

Illustration 2

g03404355

(1) Universal Warning

## (2) Hand (High Pressure)

### **WARNING**

Contact with high pressure fuel may cause fluid penetration and burn hazards. High pressure fuel spray may cause a fire hazard. Failure to follow these inspection, maintenance and service instructions may cause personal injury or death.



Illustration 3

g02382677

Typical example

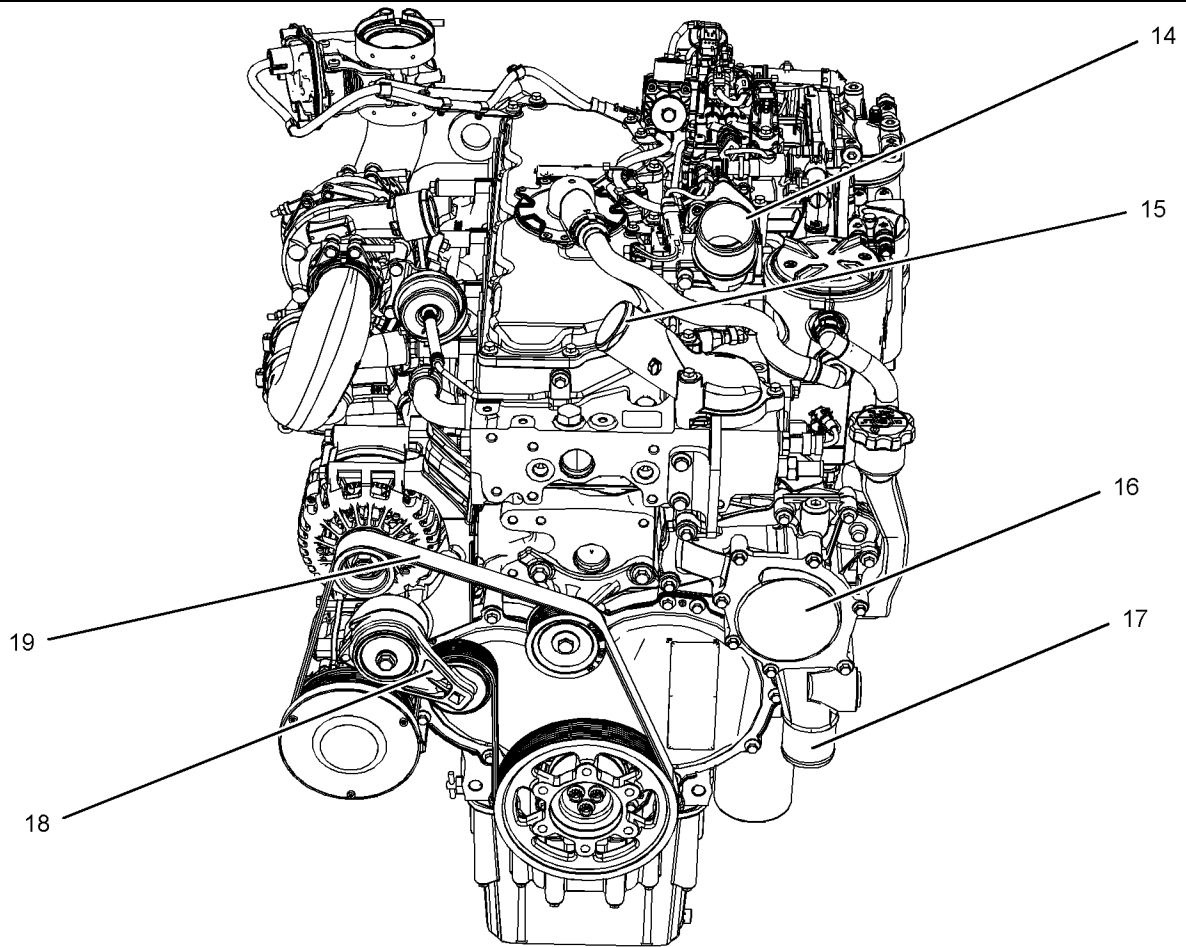


Illustration 19

g03404423

Typical example

(14) Air intake  
(15) Coolant outlet

(16) Water pump  
(17) Coolant intake

(18) Tensioner  
(19) Belt

## DOC, DPF, and SCR Serial Plate

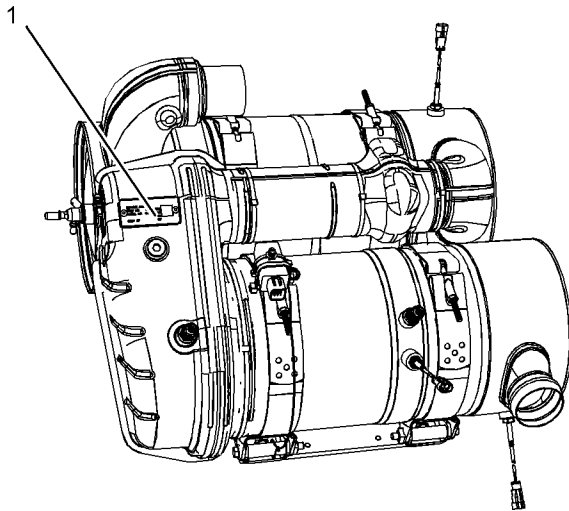


Illustration 28

g03713367

### Typical example

The plate (1) is installed after the DPF.

Record all the information on the serial plate for your aftertreatment system. The information will be required by your Perkins distributors.

