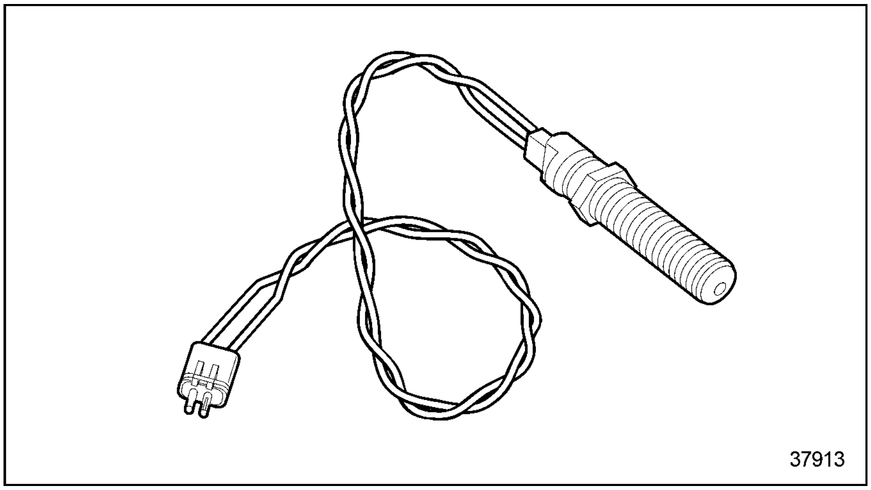


Figure 5-1 Vehicle Speed Sensor

This diagnostic condition is typically:

- ☐ Open Sensor Signal Circuit (084 03)
- ☐ Short to Ground (084 04)

5.2 TROUBLESHOOTING PID 84

The following procedure will troubleshoot PID 84.

5.2.1 084 03 – Open Circuit

Perform the following steps to troubleshoot an open circuit.

1. Measure the voltage between wires 439S- and 439S+. See Figure 5-2.

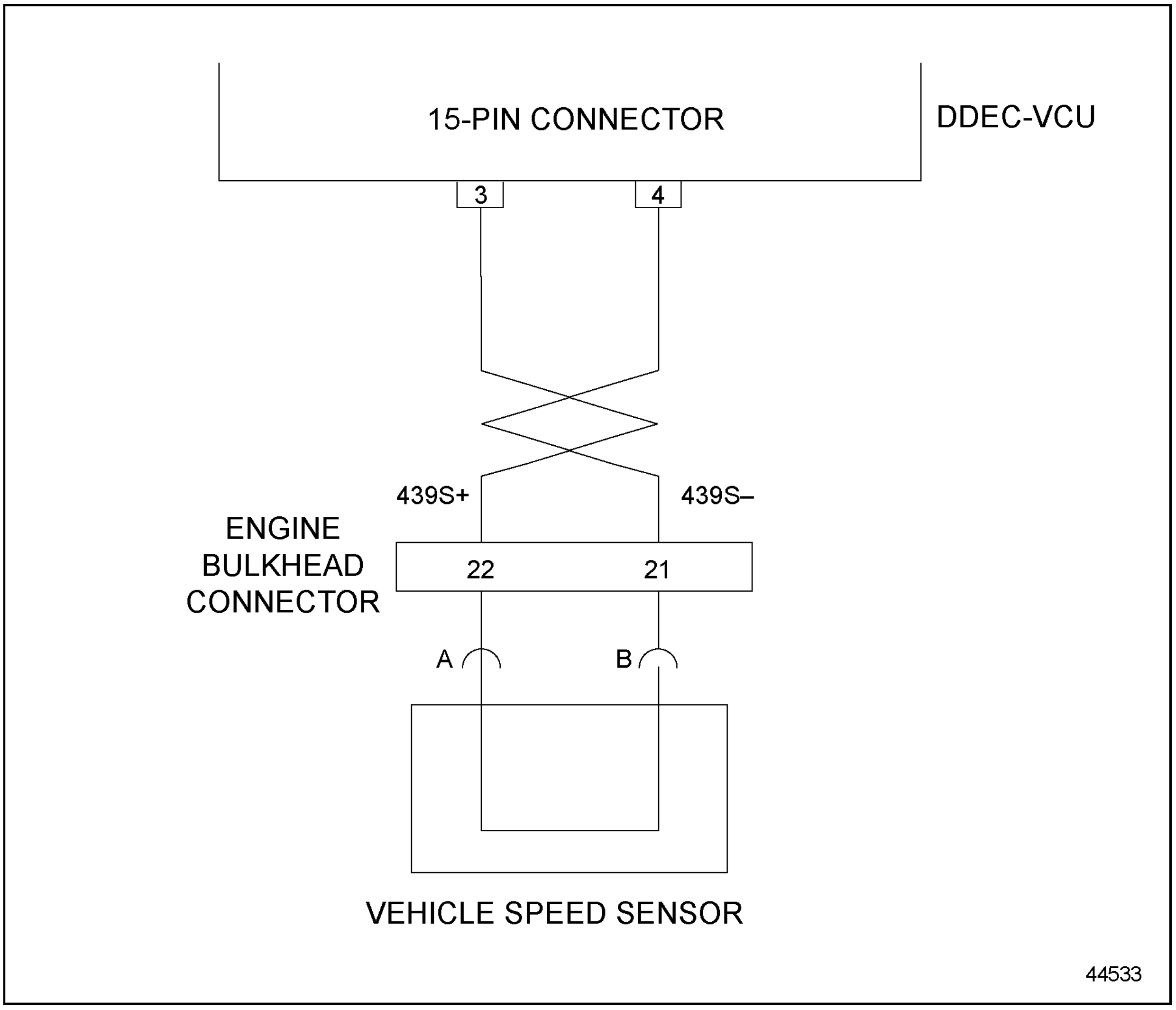


Figure 5-2 Vehicle Speed Sensor Wiring

   [a] If battery voltage was not recorded, refer to section 5.2.4.

   [b] If battery voltage was recorded, go to step 2.

2. What fault code was active when bridging the disconnected VSS wires? Go to step 3.
3. What fault is active when bridging wire 439S+ (at the VSS) to ground?

[a] If fault code 084 03 was recorded, refer to section 5.2.2 for required steps.

[b] If no fault codes were recorded, refer to section 5.2.4 for required steps.

5.2.1.1 Required Action

Perform the following steps to resolve PID 84 fault code — 439S+ Open Circuit.

1. Repair and replace open circuit in VSS wire 439S+.
2. Erase the fault code memory.

5.2.2 084 03 – Faulty Vehicle Speed Sensor

Perform the following steps to troubleshoot a faulty VSS.

1. Measure the battery voltage between wires 439S- and 439S+ at the VSS.
   [a] If battery voltage was not recorded, refer to section 5.2.4.
   [b] If battery voltage was recorded, go to step 2.
2. What fault code is active when bridging the disconnected VSS wires?
   [a] If fault 084 04 was recorded, refer to section 5.2.4.
   [b] If no fault code was recorded, refer to section 5.2.2.1 for required steps.

5.2.2.1 Required Actions

Perform the following steps to resolve 084 03 Wire 439S- Open Circuit.

1. Replace the VSS.
2. Erase the fault code memory.

5.2.3 084 03 – Short to Power

Perform the following steps to troubleshoot a short to power.

1. Measure for battery voltage between wires 439S- and 439S+ at the VSS.
   [a] If battery voltage was not recorded, refer to section 5.2.4.
   [b] If battery voltage was recorded, refer to section 5.2.3.1.

5.2.3.1 Required Actions

Perform the following steps to resolve 084 03 — Wire 439S+ Short to Power.

1. Repair the short to power in VSS wire 439S+.
2. Erase the fault code memory.

5.2.4 084 04 – Faulty Vehicle Speed Sensor

Perform the following step to troubleshoot a faulty VSS.

1. Check for active codes.
   [a] If fault 084 04 was recorded after disconnecting the VSS and waiting more than 10 seconds, refer to section 5.2.4.1.
   [b] If fault code 084 04 was not recorded after disconnecting the VSS and waiting more than 10 seconds, refer to section 5.2.5.

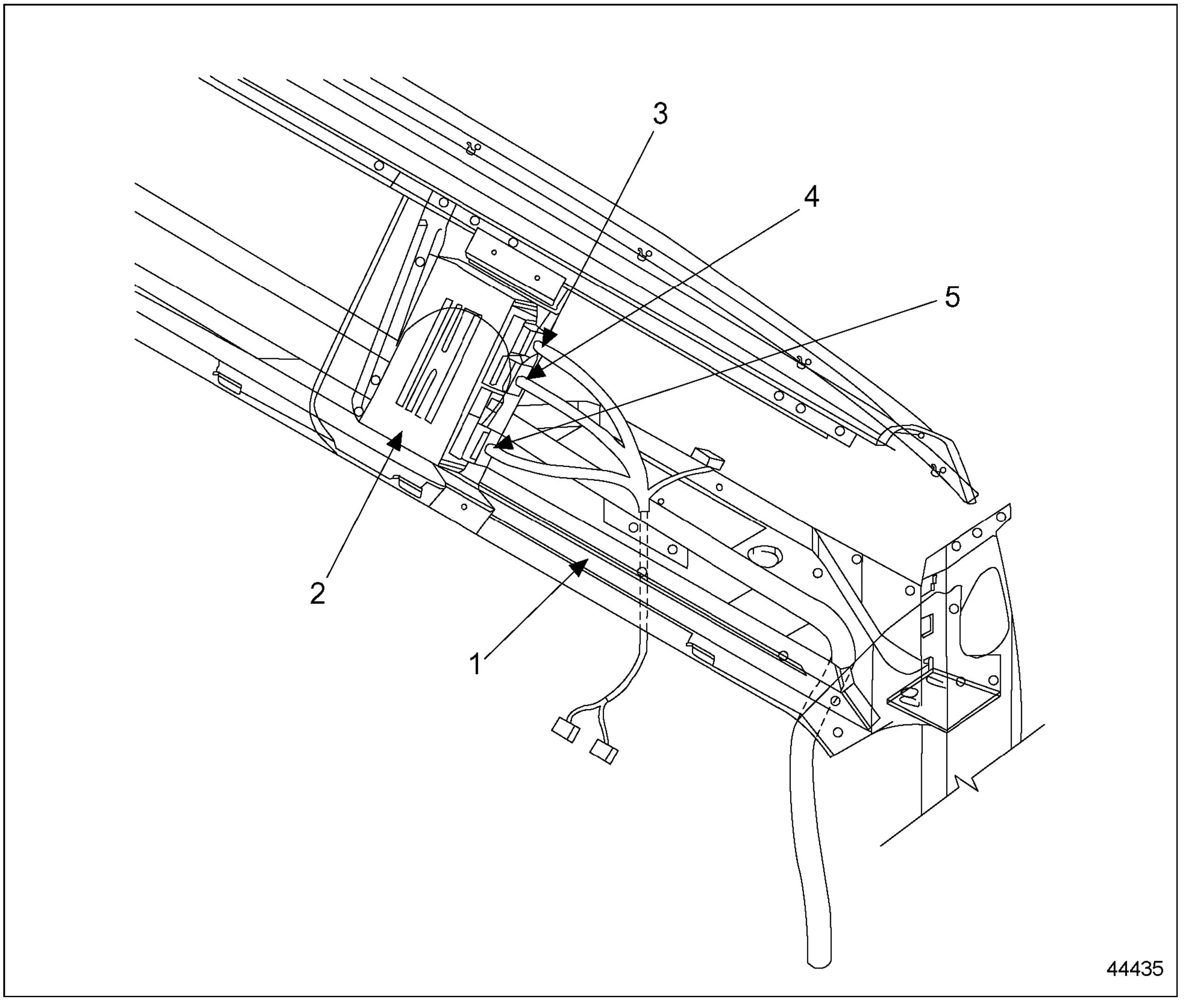
5.2.4.1 Required Actions

Perform the following steps to resolve the 084 04 — Faulty VSS.

1. Replace the VSS.
2. Erase the fault code memory.

5.2.5 084 04 – Faulty DDEC-VCU

Perform the following steps to troubleshoot a faulty DDEC-VCU. See Figure 5-3.



1. Passenger-Side Dash
2. DDEC-VCU
3. 15-Pin Connector
4. 18-Pin Connector
5. 21-Pin Connector

Figure 5-3 Location of DDEC-VCU and Wiring Harness Connectors

1. Disconnect the VSS.
2. Check for active codes.
   [a] If fault code 084 04 was not recorded after disconnecting the VSS and waiting more than ten seconds, refer to section 5.2.6.
   [b] If fault code 084 04 was recorded after disconnecting the VSS and waiting more than 10 seconds, refer to section 5.2.5.1.

3. Check for active codes.
   [a] If fault code 084 04 was not recorded after disconnecting the 15-Pin connector, refer to section 5.2.6.
   [b] If fault code 084 04 was recorded after disconnecting the 15-Pin connector, refer to section 5.2.5.1.

5.2.5.1 Required Actions

Perform the following steps to resolve the 084 04 — Faulty DDEC-VCU.

1. Replace the DDEC-VCU.
2. Erase the fault code memory.

5.2.6 084 04 – Short to Ground

Perform the following steps to troubleshoot the 084 04 Wire 439S+ short to ground.

1. Disconnect the VSS and wait ten seconds.
2. Check for active codes.
   [a] If fault code 084 04 was not active after disconnecting the VSS and waiting ten seconds, refer to section 5.2.7.
   [b] If fault code 084 04 was active after disconnecting the VSS and waiting ten seconds, go to step 4.
3. Disconnect the 15-Pin connector.
4. Check for active codes.
   [a] If fault code 084 04 was not active after disconnecting the 15-Pin connector, refer to section 5.2.7.
   [b] If fault code 084 04 was active after disconnecting the 15-Pin connector, go to step 5.
5. Measure for continuity between the VSS wires 439S+ and 439S-.
   [a] If continuity was recorded between wires 439S+ and 439S-, refer to section 5.2.7.
   [b] If continuity was not recorded between wires 439S+ and 439S-, refer to section 5.2.6.1.

5.2.6.1 Required Actions

Perform the following steps to resolve 084 04 Wire 439S+ Short to Ground.

1. Repair the short to ground in the VSS wire 439S+.
2. Erase the fault code memory.

5.2.7 084 04 – Short Between Wires 439S+ and 439S-

Perform the following steps to troubleshoot 084 04 short between wires 439S+ and 439S-.

NOTE:
The short could be between the DDEC-VCU and the Bulkhead connector or between the Bulkhead connector and the VSS.

1. Disconnect the VSS and wait ten seconds.
2. Check for active codes.
   [a] If fault code 084 04 was not active, contact the Detroit Diesel Technical Support Group.
   [b] If fault code 084 04 was active, go to step 4.
3. Disconnect the 15-Pin connector.
4. Check for active codes.
   [a] If fault code 084 04 was active, contact the Detroit Diesel Technical Support Group.
   [b] If fault code 084 04 was not active, go to step 5.
5. Measure for continuity between the VSS wires 439S+ and 439S-.
   [a] If no continuity was measured, contact the Detroit Diesel Technical Support Group.
   [b] If continuity was measured, refer to section 5.2.7.1.

5.2.7.1 Required Actions

Perform the following steps to resolve 084 04 Short Between Wires 439S+ and 439S-.

1. Repair the short circuit in the VSS wires 439S+ and 439S-.
2. Erase the fault code memory.

6 PID 91

Section **Page**

6.1 DESCRIPTION OF PID 91 – ACCELERATOR PEDAL SENSOR FAULT

PID 91 indicates that during operation, the Accelerator Pedal (AP) sensor input voltage is:

- ☐ Erratic (91 02)
- ☐ High (91 03)
- ☐ Low (91 04)

The Accelerator Pedal is remotely mounted and connected to the DDEC-VCU. See Figure 6-1, Figure 6-2, and Figure 6-3.

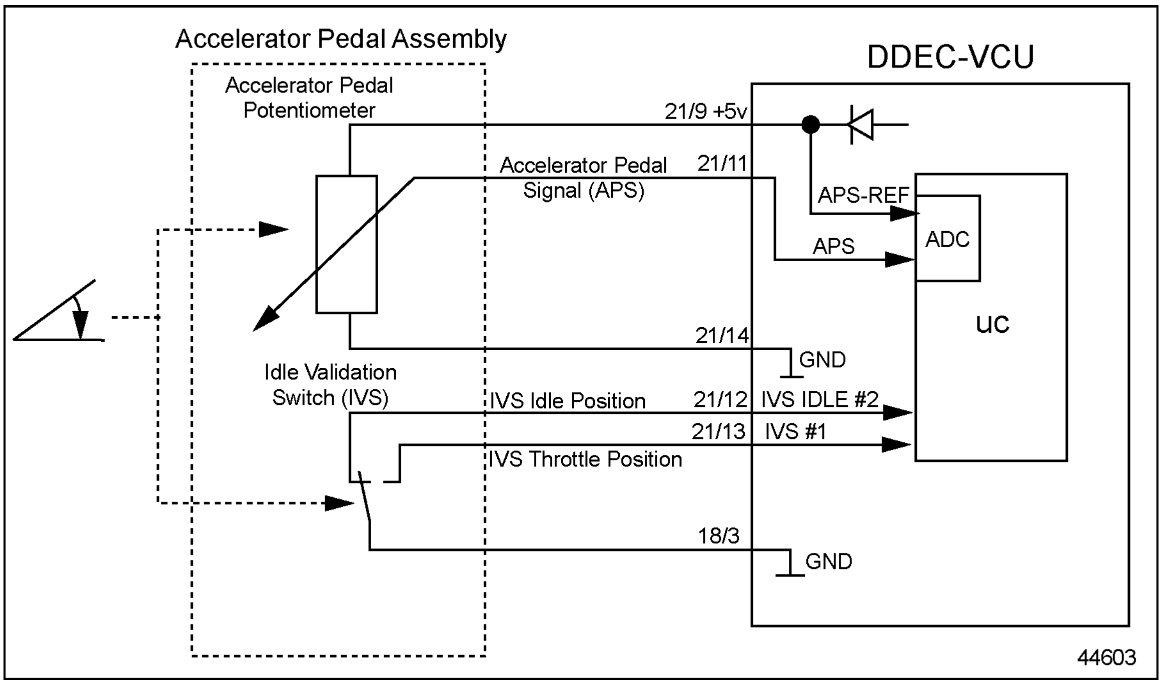
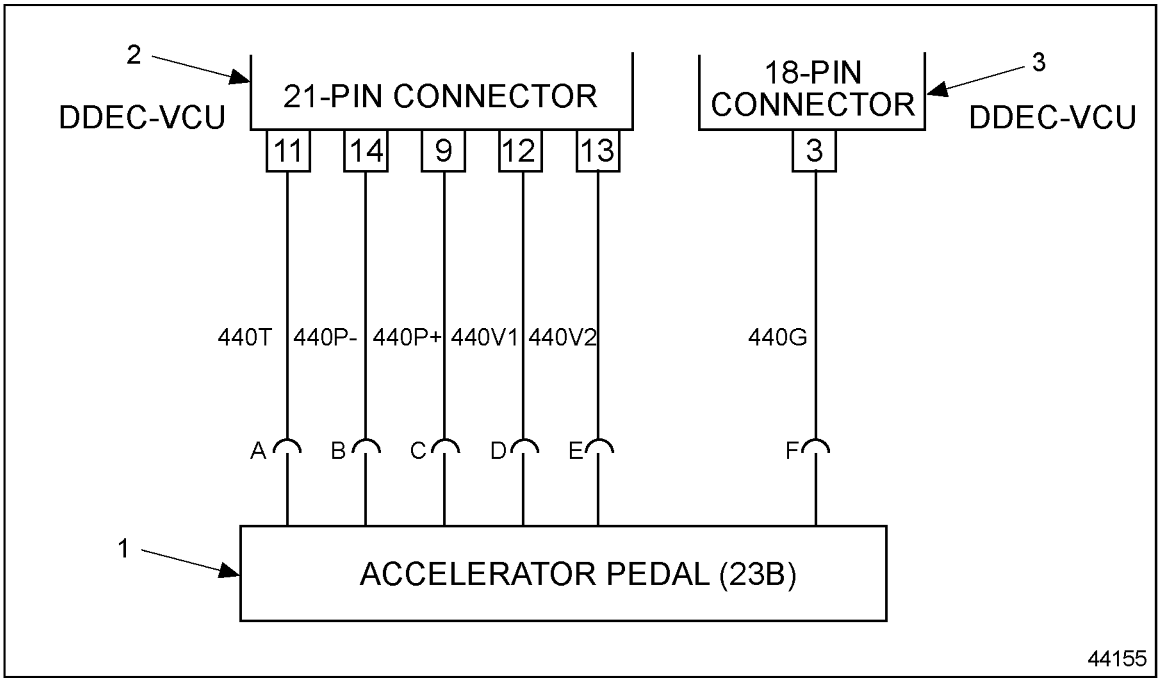
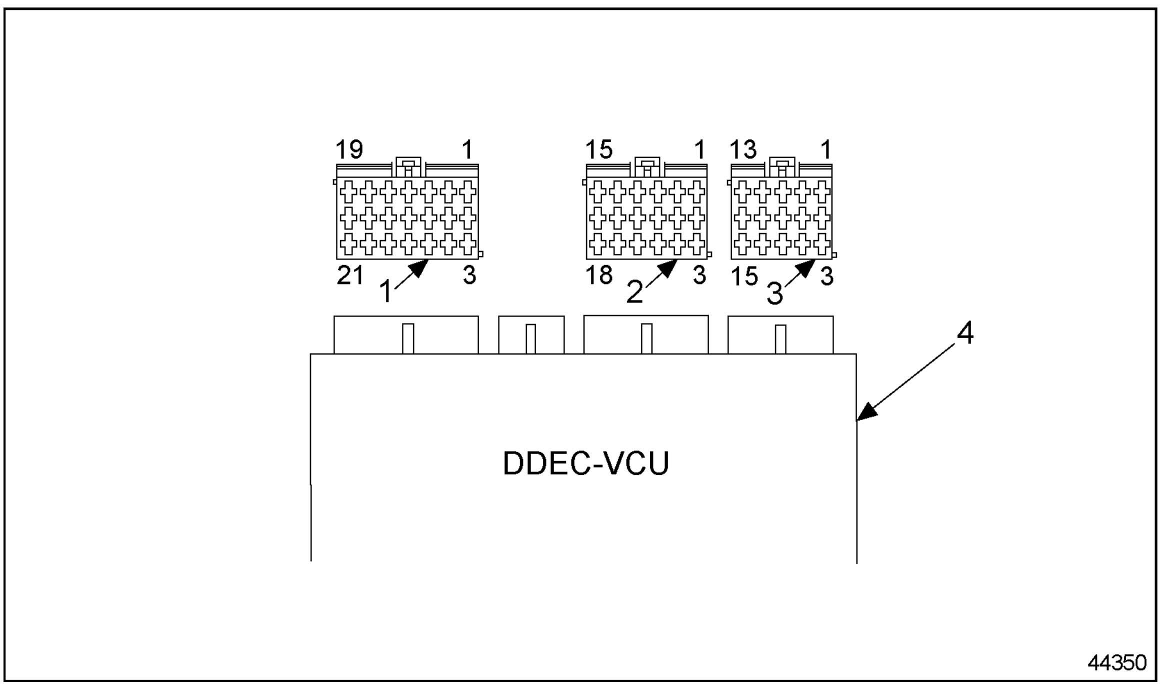


Figure 6-1 Accelerator Pedal Installation



1. Accelerator Pedal
2. 21-Pin DDEC-VCU Connector (VC1)
3. 18-Pin DDEC-VCU Connector (VC3)

Figure 6-2 Accelerator Pedal to DDEC-VCU Connectors



1. 21-Pin DDEC-VCU Connector (VC1)
2. 18-Pin DDEC-VCU Connector (VC3)
3. 15-Pin DDEC-VCU Connector (VC4)
4. DDEC-VCU

Figure 6-3 Accelerator Pedal to DDEC-VCU Connector

6.2 TROUBLESHOOTING PID 91

The following procedure will troubleshoot PID 91.

6.2.1 091 02 – Position Active Fault (Erratic Data)

Perform the following steps to troubleshoot a position active fault.

1. Check for active codes.
   [a] If fault code 091 04 was active, refer to section 6.2.3.
   [b] If fault code 091 03 was active, refer to section 6.2.2.
   [c] If no other fault codes were active, go to step 2.
2. Measure the power supply voltage to the AP assembly.
   [a] If the voltage measured was not within the range of 4.8 – 5.2 V, go to step 3.
   [b] If the voltage measured was within the range of 4.8 – 5.2 V, refer to section 6.2.1.1.
3. Unplug the AP connector from the foot pedal and measure the power supply voltage.
   [a] If the power voltage was not within 4.8 – 5.2 V, go to step 5.
   [b] If the power voltage was within 4.8 – 5.2 V, refer to section 6.2.1.2.
4. Reconnect the AP connector.
5. Measure the power supply voltage to the AP assembly with wires 440P+ (pin 9 of the 21-pin connector) and 440P- (pin 14 of the 21-pin connector) disconnected. See Figure 6-2.
   [a] If the power voltage was not within 4.8 – 5.2 V, contact the Detroit Diesel Technical Service Group.
   [b] If the power voltage was within 4.8 – 5.2 V, refer to section 6.2.1.3.

6.2.1.1 Required Actions

Perform the following step to resolve a position active fault.

1. Repair or replace wires 440T, 440P+, and 440P- (pins 11, 9, and 14 of the 21-pin connector) as necessary.

6.2.1.2 Required Actions

Perform the following steps to resolve a position active fault.

1. Replace the AP assembly.
2. Erase the fault code memory.

6.2.1.3 Required Actions

Perform the following steps to resolve a position active fault.

1. Repair or replace wires 440P+ and 440P- (pins 9 and 14 of the 21-pin connector).
2. Replace the DDEC-VCU, if necessary.
3. Erase the fault code memory.

6.2.2 091 03 – Voltage High

Perform the following steps to troubleshoot voltage high.

1. Check for continuity between wires 440P+ and 440T with the 21-pin connector disconnected. See Figure 6-2.
   [a] If continuity was not measured, go to step 2.
   [b] If continuity was measured, refer to section 6.2.2.1.
2. Check for continuity in wire 440P- between pin 14 of the 21-pin connector and the AP sensor connector pin B.
   [a] If continuity was measured, go to step 3.
   [b] If continuity was not measured, refer to section 6.2.2.2.
3. Check for continuity in wire 440T between the AP sensor connector pin A and pin 11 of the 21-pin connector.
   [a] If continuity was measured, refer to section 6.2.2.4.
   [b] If continuity was not measured, refer to section 6.2.2.3.

6.2.2.1 Required Actions

Perform the following steps to resolve voltage high.

1. Repair the short circuit between wires 440P+ and 440T connecting the DDEC-VCU to the AP sensor.
2. Erase the fault code memory.

6.2.2.2 Required Actions

Perform the following steps to resolve voltage high.

1. Repair the open circuit in wire 440P- connecting the DDEC-VCU to the AP connector.
2. Erase the fault code memory.

6.2.2.3 Required Actions

Perform the following steps to resolve voltage high.

1. Repair the open circuit in wire 440T connecting the DDEC-VCU to the AP connector.
2. Erase the fault code memory.

6.2.2.4 Required Actions

Perform the following steps to resolve voltage high.

1. Replace the AP assembly.
2. Erase the fault code memory.

6.2.3 091 04 – Voltage Low

Perform the following steps to troubleshoot voltage low.

1. Measure for a short to ground from wire 440T at the AP connector.
   [a] If a short to ground was not measured, go to step 2.
   [b] If a short to ground was measured, refer to section 6.2.3.1.
2. Check for continuity in wire 440P+.
   [a] If continuity was not measured, refer to section 6.2.3.2.
   [b] If continuity was measured, refer to section 6.2.3.3.

6.2.3.1 Required Actions

Perform the following steps to resolve voltage low.

1. Repair the short to ground in wire 440T.
2. Erase the fault code memory.

6.2.3.2 Required Actions

Perform the following steps to resolve voltage low.

1. Repair the open circuit in wire 440P+.
2. Erase the fault code memory.

6.2.3.3 Required Actions

Perform the following steps to resolve voltage low.

1. Replace the AP assembly.
2. Erase the fault code memory.

7 PID 100

Section **Page**

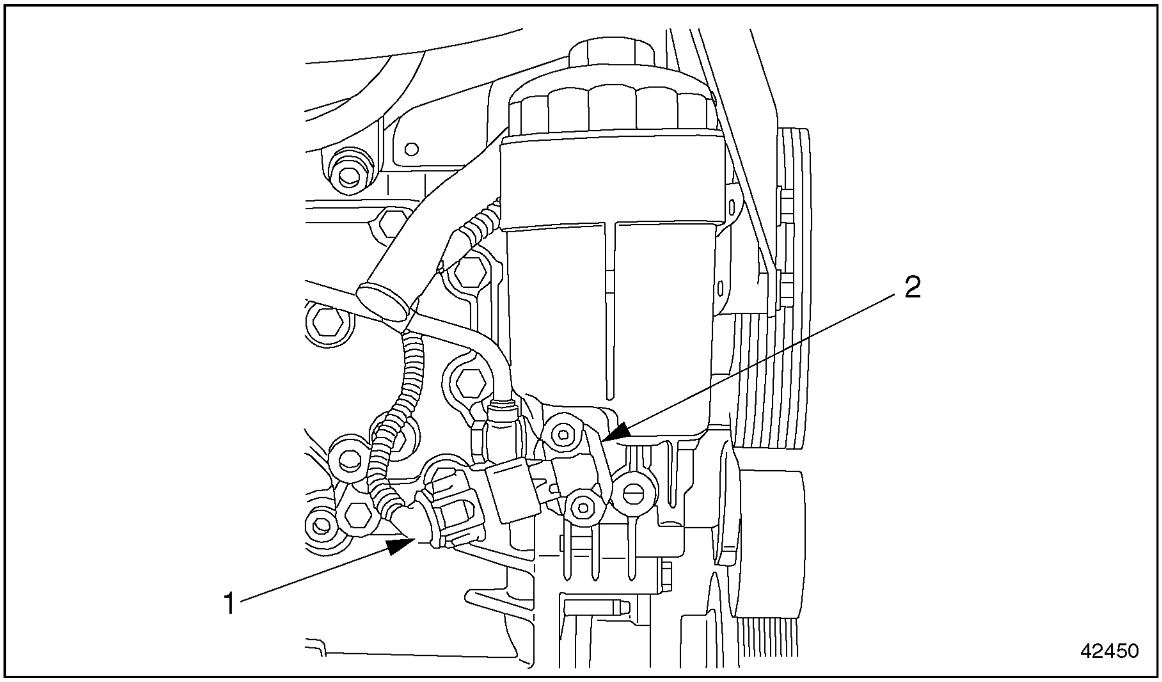
7.1 DESCRIPTION OF PID 100 – ENGINE OIL PRESSURE OUTSIDE OF NORMAL OPERATING RANGE

PID 100 indicates that the PLD-MR control unit has detected the engine oil pressure is operating outside of the normal operating conditions.

- ☐ Oil Pressure Low (100 01)
- ☐ Oil Combination Sensor Data Erratic (100 02)
- ☐ Oil Combination Sensor Open Circuit (100 03)
- ☐ Oil Combination Sensor Short to Ground (100 04)
- ☐ Oil Pressure Very Low (100 14)

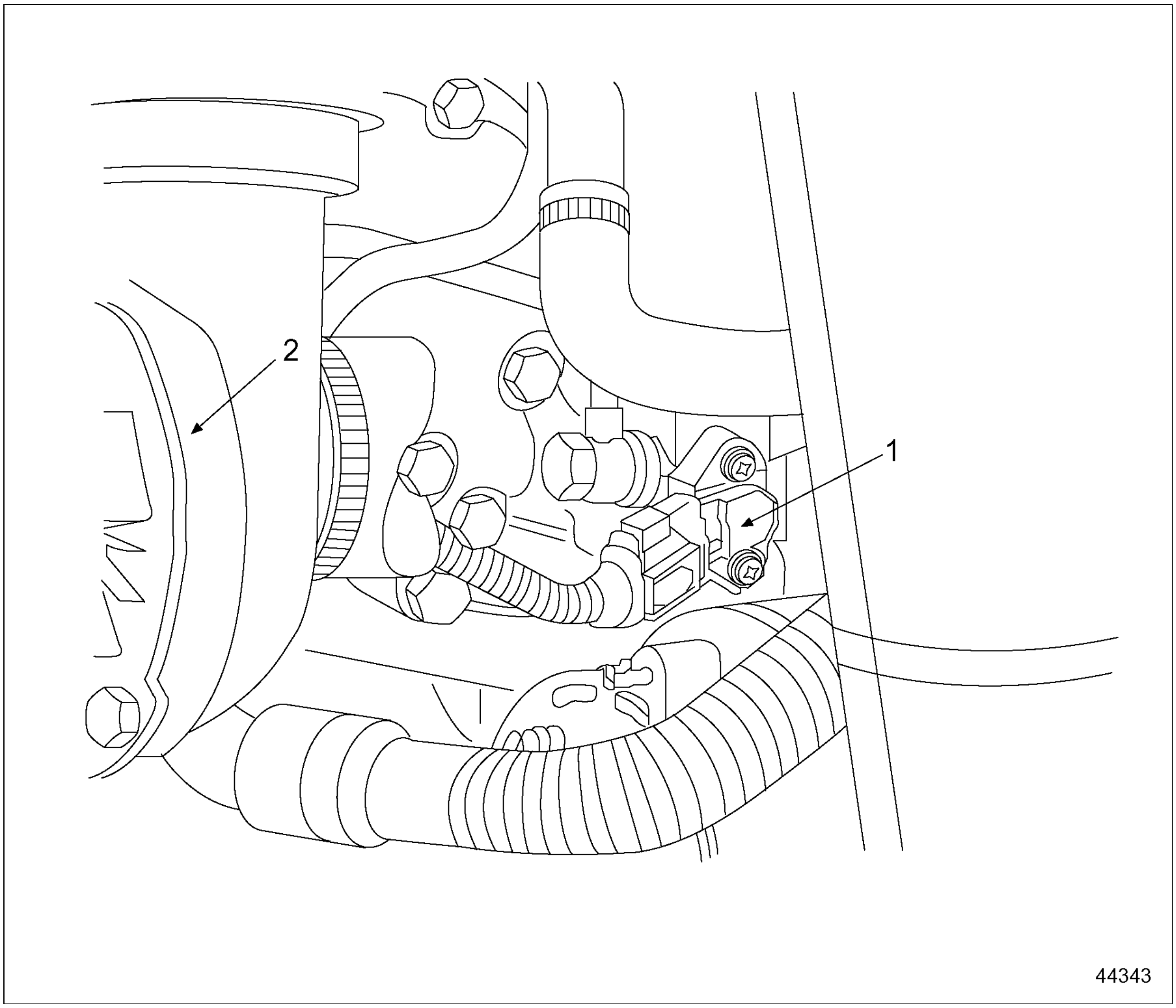
7.2 TROUBLESHOOTING PID 100

The Oil Combination Sensor contains an Engine Oil Pressure sensor and an Oil Temperature Sensor. It is located at the base of the oil filter, mounted on the right-front side of the engine. See Figure 7-1 and see Figure 7-2.



1. Wiring Connector
2. Oil Combination Sensor

Figure 7-1 Location of the Oil Combination Sensor



1. Oil Combination Sensor
2. Turbocharger

Figure 7-2 Close-up View of Oil Combination Sensor

The following procedures will troubleshoot PID 100.

7.2.1 100 01 – Oil Pressure Low

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

1. Check for active codes.
   [a] If fault codes 100 01 and 100 03 are both active, refer to section 7.2.3.
   [b] If fault codes 100 01 and 100 04 are both active, refer to section 7.2.4
   [c] If only fault code 100 01 is active, go to step 2.
2. Observe the stability of the oil pressure.
   [a] If the oil pressure is in normal operating range and stable, go to step 3.

[b] If the oil pressure is fluctuating, go to step 4.

3. Check the oil level.

   [a] If the oil level is high, refer to section 7.2.1.1.

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

   [b] If the engine oil level is low, fill oil to proper level. Erase fault code memory.

4. Check the operation of the oil gage. If the oil gage readings are erratic, refer to section 7.2.1.2.
5. Check the condition of the oil pump suction pipe. If the pipe is loose or cracked, refer to section 7.2.1.3.
6. Check the condition of the oil pump drive and driven gears. If either gear is loose, refer to section 7.2.1.4.
7. Check for a faulty oil pressure relief valve. If the relief valve does not open at the set pressure or sticks open, refer to section 7.2.1.5.
8. If fault code 100 01 is still active, contact Detroit Diesel Technical Service Group.

7.2.1.1 Required Actions

Perform the following steps to resolve a high oil level:

1. Check for fuel entering into the engine oil system and repair as required.

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

2. Change the engine oil.
3. Erase the fault code memory.

7.2.1.2 Required Action

Perform the following steps to resolve a faulty oil gage:

1. Repair or replace the oil gage as required.
2. Erase the fault code memory.

7.2.1.3 Required Action

Perform the following steps to resolve a faulty oil pump suction pipe:

1. If the suction pipe is cracked, replace it.
2. If the suction pipe is loose, reinstall it.

3. Erase the fault code memory.

7.2.1.4 Required Action

Perform the following steps to resolve a loose drive or driven gear:

1. Repair or replace loose gears as required.
2. Erase the fault code memory.

7.2.1.5 Required Action

Perform the following steps to resolve a faulty oil pressure relief valve:

1. Repair or replace a faulty oil pressure relief valve as required.
2. Erase the fault code memory.

7.2.2 100 02 – Oil Combination Sensor Data Erratic

Perform the following steps to troubleshoot erratic data from the oil combination sensor:

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. Erase fault code memory.
   - [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 03 is active in addition to code 100 02, refer to section 7.2.3.
   - [b] If fault code 100 04 is active in addition to code 100 02, refer to section 7.2.4.

[c] If only fault code 100 02 is active, check and clean sensor contacts (remove any corrosion). See Figure 7-3. Erase fault code memory.

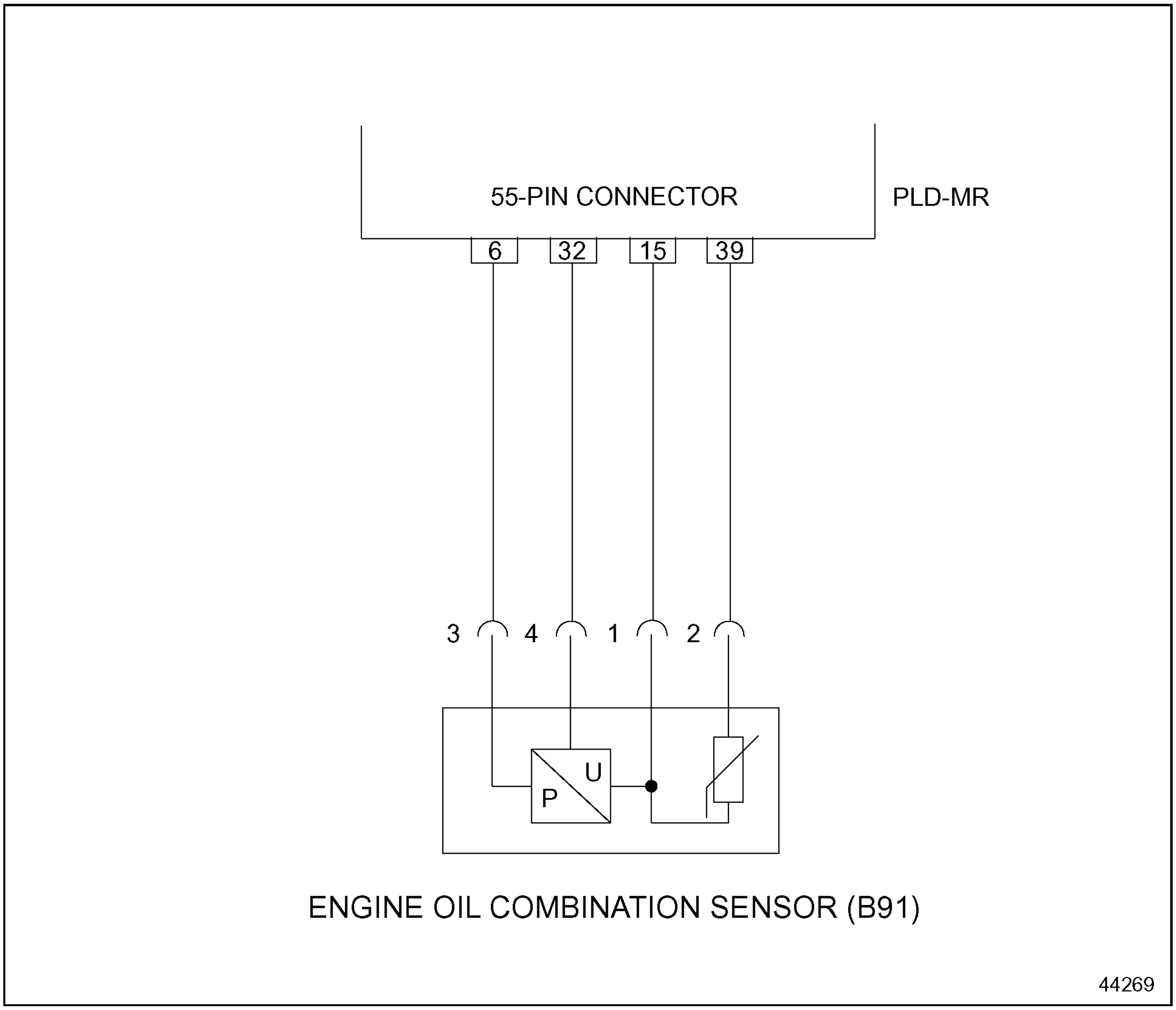


Figure 7-3 Oil Combination Sensor Wiring

7.2.3 100 03 – Oil Combination Sensor Open Circuit

Perform the following steps to troubleshoot an oil combination sensor open circuit fault:

1. Check for additional active fault codes with combination sensor connected.
   - [a] If fault code 175 03 is active in addition to code 100 03, repair open circuit in 55-pin connector wire 15 to pin 1 of the sensor. See Figure 7-3. Erase fault code memory.
   - [b] If only fault 100 03 is active, go to step 2.
2. Bridge pins 1 and 4 of the combination sensor. See Figure 7-3.
   - [a] If new fault 100 04 is active, repair short to power in 55-pin connector wire 32 to pin 4 of the sensor. Erase fault code memory.

[b] If new fault 100 04 is not active, repair open circuit in 55-pin connector wire 32 to pin 4 of the connector. Erase fault code memory.

7.2.4 100 04 – Oil Combination Sensor Short to Ground

Perform the following steps to troubleshoot an oil combination sensor short-to-ground fault:

1. Unplug the oil combination sensor and check for active fault codes
   - [a] If new fault codes 175 03 and 100 03 are active, replace the combination sensor. Erase fault code memory.
   - [b] If new fault code 175 03 is active in addition to code 100 04, go to step 2.
2. Measure the resistance between pins 1 and 3 on the combination sensor. See Figure 7-3.
   - [a] If resistance is less than 30 kΩ, repair short circuit between 55-pin connector wires 15 and 6. Erase fault code memory.
   - [b] If resistance is more than 30 kΩ, go to step 3.
3. Measure the resistance between pin 4 on the combination sensor and vehicle ground. See Figure 7-3.
   - [a] If resistance is less than 30 kΩ, repair short to ground in 55-pin connector wire 32 to pin 4 of the combination sensor. Erase fault code memory.
   - [b] If resistance is more than 30 kΩ, go to step 4.
4. Measure the resistance between pin 3 on the combination sensor and vehicle ground. See Figure 7-3.
   - [a] If resistance is less than 30 kΩ, repair short to ground in 55-pin connector wire 6 to pin 3 of the combination sensor. Erase fault code memory.
   - [b] If resistance is more than 30 kΩ, go to step 5.
5. Check and clean contacts (remove any corrosion), then check for active codes.
   - [a] If fault 100 04 is still active, contact Detroit Diesel Technical Service for authorization to replace the PLD-MR. Set parameters on the new PLD-MR.
   - [b] If fault 100 04 is not active, erase fault code memory.

7.2.5 100 14 – Oil Pressure Very Low

Perform the following steps to troubleshoot an oil pressure very low fault:

1. Check for additional active fault codes.
   - [a] If fault code 100 03 is active in addition to code 100 04, refer to section 7.2.3.
   - [b] If fault code 100 04 is active in addition to code 100 04, refer to section 7.2.4.
   - [c] If only fault code 100 14 is active, go to step 2.
2. Start engine and check oil pressure.

[a] If pressure is fluctuating, go to step 3.

[b] If pressure is low but stable, go to step 4.

3. Stop the engine and allow sufficient time for the oil to drain into the oil pan. Perform the following steps:

   [a] Check the oil level. Add recommended oil to bring it to the proper level, if required.

   [b] Check for faulty oil gage. Replace, if required.

   [c] Check for loose or cracked oil pump suction pipe. Repair or replace, as required.

   [d] Check for loose drive or driven oil pump gear. Repair or replace, as required.

   [e] Check for faulty oil pressure relief valve. Repair or replace, as required.

   [f] Erase fault code memory.

4. Stop the engine and allow sufficient time for the oil to drain into the oil pan. Check the oil level.

   [a] If oil is above maximum level with no oil previously added, go to step 5.

   [b] If oil is not above maximum level, contact Detroit Diesel Technical Service.

5. Check for possible fuel in oil.

   [a] If fuel is found, locate and repair source of fuel leak. Change the Oil. Erase fault code memory.

   [b] If fuel is not found, contact Detroit Diesel Technical Service.

8 PID 102

Section **Page**

8.1 DESCRIPTION OF PID 102 – TURBO BOOST PRESSURE OUTSIDE OF NORMAL OPERATING RANGE

PID 102 indicates that the PLD-MR has detected turbo boost pressure operating outside of the normal range.

The diagnostic condition is typically:

- ☐ Boost Pressure High (102 00)
- ☐ Boost Pressure Low (102 01)
- ☐ Boost Pressure Sensor Data Erratic (102 02)
- ☐ Boost Pressure Sensor Open Circuit (102 03)
- ☐ Boost Pressure Sensor Short to Ground (102 04)

Boost pressure is monitored by the turbo boost air combination sensor installed in the intake manifold. See Figure 8-1.

8.2 TROUBLESHOOTING PID 102

The following procedures will troubleshoot PID 102.

8.2.1 102 00 – Boost Pressure High Fault

Perform the following steps to troubleshoot a boost pressure high fault:

1. Check for historic fault codes in addition to 102 00.
   [a] If other historic fault codes are present, troubleshoot other fault codes first.
   [b] If only fault code 102 00 is present, go to step 2.
2. Check the condition of the boost air combination sensor (look for cracks, corrosion, missing or bent pins). See Figure 8-1.

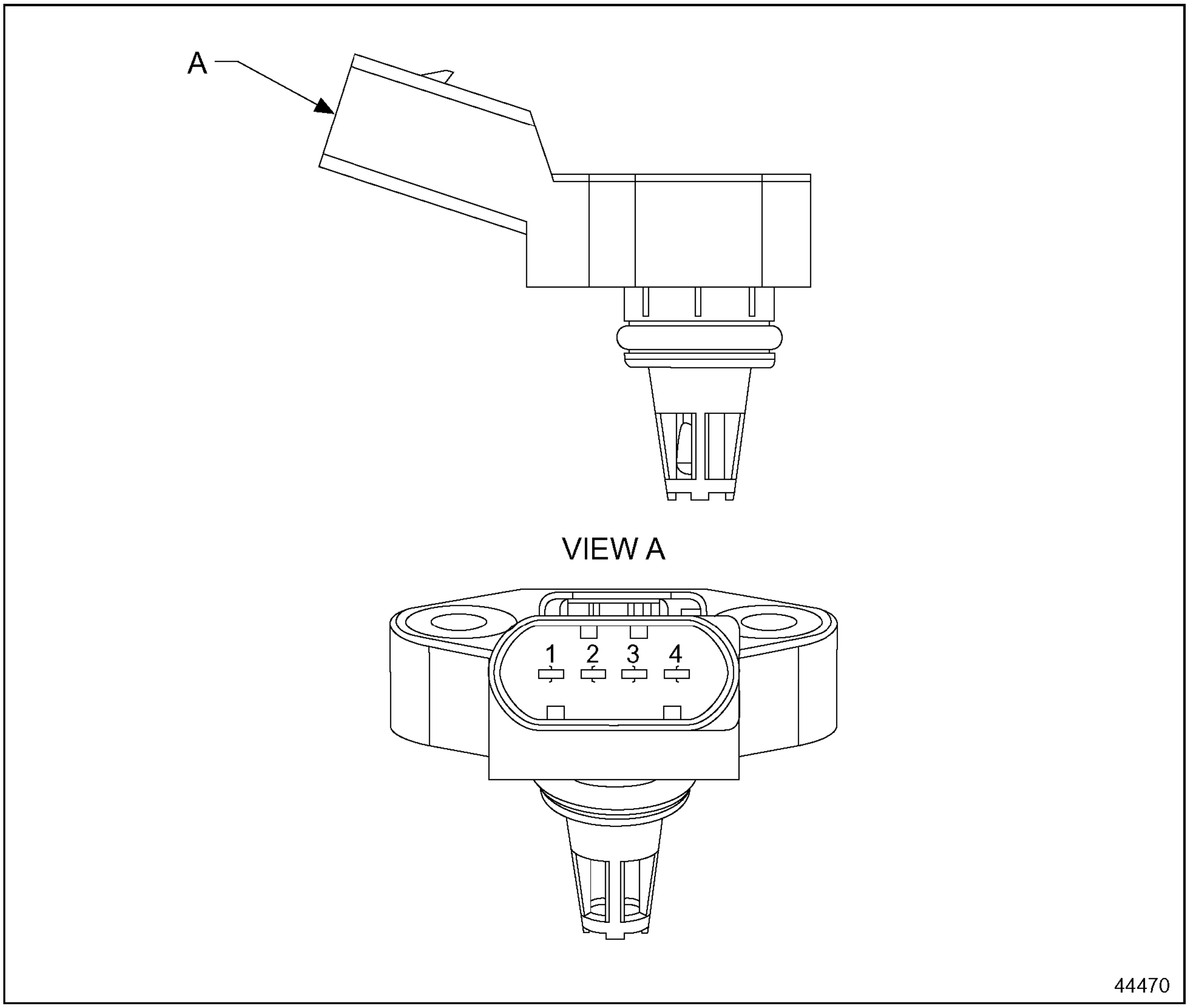


Figure 8-1 Turbo Boost Air Combination Sensor

[a] If sensor is not in good condition, replace sensor. Erase fault code memory.

[b] If sensor is in good condition, go to step 3.

3. Check waste gate operation.

   [a] If waste gate is not working, repair or replace the turbocharger. Erase fault code memory.

   [b] If waste gate is working, go to step 4.

4. Measure turbo boost pressure.

   [a] If boost pressure is not within acceptable range, repair or replace the turbocharger. Erase fault code memory.

   [b] If boost pressure is within acceptable range, contact Detroit Diesel Technical Service.

8.2.2 102 01 – Boost Pressure Low Fault

Perform the following steps to troubleshoot a 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. Erase fault code memory.

   [b] If the air filter or air intake system is not restricted, go to step 2.

2. Check the condition of the boost air combination sensor. See Figure 8-1.

   [a] If sensor is not in good condition, replace sensor. Erase fault code memory.

   [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. Erase fault code memory.

   [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. Erase fault code memory.

   [b] If the turbocharger is not faulty, go to step 5.

5. Check for other historic fault codes.

   [a] If other historic fault codes are present, refer to the other fault codes.

   [b] If only fault code 102 01 is present, go to step 6.

6. Check waste gate operation.

   [a] If waste gate is not working, repair or replace the turbocharger. Erase fault code memory.

   [b] If waste gate is working, go to step 7.

7. Verify that fuel delivery is within specifications (no restrictions to fuel flow).
   [a] If fuel delivery is not within specifications, eliminate restrictions in fuel delivery system. Erase fault code memory.
   [b] If fuel delivery is within specifications, contact Detroit Diesel Technical Service.

8.2.3 102 02 – Boost Pressure Sensor Data Erratic Fault

Perform the following steps to troubleshoot a boost pressure sensor data erratic fault:

1. Check for additional active fault codes.
   [a] If fault code 233 12 is active in addition to fault code 102 02, refer to section 28.2.1.
   [b] If only fault code 102 02 is active, go to step 2.
2. Measure turbo boost pressure with the engine running. Stop the engine and compare with atmospheric pressure.
   [a] If boost pressure is within the acceptable range, check and clean the combination sensor contacts (remove any corrosion). Erase fault code memory.
   [b] If boost pressure is not within the acceptable range, go to step 3.
3. Bridge pins 1 and 3 of the combination sensor. See Figure 8-1, and see Figure 8-2.
   [a] If new fault code 102 04 is active after bridging pins, replace the sensor. Erase fault code memory.
   [b] If fault code 102 04 is not active after bridging pins, go to step 4.

4. Measure the resistance between pin 3 of the combination sensor and wire 7 of the 55-pin connector harness. See Figure 8-1, and see Figure 8-2.

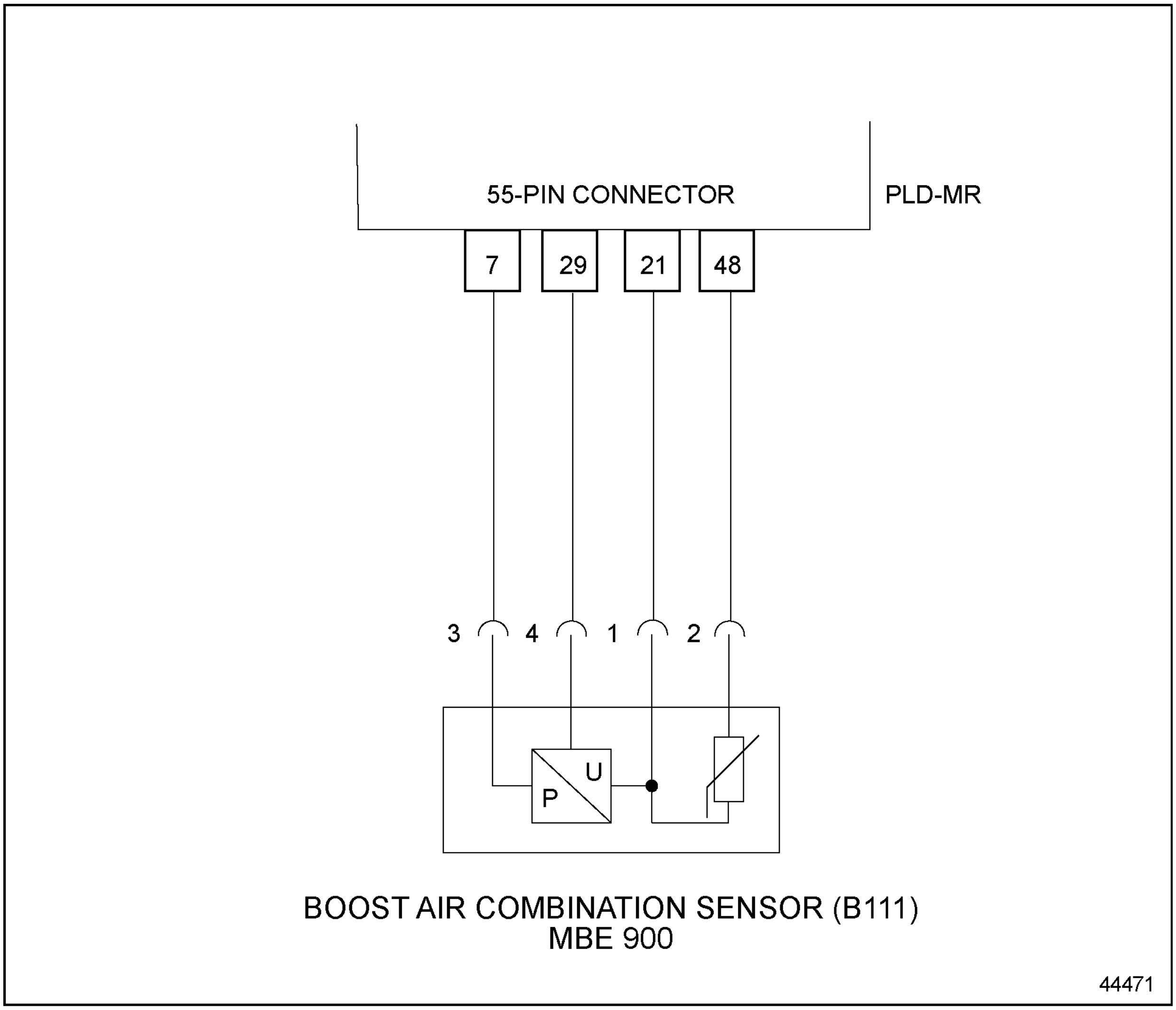


Figure 8-2 Location of Boost Air Combination Sensor Harness Wires

[a] If resistance is greater than 3 Ω, repair open circuit in 55-pin connector wire 7 to pin 3 of the sensor. Erase fault code memory.

[b] If resistance is less than 3 Ω, check and clean contacts (remove any corrosion). Erase fault code memory.

8.2.4 102 03 – Boost Pressure Sensor Open Circuit Fault

Perform the following steps to troubleshoot a boost pressure sensor open circuit fault:

1. Check for additional active fault codes.

[a] If fault code 105 03 is active in addition to fault code 102 03 with boost air combination sensor connected, repair open circuit in 55-pin connector wire 21 to pin 1 of the sensor. See Figure 8-2. Erase fault code memory.

[b] If only fault code 102 03 is active with sensor connected, go to step 2.

2. Bridge pins 1 and 4 of the combination sensor. See Figure 8-1, and see Figure 8-2.

   [a] If new fault 102 04 is active, repair short to power in 55-pin connector wire 29 to pin 4 of the sensor. Erase fault code memory.

