647173EN (03/04/2013)

PERKINS ENGINE

854E-E34TA
854F-E34T

Repair Manual

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Valve Mechanism Cover

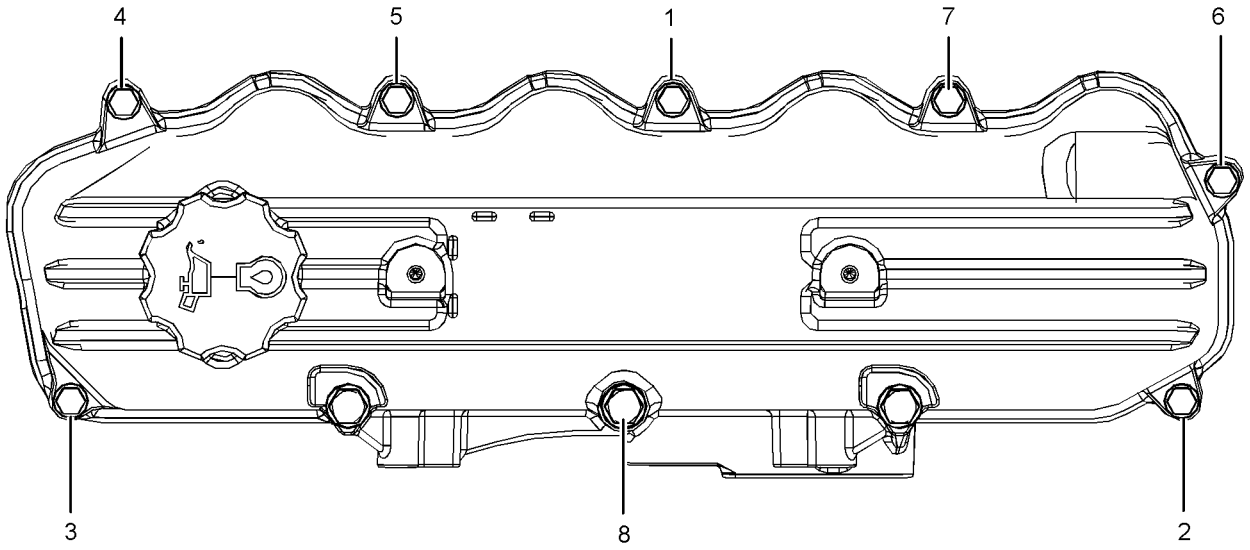

Illustration 11 g02490536

Typical example

Tighten the M6 fasteners (1), (2), (3), (4), (5), (6) and (7) in the sequence shown in illustration 11 to an initial torque. ..... 5 N·m (44 lb in)

Tighten the M8 fastener (8) in the sequence shown in illustration 11 to an initial torque. .... 10 N·m (89 lb in)

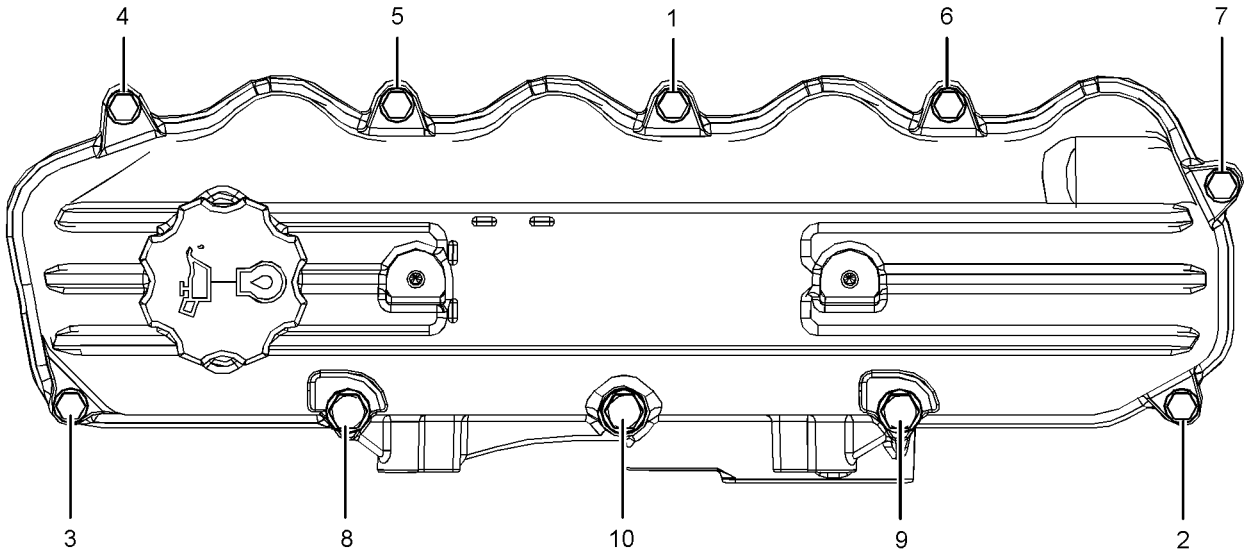

Illustration 12 g02727663

Typical example

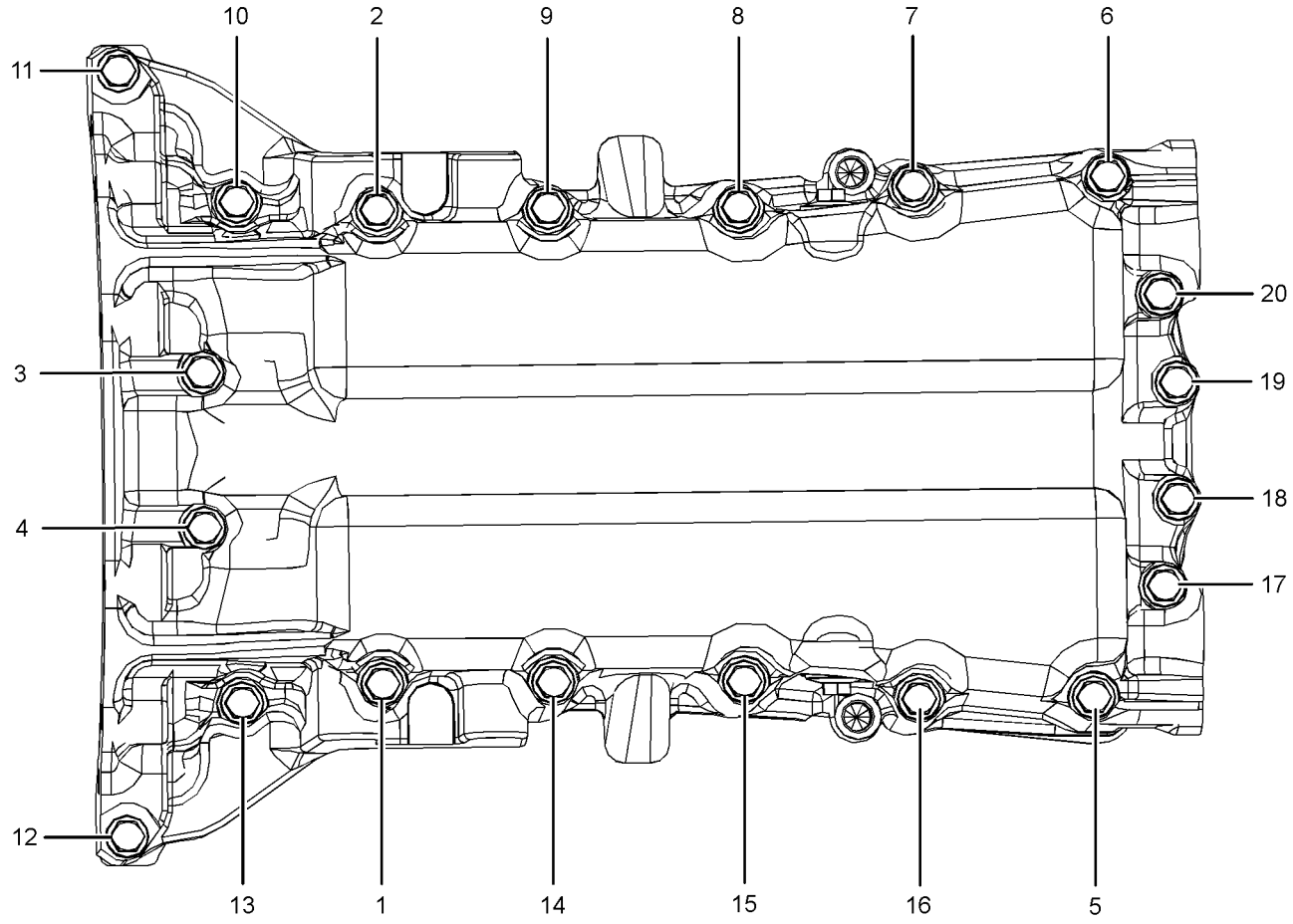

Illustration 33 g02904098

Tightening sequence for the deep tunnel oil pan

Tighten the fasteners (2) to an initial torque of 13.5 N·m (10 lb ft). Tighten the fasteners in sequence that is shown in illustration 34.

Tighten the fasteners (2) to an initial torque of 45 N·m (33 lb ft). Tighten the fasteners in sequence that is shown in illustration 34.