## Pump Electronic Unit

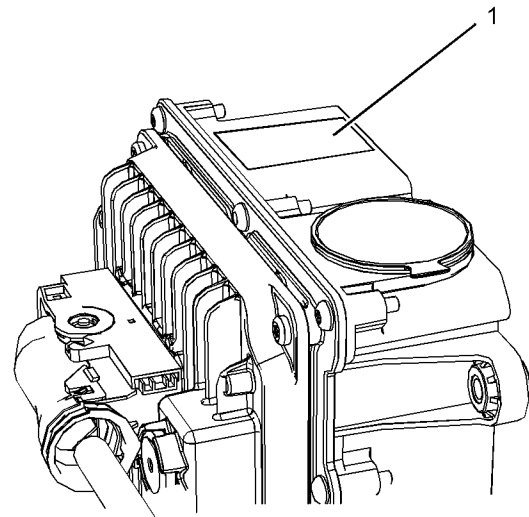


Illustration 29

g03700583

The serial plate (1) for the pump electronic unit is installed beside the diesel exhaust fluid filter.

i05673571

## Emissions Certification Film

The label for the emission is installed on the front gear cover.

**Note:** A second emission label will be supplied with the engine. If necessary, the second emission label will be installed on the application by the original equipment manufacturer.

Operation Section  
Sensors and Electrical Components

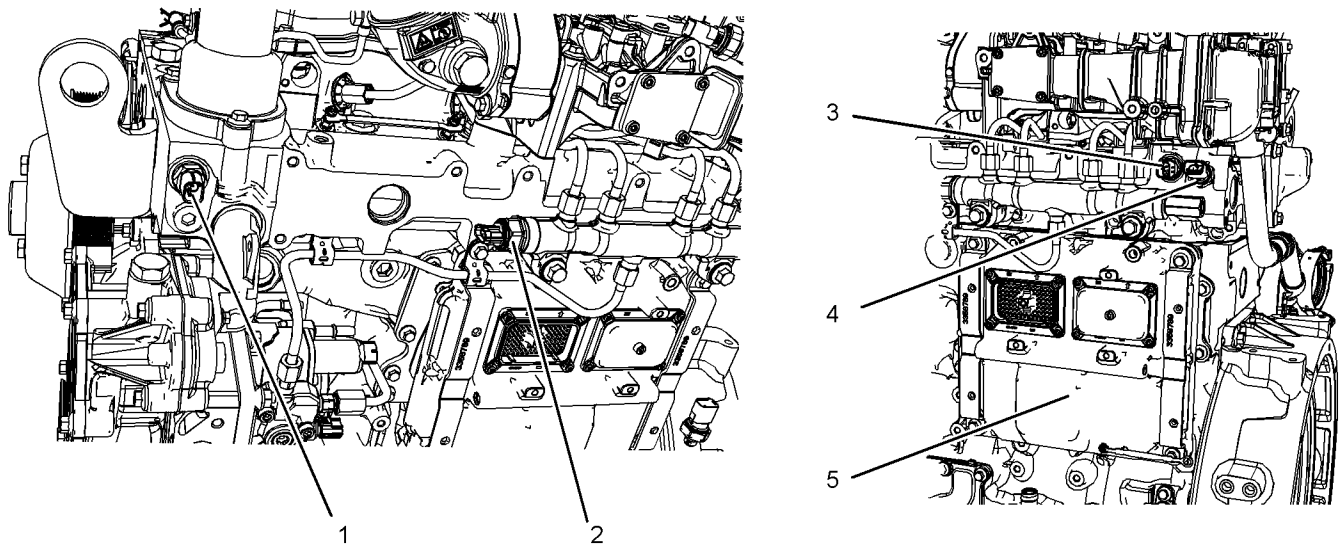


Illustration 42

g02413838

Typical example

- |  |  |
|--|--|
| (1) Coolant Temperature Sensor                       | (3) Intake Manifold Air Temperature Sensor |
| (2) Fuel Pressure Sensor (Fuel Rail Pressure Sensor) | (4) Intake Manifold Pressure Sensor        |
|  | (5) Electronic Control Module (ECM)        |