   [b] If fault 102 04 is not active, repair open circuit in 55-pin connector wire 29 to pin 4 of the sensor. Erase fault code memory.

8.2.5 102 04 – Boost Pressure Sensor Short to Ground Fault

Perform the following steps to troubleshoot a boost pressure sensor short to ground fault:

1. Unplug the boost air combination sensor and check fault codes.

   [a] If new faults 102 03 and 105 03 are active, replace the sensor. Erase fault code memory.

   [b] If new fault 105 03 is active in addition to fault 102 04, go to step 2.

2. Measure the resistance between pins 1 and 3 on the combination sensor. See Figure 8-1, view “A” and see Figure 8-2.

   [a] If resistance is less than 30 kΩ, repair short circuit between wires 21 and 7 on the 55-pin connector harness. Erase fault code memory.

   [b] If resistance is greater than 30 kΩ, go to step 3.

3. Measure the resistance between pin 4 of the combination sensor and vehicle ground. See Figure 8-1, view “A” and see Figure 8-2.

   [a] If resistance is less than 30 kΩ, repair short to ground in 55-pin connector wire 29 to pin 4 of the sensor. Erase fault code memory.

   [b] If resistance is greater than 30 kΩ, go to step 4.

4. Measure the resistance between pin 3 of the combination sensor and vehicle ground. See Figure 8-1, view “A” and see Figure 8-2.

   [a] If resistance is less than 30 kΩ, repair short to ground in 55-pin connector wire 7 to pin 3 of the sensor. Erase fault code memory.

   [b] If resistance is greater than 30 kΩ, go to step 5.

5. Clean and check combination sensor contacts (remove corrosion).

   [a] If fault is not active, erase fault code memory.

   [b] If fault is still active, contact Detroit Diesel Technical Service for authorization to replace the PLD-MR. Set parameters on new PLD-MR.

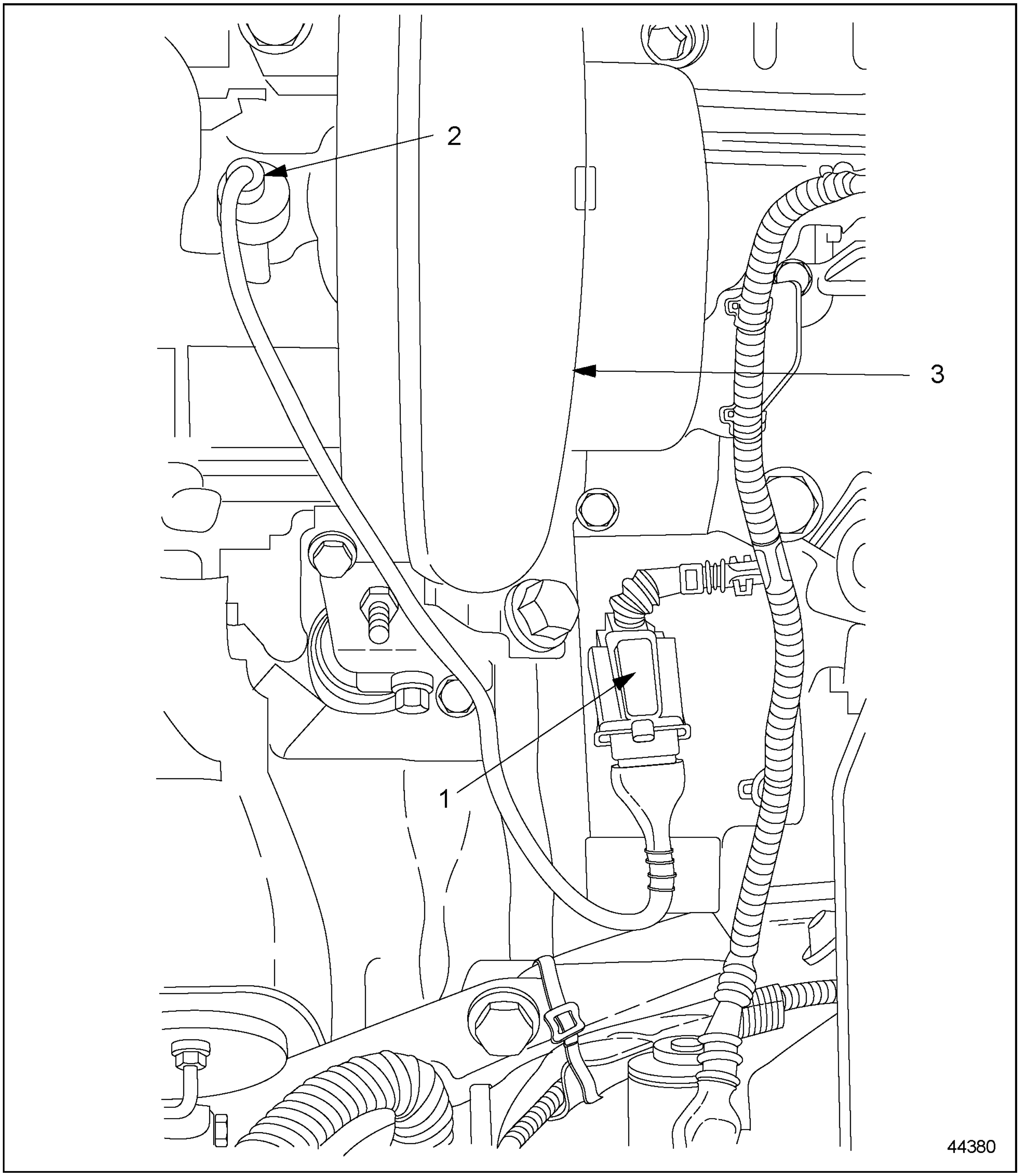
9 PID 103

Section		Page

9.1 DESCRIPTION OF PID 103 – TURBO NO REVOLUTION FAULT

PID 103 indicates that the PLD-MR has not received a turbo speed monitoring signal from the Turbo Speed Sensor (TSS).

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. See Figure 9-1. PID 103 is logged when the PLD-MR on the engine fails to receive the monitoring signal from the sensor.



1. TSS Connector
2. Turbo Speed Sensor
3. Turbocharger

Figure 9-1 Turbo Speed Sensor Location

9.2 TROUBLESHOOTING PID 103

There are two possible causes for this fault code:

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

9.2.1 103 07 – Turbo No Revolution Fault

Troubleshoot a Turbo No Revolution fault as follows:

1. With the engine stopped and at ambient temperature, unplug the TSS from the TSS connector. See Figure 9-1.
2. Measure the resistance between the sensor terminals. See Figure 9-2.

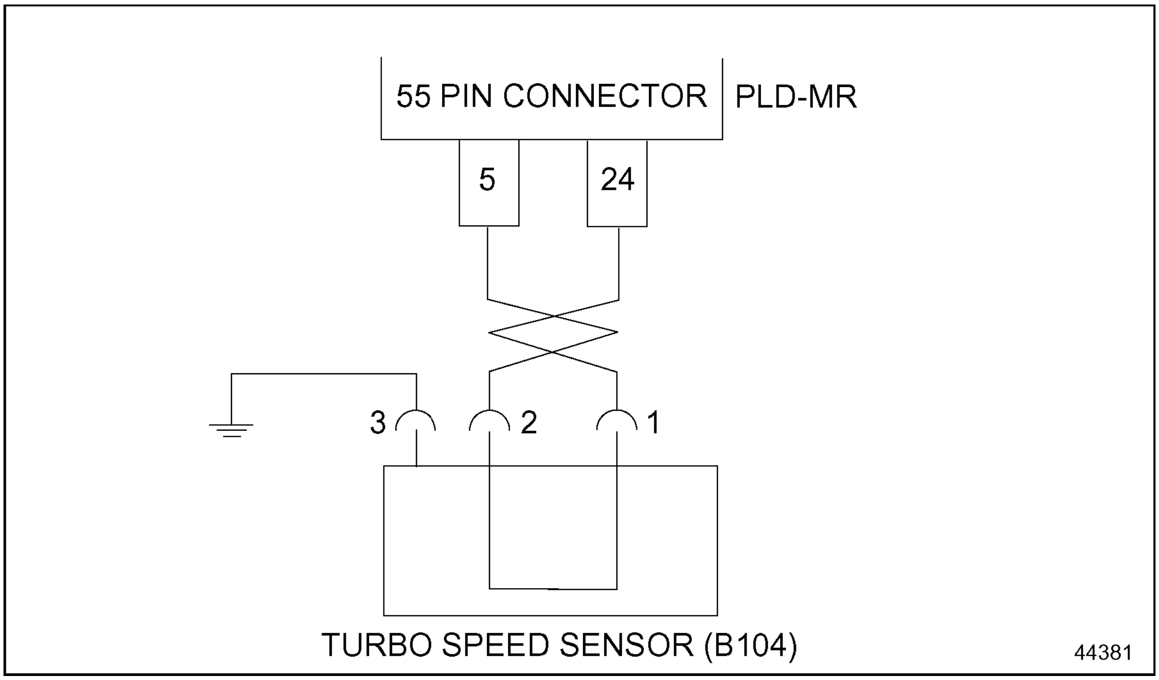


Figure 9-2 Turbo Speed Sensor Terminal and Wire Locations

[a] If resistance is approximately 900 Ω, refer to section 9.2.1.1.

[b] If resistance is zero or higher than 950 Ω, replace the sensor.

9.2.1.1 Required Action

Resolve a Turbo No Revolution fault as follows:

1. Remove the TSS from the turbo shaft housing. See Figure 9-1.
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.

4. Start the engine and check for active codes.
   [a] If any codes are still active, repeat steps 1 through 3.
   [b] If no codes are active, troubleshooting is done.

10 PID 105

10.1 DESCRIPTION OF PID 105 – INTAKE AIR TEMPERATURE OUTSIDE OF NORMAL OPERATING RANGE

PID 105 indicates that the PLD-MR has detected the intake air temperature outside of the normal operating range.

The diagnostic condition is typically:

- ☐ Intake Air Temperature (IAT) Sensor Open Circuit (105 03).
- ☐ IAT Sensor Short to Ground (105 04).

Intake air temperature is monitored by the turbo boost air combination sensor installed in the intake manifold. See Figure 10-1.

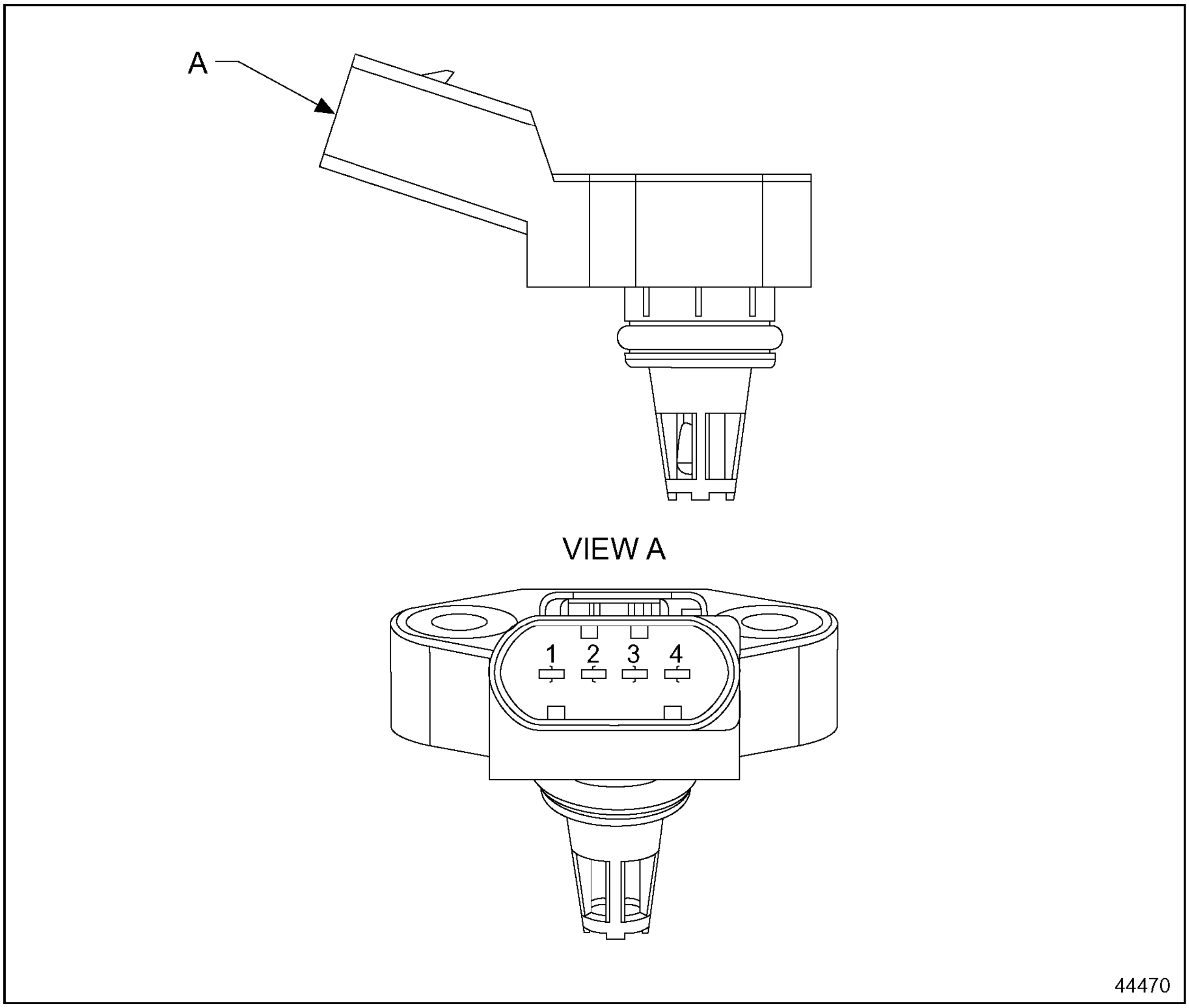


Figure 10-1 Turbo Boost Air Combination Sensor

10.2 TROUBLESHOOTING PID 105

The following procedures will troubleshoot PID 105.

10.2.1 105 03 – Intake Air Temperature Sensor Open Circuit

Perform the following steps to troubleshoot an IAT sensor open circuit fault:

1. With boost air combination sensor connected, check for additional active fault codes. See Figure 10-1.

   [a] If fault code 102 03 is active in addition to 105 03, repair open circuit in 55-pin connector wire 21 (on MBE 900 — see Figure 10-2) or wire 29 (on MBE 4000 — see Figure 10-3) to pin 1 of the sensor. Erase fault code memory.

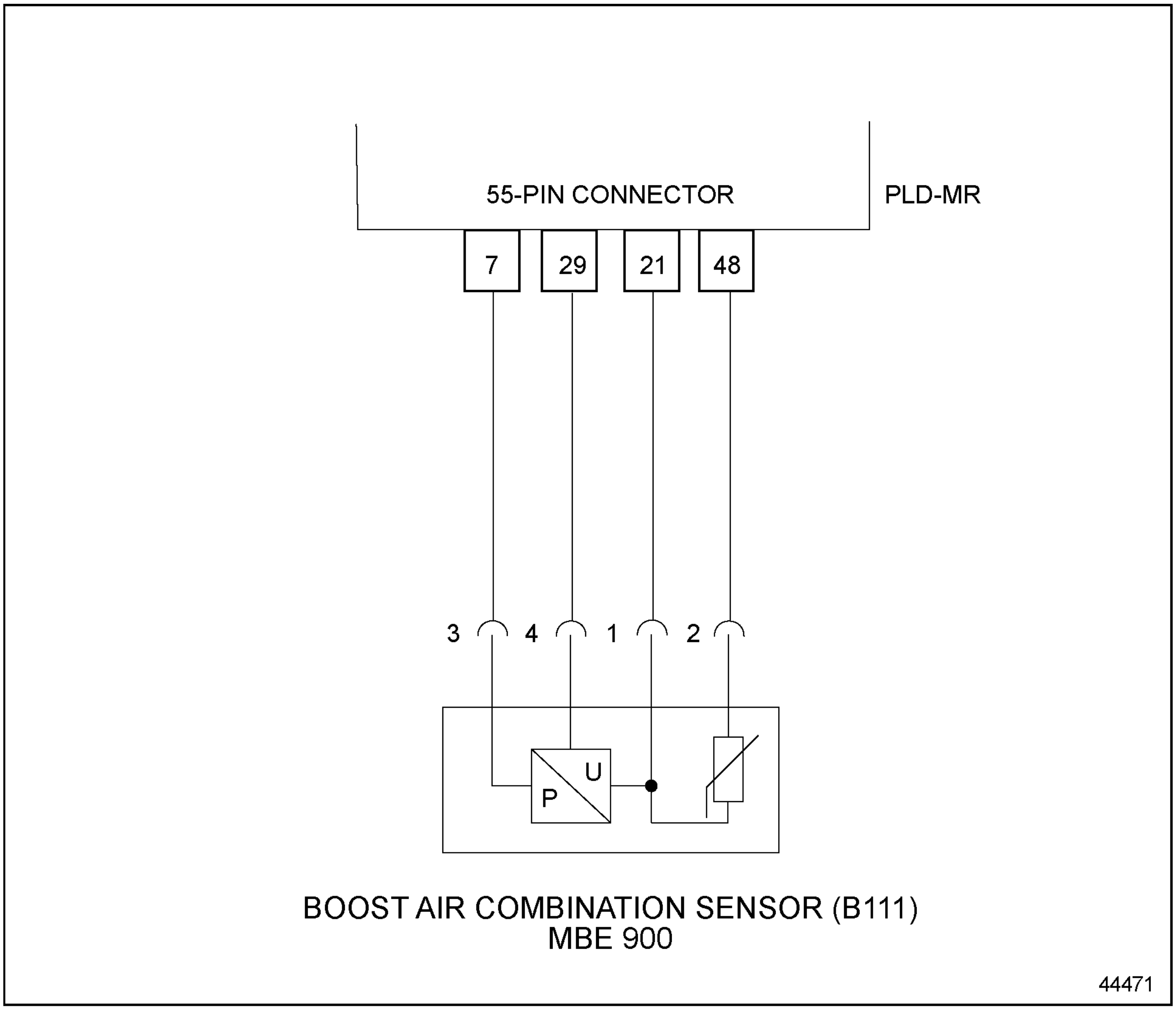


Figure 10-2 Turbo Boost Air Combination Sensor Wiring for MBE 900 Engine

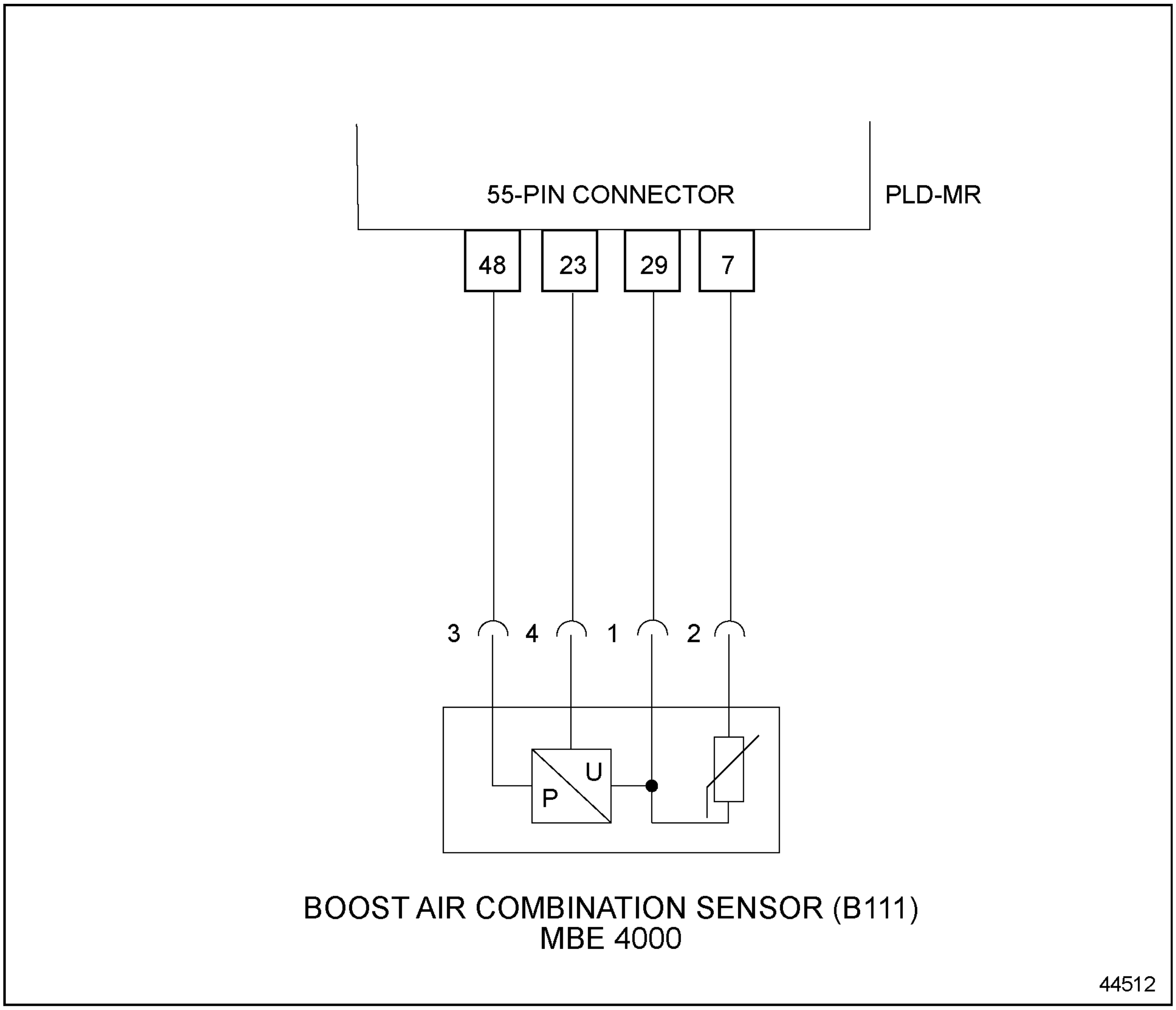


Figure 10-3 Turbo Boost Air Combination Sensor Wiring for MBE 4000 Engine

[b] If fault code 110 03 is active in addition to 105 03, go to step 2.

[c] If only fault code 105 03 is active, go to step 3.

2. Measure the voltage at pin 2 of the combination sensor. See Figure 10-1.

    [a] If more than 10 V, repair short to vehicle system power in 55-pin connector wire 48 (on the MBE 900 — see Figure 10-2) or wire 7 (on the MBE 4000 — see Figure 10-3) to pin 2 of the sensor. Erase fault code memory.

    [b] If less than 10 V, go to step 5.

3. Bridge pins 1 and 2 of the combination sensor. See Figure 10-1.

    [a] If new fault code 105 04 is not active, repair open circuit in 55-pin connector wire 48 (on the MBE 900 — see Figure 10-2) or wire 7 (on the MBE 4000 — see Figure 10-3) to pin 2 of the sensor. Erase fault code memory.

    [b] If new fault code 105 04 is active, go to step 4.

4. Bridge pins 1 and 2 of the combination sensor on the plug side. See Figure 10-1.
   - [a] If new fault 102 04 is not active, replace the combination sensor. Erase fault code memory.
   - [b] If new fault 102 04 is active, repair short to power in 55-pin connector wire 48 (on the MBE 900 — see Figure 10-2) or wire 7 (on the MBE 4000 — see Figure 10-3) to pin 2 of the sensor. Erase fault code memory.
5. With combination sensor connected, measure the voltage at pin 1 of the sensor. See Figure 10-1.
   - [a] If less than 4.5 V, inspect and repair or replace all plug connectors, as required. Erase fault code memory.
   - [b] If more than 4.5 V, repair short to vehicle system power in 55-pin connector wire 34 to pin 1 of the Engine Coolant Temperature sensor. See Figure 10-4. Erase fault code memory.

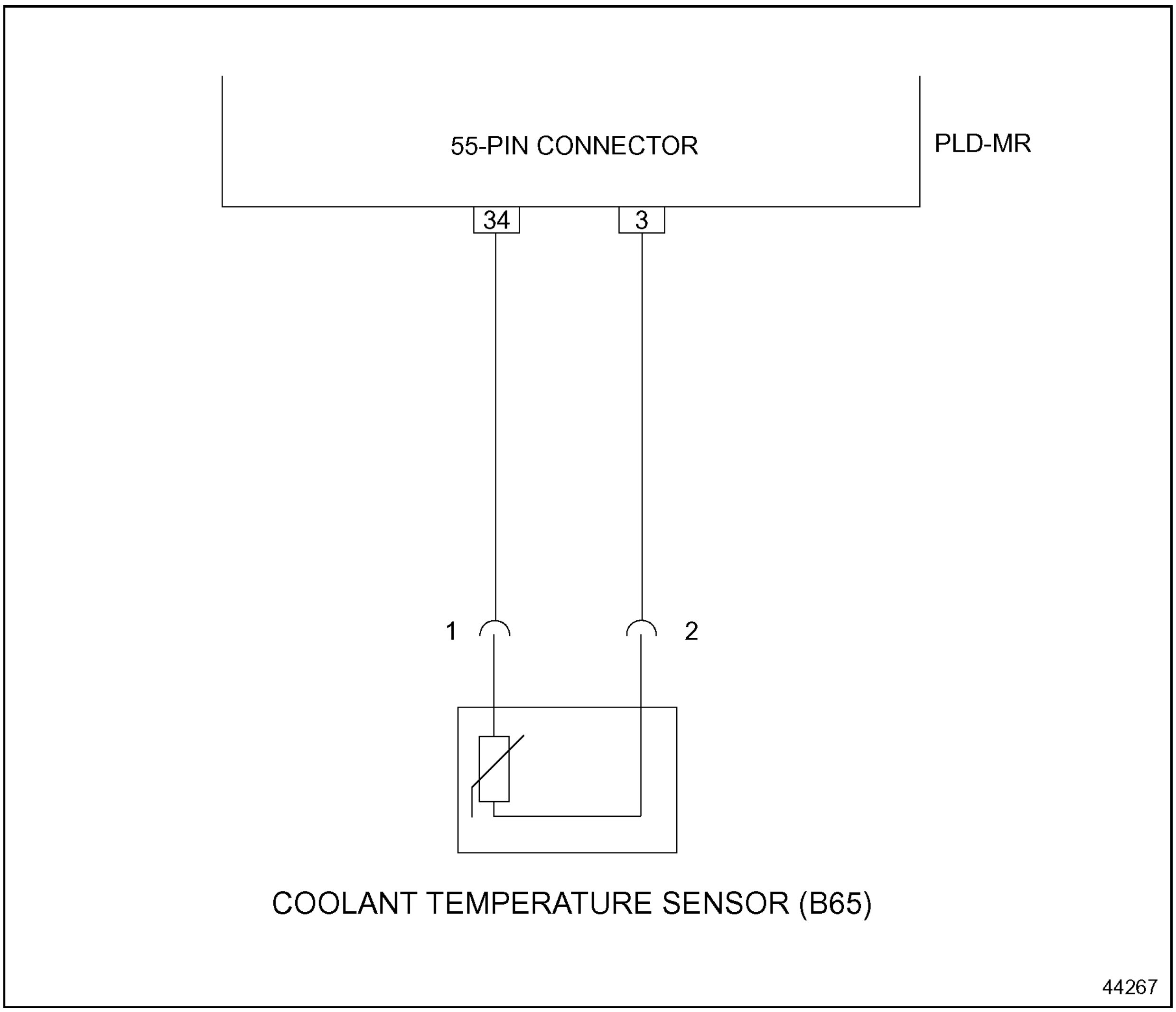


Figure 10-4 Engine Coolant Temperature Sensor Wiring

10.2.2 105 04 – Intake Air Temperature Sensor Short to Ground

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

1. Unplug the boost air combination sensor and check for additional fault codes.
   [a] If new fault code 105 03 is active in addition to code 105 04, replace the sensor. Erase fault code memory.
   [b] If new fault code 105 03 is not active, go to step 2.
2. Measure the resistance between pin 2 of the combination sensor and vehicle ground. See Figure 10-1.
   [a] If resistance is less than 30 kΩ, repair short to ground in 55-pin connector wire 48 (on the MBE 900 — see Figure 10-2) or wire 7 (on the MBE 4000 — see Figure 10-3) to pin 2 of the sensor. Erase fault code memory.
   [b] If resistance is greater than 30 kΩ, go to step 3.
3. Check and clean the sensor contacts (remove any corrosion).
   [a] If fault 105 04 is still active after checking and cleaning, replace the PLD-MR. Erase fault code memory.
   [b] If fault 105 04 is not active after checking and cleaning, erase fault code memory.

11 PID 110

Section **Page**

11.1 DESCRIPTION OF PID 110 – COOLANT TEMPERATURE ABOVE RECOMMENDED NORMAL OPERATING RANGE

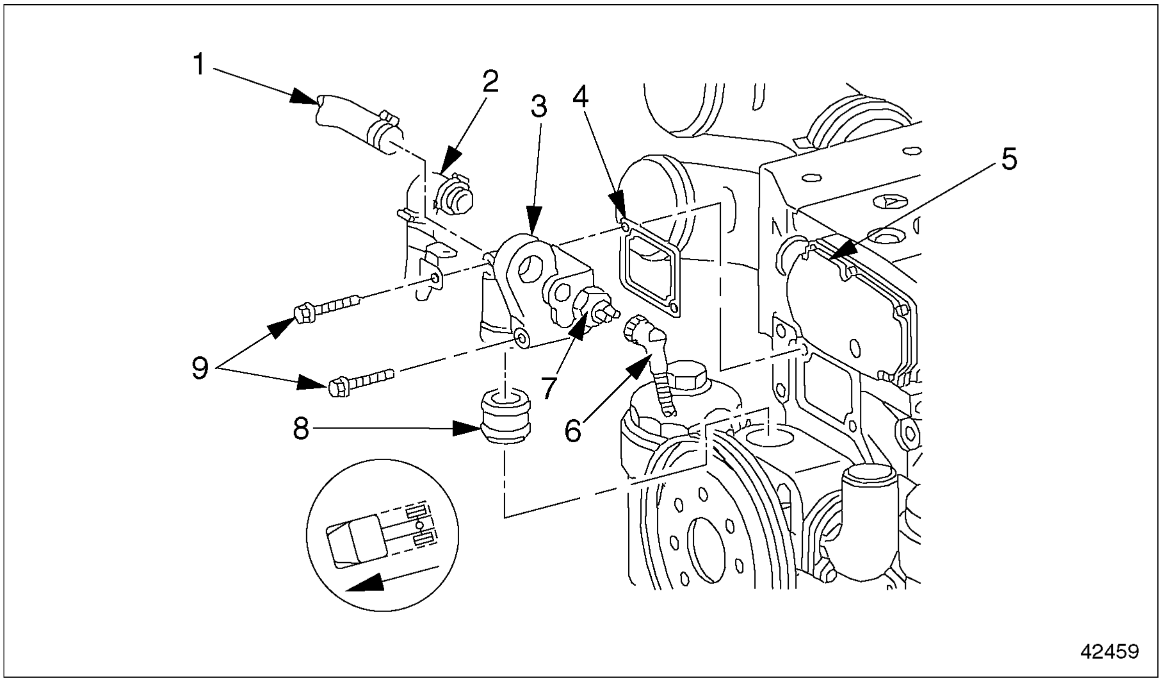
PID 110 indicates the PLD-MR control unit has detected a fault message that the coolant temperature has exceeded the recommended normal operating range.

The diagnostic condition is typically:

- ☐ Engine Coolant Temperature High (110 00)
- ☐ Engine Coolant Temperature Open Circuit (110 03)
- ☐ Engine Coolant Temperature Short to Ground (110 04)
- ☐ Engine Coolant Temperature Very High (110 14)

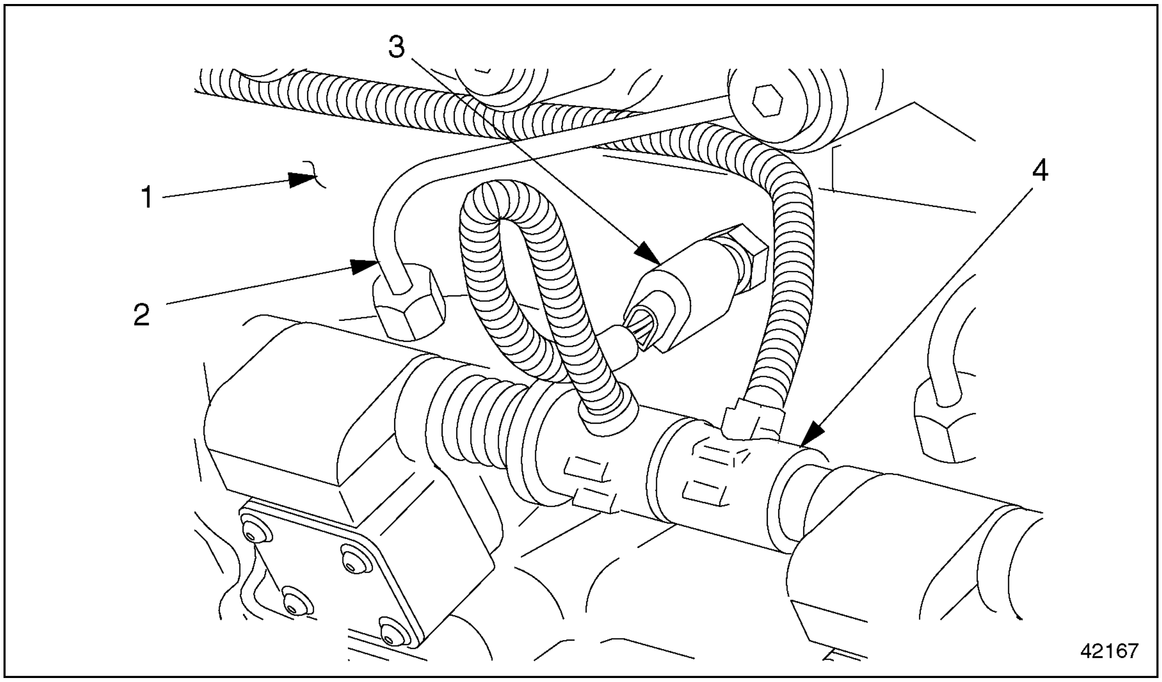
11.2 TROUBLESHOOTING PID 110

The Engine Coolant Temperature (ECT) sensor is mounted on the front connector housing toward the front of the cylinder block directly below the oil separator on the MBE 900 engines (see Figure 11-1) and on the side of cylinder block between units pumps No. 2 and 3 on the MBE 4000 engines (see Figure 11-2).



1. Coolant Delivery Hose
2. Crankcase Breather Hose
3. Front Connector Housing
4. Connector Housing Gasket
5. Oil Separator
6. Electrical Connector
7. Engine Coolant Temperature Sensor
8. Coolant Pump Connector Fitting
9. Mounting Bolt

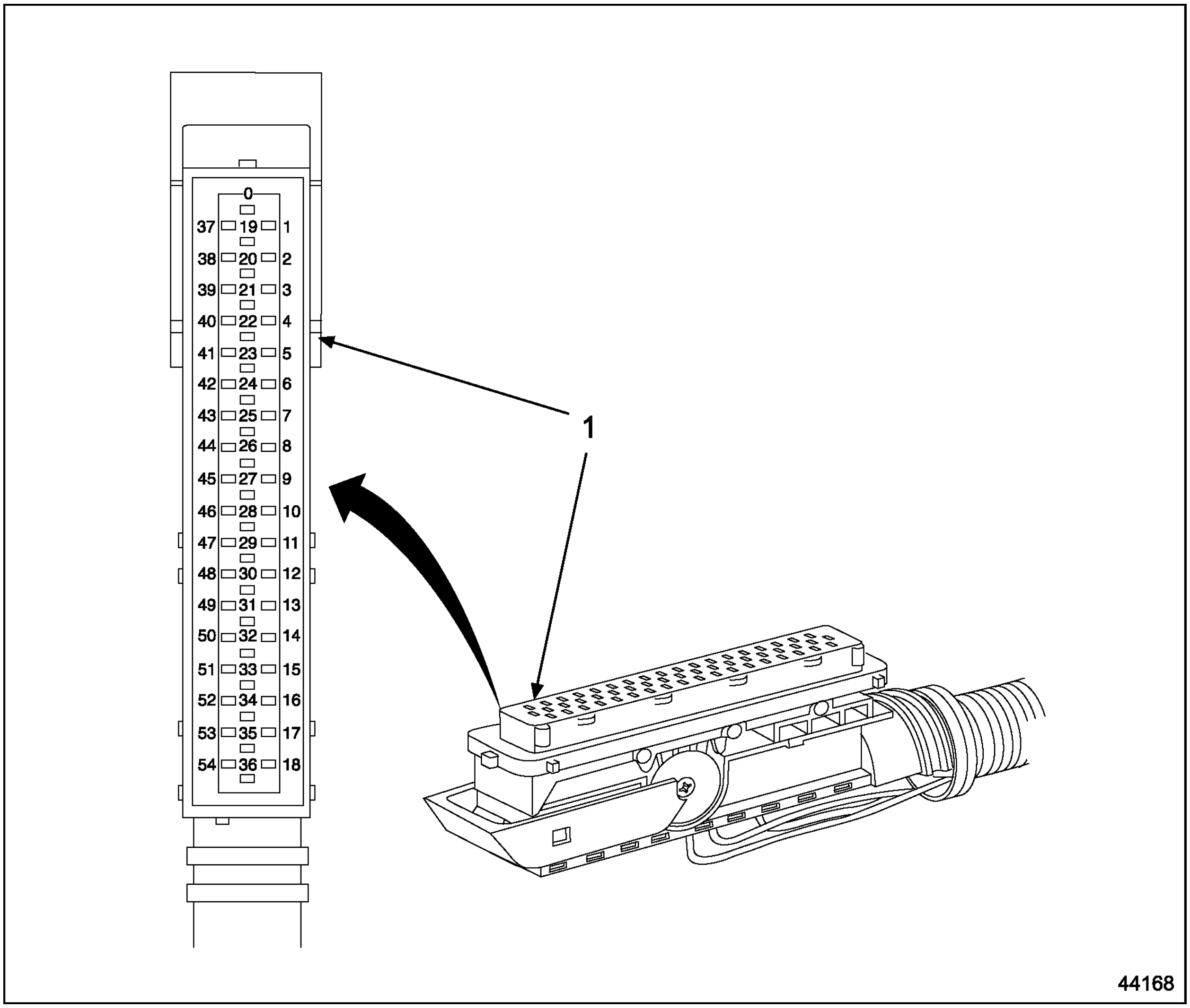
Figure 11-1 Location of Engine Coolant Temperature Sensor on the MBE 900 Engine



1. Cylinder Block
2. High-Pressure Fuel Line
3. Engine Coolant Temperature Sensor
4. Engine Sensor Harness

Figure 11-2 Location of Engine Coolant Temperature Sensor on the MBE 4000 Engine

Data from the ECT sensor is routed through wire pin locations 3 and 34 on the large, 55-pin PLD wiring harness connector. See Figure 11-3.



1. 55-Pin Connector

Figure 11-3 Pin Locations on 55-Pin Connector

11.2.1 110 00 – Engine Coolant Temperature High

Perform the following steps to troubleshoot a coolant temperature high fault:

1. If fault 110 03 is active in addition to 110 00, refer to section 11.2.2.
2. If fault 110 04 is active in addition to 110 00, refer to section 11.2.3.
3. If fault 111 01 is active in addition to 110 00, refer to section 12.2.1.
4. If only fault code 110 00 is active, refer to section 11.2.1.1.

11.2.1.1 Required Action

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.

11.2.2 110 03 – Engine Coolant Temperature Sensor Open Circuit

Perform the following steps to troubleshoot a coolant temperature sensor open circuit fault:

1. If faults 105 03 and 110 03 are active at the same time, refer to section 10.2.1.
2. If faults 105 03 and 110 03 are not active at the same time, go to step 3.

3. Bridge ECT sensor pins 1 and 2. See Figure 11-4.

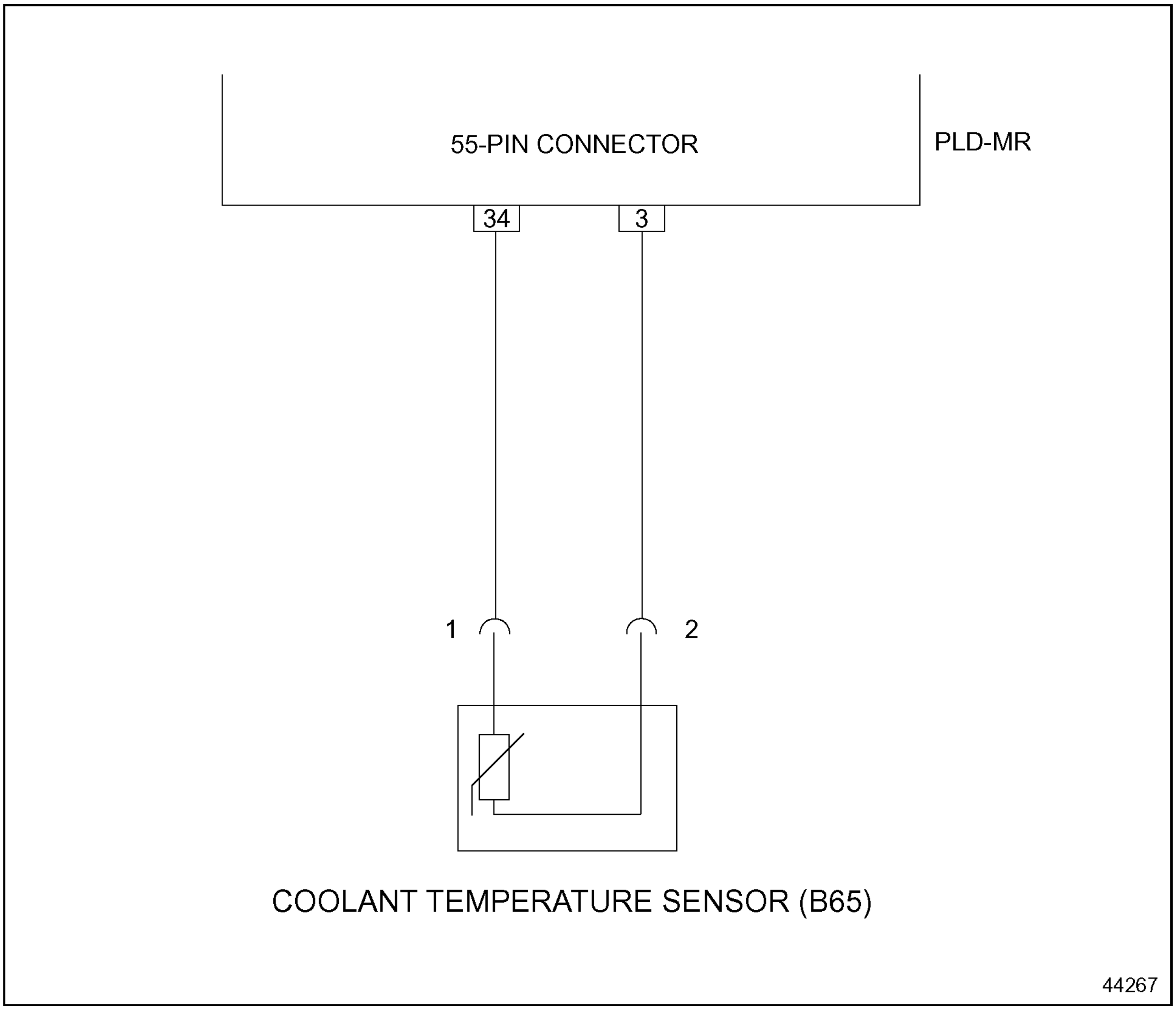


Figure 11-4 Engine Coolant Temperature Sensor Wiring

[a] If fault code 110 04 is not the only active code, go to step 4.

[b] If fault code 110 04 is the only active code, replace the ECT sensor.

[c] Erase fault code memory.

4. Bridge pin 1 of the ECT sensor to ground. See Figure 11-4.

[a] If fault code 110 04 is still active, repair open circuit in wire between pin 34 of the 55-pin connector and pin 1 of the coolant temperature sensor.

[b] If fault code 110 04 is no longer active, see below.

[c] Erase fault code memory.

5. Check the resistance between pin 3 of the 55-pin connector and pin 2 of the ECT sensor. See Figure 11-4.

[a] If resistance is greater than 3 Ω, refer to section 11.2.2.1.

[b] If resistance is less than 3 Ω, refer to section 11.2.2.2.

11.2.2.1 Required Action

Perform the following steps to resolve an ECT sensor open circuit fault:

1. Repair open circuit in wire between pin 3 of the 55-pin connector and pin 2 of the ECT sensor.
2. Erase fault code memory.

11.2.2.2 Required Action

Perform the following steps to resolve an ECT sensor open circuit fault:

1. Check all contacts and connections. Remove corrosion, if evident.
   [a] If fault 110 03 is not active, erase fault code memory.
   [b] If fault 110 03 is still active, go to step 2.
2. Contact Detroit Diesel Technical Service for authorization to replace the PLD-MR. Set parameters on the new PLD-MR.

11.2.3 110 04 – Engine Coolant Temperature Sensor Short to Ground

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

1. Unplug the ECT sensor.
   [a] If fault 110 03 is not active, go to step 3.
   [b] If fault 110 03 is active, replace ECT sensor.
   [c] Erase fault code memory.
2. Reconnect ECT sensor.
3. Check the resistance between pin 1 of the ECT sensor and ground. See Figure 11-4.
   [a] If resistance is greater than 30 kΩ, go to step 4.
   [b] If resistance is 30 kΩ or less, repair short to ground in wire between pin 34 of the 55-pin connector and pin 1 of the ECT sensor.
   [c] Erase fault code memory.
4. Check and clean all contacts.
   [a] If fault 110 04 is active after checking and cleaning the contacts, refer to section 11.2.3.1.
   [b] If fault 110 04 is not active after checking and cleaning the contacts, refer to section 11.2.3.2.

11.2.3.1 Required Action

Perform the following steps to resolve an ECT sensor short-to-ground fault.

1. Contact Detroit Diesel Technical Service for authorization to replace the PLD-MR.
2. Set parameters on the new PLD-MR.

11.2.3.2 Required Action

Perform the following steps to resolve an ECT sensor short-to-ground fault.

1. Erase fault code memory.

11.2.4 110 14 – Engine Coolant Temperature Very High

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

1. If only fault code 110 14 is active, refer to section 11.2.4.1.
2. If fault code 110 03 is active in addition to fault code 110 14, refer to section 11.2.2.
3. If fault code 110 04 is active in addition to fault code 110 14, refer to section 11.2.3.

11.2.4.1 Required Action

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.

12 PID 111

Section **Page**

12.1 DESCRIPTION OF PID 111 – COOLANT OUTSIDE NORMAL OPERATING RANGE

PID 111 indicates that the coolant level is outside of the normal operating range.

The diagnostic condition is typically:

- Engine Coolant Level Low (111 01)
- Engine Coolant Level (ECL) Sensor Open Circuit (111 03)
- ECL Sensor Short to Ground (111 04)

12.2 TROUBLESHOOTING PID 111

The ECL sensor is installed in the radiator top tank or in a remote-mounted surge tank and is connected to the VIH-VCU 15-pin connector. See Figure 12-1 for typical top tank location. See Figure 12-2 for typical sensor installation. See Figure 12-3 for the typical location of the VIH-VCU inside the tractor cab.

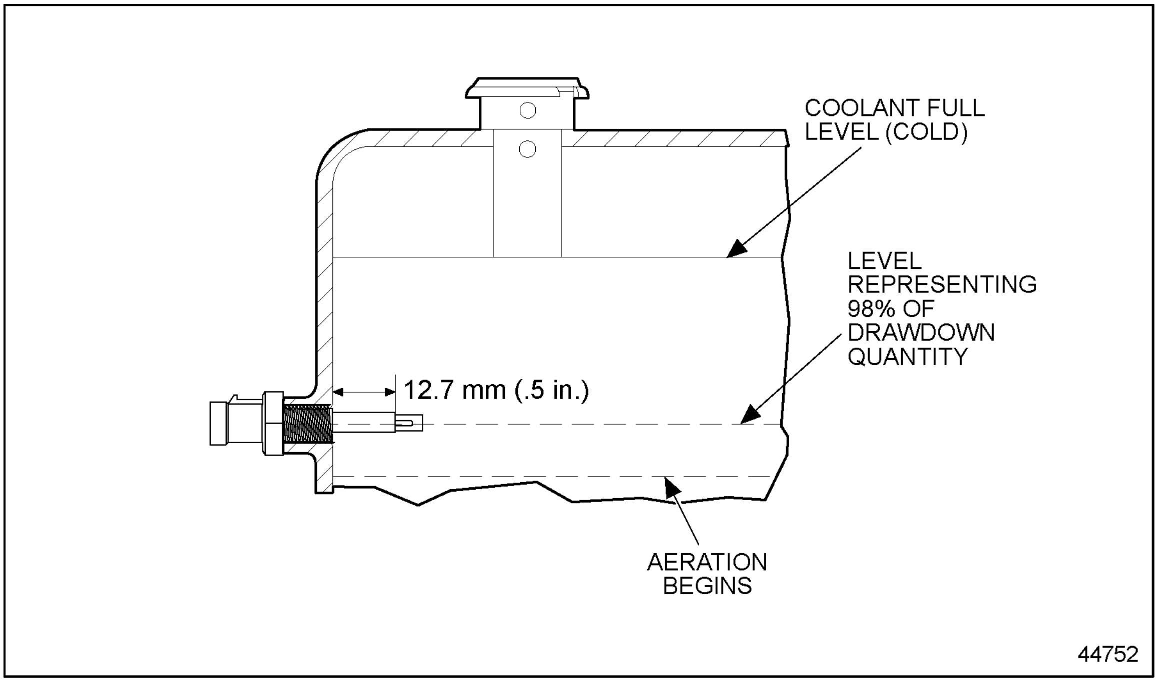
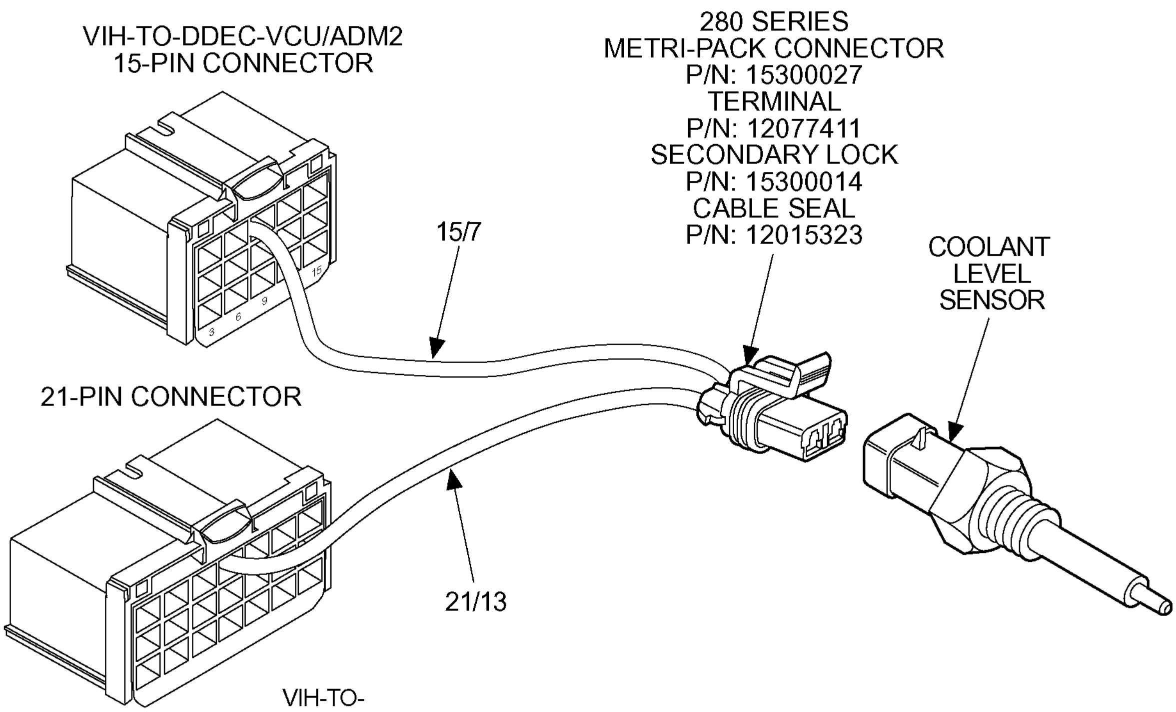


Figure 12-1 Engine Coolant Level Sensor Mounted in Radiator Top Tank



LABEL	VIH-TO-DDEC-VCU/ADM2 CONNECTOR CAVITY	WIRE COLOR	CLS CAVITY
COOLANT LEVEL	15/7	ORN	A
GROUND	21/13	BLK/WHT	B

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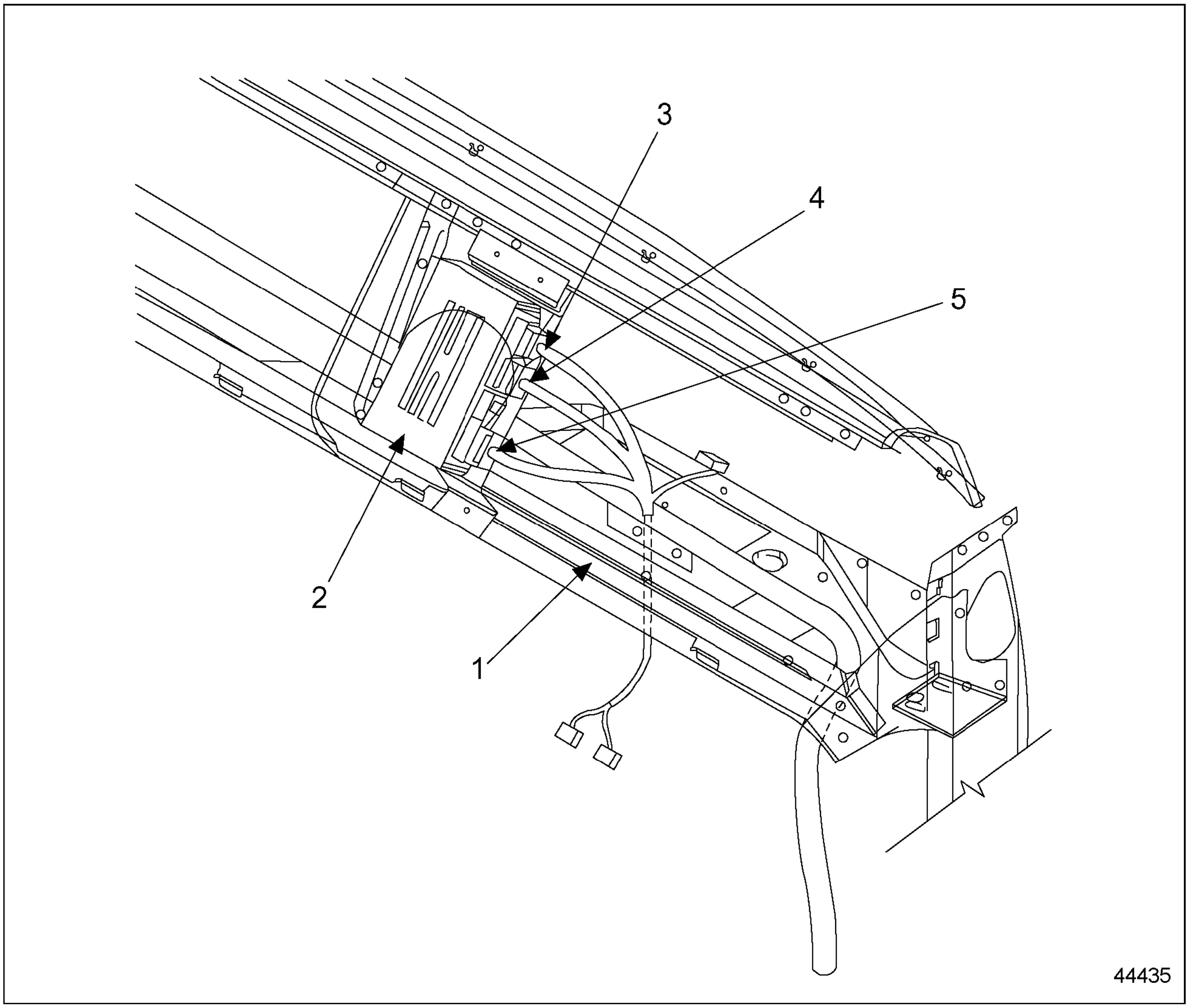
Figure 12-2 Engine Coolant Level Sensor Installation



1. Passenger-Side Dash
2. DDEC-VCU
3. 15-Pin Connector
4. 18-Pin Connector
5. 21-Pin Connector

Figure 12-3 Location of DDEC-VCU and Wiring Harness Connectors

12.2.1 111 01 – Engine Coolant Level Low

Perform the following steps to troubleshoot a coolant level low fault:

1. Check fault code display.
   - [a] If fault 111 03 is active in addition to fault 111 01, refer to section 12.2.2.
   - [b] If fault 111 04 is active in addition to fault 111 01, refer to section 12.2.3.
   - [c] If the coolant level in the reservoir is not within limit, refer to section 12.2.1.1.
   - [d] If the coolant level in the reservoir is within limit, refer to section 12.2.1.2.

12.2.1.1 Required Action

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.