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Main Bearing Journal

The original size of the main bearing journal ..... 83.980 to 84.000 mm (3.30629 to 3.30708 inch)

Maximum permissible wear of the main bearing journals ..... 0.040 mm (0.0016 inch)

Radius of the fillet of the main bearing journals ..... 3.875 to 4.125 mm (0.15256 to 0.16240 inch)

Surface finish of bearing journals and crank pins ..... Ra 0.2 microns

Surface finish of radii ..... Ra 0.4 microns

Width of new main bearing journal where the thrust washer is installed ..... 35.235 to 35.165 mm (1.3872 to 1.3844 inch)

Width of new main bearing journal where the thrust washer is not installed ..... 35.25 to 35.15 mm (1.38779 to 1.38386 inch)

The shell for the main bearings

The shells for the main bearings are available for remachined journals which have the following oversize dimensions.

Oversize bearing shell .... 0.127 mm (0.005 inch)
Oversize bearing shell .... 0.254 mm (0.010 inch)
Oversize bearing shell .... 0.508 mm (0.020 inch)

Thickness at center of the shells of oversize bearing shell 0.25 mm (0.010 inch) ..... 2.226 to 2.232 mm (0.08764 to 0.08787 inch)

Thickness at center of the shells of oversize bearing shell 0.50 mm (0.020 inch) ..... 2.353 to 2.359 mm (0.09264 to 0.09287 inch)

Thickness at center of the shells of oversize bearing shell 0.76 mm (0.030 inch) ..... 2.480 to 2.486 mm (0.09764 to 0.09787 inch)

Width of the main bearing shells .. 26.32 to 26.58 mm (1.03622 to 1.04645 inch)

Clearance between the bearing shell and the main bearing journals ..... 0.032 to 0.102 mm (0.00126 to 0.00402 inch)

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Connecting Rod

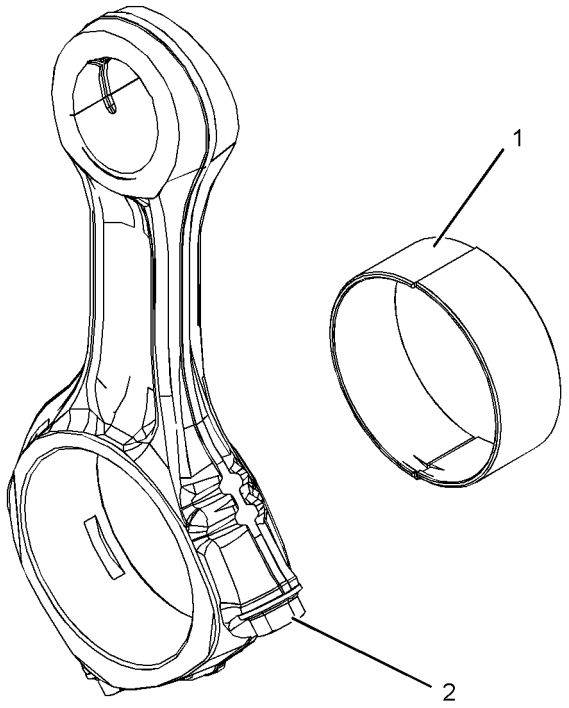

Illustration 47 g02859356
Typical example

(1) The bearing shell for the connecting rod

For the correct procedure to install the bearing shell for the connecting rod, refer to Disassembly and Assembly, “Pistons and Connecting Rods - Assemble”.

Table 5

Thickness of Connecting Rod Bearing at the Center	1.955 to 1.968 mm (0.07697 to 0.07748 inch)
Thickness of Bearing Cap at the Center	1.955 to 1.968 mm (0.07697 to 0.07748 inch)
Bearing Clearance	0.080 to 0.035 mm (0.00315 to 0.00138 inch)

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Starter Motor

12 V Starting Motor 3.2 kW

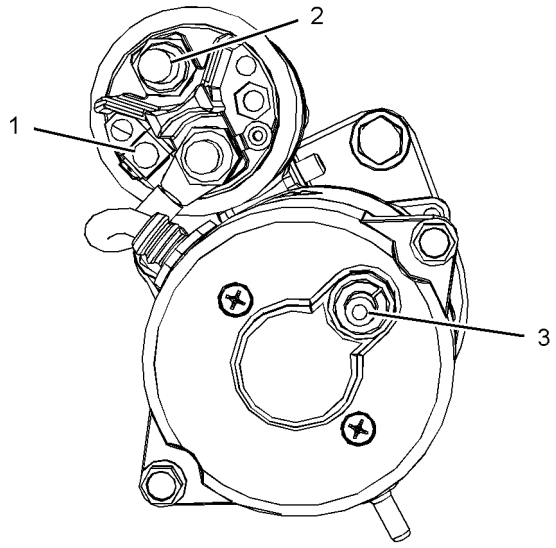

Illustration 67 g02614019

Typical example

(1) Tighten the solenoid terminal to the following torque. ..... 5.8 N·m (51 lb in)

(2) Tighten the positive terminal nut to the following torque. ..... 15 N·m (11 lb ft)

(3) Tighten the negative terminal nut to the following torque. ..... 12 N·m (106 lb in)

12 V Starting Motor 4.2 kW

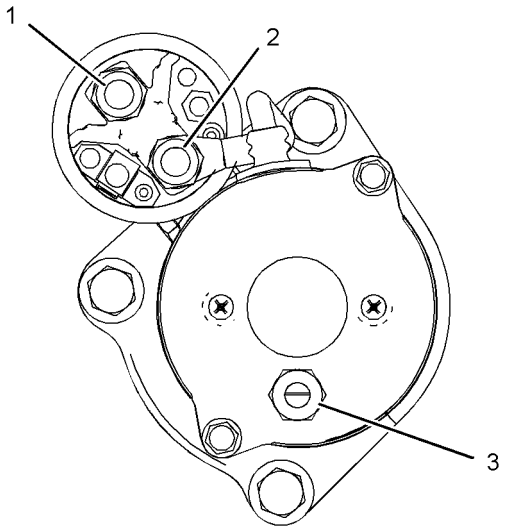

Illustration 68 g02678770

Typical example

(1) Tighten the positive terminal nut to the following torque. ..... 15 N·m (11 lb ft)

(2) Tighten the solenoid terminal to the following torque. ..... 15 N·m (11 lb ft)

(3) Tighten the negative terminal nut to the following torque. ..... 18 N·m (13 lb ft)

24 V Starting Motor 4.5 kW

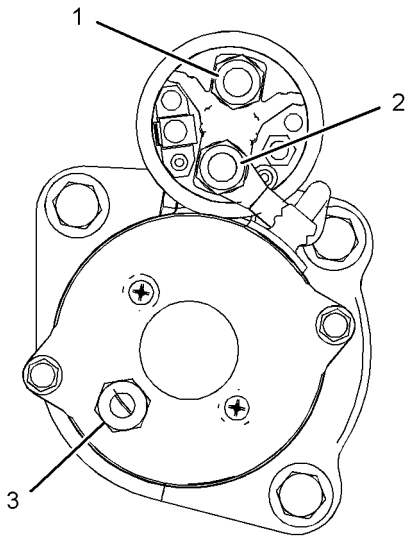

Illustration 69 g02678817

Typical example

(1) Tighten the positive terminal nut to the following torque. ..... 15 N·m (11 lb ft)

SEBU8726-01
February 2012

Operation and Maintenance Manual

854F-E34T and 854E-E34TA Industrial Engines

JR (Engine)
JS (Engine)
JT (Engine)

⚠ 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.

After the engine has stopped, you must wait for 10 minutes in order to allow the fuel pressure to be purged from the high-pressure fuel lines before any service or repair is performed on the engine fuel lines.

Ensure that the engine is stopped. Inspect all lines and hoses for wear or for deterioration. The hoses must be correctly routed. The lines and hoses must have adequate support and secure clamps.

Ensure that Oil filters and fuel filters are correctly installed. The filter housings must be tightened to the correct torque. Refer to the Disassembly and Assembly manual for more information.

Illustration 9 g00704059

Use caution when you are refueling an engine. Do not smoke while you are refueling an engine. Do not refuel an engine near open flames or sparks. Always stop the engine before refueling.

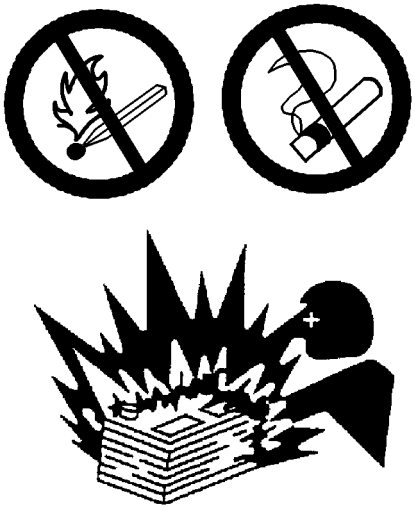

Illustration 10 g00704135

Gases from a battery can explode. Keep any open flames or sparks away from the top of a battery. Do not smoke in battery charging areas.

Never check the battery charge by placing a metal object across the terminal posts. Use a voltmeter or a hydrometer.

Incorrect jumper cable connections can cause an explosion that can result in injury. Refer to the Operation Section of this manual for specific instructions.

Do not charge a frozen battery. Charging a frozen battery may cause an explosion.