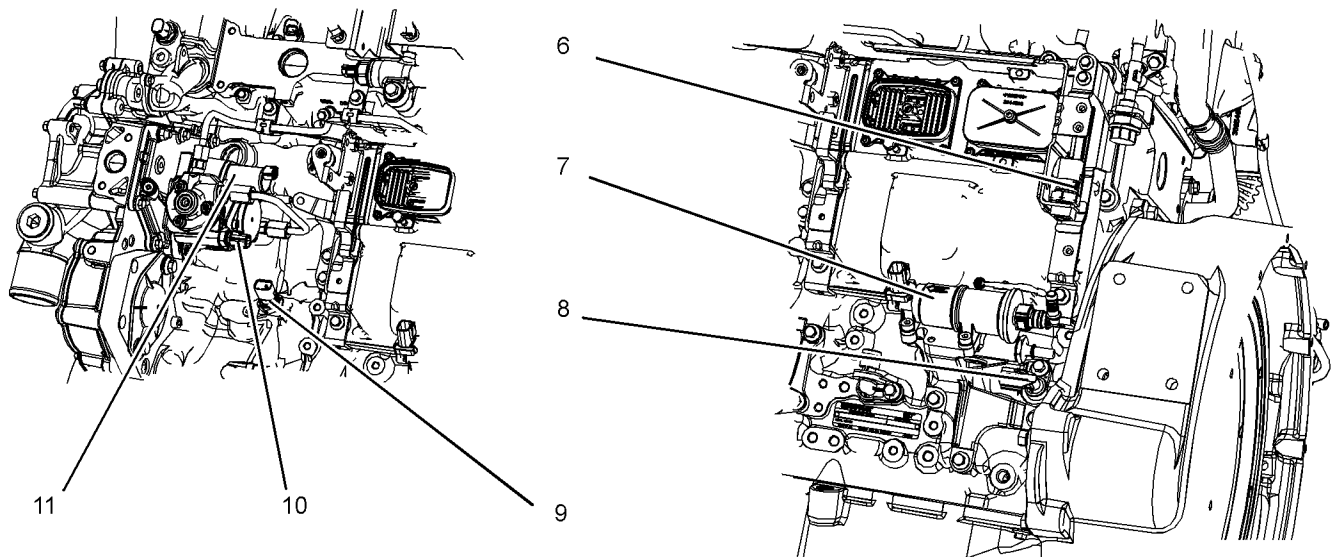


Illustration 43

g03420558

Typical example

- |  |  |   |
|--|--|---|
| (6) Atmospheric Pressure Sensor (Barometric Pressure Sensor) | (8) Primary Speed/Timing sensor (Crankshaft Position Sensor) | (10) Fuel Temperature Sensor                                |
| (7) Priming/ Transfer pump                                   | (9) Oil Pressure Sensor                                      | (11) Fuel Metering Solenoid for the High Pressure Fuel Pump |

## DOC, DPF, and SCR

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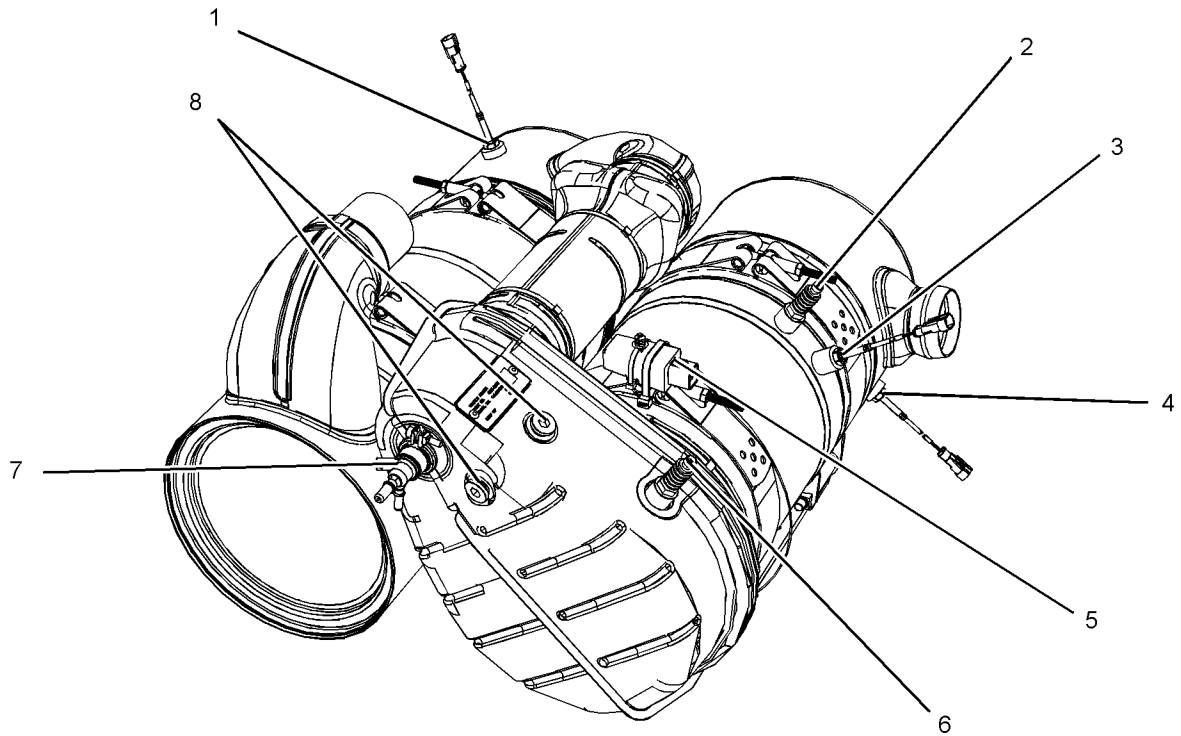


Illustration 48

g03713372

### Typical example

(1) SCR Temperature Sensor  
(2) Soot Sensor Connection  
(3) DPF Temperature Sensor

(4) DOC Temperature Sensor  
(5) Identification Module  
(6) Soot Sensor Connection

(7) DEF Injector  
(8) NOx Sensor location

(Table 13, contd)

Delayed Engine Shutdown Enable Status	
Delayed Engine Shutdown Maximum Time	
High Soot Load Aftertreatment Protection Enable Status	
Air Shutoff	
Throttle Lock Feature Installation Status	
PTO Mode	
Throttle Lock Engine Set Speed #1	
Throttle Lock Engine Set Speed #2	
Throttle Lock Increment Speed Ramp Rate	
Throttle Lock Decrement Speed Ramp Rate	
Throttle Lock Engine Set Speed Increment	
Throttle Lock Engine Set Speed Decrement	
Monitoring Mode Shutdowns	
Monitoring Mode Derates	
Limp Home Desired Engine Speed	
Engine Acceleration Rate	
Engine Speed Decelerating Ramp Rate	
Intermediate Engine Speed	
<b>Fan</b>	
Engine Fan Control	
Engine Fan Type Configuration	
Engine Cooling Fan Temperature Error Increasing Hysteresis	
Engine Cooling Fan Temperature Error Decreasing Hysteresis	
Engine Cooling Fan Current Ramp Rate	
Engine Cooling Fan Speed	
Top Engine Fan Speed	
Minimum Desired Engine Cooling Fan Speed	
Engine Cooling Fan Solenoid Minimum Current	
Engine Cooling Fan Solenoid Maximum Current	
Engine cooling Fan solenoid Dither Frequency	
Engine Cooling Fan Solenoid Dither Amplitude	
Engine Cooling Fan Pulley Ratio	
Engine Cooling Fan Speed (Proportional) Gain Percentage	
Engine Cooling Fan Speed (Integral) Stability Percentage	
<b>Fan Temperatures</b>	