12.2.1.2 Required Action

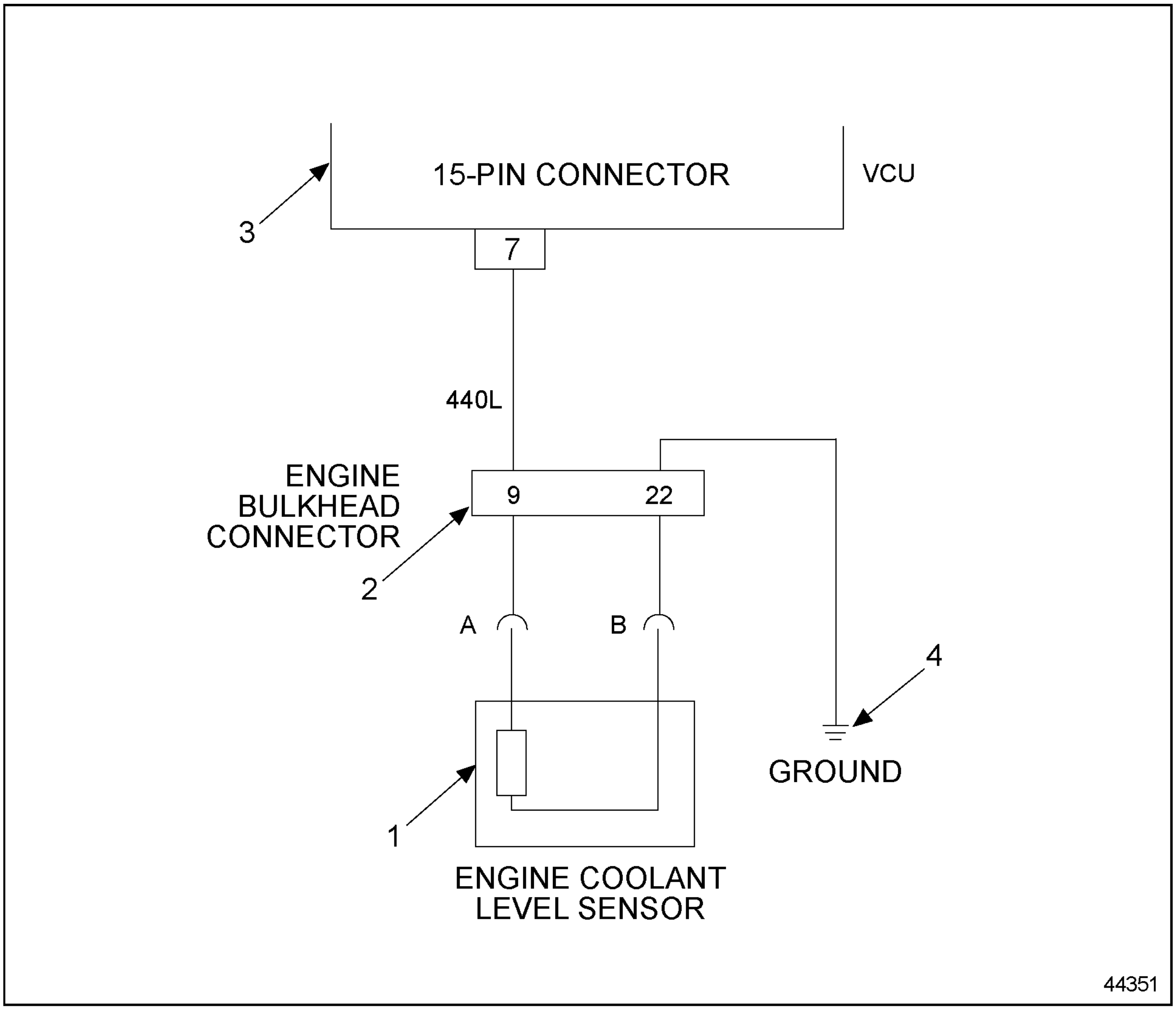
Perform the following step to resolve a coolant level low fault.

1. If the Switch/Indicator Datalink Monitor Template does not indicate that the coolant level is full, replace the ECL sensor.
2. Erase fault code memory.

12.2.2 111 03 – Engine Coolant Level Sensor Open Circuit

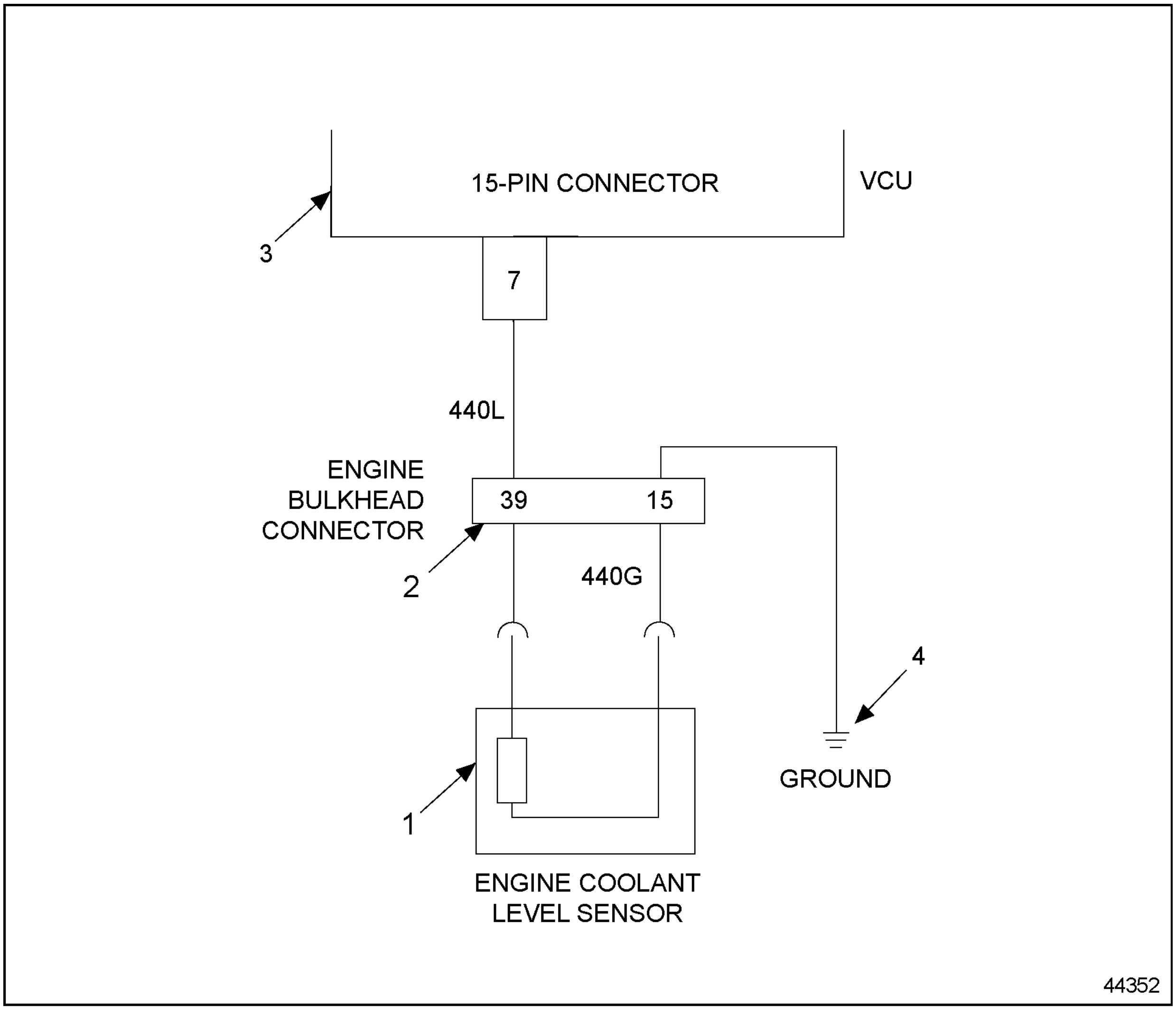
Perform the following steps to troubleshoot an ECL sensor open circuit fault:

1. Check the voltage between the DDEC-VCU 15-pin connector wires 440 (440G on Acterra) and 440L on the ECL sensor. See Figure 12-4 for 440L engine sensor wiring and see Figure 12-5 for Acterra engine sensor wiring.



1. ECL Sensor
2. Engine Bulkhead Connector
3. 15-Pin Connector
4. Ground Splice Pack No. 2

Figure 12-4 Engine Coolant Level Sensor Connector Wire Locations – 440L Engine



1. ECL Sensor
2. Engine Bulkhead Connector
3. 15-Pin Connector
4. Ground Splice Pack No. 1

Figure 12-5 Engine Coolant Level Sensor Connector Wire Locations – Acterra Engine

[a] If voltage is about 5 volts, replace ECL sensor. Erase fault code memory.

[b] If voltage is the same as battery voltage, repair short to wire in ECL sensor wire 440L. Erase fault code memory.

[c] If voltage is 0 volts, go to step 2.

2. Bridge wire 440L to battery ground.

   [a] If fault 111 03 is active, repair open circuit in ECL sensor wire 440L. Erase fault code memory.

[b] If fault 111 04 is active, repair open circuit in ECL sensor wire 440 (440G on Acterra). Erase fault code memory.

12.2.3 111 04 – Engine Coolant Level Sensor Short to Ground

Perform the following steps to troubleshoot an ECL sensor short to ground fault:

1. Disconnect the ECL sensor.
   [a] If fault 111 04 is not active after disconnecting the sensor, replace the ECL sensor.
   [b] If fault 111 04 is active after disconnecting the sensor, go to step 2.
2. Disconnect the 15-pin connector.
   [a] If fault 111 04 is active after disconnecting the connector, replace the DDEC-VCU. Erase fault code memory.
   [b] If fault 111 04 is not active after disconnecting the 15-pin connector, repair short to ground in ECL sensor wire 440L. Erase fault code memory.

13 PID 158

Section **Page**

13.1 DESCRIPTION OF PID 158 — BATTERY CHARGING FAULT

PID 158 indicates that there is a concern with the battery, starting, and charging system.

The diagnostic condition is typically:

- ☐ High System Voltage (158 00)
- ☐ Low System Voltage (158 01)
- ☐ Unmatched PLD-MR and DDEC-VCU Signals (158 02)

13.2 TROUBLESHOOTING PID 158

The following procedures will troubleshoot PID 158.

13.2.1 158 00 – Battery Voltage Switched — High

Perform the following steps to troubleshoot the high voltage fault code 158 00.

1. Start the engine and rev at rated speed.
2. Measure the voltage across the battery terminals. See Figure 13-1.

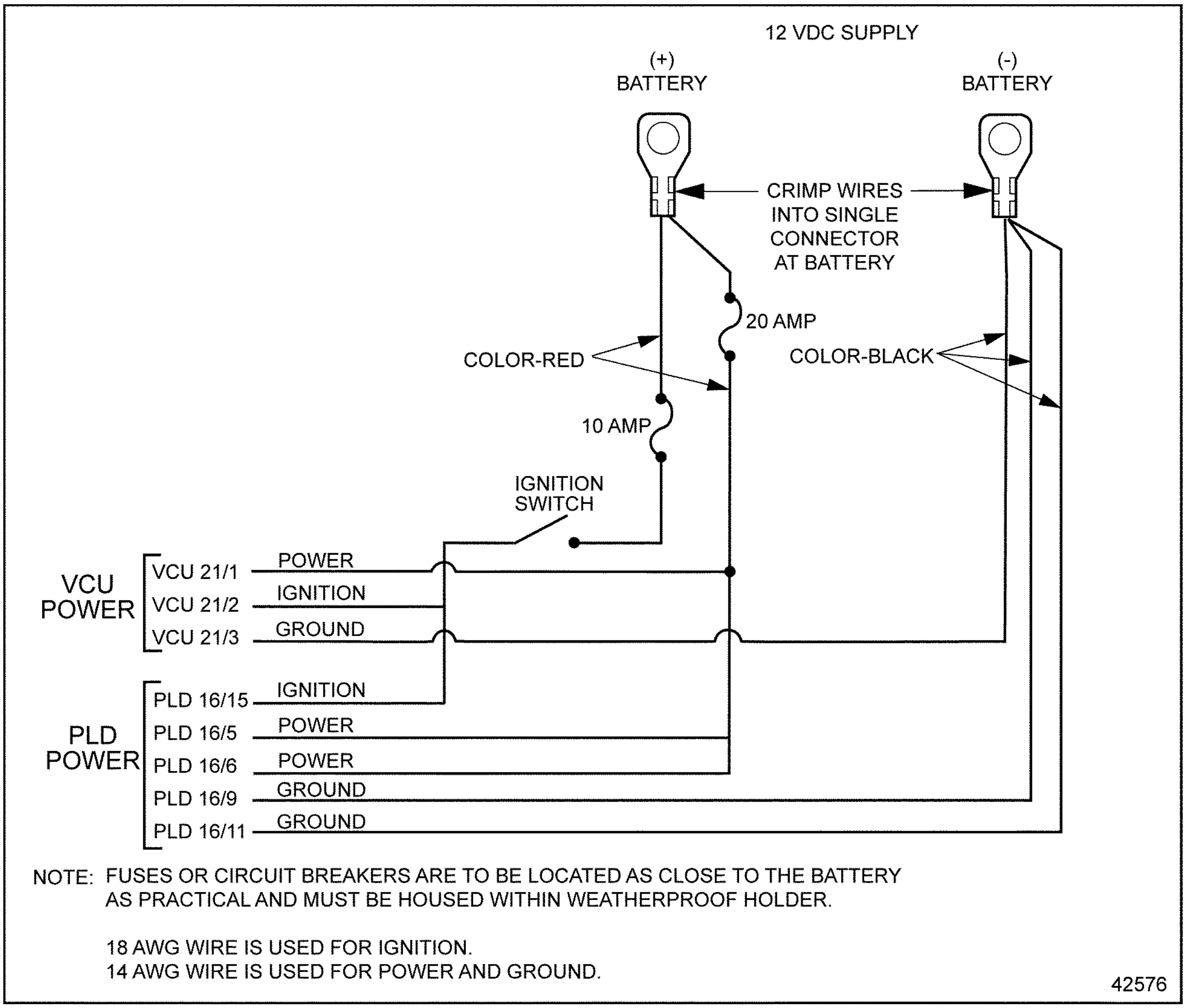


Figure 13-1 Power Wiring

[a] If the voltage is greater than 14.5 V, troubleshoot the battery, starting, and charging system for an overvoltage condition. Refer to the OEM Vehicle Manual.

[b] If the voltage is between 14.5 and 11.0 V and fault code 158 00 is still active, contact the Detroit Diesel Technical Support Group.

3. Erase the fault code memory.

13.2.2 158 01 – Battery Voltage Switched — Low

Perform the following steps to troubleshoot the low voltage fault code 158 01.

1. Turn the ignition on.
2. Measure the voltage across the battery terminals. See Figure 13-2.

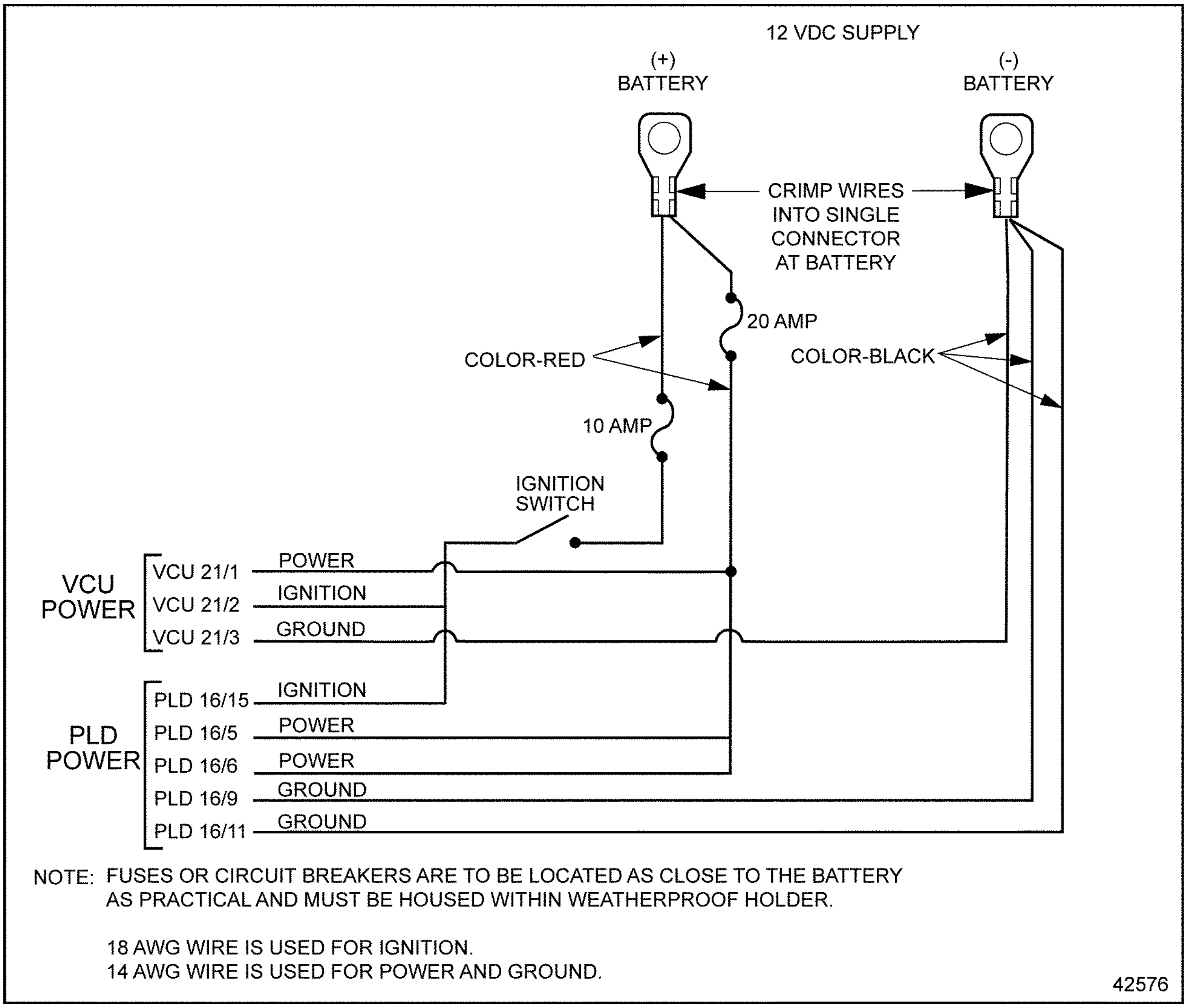


Figure 13-2 Power Wiring

3. If the voltage is less than 11.0 V, troubleshoot the battery, starting, and charging system for an undervoltage condition. Refer to the OEM Vehicle Manual.
4. Measure the voltage between pins 2 and 3 of the 21-pin connector. See Figure 13-2.
5. If the voltage is between 11.0 and 14.5 V, refer to section 13.2.2.1.

6. Start and run the engine. Measure the voltage drop between pin 2 of the 21-pin connector and the positive battery terminal.
7. If the voltage was less than 11.0 V (ignition on and engine not running) and voltage drop between pin 2 of the 21-pin connector and the positive battery terminal is greater than 0.5 V (engine running), refer to section 13.2.2.2.
8. With the engine still running, measure the voltage drop between pin 3 of the 21-pin connector and the negative battery terminal.
   - [a] If the voltage is less than 11.0 V and voltage drop between pin 3 of the 21-pin connector and the negative battery terminal is greater than 0.5 V, refer to section 13.2.2.3.
   - [b] If the voltage is less than 11.0 V and voltage drop between pin 3 of the 21-pin connector and the negative battery terminal is less than 0.5 V, contact the Detroit Diesel Technical Support Group.

13.2.2.1 Required Action

Perform the following steps to resolve fault code 158 01.

1. Replace the DDEC-VCU.
2. Erase the fault code memory.

13.2.2.2 Required Action

Perform the following steps to resolve fault code 158 01.

1. Replace or repair the supply side wires and connectors between pin 2 of the 21-pin connector and battery.
2. Erase the fault code memory.

13.2.2.3 Required Action

Perform the following steps to resolve fault code 158 01.

1. Replace or repair the ground side wires and connectors between pin 3 of the 21-pin connector and battery ground.
2. Erase the fault code memory.

13.2.3 158 02 – PLD-MR and DDEC-VCU Signals Unmatched

Perform the following steps to troubleshoot the fault code 158 02 for unmatched PLD-MR and DDEC-VCU signals.

1. Check for active codes.
   - [a] If fault codes 158 02 and 168 03 are both still active, refer to section 14.2.2.

[b] If fault codes 158 02 and 158 01 are both still active, refer to section 13.2.2

[c] If fault codes 158 02 and 158 00 are both still active, refer to section 13.2.1.

[d] If fault codes 158 02 and 168 04 are both still active, refer to section 14.2.1.

2. Measure the difference in voltage inputs between the DDEC-VCU and PLD-MR. See Figure 13-3.

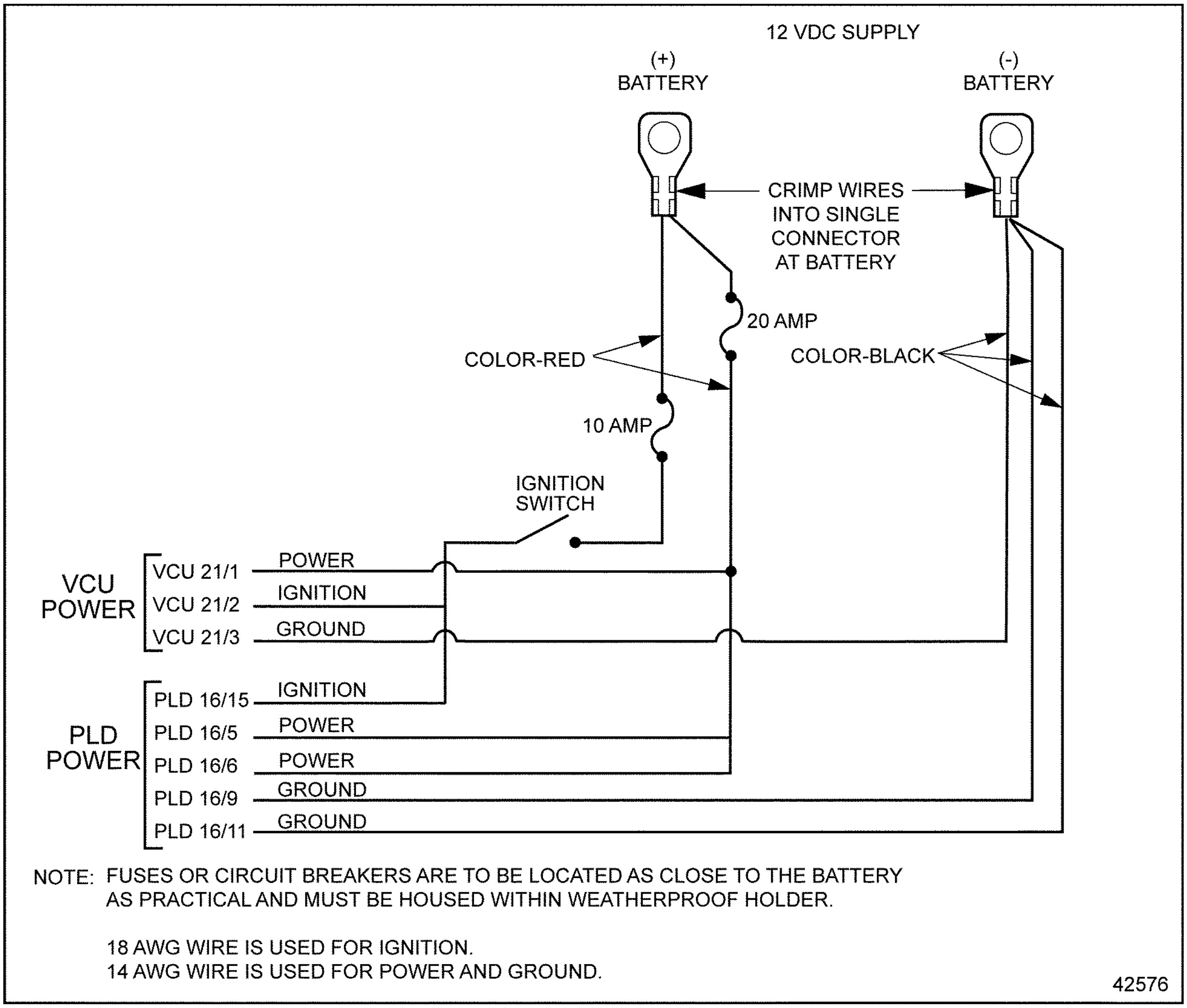


Figure 13-3 Power Wiring

[a] If the voltage difference is less than 1.0 V, contact Detroit Diesel Technical Service Group.

[b] If the voltage difference is greater than 1.0 V with the DDEC-VCU indicating the low voltage, refer to section 13.2.3.1.

[c] If the voltage difference is greater than 1.0 V with the PLD-MR indicating the low voltage, refer to section 13.2.3.2.

13.2.3.1 Required Actions

Perform the following steps to resolve fault code 158 02.

1. Replace or repair the bad contacts and/or voltage supply for pins 2 (ignition) and 3 (ground) of the 21-pin connector.
2. Erase the fault code memory.

13.2.3.2 Required Actions

Perform the following steps to resolve fault code 158 02.

1. Replace or repair the bad contacts and/or voltage supply for pin 15 (power) and pins 9 and 11 (ground) on 16-pin connector.
2. Erase the fault code memory.

14 PID 168

Section **Page**

14.1 DESCRIPTION OF PID 168 — BATTERY VOLTAGE OUTSIDE NORMAL OPERATING RANGE

PID 168 indicates that the PLD-MR control unit has detected engine battery voltage outside the normal operating range.

The diagnostic condition is typically:

- ☐ Battery Voltage High (168 03)
- ☐ Battery Voltage Low (168 04)

14.1.1 Power Supply

The voltage supply for the PLD-MR is listed in Table 14-1.

Voltage Supply	**Voltage**	
	24 V	**12 V**
Nominal Voltage	22 V ≤ V ≤ 30 V	11 V ≤ V ≤ 16 V
Low Voltage	8 V ≤ V ≤ 22 V Limited Operating Range	6.5 V ≤ V ≤ 11 V Limited Operating Range
Overload Switch-Off	V > 33 V	V > 33 V

Table 14-1 PLD-MR Voltage Supply

See Figure 14-1 for the connectors to the PLD-MR.

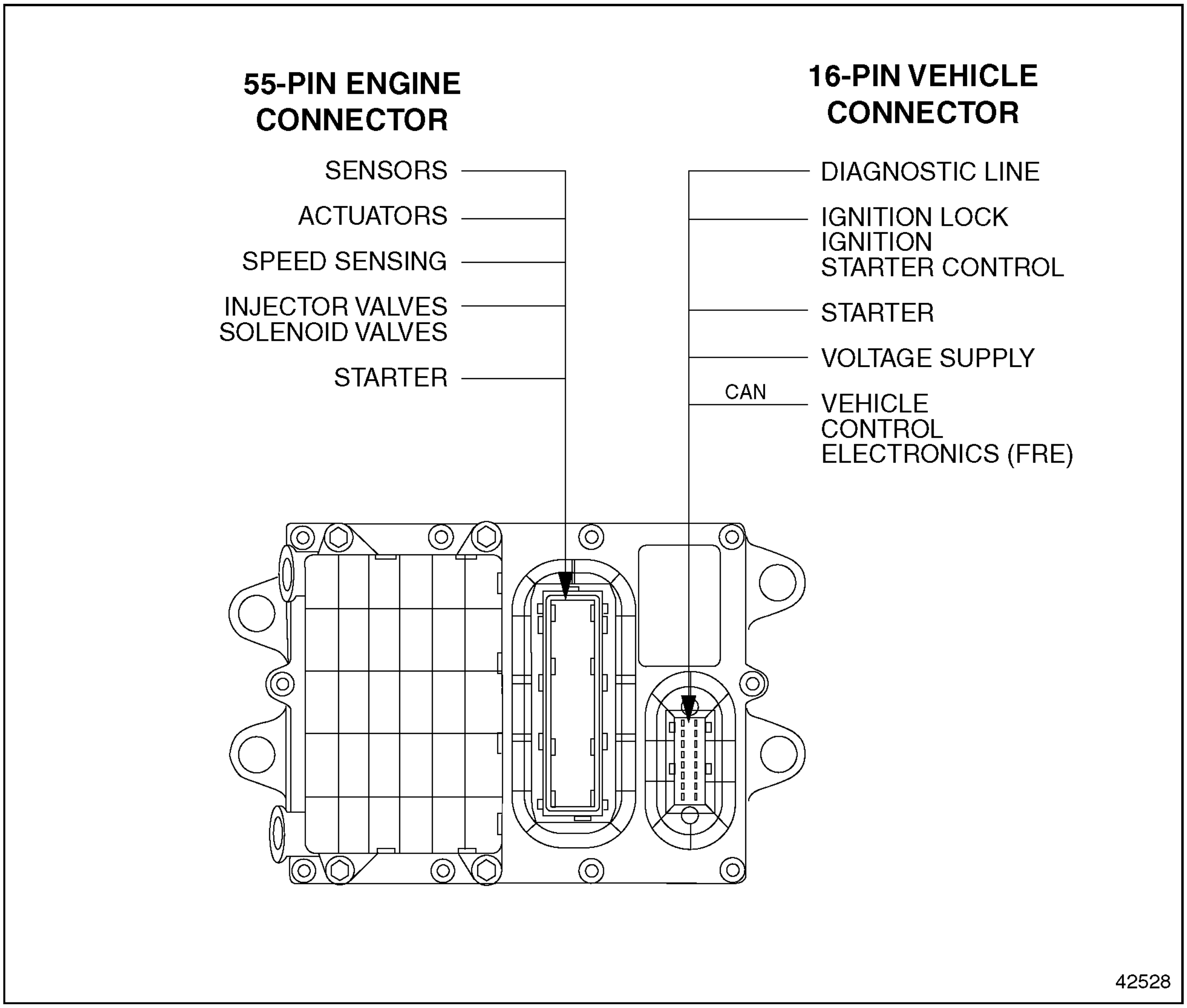
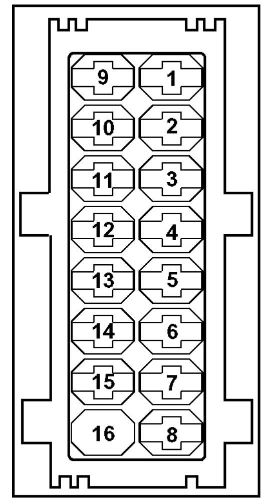


Figure 14-1 PLD-MR Connectors

The wiring for the VIH 16-pin connector to the PLD-MR is listed in Table 14-2. The side of the connector shown is looking into the pins.

Pin	Signal Type	Function	Connector
1	Data Link	CAN Interface (High Line)	
2	Data Link	CAN Interface (Low Line)	
3	Data Link	CAN HF Ground	
4	Data Link	CAN HF Ground	
5	Power Supply	Battery Voltage (+)	
6	Power Supply	Battery Voltage (+)	
7	NC	NC	
8	Digital Output	Starter Control Signal	
9	Ground	Battery Ground (-)	
10	Digital Output	Proportional Valve 1 – 4 High Side Supply	
11	Ground	Battery Ground (-)	
12	Digital Output	Starter High Side Control	
13	Digital Data Link	Diagnostic Link K-Line (ISO)	
14	Digital Output	Proportional Valve 3 Low Side Control	
15	Ignition Input	Ignition	
16	Digital Output	Proportional Valve 4 Low Side Control	



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Front
Looking into the Pins on the Harness

Table 14-2 16-Pin Connector to the PLD-MR

14.1.2 VIH Power Wiring

The OEM-supplied VIH power wiring (see Figure 14-2) supplies 12 volts to the DDEC-VCU and PLD-MR. The terminals are designed to accept 14 AWG standard wire size.

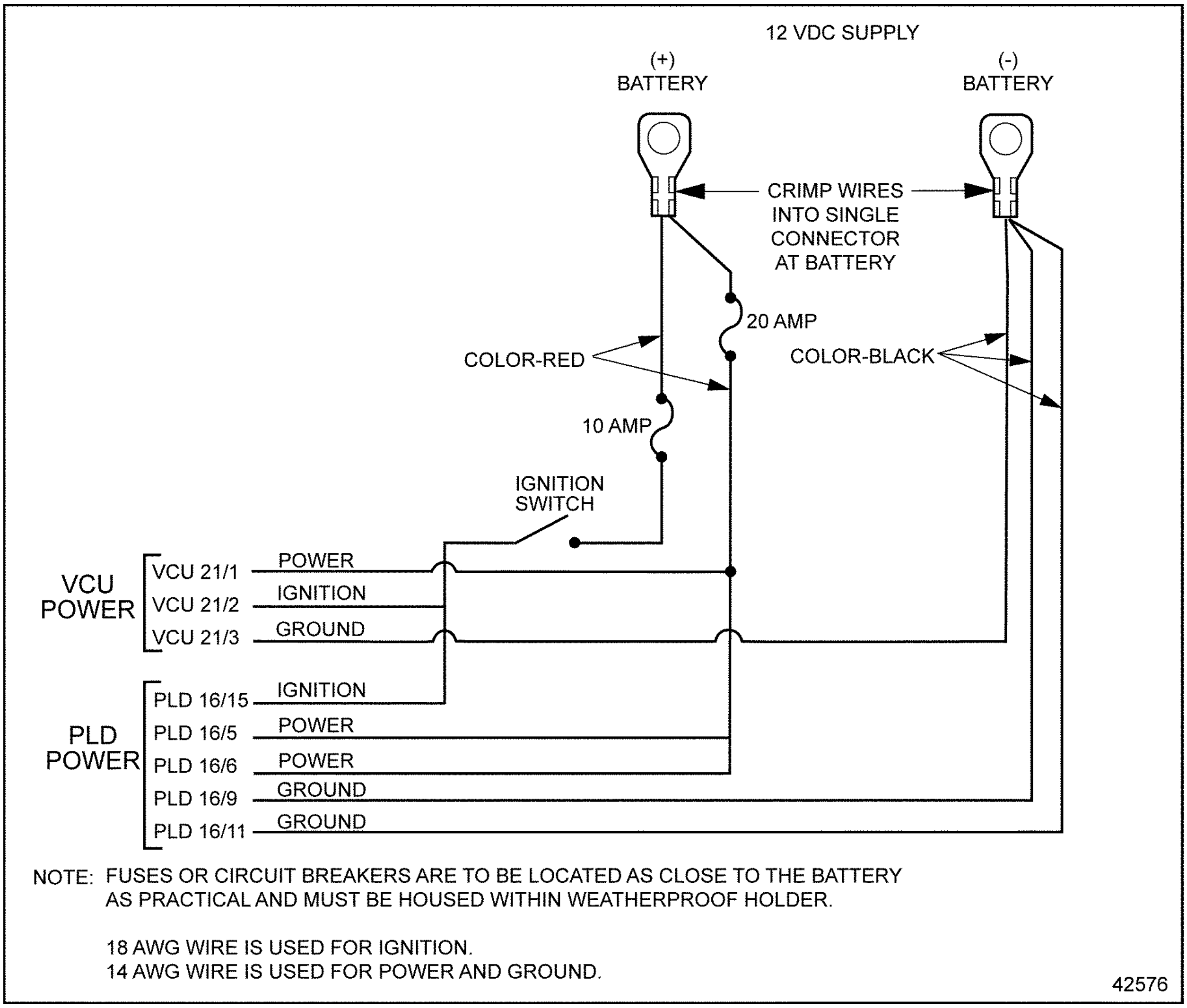


Figure 14-2 Power Wiring

14.2 TROUBLESHOOTING PID 168

The following procedures will troubleshoot PID 168.

14.2.1 168 03 – Battery Voltage High Fault

Perform the following steps to troubleshoot a battery voltage high fault:

1. Measure battery voltage with the engine running at maximum rpm.
   [a] If greater than 14.5 volts, check for proper alternator operation and repair or replace, as required.
   [b] Erase fault code memory.

14.2.2 168 04 – Battery Voltage Low Fault

Perform the following steps to troubleshoot a battery voltage low fault:

1. Check the condition of the alternator drive belt and replace, if required.
   [a] If fault is no longer active, erase fault code memory.
   [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, erase fault code memory.
   [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, erase fault code memory.
   [b] If fault is still active, go to step 5.
5. Measure the resistance of the individual wires in the ground circuit.
   [a] If resistance is greater than 0.5 Ω in any wire, repair or replace the wire and connector. Erase fault code memory.
   [b] If resistance is less than 0.5 Ω in all wires, go to step 6.
6. Measure the resistance of the individual wires in the power circuit with the engine running and battery voltage greater than 12.5 V.
   [a] If resistance is greater than 0.5 Ω in any wire, repair or replace the power circuit wires and connector. Erase fault code memory.
   [b] If resistance is less than 0.5 Ω in any wire, go to step 7.
7. Measure the current drop of the individual wires in the ground circuit.

[a] If the current drop is more than 0.2 volts in any wire, repair or replace the ground circuit wires and connector. Erase fault code memory.

[b] If the current drop is less than 0.2 volts in any wire, go to step 8.

8. Measure the current drop of the individual wires in the power circuit.

   [a] If the current drop is more than 0.2 volts in any wire, repair or replace the power circuit wires and connector. Erase fault code memory.

15 PID 174

Section **Page**

15.1 DESCRIPTION OF PID 174 – SUPPLY FUEL TEMPERATURE SENSOR FAULT

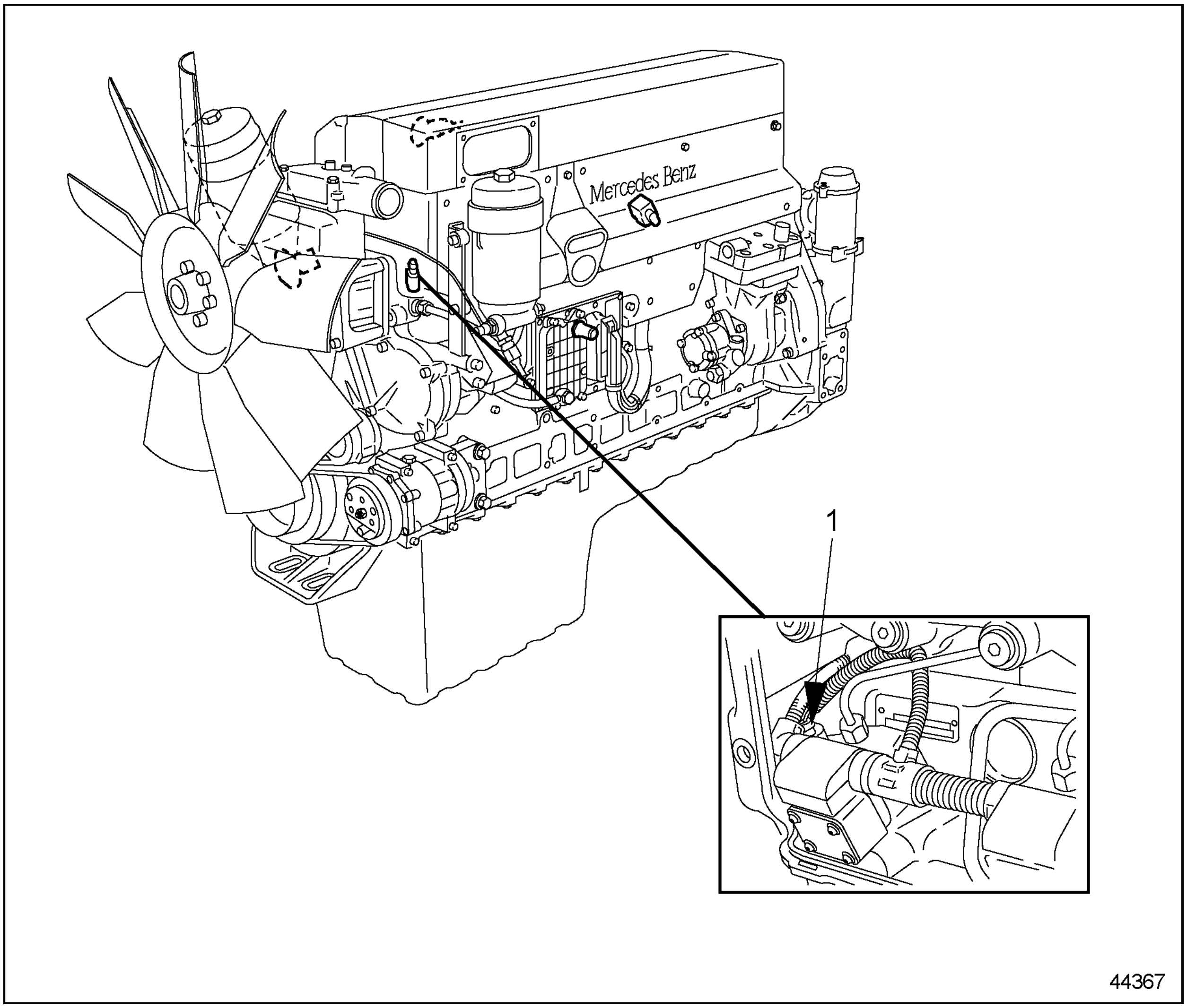
PID 174 indicates the PLD-MR unit has detected that the fuel temperature is outside the normal operating range.

The diagnostic condition is typically:

- ☐ Supply Fuel Temperature (SFT) Sensor Open Circuit (174 03)
- ☐ SFT Sensor Short to Ground (174 04)

15.2 TROUBLESHOOTING PID 174

The following will troubleshoot PID 174. See Figure 15-1 for SFT sensor location.



1. SFT Sensor

Figure 15-1 Location of Supply Fuel Temperature Sensor

15.2.1 174 03 – Supply Fuel Temperature Sensor Open Circuit

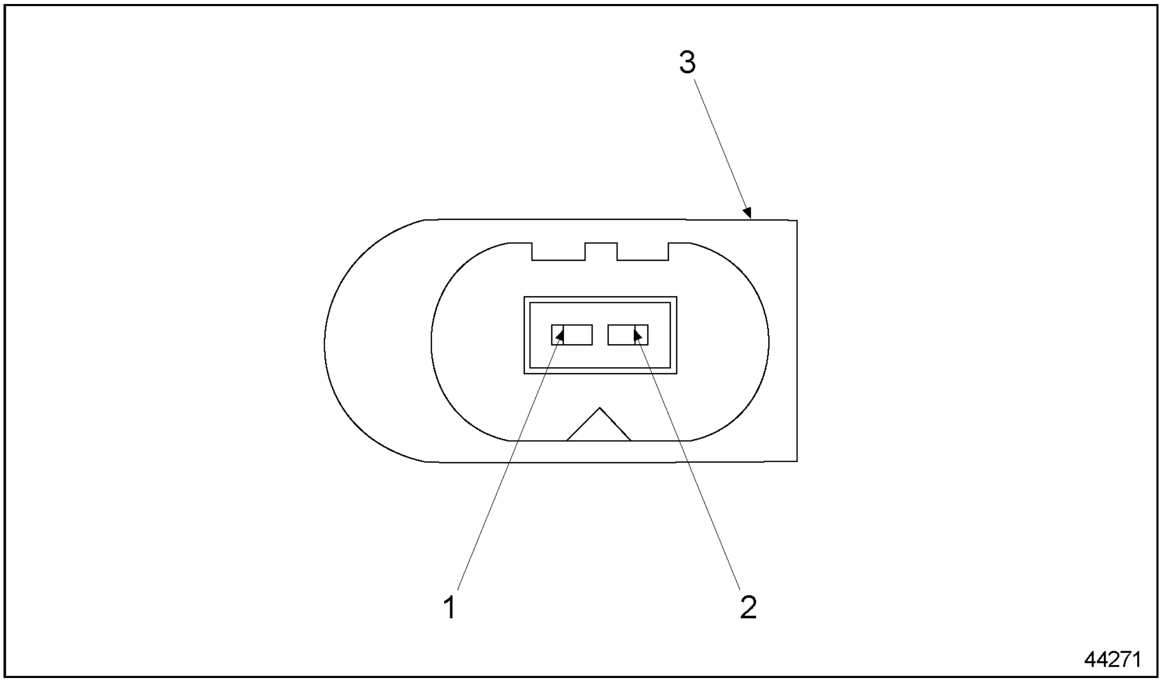
Perform the following steps to troubleshoot an SFT sensor open circuit fault:

1. If faults 174 03 and 175 03 are active at the same time, refer to section 16.2.1.
2. If faults 174 03 and 175 03 are not active at the same time, go to step 3.
3. Bridge pins 1 and 2 of the SFT sensor.

[a] If fault 174 04 is the only active fault after bridging pins, replace SFT sensor. Erase fault code memory.

[b] If fault 174 04 is not the only active fault after bridging pins, go to step 4.

4. Bridge pin 1 of the SFT sensor connector to ground. See Figure 15-2.



1. Pin 1
2. Pin 2
3. SFT Sensor Connector

Figure 15-2 Supply Fuel Temperature Sensor Connector

[a] If fault 174 04 is not active after bridging pin 1 to ground, refer to section 15.2.1.1.

[b] If fault 174 04 is active after bridging pin 1 to ground, go to step 5.

5. Measure the resistance in 55-pin connector wire 4 to pin 2 of the SFT sensor connector. See Figure 15-3.

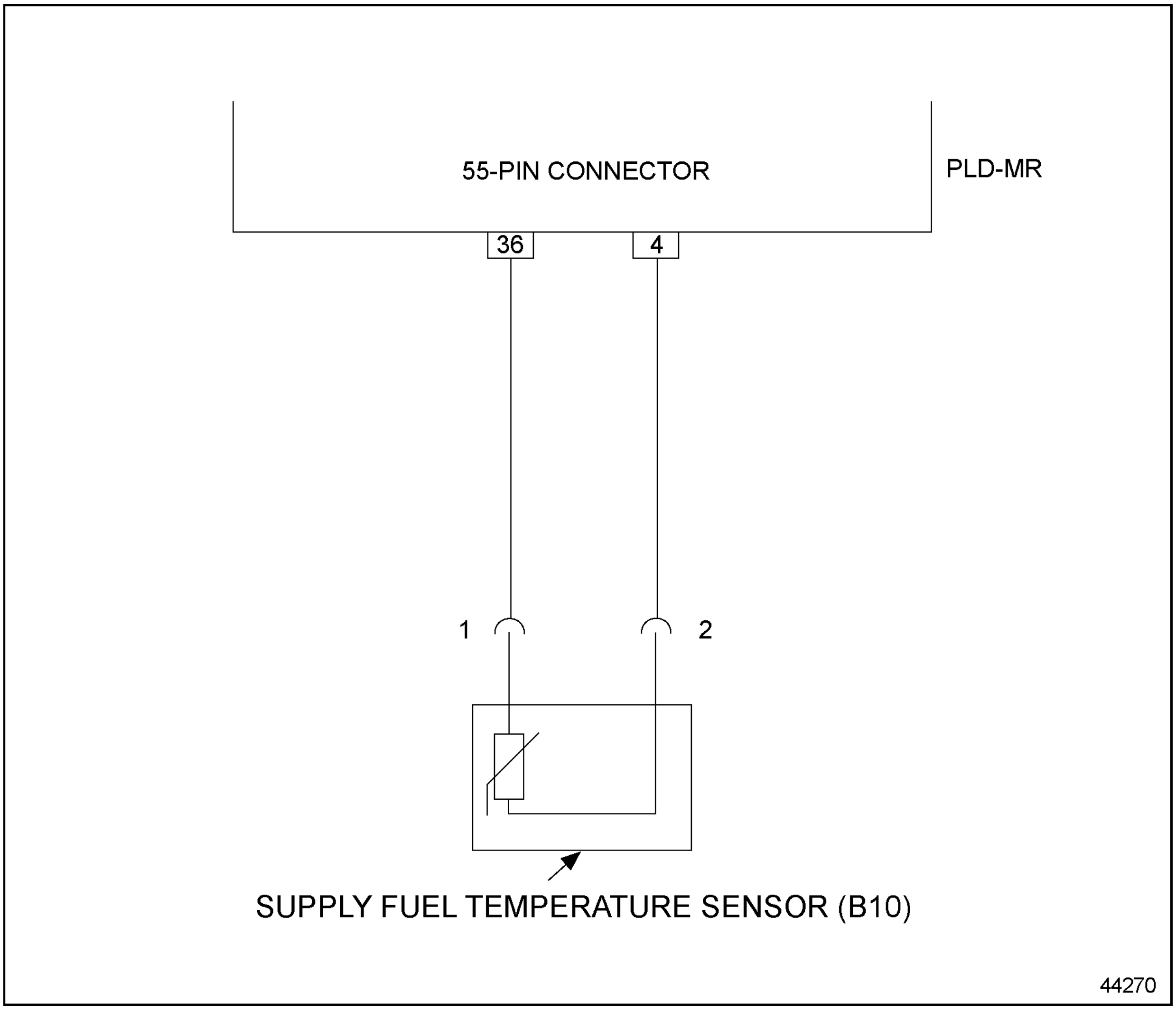


Figure 15-3 Supply Fuel Temperature Sensor Pins and 55-Pin Connector Wires

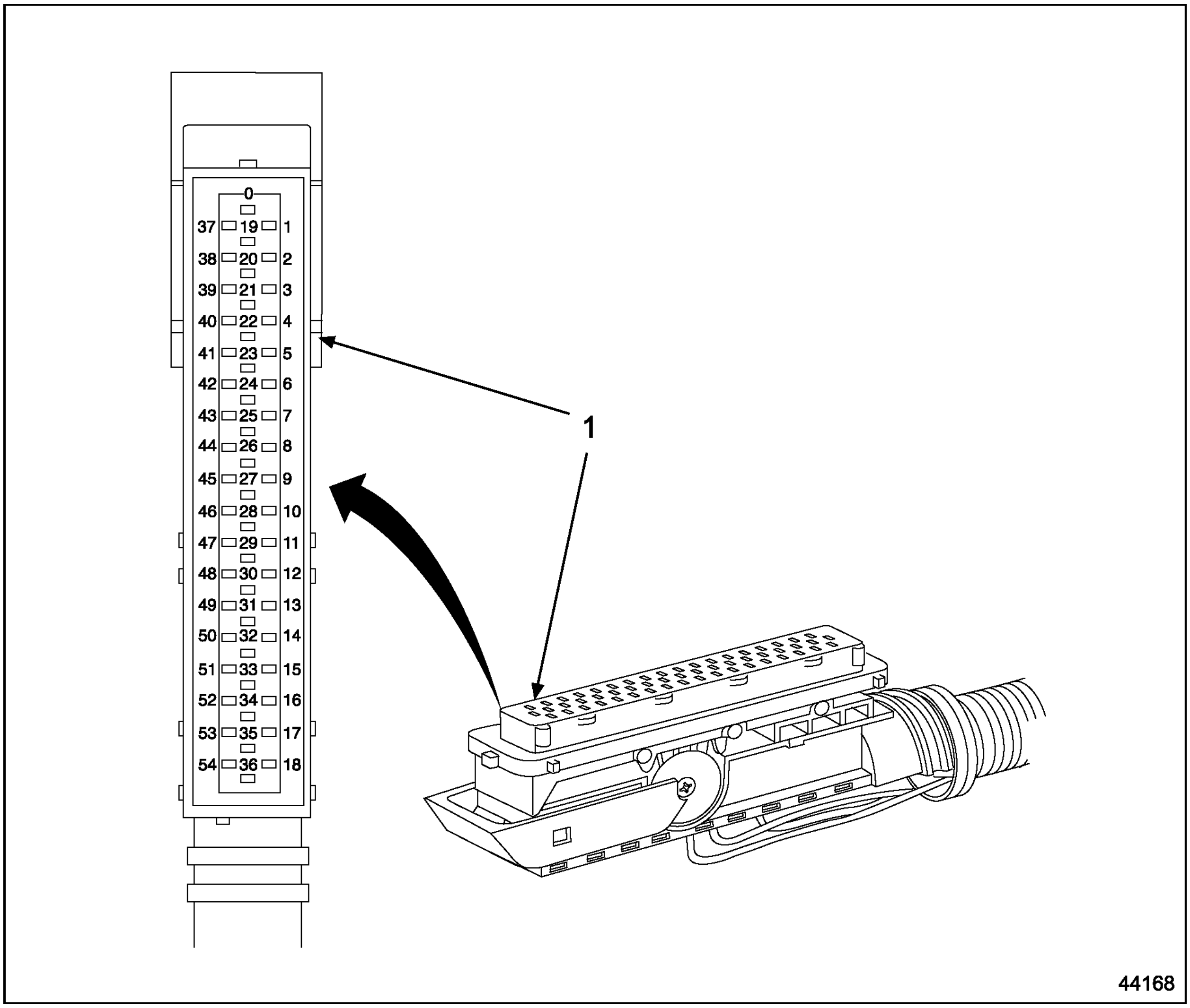
[a] If resistance is less than 3 Ω, refer to section 15.2.1.2.

[b] If resistance is more than 3 Ω, refer to section 15.2.1.3.

15.2.1.1 Required Action

Perform the following steps to resolve an SFT sensor open circuit fault:

1. Repair or replace open circuit in wire between pin 36 of the 55-pin connector and pin 1 of the SFT sensor. See Figure 15-4.



1. 55-Pin Harness Connector

Figure 15-4 55-Pin Engine Wiring Harness Connector

2. Erase fault code memory.

15.2.1.2 Required Action

Perform the following steps to resolve an SFT sensor open circuit fault:

1. Check all contacts and connections.
2. Contact Detroit Diesel Technical Service for authorization to replace the PLD-MR. Set parameters on new PLD-MR.
3. Erase fault code memory.

15.2.1.3 Required Action

Perform the following steps to resolve an SFT sensor open circuit fault:

1. Repair open circuit in 55-pin connector wire 4 to pin 2 of the SFT sensor connector. See Figure 15-3.
2. Erase fault code memory.

15.2.2 174 04 – Supply Fuel Temperature Sensor Short to Ground

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

1. Unplug the SFT sensor connector.
   [a] If new fault 174 03 is active after the connector is unplugged, refer to section 15.2.2.1.
   [b] If new fault 174 03 is not active after the connector is unplugged, go to step 2.
2. Check the resistance between pin 1 of the SFT sensor and ground.
   [a] If resistance is less than 30 Ω, refer to section 15.2.2.2.
   [b] If resistance is greater than 30 Ω, refer to section 15.2.2.3.

15.2.2.1 Required Action

Perform the following steps to resolve an SFT sensor short-to-ground fault.

1. Remove and replace SFT sensor.
2. Erase fault code memory.

15.2.2.2 Required Action

Perform the following steps to resolve an SFT sensor short-to-ground fault.

1. Repair short to ground in 55-pin connector wire 36 to pin 1 of the SFT sensor connector.
2. Erase fault code memory.

15.2.2.3 Required Action

Perform the following steps to resolve an SFT sensor short-to-ground fault.

1. Clean and check the SFT sensor contacts.
2. If fault 174 03 is active after cleaning and checking the contacts, perform the following steps:
   [a] Contact Detroit Diesel Technical Service for authorization to replace the PLD-MR. Set parameters on new PLD-MR.
   [b] Erase fault code memory.

16 PID 175

Section **Page**

16.1 DESCRIPTION OF PID 175 – ENGINE OIL TEMPERATURE OUTSIDE OF NORMAL OPERATING RANGE

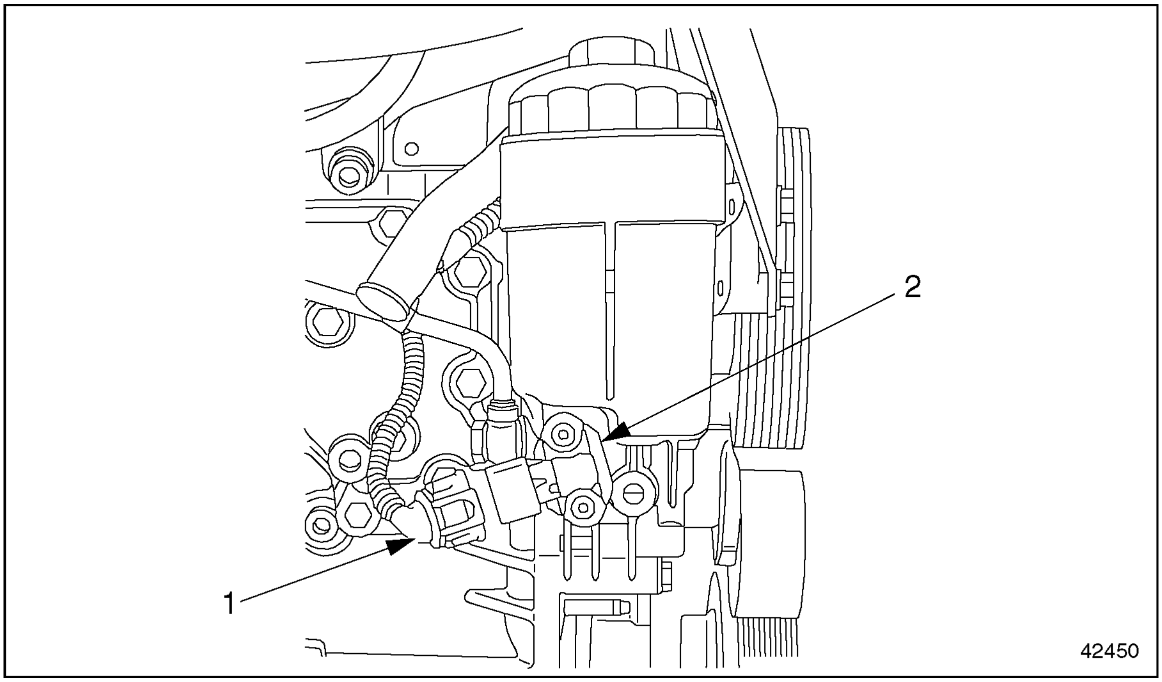
PID 175 indicates that the PLD-MR control unit has detected engine oil temperature outside the normal operating range.