The batteries must be kept clean. The covers (if equipped) must be kept on the cells. Use the recommended cables, connections, and battery box covers when the engine is operated.

Fire Extinguisher

Make sure that a fire extinguisher is available. Be familiar with the operation of the fire extinguisher. Inspect the fire extinguisher and service the fire extinguisher regularly. Obey the recommendations on the instruction plate.

Lines, Tubes, and Hoses

Do not bend high-pressure lines. Do not strike high-pressure lines. Do not install any lines that are damaged.

Leaks can cause fires. Consult your Perkins dealer or your Perkins distributor for replacement parts.

Table 1

854F-E34T and 854E-E34TA Engine Specifications	
Operating Range (rpm)	800 to 2500[1]
Number of Cylinders	4 In-Line
Bore	99 mm (3.89763 inch)
Stroke	110 mm (4.33070 inch)
Power	854F 45 to 55.4 kW (60.345 to 74.3 hp) 854E 62 to 86 kW (83.142 to 115.326 hp)
Aspiration	854F Turbocharged 854E Turbocharged charge cooled
Compression Ratio	17: 1
Displacement	3.4 L (207.48 cubic inch)
Firing Order	1-3-4-2
Rotation (flywheel end)	Counterclockwise

(1) The operating rpm is dependent on the engine rating, the application, and the configuration of the throttle.

Engine Type

There are three different engine types. The 854E-E34TA is turbocharged, charge cooled engine, with a wall flow DPF. The letters JR will be on the identification plate.

The 854F-E34T is divided into two different engine types. The engine with JS on the identification plate will have a wall flow DPF. The engine with the letters JT on the identification plate will have a through flow DPF.

Electronic Engine Features

The engine operating conditions are monitored. The Electronic Control Module (ECM) controls the response of the engine to these conditions and to the demands of the operator. These conditions and operator demands determine the precise control of fuel injection by the ECM. The electronic engine control system provides the following features:

- Engine monitoring
- Engine speed governing
- Control of the injection pressure
- Cold start strategy
- Automatic air/fuel ratio control
- Torque rise shaping
- Injection timing control
- System diagnostics
- Aftertreatment Regeneration

For more information on electronic engine features, refer to the Operation and Maintenance Manual, “Features and Controls” topic (Operation Section).

Engine Diagnostics

The engine has built-in diagnostics in order to ensure that the engine systems are functioning correctly. The operator will be alerted to the condition by a “Stop or Warning” lamp. Under certain conditions, the engine horsepower and the vehicle speed may be limited. The electronic service tool may be used to display the diagnostic codes.

There are three types of diagnostic codes: active, logged, and event.

Most of the diagnostic codes are logged and stored in the ECM. For additional information, refer to the Operation and Maintenance Manual, “Engine Diagnostics” topic (Operation Section).

The ECM provides an electronic governor that controls the injector output in order to maintain the desired engine rpm.

Engine Cooling and Lubrication

The cooling system and lubrication system consists of the following components:

- Belt driven centrifugal water pump
- Water temperature regulator which regulates the engine coolant temperature
- Gear-driven rotor type oil pump
- Multi plate oil cooler

The engine lubricating oil is cooled and the engine lubricating oil is filtered.

Engine Service Life

Engine efficiency and maximum utilization of engine performance depend on the adherence to proper operation and maintenance recommendations. In addition, use recommended fuels, coolants, and lubricants. Use the Operation and Maintenance Manual as a guide for required engine maintenance.

Features and Controls

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Monitoring System (Table for the Indicator lamps)

When in operation the amber warning indicator has three states, on solid, flashing and fast flashing. The sequence is to give a visual indication of the importance of the warning. Some application can have an audible warning installed.

Some engines can have a breather heater (22) for the crankcase breather installed.

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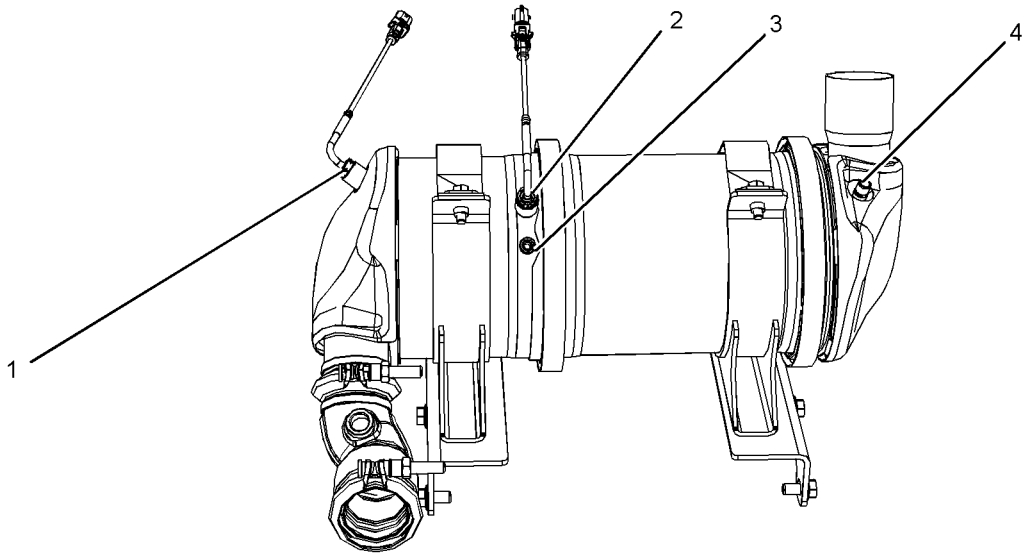
Sensors and Electrical Components (Aftertreatment)

There are two types of aftertreatment that can be installed. The engine power will determine the type of aftertreatment that is installed.

Wall Flow Aftertreatment



g02477078

Illustration 32

Typical example

(1) Diesel oxidation catalyst temperature sensor
(2) Diesel particulate filter (DPF) temperature sensor
(3) Inlet connection for the differential pressure sensor
(4) Outlet connection for the differential pressure sensor

NOTICE
Using a battery source with the same voltage as the electric starting motor. Use ONLY equal voltage for jump starting. The use of higher voltage will damage the electrical system.

Do not reverse the battery cables. The alternator can be damaged. Attach ground cable last and remove first.

Turn all electrical accessories OFF before attaching the jump start cables.

Ensure that the main power switch is in the OFF position before attaching the jump start cables to the engine being started.

1. Turn the start switch on the stalled engine to the OFF position. Turn off all the engine's accessories.

2. Connect one positive end of the jump start cable to the positive cable terminal of the discharged battery. Connect the other positive end of the jump start cable to the positive cable terminal of the electrical source.

3. Connect one negative end of the jump start cable to the negative cable terminal of the electrical source. Connect the other negative end of the jump start cable to the engine block or to the chassis ground. This procedure helps to prevent potential sparks from igniting the combustible gases that are produced by some batteries.

Note: The engine ECM must be powered before the starting motor is operated or damage can occur.

4. Start the engine in the normal operating procedure. Refer to this Operation and Maintenance Manual, “Starting the Engine”.

5. Immediately after the engine is started, disconnect the jump start cables in reverse order.

After jump starting, the alternator may not be able to fully recharge batteries that are severely discharged. The batteries must be replaced or charged to the proper voltage with a battery charger after the engine is stopped. Many batteries which are considered unusable are still rechargeable. Refer to Operation and Maintenance Manual, “Battery - Replace” and Testing and Adjusting Manual, “Battery - Test”.

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After Starting Engine

Note: In ambient temperatures from 0 to 60°C (32 to 140°F), the warm-up time is approximately three minutes. In temperatures below 0°C (32°F), additional warm-up time may be required.

When the engine idles during warm-up, observe the following conditions:

Do not check the high pressure fuel lines with the engine or the starting motor in operation. If you inspect the engine in operation, always use the proper inspection procedure in order to avoid a fluid penetration hazard. Refer to Operation and Maintenance Manual, “General hazard Information”.

- Check for any fluid or for any air leaks at idle rpm and at one-half full rpm (no load on the engine) before operating the engine under load. This is not possible in some applications.

- Allow the engine to idle for three to five minutes, or allow the engine to idle until the water temperature indicator begins to rise. Check all gauges during the warm-up period.

Note: Gauge readings should be observed and the data should be recorded frequently while the engine is operating. Comparing the data over time will help to determine normal readings for each gauge. Comparing data over time will also help detect abnormal operating developments. Significant changes in the readings should be investigated.

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Fuel Related Components in Cold Weather

Fuel Tanks

Condensation can form in partially filled fuel tanks. Top off the fuel tanks after you operate the engine.

Fuel tanks should contain some provision for draining water and sediment from the bottom of the tanks.

Some fuel tanks use supply pipes that allow water and sediment to settle below the end of the fuel supply pipe.

Some fuel tanks use supply lines that take fuel directly from the bottom of the tank. If the engine is equipped with this system, regular maintenance of the fuel system filter is important.

Drain the water and sediment from any fuel storage tank at the following intervals: weekly, service intervals, and refueling of the fuel tank. This will help prevent water and/or sediment from being pumped from the fuel storage tank and into the engine fuel tank.

Fuel Filters

A primary fuel filter is installed between the fuel tank and the engine fuel inlet. After you change the fuel filter, always prime the fuel system in order to remove air bubbles from the fuel system. Refer to the Operation and Maintenance Manual in the Maintenance Section for more information on priming the fuel system.