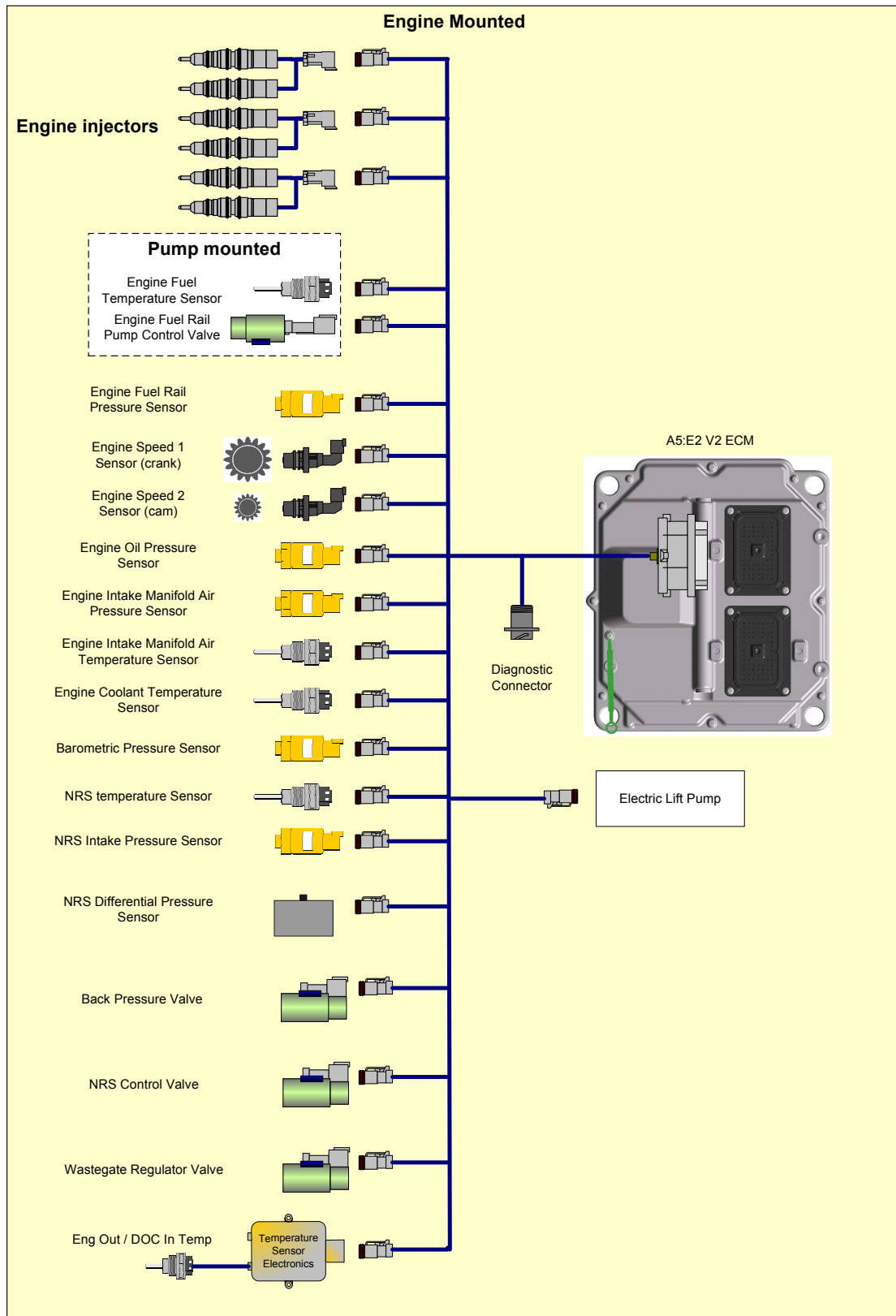
(continued)

### 2.2.3 Selective Catalytic Reduction (SCR) Technologies

The SCR system supplied by Perkins with each Tier 4 Final engine family differs depending on the selected product. In principle however the 1204F and 1206F DEF systems are made up of the same core components as listed below;

- **DEF Tank and Header Unit.** The Header controls feed of DEF out to the DEF pump and houses temperature and level sensors. Unit also provides mechanism for tank thaw to be achieved during engine running.
- **Coolant Valve.** Controls the flow of engine coolant out to the DEF header to aid DEF thaw.
- **DEF Heated Lines.** Required to supply DEF to and from the DEF pump and from the DEF pump out to the DEF injector. Each line has a heated element electrical connection to ensure DEF flowing through the lines is kept from freezing.
- **Dosing Control Unit.** The SCR system DCU controller is required to provide localised control of the aftertreatment DEF system and manage the system communication between the SCR system and the engine ECM.
- **DEF Pump Unit.** The DEF pump unit is required to draw DEF from the tank and provide pressurised fluid to the DEF injector. The DEF pump is also responsible for purging the system of DEF during engine shutdown.
- **DEF Injector.** The DEF injector is responsible for dispersing DEF into the engine exhaust Post DOC / DPF to provide DEF storage across the SCR catalyst.
- **SCR (Selective Catalytic Reduction) Catalyst.** Used to store DEF (Urea) across a catalyst material so that when engine exhaust gas is passed over it NO<sub>x</sub> gas is removed.

### 2.3.2 1206F Engine and Aftertreatment Layout



## 5.0 Connectors & Wiring Harness Requirements

This section provides details on each of the connector that must be used to connect the mandatory engine and aftertreatment electrical components.