The diagnostic condition is typically:

- ☐ Engine Oil Temperature Open Circuit (175 03)
- ☐ Engine Oil Temperature Short to Ground (175 04)

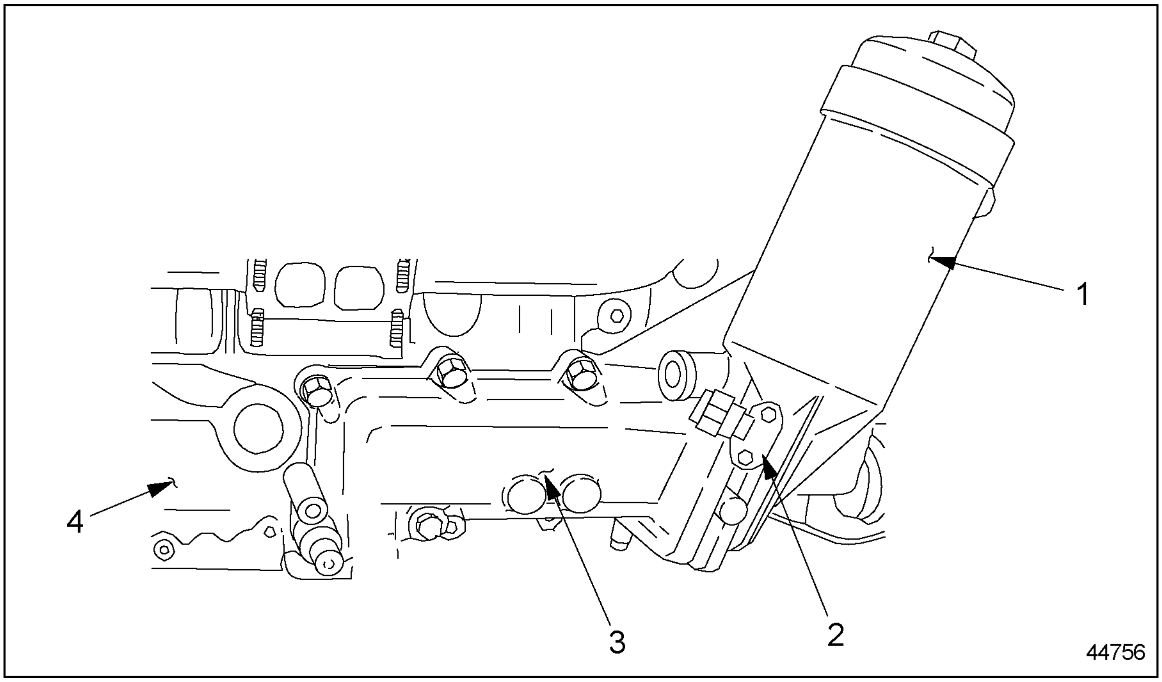
16.2 TROUBLESHOOTING PID 175

The engine oil combination sensor monitors engine oil temperature and engine oil pressure. The sensor is installed in the front of the base of the oil filter for the MBE 900 engines (see Figure 16-1) and at the front of the heat exchanger housing for the MBE 4000 engines (see Figure 16-2). The following procedure will troubleshoot PID 175.



1. Wiring Connector
2. Oil Combination Sensor

Figure 16-1 Location of Engine Oil Combination Sensor on the MBE 900 Engine



1. Oil Filter Housing
2. Oil Combination Sensor
3. Heat Exchanger Housing
4. Cylinder Block

Figure 16-2 Location of Engine Oil Combination Sensor on the MBE 4000 Engine

16.2.1 175 03 – Engine Oil Temperature Open Circuit

Perform the following steps to troubleshoot an engine oil temperature open circuit fault:

1. If fault 100 03 is active in addition to fault 175 03 with oil combination sensor connected, resolve as follows:

[a] Repair open circuit in wire between pin 15 of 55-pin connector and pin 1 of the oil combination sensor. See Figure 16-3.

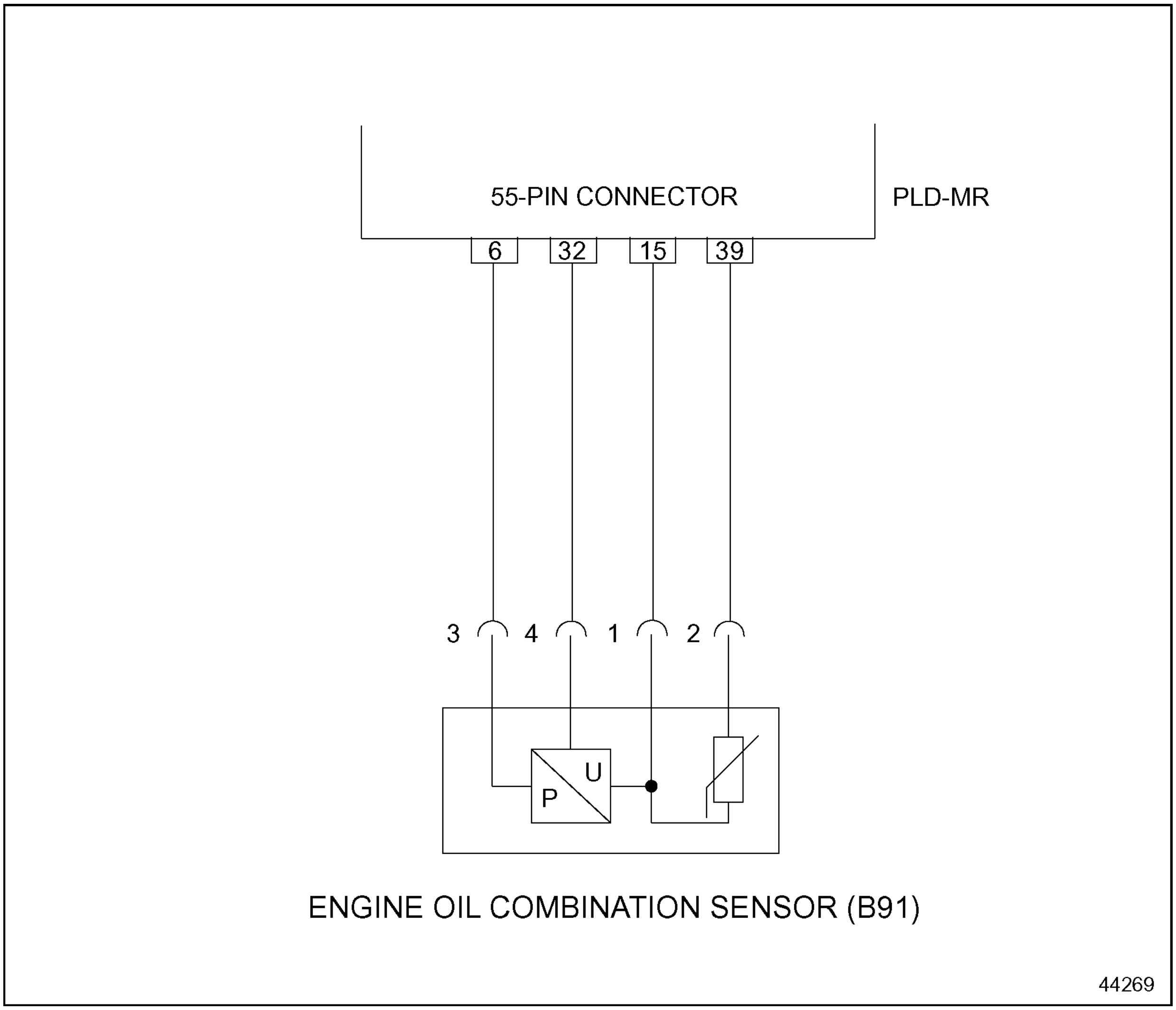


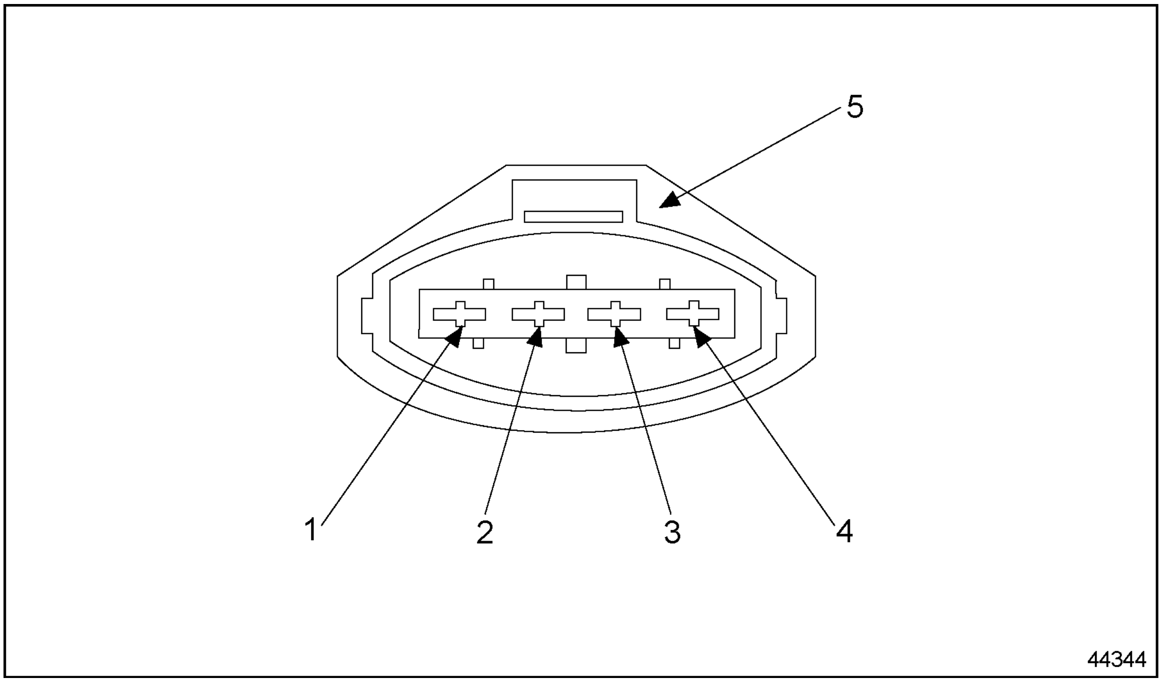
Figure 16-3 Engine Oil Combination Sensor Wiring Harness Connections

[b] Erase fault code memory.

2. If fault 174 03 is active in addition to fault 175 03 with oil combination sensor connected, go to step 4.
3. If only fault 175 03 is active with oil combination sensor connected, go to step 5.
4. Measure the voltage at pin 2 of the oil combination sensor connector. See Figure 16-4.
   [a] If the voltage is above 10 volts, refer to section 16.2.1.2.
   [b] If the voltage is below 10 volts, go to step 6.
5. Bridge pins 1 and 2 of the oil combination sensor connector.
   [a] If new fault 175 04 is active after bridging pins, go to step 7.

[b] If new fault 175 04 is not active after bridging pins, refer to section 16.2.1.3.

6. Measure the voltage at pin 1 of the oil combination sensor connector.
   [a] If the voltage is below 4.5 volts, inspect all plug connectors and repair or replace, as required. Erase fault code memory.
   [b] If the voltage is above 4.5 volts, refer to section 16.2.1.4.
7. Bridge pins 1 and 2 of the oil combination sensor connector.
   [a] If new fault 100 04 is not active after bridging pins, refer to section 16.2.1.1.
   [b] If new fault 100 04 is active after bridging pins, refer to section 16.2.1.2.



1. Pin 1
2. Pin 2
3. Pin 3
4. Pin 4
5. Oil Combination Sensor Connector

Figure 16-4 Location of Pins on Engine Oil Combination Sensor

16.2.1.1 Required Action

Perform the following steps to resolve an engine oil temperature open circuit fault:

1. Replace oil combination sensor.
2. Erase fault code memory.

16.2.1.2 Required Action

Perform the following steps to resolve an engine oil temperature open circuit fault:

1. Repair short to power in wire between pin 39 of the 55-pin connector and pin 2 of the oil combination sensor connector.
2. Erase fault code memory.

16.2.1.3 Required Action

Perform the following steps to resolve an engine oil temperature open circuit fault:

1. Repair open circuit in wire between pin 39 of the 55-pin connector and pin 2 of the oil combination sensor.
2. Erase fault code memory.

16.2.1.4 Required Action

Perform the following steps to resolve an engine oil temperature open circuit fault:

1. Repair short to power in wire between pin 36 of the 55-pin connector and pin 1 of the oil combination sensor connector.
2. Erase fault code memory.

16.2.2 175 04 – Engine Oil Temperature Short to Ground

Perform the following steps to troubleshoot an engine oil temperature short to ground fault:

1. Unplug the engine oil combination sensor.
   - [a] If new fault 175 03 is not active after unplugging sensor, go to step 2.
   - [b] If new fault 175 03 is active after unplugging sensor, replace oil combination sensor. Erase fault code memory.
2. Measure the resistance between pin 2 on the engine oil combination sensor and ground.
   - [a] If resistance is less than 30 kΩ, repair short to ground in 55-pin connector wire 39 to pin 2 on sensor connector. Erase fault code memory.
   - □ If resistance is more than 30 kΩ, go to step 3.
3. Clean and check contacts.
   - [a] If fault 175 04 is still active after cleaning and checking contacts, contact Detroit Diesel Technical Service for authorization to replace the PLD-MR. Set parameters on new PLD-MR.
   - [b] If fault 175 04 is not active after cleaning and checking the contacts, erase fault code memory.

17 PID 190

Section Page

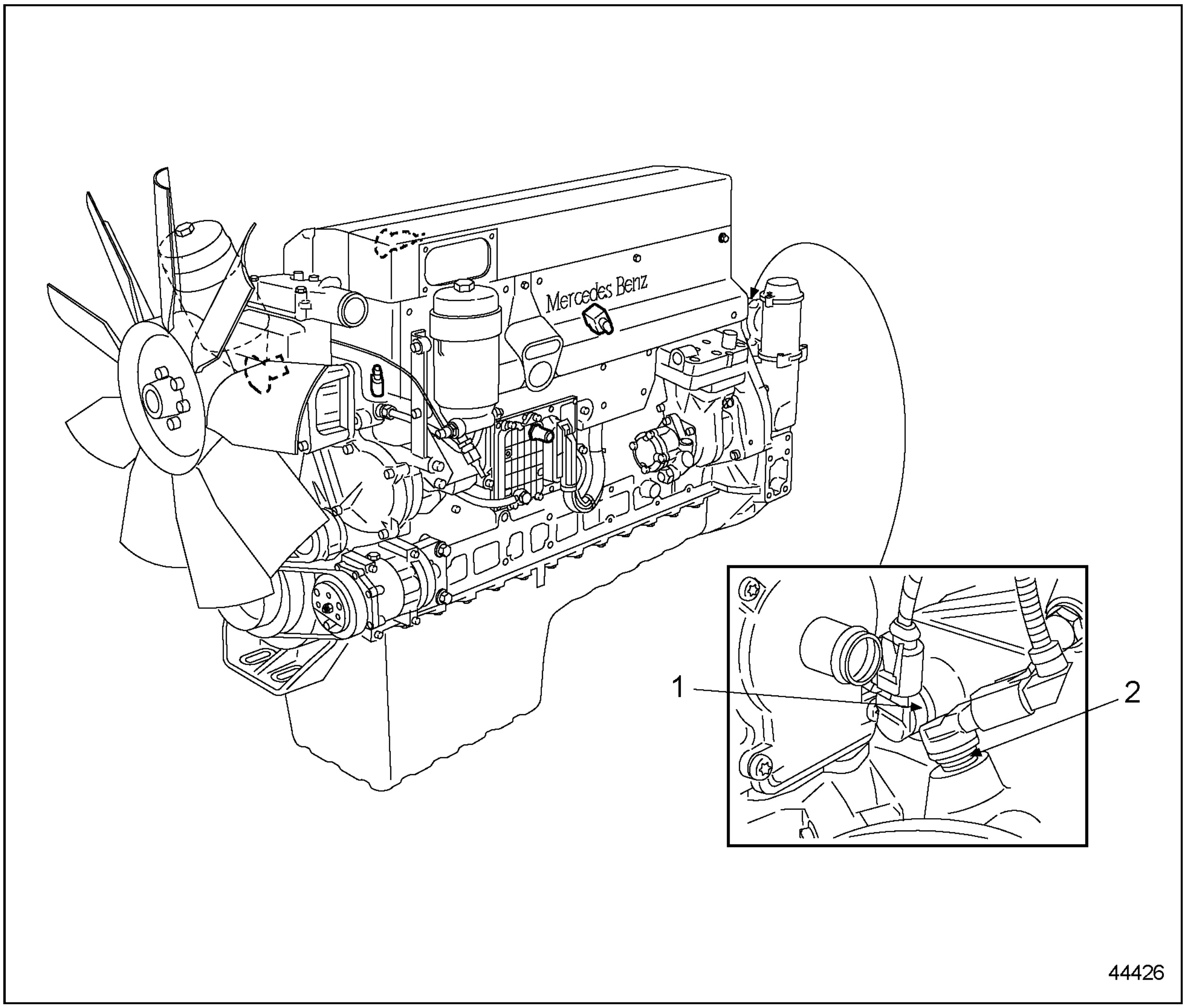
17.1 DESCRIPTION OF PID 190 – ENGINE SPEED OUTSIDE NORMAL OPERATING RANGE

PID 190 indicates the PLD-MR control unit has detected engine operating outside of the normal range.

The diagnostic condition is typically:

- ☐ Engine Speed High (190 00)

A Crankshaft Position sensor (variable reluctance magnetic pickup) is used to monitor engine speed along with crankshaft position. A camshaft position sensor is used to monitor engine speed and camshaft position for functions such as fuel control strategy. See Figure 17-1.



1. Camshaft Position Sensor (magnetic pickup)
2. Crankshaft Position Sensor (magnetic pickup)

Figure 17-1 Location of Camshaft Position Sensor and Crankshaft Position Sensor

17.2 TROUBLESHOOTING PID 190

The following procedures will troubleshoot PID 190.

17.2.1 190 00 – Engine Speed High Fault

Perform the following steps to troubleshoot an engine speed high fault:

1. Reset the PLD-MR and DDEC-VCU.
   [a] If fault code 190 00 is not active after resetting the PLD-MR and DDEC-VCU, erase fault code memory.
   [b] If fault code 190 00 is still active after resetting the PLD-MR and DDEC-VCU, go to step 2.
2. Check for additional active fault codes.
   [a] If additional fault codes are active, refer to the active faults.

NOTE:
If this fault code is a historic code, engine overspeed is suspect.

   [b] If only fault code 190 00 is active, contact Detroit Diesel Technical Service.

18 SIDS 1–6

Section **Page**

18.1 DESCRIPTION OF SIDS 1–6 INJECTOR UNIT PUMP NOT OPERATING IN A NORMAL MANNER

SIDS 1–6 indicate that an injector unit pump, cylinders 1 through 6, is not operating in a normal manner.

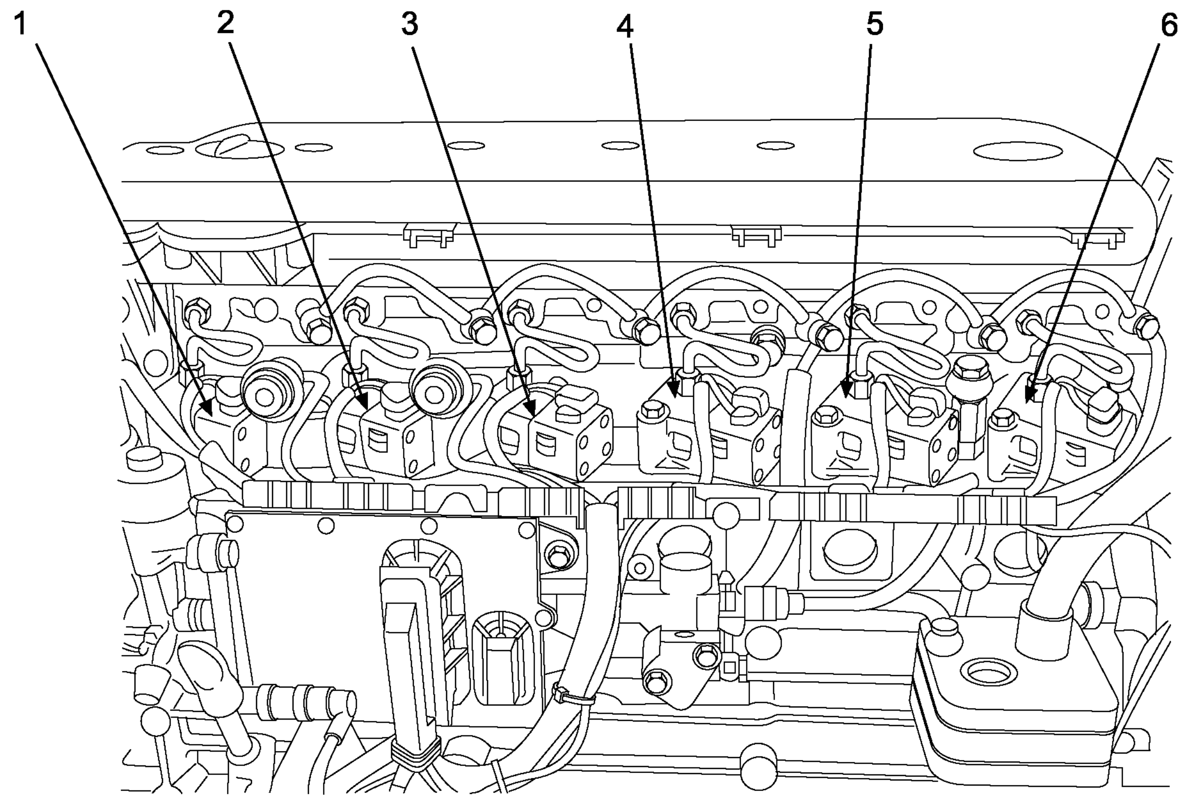
The diagnostic condition is typically:

- ☐ Current Below Normal or Open Circuit (001/6–05)
- ☐ Short Circuit (001/6–06)
- ☐ No Plunger (001/6–07)
- ☐ Idle Smoothness Governor at Limit (001/6 12)
- ☐ Single Cylinder Correction at Limit (001/6 14)

18.2 TROUBLESHOOTING SIDS 1–6

Refer to the following illustrations when troubleshooting SIDs 1–6.

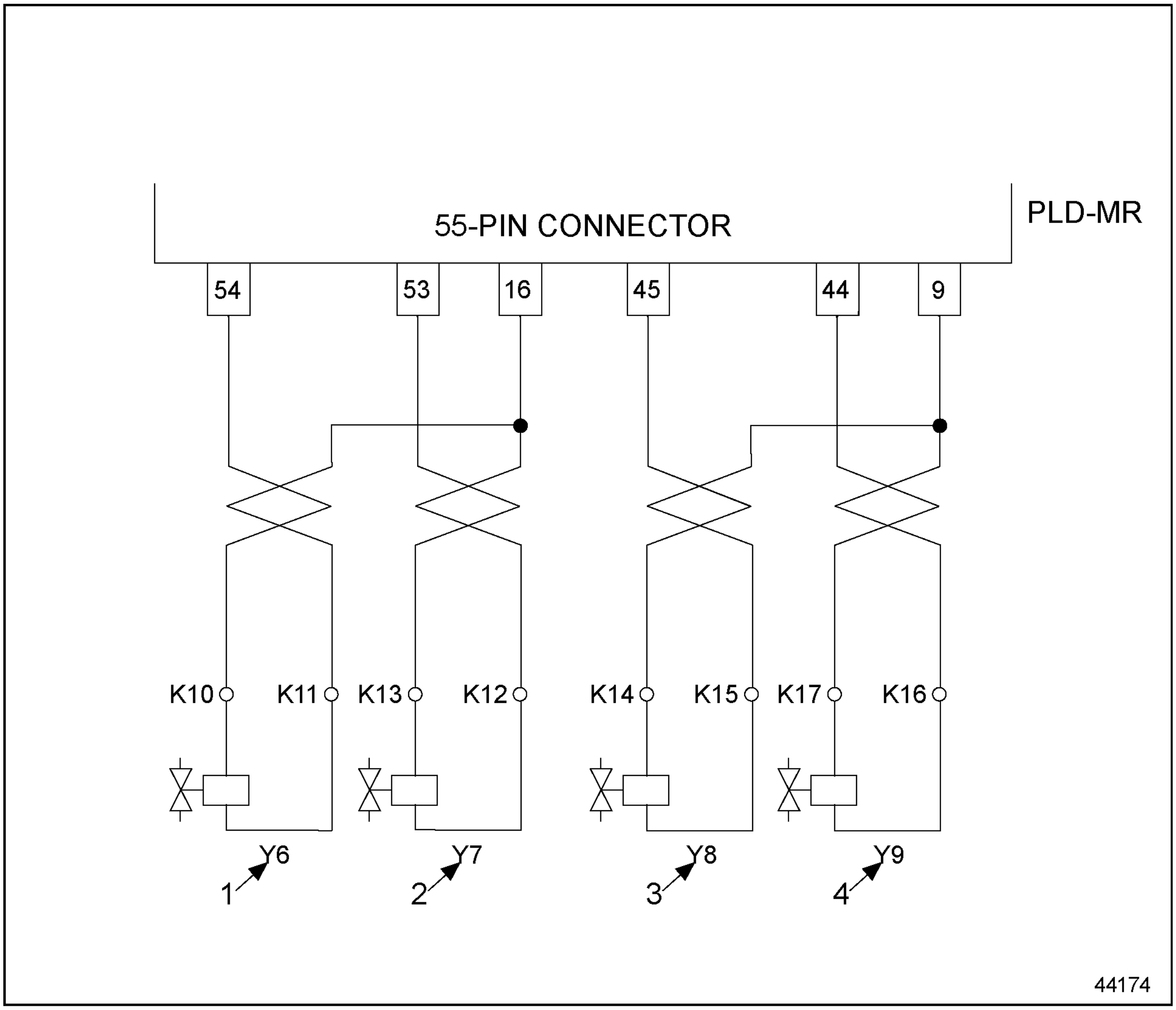
See Figure 18-1 for injector unit pump locations on the 6-cylinder engine.



1. Unit Pump No. 1
2. Unit Pump No. 2
3. Unit Pump No. 3
4. Unit Pump No. 4
5. Unit Pump No. 5
6. Unit Pump No. 6

Figure 18-1 Injector Unit Pump Wiring on 6-Cylinder Engine

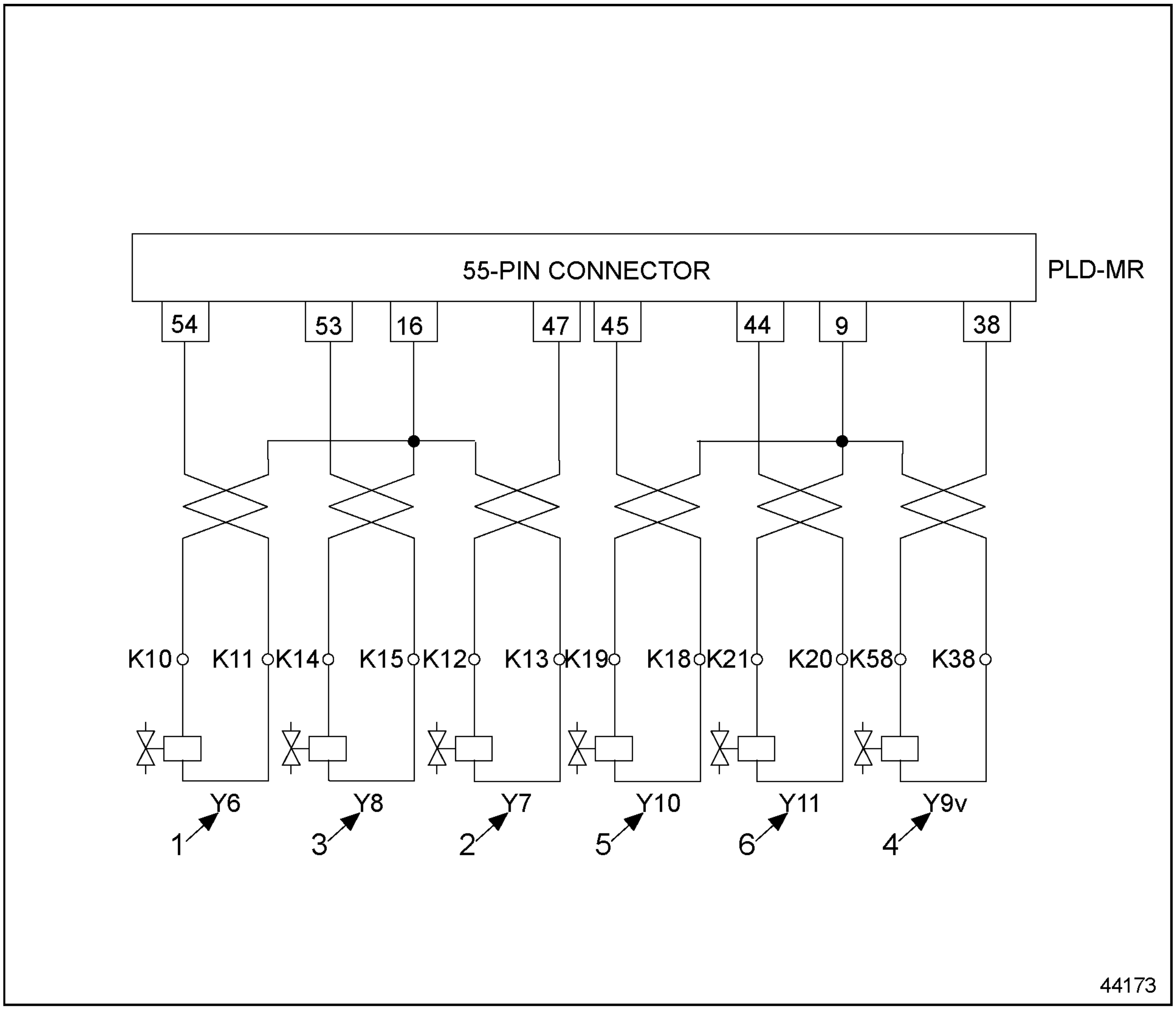
See Figure 18-2 for the injector unit pump wiring on the 4-cylinder engine.



1. Unit Pump No. 1
2. Unit Pump No. 2
3. Unit Pump No. 3
4. Unit Pump No. 4

Figure 18-2 Injector Unit Pump Wiring on 4-Cylinder Engine

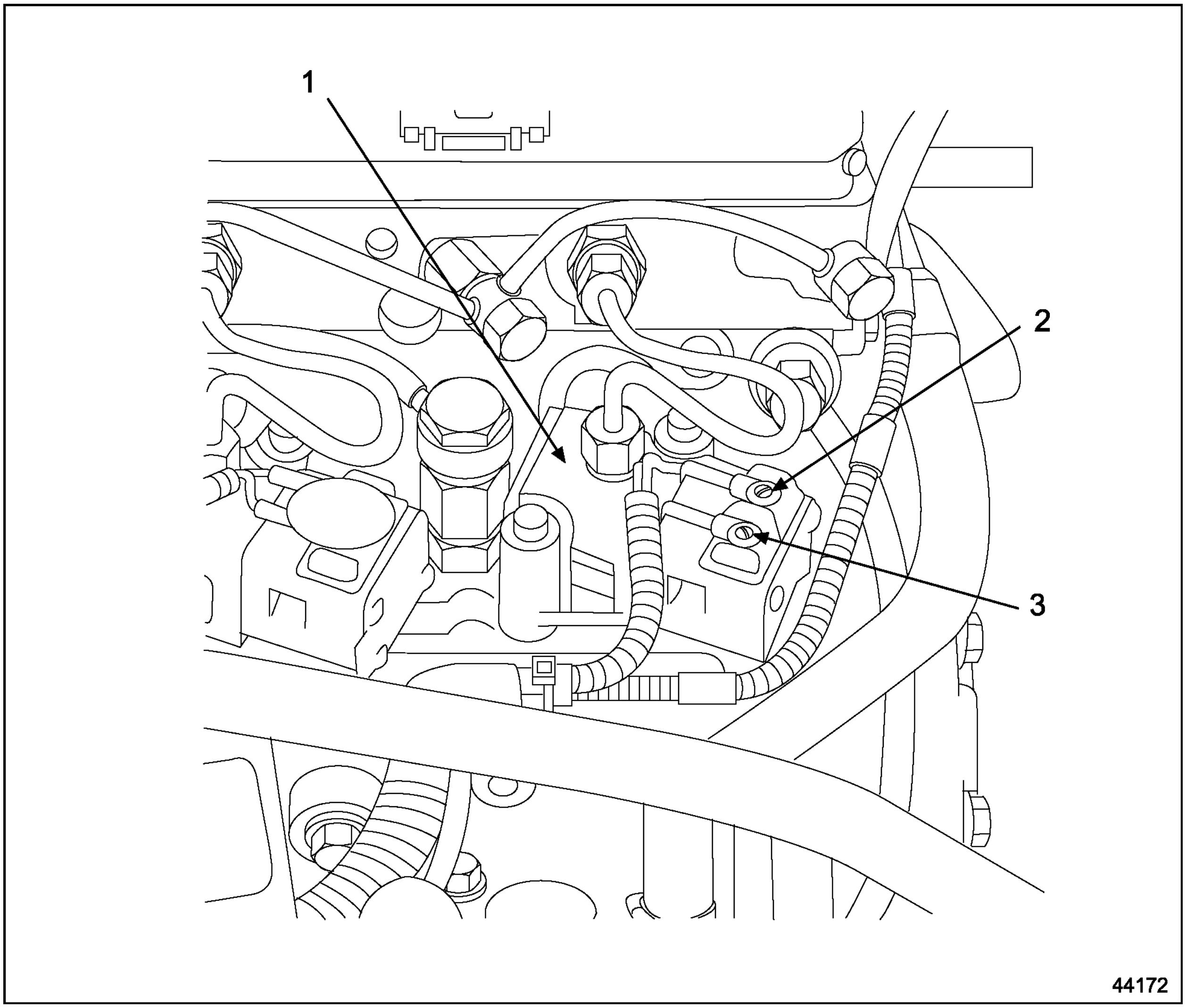
See Figure 18-3 for the injector unit pump wiring on the 6-cylinder engine.



1. Unit Pump No. 1
2. Unit Pump No. 2
3. Unit Pump No. 3
4. Unit Pump No. 4
5. Unit Pump No. 5
6. Unit Pump No. 6

Figure 18-3 Injector Unit Pump Wiring on 6-Cylinder Engine

See Figure 18-4 for the injector unit pump wiring on the 4-cylinder engine.



1. Unit Pump
2. Terminal
3. Terminal

Figure 18-4 Terminal Locations on Injector Unit Pump

Troubleshoot SIDs 1–6 as follows:

18.2.1 001 05 – Current Below Normal or Open Circuit

To troubleshoot a current below normal or open circuit fault, perform the following steps with unit pump connected and engine running:

1. Check fault code display:
   [a] If fault code 168 04 is active in addition to code 001 05, refer to section 14.2.1.
   [b] If following fault codes are active in addition to code 001 05, refer to section 18.2.1.1:

- □ *6-Cylinder Engine* – 002 05 and 003 05.
- □ *4-Cylinder Engine* – 002 05.

[c] If following fault codes are active in addition to code 001 05, refer to section 14.2.1:

- □ *6-Cylinder Engine* – 168 04 and 003 05.
- □ *4-Cylinder Engine* – 168 04 and 002 05.

[d] If only fault code 001 05 is active with no additional fault codes, go to step 2.

2. Bridge terminals K10 and K11 of unit pump 1.

[a] If new fault 001 06 is not active when bridging terminals, repair open circuit in 55-pin connector wire 54 attached to terminal K10 of unit pump 1. Erase fault code memory.See Figure 18-3.

[b] If new fault 001 06 is active when bridging terminals, go to step 3.

3. Swap the unit pump.

[a] If fault code 001 05 is not active after swapping pump, replace the original unit pump. Erase fault code memory.

[b] If fault code 001 05 is still active after swapping pump, go to step 4.

4. Clean and check contacts.

[a] If fault code 001 05 is not active after cleaning and checking contacts, erase fault code memory.

[b] If fault code 001 05 is still active after cleaning and checking contacts, contact Detroit Diesel Technical Service for authorization to replace the PLD-MR. Set parameters on new PLD-MR.

18.2.1.1 Required Action

Perform the following steps to resolve a current below normal or open circuit fault. See Figure 18-3.

1. Repair open circuit in the following 55-pin connector wire:
   - □ *6-Cylinder Engine* – Wire 16 attached to terminal K11 of unit pump 1 or terminal K15 of unit pump 3 or terminal K12 of unit pump 2.
   - □ *4-Cylinder Engine* – Wire 16 attached to terminal K11 of unit pump 1 or terminal K12 of unit pump 2.

2. Erase fault code memory.

18.2.2 002 05 – Current Below Normal or Open Circuit

To troubleshoot a current below normal or open circuit fault, perform the following steps with unit pump connected and engine running:

1. Check fault code display:

[a] If fault code 168 04 is active in addition to code 002 05, refer to section 14.2.1.

[b] If following fault codes are active in addition to 002 05, refer to section 14.2.1.

- ☐ *6-Cylinder Engine* – 168 04 and 001 05 and 003 05.
- ☐ *4-Cylinder Engine* – 168 04 and 001 05.

[c] If following fault codes are active in addition to 002 05, refer to section 18.2.2.1:

- ☐ *6-Cylinder Engine* – 001 05 and 003 05.
- ☐ *4-Cylinder Engine* – 001 05.

[d] If only fault code 002 05 is active with no additional fault codes, go to step 2.

2. Bridge the following unit pump terminals:
   - ☐ *6-Cylinder Engine* – K12 and K13 on injector unit pump 2.
   - ☐ *4-Cylinder Engine* – K12 and K13 on unit pump 2.

   [a] If new fault 002 06 is not active on 6-cylinder engines or if new fault 001 06 is not active on 4-cylinder engines while bridging terminals, refer to section 18.2.2.2.

   [b] If new fault 002 06 is active on 6-cylinder engines or if new fault code 001 06 is active on 4-cylinder engines while bridging terminals, go to step 3.

3. Swap unit pump.

   [a] If fault 002 05 is not active after swapping pump, replace original cylinder unit pump. Erase fault code memory.

   [b] If fault 002 05 is still active after swapping pump, go to step 4.

4. Clean and check contacts.

   [a] If fault code 002 05 is not active after cleaning and checking contacts, erase fault code memory.

   [b] If fault code 002 05 is still active after cleaning and checking contacts, contact Detroit Diesel Technical Service for authorization to replace the PLD-MR. Set parameters on new PLD-MR.

18.2.2.1 Required Action

Perform the following steps to resolve a current below normal or open circuit fault:

1. Repair open circuit in 55-pin connector wire:
   - ☐ *6-Cylinder Engine* – Wire 16 attached to terminal K11 of injector unit pump 1 or terminal K12 of unit pump 2 or terminal K15 of unit pump 3.
   - ☐ *4-Cylinder Engine* – Wire 16 attached to terminal K11 of injector unit pump 1 or terminal K12 of unit pump 2
2. Erase fault code memory.

18.2.2.2 Required Action

Perform the following steps to resolve a current below normal or open circuit fault:

1. Repair open circuit in 55-pin connector wire:

- ☐ *6-Cylinder Engine* – Wire 47 attached to terminal K13 of injector unit pump 3.
- ☐ *4-Cylinder Engine* – Wire 16 attached to terminal K12 of injector unit pump 2.

2. Erase fault code memory.

18.2.3 003 05 – Current Below Normal or Open Circuit

To troubleshoot a current below normal or open circuit fault, perform the following steps with unit pump connected and engine running:

1. Check fault code display:

   [a] If fault code 168 04 is active in addition to code 003 05, refer to section 14.2.1.

   [b] If following fault codes are active in addition to 003 05, refer to section 14.2.1:

   - ☐ *6-Cylinder Engine* – 168 04 and 001 05 and 002 05.
   - ☐ *4-Cylinder Engine* – 168 04 and 004 05.

   [c] If following fault codes are active in addition to 003 05, refer to section 18.2.3.1:

   - ☐ *6-Cylinder Engine* – 001 05 and 004 05.
   - ☐ *4-Cylinder Engine* – 004 05.

   [d] If only fault code 003 05 is active with no additional fault codes, go to step 2.

2. Bridge the following unit pump terminals:
   - ☐ *6-Cylinder Engine* – K14 and K15 on injector unit pump 3.
   - ☐ *4-Cyl Eng.* – K14 and K15 on unit pump 3.

   [a] If new fault 003 06 is not active while bridging terminals, refer to section 18.2.3.2.

   [b] If new fault 003 06 is active while bridging terminals, go to step 3.

3. Swap unit pump.

   [a] If fault 003 05 is not active after swapping pump, replace original cylinder unit pump. Erase fault code memory.

   [b] If fault 003 05 is still active after swapping pump, go to step 4.

4. Clean and check contacts.

   [a] If fault code 003 05 is not active after cleaning and checking contacts, erase fault code memory.

   [b] If fault code 003 05 is still active after cleaning and checking contacts, contact Detroit Diesel Technical Service for authorization to replace the PLD-MR. Set parameters on new PLD-MR.

18.2.3.1 Required Action

Perform the following steps to resolve a current below normal or open circuit fault:

1. Repair open circuit in 55-pin connector wire:
   - ☐ *6-Cyl Eng.*– Wire 16 attached to terminal K11 of injector unit pump 1 or terminal K15 of unit pump 3 or terminal K12 of unit pump 2.

- □ *4-Cyl Eng.*– Wire 9 attached to terminal K15 of injector unit pump 3 or terminal K16 of unit pump 4.

2. Erase fault code memory.

18.2.3.2 Required Action

Perform the following steps to resolve a current below normal or open circuit fault:

1. Repair open circuit in 55-pin connector wire:
   - □ *6-Cylinder Engine*– Wire 53 attached to terminal K14 of injector unit pump 3.
   - □ *4-Cylinder Engine*– Wire 45 attached to terminal K14 of injector unit pump 3.
2. Erase fault code memory.

18.2.4 004 05 – Current Below Normal or Open Circuit

To troubleshoot a current below normal or open circuit fault, perform the following steps with unit pump connected and engine running:

1. Check fault code display.

   [a] If fault code 168 04 is active in addition to code 004 05, refer to section 14.2.1.

   [b] If following fault codes are active in addition to 004 05, refer to section 14.2.1.

   - □ *6-Cylinder Engine* – 168 04 and 005 05 and 006 05.
   - □ *4-Cylinder Engine* – 168 04 and 003 05.

   [c] If following fault codes are active in addition to 004 05, refer to section 18.2.4.1:

   - □ *6-Cylinder Engine* – 005 05 and 006 05.
   - □ *4-Cylinder Engine* – 003 05.

   [d] If only fault code 004 05 is active with no additional fault codes, go to step 2.

2. Bridge the following unit pump terminals:
   - □ *6-Cylinder Engine* – K38 and K58 on injector unit pump 4.
   - □ *4-Cyl Eng.* – K16 and K17 on injector unit pump 4.

   [a] If new fault 004 06 is not active while bridging terminals, refer to section 18.2.4.2.

   [b] If new fault 004 06 is active while bridging terminals, go to step 3.

3. Swap unit pump.

   [a] If fault 004 05 is not active after swapping pump, replace original cylinder unit pump. Erase fault code memory.

   [b] If fault 004 05 is still active after swapping pump, go to step 4.

4. Clean and check contacts.

   [a] If fault code 004 05 is not active after cleaning and checking contacts, erase fault code memory.

[b] If fault code 004 05 is still active after cleaning and checking contacts, contact Detroit Diesel Technical Service for authorization to replace the PLD-MR. Set parameters on new PLD-MR.

18.2.4.1 Required Action

Perform the following steps to resolve a current below normal or open circuit fault:

1. Repair open circuit in the following 55-pin connector wire:
   - □ *6-Cylinder Engine*– Wire 9 attached to terminal K58 of injector unit pump 4 or terminal K18 of unit pump 5 or terminal K20 of unit pump 6.
   - □ *4-Cylinder Engine*– Wire 9 attached to terminal K15 of injector unit pump 3 or terminal K16 of unit pump 4
2. Erase fault code memory.

18.2.4.2 Required Action

Perform the following steps to resolve a current below normal or open circuit fault:

1. Repair open circuit in the following 55-pin connector wire:
   - □ *6-Cylinder Engine*– Wire 38 attached to terminal K38 of injector unit pump 4.
   - □ *4-Cylinder Engine*– Wire 44 attached to terminal K17 of injector unit pump 4.
2. Erase fault code memory.

18.2.5 005 05 – Current Below Normal or Open Circuit

To troubleshoot a current below normal or open circuit fault, perform the following steps with unit pump connected and engine running:

1. Check fault code display:
   - [a] If fault code 168 04 is active in addition to code 005 05, refer to section 14.2.1.
   - [b] If fault codes 168 04 and 004 05 and 006 05 are active in addition to 005 05, refer to section 14.2.1.
   - [c] If fault codes 004 05 and 006 05 are active in addition to 005 05, refer to section 18.2.5.1.
   - [d] If only fault code 005 05 is active with no additional fault codes, go to step 2.
2. Bridge terminals K18 and K19 on injector unit pump 5.
   - [a] If new fault 005 06 is not active while bridging terminals, refer to section 18.2.5.2.
   - [b] If new fault 005 06 is active while bridging terminals, go to step 3.
3. Swap unit pump.
   - [a] If fault 005 05 is not active after swapping pump, replace original cylinder unit pump. Erase fault code memory.
   - [b] If fault 005 05 is still active after swapping pump, go to step 4.

4. Clean and check contacts.
   [a] If fault code 005 05 is not active after cleaning and checking contacts, erase fault code memory.
   [b] If fault code 005 05 is still active after cleaning and checking contacts, contact Detroit Diesel Technical Service for authorization to replace the PLD-MR. Set parameters on new PLD-MR.

18.2.5.1 Required Action

Perform the following steps to resolve a current below normal or open circuit fault:

1. Repair intermittent open circuit in 55-pin connector wire 9 attached to terminal K58 of injector unit pump 4 or terminal K18 of unit pump 5 or terminal K20 of unit pump 6.
2. Erase fault code memory.

18.2.5.2 Required Action

Perform the following steps to resolve a current below normal or open circuit fault:

1. Repair open circuit in 55-pin connector wire 45 attached to terminal K19 of injector unit pump 5.
2. Erase fault code memory.

18.2.6 006 05 – Current Below Normal or Open Circuit

To troubleshoot a current below normal or open circuit fault, perform the following steps with unit pump connected and engine running:

1. Check fault code display.
   [a] If fault code 168 04 is active in addition to code 006 05, refer to section 14.2.1.
   [b] If fault codes 168 04 and 004 05 and 005 05 are active in addition to 006 05, refer to section 14.2.1.
   [c] If fault codes 004 05 and 005 05 are active in addition to 006 05, refer to section 18.2.6.1.
   [d] If only fault code 006 05 is active with no additional fault codes, go to step 2.
2. Bridge terminals K20 and K21 on injector unit pump 6.
   [a] If new fault 006 06 is not active while bridging terminals, refer to section 18.2.6.2.
   [b] If new fault 006 06 is active while bridging terminals, go to step 3.
3. Swap unit pump.
   [a] If fault 006 05 is not active after swapping pump, replace original cylinder unit pump. Erase fault code memory.
   [b] If fault 006 05 is still active after swapping pump, go to step 4.

4. Clean and check contacts.
   [a] If fault code 006 05 is not active after cleaning and checking contacts, erase fault code memory.
   [b] If fault code 006 05 is still active after cleaning and checking contacts, contact Detroit Diesel Technical Service for authorization to replace the PLD-MR. Set parameters on new PLD-MR.

18.2.6.1 Required Action

Perform the following steps to resolve a current below normal or open circuit fault:

1. Repair intermittent open circuit in 55-pin connector wire 9 attached to terminal K58 of injector unit pump 4 or terminal K18 of unit pump 5 or terminal K20 of unit pump 6.
2. Erase fault code memory.

18.2.6.2 Required Action

Perform the following steps to resolve a current below normal or open circuit fault:

1. Repair open circuit in 55-pin connector wire 9 attached to terminal K20 of injector unit pump 6.
2. Erase fault code memory.

18.2.7 001 06 Through 006 06 – Short Circuit

To troubleshoot an injector unit pump short circuit fault, perform the following steps with unit pump connected and engine running:

1. Check fault code display.
   [a] If fault code 001 06, 002 06, 003 06, 004 06, 005 06 or 006 06 is active while the engine is running, go to step 2.
   [b] If fault code 001 06, 002 06, 003 06, 004 06, 005 06 or 006 06 is active after disconnecting pump, refer to section 18.2.7.1.
2. Measure the resistance between ground and the wire sides of injector unit pumps 1, 2, 3, 4, 5 or 6.
   [a] If resistance is less than 30 kΩ on any wire, refer to section 18.2.7.1.
   [b] If resistance is more than 30 kΩ, go to step 3.
3. Swap the unit pump.
   [a] If fault code 001 06, 002 06, 003 06, 004 06, 005 06 or 006 06 is not active after swapping pump, replace original cylinder unit pump. Erase fault code memory.
   [b] If fault code 001 06, 002 06, 003 06, 004 06, 005 06 or 006 06 is still active after swapping pump, go to step 4.

4. Check and clean contacts as required.
   [a] If fault code 001 06, 002 06, 003 06, 004 06, 005 06 or 006 06 is not active after checking and cleaning contacts, erase fault code memory.
   [b] If fault code 001 06, 002 06, 003 06, 004 06, 005 06 or 006 06 is still active after cleaning and checking contacts, contact Detroit Diesel Technical Service for authorization to replace the PLD-MR. Set parameters on new PLD-MR.

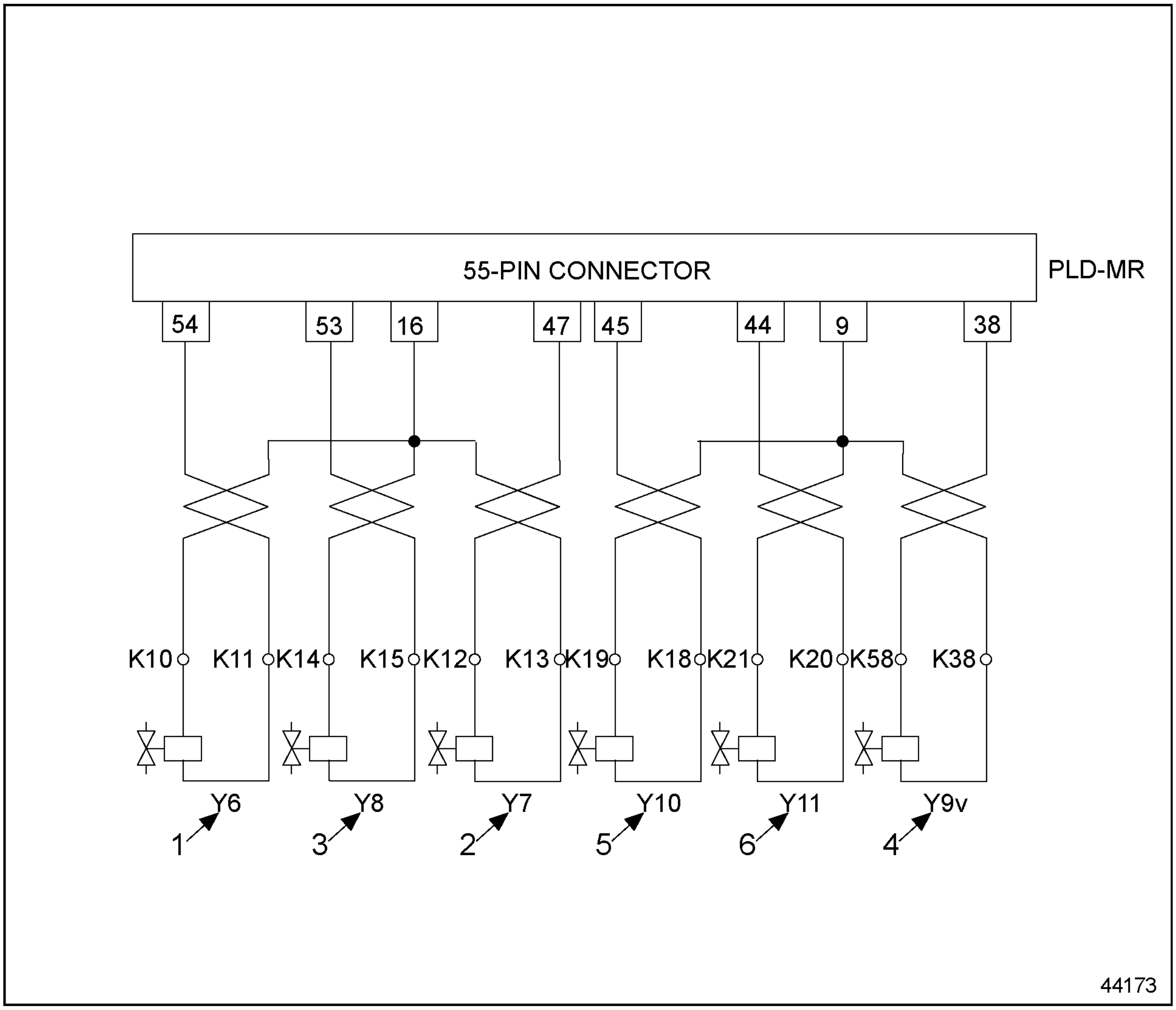
18.2.7.1 Required Action

Perform the following steps to resolve a short circuit fault:

1. On 6-cylinder engines, repair short to ground in the required injector unit pump wire listed in Table 18-1. See Figure 18-5 for location of pump wires.

<table>
<tr><th colspan="3">Resistance Less than 30 kΩ in Injector Unit Pump Terminal Wire</th><th colspan="3">Repair Short to Ground in Injector Unit Pump Terminal Wire</th></tr>
<tr><th>Unit Pump No.</th><th>Terminal No.</th><th>Wire No.</th><th>Unit Pump No.</th><th>Terminal No.</th><th>Wire No.</th></tr>
<tr><td rowspan="4">1</td><td>K10</td><td>54</td><td>1</td><td>K10</td><td>54</td></tr>
<tr><td rowspan="3">K11</td><td rowspan="3">16</td><td>1</td><td>K11</td><td>16</td></tr>
<tr><td>2</td><td>K12</td><td>16</td></tr>
<tr><td>3</td><td>K15</td><td>16</td></tr>
<tr><td rowspan="4">3</td><td>K14</td><td>53</td><td>3</td><td>K14</td><td>53</td></tr>
<tr><td rowspan="3">K15</td><td rowspan="3">16</td><td>1</td><td>K11</td><td>16</td></tr>
<tr><td>3</td><td>K15</td><td>16</td></tr>
<tr><td>2</td><td>K12</td><td>16</td></tr>
<tr><td rowspan="4">2</td><td>K13</td><td>47</td><td>2</td><td>K13</td><td>47</td></tr>
<tr><td rowspan="3">K12</td><td rowspan="3">16</td><td>1</td><td>K11</td><td>16</td></tr>
<tr><td>2</td><td>K12</td><td>16</td></tr>
<tr><td>3</td><td>K15</td><td>16</td></tr>
<tr><td rowspan="4">5</td><td>K19</td><td>45</td><td>5</td><td>K19</td><td>45</td></tr>
<tr><td rowspan="3">K18</td><td rowspan="3">9</td><td>4</td><td>K58</td><td>9</td></tr>
<tr><td>5</td><td>K18</td><td>9</td></tr>
<tr><td>6</td><td>K20</td><td>9</td></tr>
<tr><td rowspan="4">6</td><td>K21</td><td>44</td><td>6</td><td>K21</td><td>44</td></tr>
<tr><td rowspan="3">K20</td><td rowspan="3">9</td><td>4</td><td>K58</td><td>9</td></tr>
<tr><td>5</td><td>K18</td><td>9</td></tr>
<tr><td>6</td><td>K20</td><td>9</td></tr>
<tr><td rowspan="4">4</td><td>K38</td><td>38</td><td>4</td><td>K38</td><td>38</td></tr>
<tr><td rowspan="3">K58</td><td rowspan="3">9</td><td>4</td><td>K58</td><td>9</td></tr>
<tr><td>5</td><td>K18</td><td>9</td></tr>
<tr><td>6</td><td>K20</td><td>9</td></tr>
</table>

Table 18-1 6-Cylinder Engine Injector Unit Pump Low Resistance Wires/Repair Wires



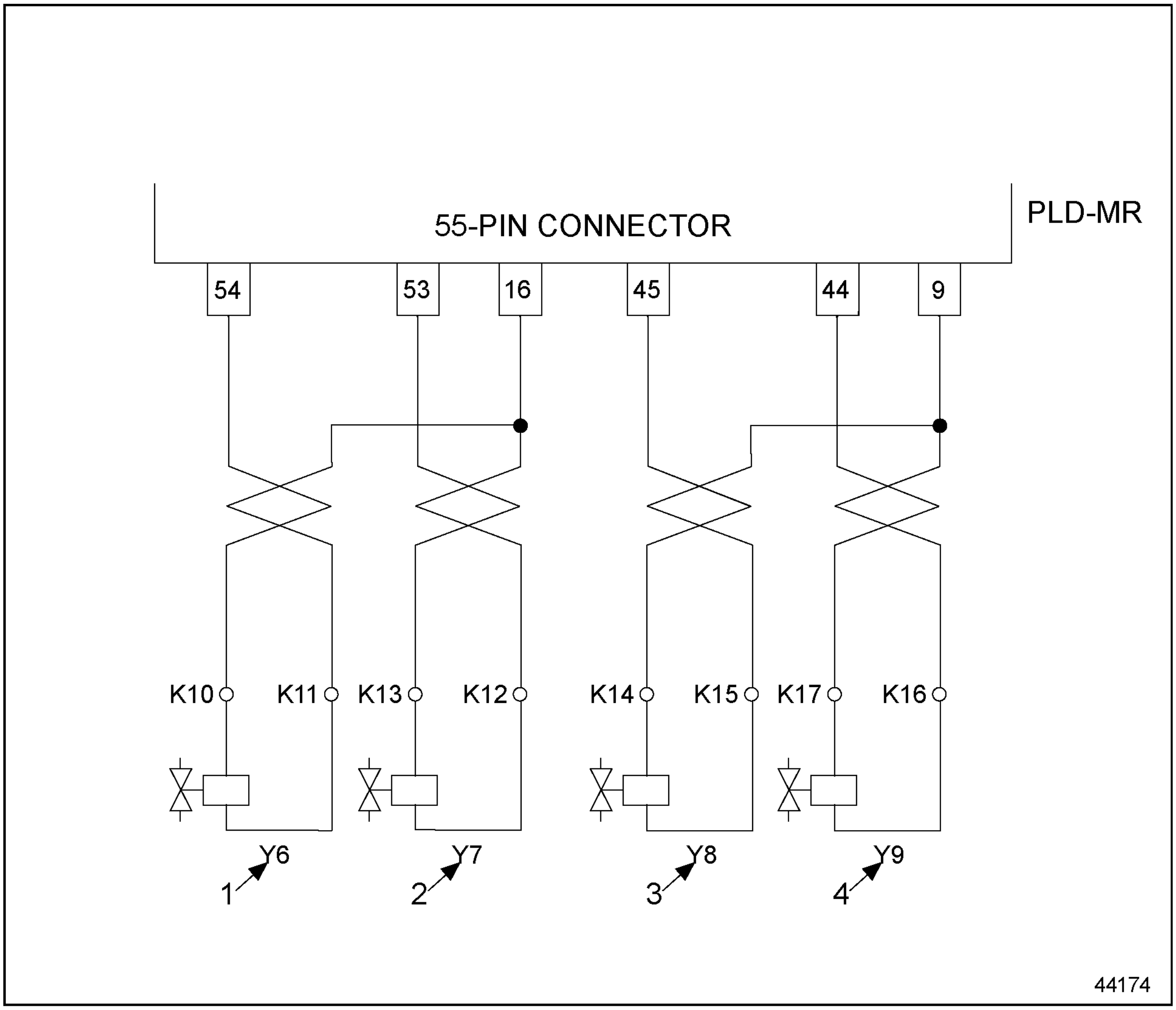
1. Unit Pump 1
2. Unit Pump 2
3. Unit Pump 3
4. Unit Pump 4
5. Unit Pump 5
6. Unit Pump 6

Figure 18-5 Location of Unit Pumps, Terminals and Wires on 6-Cylinder Engine

2. On 4-cylinder engines, repair short to ground in the required injector unit pump wire listed in Table 18-2. See Figure 18-6 for location of pump wires.