The location of a primary fuel filter is important in cold weather operation. The primary fuel filter and the fuel supply line are the most common components that are affected by cold fuel.

Fuel Heaters

Note: The OEM may equip the application with fuel heaters. If this is the case, the temperature of the fuel must not exceed 73 °C (163 °F) at the fuel transfer pump.

For more information about fuel heaters (if equipped), refer to the OEM information.

NOTICE
Frequently check the specific gravity of the coolant for proper freeze protection or for anti-boil protection.

Clean the cooling system for the following reasons:

- Contamination of the cooling system
- Overheating of the engine
- Foaming of the coolant

NOTICE
Never operate an engine without water temperature regulators in the cooling system. Water temperature regulators help to maintain the engine coolant at the proper operating temperature. Cooling system problems can develop without water temperature regulators.

Many engine failures are related to the cooling system. The following problems are related to cooling system failures: Overheating, leakage of the water pump, and plugged radiators or heat exchangers.

These failures can be avoided with correct cooling system maintenance. Cooling system maintenance is as important as maintenance of the fuel system and the lubrication system. Quality of the coolant is as important as the quality of the fuel and the lubricating oil.

Coolant is normally composed of three elements: Water, additives, and glycol.

Water

Water is used in the cooling system in order to transfer heat.

Distilled water or deionized water is recommended for use in engine cooling systems.

DO NOT use the following types of water in cooling systems: Hard water, softened water that has been conditioned with salt, and sea water.

If distilled water or deionized water is not available, use water with the properties that are listed in Table 10.

Table 10

Acceptable Water	
Property	**Maximum Limit**
Chloride (Cl)	40 mg/L
Sulfate (SO_4)	100 mg/L
Total Hardness	170 mg/L
Total Solids	340 mg/L
Acidity	pH of 5.5 to 9.0

For a water analysis, consult one of the following sources:

- Local water utility company
- Agricultural agent
- Independent laboratory

Additives

Additives help to protect the metal surfaces of the cooling system. A lack of coolant additives or insufficient amounts of additives enable the following conditions to occur:

- Corrosion
- Formation of mineral deposits
- Rust
- Scale
- Foaming of the coolant

Many additives are depleted during engine operation. These additives must be replaced periodically.

Additives must be added at the correct concentration. Over concentration of additives can cause the inhibitors to drop out-of-solution. The deposits can enable the following problems to occur:

- Formation of gel compounds
- Reduction of heat transfer
- Leakage of the water pump seal
- Plugging of radiators, coolers, and small passages

Glycol

Glycol in the coolant helps to provide protection against the following conditions:

- Boiling

9. Connect the NEGATIVE “-” cable to the NEGATIVE “-” battery terminal.

10. Turn the battery disconnect switch to the ON position.

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Battery Electrolyte Level - Check

When the engine is not run for long periods of time or when the engine is run for short periods, the batteries may not fully recharge. Ensure a full charge in order to help prevent the battery from freezing. If batteries are correctly charged, the ammeter reading should be very near zero, when the engine is in operation.

⚠ WARNING

All lead-acid batteries contain sulfuric acid which can burn the skin and clothing. Always wear a face shield and protective clothing when working on or near batteries.

1. Remove the filler caps. Maintain the electrolyte level to the “FULL” mark on the battery.

   If the addition of water is necessary, use distilled water. If distilled water is not available use clean water that is low in minerals. Do not use artificially softened water.

2. Check the condition of the electrolyte with a suitable battery tester.

3. Install the caps.

4. Keep the batteries clean.

   Clean the battery case with one of the following cleaning solutions:

   - Use a solution of 0.1 kg (0.2 lb) baking soda and 1 L (1 qt) of clean water.
   - Use a solution of ammonium hydroxide.

   Thoroughly rinse the battery case with clean water.

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Battery or Battery Cable - Disconnect

⚠ WARNING

The battery cables or the batteries should not be removed with the battery cover in place. The battery cover should be removed before any servicing is attempted.

Removing the battery cables or the batteries with the cover in place may cause a battery explosion resulting in personal injury.

1. Turn the start switch to the OFF position. Turn the ignition switch (if equipped) to the OFF position and remove the key and all electrical loads.

2. Disconnect the negative battery terminal. Ensure that the cable cannot contact the terminal. When four 12 volt batteries are involved, two negative connection must be disconnected.

3. Remove the positive connection.

4. Clean all disconnected connection and battery terminals.

5. Use a fine grade of sandpaper to clean the terminals and the cable clamps. Clean the items until the surfaces are bright or shiny. DO NOT remove material excessively. Excessive removal of material can cause the clamps to not fit correctly. Coat the clamps and the terminals with a suitable silicone lubricant or petroleum jelly.

6. Tape the cable connections in order to help prevent accidental starting.

7. Proceed with necessary system repairs.

8. In order to connect the battery, connect the positive connection before the negative connector.

Note: Refer to “Inspecting the Primary Air Cleaner Elements”.

Inspecting the Primary Air Cleaner Elements

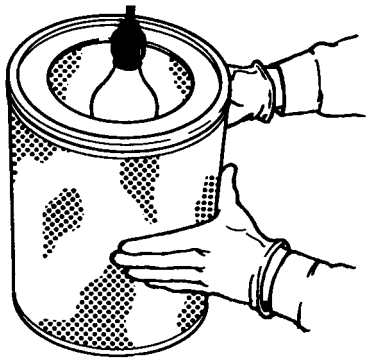

Illustration 50 g00281693

Inspect the clean, dry primary air cleaner element. Use a 60 watt blue light in a dark room or in a similar facility. Place the blue light in the primary air cleaner element. Rotate the primary air cleaner element. Inspect the primary air cleaner element for tears and/or holes. Inspect the primary air cleaner element for light that may show through the filter material. If it is necessary in order to confirm the result, compare the primary air cleaner element to a new primary air cleaner element that has the same part number.

Do not use a primary air cleaner element that has any tears and/or holes in the filter material. Do not use a primary air cleaner element with damaged pleats, gaskets or seals. Discard damaged primary air cleaner elements.

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Engine Air Cleaner Element (Single Element) - Inspect/Replace

Refer to Operation and Maintenance Manual, “Engine Air Cleaner Service Indicator-Inspect”.

NOTICE
Never run the engine without an air cleaner element installed. Never run the engine with a damaged air cleaner element. Do not use air cleaner elements with damaged pleats, gaskets or seals. Dirt entering the engine causes premature wear and damage to engine components. Air cleaner elements help to prevent air-borne debris from entering the air inlet.

NOTICE
Never service the air cleaner element with the engine running since this will allow dirt to enter the engine.

A wide variety of air cleaners may be installed for use with this engine. Consult the OEM information for the correct procedure to replace the air cleaner.

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Engine Air Cleaner Service Indicator - Inspect

Some engines may be equipped with a different service indicator.

Some engines are equipped with a differential gauge for inlet air pressure. The differential gauge for inlet air pressure displays the difference in the pressure that is measured before the air cleaner element and the pressure that is measured after the air cleaner element. As the air cleaner element becomes dirty, the pressure differential rises. If your engine is equipped with a different type of service indicator, follow the OEM recommendations in order to service the air cleaner service indicator.

The service indicator may be mounted on the air cleaner element or in a remote location.

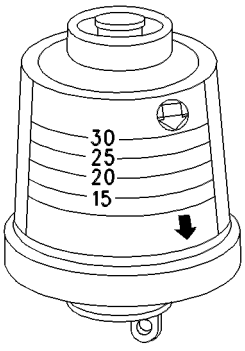

Illustration 51 g00103777
Typical service indicator

Observe the service indicator. The air cleaner element should be cleaned or the air cleaner element should be replaced when one of the following conditions occur:

- The yellow diaphragm enters the red zone.
- The red piston locks in the visible position.

2. Lubricate the O ring seal (7) with clean engine oil. Do NOT fill the bowl with fuel before the assembly is installed.

3. Do NOT use a tool in order to install the filter assembly. Tighten the filter bowl (6) by hand. Install the filter bowl (6) and align with your temporary marks (A).

4. Tighten the valve (2) securely. Remove the container and dispose of the fuel in a safe place.

5. The secondary filter element must be replaced at the same time as the primary filter element. Refer to the Operation and Maintenance Manual , “Fuel System Filter - Replace”.

i04366973

Fuel System Primary Filter/Water Separator - Drain

⚠ WARNING

Fuel leaked or spilled onto hot surfaces or electrical components can cause a fire. To help prevent possible injury, turn the start switch off when changing fuel filters or water separator elements. Clean up fuel spills immediately.

NOTICE
Ensure that the engine is stopped before any servicing or repair is performed.

NOTICE
The water separator can be under suction during normal engine operation. Ensure that the drain valve is tightened securely to help prevent air from entering the fuel system.

1. Place a suitable container under the water separator in order to catch any fluid that might spill. Clean up any spilled fluid.