### 5.1 Engine ECM J1 Connector

The engine ECM connector for the Tier 4Final/Stage IV engine A5:E2 V2 ECM is an 86 pin connector. The ECM J1 connection is used by the customer / OEM as the main interface back to the engine control module for both the engine aftertreatment system and machine control.

Qty	Description	Supplier Part Number	Supplier
1	86 Way J1 ECM Plug Assembly	DRCP28-86SA	Deutsch
1	Connector Dress Cover	398-3671	Perkins
1	Seal	0413-204-2005	Deutsch
<b>High Volume Terminals</b>			
80	Connector 16,18 AWG Socket Stamped and Formed	1062-20-0377	Deutsch
6	Connector 12, 14 AWG Socket Stamped and Formed	1062-12-0166	Deutsch
<b>Solid Terminals Low Volume</b>			
80	Connector 18-16AWG Socket	0462-005-20309	Deutsch
6	Connector 12-14AWG Socket	0462-203-12141	Deutsch
<b>Cavity Seals</b>			
N/A	Connector Cavity Seals 1-80	0413-204-2005	Deutsch
N/A	Connector Cavity Seals Position 81-86	114017	Deutsch

Table 5.1 ECM J1 Connector Components

#### 5.1.1 J1 Connector Layout

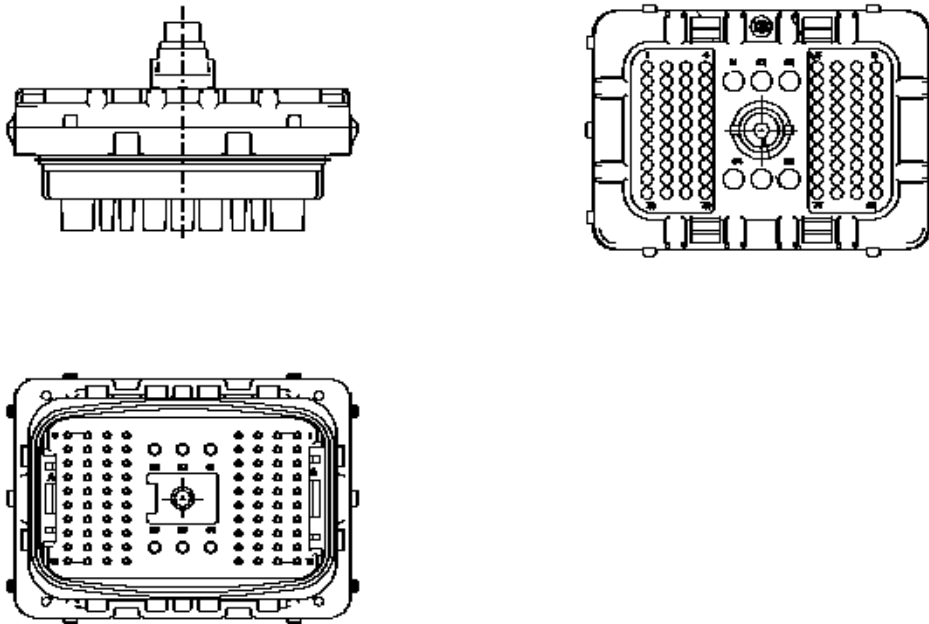


Figure 5.1 ECM J1 Deutsch DRC Connector

All connectors, seals and terminals shown throughout this document have been specified to suit the SAE J1128 GXL or TXL cabling standard. If other wiring standards are to be used the following points must be considered.

- Cable Insulation Outside Diameter
- Cable Conductor Cross Sectional Area (CSA)
- Temperature Exposure
- Abrasion Risk

To ensure all of the above points are taken into consideration please consult the manufacturers cable specification.

### 5.7.1 Wire Thickness Overview

The following sections provide some guidance on the differences in min/max cable thickness for some of the most popular wiring standards.

#### 5.7.1.1 SAE J1128 GXL

GXL cable is the recommended cable size for the connector system used. Using this cable with the specified wire seals and terminals (where appropriate) will result in the correct sealing of the electrical system.

SAE Conductor Size	Wall Thickness Nominal (mm)	Wall Thickness Minimum (mm)	Max Cable Diameter (mm)
20	0.58	0.41	2.40
18	0.58	0.41	2.50
16	0.58	0.41	2.90
14	0.58	0.41	3.20
12	0.66	0.46	3.80
10	0.79	0.55	4.70

#### 5.7.1.2 ISO6722 - Thin Wall

Please contact your Applications Engineering department if ISO specification wiring is required.

ISO Conductor Size (mm <sup>2</sup> )	GXL Equivalent	Dia	Wall Thickness Nominal (mm)	Wall Thickness Minimum (mm)	Max Cable Diameter (mm)
0.5	20	1.1	0.28	0.22	1.70
0.75	18	1.3	0.3	0.24	1.90
1	16	1.5	0.3	0.24	2.10
1.25	-	1.7	0.3	0.24	2.30
1.5	-	1.8	0.3	0.24	2.40
2	14	2.0	0.35	0.28	2.80
2.5	-	2.2	0.35	0.28	3.00
3.0	12	2.4	0.4	0.32	3.40

#### 5.7.1.3 ISO6722 – Thick Wall

Unsuitable for the connector and sealing system used.