Resistance Less than 30 kΩ in Injector Unit Pump Terminal Wire			Repair Short to Ground in Injector Unit Pump Terminal Wire		
Unit Pump No.	**Terminal No.**	**Wire No.**	**Unit Pump No.**	**Terminal No.**	**Wire No.**
1	K10	54	1	K10	54
	K11	16	1	K11	16
			2	K12	16
2	K13	53	2	K13	53
	K12	16	1	K11	16
			2	K12	16
3	K14	45	3	K14	45
	K15	9	3	K15	9
			4	K16	9
4	K17	44	4	K17	44
	K16	9	3	K15	9
			4	K16	9

Table 18-2 4-Cylinder Engine Injector Unit Pump Low Resistance Wires/Repair Wires



1. Unit Pump 1
2. Unit Pump 2
3. Unit Pump 3
4. Unit Pump 4

Figure 18-6 Location of Unit Pumps, Terminals and Wires on 4-Cylinder Engine

3. Erase fault code memory.

18.2.8 001 07 – No Plunger

To troubleshoot a no plunger fault, perform the following steps with unit pump connected and engine running:

1. Check fault code display.
   [a] If fault code 001 07 is not active after running the engine for at least 5 minutes, erase fault code memory.

[b] If fault code 001 07 is still active after running the engine for at least 5 minutes, go to step 2.

2. Check for additional fault codes:

   [a] If additional fault code 001 06 is produced, refer to section 18.2.7.

   [b] If additional fault code 168 04 is produced, refer to section 14.2.1.

   [c] If additional fault code 001 05 is produced, refer to section 18.2.1.

   [d] If additional fault code 002 07 is produced, go to step 3.

   [e] If additional fault code 003 07 is produced, go to step 4.

3. Measure resistance between the following 55-pin connector wires. See Figure 18-5 for location of pump wires on 6-cylinder engine and see Figure 18-6 for location of pump wires on 4-cylinder engines.
   - □ Wire 54 to terminal K10 on unit pump 1.
   - □ Wire 47 to terminal K13 on unit pump 2.

   [a] If resistance is not greater than 30 kΩ, refer to section 18.2.8.1.

   [b] If resistance is greater than 30 kΩ, go to step 5.

4. Measure resistance between the following 55-pin connector wires:
   - □ Wire 54 to terminal K10 of unit pump 1.
   - □ Wire 53 to terminal K14 of unit pump 3.

   [a] If resistance is not greater than 30 kΩ, refer to section 18.2.8.2.

   [b] If resistance is greater than 30 kΩ, go to step 5.

5. Swap unit pump. Start engine.

   [a] If fault 001 07 is not active after swapping pump, replace original unit pump. Erase fault code memory.

   [b] If fault 001 07 is still active after swapping pump, contact Detroit Diesel Technical Service.

18.2.8.1 Required Action

To resolve a no plunger fault, perform the following steps:

1. Repair short circuit in the following 55-pin connector wire:
   - □ Wire 54 to terminal K10 of unit pump 1.
   - □ Wire 47 to terminal K13 of unit pump 2.

2. Erase fault code memory.

18.2.8.2 Required Action

To resolve a no plunger fault, perform the following steps:

1. Repair short circuit in the following 55-pin connector wires:
   - □ Wire 54 to terminal K10 of unit pump 1.

□ Wire 53 to terminal K14 of unit pump 3.

2. Erase fault code memory.

18.2.9 002 07 – No Plunger

To troubleshoot a no plunger fault, perform the following steps with unit pump connected and engine running:

1. Check fault code display.
   - [a] If fault code 002 07 is not active after running the engine for at least 5 minutes, erase fault code memory.
   - [b] If fault code 002 07 is still active after running the engine for at least 5 minutes, go to step 2.
2. Check for additional fault codes:
   - [a] If additional fault code 002 06 is produced, refer to section 18.2.7.
   - [b] If additional fault code 168 04 is produced, refer to section 14.2.1.
   - [c] If additional fault code 002 05 is produced, refer to section 18.2.2.
   - [d] If additional fault code 001 07 is produced, go to step 3.
   - [e] If additional fault code 003 07 is produced, go to step 5.
3. Measure resistance between the following 55-pin connector wires. See Figure 18-5 for location of pump wires on 6-cylinder engine and see Figure 18-6 for location of pump wires on 4-cylinder engines.
   □ Wire 54 to terminal K10 on unit pump 1.
   □ Wire 47 to terminal K13 on unit pump 2.
   - [a] If resistance is not greater than 30 kΩ, refer to section 18.2.9.1.
   - [b] If resistance is greater than 30 kΩ, go to step 4.
4. Swap unit pump. Start engine.
   - [a] If fault 002 07 is not active after swapping pump, replace original cylinder unit pump. Erase fault code memory.
   - [b] If fault 002 07 is still active after swapping pump, contact Detroit Diesel Technical Service.
5. Measure resistance between the following 55-pin connector wires:
   □ Wire 54 to terminal K10 of unit pump 1.
   □ Wire 53 to terminal K14 of unit pump 3.
   - [a] If resistance is not greater than 30 kΩ, refer to section 18.2.9.2.
   - [b] If resistance is greater than 30 kΩ, go to step 4.

18.2.9.1 Required Action

To resolve a no plunger fault, perform the following steps:

1. Repair short circuit in the following 55-pin connector wire:
   - □ Wire 54 to terminal K10 of unit pump 1.
   - □ Wire 47 to terminal K13 of unit pump 2.
2. Erase fault code memory.

18.2.9.2 Required Action

To resolve a no plunger fault, perform the following steps:

1. Repair short circuit in the following 55-pin connector wires:
   - □ Wire 47 to terminal K13 of unit pump 2.
   - □ Wire 53 to terminal K14 of unit pump 3.
2. Erase fault code memory.

18.2.10 003 07 – No Plunger

To troubleshoot a no plunger fault, perform the following steps with unit pump connected and engine running:

1. Check fault code display:
   - [a] If fault code 003 07 is not active after running the engine for at least 5 minutes, erase fault code memory.
   - [b] If fault code 003 07 is still active after running the engine for at least 5 minutes, go to step 2.
2. Check for additional fault codes:
   - [a] If additional fault code 003 05 is produced, refer to section 18.2.3.
   - [b] If additional fault code 168 04 is produced, refer to section 14.2.1.
   - [c] If additional fault code 003 06 is produced, refer to section 18.2.7.
   - [d] If additional fault code 002 07 is produced, go to step 3.
   - [e] If additional fault code 001 07 is produced, go to step 5.
3. Measure resistance between the following 55-pin connector wires. See Figure 18-5 for location of pump wires on 6-cylinder engine and see Figure 18-6 for location of pump wires on 4-cylinder engines.
   - □ Wire 53 to terminal K14 on unit pump 3.
   - □ Wire 47 to terminal K13 on unit pump 2.
   - [a] If resistance is not greater than 30 kΩ, refer to section 18.2.10.1.
   - [b] If resistance is greater than 30 kΩ, go to step 4.
4. Swap unit pump. Start engine.

[a] If fault 003 07 is not active after swapping pump, replace original cylinder unit pump. Erase fault code memory.

[b] If fault 003 07 is still active after swapping pump, contact Detroit Diesel Technical Service.

5. Measure resistance between the following 55-pin connector wires:
   - □ Wire 54 to terminal K10 of unit pump 1.
   - □ Wire 53 to terminal K14 of unit pump 3.

   [a] If resistance is not greater than 30 kΩ, refer to section 18.2.10.2.

   [b] If resistance is greater than 30 kΩ, go to step 4.

18.2.10.1 Required Action

To resolve a no plunger fault, perform the following steps:

1. Repair short circuit in the following 55-pin connector wire:
   - □ Wire 53 to terminal K14 of unit pump 3.
   - □ Wire 47 to terminal K13 of unit pump 2.
2. Erase fault code memory.

18.2.10.2 Required Action

To resolve a no plunger fault, perform the following steps:

1. Repair short circuit in the following 55-pin connector wires:
   - □ Wire 54 to terminal K10 of unit pump 1.
   - □ Wire 53 to terminal K14 of unit pump 3.
2. Erase fault code memory.

18.2.11 004 07 – No Plunger

To troubleshoot a no plunger fault, perform the following steps with unit pump connected and engine running:

1. Check fault code display:

   [a] If fault code 004 07 is not active after running the engine for at least 5 minutes, erase fault code memory.

   [b] If fault code 004 07 is still active after running the engine for at least 5 minutes, go to step 2.

2. Check for additional fault codes:

   [a] If additional fault code 004 05 is produced, refer to section 18.2.4.

   [b] If additional fault code 168 04 is produced, refer to section 14.2.1.

   [c] If additional fault code 004 06 is produced, refer to section 18.2.7.

[d] If additional fault code 006 07 is produced, go to step 3.

[e] If additional fault code 005 07 is produced, go to step 5.

3. Measure resistance between the following 55-pin connector wires. See Figure 18-5 for location of pump wires on 6-cylinder engine and see Figure 18-6 for location of pump wires on 4-cylinder engines.
   □ Wire 44 to terminal K21 on unit pump 6.
   □ Wire 38 to terminal K38 on unit pump 4.

   [a] If resistance is not greater than 30 kΩ, refer to section 18.2.11.1.

   [b] If resistance is greater than 30 kΩ, go to step 4.

4. Swap unit pump. Start engine.

   [a] If fault 004 07 is not active after swapping pump, replace original cylinder unit pump. Erase fault code memory.

   [b] If fault 004 07 is still active after swapping pump, contact Detroit Diesel Technical Service.

5. Measure resistance between the following 55-pin connector wires:
   □ Wire 45 to terminal K19 of unit pump 5.
   □ Wire 38 to terminal K38 of unit pump 4.

   [a] If resistance is not greater than 30 kΩ, refer to section 18.2.11.2.

   [b] If resistance is greater than 30 kΩ, go to step 4.

18.2.11.1 Required Action

To resolve a no plunger fault, perform the following steps:

1. Repair short circuit in the following 55-pin connector wire:
   □ Wire 44 to terminal K21 of unit pump 6.
   □ Wire 38 to terminal K38 of unit pump 4.

2. Erase fault code memory.

18.2.11.2 Required Action

To resolve a no plunger fault, perform the following steps:

1. Repair short circuit in the following 55-pin connector wires:
   □ Wire 38 to terminal K38 of unit pump 4.
   □ Wire 45 to terminal K19 of unit pump 5.

2. Erase fault code memory.

18.2.12 005 07 – No Plunger

To troubleshoot a no plunger fault, perform the following steps with unit pump connected and engine running:

1. Check fault code display.

   [a] If fault code 005 07 is not active after running the engine for at least 5 minutes, erase fault code memory.

   [b] If fault code 005 07 is still active after running the engine for at least 5 minutes, go to step 2.

2. Check for additional fault codes:

   [a] If additional fault code 005 05 is produced, refer to section 18.2.5.

   [b] If additional fault code 168 04 is produced, refer to section 14.2.1.

   [c] If additional fault code 005 06 is produced, refer to section 18.2.7.

   [d] If additional fault code 006 07 is produced, go to step 3.

   [e] If additional fault code 004 07 is produced, go to step 5.

3. Measure resistance between the following 55-pin connector wires. See Figure 18-5 for location of pump wires on 6-cylinder engine and see Figure 18-6 for location of pump wires on 4-cylinder engines.
   - □ Wire 44 to terminal K21 on unit pump 6.
   - □ Wire 45 to terminal K19 on unit pump 5.

   [a] If resistance is not greater than 30 kΩ, refer to section 18.2.12.1.

   [b] If resistance is greater than 30 kΩ, go to step 4.

4. Swap unit pump. Start engine.

   [a] If fault 005 07 is not active after swapping pump, replace original cylinder unit pump. Erase fault code memory.

   [b] If fault 005 07 is still active after swapping pump, contact Detroit Diesel Technical Service.

5. Measure resistance between the following 55-pin connector wires:
   - □ Wire 45 to terminal K19 of unit pump 5.
   - □ Wire 38 to terminal K38 of unit pump 4.

   [a] If resistance is not greater than 30 kΩ, refer to section 18.2.12.2.

   [b] If resistance is greater than 30 kΩ, go to step 4.

18.2.12.1 Required Action

To resolve a no plunger fault, perform the following steps:

1. Repair short circuit in the following 55-pin connector wire:
   - □ Wire 44 to terminal K21 of unit pump 6.
   - □ Wire 45 to terminal K19 of unit pump 5.

2. Erase fault code memory.

18.2.12.2 Required Action

To resolve a no plunger fault, perform the following steps:

1. Repair short circuit in the following 55-pin connector wires:
   - □ Wire 38 to terminal K38 of unit pump 4.
   - □ Wire 45 to terminal K19 of unit pump 5.
2. Erase fault code memory.

18.2.13 006 07 – No Plunger

To troubleshoot a no plunger fault, perform the following steps with unit pump connected and engine running:

1. Check fault code display:
   - [a] If fault code 006 07 is not active after running the engine for at least 5 minutes, erase fault code memory.
   - [b] If fault code 006 07 is still active after running the engine for at least 5 minutes, go to step 2.
2. Check for additional fault codes:
   - [a] If additional fault code 006 05 is produced, refer to section 18.2.6.
   - [b] If additional fault code 168 04 is produced, refer to section 14.2.1.
   - [c] If additional fault code 006 06 is produced, refer to section 18.2.7.
   - [d] If additional fault code 005 07 is produced, go to step 3.
   - [e] If additional fault code 004 07 is produced, go to step 5.
   - [f] If only fault code 006 07 is active with no additional fault codes, go to step 4.
3. Measure resistance between the following 55-pin connector wires. See Figure 18-5 for location of pump wires on 6-cylinder engine and see Figure 18-6 for location of pump wires on 4-cylinder engines.
   - □ Wire 44 to terminal K21 on unit pump 6.
   - □ Wire 45 to terminal K19 on unit pump 5.
   - [a] If resistance is not greater than 30 kΩ, refer to section 18.2.13.1.
   - [b] If resistance is greater than 30 kΩ, go to step 4.
4. Swap unit pump. Start engine.
   - [a] If fault 006 07 is not active after swapping pump, replace original cylinder unit pump. Erase fault code memory.
   - [b] If fault 006 07 is still active after swapping pump, contact Detroit Diesel Technical Service.
5. Measure resistance between the following 55-pin connector wires:
   - □ Wire 44 to terminal K21 of unit pump 6.

- □ Wire 38 to terminal K38 of unit pump 4.

[a] If resistance is not greater than 30 kΩ, refer to section 18.2.13.2.

[b] If resistance is greater than 30 kΩ, go to step 4.

18.2.13.1 Required Action

To resolve a no plunger fault, perform the following steps:

1. Repair short circuit in the following 55-pin connector wire:
   - □ Wire 44 to terminal K21 of unit pump 6.
   - □ Wire 45 to terminal K19 of unit pump 5.
2. Erase fault code memory.

18.2.13.2 Required Action

To resolve a no plunger fault, perform the following steps:

1. Repair short circuit in the following 55-pin connector wires:
   - □ Wire 44 to terminal K21 of unit pump 6.
   - □ Wire 38 to terminal K38 of unit pump 4.
2. Erase fault code memory.

18.2.14 001 12 Through 006 12 – Idle Smoothness Governor at Limit

To troubleshoot an idle smoothness governor at limit fault, perform the following steps with unit pump connected and engine running:

1. Check fault code display:

   [a] If a fault code between 001 06 and 006 06 is active in addition to any fault code between 001 12 and 006 12, refer to section 18.2.7.

   [b] If a fault code between 001 12 and 006 012 is active with no additional fault codes, go to step 2.

2. Run an idle speed balance test.

   [a] If injectors are out of balance, identify and correct faulty injectors.

   [b] If injectors are in balance, go to step 3.

3. Perform a comparative compression test on all cylinders.

   [a] If the test reveals a compression leak in the relevant cylinder, determine the cause and repair/correct the compression leak. Erase fault code memory.

   [b] If the test does not reveal a compression leak in the relevant cylinder, contact Detroit Diesel Technical Service.

18.2.15 001 14 Through 006 14 – Single Cylinder Correction at Idle

To troubleshoot a single cylinder correction at idle fault, perform the following step:

1. Contact Detroit Diesel Technical Service.

19 SID 21

Section **Page**

19.1 DESCRIPTION OF SID 21 – CRANKSHAFT POSITION SENSOR OUTSIDE OF NORMAL OPERATING CONDITIONS

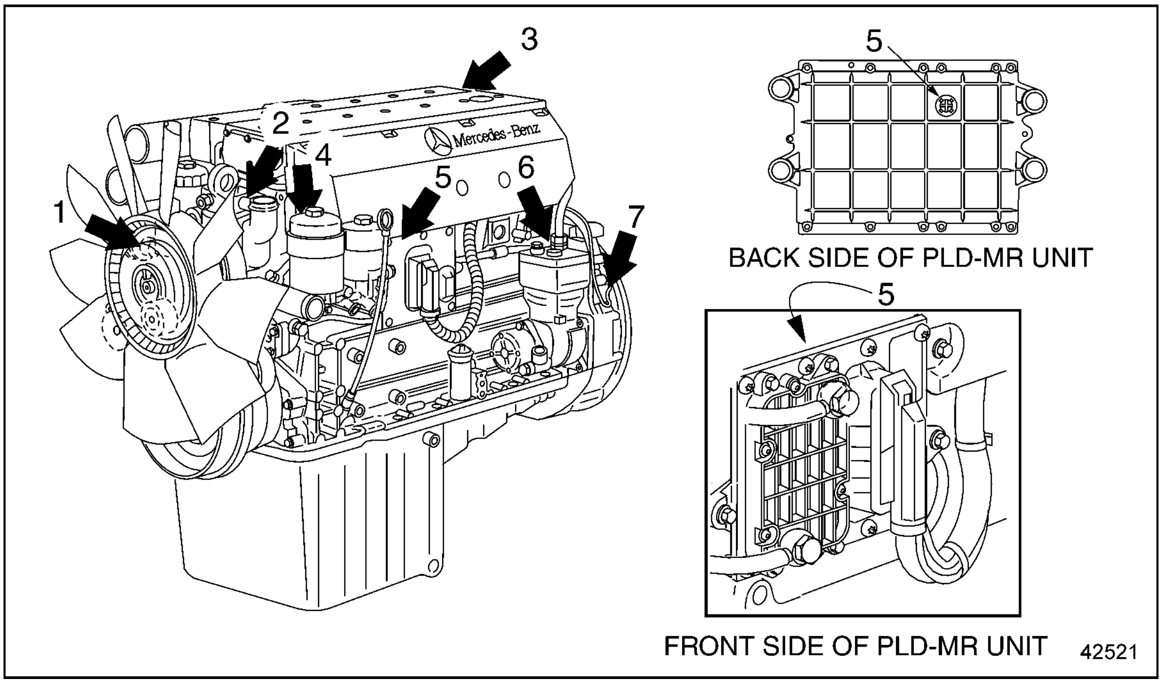
SID 021 indicates that the PLD-MR control unit has detected the Crankshaft Position (CKP) sensor operating outside of normal operating conditions.

The diagnostic condition is typically:

- ☐ CKP Sensor Signal Voltage Too Low (021 01)
- ☐ CKP Sensor Open Circuit (021 03)
- ☐ CKP Sensor Short to Ground (021 04)
- ☐ No Match of Camshaft and Crankshaft Signals (021 07)
- ☐ CKP Sensor Time Out (021 08)
- ☐ CKP Sensor Pins Swapped (021 14)

See Figure 19-1 for sensor locations on the typical MBE 6-cylinder engine.

NOTE:
Sensor locations are similar on the 4-cylinder engine. The Engine Oil Level (EOL) sensor, if used, is located at the bottom of the oil pan.



1. Engine Oil Pressure (EOP) Sensor
2. Engine Coolant Temperature (ECT) Sensor
3. Intake Manifold Pressure (IMP) Sensor
4. Supply Fuel Temperature (SFT) Sensor
5. Barometric Pressure (Baro) Sensor *
6. Camshaft Position (CMP) Sensor – on Cylinder Block
7. CKP Sensor - on Timing Case

* The Baro sensor is integrated into the PLD-MR unit.

Figure 19-1 Sensor Location on MBE 6-Cylinder Engine

The engine harness is delivered to the factory with the engine sensors and the PLD-MR already connected. See Figure 19-2 for a typical six-cylinder engine harness. Engine harness sensor pin locations are listed in Table 19-1.

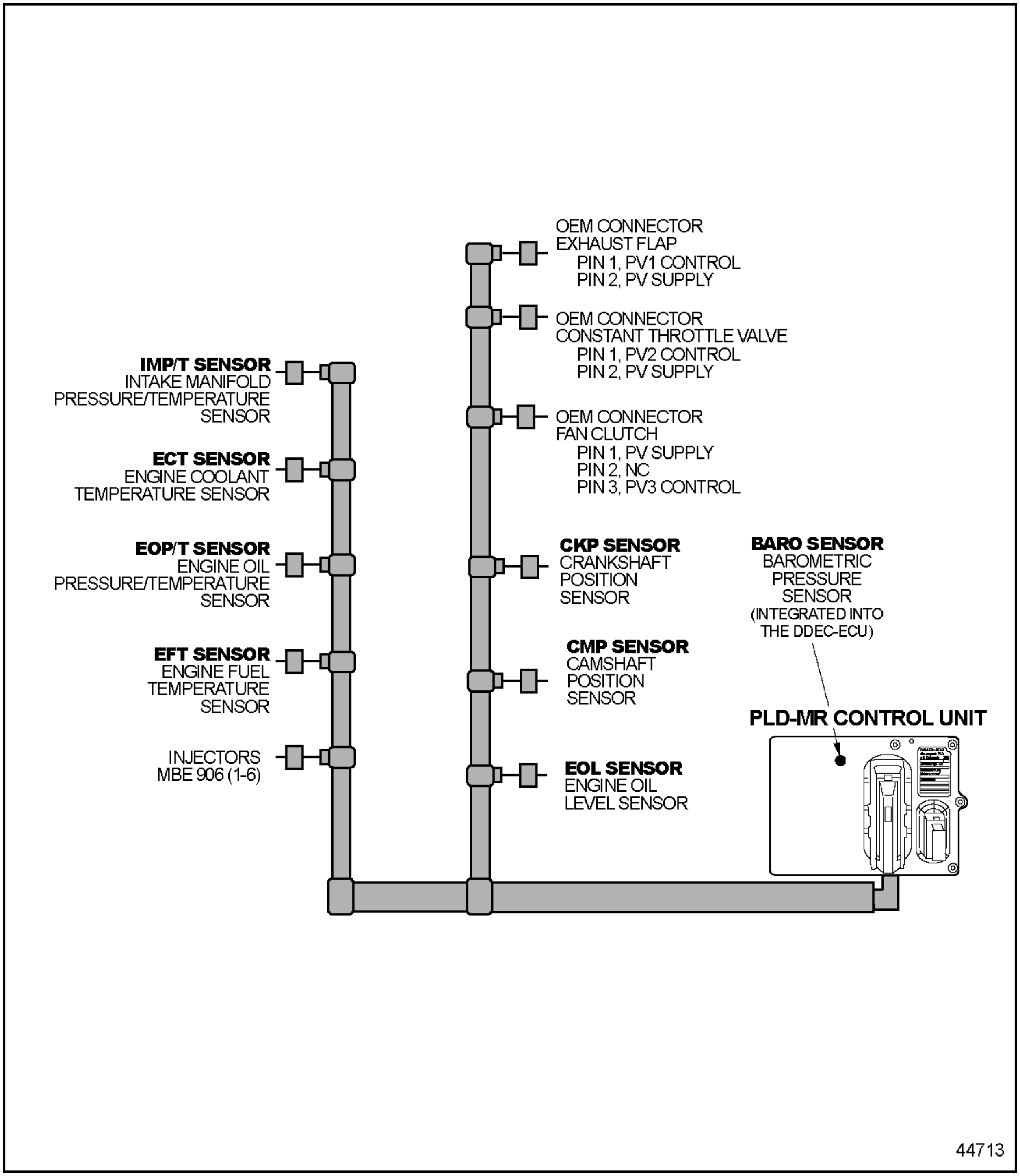


Figure 19-2 Typical On-Highway Six-Cylinder Engine Harness

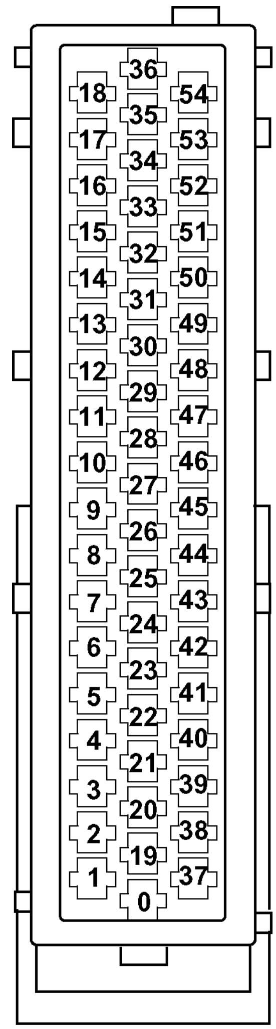
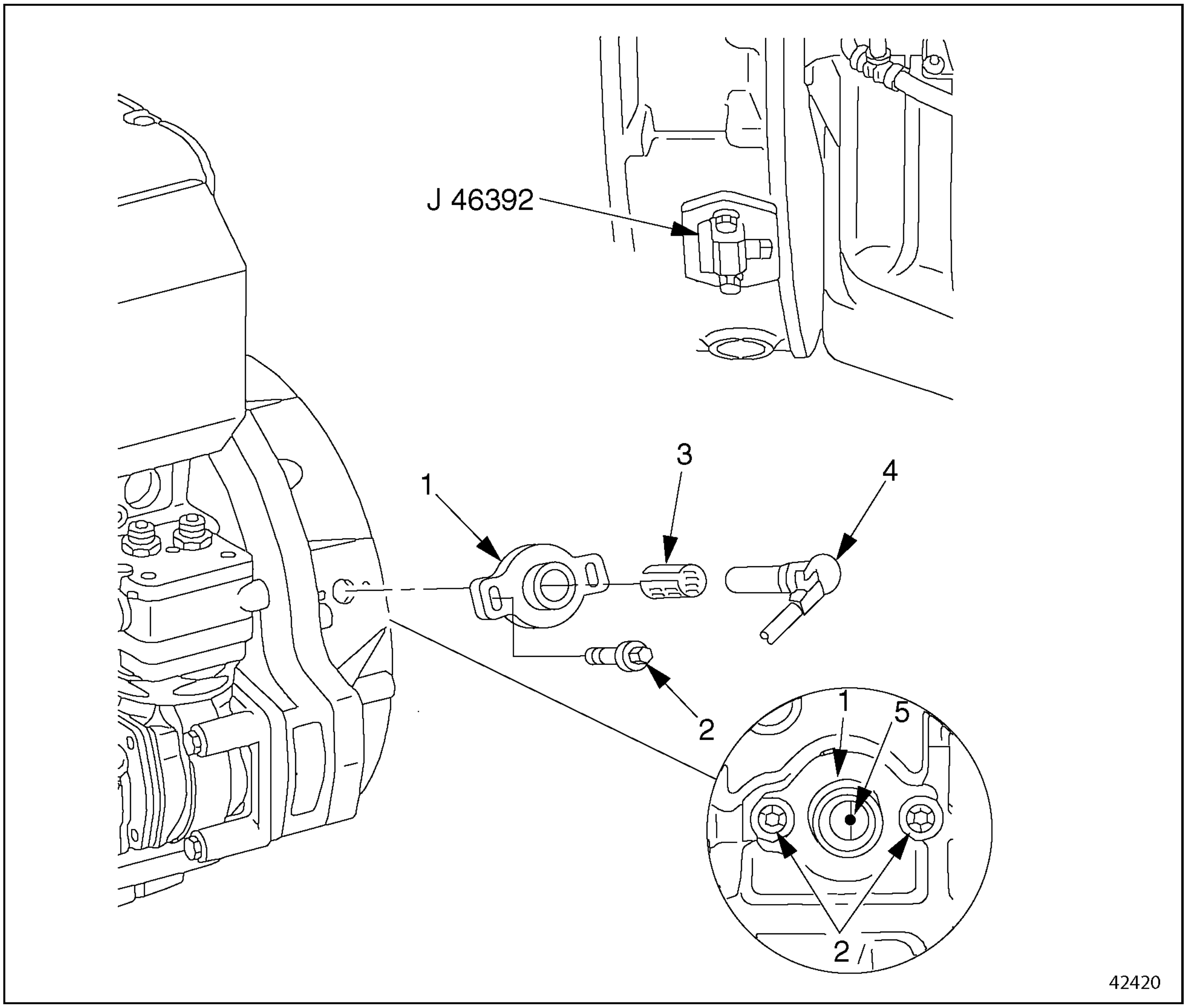
Pin	Wire Color		Signal Type	Function	Connector
	6-Cylinder	4-Cylinder			
1	Blk/Yel	Blk/Yel	Sensor Return	CMP Sensor (-)	 Front Looking into the Pins
2	Blk/Viol	Blk/Viol	Sensor Return	CKP Sensor (-)	
19	Brn/Viol	Brn/Viol	Fre-quency Input	CKP Sensor (+)	
20	Brn/Yel	Brn/Yel	Fre-quency Input	CMP Sensor (+)	

Table 19-1 Selected Harness Pin Locations

The CKP sensor and its bracket are located on the flywheel housing. See Figure 19-3. In most cases the CKP sensor bracket is replaced only when the flywheel housing is replaced.



1. CKP Sensor Bracket
2. Shear Bolt (2 Qty.)
3. Spring Bushing
4. CKP Sensor
5. Reference Hole on Flywheel Edge

Figure 19-3 Crankshaft Position Sensor and Bracket Location

19.2 TROUBLESHOOTING SID 21

Perform the following steps to troubleshoot SID 21.

19.2.1 021 01 – Crankshaft Position Sensor Signal Voltage Too Low

Troubleshoot a CKP sensor signal voltage too low fault 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 PLD-MR. See Figure 19-4.

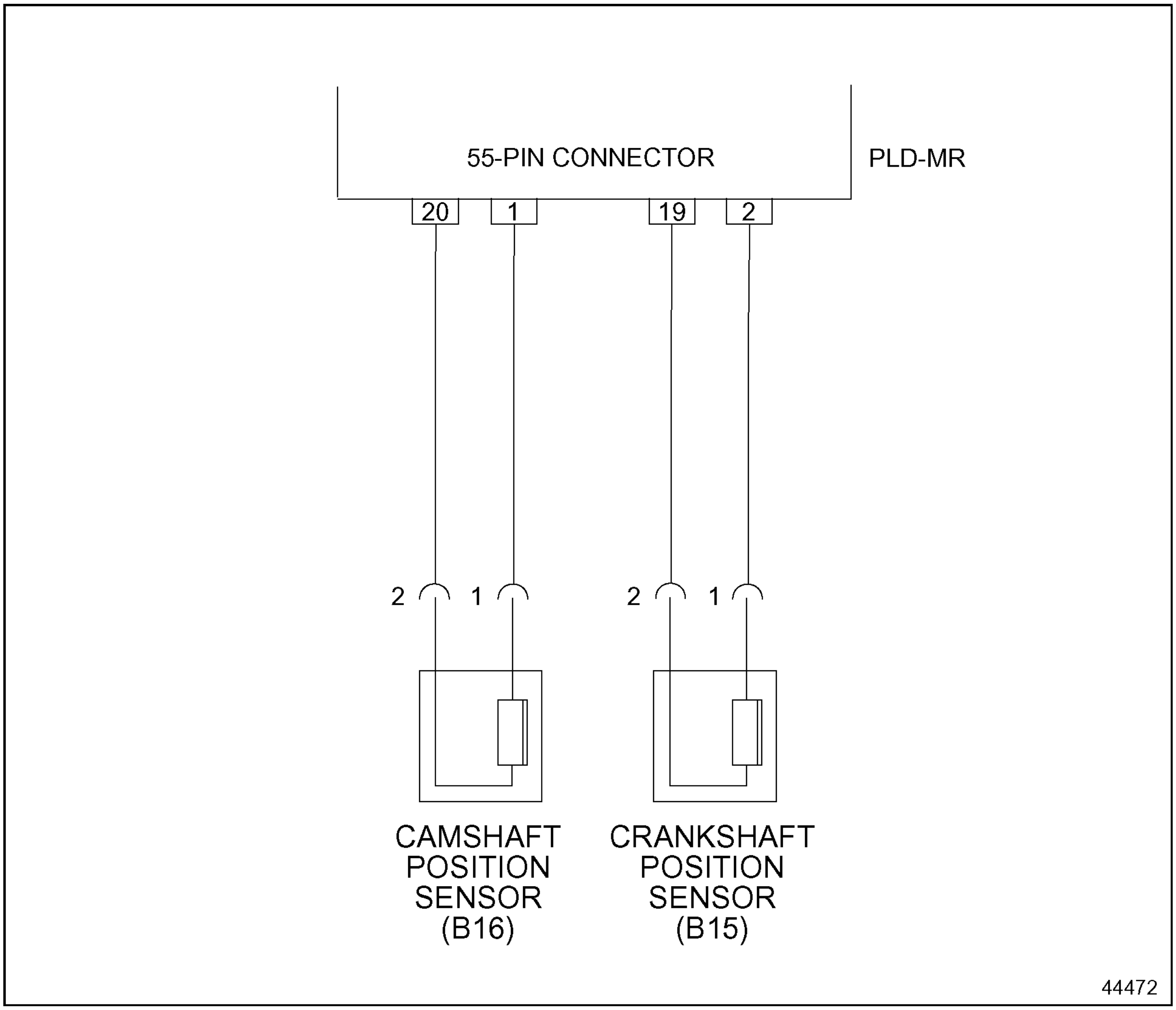


Figure 19-4 Crankshaft Position Sensor and Camshaft Position Sensor Wiring

[a] If wires are not correctly wired, repair or replace wires as required. Erase fault code memory.

[b] If wires are correctly wired, go to step 2.

2. If fault occurs at other times then when cranking the engine (and engine will not start), check the CKP sensor position.

   [a] If fault is not active after checking CKP sensor position, repair the CKP sensor clamping sleeve. Erase fault code memory.

   [b] If fault is still active after checking the CKP sensor position, go to step 3.

3. Check the flywheel sensor position through the inspection window of the timing case using turning tool.

   [a] If sensors are out of position, repair or replace, as required. Erase fault code memory.

   [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. Erase fault code memory.

   [b] If axial play is within specifications, contact Detroit Diesel Technical Service.

19.2.2 021 03 – Crankshaft Position Sensor Open Circuit

Troubleshoot a CKP sensor open circuit fault as follows:

1. Bridge pins 2 and 19 on the 55-pin connector. See Figure 19-4. Pin locations are listed in Table 19-1.

   [a] If new fault 021 04 is active, replace CKP sensor and clamping sleeve. Erase fault code memory.

   [b] If new fault 021 04 is not active, go to step 2.

2. Check and clean contacts.

   [a] If fault 021 03 is still active, contact Detroit Diesel Technical Service for authorization to replace the PLD-MR. Set parameters on the new PLD-MR.

   [b] If fault 021 03 is not active, erase fault code memory.

19.2.3 021 04 – Crankshaft Position Sensor Short to Ground

Troubleshoot a CKP sensor short to ground fault as follows:

1. Unplug the 55-pin connector from the PLD-MR.

   [a] If new fault code 021 03 is active, replace the CKP sensor and clamping sleeve. Erase fault code memory.

   [b] If new fault code 021 03 is not active, go to step 2.

2. Check and clean contacts.

   [a] If fault 021 04 is active, contact Detroit Diesel Technical Service for authorization to replace the PLD-MR. Set parameters on the new PLD-MR.

[b] If fault 021 04 is not active, check the contact, clean contacts (if necessary), and erase fault code memory.

19.2.4 021 07 – No Match of Camshaft and Crankshaft Signals

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

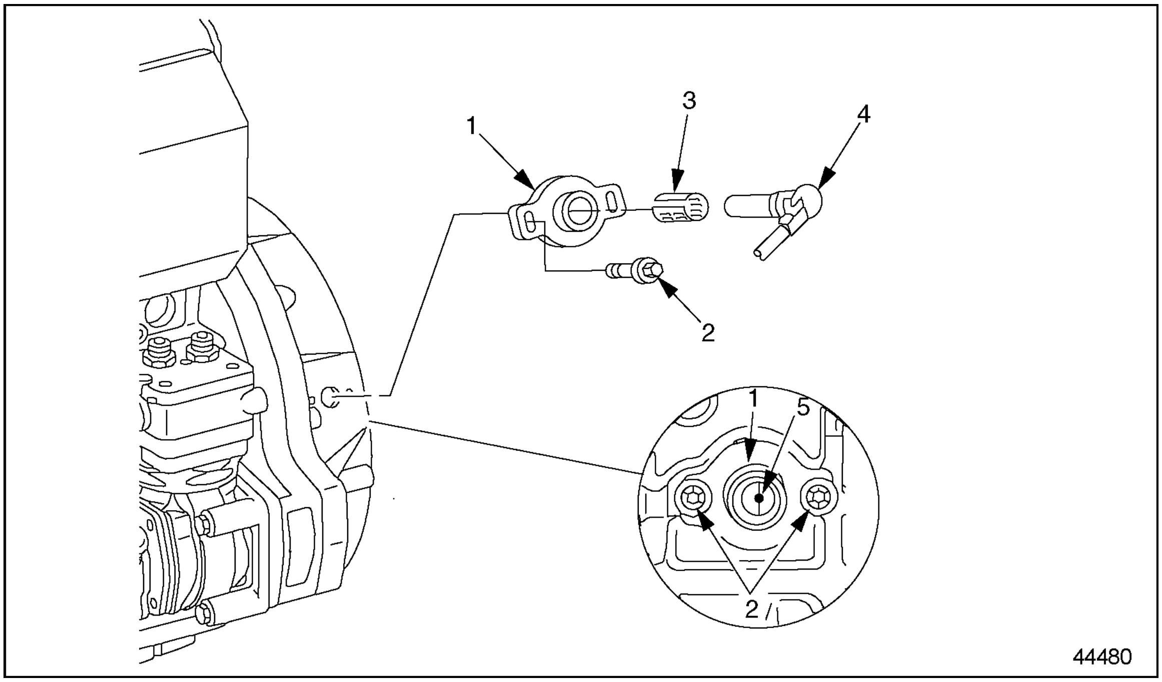
1. Perform a polarity test on the engine speed sensor.
   [a] If fault 021 07 is not active after performing test, erase fault code memory.
   [b] If fault 021 07 is active after performing test, go to step 2.
2. Reseat the CKP and CMP sensors and check for crossed wires on the 55-pin connector. See Figure 19-4.
   [a] If wires are crossed, repair or replace wires. Erase fault code memory.
   [b] If wires are not crossed, contact Detroit Diesel Technical Service.

19.2.5 021 08 – Sensor Time Out

Troubleshoot a sensor time out fault, as follows:

1. If fault 021 03 is active in addition to fault 021 08 with engine running, refer to section 19.2.2.
2. If fault 021 04 is active in addition to fault 021 08 with engine running, refer to section 19.2.3.
3. Check the sensor position.
   [a] If fault 021 08 is not active after checking position, replace CKP sensor clamping sleeve. Erase fault code memory.
   [b] If fault 021 08 is active after checking position, go to step 4.
4. Perform a polarity test on the CKP sensor.
   [a] If test confirms polarity is reversed (fault 021 14 is present), check for crossed wires on the 55-pin connector and repair or replace wires. See Figure 19-4. Erase fault code memory.
   [b] If sensor polarity is not reversed, go to step 5.
5. Replace the engine speed sensor.
   [a] If fault 021 08 is not active, erase fault code memory.
   [b] If fault 021 08 is still active, go to step 6.
6. Check the flywheel sensor position in the timing case through the inspection window using turning tool.

[a] If sensors are out of position, repair or replace the spring bushing, as required. Erase fault code memory. See Figure 19-5.



1. Crankshaft Position Sensor Bracket
2. Shear Bolt
3. Spring Bushing
4. Crankshaft Position Sensor
5. Reference Hole on the Flywheel Edge

Figure 19-5 Crankshaft Position Sensor Location

[b] If sensors are not out of position, go to step 7.

7. Check crankshaft axial play.

[a] If axial play is not within specifications, repair or replace crankshaft thrust bearings, as required. Erase fault code memory.

[b] If axial play is within specifications, contact Detroit Diesel Technical Service.

19.2.6 021 14– Pins Swapped

Troubleshoot a pins swapped fault as follows:

1. Perform a polarity test on the engine speed sensor.

[a] If polarity is not reversed, erase fault code memory.

[b] If polarity is reversed (fault 021 14 is present), go to step 2.

2. Reseat the CKP and CMP sensors and check for crossed wires. See Figure 19-4.

[a] If crossed wires are found, repair or replace wires. Erase fault code memory.

[b] If crossed wires are not found, contact Detroit Diesel Technical Service.

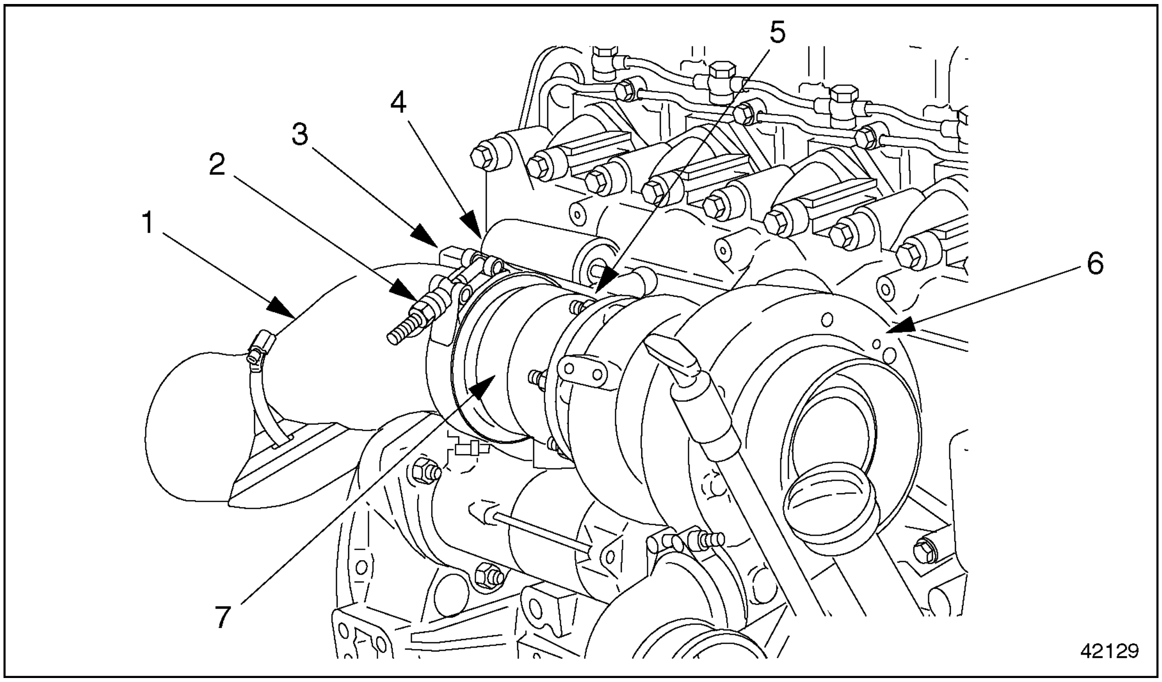
20 SID 57

Section **Page**

20.1 DESCRIPTION OF SID 57 — EXHAUST BRAKE FAULT

SID 57 indicates that during engine operation of the exhaust brake, a fault occurred with the solenoid that actuates the exhaust brake valve. See Figure 20-1.

NOTE:
The exhaust brake solenoid is commonly located on the firewall, not shown in the following figure.



1. Exhaust Pipe
2. Constant Torque Clamp
3. Bracket
4. Exhaust Brake Cylinder
5. Mounting Stud
6. Turbocharger
7. Exhaust Brake Valve Housing

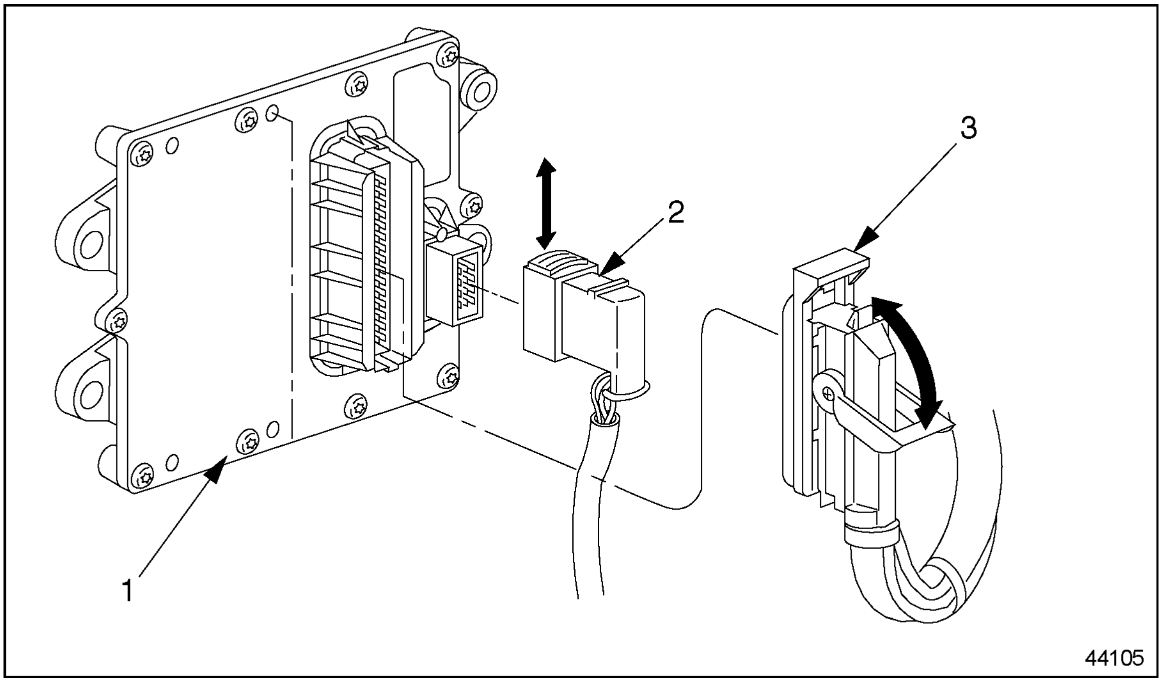
Figure 20-1 Typical Exhaust Brake Installation

This diagnostic condition is typically:

- ☐ Open Circuit (057 05)
- ☐ Short to Ground (057 06)

20.2 TROUBLESHOOTING SID 57

Perform the following steps to troubleshoot SID 57. See Figure 20-2 for the Engine Electrical Connector (55-pin).



1. PLD-MR
2. Vehicle Electrical Connector (16-pin)
3. Engine Electrical Connector (55-pin)

Figure 20-2 PLD-MR and Harness Connectors

20.2.1 057 05 — Open Circuit in the Engine Brake Flap Solenoid Valve and Wiring

Perform the following procedures to troubleshoot an open circuit in the engine brake flap solenoid valve and wiring.

If the engine has no exhaust brake flap, perform the following step:

1. Read Parameter 00601.

   [a] If Parameter 00601 is “Not Active”, contact Detroit Diesel Technical Service Group.

   [b] If Parameter 00601 is “Active”, refer to section 20.2.1.1.

If the engine has an exhaust brake flap, perform the following steps:

1. Measure the resistance between the 55-pin connector wires 12 and 51 of the bridged exhaust brake. See Figure 20-3.

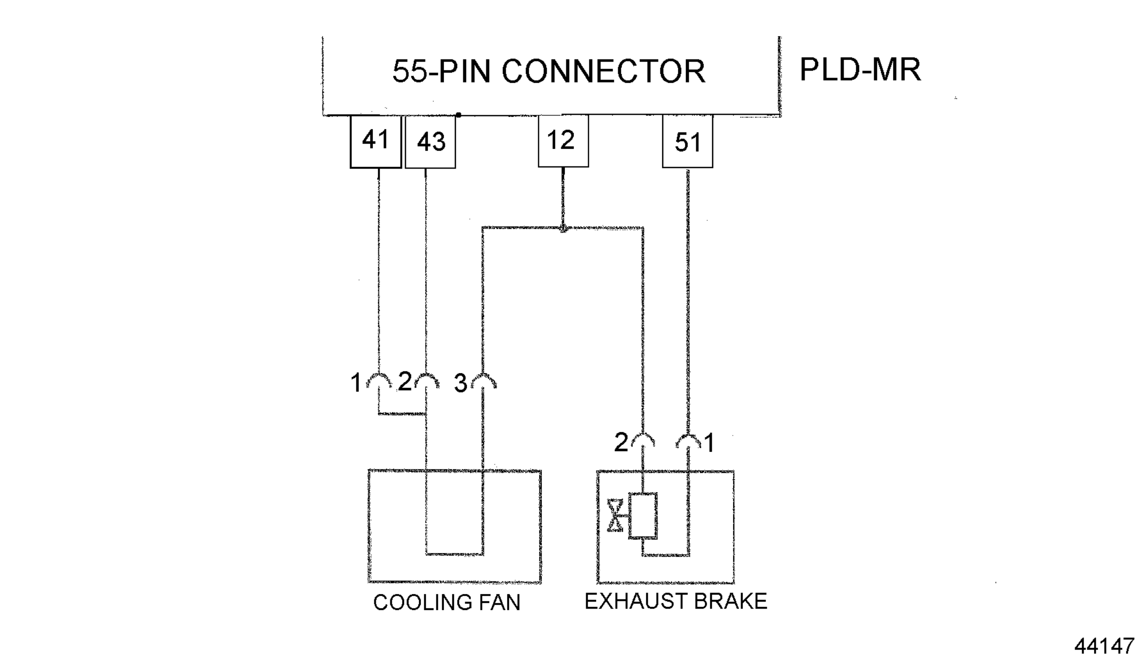


Figure 20-3 Exhaust brake and Cooling Fan Wiring

[a] If the resistance is less than 3 Ω, contact Detroit Diesel Technical Service Group.

[b] If the resistance is greater than or equal to 3 Ω, refer to section 20.2.1.2.

2. Bridge the exhaust brake solenoid wires and read the active fault codes.

[a] If Fault Code 057 06 is present, refer to section 20.2.1.3.

[b] If there are no active fault codes, erase the fault code memory and troubleshooting is done.

20.2.1.1 Required Actions

Perform the following steps to resolve 057 05 for an engine with no exhaust brake flap.

1. Set Parameters 00603 and 00604 to “Not Active”.
2. Erase the fault code memory.

20.2.1.2 Required Actions

Perform the following steps to resolve 057 05 with an open circuit.

1. Repair open circuit and/or replace bad contacts in the 55-pin connector wires 51 and/or 12.
2. Erase the fault code memory.

20.2.1.3 Required Actions

Perform the following steps to resolve 057 05.

1. Remove and replace the exhaust brake flap solenoid valve.

NOTE:
The solenoid valve is typically located on the firewall.

2. Erase the fault code memory.

20.2.2 057 06 — Short in the Engine Brake Flap Solenoid Valve and Wiring

Perform the following procedures to troubleshoot a short in the engine brake flap solenoid valve and wiring.

If the engine has no exhaust brake flap, perform the following step:

1. Read Parameter 00601.
   [a] If Parameter 00601 is “Not Active”, contact Detroit Diesel Technical Service Group.
   [b] If Parameter 00601 is “Active”, refer to section 20.2.2.1.

If the engine has an exhaust brake flap, perform the following steps:

1. Measure the resistance between the 55-pin connector wire 12 and vehicle ground. See Figure 20-4.

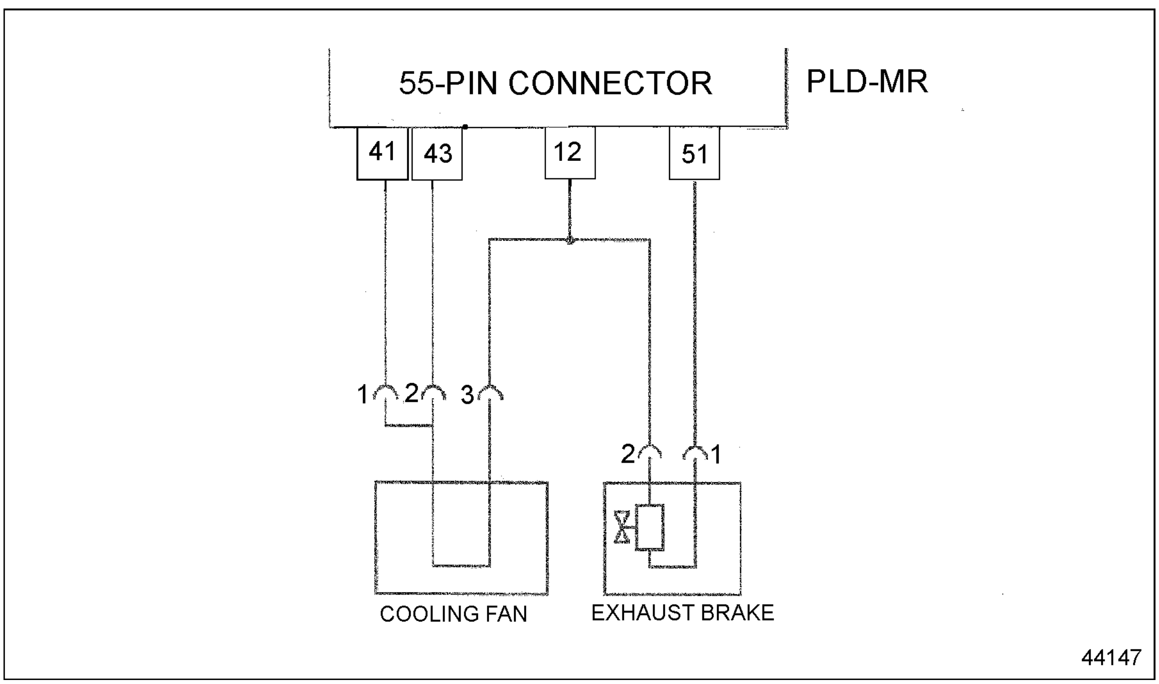


Figure 20-4 Exhaust Brake and Cooling Fan Wiring

[a] If the resistance is less than 30 kΩ, refer to section 20.2.2.2.

[b] If the resistance is greater than or equal to 30 kΩ, contact Detroit Diesel Technical Service Group.

2. Measure the resistance between the 55-pin connector wire 51 and vehicle ground. See Figure 20-4.

   [a] If the resistance is less than 30 kΩ, refer to section 20.2.2.3.

3. Measure the resistance between the 55-pin connector wires 12 and 51. See Figure 20-4.

   [a] If the resistance is less than 3 kΩ, refer to section 20.2.2.4.

4. Unplug the exhaust brake solenoid and read the active fault codes.

   [a] If Fault Code 057 05 is present, refer to section 20.2.2.5.

   [b] If there are no active fault codes, erase the fault code memory and troubleshooting is done.

20.2.2.1 Required Actions

Perform the following steps to resolve 057 06 for an engine with no exhaust brake flap.

1. Set Parameters 00603 and 00604 to “Not Active”.
2. Erase the fault code memory.

20.2.2.2 Required Actions

Perform the following steps to resolve 057 06, short to ground in the 55-pin connector wire 12.