2. Ensure that the outer body of the filter assembly is clean and free from dirt.

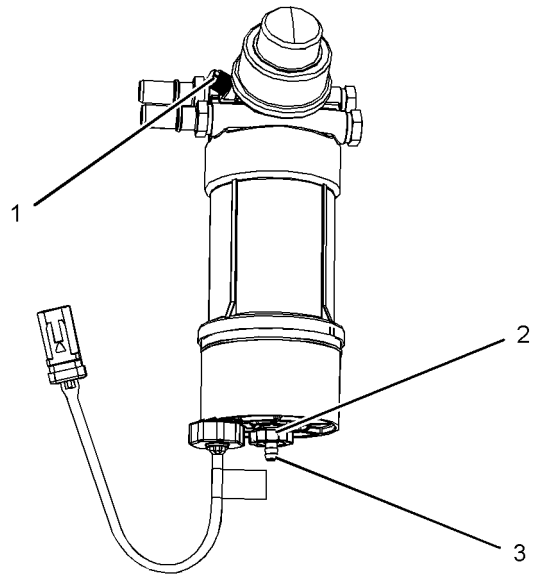

Illustration 64 g02520797
Typical example

3. Install a suitable tube onto drain (3). Open the drain valve (2). Rotate the drain valve counterclockwise. Two full turns are required. Loosen vent screw (1).

Note: Two complete rotations of the valve will release the valve from the filter element.

4. Allow the fluid to drain into the container.

5. Engage the threads of the valve into the filter element and tighten the drain valve by hand pressure only. Tighten vent screw securely.

6. Remove the tube and remove the container.

i04367528

Fuel System Secondary Filter - Replace

⚠ WARNING

Fuel leaked or spilled onto hot surfaces or electrical components can cause a fire. To help prevent possible injury, turn the start switch off when changing fuel filters or water separator elements. Clean up fuel spills immediately.

NOTICE
Ensure that the engine is stopped before any servicing or repair is performed.

Note: Items that are replaced under this warranty become the property of Perkins Engine Company limited .

Owner Responsibilities

During the emission warranty period, the owner is responsible for the following items:

- The costs in order to investigate complaints which are not caused by a defect in Perkins Engine Company limited material or Perkins Engine Company limited workmanship.
- Providing timely notice of a warrantable failure and promptly making the product available for repair

Limitations

Perkins Engine Company limited is not responsible for resultant damages to an emission-related part or component resulting from the following items:

- Any application or any installation that Perkins Engine Company limited deems improper.
- Attachments, accessory items, or parts not sold nor approved by Perkins Engine Company limited
- Improper engine maintenance, repair, or abuse.
- Use of improper fuel, lubricants, or fluids.
- Owners unreasonable delay in making the product available after being notified of a potential product problem.

This warranty is in addition to Perkins Engine Company limited standard warranty, applicable to the engine product involved.

Remedies under this warranty are limited to the provision of material and services as specified herein. Perkins Engine Company limited is not responsible for incidental or consequential damages, including but not limited to downtime or loss-of-use of engine.

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California Emission Control Warranty Statement

Emissions Warranty

The 854F-E34T and the 854E-E34TA are a nonroad compression ignition engine.

The California Air Resources Board (CARB) and Perkins Engines Company Limited are pleased to explain the emission control system warranty on both of these diesel engines.

In California, new motor vehicle engines must be designed, built, and equipped in order to meet the state's stringent anti-smog standards. Perkins Engines Company Limited must warrant the emission control system on your engine for the duration of time listed below provided, there has not been any abuse, neglect, or improper maintenance of your engine or your engine aftertreatment system.

Perkins Engines Company Limited warrants to the initial owner and to the subsequent owner of the 854F-E34T and the 854E-E34TA diesel engines that such an engine is:

1. Designed, built, and equipped so that the engine conforms, at the time of sale, with all applicable regulations adopted by the California Air Resources Board (CARB).
2. Free from defects in materials and workmanship in specific emission-related parts for the following period:

   - The warranty period is for 3000 hours or for 5 years, whichever occurs first, after the date of delivery to the owner that operates the engine.

   If an emission-related part fails during any of the warranty periods, the part will be repaired or replaced. Any such part repaired or replaced under warranty is warranted for the remainder of the warranty period.

   During the term of this warranty, Perkins Engines Company Limited will provide through a Perkins distributor or your Perkins dealer or other establishment authorized by it, repair or replacement of any warranted part at no charge to the engine owner.

   In an emergency, repairs may be performed at any service establishment, or by the owner, using any replacement part. It is recommended that emission-related parts be replaced with genuine Perkins Engines Company Limited parts.

   Perkins Engines Company Limited will reimburse the owner for their expenses, including diagnostic charges for such an emergency repair. These expenses shall not exceed the Perkins Engines Company Limited suggested retail price for all warranted parts replaced, and labor charges based on Perkins Engines Company Limited recommended time allowance for the warranty repair and the geographically appropriate hourly labor rate.

UENR0623
March 2012

Systems Operation Testing and Adjusting

854E-E34TA and 854F-E34T Industrial Engines

JR (Engine)
JS (Engine)
JT (Engine)

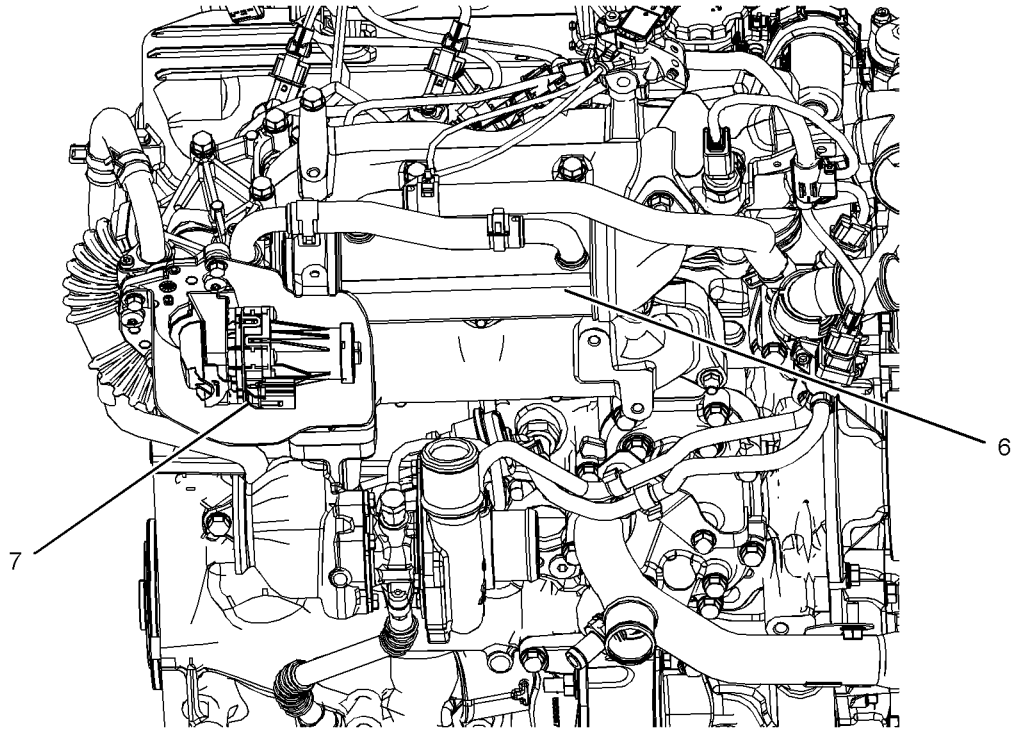


Illustration 9 g02720984
Typical example

The NOx Reduction System (NRS) operates with the transfer of the hot exhaust gas from the exhaust manifold to the assembly of the exhaust gas valve.

The assembly of the exhaust gas valve consists of an exhaust gas valve and an electronically controlled actuator.

As the electronically controlled actuator (7) starts to open the flow of exhaust gas from the exhaust gas valve mixes with the air flow from the charge air aftercooler. The mixing of the exhaust gas and the air flow from the charge air aftercooler reduces the oxygen content of the gas mixture. This results in a lower combustion temperature, so decreases the production of NOx.

As the demand for more exhaust gas increases the electronically controlled actuator opens further. The further opening of the actuator increases the flow of exhaust gas from the exhaust gas valve. As the demand for exhaust gas decreases, the electronically controlled actuator closes. This decreases the flow of exhaust gas from the exhaust gas valve.

The hot exhaust gas is then cooled in the exhaust cooler (6). The cooled gas then travels from the exhaust cooler (6) to the inlet manifold.

Exhaust gases from the exhaust manifold enter the inlet of the turbocharger in order to turn the turbocharger turbine wheel. The turbine wheel is connected to a shaft that rotates. The exhaust gases pass from the turbocharger through the following components: exhaust outlet, Diesel Oxidation Catalyst (DOC), Diesel Particulate Filter (DPF), and exhaust pipe.