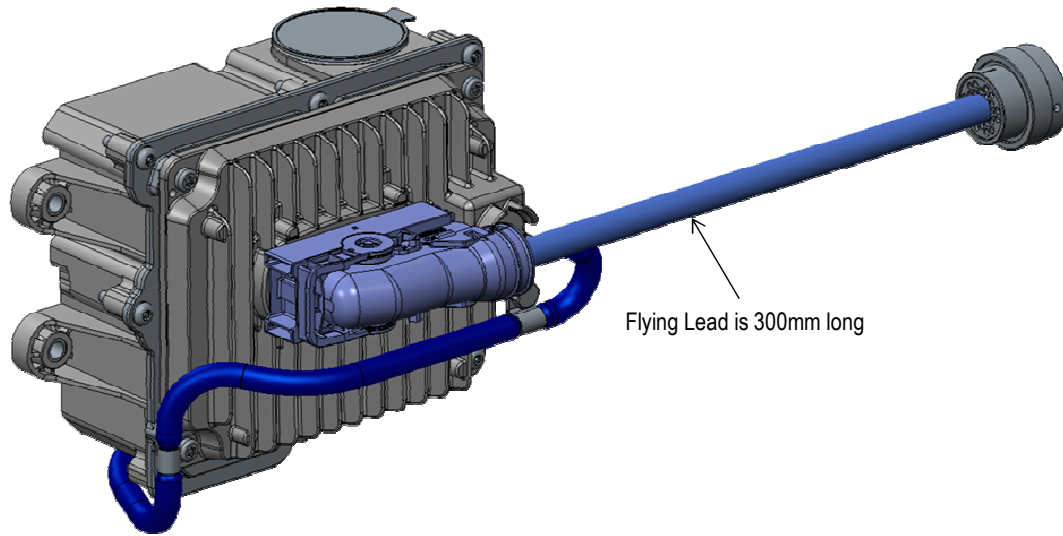


Figure 7.6 Tenneco XNOx DCU and Pump Unit With Factory Supplied Harness

Connection to the 31 pin customer interface connector is made using one of the two part numbers listed below in table 7.6. The choice of which will be dependent upon the wire gauge diameter used.

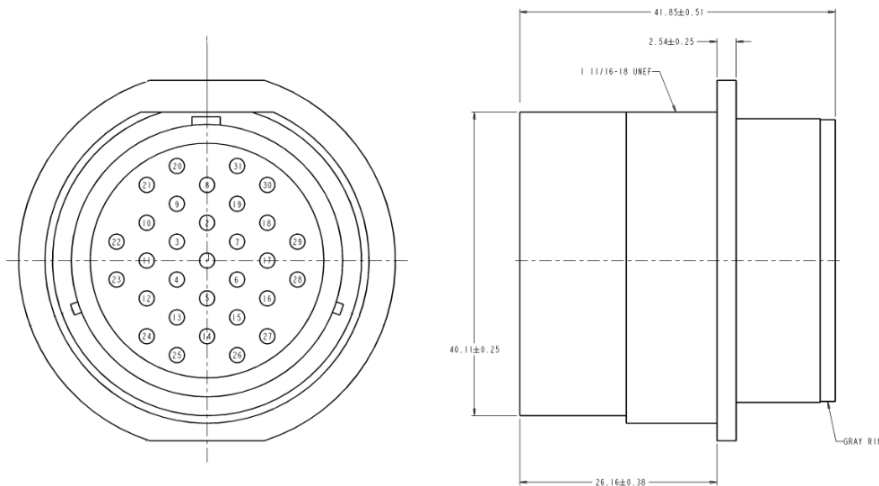


Figure 7.7 Tenneco XNOx DCU & Pump Unit 31 Pin Interface Connector

Component Description	Perkins Part Number	Supplier Part Number	Quantity
31-way Receptacle (reverse mount) with sockets std Wire diameter 2.23 – 3.4mm	TBD	Deutsch HDP24-24-31ST	1
31-way Receptacle (reverse mount) with sockets Wire diameter 2.23 – 2.69mm	TBD	Deutsch HDP24-24-31SE	N/A
Sockets	2900A016	Deutsch 0462-201-1631	24
Sealing Plug	2900A011	Deutsch 114017	7

Table 7.6 Tenneco XNOx DCU & Pump Unit Connector Part Number

## 9.0 Component Installation Requirements

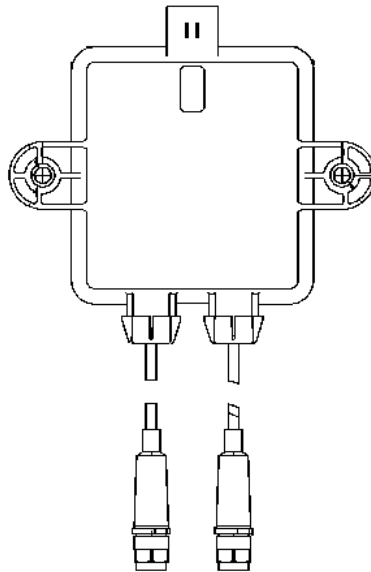
This section provides the individual emissions system components installation requirements. For details of the specific components required for each engine and AT system please refer to sections 5 and 6 of this document.

### 9.1 DPF Soot Sensor

#### 9.1.1 DPF Soot Sensor Operation

The function of the DPF Soot sensor is to provide information for the determination of the amount of soot in a diesel particulate filter. Two antennas are installed in the diesel particulate filter, one upstream and one downstream of the filter section. The Soot sensor is connected to the antennas and the engine electronic control module (see wiring schematic for specific engine family for more details).

The Soot sensor cables are coaxial cables. The connection of these cables to the antennas is non-polarity specific and so can be connected to the antennas interchangeably. The order is insignificant to the sensor function. The coaxial cables used to connect the antennas to the main body of the sensor are supplied attached to the sensor body and are available in two lengths 1.5m and 2.5m.



The Soot sensor is designed to operate with specific combinations of diesel particulate filters and engine software. The sensor outputs its measurement in SAE J1939 publicly approved messages over a Controller Area Network (CAN) bus.