1. Repair the short to ground in the 55-pin connector wire 12.
2. Erase the fault code memory.

20.2.2.3 Required Actions

Perform the following steps to resolve 057 06, short to ground in the 55-pin connector wire 51.

1. Repair the short to ground in the 55-pin connector wire 51.
2. Erase the fault code memory.

20.2.2.4 Required Actions

Perform the following steps to resolve 057 06, short between the 55-pin connector wires 12 and 51.

1. Repair the short between the 55-pin connector wires 12 and 51.
2. Erase the fault code memory.

20.2.2.5 Required Actions

Perform the following steps to resolve 057 06.

1. Remove and replace the exhaust brake flap solenoid valve.

NOTE:
The solenoid valve is typically located on the firewall.

2. Erase the fault code memory.

21 SID 58

Section **Page**

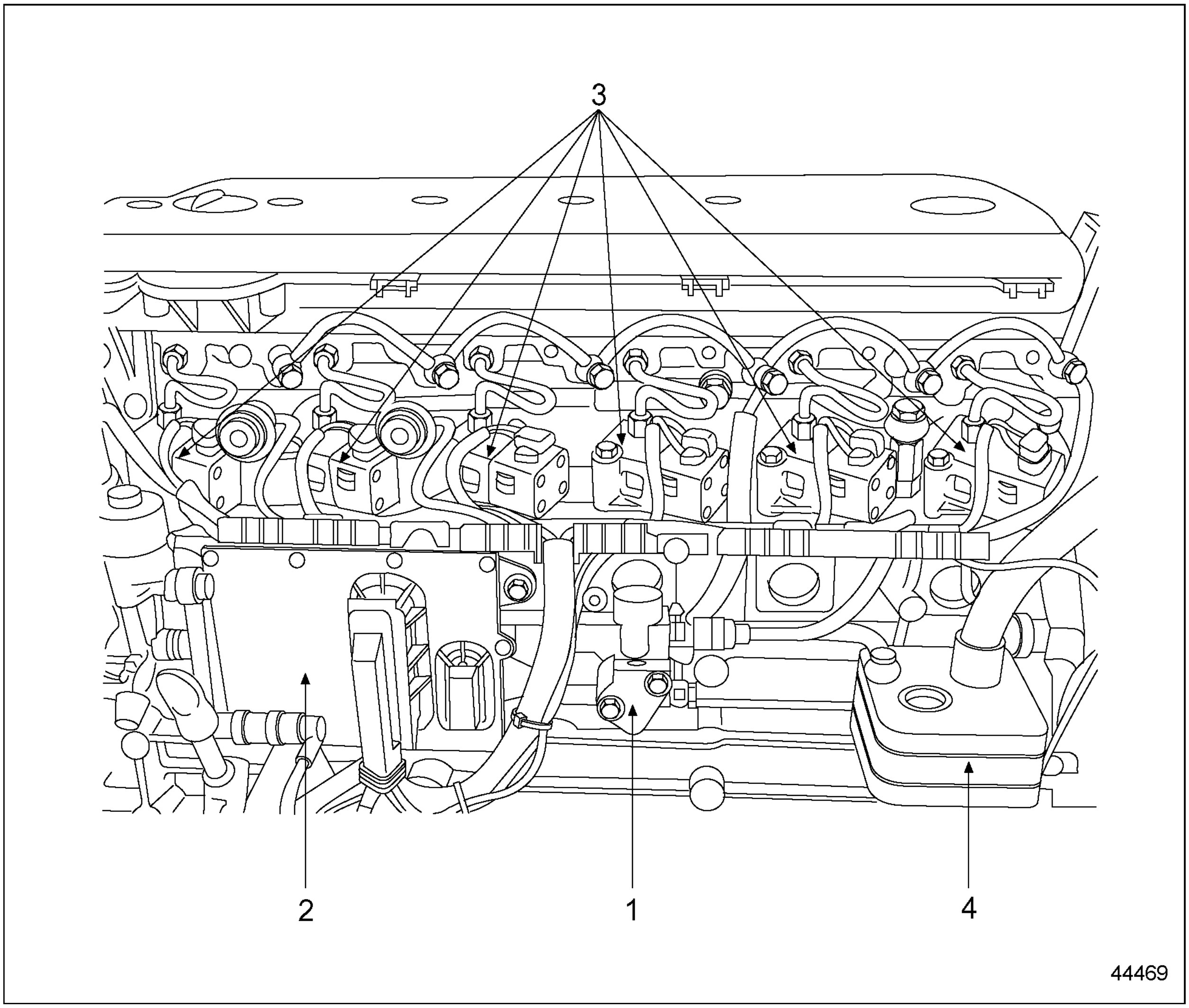
21.1 DESCRIPTION OF SID 58 – ENGINE BRAKE FAULT

SID 58 indicates that a fault occurred during operation of the engine brake.

The diagnostic condition is typically:

- ☐ Constant Throttle Solenoid Valve Short to Power (058 03)
- ☐ Constant Throttle Solenoid Valve Open Circuit (058 05)
- ☐ Constant Throttle Solenoid Valve Short to Ground (058 06)

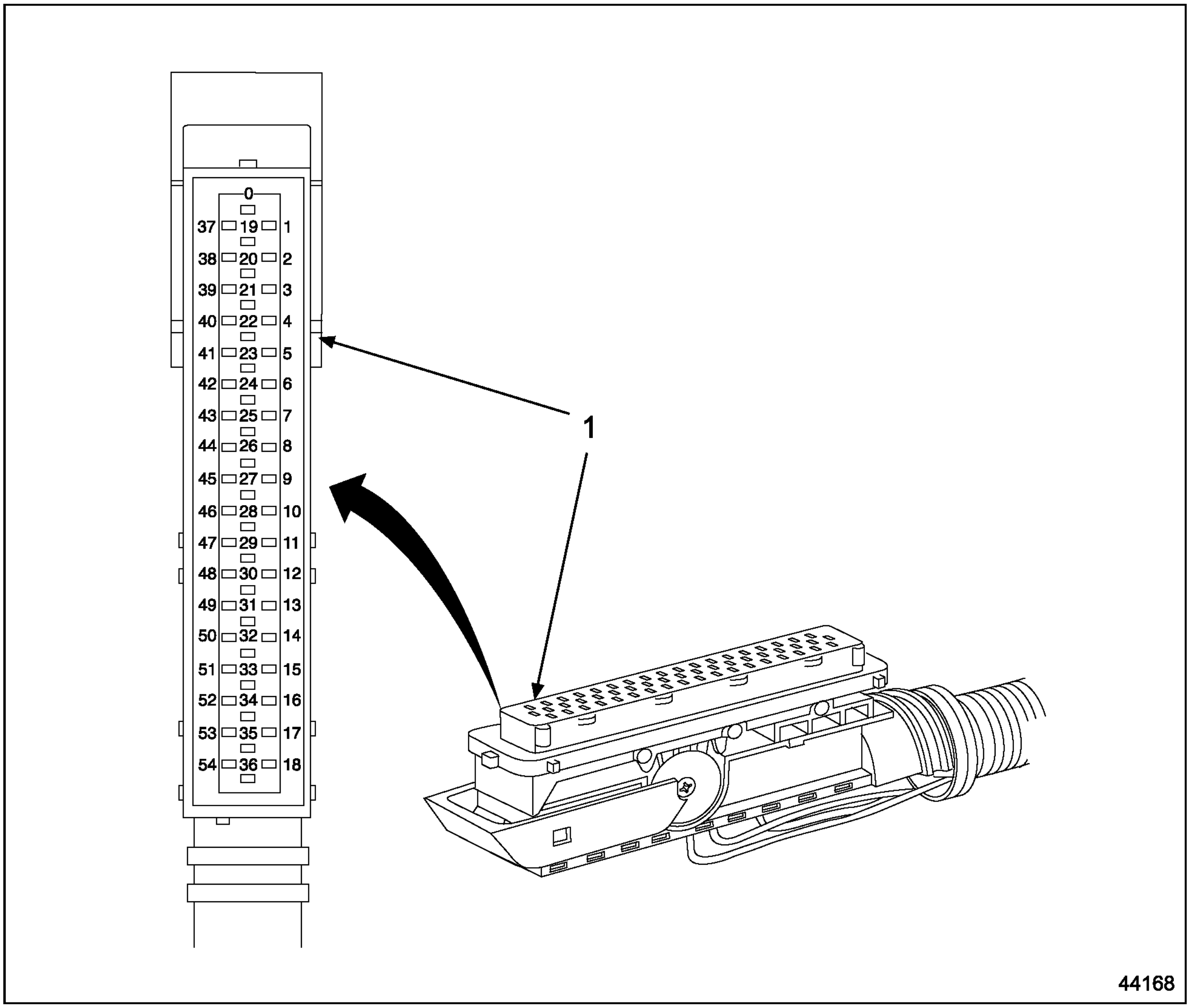
The engine brake function is activated by the constant throttle solenoid valve mounted on the side of the block. See Figure 21-1.



1. Constant Throttle Solenoid Valve
2. PLD-MR
3. Unit Pumps
4. Air Compressor

Figure 21-1 Location of Constant Throttle Solenoid Valve

The constant throttle solenoid valve is linked to the engine PLD-MR through a 2-pin connector harness attached to the large 55-pin connector harness. See Figure 21-2. For the four-cylinder MBE 900 engines, air pressure passing through the constant throttle solenoid valve from the adjacent air compressor enables engine braking during engine operation. For the six-cylinder MBE 900 and MBE 4000 engines, oil pressure enables engine braking.



1. 55-Pin Connector

Figure 21-2 55- Pin Wiring Harness Connector

21.2 TROUBLESHOOTING SID 58

The following procedures will troubleshoot SID 58.

21.2.1 058 03 – Constant Throttle Solenoid Valve Short to Power

Troubleshoot a Constant Throttle Solenoid Valve short to power fault as follows:

1. Determine if the engine has a constant throttle solenoid valve. See Figure 21-1.
   [a] If the engine has a constant throttle solenoid valve, repair short to power in 55-pin connector wire 50. Erase fault code memory. See Figure 21-3.

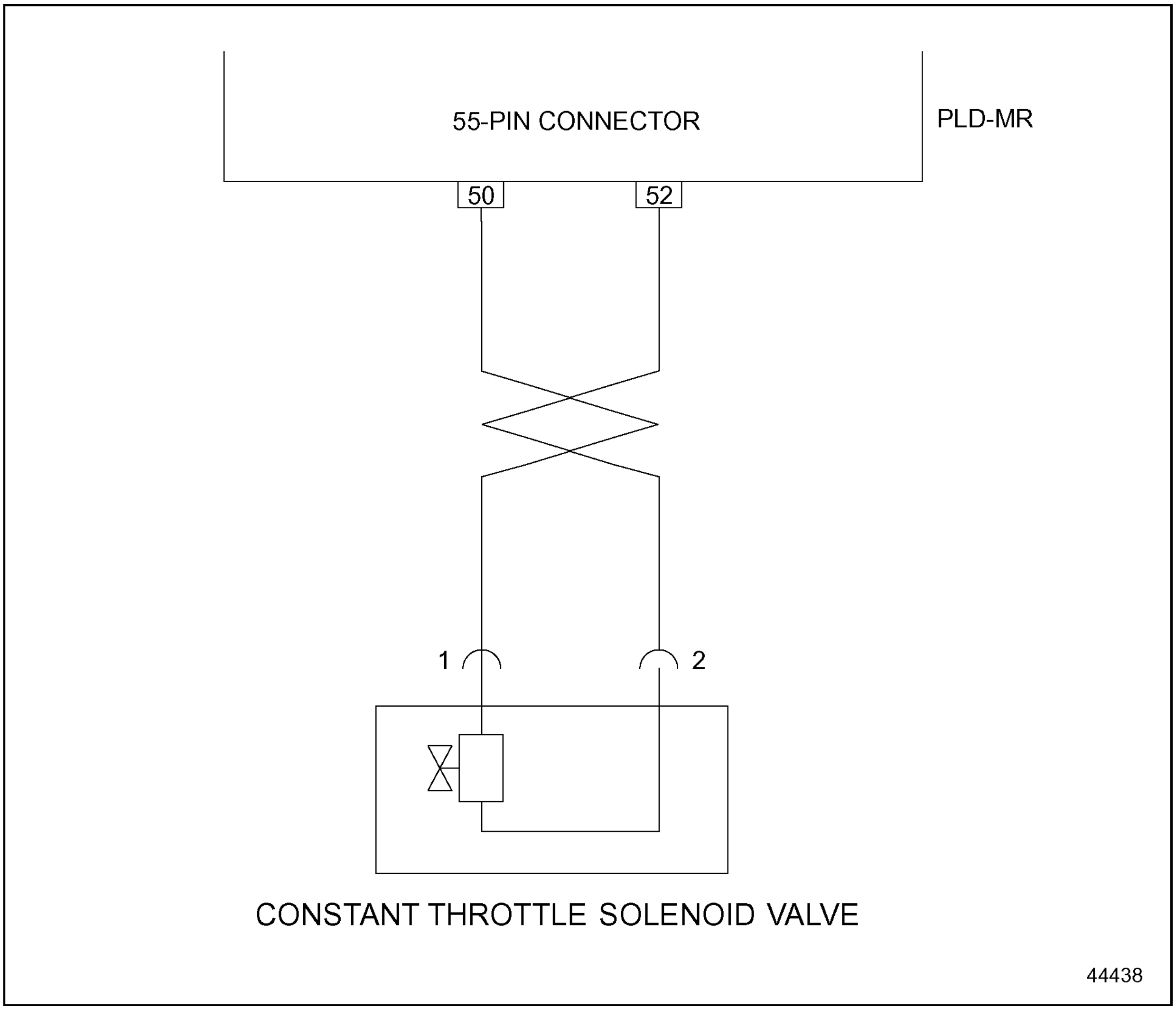


Figure 21-3 Constant Throttle Solenoid Valve Connector Wiring

   [b] If the engine does not have a constant throttle solenoid valve, go to step 2.
2. Check for a setting of Parameter 006 02.

[a] If Parameter 006 02 is not active, contact Detroit Diesel Technical Service.

[b] If Parameter 006 02 is active, set parameters 006 03 and/or 006 04 to “Not Active.” Erase fault code memory.

21.2.2 058 05 – Constant Throttle Solenoid Valve Open Circuit

Troubleshoot a Constant Throttle Solenoid Valve open circuit fault as follows:

1. Determine if the engine has a constant throttle solenoid valve. See Figure 21-1.
   [a] If the engine does not have a constant throttle solenoid valve, go to go to step 2.
   [b] If the engine has a constant throttle solenoid valve, go to step 3.
2. Check for a setting of Parameter 006 02.
   [a] If Parameter 006 02 is not active, contact Detroit Diesel Technical Service.
   [b] If Parameter 006 02 is active, set parameters 006 03 and/or 006 04 to “Not Active.” Erase fault code memory.
3. Bridge wires 1 and 2 on the constant throttle solenoid valve connector. See Figure 21-3.
   [a] If new fault code 058 06 is active, go to step 4.
   [b] If new fault code 058 05 is active, go to step 5.
4. Measure the resistance between wire 52 on the 55-pin connector and vehicle ground. See Figure 21-3.
   [a] If resistance is less than 30 kΩ, repair short to ground in wire 52. Erase fault code memory.
   [b] If resistance is greater than 30 kΩ, repair or replace the constant throttle solenoid valve. Erase fault code memory.
5. Measure the resistance between wire 52 and wire 50 on the 55-pin connector. See Figure 21-3.
   [a] If resistance is less than 3 Ω, contact Detroit Diesel Technical Service.
   [b] If resistance is greater than 3 Ω, repair open circuit or bad contact in wire 50 or 52. Erase fault code memory.

21.2.3 058 06 – Constant Throttle Solenoid Valve Short to Ground

Troubleshoot a Constant Throttle Solenoid Valve short to ground fault as follows:

1. Determine if the engine has a constant throttle solenoid valve. See Figure 21-1.
   [a] If the engine has a constant throttle solenoid valve, go to step 2.
   [b] If the engine does not have a constant throttle solenoid valve, go to step 3.
2. Measure the resistance between wire 50 on the 55-pin connector and vehicle ground. See Figure 21-3.

[a] If resistance is greater than 30 kΩ, contact Detroit Diesel Technical Service.

[b] If resistance is less than 30 kΩ, repair short to ground in wire 50. Erase fault code memory.

[c] If fault code 058 06 is still active, go to step 4.

3. Check for a setting of Parameter 006 02.

   [a] If Parameter 006 02 is not active, contact Detroit Diesel Technical Service.

   [b] If Parameter 006 02 is active, set parameters 006 03 and/or 006 04 to “Not Active.” Erase fault code memory.

4. Measure the resistance between wire 50 and wire 52 on the 55-pin connector. See Figure 21-3.

   [a] If resistance is less than 3 Ω, repair short circuit between wires 50 and 52. Erase fault code memory.

   [b] If fault 058 06 is still active, go to step 5.

5. Unplug the constant throttle solenoid valve .

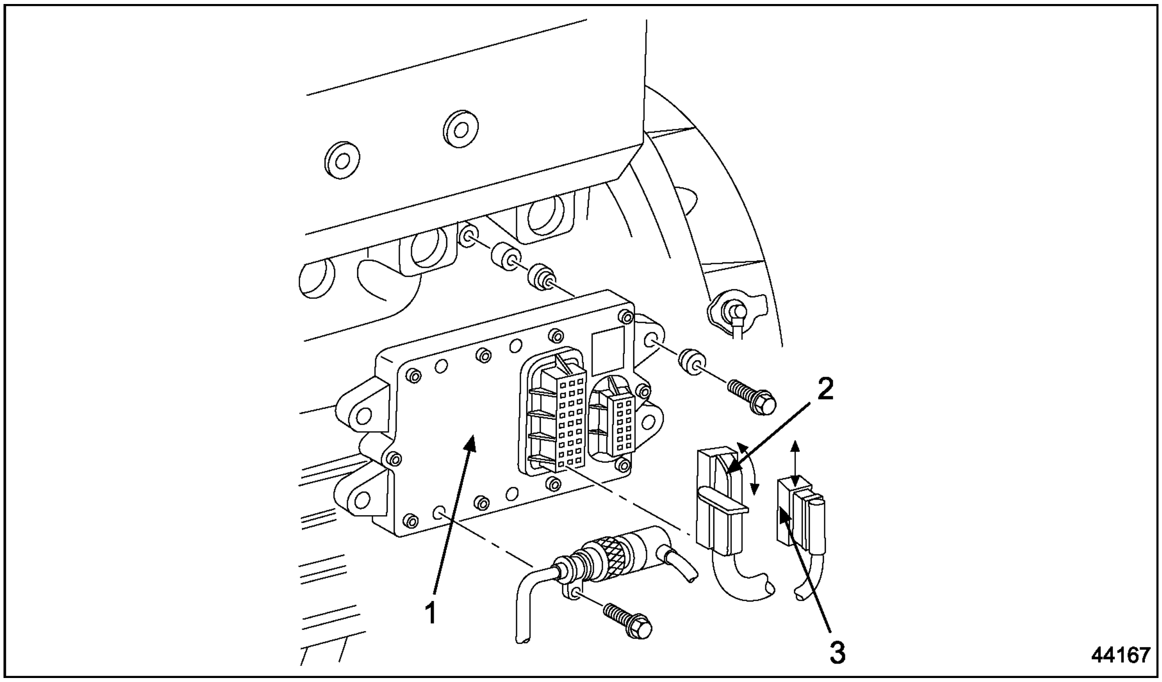
   [a] If new fault code 057 05 is active, repair or replace the constant throttle solenoid valve. Erase fault code memory.

22 SID 59

Section | Page

22.1 DESCRIPTION OF SID 59 – DUAL-SPEED FAN LOW STAGE OPERATION FAULT

SID 59 indicates that a fault occurred during low stage operation of the electronically controlled dual-speed cooling fan. The fan is linked to the engine PLD-MR through the large 55-pin wiring harness connector. See Figure 22-1.



1. PLD-MR (Engine Computer)
2. Large 55-Pin Wiring Harness Connector
3. Small 16-Pin Wiring Harness Connector

Figure 22-1 Location of Wiring Harness Connectors

The fan fault diagnostic condition is typically:

- ☐ Open Circuit (059 05).
- ☐ Short to Ground (059 06).

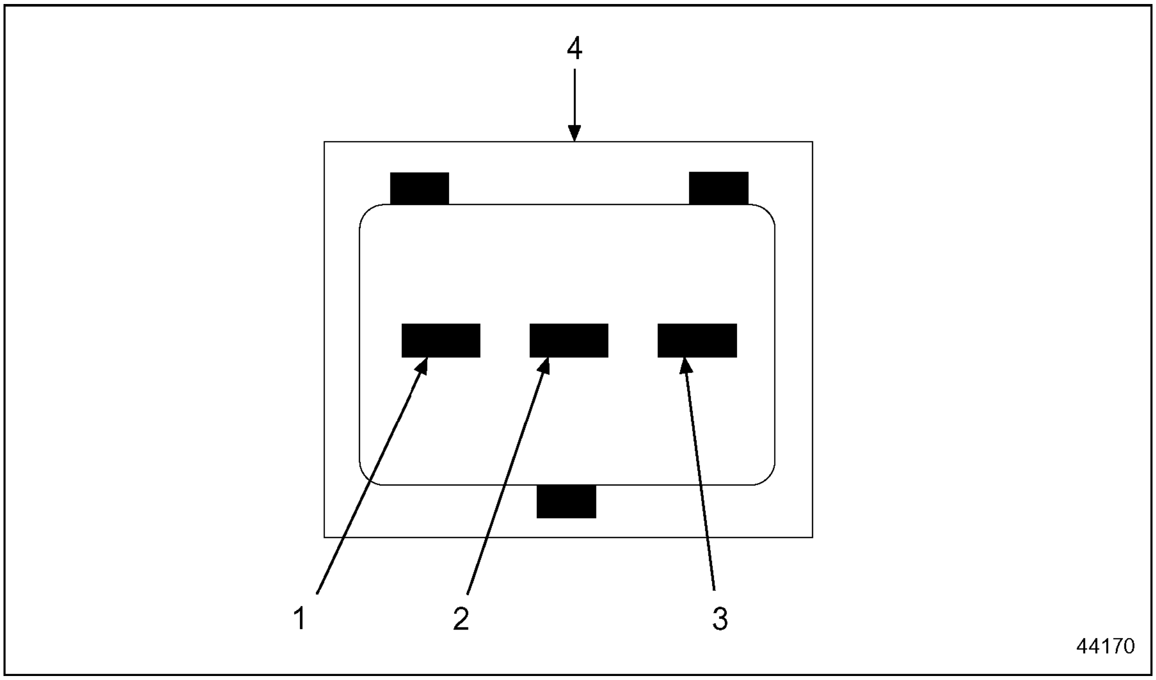
22.2 TROUBLESHOOTING SID 59

The following procedures will troubleshoot SID 59.

22.2.1 059 05 – Fan Open Circuit

Perform the following steps to troubleshoot a fan open circuit fault:

1. Bridge pins 1 and 3 on the fan electrical connector. See Figure 22-2.



1. Pin 1
2. Pin 2
3. Pin 3
4. Fan Connector

Figure 22-2 Pin Locations on Fan Electrical Connector

[a] If new fault code 059 06 is active, repair or replace the fan control clutch. Erase fault code memory.

[b] If new fault code 059 06 is not active, go to step 2.

2. Measure the resistance between wires 41 and 12 on the 55-pin wiring harness connector. See Figure 22-3.

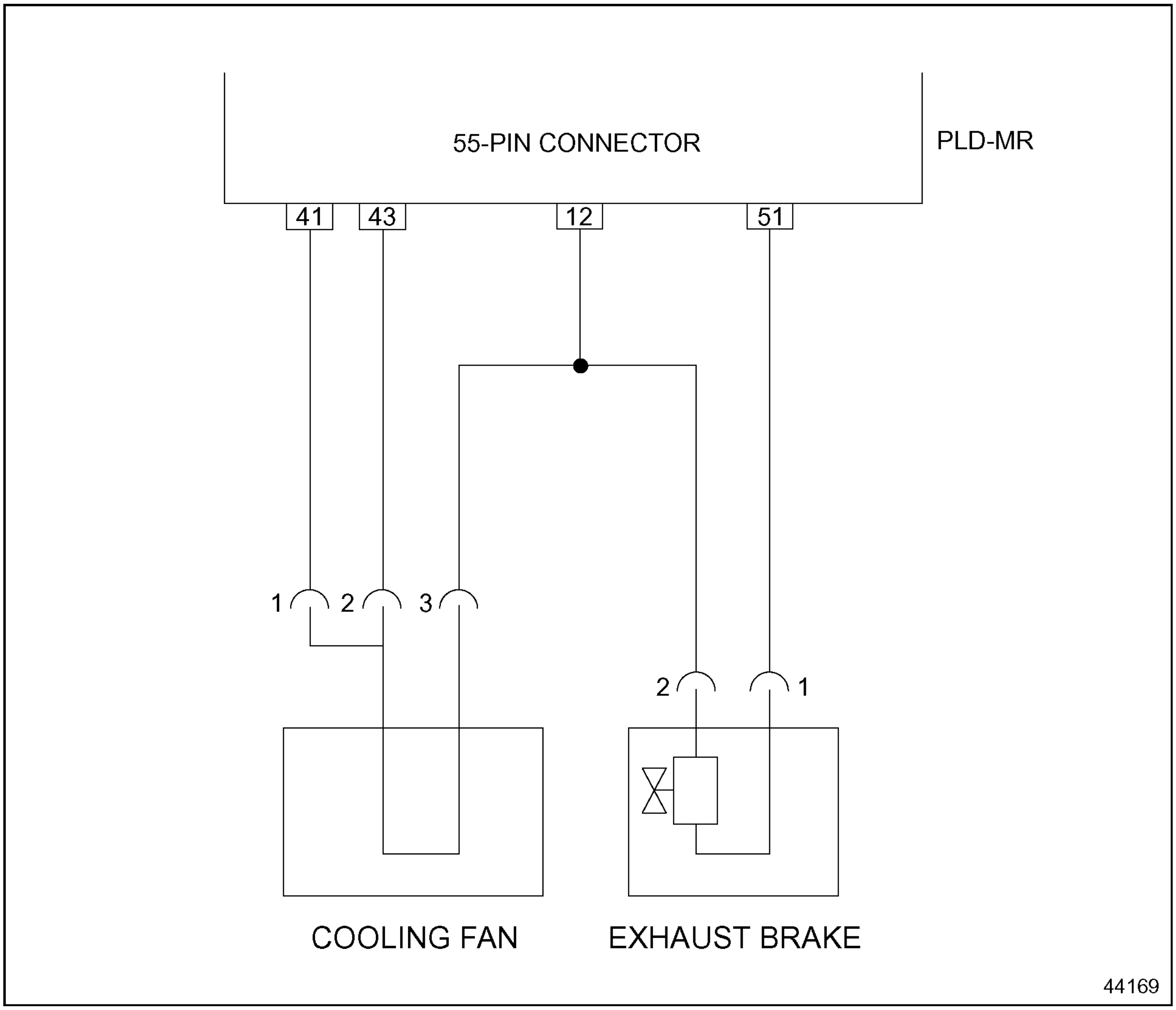


Figure 22-3 Location of Fan Control Wires

[a] If resistance is less than 3 Ω, contact Detroit Diesel Technical Service.

[b] If resistance is greater than 3 Ω, repair open circuit or bad contact in wire 41 or 12. Erase fault code memory.

22.2.2 059 06 – Fan Short to Ground

Perform the following steps to troubleshoot a fan short-to-ground fault:

1. Unplug the fan.

   [a] If new fault code 059 05 is active, repair or replace the fan control clutch. Erase fault code memory.

[b] If new fault code 059 05 is not active, go to step 2.

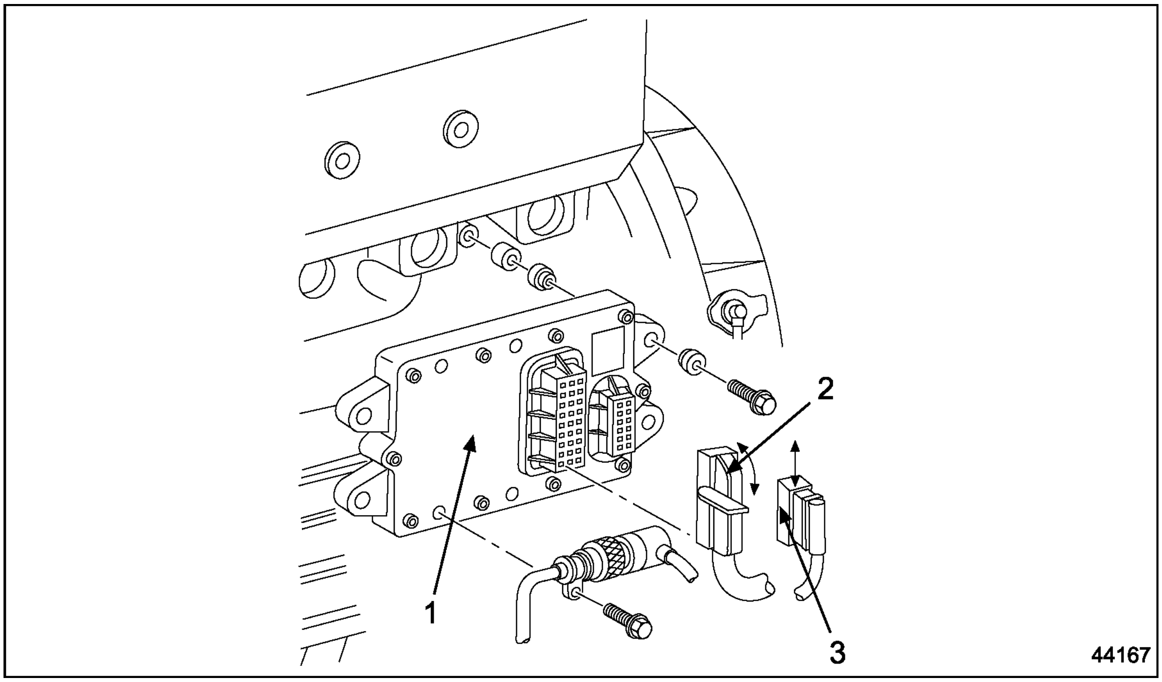
2. Measure the resistance between wires 41 and 12 on the fan electrical connector. See Figure 22-3.
   [a] If resistance is less than 3 Ω, repair short circuit between wires 41 and 12. Erase fault code memory.
   [b] If resistance is greater than 3 Ω, go to step 3.
3. Measure the resistance between wires 43 and 12 on the fan electrical connector. See Figure 22-3.
   [a] If resistance is less than 3 Ω, repair short circuit between wires 43 and 12. Erase fault code memory.
   [b] If resistance is greater than 3 Ω, go to step 4.
4. Measure the resistance between wire 41 on the fan electrical connector and vehicle ground. See Figure 22-3.
   [a] If resistance is less than 30 kΩ, repair short to ground in wire 41. Erase fault code memory.
   [b] If resistance is greater than 30 kΩ, go to step 5.
5. Measure the resistance between wire 43 on the fan electrical connector and vehicle ground. See Figure 22-3.
   [a] If resistance is less than 30 kΩ, repair short to ground in wire 43. Erase fault code memory.
   [b] If resistance is greater than 30 kΩ, contact Detroit Diesel Technical Service.

23 SID 60

Section **Page**

23.1 DESCRIPTION OF SID 60 – DUAL-SPEED FAN HIGH STAGE OPERATION FAULT

SID 060 indicates that a fault occurred during high stage operation of the electronically controlled, dual-speed cooling fan. The fan is linked to the engine PLD-MR through the large 55-pin wiring harness connector. See Figure 23-1 for PLD-MR and wiring harness connector locations.



1. PLD-MR (Engine Computer)
2. Large Wiring Harness Connector (55 Pin)
3. Small Wiring Harness Connector (16 Pin)

Figure 23-1 Location of Wiring Harness Connectors

The fan fault diagnostic condition is typically:

- ☐ Open Circuit (060 05)
- ☐ Short to Ground (060 06)

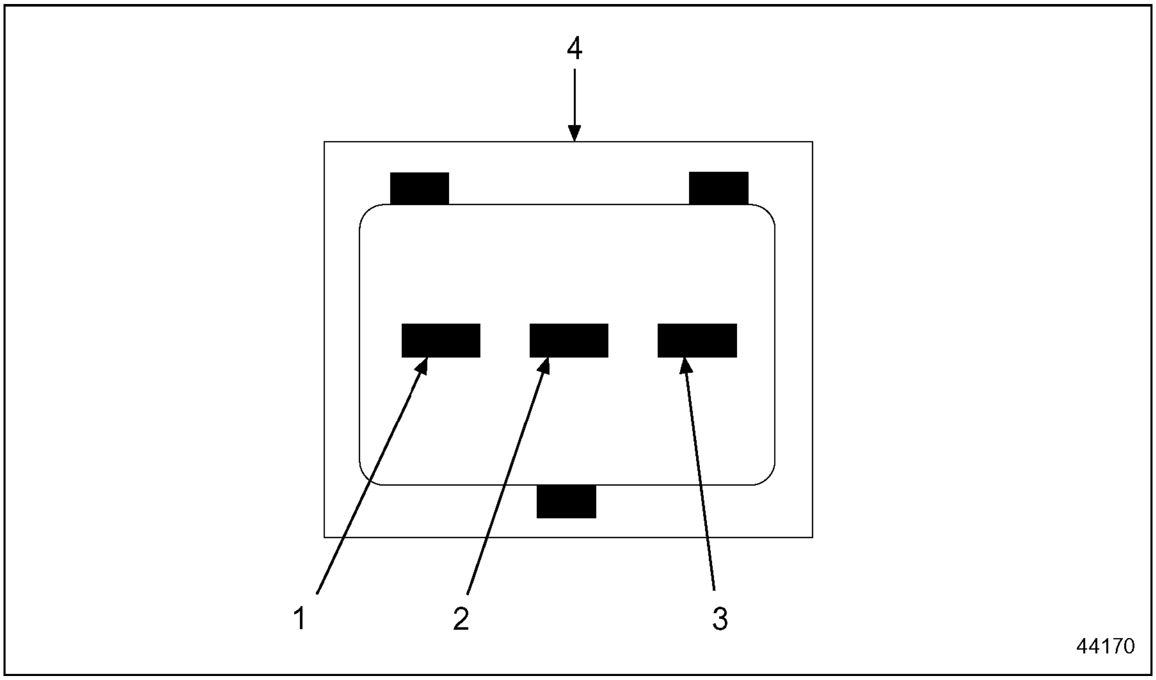
23.2 TROUBLESHOOTING SID 60

The following procedures will troubleshoot SID 60.

23.2.1 060 05 – Fan Open Circuit

Perform the following steps to troubleshoot a fan open circuit fault.

1. Bridge pins 2 and 3 on the fan electrical connector. See Figure 23-2.



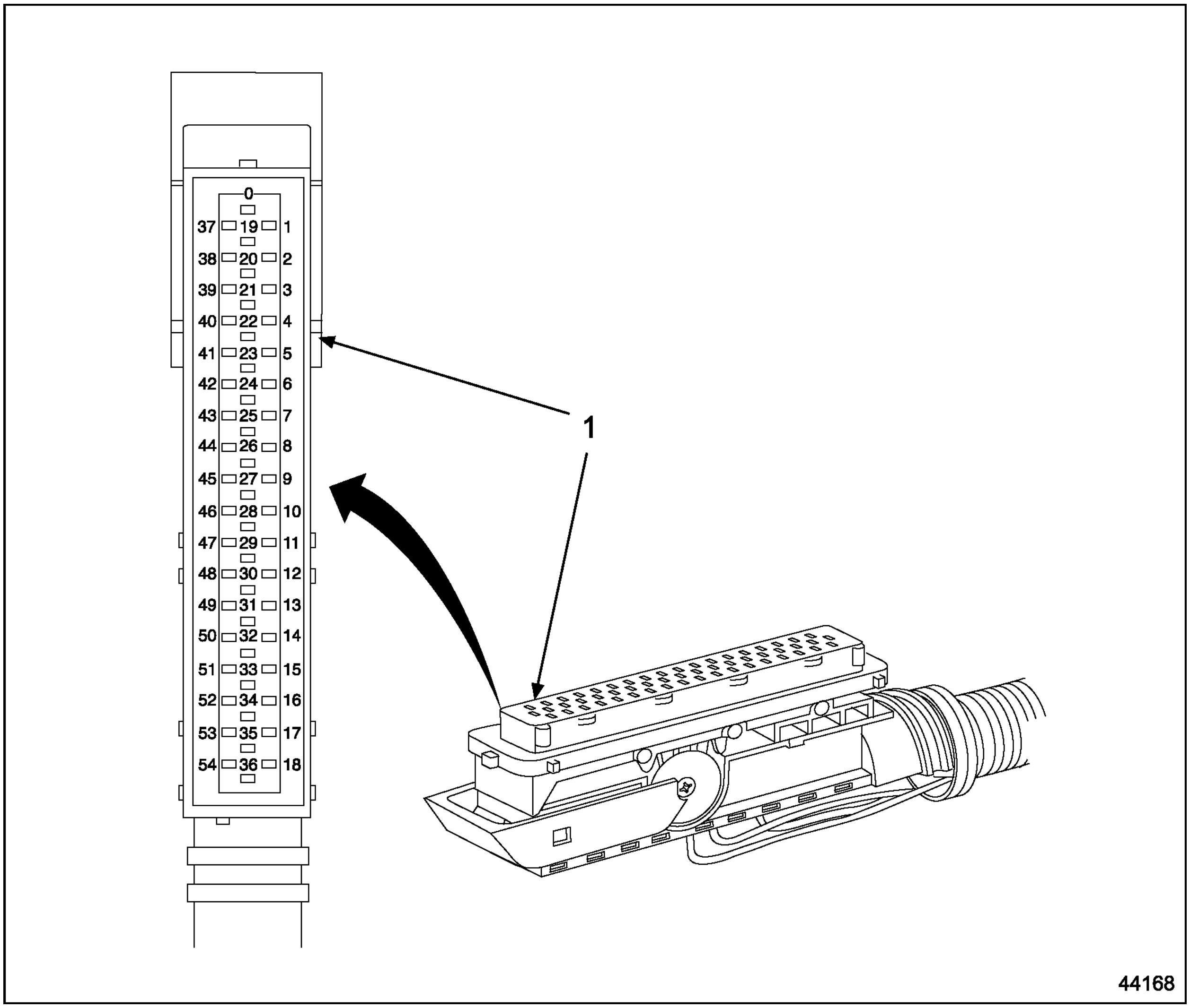
1. Pin 1
2. Pin 2
3. Pin 3
4. Fan Connector

Figure 23-2 Pin Locations on Fan Electrical Connector

[a] If code 060 06 is active, repair or replace the fan control clutch. Erase fault code memory.

[b] If code 060 06 is not active, go to step 2.

2. Measure resistance between pins 43 and 12 on the 55-pin connector. See Figure 23-3 and see Figure 23-4.



1. 55-Pin Wiring Harness Connector

Figure 23-3 55-Pin Wiring Harness Connector

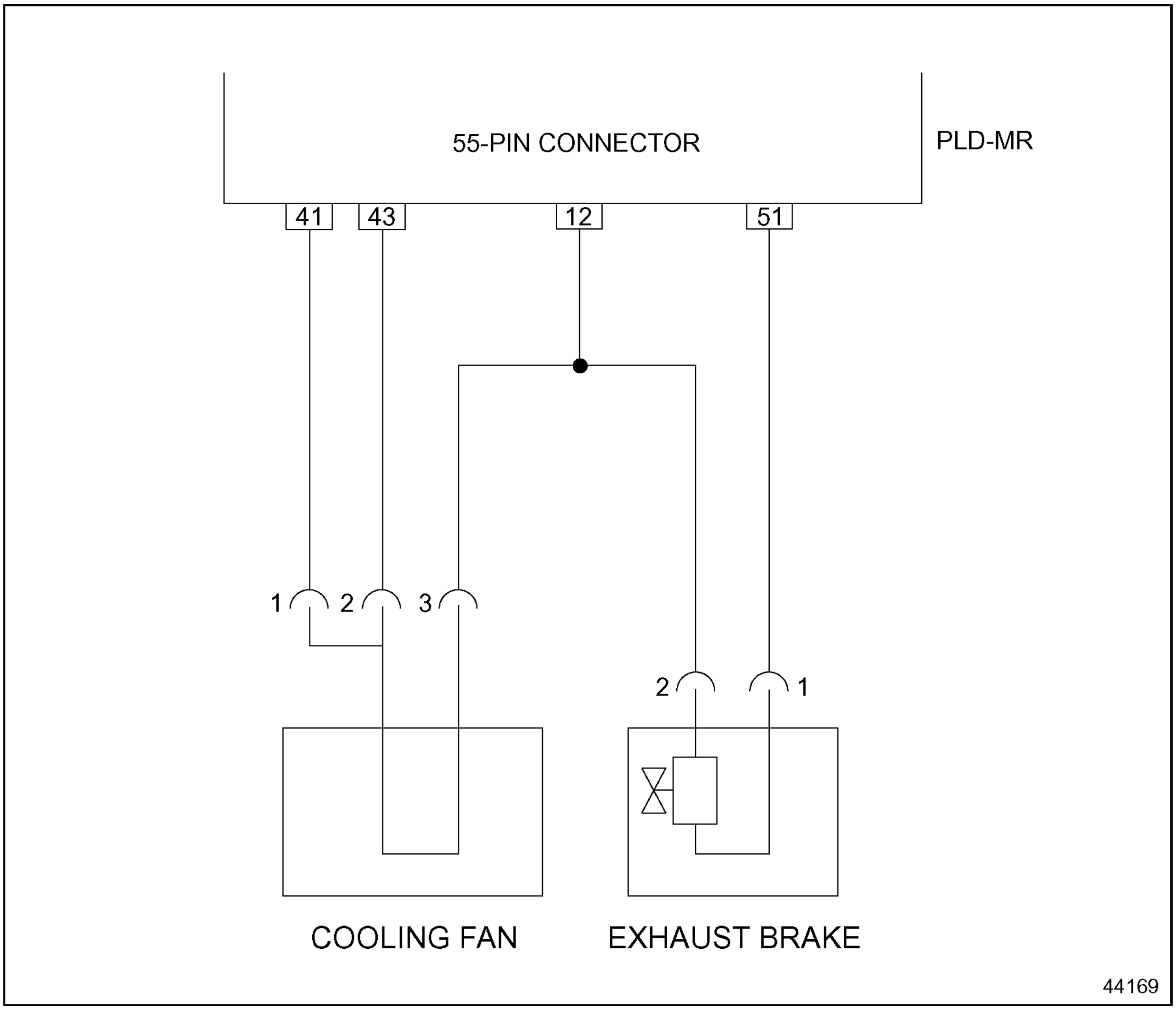


Figure 23-4 Location of Fan Control Wires

[a] If resistance is less than 3 Ω, contact Detroit Diesel Technical Service.

[b] If resistance is greater than 3 Ω, repair open circuit in wire 43 or wire 12 on the 55-pin connector. Erase fault code memory.

23.2.2 060 06 – Fan Short to Ground

Perform the following steps to troubleshoot a fan short to ground fault:

1. Unplug cooling fan.

   [a] If new fault 060 05 is active when the cooling fan is unplugged, repair or replace the fan control clutch. Erase fault code memory.

   [b] If new fault 060 05 is not active when the cooling fan is unplugged, go to step 2.

2. Measure the resistance between wire 41 and wire 12 on the 55-pin connector. See Figure 23-4.

[a] If the resistance is less than 30 kΩ, repair short circuit between wire 41 and wire 12 on the 55-pin connector. Erase fault code memory.

[b] If resistance is greater than 30 kΩ, go to step 3.

3. Measure the resistance between wire 43 and wire 12 on the 55-pin connector. See Figure 23-4.

   [a] If resistance is less than 30 kΩ, repair short circuit between wire 43 and wire 12 on the 55-pin connector. Erase fault code memory.

   [b] If resistance is greater than 30 kΩ, go to step 4.

4. Measure the resistance between wire 43 and vehicle ground.

   [a] If resistance is greater than 30 kΩ, contact Detroit Diesel Technical Service.

   [b] If resistance is less than 30 kΩ, repair short to ground in wire 43 of the 55-pin connector. Erase fault code memory.

24 SID 64

Section | Page

24.1 DESCRIPTION OF SID 64 — CAMSHAFT POSITION SENSOR FAULT

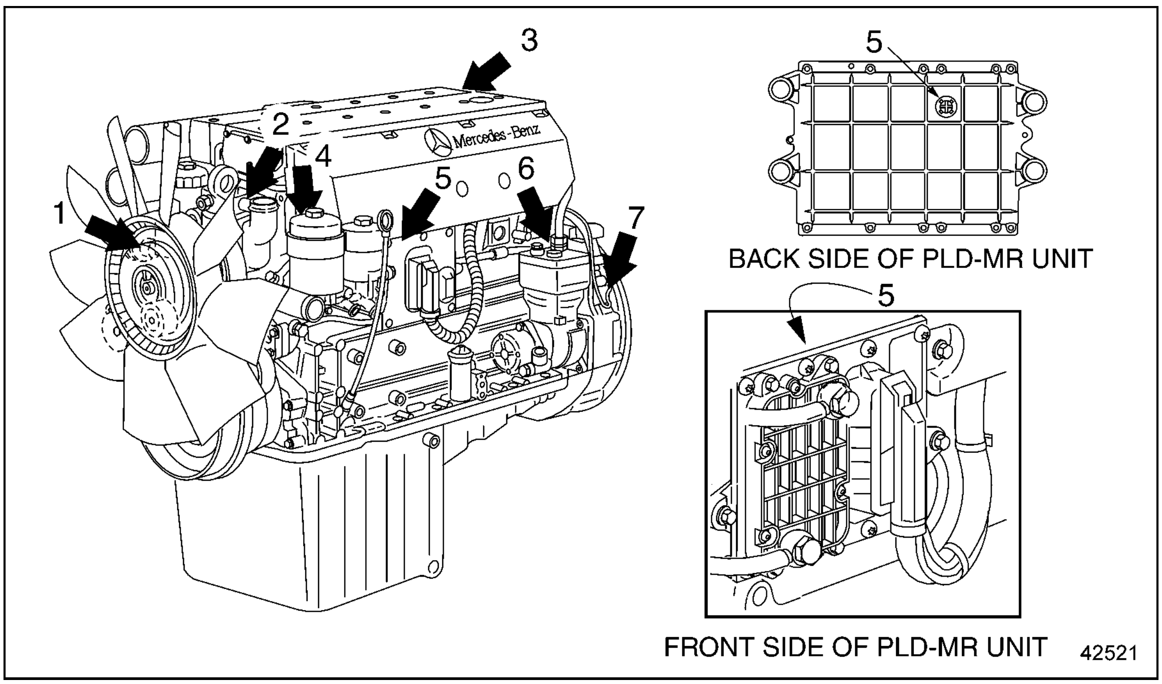
SID 64 indicates that during engine operation, a fault occurred with the camshaft position sensor.

The Camshaft Position sensor (CMP sensor) senses camshaft position. The camshaft position is used to calculate crankshaft position, specific cylinder positions, and engine speed for functions such as fuel control strategy.

The diagnostic condition is typically:

- ☐ Open Circuit (64 03)
- ☐ Short to Ground (64 04)
- ☐ Time Out (64 08)
- ☐ Pins Swapped (64 14)

See Figure 24-1 for the sensor locations on the MBE 900 engine.



1. Oil Combination Sensor
2. Engine Coolant Temperature Sensor
3. Boost Air Combination Sensor
4. Supply Fuel Temperature Sensor
5. Barometric Pressure Sensor (Integrated into PLD-MR)
6. Camshaft Position Sensor
7. Crankshaft Position Sensor

Figure 24-1 Sensor Location on the MBE 900 Engine

See Figure 24-2 for typical MBE 900 engine harness.

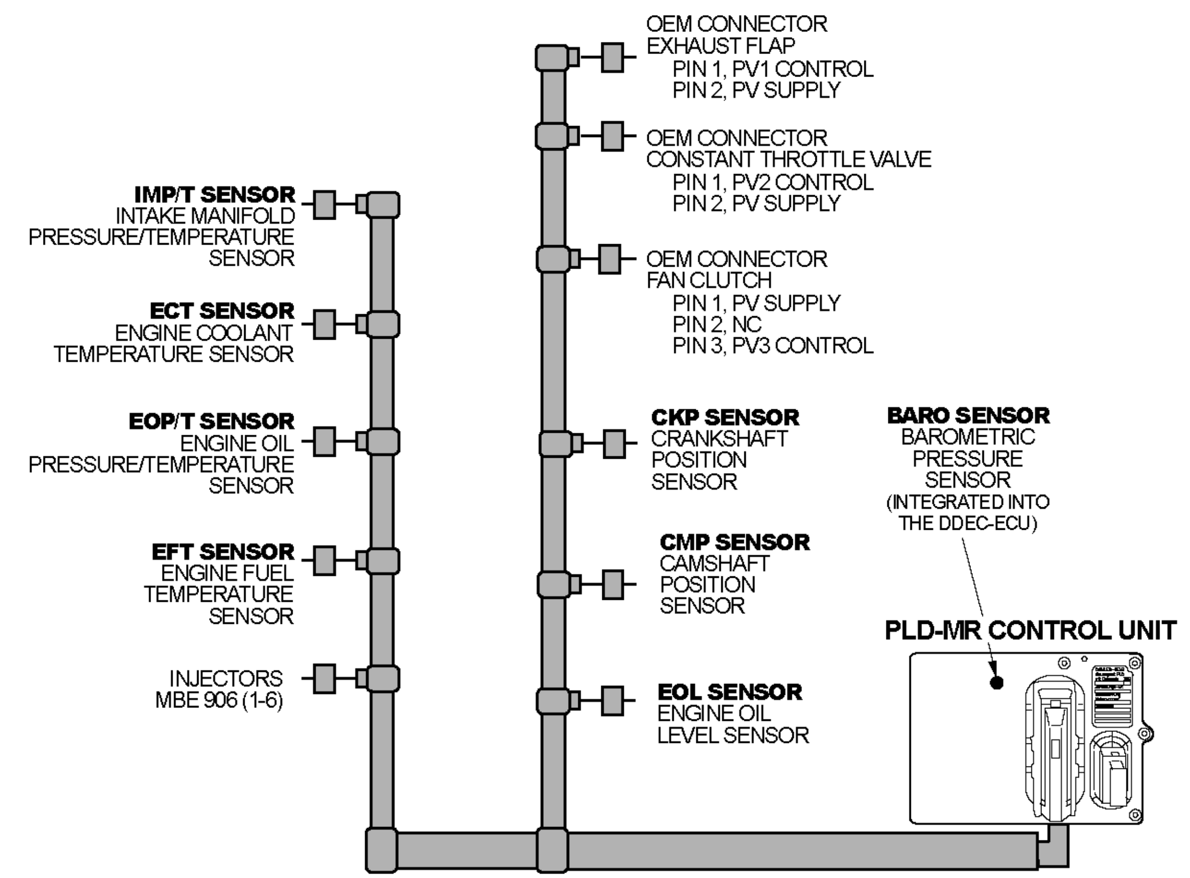
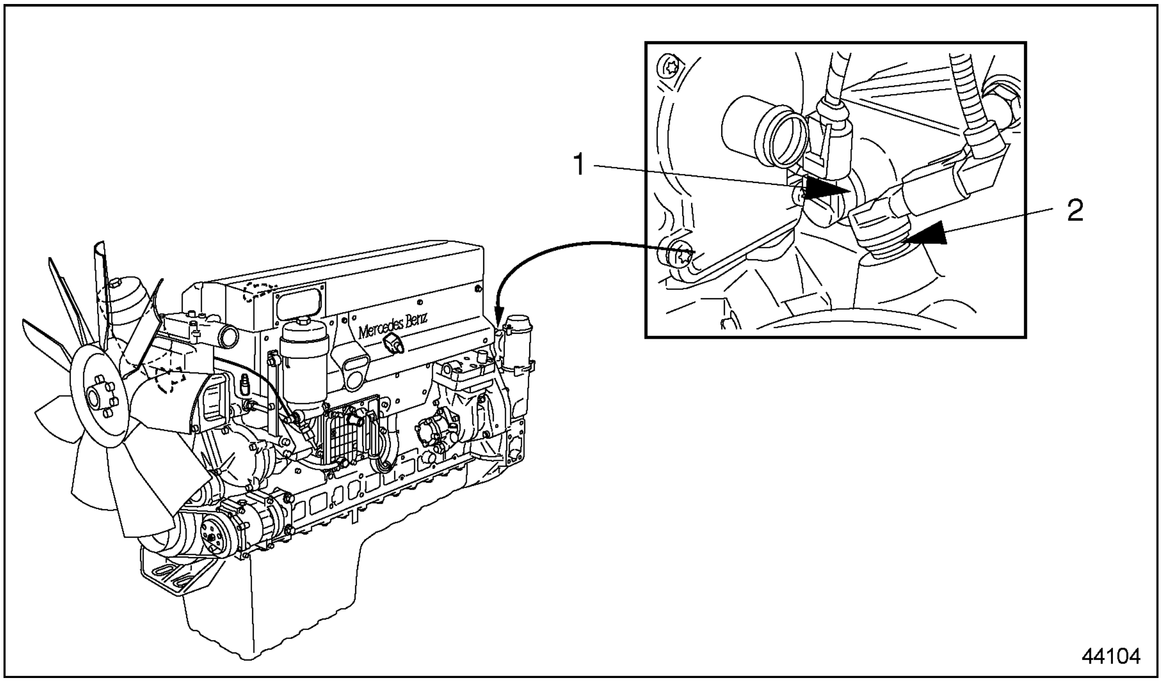


Figure 24-2 Typical MBE 900 Engine Harness

See Figure 24-3 for the location of the MBE 4000 camshaft/crankshaft sensors.



1. Camshaft Position Sensor
2. Crankshaft Position Sensor

Figure 24-3 Sensor Location on the MBE 4000 Engine

See Figure 24-4 for a typical MBE 4000 engine harness.

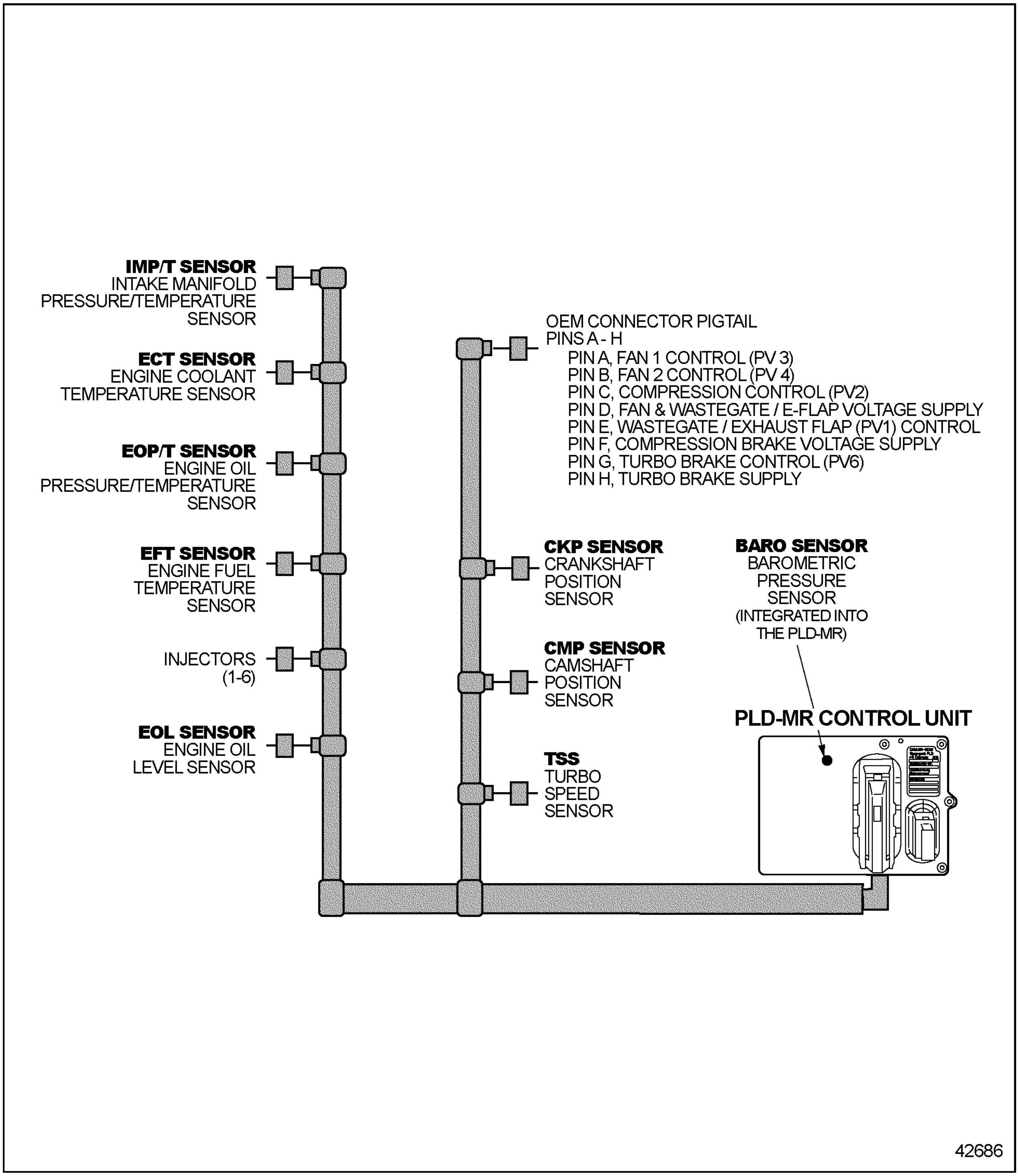
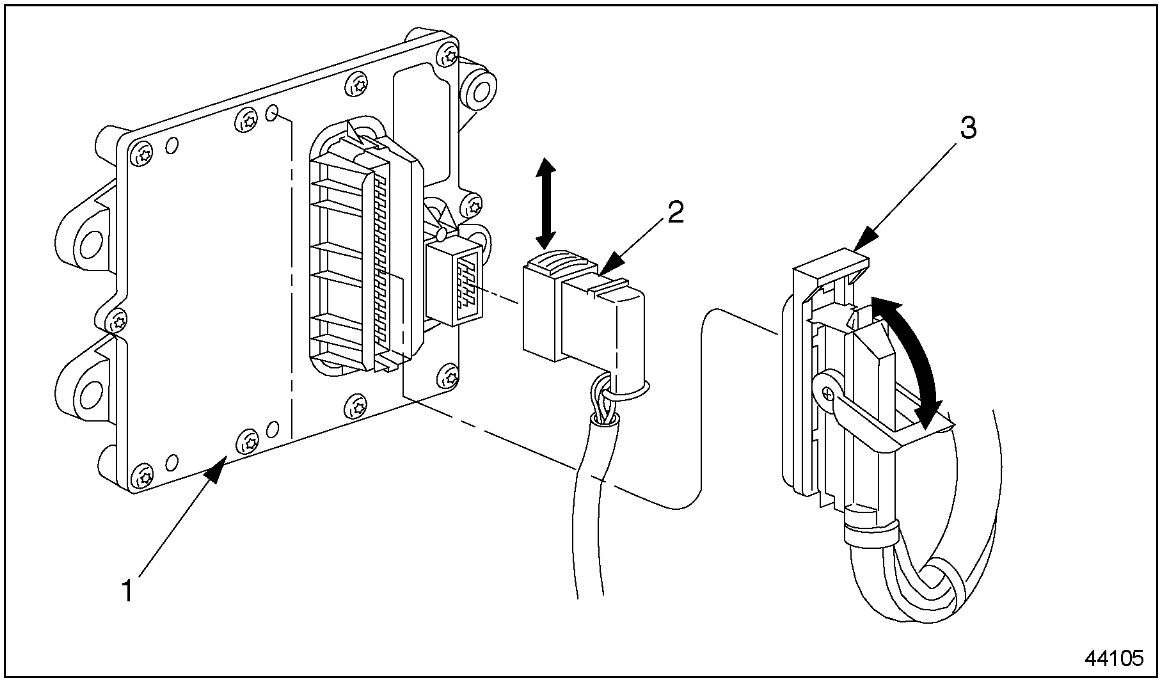


Figure 24-4 Typical MBE 4000 Engine Harness

See Figure 24-5 for the 55-pin and 16-pin connectors.