High Pressure Fuel System

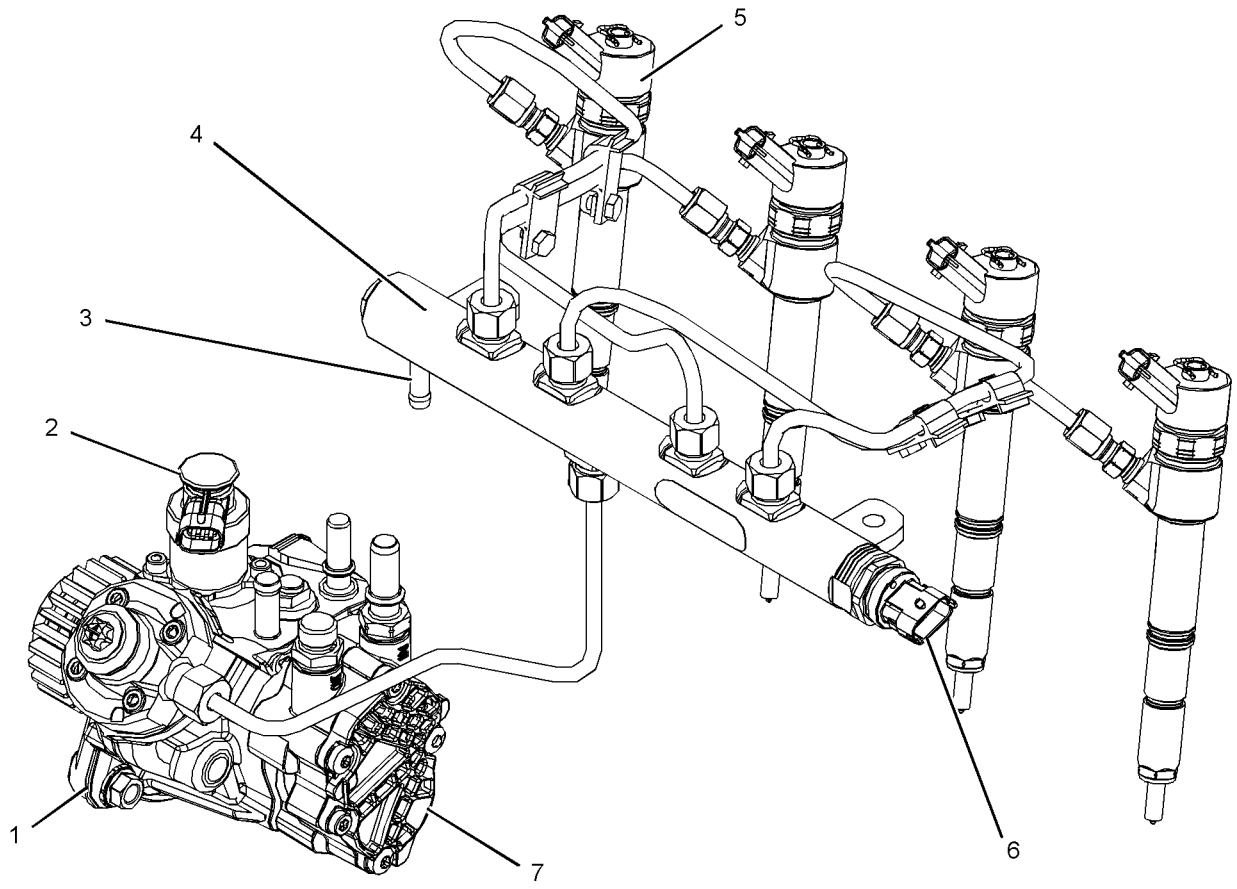


Illustration 16 g02493876

Typical example

(1) Fuel injection pump
(2) Suction control valve for the fuel injection pump
(3) Pressure relief valve
(4) Fuel manifold (rail)
(5) Electronic unit injector
(6) Fuel pressure sensor
(7) Fuel transfer pump

The fuel injection pump (1) feeds fuel to the high-pressure fuel manifold (rail) (4). The fuel is at a pressure of up to 160 MPa (23200 psi). A pressure sensor (6) in the high-pressure fuel manifold (rail) (4) monitors the fuel pressure in the high-pressure fuel manifold (rail). The ECM controls a suction control valve (2) in the fuel injection pump in order to maintain the actual pressure in the high-pressure fuel manifold at the desired level. The high-pressure fuel is continuously available at each injector (5). The ECM determines the correct time for activation of the correct electronic unit injector (5) which allows fuel to be injected into the cylinder. The leakoff fuel from each injector passes through an external pipe above the electronic unit injectors. The leakoff fuel then flows to a connector block on the left-hand side of the engine. A pipe is connected from the connector block in order to return the leakoff fuel to the fuel tank.

Components of the Fuel Injection System

The fuel injection system has the following mechanical components:

- Primary filter/water separator
- Fuel transfer pump
- Secondary fuel filter
- Fuel injection pump
- Fuel injectors
- Fuel manifold
- Pressure relief valve
- Fuel pressure sensor

Sensor Locations for the Clean Emissions Module

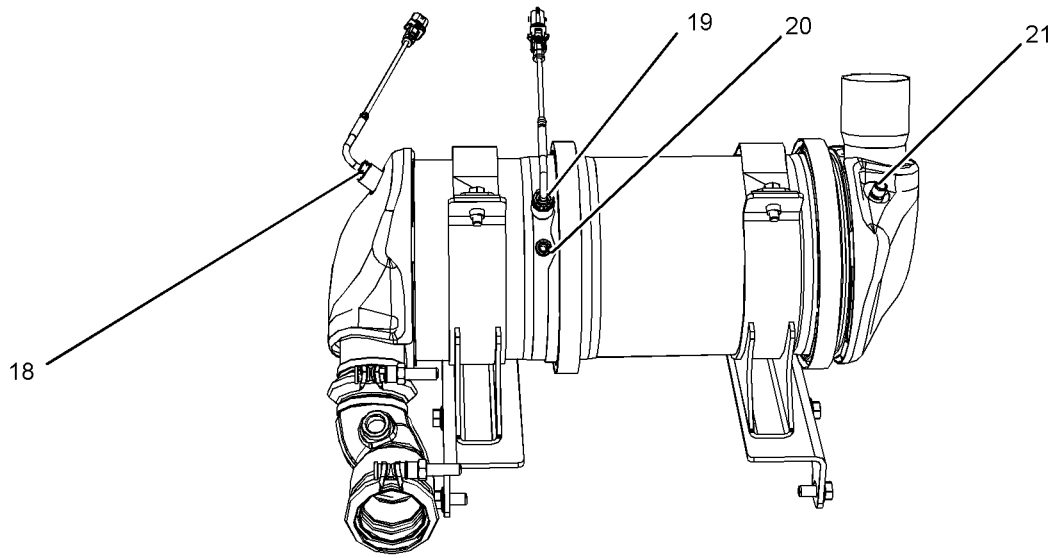


Illustration 28 g02738216

Typical view of the sensor locations

(18) Diesel Oxidation Catalyst (DOC) inlet temperature sensor
(19) Diesel Particulate Filter (DPF) inlet temperature sensor
(20) Inlet connection for the DPF differential pressure sensor
(21) Outlet connection for the DPF differential pressure sensor

ECM

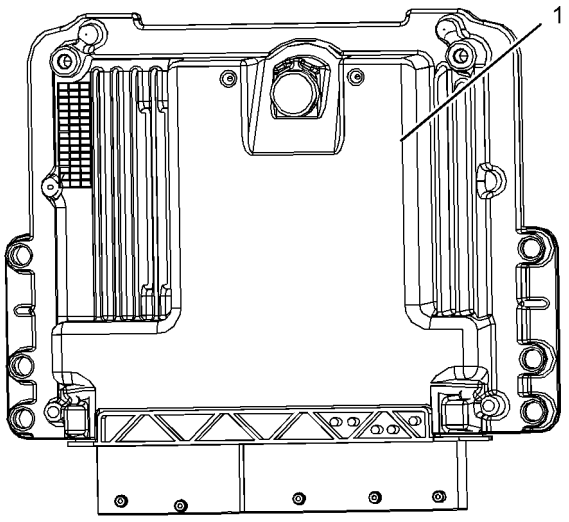


Illustration 29 g02722357

Typical example

The Electronic Control Module (ECM) (1) functions as a governor and a computer for the fuel system. The ECM receives signals from the sensors in order to control the timing and the engine speed.

The electronic system consists of the ECM, the engine sensors, and inputs from the parent machine. The ECM is the computer. The personality module is the software for the computer. The personality module contains the operating maps. The operating maps define the following characteristics of the engine:

- Engine rating
- Torque curves
- High and low idle speed (rpm)
- Emissions
- Injection timing

Passwords restrict changes to authorized personnel. Refer to Troubleshooting for more information on the passwords.

The ECM has an excellent record of reliability. Any problems in the system are most likely to be the connectors and the wiring harness. The ECM should be the last item in troubleshooting the engine.

The programmable software contains all the fuel setting information. The information determines the engine performance.

J1939 CAN Data Link – This data link is a SAE standard diagnostic communications data link that is used to communicate between the ECM and other electronic devices.

Logged Diagnostic Codes – Logged diagnostic codes are codes which are stored in the memory. These codes are an indicator of possible causes for intermittent problems. Refer to the term “Diagnostic Trouble Codes” for more information.

NOx Reduction System – The NOx Reduction System recycles a portion of the exhaust gases back into the inlet air in order to reduce the amount of nitrous oxide (NOx) in the exhaust gases. The recycled exhaust gas passes through a cooler before being introduced into the inlet air.

OEM – OEM is an abbreviation for the Original Equipment Manufacturer. This is the manufacturer of the machine or the vehicle that uses the engine.

Open Circuit – An open circuit is a condition that is caused by an open switch, or by an electrical wire or a connection that is broken. When this condition exists, the signal or the supply voltage can no longer reach the intended destination.

Oxygen Sensor – The oxygen sensor detects the level of oxygen. The level of oxygen is inputted to the combustion control.