#### 9.1.2 DPF Soot Sensor Configuration

No first fit configuration of the DPF soot sensor is required.

#### 9.1.3 DPF Soot Sensor Installation

The preferred mounting orientation for the electronic boxes is shown in the picture below. Having the cables and harness lead wires both exiting horizontally is the preferred method to avoid water collecting on the wire

## 11.0 Engine Speed Demand

It is necessary to select a device that converts the speed requirements of the engine operator or controller to an electrical signal recognized by the engine ECM. There are five types of speed demand input:

- Pulse Width Modulation (PWM) Sensor
- Analogue Sensor
- Throttle lock (PTO mode) - also known as “engine speed cruise control” or “set speed control”.
- Multi Position Throttle Switches (MPTS)
- Torque Speed Control - TSC1 (Speed control over CAN J1939)

The speed demand type must be carefully considered and appropriate for the application.

There are two dedicated software input channels that can be configured to accept specific types of speed demand inputs. The valid combinations and throttle logic are given in the following diagram. PTO mode can be used with Analogue/PWM combinations; it cannot be used with multi position switch. The J1939 TSC1 parameter will override any speed demand input when broadcast. Droop is applied to the requested desired engine speed only when All Speed governing is selected.

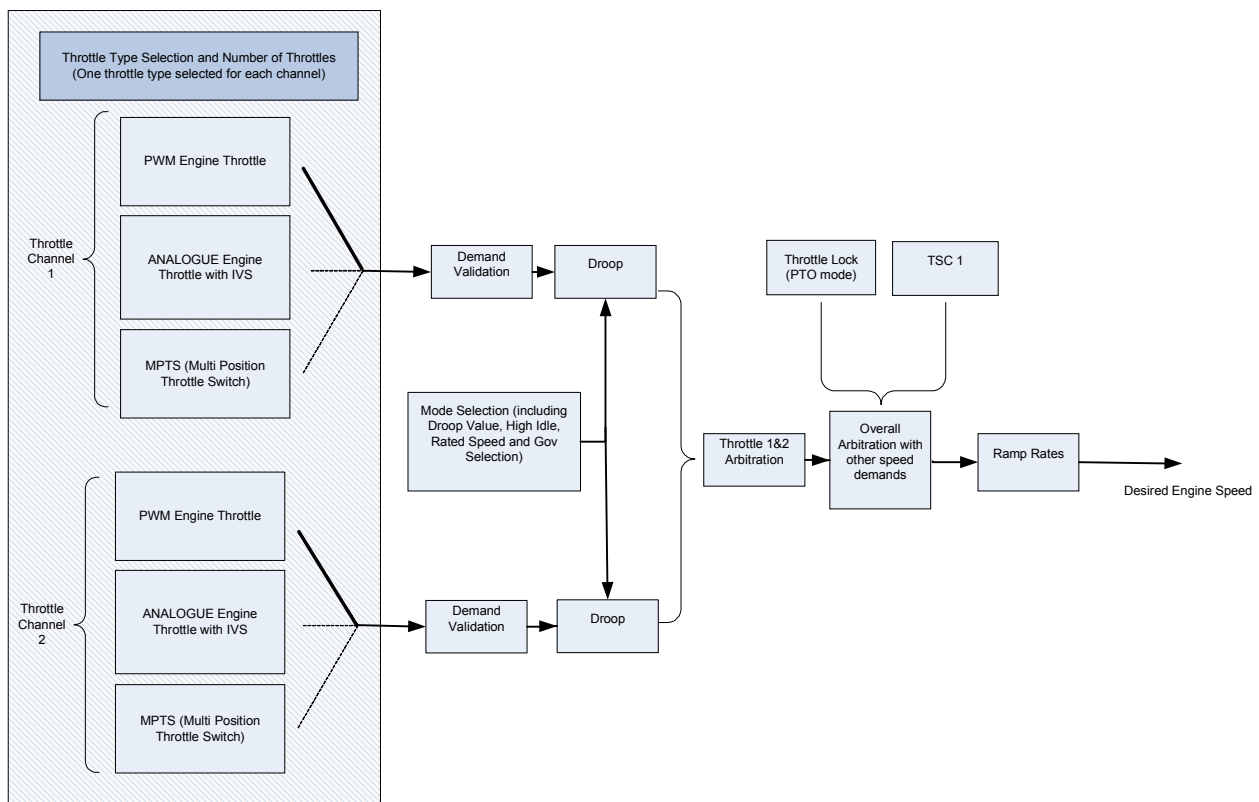


Figure 11.1 Engine Speed Demand Software Control

### 11.10.2 Throttle Calibration Function

When the engine ECM is active the raw throttle signal is continuously monitored. The following diagrams explain how the automatic calibration functions. The adjustment screws in the diagram have been purposely adjusted and differ from the previous throttle pedal diagram. When the engine ECM is active the raw throttle value is checked, if the value falls within the lower calibration region (defined by the 'lower position limit' & 'Initial lower position limit') calibration will take place. In the diagram below the lever position is at 11% and falls within the lower calibration area so auto calibration will be applied.