1. PLD-MR
2. Engine Electrical Connector (55-pin)
3. Vehicle Electrical Connector (16-pin)

Figure 24-5 PLD-MR and Harness Connectors

24.2 TROUBLESHOOTING SID 64

The following procedure will troubleshoot SID 64.

24.2.1 064 03 – Open Circuit

Perform the following steps to troubleshoot an open circuit.

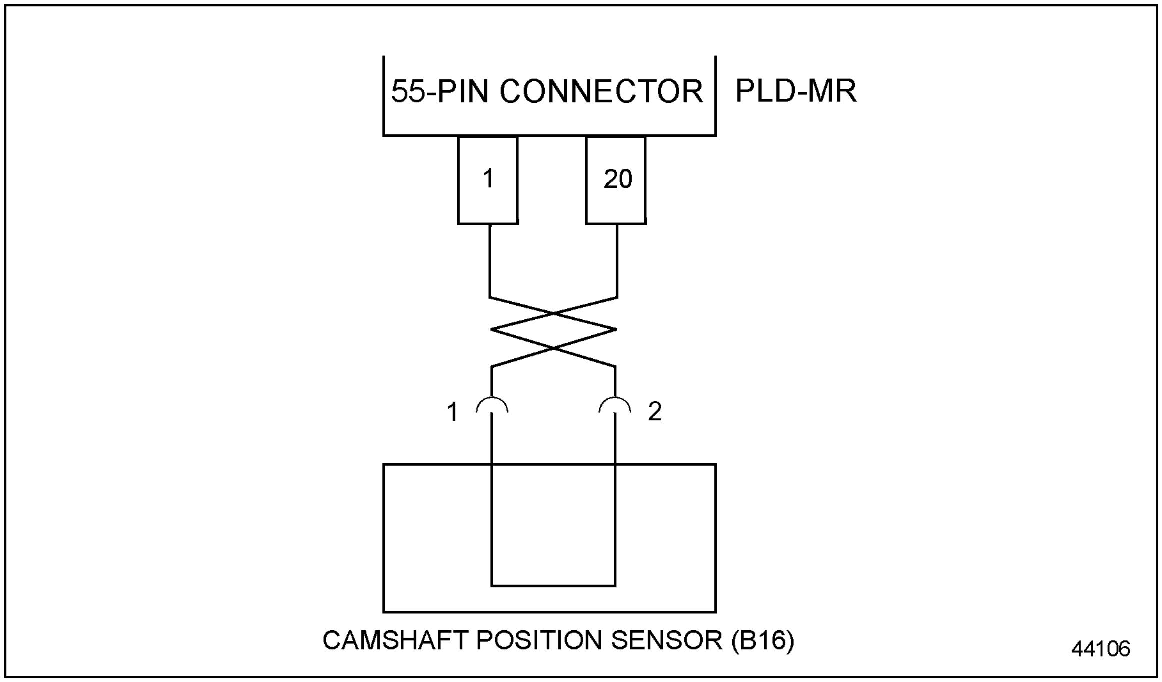


Figure 24-6 PLD-MR — Camshaft Position Sensor Schematic

1. Bridge pins 1 and 20 of the 55-pin connector and check for active fault codes. See Figure 24-6.
   [a] If no new fault codes were active, go to step 2.
   [b] If a new fault code 064 04 is active, refer to section 24.2.1.1.
2. Check for active codes.
   [a] If fault code 064 03 was active, refer to section 24.2.1.2.
   [b] If fault code 064 03 was not active, refer to section 24.2.1.3.

24.2.1.1 Required Actions

Perform the following steps to resolve an open circuit.

1. Replace the camshaft position sensor and the clamping sleeve.
2. Erase the fault code memory.

24.2.1.2 Required Actions

Perform the following steps to resolve an open circuit.

1. Contact Detroit Diesel Technical Service for authorization to replace the PLD-MR. Set parameter on new PLD-MR.
2. Erase the fault code memory.

24.2.1.3 Required Actions

Perform the following steps to resolve an open circuit.

1. Inspect the contacts for damage and repair as necessary.
2. Erase the fault code memory.

24.2.2 064 04 – Short to Ground

Perform the following step to troubleshoot a short to ground.

1. Check the engine speed sensor for reversed polarity and check for active codes.
   [a] If the polarity is correct and fault code 064 14 was not active, go to step 2.
   [b] If the polarity is not correct and fault code 064 04 was active, refer to section 24.2.2.1.
2. Check the engine speed sensor for reversed polarity and check for active codes.
   [a] If the polarity is correct and fault code 064 14 was active, go to step 5.
   [b] If the polarity is not correct and fault code 064 14 was not active, go to step 3.
3. Disconnect 55-pin connector and check for active codes.
   [a] If fault code 064 03 was not active, go to step 5.
   [b] If fault code 064 03 was active, refer to section 24.2.2.2.
4. Reconnect the 55-pin connector.
5. Visually inspect the 55-pin connector for damage and check for active codes.
   [a] If fault code 064 04 was not active, refer to section 24.2.3.
   [b] If fault code 064 04 was active, refer to section 24.2.2.3.
6. Reconnect the 55-pin connector.

24.2.2.1 Required Actions

Perform the following steps to resolve a short to ground.

1. Ensure that the camshaft position sensor wires are properly connected (not crossed) on the 55-pin connector. Repair as necessary. See Figure 24-6.
2. Erase the fault code memory.

24.2.2.2 Required Actions

Perform the following steps to resolve a short to ground.

1. Refer to section 7.2 to troubleshoot fault code 100 04.

NOTE:
A faulty oil pressure sensor will cause erratic codes.

2. Erase fault code memory.

24.2.2.3 Required Actions

Perform the following steps to resolve a short to ground.

1. Contact Detroit Diesel Technical Service for authorization to replace the PLD-MR.
2. Set parameters on the new PLD-MR.
3. Erase fault code memory.

24.2.3 064 08 – Time Out

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 064 03 and 064 08 are not active, go to step 5.
   - [b] If fault codes 064 03 and 064 08 are active, refer to section 24.2.3.1.
3. Shutdown the engine.
4. Start and run the engine.
5. Check for active fault codes.
   - [a] If fault codes 064 04 and 064 08 are not active, go to step 7.
   - [b] If fault codes 064 04 and 064 08 are active, refer to section 24.2.3.2.
6. Shutdown the engine.
7. Start and run the engine.
8. Ensure that the sensor is correctly positioned and check for active codes.
   - [a] If the sensor position is correct and fault code 064 08 are active, refer to section 24.2.4.
   - [b] If the sensor position is incorrect and fault code 064 08 is not active, refer to section 24.2.3.3.
9. Shutdown the engine.
10. Ensure that the sensor is correctly positioned and check for active codes.

[a] If the sensor position is correct and fault code 064 08 is active, refer to section 24.2.3.4.

[b] If the sensor position is incorrect and fault code 064 08 is not active, refer to section 24.2.3.3.

24.2.3.1 Required Actions

Perform the following steps to resolve a time out.

1. Troubleshoot active fault code 064 03. Refer to section 24.2.1.
2. Erase the fault code memory.

24.2.3.2 Required Actions

Perform the following step to resolve a time out.

1. Troubleshoot for active fault code 064 04. Refer to section 24.2.2.

24.2.3.3 Required Actions

Perform the following steps to resolve a time out.

1. Remove and replace the camshaft sensor sleeve.
2. Erase the fault code memory.

24.2.3.4 Required Actions

Perform the following steps to resolve a time out.

1. Remove the camshaft sensor and ensure that the sensor bores are not damaged. If damaged is present, repair as necessary.
2. Check the camshaft sensor for proper axial play. Repair as necessary if the axial play is incorrect.
3. Erase the fault code memory.

24.2.4 064 14 – Pins Swapped

Perform the following step to troubleshoot pins swapped.

1. Check the engine speed sensor for reversed polarity and check for active codes.

   [a] If fault code 064 14 was not active, erase the fault code memory.

   [b] If fault code 064 14 is active, refer to section 24.2.4.1.

24.2.4.1 Required Actions

Perform the following steps to resolve a pins swapped. See Figure 24-7.

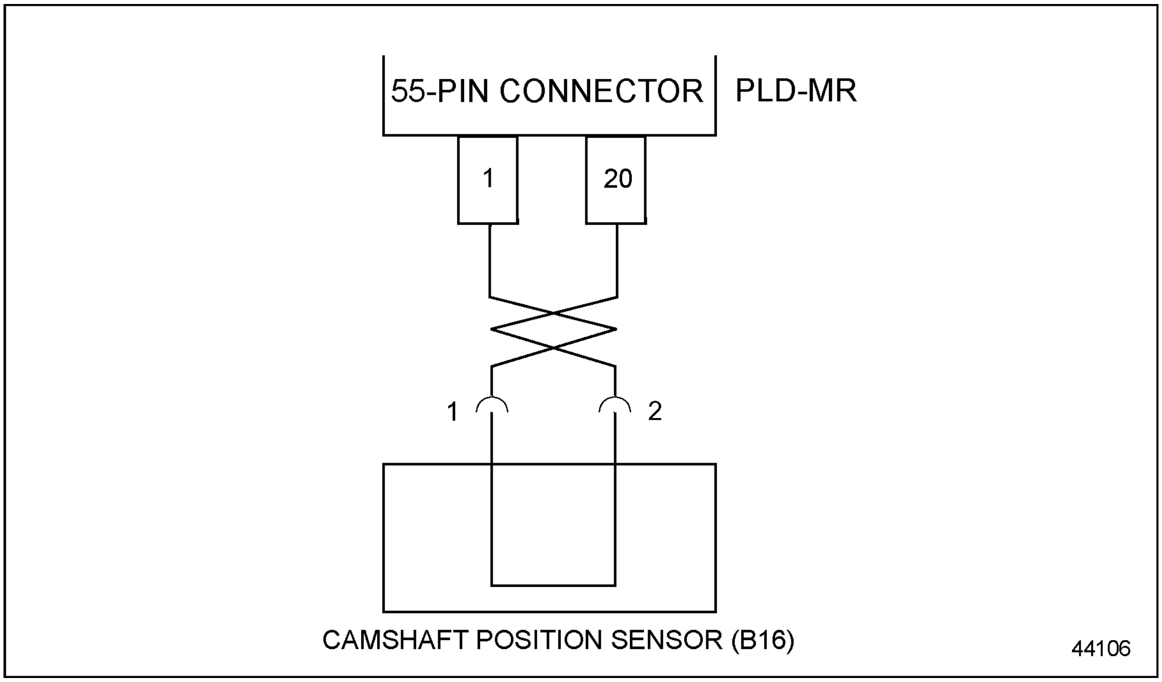


Figure 24-7 Camshaft Position Sensor

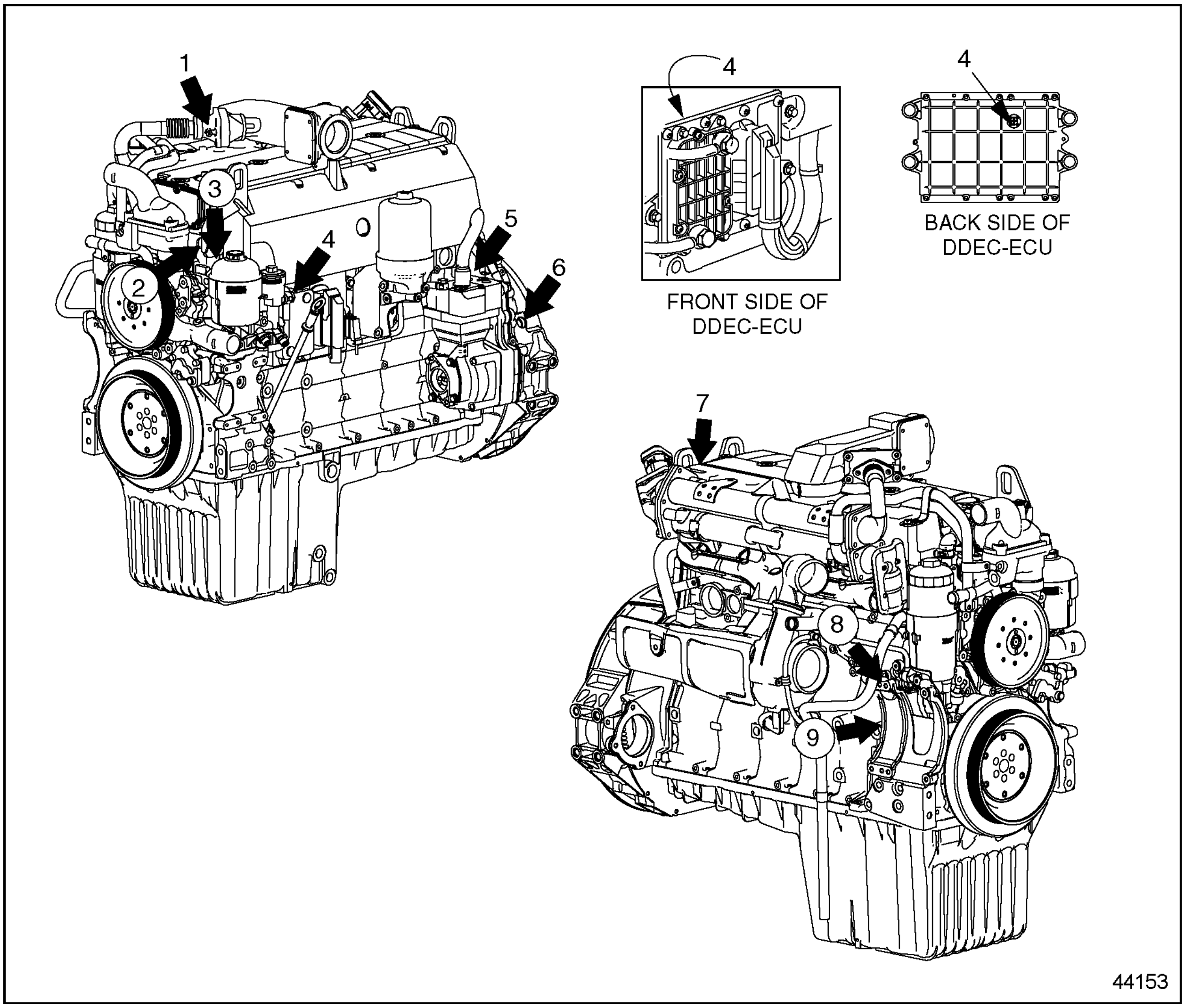
1. Reseat the camshaft (B16) and crankshaft (B15) sensors.
2. Ensure that the 55-pin connector wires are not crossed. If crossed, repair as necessary.
3. Erase the fault code memory.

25 SID 146

Section **Page**

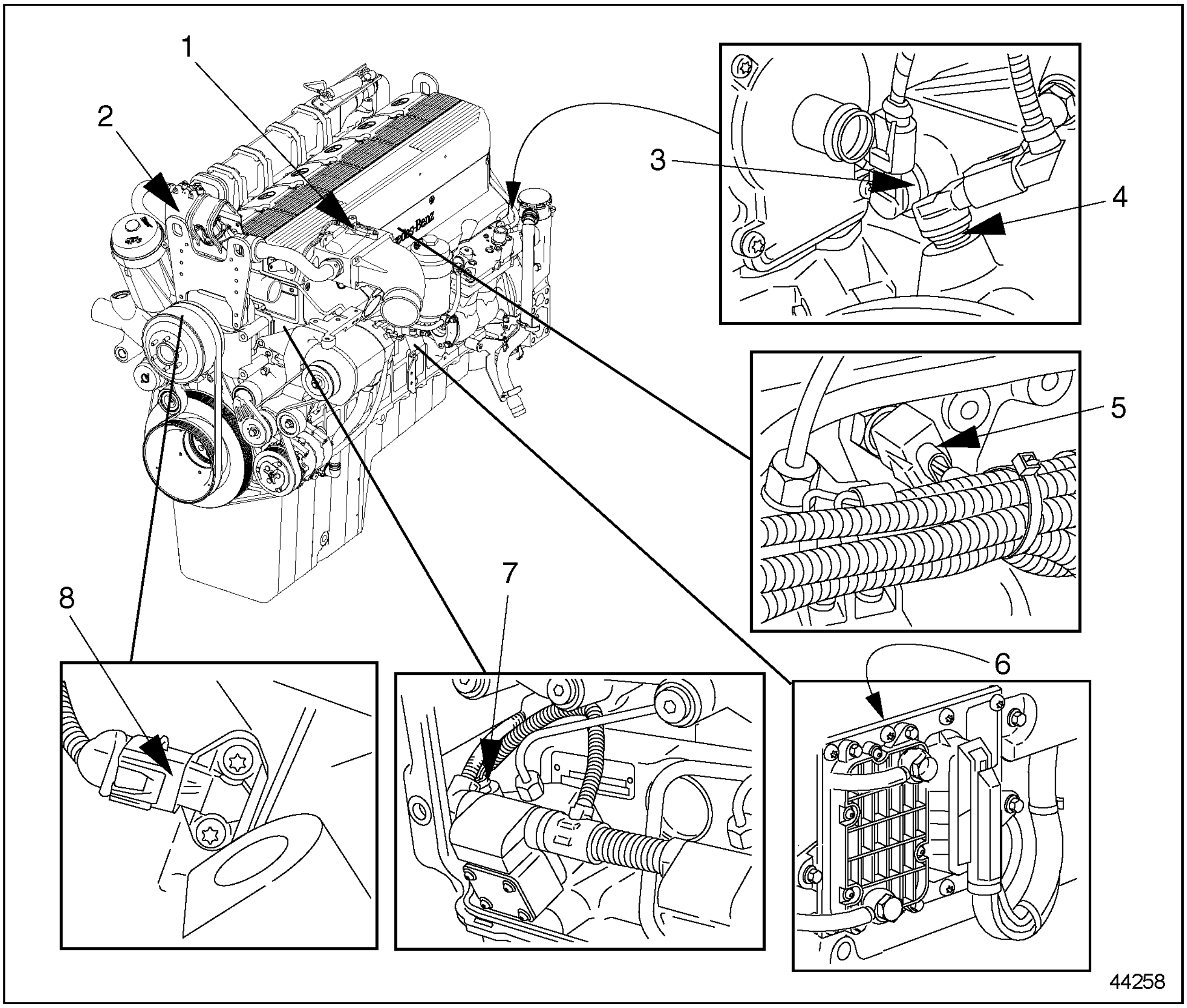
25.1 DESCRIPTION OF SID 146 EGR SYSTEM FAULT

The EGR Temperature Sensor is located in the EGR supply tube on the top front section of the engine. See Figure 25-1 for the MBE 900 engine and Figure 25-2 for the MBE 4000 engine.



1. EGR Temperature Sensor
2. Engine Coolant Temperature Sensor
3. Supply Fuel Temperature Sensor
4. Barometric Pressure Sensor (integrated into PLD-MR)
5. Camshaft Position Sensor (on camshaft)
6. Crankshaft Position Sensor (on timing case)
7. Boost Air Combination Sensor
8. Engine Oil Temperature Sensor
9. Engine Oil Pressure Sensor

Figure 25-1 Sensor Locations on the MBE 900 Engine with EGR



1. Boost Air Combination Sensor
2. EGR Temperature Sensor
3. Camshaft Position Sensor (on camshaft)
4. Crankshaft Position Sensor (on timing case)
5. Engine Coolant Temperature Sensor
6. Barometric Pressure Sensor (integrated into PLD-MR)
7. Supply Fuel Temperature Sensor
8. Oil Combination Sensor

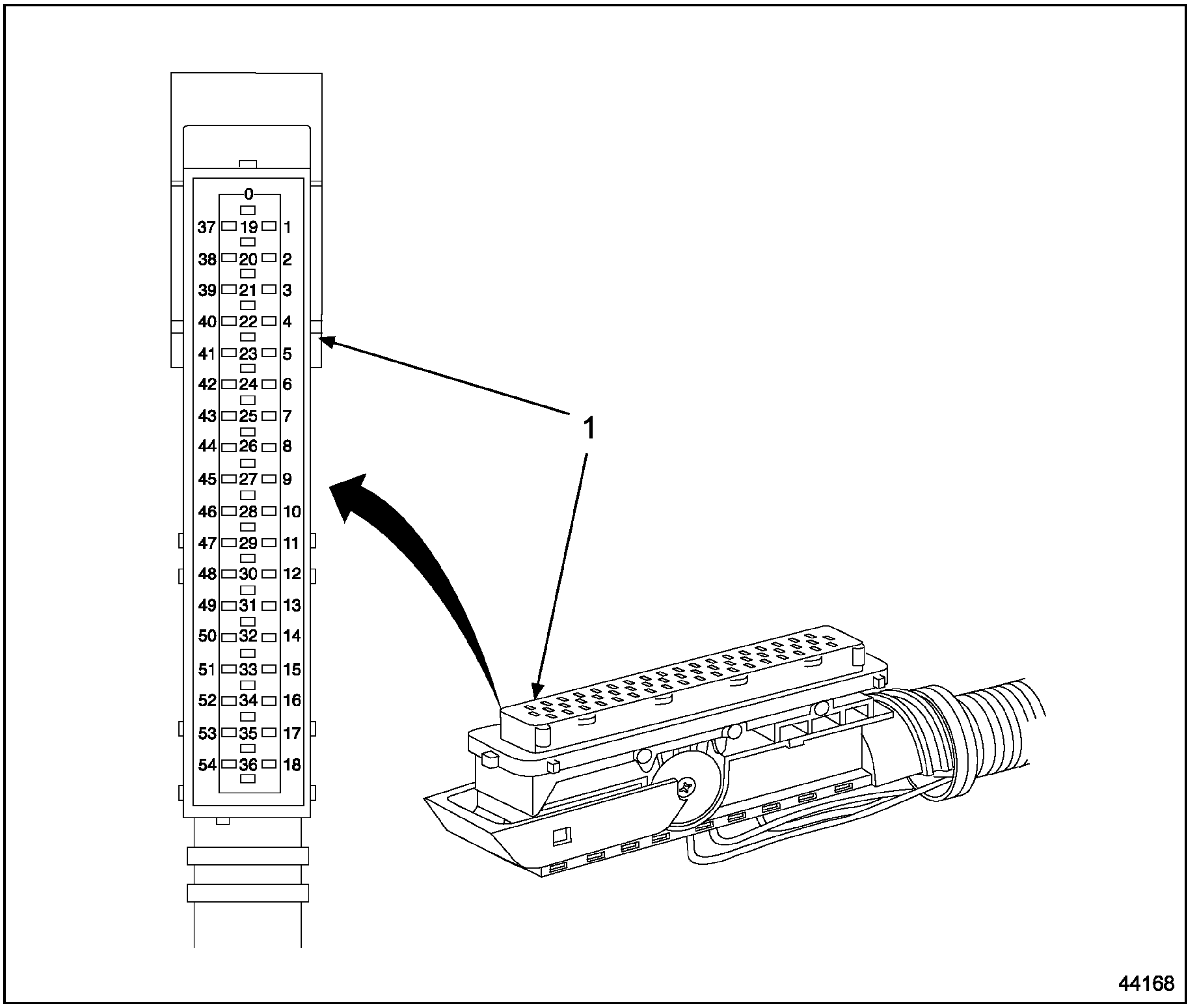
Figure 25-2 Sensor Locations on the MBE 4000 Engine with EGR

SID 146 indicates that during engine operation, the PLD-MR received EGR system parameters outside their normal range resulting in one or more of the following fault codes:

- EGR Temperature above Normal (146 00)
- EGR Temperature below Normal (146 01)
- Data Erratic (146 02)
- EGR Valve not Responding (146 07)
- Bad Component (146 12)

25.2 TROUBLESHOOTING SID 146

Data for the EGR temperature sensor is routed through pins 28 and 22 on the 55-pin connector. See Figure 25-3.



1. 55-Pin Connector

Figure 25-3 Pin Locations on 55-Pin Connector

The following procedures will troubleshoot SID 146.

25.2.1 146 00 – EGR Temperature above Normal

Perform the following steps to troubleshoot EGR temperature above normal:

1. Check active codes.

[a] If fault codes 110 00 and 146 00 are active at the same time, refer to section 11.2.1. Repair or replace parts as required. Erase fault code memory.

[b] If only fault code 146 00 is still active, verify proper coolant flow through the EGR cooler. Refer to OEM Vehicle Manual. Repair or replace parts and coolant as necessary. Erase fault code memory.

[c] If fault 146 00 is still active, check for an EGR temperature sensor circuit fault: Go to step 2.

2. Bridge pins 1 and 2 on the EGR temperature sensor and check for active fault codes. See Figure 25-4.

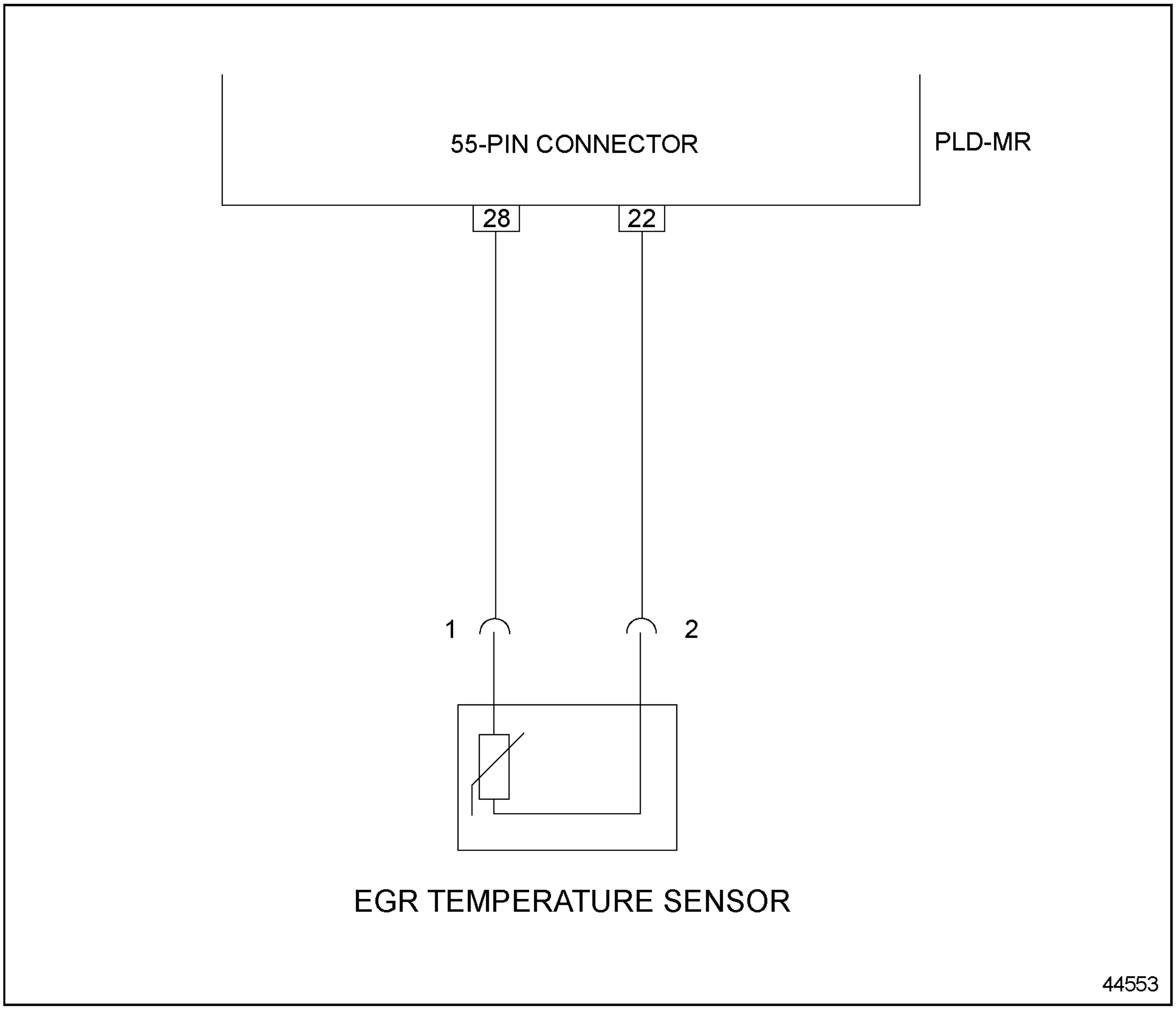


Figure 25-4 EGR Temperature Sensor Pins and 55-Pin Connector Wires

[a] If fault code 146 00 is the only active code, replace the EGR temperature sensor. Erase fault code memory.

[b] If fault code 146 00 is not the only active code, go to step 3.

3. Bridge pin 1 of the EGR temperature sensor to ground and check for active fault codes. See Figure 25-4.
   - [a] If fault code 146 00 is still active, repair open circuit in wire between pin 28 of the 55-pin connector and pin 1 of the EGR temperature sensor.
   - [b] If fault code 146 00 is no longer active, erase fault code memory.
   - [c] If fault code 146 00 is still active, go to step 4.
4. Measure the resistance between pin 22 of the 55-pin connector and pin 2 of the EGR temperature sensor. See Figure 25-4.
   - [a] If resistance is greater than 3 Ω, repair open circuit in wire between pin 22 of the 55-pin connector and pin 2 of the EGR temperature sensor.
   - [b] If resistance is less than 3 Ω, check all contacts and connections. If any corrosion is evident, remove it.
   - [c] If fault code 146 00 is not active, erase fault code memory.
   - [d] If fault code 146 00 is still active, go to step 5.
5. Check for damage to the reed valves as follows:
   - [a] Look for open valves (damaged or stuck). Replace valves as required.
   - [b] Look for soot deposits on the valves. If necessary, clean valves.
   - [c] If fault code 146 00 is still active, contact Detroit Diesel Technical Service for authorization to replace the PLD-MR. Set parameters on new PLD-MR.

25.2.2 146 01 – EGR Temperature below Normal

Perform the following steps to troubleshoot EGR temperature below normal:

1. Verify the PLD-MR hardware and software are correct as follows:
   - [a] Plug the Diagnostic Data Reader (DDR), the Diesel Diagnostic Data Link (DDDL) or Minidiag2 into the Diagnostic Connector and read software level and PLD-MR hardware part number.

NOTE:
Use the Pro-Link kit J 38500-H to connect the DDR. Use PC card J 38500-2300 installed in the computer to connect the DDDL.

   - [b] The required software level is: SW60- HW D3.1. The required PLD-MR part number is: 0014466440. Remove and replace the PLD-MR and/or the software if necessary.
2. Check active codes.
   - [a] If fault codes 146 01 and 146 12 are active at the same time, check the EGR valve for damage. Repair or replace the valve as required.
     - □ For MBE 900 engine, refer to DDC service manual *6SE414*, section 10.6, EGR Rotary Valve.

- □ For MBE 4000 engine, refer to DDC service manual *6SE412*, section 7.5, EGR Control Valve, Gas Outlet Pipe, and Gas Mixer.

  [b] If fault codes 146 01 and 146 00 are active at the same time, check fault code 146 00. Refer to section 25.2.1.

3. Check active codes. If fault code 146 01 is the only active code, check for damage to the reed valves as follows:
   [a] Look for open valves (damaged or stuck). Replace the valves if necessary.
   [b] Look for soot deposits on the valves. If necessary, clean valves.
   [c] Replace the valves as required.
4. Check active codes. If fault code 146 01 is still active on the MBE 4000 engine, check the EGR shutoff valve for damage. Refer to DDC service manual *6SE412*, section 7.4, EGR COOLER AND COOLER SUPPORT BRACKET. Replace the EGR shutoff valve if necessary. Erase fault code memory.
5. If fault code 146 01 is still active, contact Detroit Diesel Technical Service for authorization to replace the PLD-MR. Set parameters on new PLD-MR.

25.2.3 146 02 – Data Erratic

Perform the following steps to resolve erratic EGR data:

1. Check active codes.
   [a] If fault codes 146 02 and 146 00 are active at the same time, refer to section 25.2.1.

[b] If fault code 146 02 is the only code active, check the wiring between the EGR valve and the PLD-MR. See Figure 25-5. Repair as required. If fault code 146 02 is still active, go to step 2.

NOTE:
Look for bad wire connections, corrosion on terminals, short circuits, and lost continuity between the PLD-MR and the EGR valve.

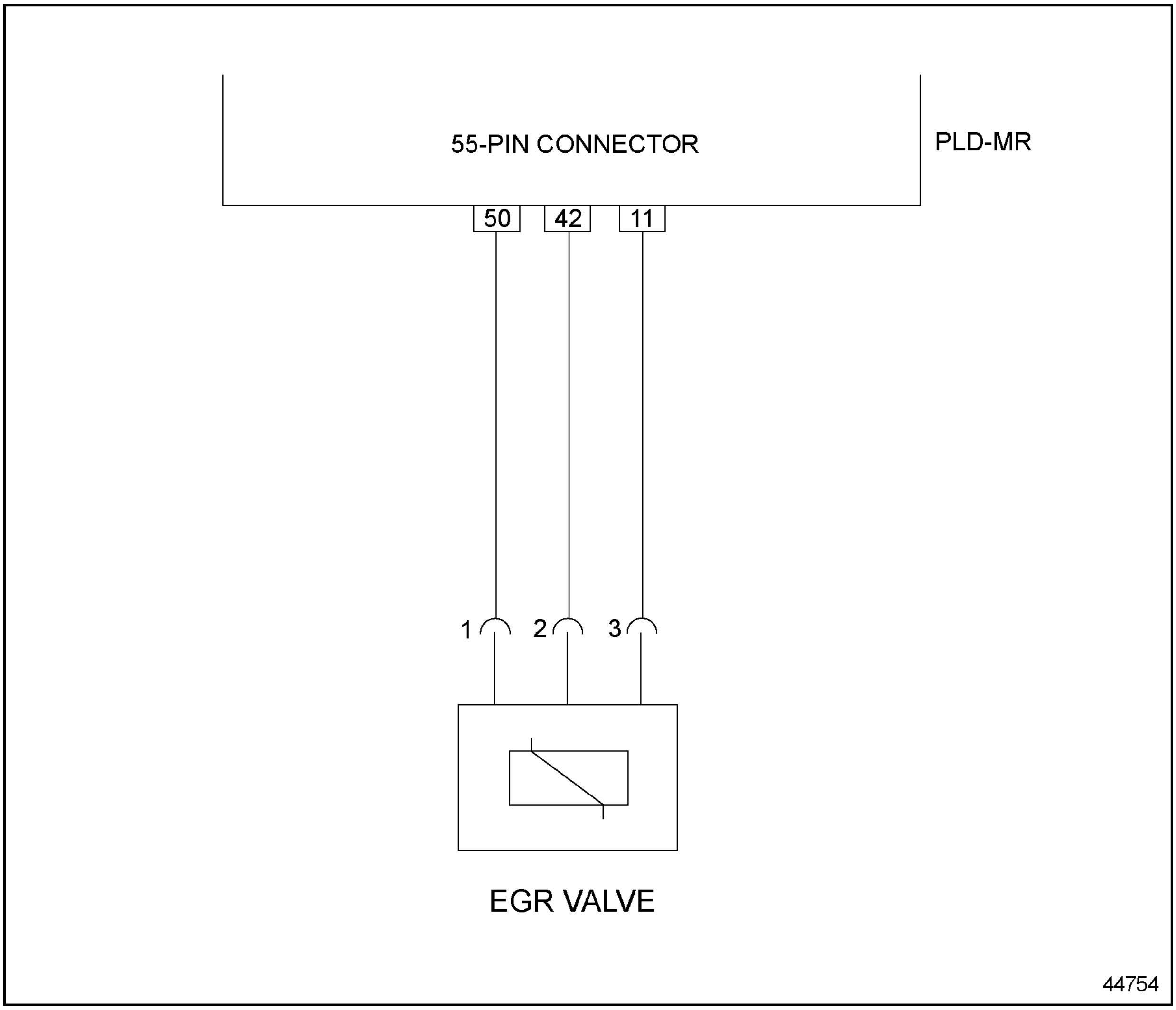


Figure 25-5 EGR Valve Wiring Diagram

2. Check the resistance between pin 42 of the 55-pin connector and pin 2 of the EGR valve. See Figure 25-5.

   [a] If the resistance is greater than 3 Ω, repair open circuit in wire between pin 42 of the 55-pin connector and pin 2 of the EGR valve. Erase fault code memory.

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

3. Check all contacts and connections. Remove corrosion as required. Check for active fault codes.

[a] If fault code 146 02 is not active, erase fault code memory.

[b] If fault code 146 02 is still active, go to step 4.

4. Bridge pin 3 of the EGR valve to ground and check for active fault codes. See Figure 25-5.

[a] If fault code 146 02 is no longer active, repair open circuit in wire between pin 11 of the 55-pin connector and pin 3 of the EGR valve and check for active fault codes. If fault code 146 02 is no longer active, erase fault code memory.

[b] If fault code 146 02 is still active, go to step 5.

5. Check the resistance between pin 50 of the 55-pin connector and pin 1 of the EGR valve. See Figure 25-5.

[a] If the resistance is greater than 3 Ω, repair the open circuit in the wire between pin 50 of the 55-pin connector and pin 1 of the EGR valve. If fault code 146 02 is no longer active, erase fault code memory.

[b] If the resistance is less than 3 Ω, contact Detroit Diesel Technical Service.

25.2.4 146 07 – EGR Valve not Responding

Perform the following steps to resolve an EGR valve not responding:

1. Check active codes.

[a] If fault codes 146 07 and 146 02 are both active, refer to section 25.2.3.

[b] If fault code 146 07 is the only code active, check for lost continuity between the PLD-MR and the EGR valve (PV2). Refer to section 25.2.3.

[c] If fault code 146 07 is still active, test the EGR valve. Contact Detroit Diesel Technical Service for test procedure and test criteria.

[d] If fault code 146 07 is still active, contact Detroit Diesel Technical Service for authorization to replace the PLD-MR. Set parameters on new PLD-MR.

2. Check for active fault codes. If 146 07 is no longer active, erase fault code memory.

25.2.5 146 12 – Bad Component

Perform the following steps to resolve a Bad Component fault code.

1. Check active codes.

[a] If fault code 146 12 is active, inspect the EGR valve flap. If freedom of movement is restricted. remove soot and clean deposits as required.

[b] If fault code 146 12 is still active, contact Detroit Diesel Technical Service for instructions to perform a PV2 activation test to verify flap valve functionality.

2. Check for active fault codes

[a] If fault code 146 12 is still active, replace the EGR valve.

[b] If 146 12 is no longer active, erase fault code memory.

26 SID 230

Section **Page**

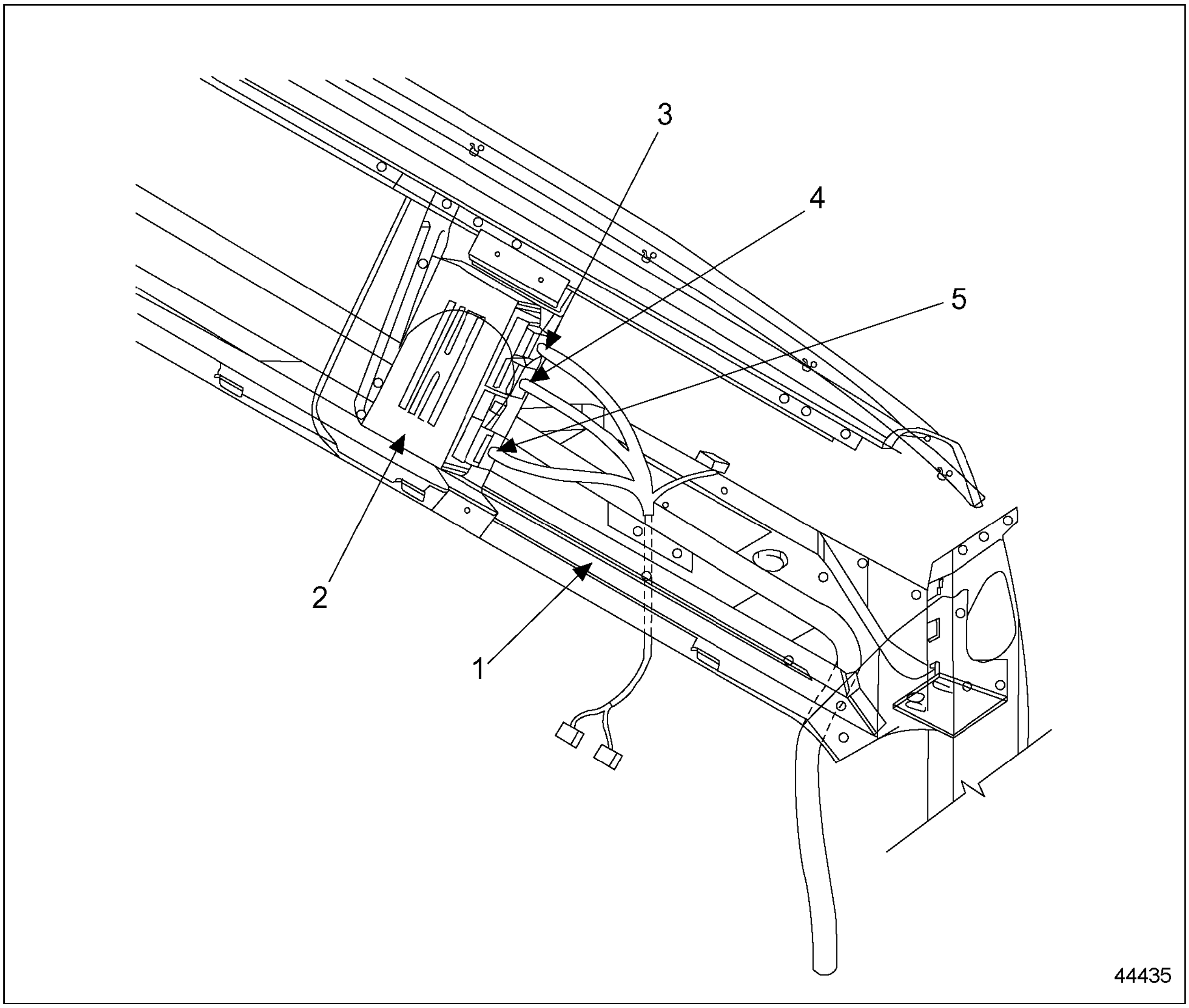
26.1 DESCRIPTION OF SID 230 – THROTTLE CONTROL FAULT

SID 230 indicates that a fault has occurred in the throttle control.

The diagnostic condition is typically:

- ☐ Idle Validation Switch Open Circuit (230 05)
- ☐ Idle Validation Switch Short to Ground (230 12)

Accelerator Pedal – The accelerator pedal (AP) sends an input signal which the DDEC-VCU uses to calculate engine power proportional to the foot pedal position. See Figure 26-1. This assembly is also referred to as the AP Sensor assembly.



1. Right-Side Dash
2. DDEC-VCU
3. 15-Pin Connector
4. 18-Pin Connector
5. 21-Pin Connector

Figure 26-1 Location of DDEC-VCU and Wiring Harness Connectors

Accelerator Pedal Installation– MBE electronic controls are compatible with an AP which has an output voltage that meets SAE J1843 and has less than 5% of voltage supply closed throttle variability. See Figure 26-2.

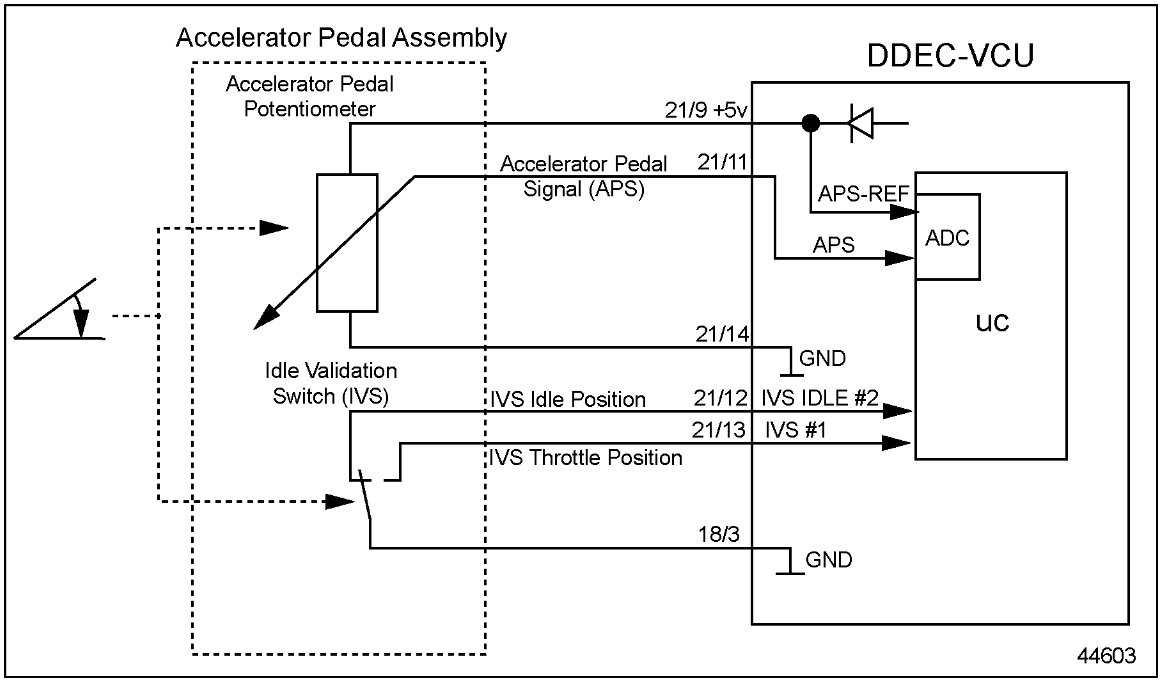


Figure 26-2 Typical Accelerator Pedal Installation

The AP is an OEM-supplied part. Vendor sources may be contacted for additional design and installation details.

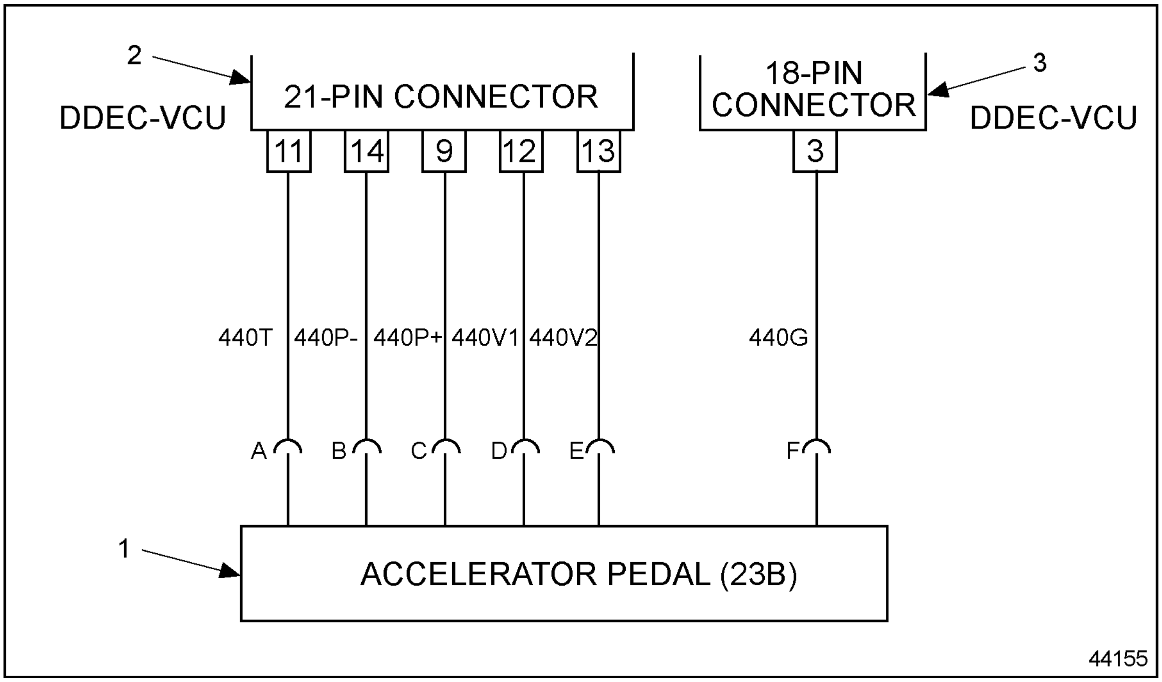
26.2 TROUBLESHOOTING SID 230

The following procedures will troubleshoot SID 230.

26.2.1 230 05 – Idle Validation Switch Open Circuit Fault

Perform the following steps to troubleshoot an idle validation switch open circuit fault:

1. Check for battery voltage at position “D,” wire 440V1, on the AP sensor connector. See Figure 26-3.



1. Accelerator Pedal
2. 21-Pin DDEC-VCU Connector (VC1)
3. 18-Pin DDEC-VCU Connector (VC3)

Figure 26-3 Accelerator (Throttle) Pedal Wiring Schematic

[a] If voltage is present in wire 440V1, repair short to vehicle power in wire 440V1. Erase fault code memory.

[b] If no voltage is present in wire 440V1, go to step 2.

2. Check for battery voltage at position “F,” wire 440G, on the AP sensor connector. See Figure 26-3.

[a] If voltage is present in wire 440G, repair short to ground in wire 440G. Erase fault code memory.

[b] If voltage is not present in wire 440G, go to step 3.

3. Check for continuity in wire 440G between pin “F” on the pedal sensor connector and pin 3 on the 18-pin wiring harness connector. See Figure 26-3.

[a] If there is no continuity in wire 440G, repair open circuit in wire 440G. Erase fault code memory.

[b] If there is continuity in wire 440G, go to step 4.

4. Check for continuity in wire 440V1 between the pin “D” on the pedal sensor and pin 12 on the 18-pin wiring harness connector. See Figure 26-3.

   [a] If there is no continuity in wire 440V1, repair short circuit in wire 440V1. Erase fault code memory.

   [b] If there is continuity in wire 440V1, replace the AP.

26.2.2 230 12– Idle Validation Switch Short to Ground Fault

Perform the following steps to troubleshoot an idle validation switch short to ground fault:

1. Check wire 440V2 for short to ground. See Figure 26-3.

   [a] If wire 440V2 is shorted to ground, repair short to ground in wire 440V2. Erase fault code memory.

   [b] If wire 440V2 is not shorted to ground, replace the AP. Erase fault code memory.

27 SID 232

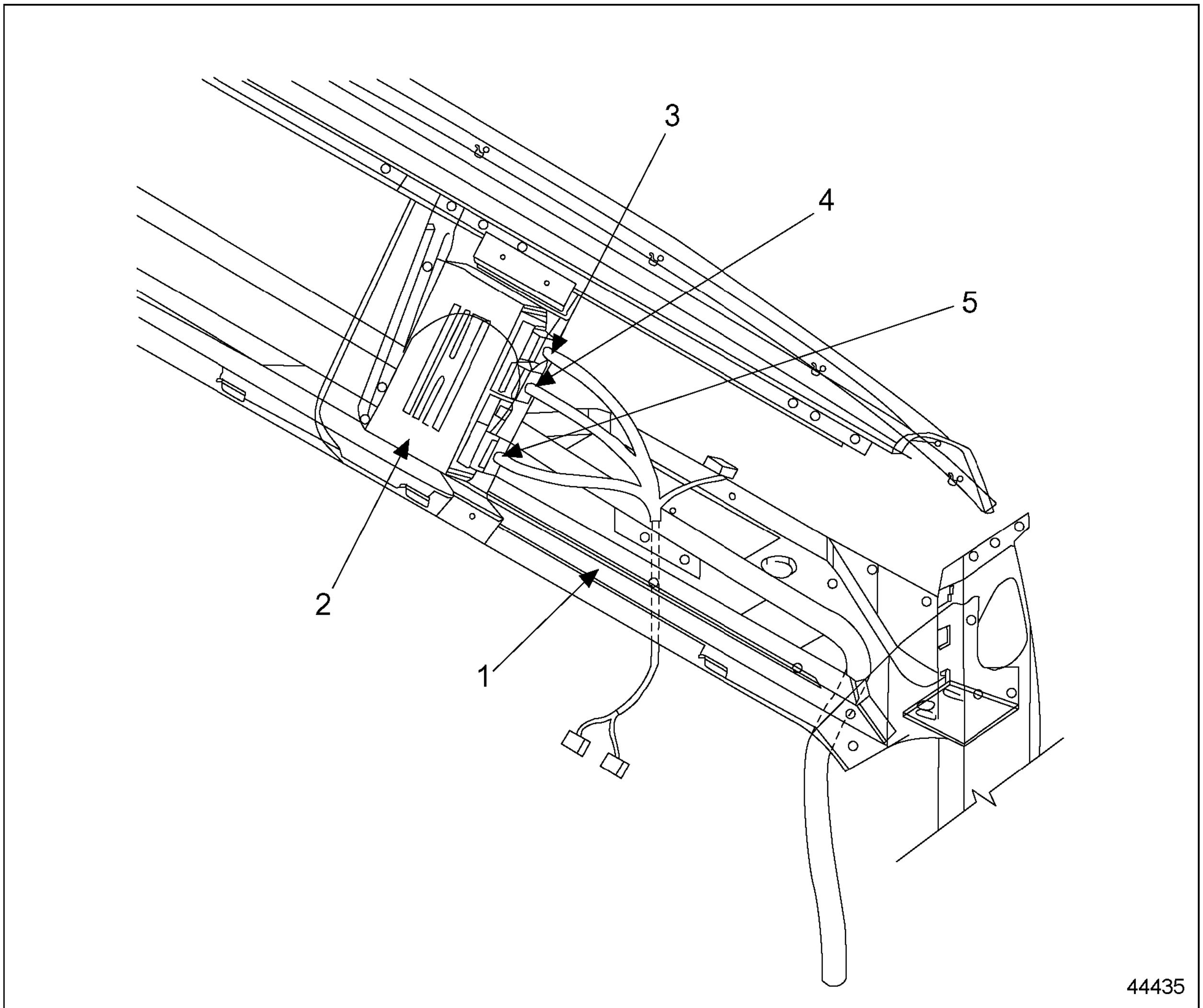
27.1 DESCRIPTION OF SID 232 – ACCELERATOR PEDAL SUPPLY VOLTAGE FAULT

SID 232 indicates that a fault has occurred in the supply voltage to the Accelerator Pedal (AP) assembly.