Parameter – A parameter is a value or a limit that is programmable. This helps determine specific characteristics or behaviors of the engine.

Password – A password is a group of numeric characters or a group of alphanumeric characters that is designed to restrict access to parameters.

Power Cycling – Power cycling refers to the action of cycling the keyswitch from any position to the OFF position, and to the START/RUN position.

Pressure Limiting Valve (PLV) – The PLV is a valve in the fuel rail that prevents excessive pressure. The PLV will reduce the pressure to a safe level that will limit engine operation but the reduced pressure will not stop the engine.

Programmable Software – The software is programmed into the ECM. The software contains all the instructions (software) for the ECM and the software contains the performance maps for a specific engine. The software may be reprogrammed through flash programming.

Primary Speed/Timing Sensor – This sensor determines the position of the crankshaft during engine operation. If the primary speed/timing sensor fails during engine operation, the secondary speed/timing sensor is used to provide the signal.

Pulse Width Modulation (PWM) – The PWM is a signal that consists of pulses that are of variable width. These pulses occur at fixed intervals. The ratio of “TIME ON” versus total “TIME OFF” can be varied. This ratio is also referred to as a duty cycle.

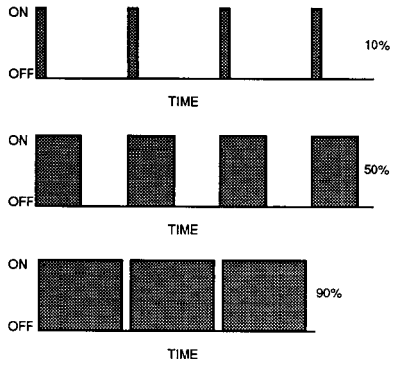


Illustration 38 g00284479

Rated Fuel Limit – This is a limit that is based on the power rating of the engine and on the engine rpm. The Rated Fuel Limit enables the engine power and torque outputs to conform to the power and torque curves of a specific engine model. These limits are in the flash file and these limits cannot be changed.

Reference Voltage – Reference voltage is a regulated voltage and a steady voltage that is supplied by the ECM to a sensor. The reference voltage is used by the sensor to generate a signal voltage.

Relay – A relay is an electromechanical switch. A flow of electricity in one circuit is used to control the flow of electricity in another circuit. A small current or voltage is applied to a relay in order to switch a much larger current or voltage.

Secondary Speed/Timing Sensor – This sensor determines the position of the camshaft during engine operation. If the primary speed/timing sensor fails during engine operation, the secondary speed/timing sensor is used to provide the signal.

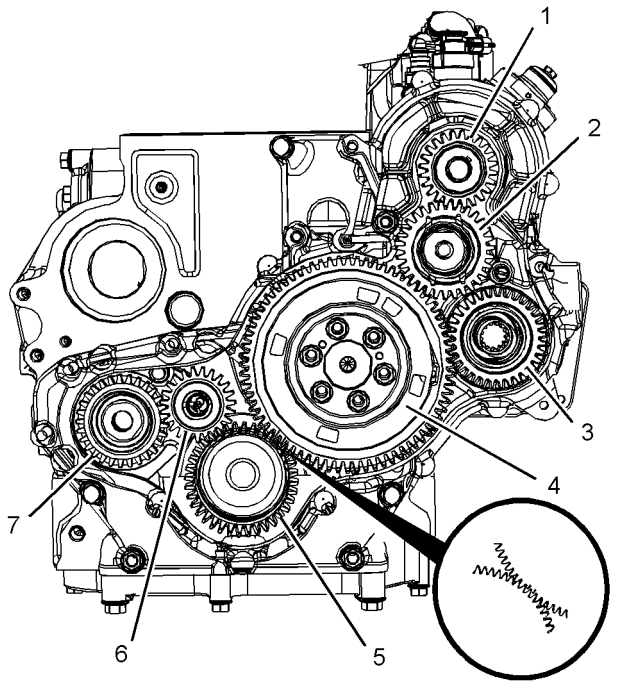
Sensor – A sensor is used to detect a change in the pressure, in the temperature, or in mechanical movement. When any of these changes are detected, a sensor converts the change into an electrical signal.

Short Circuit – A short circuit is a condition that has an electrical circuit that is inadvertently connected to an undesirable point. An example of a short circuit is a wire which rubs against a vehicle frame and this rubbing eventually wears off the wire insulation. Electrical contact with the frame is made and a short circuit results.

Signal – The signal is a voltage or a waveform that is used in order to transmit information typically from a sensor to the ECM.

i04170049

Gear Group (Front) - Time



g02859779

Illustration 45

Typical example

(3) Accessory drive gear (if equipped)
(5) Crankshaft gear
(6) Oil pump idler gear
(7) Oil pump gear

1. Install the camshaft gear (4) onto the camshaft. Refer to Disassembly and Assembly, “Camshaft Gear - Remove and Install” for the correct procedure.

2. Ensure that the crankshaft and the camshaft are locked in the correct position. Ensure that the fuel injection pump is in the correct position. Refer to Disassembly and Assembly, “Fuel Injection Pump - Remove” for the correct procedure.

3. Install the idler gear (2). Refer to Disassembly and Assembly, “Idler Gear - Remove and Install” for the correct procedure.

4. Install the fuel injection pump and gear assembly (1). Refer to Disassembly and Assembly for the correct procedure.

5. Make sure that the timing marks on the gears are in alignment. If the timing marks are not aligned, refer to Disassembly and Assembly, “Gear Group (Front) - Remove and Install”.

Engine Oil Leaks into the Combustion Area of the Cylinders

Engine oil that is leaking into the combustion area of the cylinders can be the cause of blue smoke. There are several possible ways for engine oil to leak into the combustion area of the cylinders:

- Failed valve stem seals
- Leaks between worn valve guides and valve stems
- Worn components or damaged components (pistons, piston rings, or dirty return holes for the engine oil)
- Incorrect installation of the compression ring and/or the intermediate ring
- Leaks past the seal rings in the turbocharger shaft
- Overfilling of the crankcase
- Wrong dipstick or guide tube
- Sustained operation at light loads

Excessive consumption of engine oil can also result if engine oil with the wrong viscosity is used. Engine oil with a thin viscosity can be caused by fuel leakage into the crankcase or by increased engine temperature.

i03577881

Increased Engine Oil Temperature - Inspect

Look for a restriction in the oil passages of the oil cooler. The oil temperature may be higher than normal when the engine is operating. In such a case, the oil cooler may have a restriction.

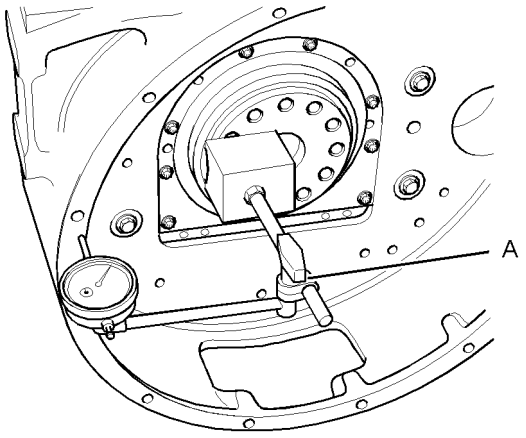


Illustration 66 g01199467

Typical example

1. Install Tooling (A). See illustration 66.
2. Set the pointer of the dial indicator to 0 mm (0 inch).
3. Check the alignment at intervals of 45 degrees around the flywheel housing.
4. Calculate the difference between the lowest measurement and the highest measurement. This difference must not be greater than the limit that is given in Table 13.

Note: Any necessary adjustment must be made on the flywheel housing.

Table 13

Limits for Flywheel Housing Runout and Alignment (Total Indicator Reading)	
Bore of the Housing Flange	**Maximum Limit (Total Indicator Reading)**
410 mm (16.14 inch)	0.25 mm (0.010 inch)
448 mm (17.63 inch)	0.28 mm (0.011 inch)

i04175270

Gear Group - Inspect

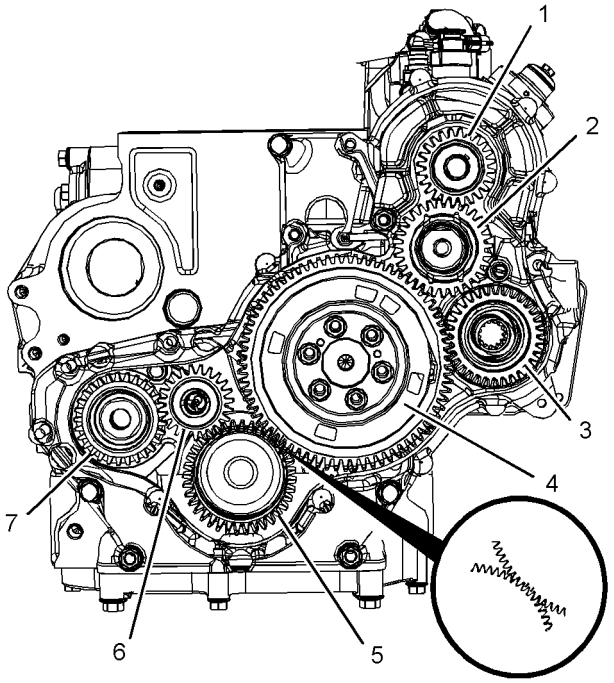


Illustration 67 g02859779

Typical example

(3) Accessory drive gear (if equipped)
(7) Oil pump gear

Note: If one or more of the gears need to be removed for repair, refer to Disassembly and Assembly, “Gear Group (Front) - Remove” in order to remove the gears. Refer to the Disassembly and Assembly, “Gear Group (Front) - Install” in order to install the gears.