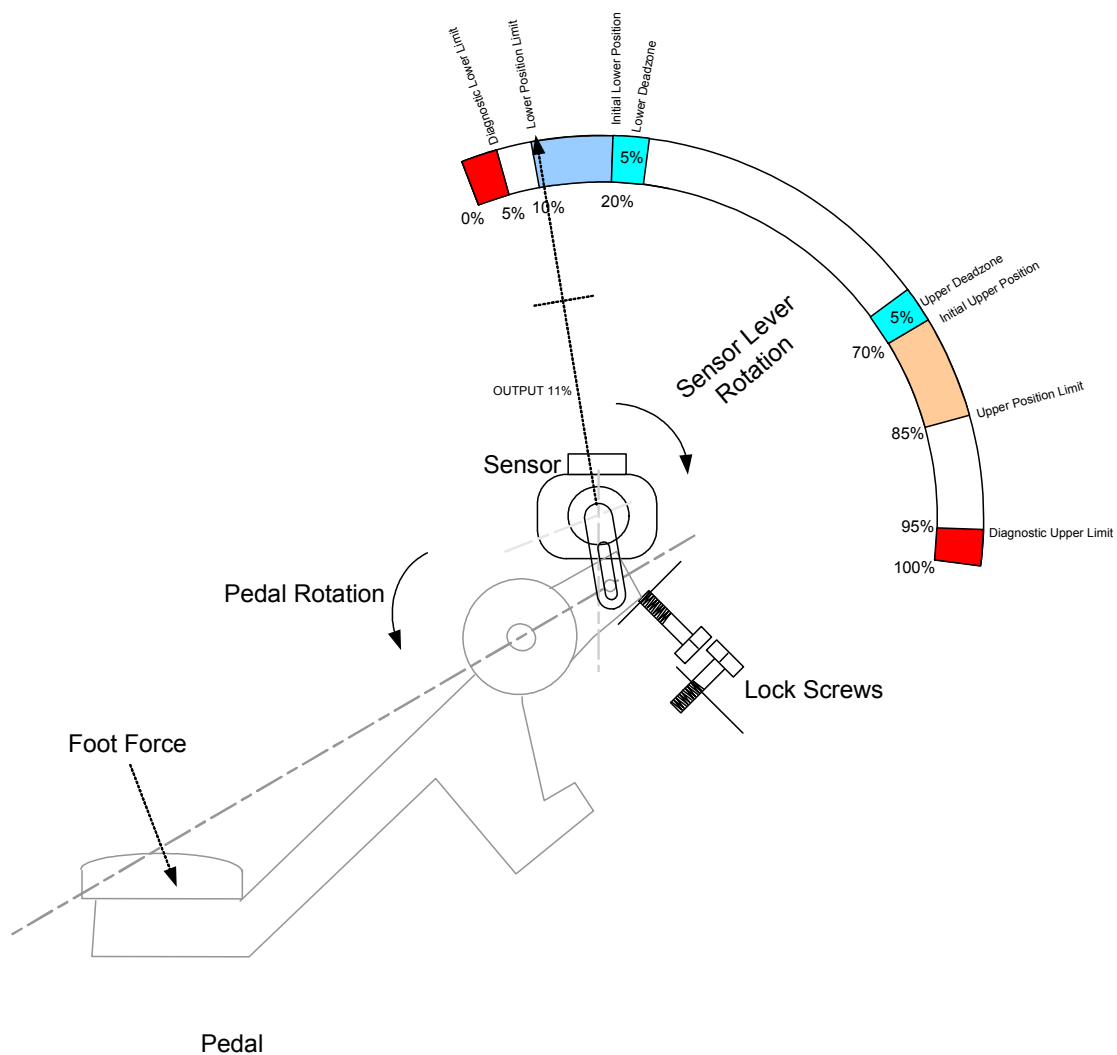


Figure 11.9 Analogue Throttle Lower Calibration Prior to Calibration

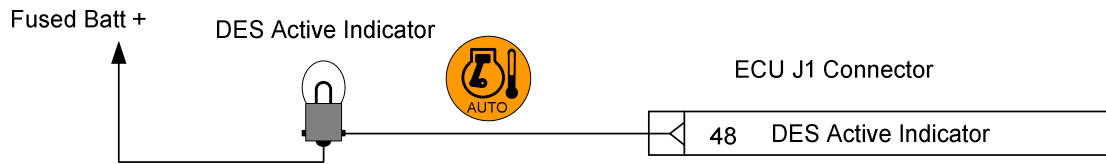
Diagram A, *before calibration*, the sensor output falls within the lower calibration region, without auto calibration the 'initial lower position limit' is used by the engine ECM as the throttle start point. Once clear of the

switch OFF until the engine exhaust temperature has dropped below a defined threshold. The DES indicator will illuminate whilst the DES cool down procedure is active. Further information regarding the DES procedure and operation can be found in section 16.0 of this document.

**13.3.11.2 DES Indicator Configuration**

There are no configuration requirements relating specifically to the DES indicator however the DES feature must be enabled for the indicator to operate

**13.3.11.3 DES Indicator Installation**



Function	PGN	SPN / Byte	Start bit	Length	Applicable States
Engine Cooldown In Operation	64914	3543	1.1	4 bits	0101 – Cool down

**Note: General Hardwired Indicator Lamp Requirements**

Where the engine controller is used to directly control the various engine warning lamps, it is recommended that Light Emitting Diode-type lamps are used in all cases. Many generic LED lamp assemblies incorporate a resistor in parallel with the LED; LED lamp assemblies with a parallel resistance value of less than 5kΩ should not be used. Where incandescent bulb-type lamps are used, it is required that a MUR460-type diode (or equivalent) is fitted in series between the incandescent lamp and the corresponding ECM pin. Where the engine controller communicates a warning lamp status to a display via CAN, and does not drive the warning lamps directly, these requirements may be waived.

**14.0 Engine & Aftertreatment Monitoring System**

The engine control system is designed to monitor each engine and aftertreatment sensor / actuator and react to system critical or emissions critical failures. When a system error occurs such as high engine coolant temperature the engine monitoring system reacts by raising the appropriate engine diagnostic level and in some cases forces the engine into a derate condition or controlled shutdown.

It is recognized that for some applications a control system induced engine shutdown or derate could cause safety concerns or auxiliary equipment damage and for these reasons the engine response can be configured.