The diagnostic condition is typically:

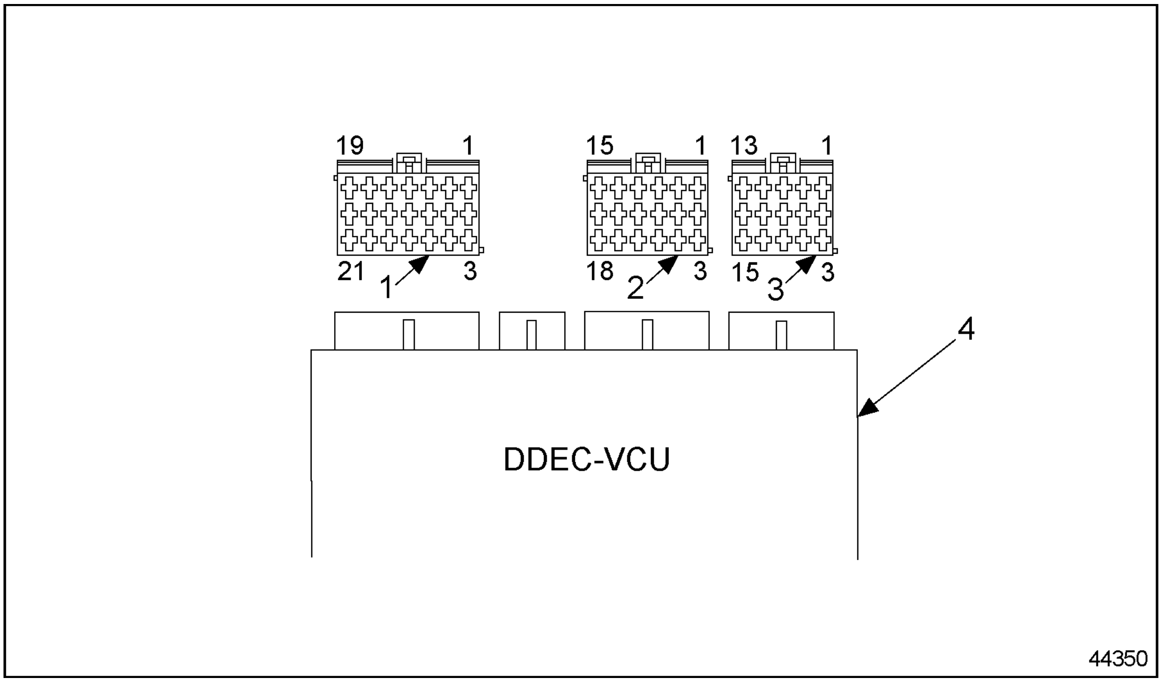
- ☐ AP Supply Voltage above Normal (232 03).
- ☐ AP Supply Voltage below Normal (232 04).

Voltage is supplied to the AP through the 21-pin connector attached to the PLD-MR and the 18-pin connector attached to the DDEC-VCU. See Figure 27-1 for connector locations within the vehicle and see Figure 27-2 for connector positions on the DDEC-VCU.



1. Passenger-Side Dash
2. DDEC-VCU
3. 15-Pin Connector
4. 18-Pin Connector
5. 21-Pin Connector

Figure 27-1 Location of DDEC-VCU and Wiring Harness Connectors



1. 21-Pin DDEC-VCU Connector (VC1)
2. 18-Pin DDEC-VCU Connector (VC3)
3. 15-Pin DDEC-VCU Connector (VC4)
4. DDEC-VCU

Figure 27-2 DDEC-VCU Connectors

27.2 TROUBLESHOOTING SID 232

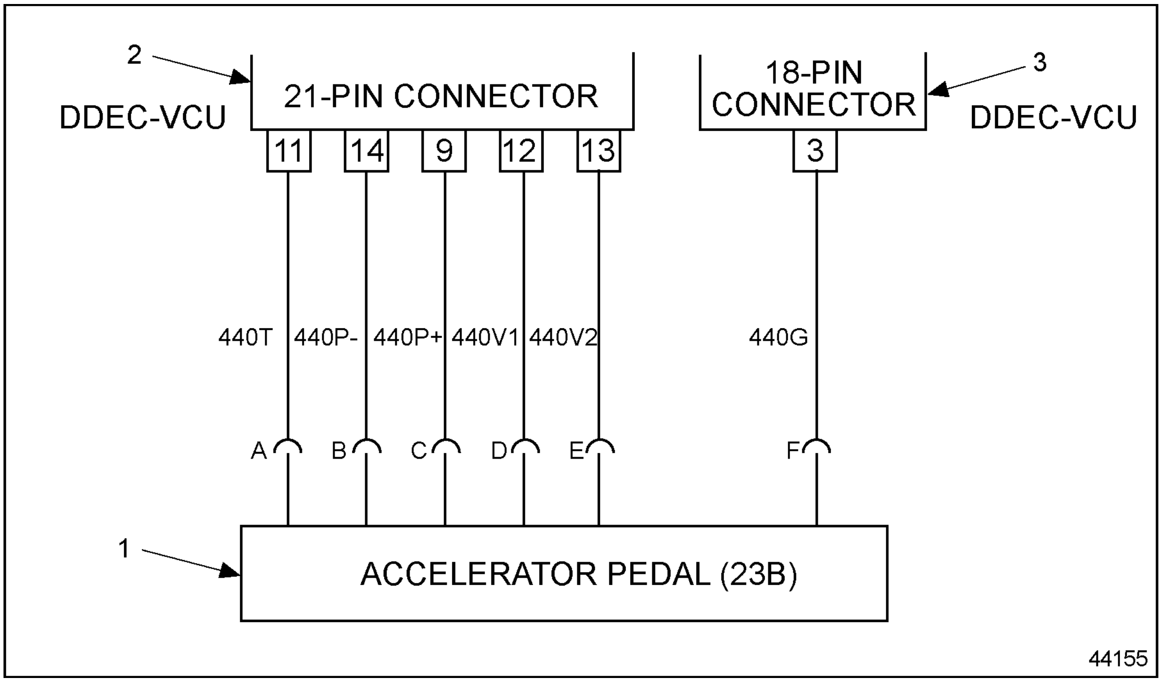
Perform the following steps to troubleshoot SID 232:

27.2.1 232 03 – Accelerator Pedal Supply Voltage Above Normal

Troubleshoot a AP supply voltage above normal fault as follows:

1. Check for battery voltage at position “C,” wire 440P+ on the AP sensor connector. See Figure 27-3.
   - [a] If voltage is present in wire 440P+, repair short to vehicle power in wire 440P+. Erase fault code memory.
   - [b] If voltage is not present in wire 440P+, go to step 2.
2. Check for battery voltage at position “A,” wire 440T, on the AP sensor connector. See Figure 27-3.
   - [a] If voltage is present in wire 440T, repair short to vehicle power in wire 440T. Erase fault code memory.
   - [b] If voltage is not present in wire 440T, go to step 3.
3. Check for continuity between wires 440P+ and 440T with the 21-pin connector disconnected. See Figure 27-3.
   - [a] If there is continuity between wires 440P+ and 440T, repair short circuit between wires 440P+ and 440T connecting the DDEC-VCU to the AP sensor. Erase fault code memory.

[b] If there is no continuity between wires 440P+ and 440T, erase fault code memory.



1. Accelerator Pedal
2. 21-Pin DDEC-VCU Connector (VC1)
3. 18-Pin DDEC-VCU Connector (VC3)

Figure 27-3 Accelerator Pedal Wiring Connections

27.2.2 232 04 – Accelerator Pedal Supply Voltage Below Normal

Troubleshoot a AP supply voltage below normal fault as follows:

1. Disconnect the AP assembly.
   [a] If fault 232 04 is not active after disconnecting the pedal, replace the AP assembly. Erase fault code memory.
   [b] If fault 232 04 is active after disconnecting the AP assembly, go to step 2.
2. Check for continuity between wires 440P+ and 440V2 connecting the DDEC-VCU to the AP sensor. See Figure 27-3.
   [a] If there is continuity between wires 440P+ and 440V2, repair short circuit between wires 440P+ and 440V2 connecting the DDEC-VCU to the AP sensor. Erase fault code memory.
   [b] If there is no continuity between wires 440P+ and 440V2, go to step 3.
3. Check for a short to ground in throttle position sensor power wire 440P+. See Figure 27-3.
   [a] If wire 440P+ is shorted to ground, repair short to ground in wire 440P+. Erase fault code memory.

[b] If wire 440P+ is not shorted to ground, erase fault code memory.

28 SID 233

Section **Page**

28.1 DESCRIPTION OF SID 233 – PLD-MR FAULT (ERRONEOUS DATA)

SID 233 indicates that a fault has occurred in the PLD-MR, making the PLD-MR data erroneous.

This diagnostic condition is typically:

- ☐ PLD-MR Failed or Programmed Incorrectly (233 12).
- ☐ Incorrect or Misprogrammed PLD-MR (233 14).

The PLD-MR or engine-resident control unit is located on the left-hand side of the engine. See Figure 28-1. The PLD-MR is connected by a proprietary datalink to the DDEC-VCU. All necessary data and information is exchanged through the datalink. The DDEC-VCU then broadcasts all information on the J1587 and J1939 data links, where it can be read by minidiag2.

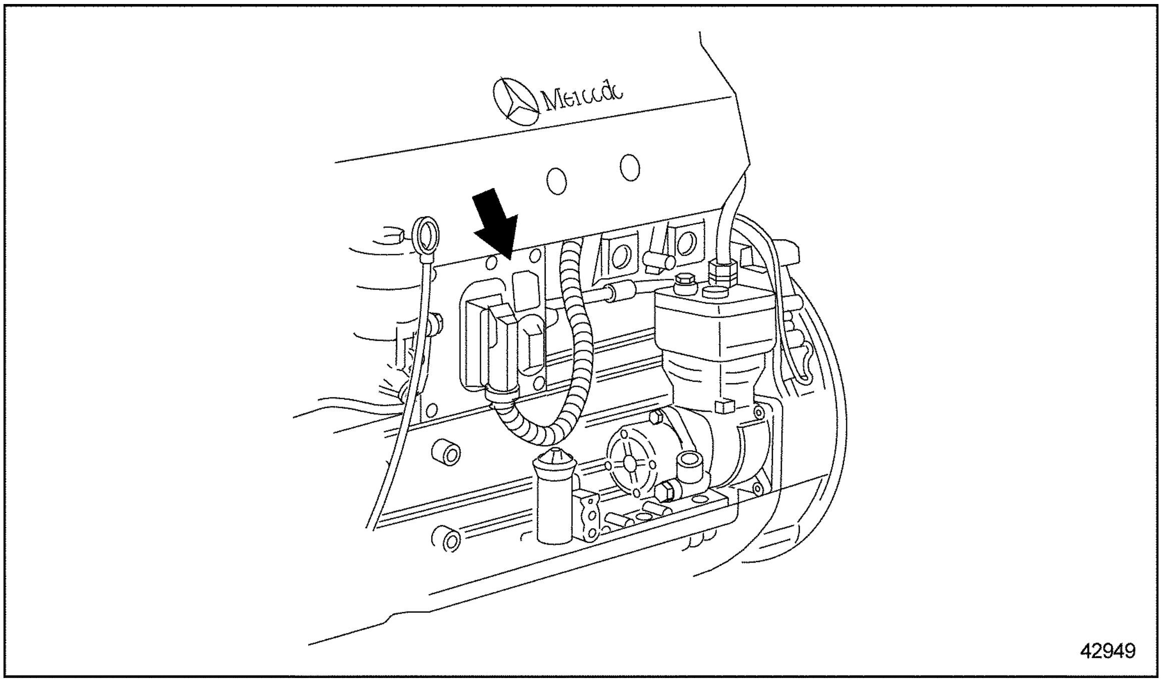


Figure 28-1 Location of PLD-MR Control Unit

NOTE:
To obtain a replacement PLD-MR control unit, all data given on the control unit data plate is required. The data plate is located on the face of the PLD-MR unit.

28.2 TROUBLESHOOTING SID 233

Perform the following steps to troubleshoot SID 233:

28.2.1 233 12 – PLD-MR Failed or Programmed Incorrectly

Troubleshoot a PLD-MR failed or programmed incorrectly fault as follows:

1. Reset the parameters on the PLD-MR.
   [a] If fault code 233 12 is not active after resetting parameters, stop. Fault code has been cleared.
   [b] If fault code 233 12 is still active after resetting parameters, go to step 2.
2. Check PLD parameters to ensure they are correct for the vehicle configuration.
   [a] If parameters are not correct, reset parameters on the PLD-MR.
   [b] If parameters are correct, contact Detroit Diesel Technical Service for authorization to replace the PLD-MR. Set parameters on the new PLD-MR.

28.2.2 233 14 – Incorrect or Misprogrammed PLD-MR

Troubleshoot an incorrect or misprogrammed PLD-MR as follows:

1. Check to ensure the PLD-MR is correct for the engine.
   [a] If PLD-MR is correct for the engine, go to step 2.
   [b] If PLD-MR is not correct for the engine, contact Detroit Diesel Technical Service for authorization to replace the PLD-MR. Set parameters on the new PLD-MR.
2. Reset the PLD parameters.
   [a] If fault code 233 14 is not active after PLD parameters are reset, stop. Fault code has been cleared.
   [b] If fault code 233 14 is still active after PLD parameters are reset, go to step 3.
3. Check PLD parameters to ensure they are correct for the vehicle configuration.
   [a] If PLD parameters are not correct, reset parameters on PLD-MR. Erase fault code memory.
   [b] If PLD parameters are correct, contact Detroit Diesel Technical Service for authorization to replace the PLD-MR. Set parameters on the new PLD-MR.

29 SID 242

Section | Page

29.1 DESCRIPTION OF SID 242 – CRUISE CONTROL SET/RESUME SWITCH FAULT

SID 242 indicates that a fault has occurred in the cruise control Set/Resume Switch. See Figure 29-1.

The diagnostic condition is typically:

- "SET" and "RES" Contacts Closed at the Same Time (242 12)

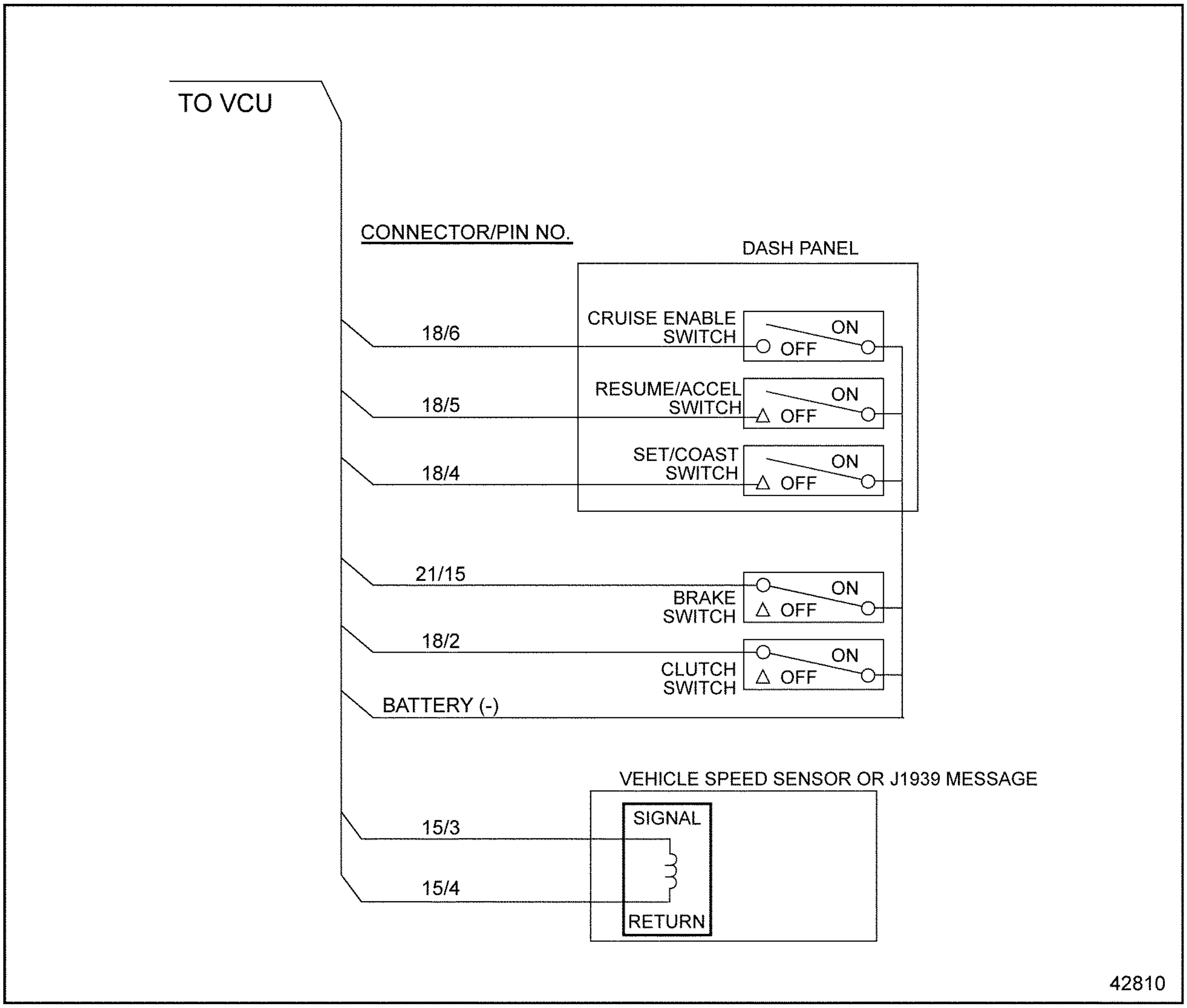


Figure 29-1 Cruise Control Circuit

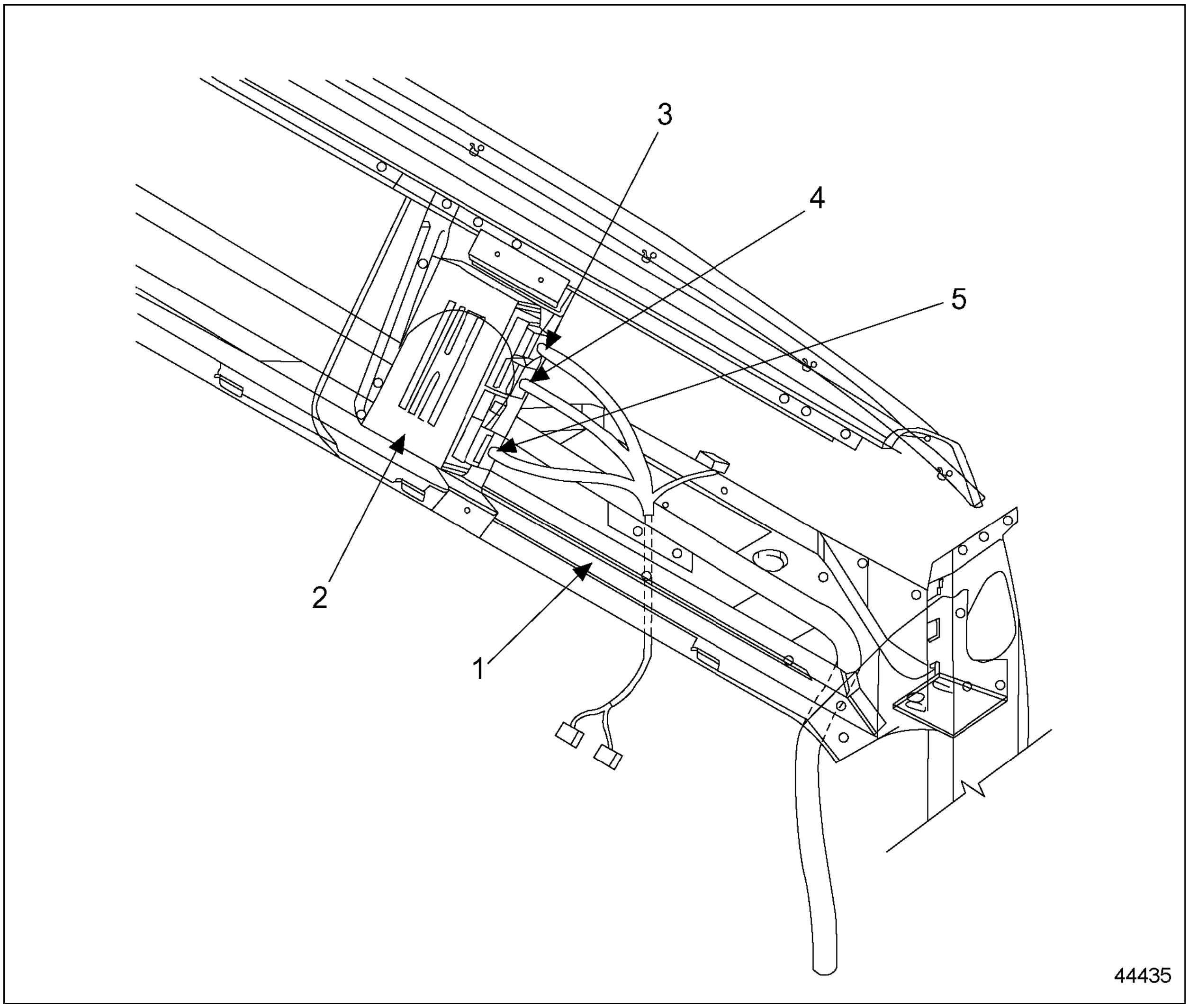
29.2 TROUBLESHOOTING SID 242

The following procedure will troubleshoot SID 242.

29.2.1 242 12 – Cruise Control Switch SET and RES Contacts Closed at the Same Time

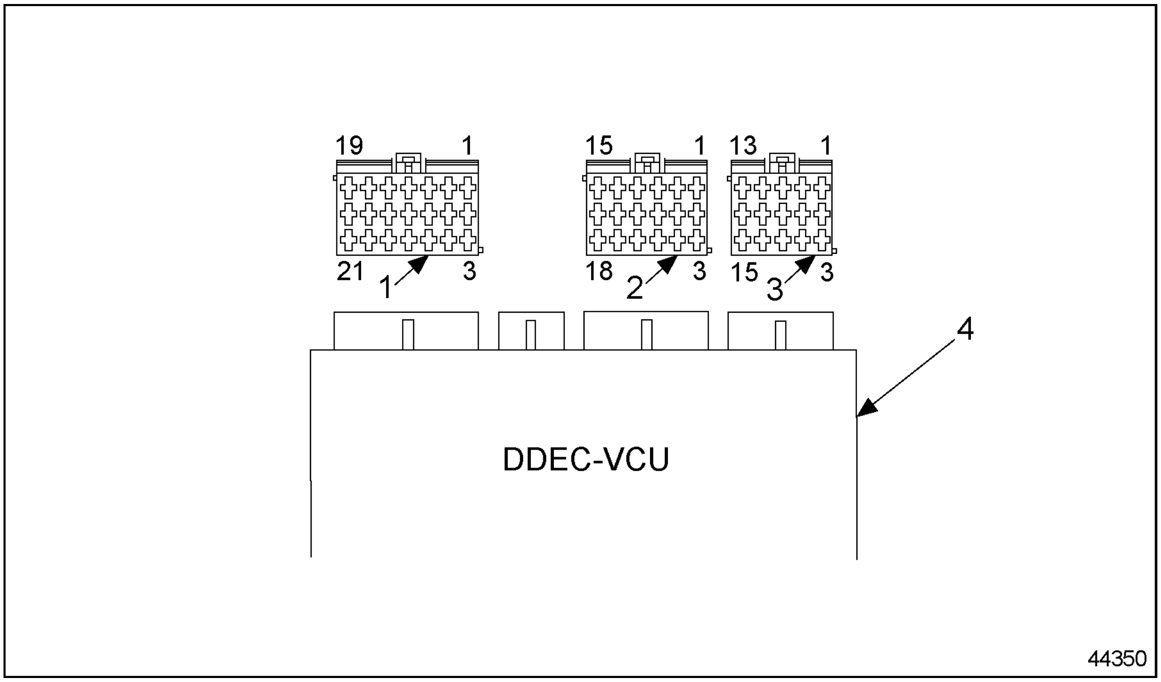
Troubleshoot a cruise control SET/RESUME switch fault as follows:

1. Turn ignition on and place the cruise control switch in the “Off” position. **Do not start the engine.**
2. Note 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 cruise control switch.
   [a] If “RES” status is no longer displayed, replace the cruise control SET/RES switch. Erase fault code memory.
   [b] If “RES” status is still displayed, repair short to ground in wire 440F to pin 5 of the 18-pin connector. Erase fault code memory. See Figure 29-2 and see Figure 29-3 for connector location.
4. Unplug the cruise control switch. See Figure 29-3.
   [a] If “SET” status is no longer displayed, replace the cruise control SET/RES switch. Erase fault code memory.
   [b] If “SET” status is still displayed, repair short to ground in wire 440E to pin 4 of the 18-pin connector. Erase fault code memory. See Figure 29-2 and see Figure 29-3 for connector location.



1. Passenger-Side Dash
2. DDEC-VCU
3. 15-Pin Connector
4. 18-Pin Connector
5. 21-Pin Connector

Figure 29-2 Location of DDEC-VCU and Wiring Harness Connectors



1. 21-Pin DDEC-VCU Connector (VC1)
2. 18-Pin DDEC-VCU Connector (VC3)
3. 15-Pin DDEC-VCU Connector (VC4)
4. DDEC-VCU

Figure 29-3 Connector Locations on DDEC-VCU

30 SID 243

Section **Page**

30.1 DESCRIPTION OF SID 243 — CRUISE CONTROL SET AND RESUME SWITCH FAULT

SID 243 indicates that a fault has occurred in the cruise control SET and RESUME switches. See Figure 30-1 for the typical cruise control circuit.

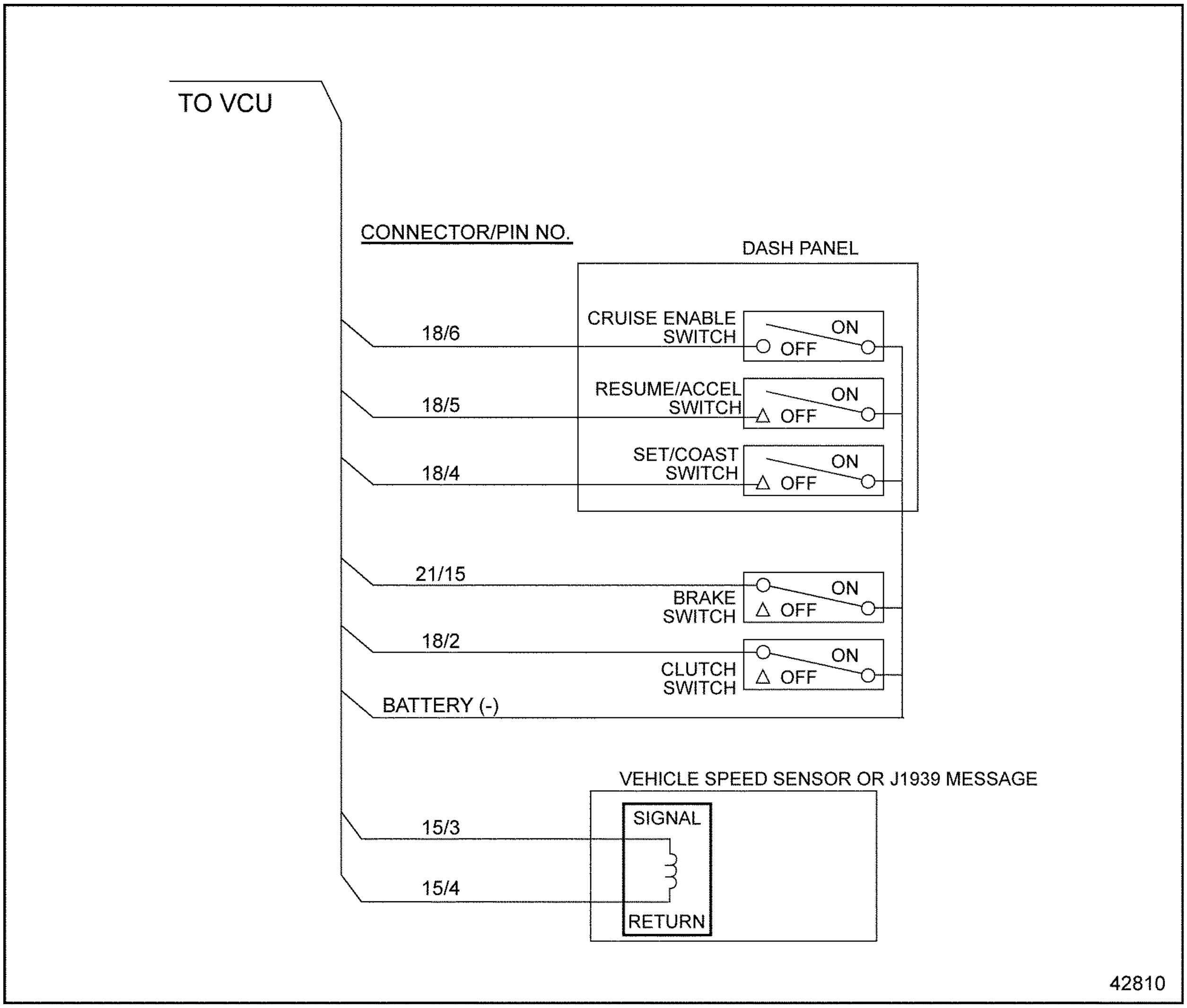


Figure 30-1 Cruise Control Circuit

The diagnostic condition is typically:

- ☐ SET and RES Contacts Closed at the Same Time (243 12).

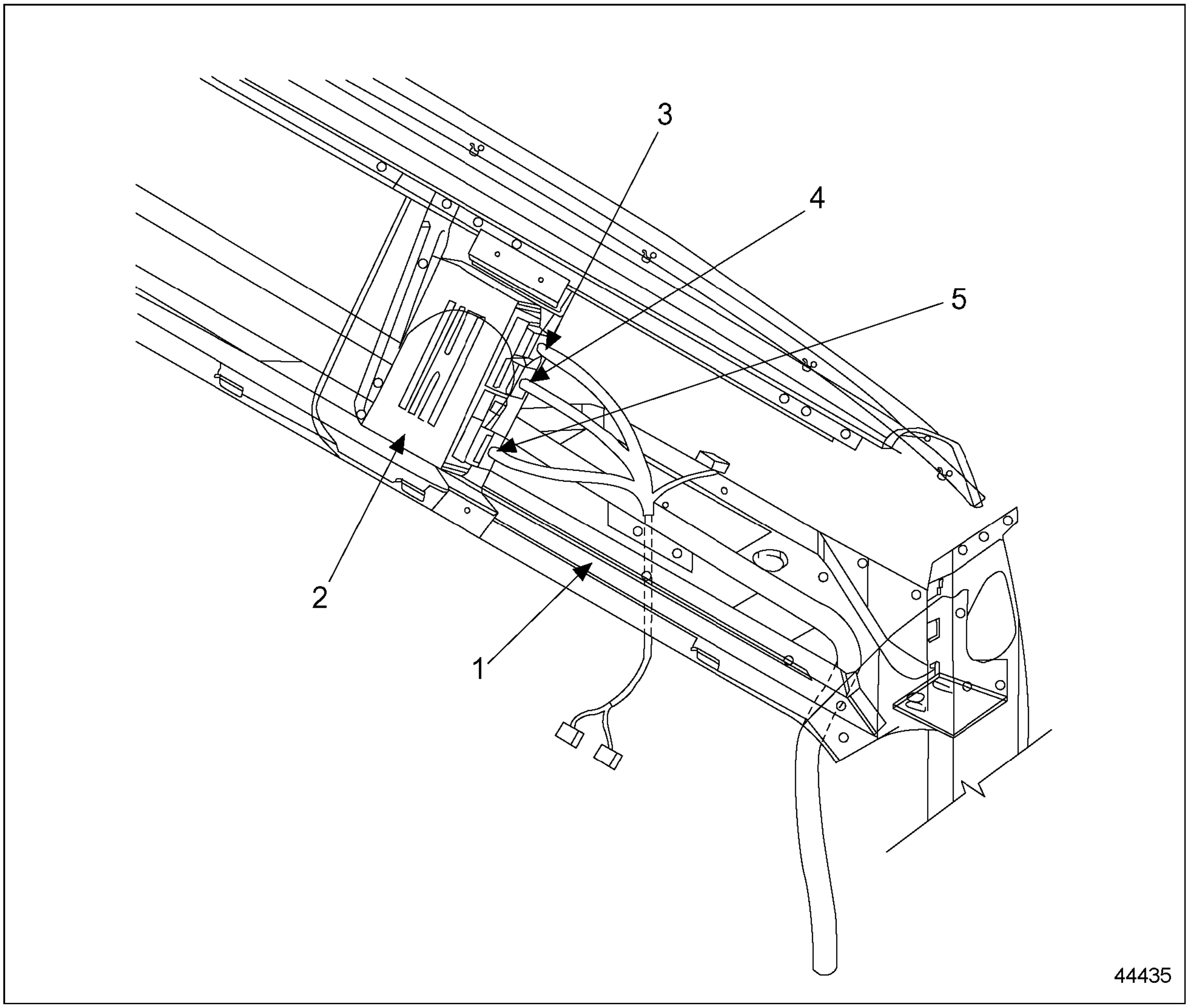
30.2 TROUBLESHOOTING SID 243

The following steps will troubleshoot SID 243.

30.2.1 243 12 – Cruise Control Switch SET and RES Contacts Closed at the Same Time

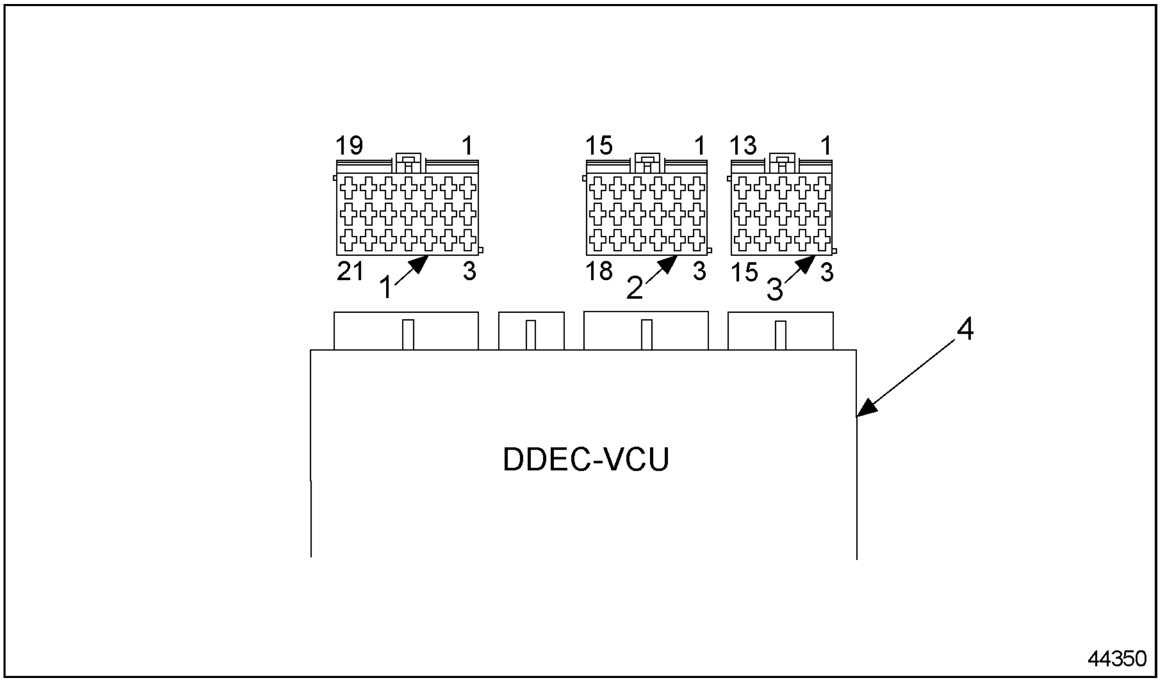
Perform the following steps to troubleshoot a Cruise Control Switch SET and RES Contacts Closed at the Same Time fault.

1. Turn the ignition on and set the cruise control switch to the OFF position. **Do not start the engine,** since all troubleshooting will be done with the engine off.
2. Note the driver display console.
   [a] If the RES status is not displayed, go to step 3.
   [b] If the RES status is displayed, go to step 5.
3. Check the cruise control switch status.
   [a] If the switch status is not displayed as “SET,” contact Detroit Diesel Technical Service.
   [b] If the switch status is displayed as “SET,” go to step 4.
4. Unplug the cruise control switch.
   [a] If the status of the SET switch is displayed as “OFF,” replace the cruise control SET/RES switch. Erase fault code memory.
   [b] If the status of the SET switch is displayed as “ON,” repair short to ground in 18-pin connector wire 440E. See Figure 30-2 for wiring harness connector locations and see Figure 30-3 for connector positions on DDEC-VCU. Erase fault code memory.



1. Passenger-Side Dash
2. DDEC-VCU
3. 15-Pin Connector (VC4)
4. 18-Pin Connector (VC3)
5. 21-Pin Connector (VC1)

Figure 30-2 Location of DDEC-VCU and Wiring Harness Connectors



1. 21-Pin DDEC-VCU Connector (VC1)
2. 18-Pin DDEC-VCU Connector (VC3)
3. 15-Pin DDEC-VCU Connector (VC4)
4. DDEC-VCU

Figure 30-3 Connector Positions on DDEC-VCU

5. Unplug the RES switch.

[a] If the status of the RES switch is not “RES,” replace the cruise control SET and RES switch. Erase fault code memory.

[b] If the status of the RES switch is “RES,” repair short to ground in 18-pin connector wire 440F. Erase fault code memory. See Figure 30-2 for wiring harness connector locations and see Figure 30-3 for connector positions on DDEC-VCU.

31 SID 248

Section | Page

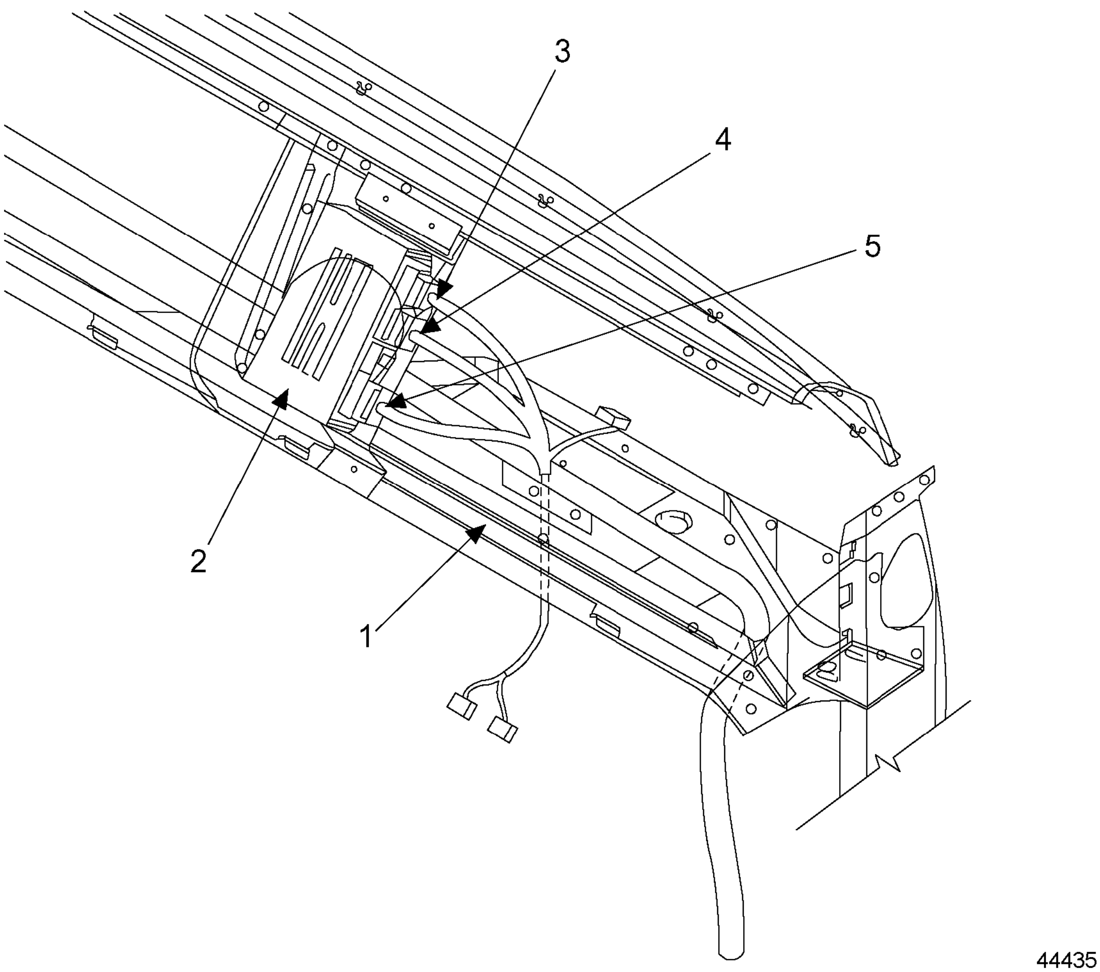
31.1 DESCRIPTION OF SID 248 – PLD-MR DDEC-VCU DATALINK FAULT

SID 248 indicates that a fault has occurred in the PLD-MR DDEC-VCU datalink.

The diagnostic condition is typically:

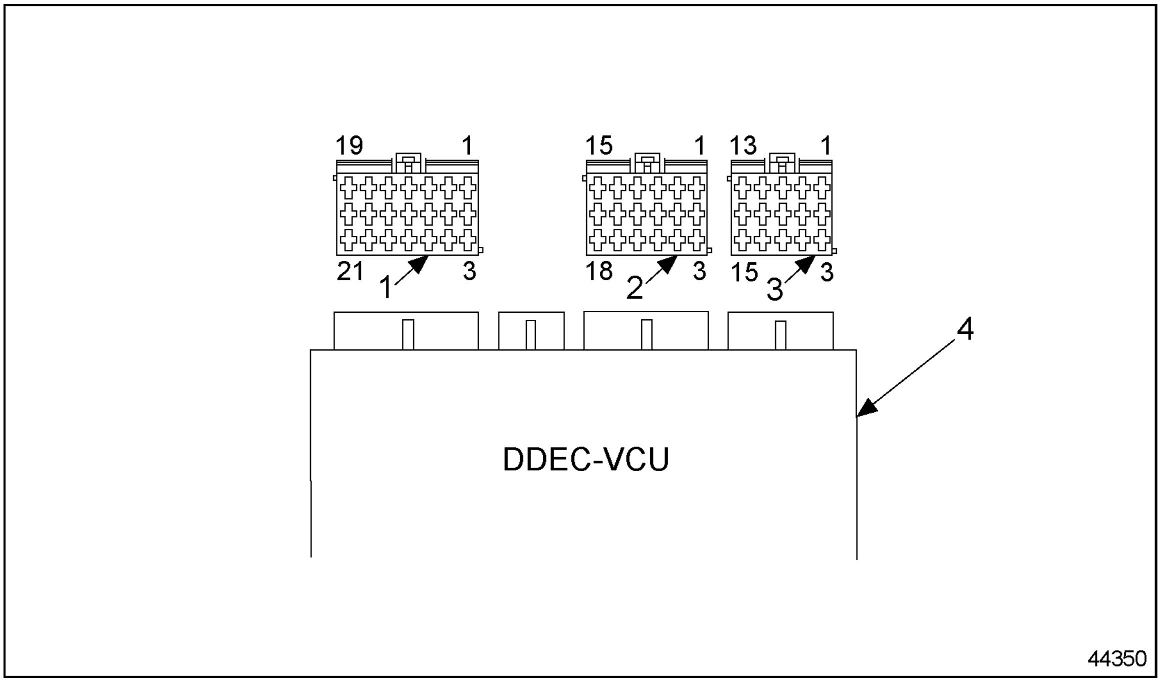
- ☐ Propriety Datalink Fault (248 02)
- ☐ DDEC-VCU Internal Error Fault (248 14)

See Figure 31-1 for location of wiring harness connectors. See Figure 31-2 for connector positions on DDEC-VCU. See Figure 31-3 and see Figure 31-4 for wiring schematics.



1. Passenger-Side Dash
2. DDEC-VCU
3. 15-Pin Harness Connector (VC4)
4. 18-Pin Harness Connector (VC3)
5. 21-Pin Harness Connector (VC1)

Figure 31-1 Location of DDEC-VCU and Wiring Harness Connectors



1. 21-PinPin DDEC-VCU Connector (VC1)
2. 18-Pin DDEC-VCU Connector (VC3)
3. 15-Pin DDEC-VCU Connector (VC4)
4. DDEC-VCU

Figure 31-2 Connector Positions on DDEC-VCU

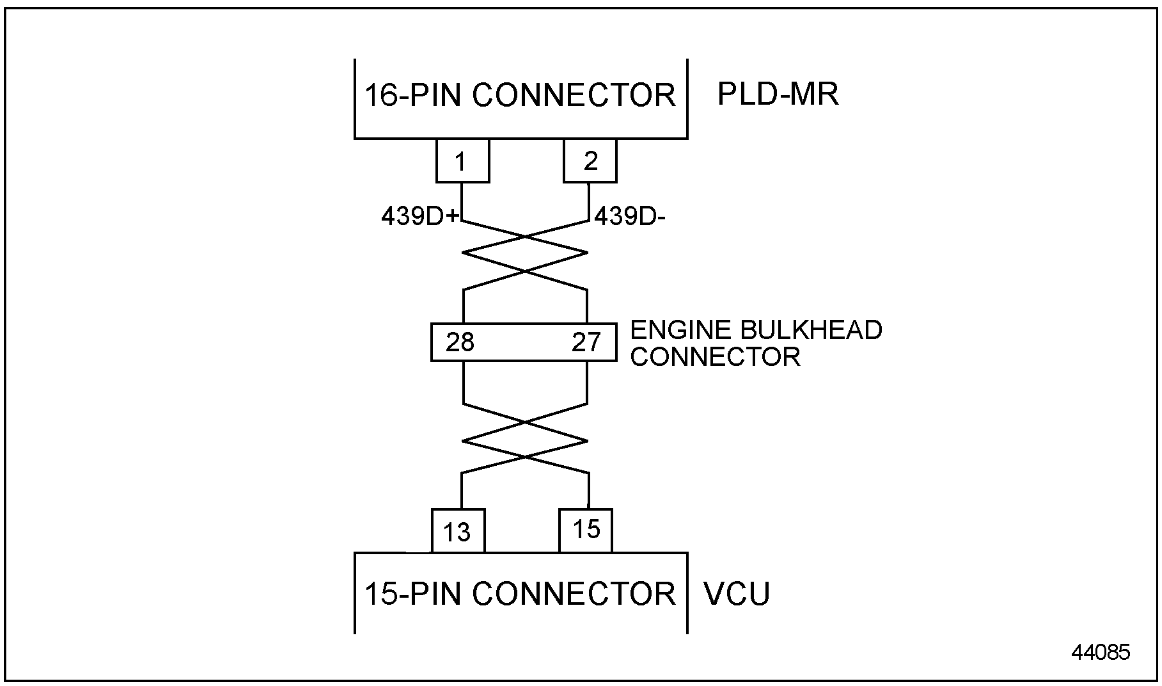


Figure 31-3 PLD-MR Engine Bulkhead Schematic — Business Class

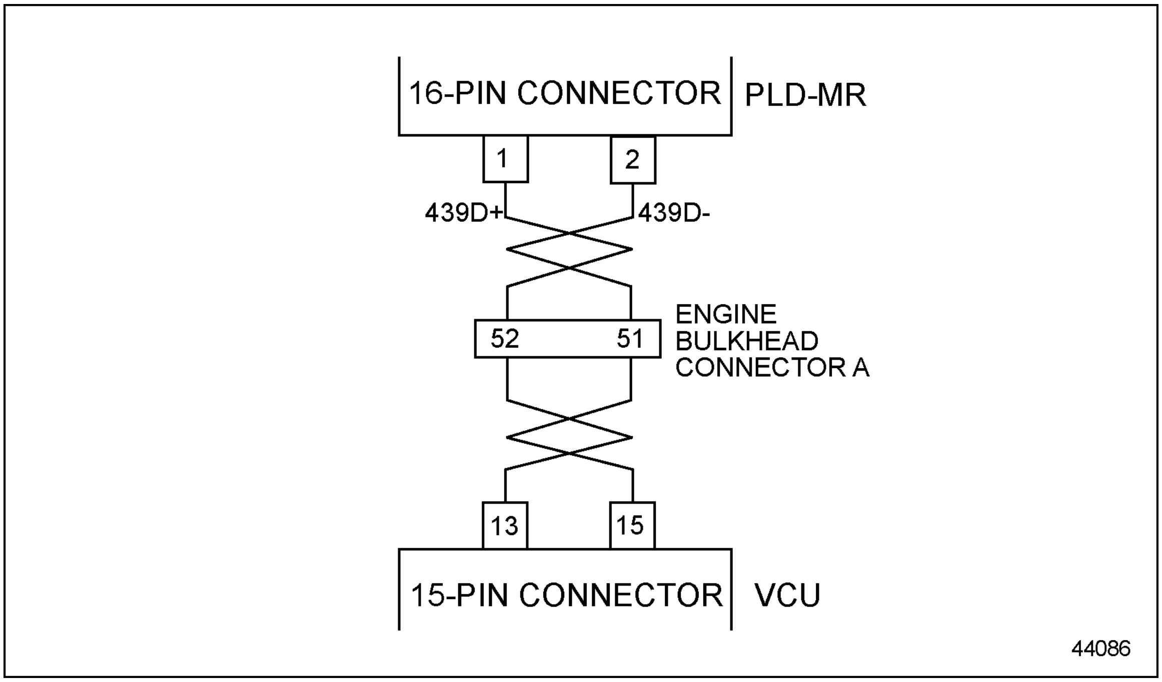


Figure 31-4 PLD-MR Engine Bulkhead Schematic — Acterra

31.2 TROUBLESHOOTING SID 248

The following procedure will troubleshoot SID 248.

31.2.1 248 02 – Proprietary Datalink Fault

Perform the following steps to troubleshoot a proprietary datalink fault.

1. With the ignition switch set to the ON position and the engine not running, check for battery voltage at pin 15 on the small PLD-MR wiring harness connector on the 16-pin connector wiring harness. See Figure 31-3 and see Figure 31-4 for wiring schematics.
   [a] If no battery voltage is measured, refer to section 31.2.1.1.
   [b] If battery voltage is measured, go to step 2.
2. Disconnect and reconnect the small harness connector (16-pin).
   [a] If fault 248 02 is not active, refer to section 31.2.1.2.
   [b] If fault 248 02 is active, go to step 3.
3. Disconnect and reconnect the 15-pin connector.
   [a] If fault code 248 02 is not active, refer to section 31.2.1.3.
   [b] If fault code 248 02 is active, go to step 4.
4. Check for continuity in wire 439D+ between 15-pin connector pin 13 and the small PLD-MR harness 16-pin connector pin 1. See Figure 31-3 and see Figure 31-4 for wiring schematics.
   [a] If no continuity is measured, refer to section 31.2.1.4.
   [b] If continuity is measured, go to step 5.
5. Check for continuity in wire 439D- between 15-pin connector pin 15 and small PLD-MR harness 16-pin connector pin 2.
   [a] If no continuity is measured, refer to section 31.2.1.4.
   [b] If continuity is measured, refer to section 31.2.1.5.

31.2.1.1 Required Actions

Perform the following steps to resolve a proprietary datalink fault.

1. Restore battery voltage at wire 15 on the small engine harness connector (16-pin) on the PLD-MR.

31.2.1.2 Required Actions

Perform the following steps to resolve a proprietary datalink fault.

1. Clean or repair as required the terminals on the small engine harness connector (16-pin) plug on the PLD-MR. See Figure 31-3 and see Figure 31-4 for wiring schematics.

2. Erase the fault code memory.

31.2.1.3 Required Actions

Perform the following steps to resolve a proprietary datalink fault.

1. Replace or clean the 15-pin connector contacts on the DDEC-VCU as required.
2. Erase fault code memory.

31.2.1.4 Required Actions

Perform the following steps to resolve a proprietary datalink fault.

1. Replace the twisted wire pair set 439D- and 439D+ between the PLD-MR and the DDEC-VCU.
2. Erase the fault code memory.

31.2.1.5 Required Actions

Perform the following steps to resolve a proprietary datalink fault.

1. Check the DDEC-VCU and PLD-MR ground wires for continuity.
2. Erase the fault code memory.

31.2.2 248 14 – DDEC-VCU Internal Error

Perform the following step to troubleshoot a DDEC-VCU internal error fault.

1. Check for continuity in wires 439D- and 439D+ connecting the PLD-MR and the DDEC-VCU. See Figure 31-3 and see Figure 31-4 for wiring schematics.
   [a] If continuity was not measured in wires 439D- and 439D+, refer to section 31.2.2.1.
   [b] If continuity was measured in wires 439D- and 439D+, go to step 2.
2. Check for a short to power between wires 439D- and 439D+ connecting the PLD-MR to the DDEC-VCU.
   [a] If a short was measured, refer to section 31.2.2.1.
   [b] If a short was not measured, go to step 3.
3. Check for a short to ground in wires 439D- and 439D+ connecting the PLD-MR to the DDEC-VCU.
   [a] If a short was detected, refer to section 31.2.2.1.
   [b] If a short was not detected, refer to section 31.2.2.2.

31.2.2.1 Required Actions

Perform the following steps to resolve a DDEC-VCU internal error fault.

1. Replace the twisted pair wire set 439D- and 439D+ between the PLD-MR and the DDEC-VCU.
2. Erase the fault code memory.

31.2.2.2 Required Actions

Perform the following steps to resolve a DDEC-VCU internal error fault.

1. Inspect and clean the wire contacts as required.
2. Erase the fault code memory.

32 SID 254

Section Page

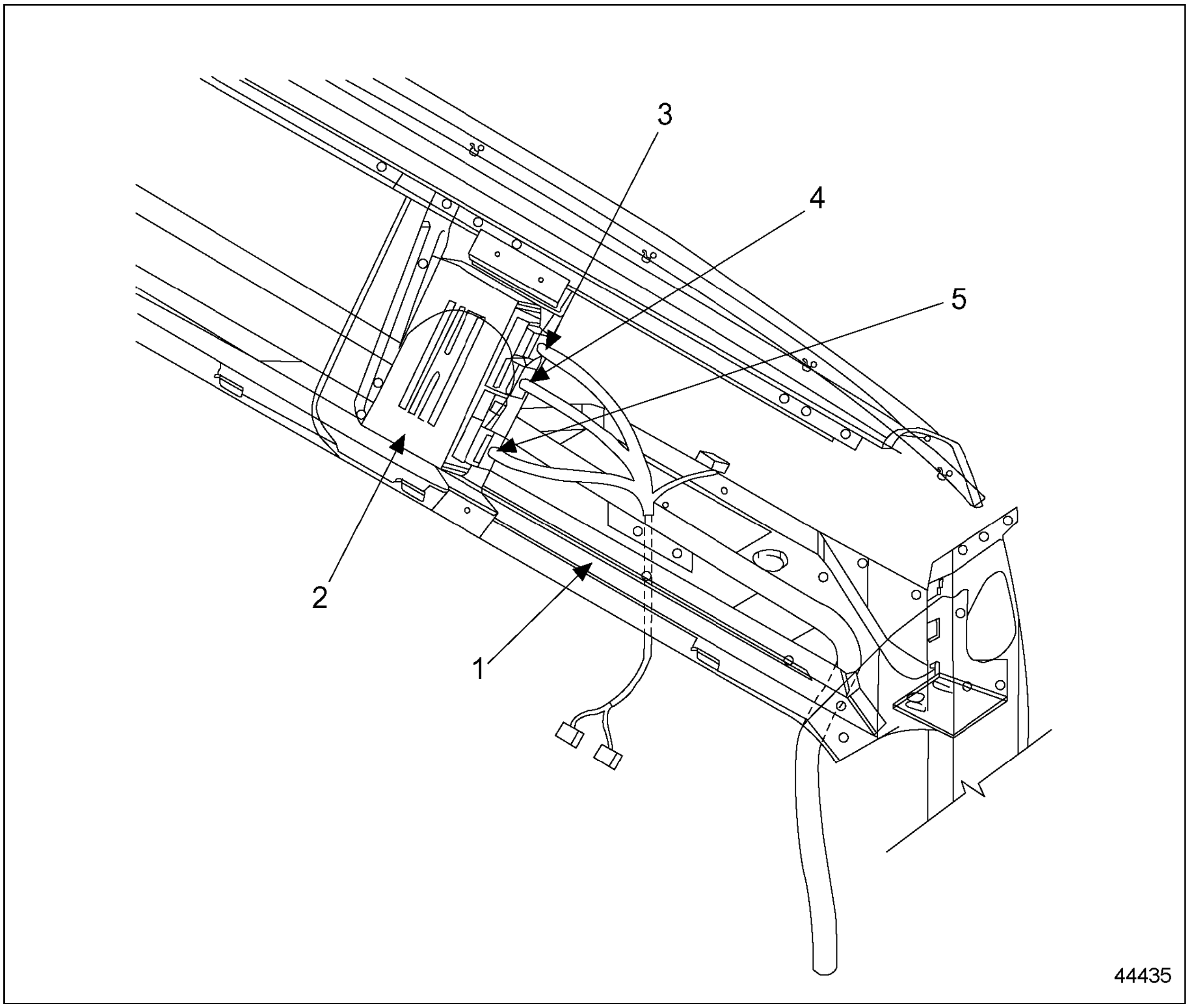
32.1 DESCRIPTION OF SID 254 – DDEC-VCU FAULT

SID 254 indicates that a fault has occurred in the DDEC-VCU.

This diagnostic condition is typically:

- Internal Error in DDEC-VCU (254 12).

See Figure 32-1 for location of DDEC-VCU.



1. Passenger-Side Dash
2. DDEC-VCU
3. 15-Pin Connector
4. 18-Pin Connector
5. 21-Pin Connector

Figure 32-1 Location of DDEC-VCU and Wiring Harness Connectors

32.2 TROUBLESHOOTING SID 254

The following procedure will troubleshoot SID 254.

32.2.1 254 12 – DDEC-VCU Internal Error

Perform the following steps to troubleshoot 254 12, DDEC-VCU internal error.

1. Reset the DDEC-VCU.

NOTE:
Turning the ignition off for more than 10 seconds will reset the DDEC-VCU.

2. Check for active fault codes.
   [a] If fault code 254 12 is no longer active, erase fault code memory.
   [b] If fault code 254 12 is still active, go to step 3.
3. Check for other active fault codes.
   [a] If there are other active fault codes, refer to their appropriate sections.
   [b] If there are no other fault codes, replace the DDEC-VCU. Erase fault code memory.

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