1. Inspect the gears for wear or for damage. If the gears are worn or damaged, use new parts for replacement.
2. Measure the clearance between the crankshaft gear (5) and the camshaft gear (4). Refer to Specifications, “Gear Group (Front)” for the clearance measurement.
3. Measure the clearance between the idler gear (6) for the oil pump and the crankshaft gear (5). Refer to Specifications, “Gear Group (Front)” for the clearance measurement.
4. Measure the backlash between the fuel injection pump gear (1) and the idler gear (2). Refer to Specifications, “Gear Group (Front)” for the backlash measurement.

Index

NOTICE

Ensure that all adjustments and repairs that are carried out to the fuel system are performed by authorized personnel that have the correct training.

Before beginning ANY work on the fuel system, refer to Operation and Maintenance Manual, "General Hazard Information and High Pressure Fuel Lines" for safety information.

Refer to System Operation, Testing and Adjusting, "Cleanliness of Fuel System Components" for detailed information on the standards of cleanliness that must be observed during ALL work on the fuel system.

1. Turn the fuel supply to the OFF position.
2. Turn the battery disconnect switch to the OFF position.

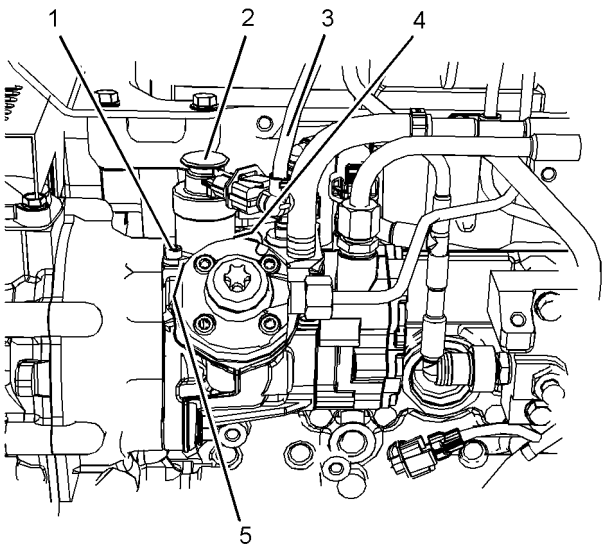


Illustration 3 g02986577

3. Clean the area around flow control valve (2) and fuel injection pump. Ensure that the area is free from contamination before beginning disassembly.
4. Disconnect harness assembly (3) from flow control valve (2).
5. Make temporary marks on the flow control valve and the fuel injection pump for installation purpose.
6. Remove Torx heads screws (1) from the flow control valve.
7. Remove flow control valve (2) from the fuel injection pump.
8. Use Tooling (A) in order to plug the fuel injection pump.
9. Remove O-ring seal (4) (not shown) and O-ring seal (5) (not shown).

Installation Procedure

1. Ensure that all component at free from wear and damage. If any part of the flow control valve is worn or damaged, the flow control valve must be replaced as an assembly.

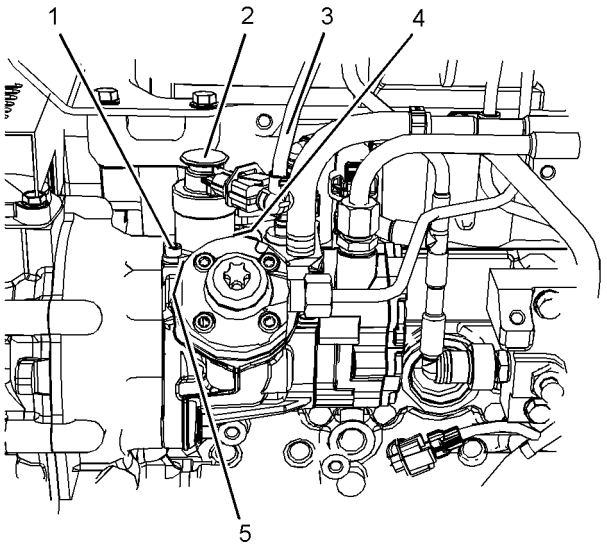


Illustration 4 g02986577

2. Position a new O-ring seal (4) (not shown) and new O-ring seal (5) (not shown) onto the flow control valve assembly.
3. Check O-ring seal (4) (not shown) and O-ring seal (5) (not shown) are correctly positioned. Ensure that O-ring seals are not damaged.
4. Lubricate O-ring seal (4) (not shown) and O-ring seal (5) (not shown) with clean fuel.

Note: Ensure that the O-ring seals are not damaged or misaligned.

5. Remove Tooling (A) from the fuel injection pump.
6. Install flow control valve (3) to the fuel injection pump.
7. Install Torx head screws (2) from the flow control valve repair kit.
8. Tighten Torx head screws (2) equally until the flow control valve is seated correctly onto the fuel injection pump.

4. Disconnect the Original Equipment Manufacturers (OEM) wiring harness assembly from connection (5) and connection (8).

5. Cut cable straps (1) from the wiring harness assemblies.

6. Slide the locking tab for wiring harness assembly (3) into the unlocked position. Disconnect wiring harness assembly (3) from pressure sensor (2).

7. Disconnect wiring harness assembly (14) from oil pressure switch (13).

8. If necessary, cut cable straps in order to remove the wiring harness assemblies.

9. Slide the locking tab for wiring harness assembly (15) into the unlocked position. Disconnect wiring harness assembly (15) from crankshaft position sensor (16).

10. Slide the locking tab for wiring harness assembly (17) into the unlocked position. Disconnect wiring harness assembly (17) from camshaft position sensor (18).

11. Slide the locking tab for wiring harness assembly (9) into the unlocked position. Disconnect wiring harness assembly (9) from fuel metering valve (10).

12. Disconnect the wiring harness assembly from fuel temperature sensor (4).

13. Remove bolt (6) from wiring harness assembly (11).

14. Position wiring harness assembly (11) away from fuel injection lines (12).

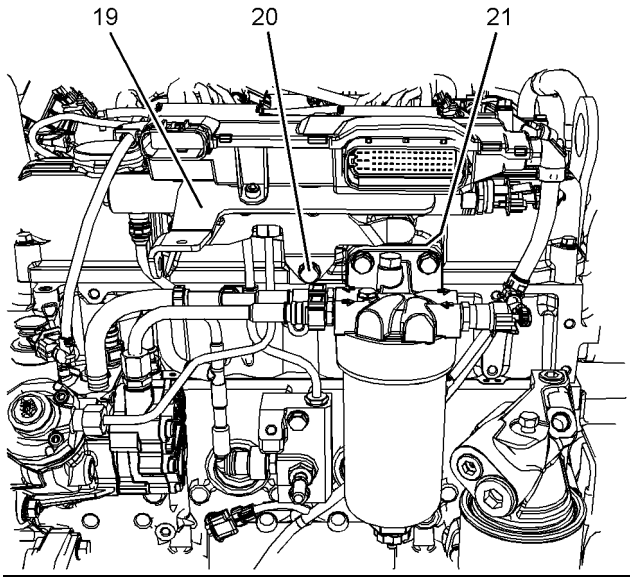


Illustration 21 g02848956

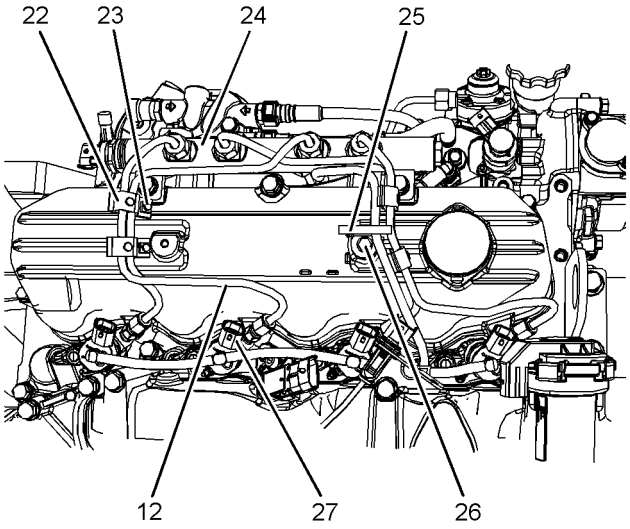


Illustration 22 g02683858

15. Remove fuel filter base mounting bracket (21) (not shown). Refer to Disassembly and Assembly, “Fuel Filter Base - Remove and Install” for the correct procedure.

16. Remove bolt (23) from tube clamp (22). Remove tube clamp (22) from fuel injection lines (12).

Note: Make temporary marks to identify the position of the tube clamps.

17. Repeat Step 16 in order to remove the remaining tube clamps.

18. Remove bolt (26). Remove bracket (25) from the valve mechanism cover.

19. Clean the area around the nuts for fuel injection lines (12). Ensure that the area is free from contamination before beginning disassembly.

20. Use Tooling (B) in order to disconnect fuel injection line (12) from electronic unit injector (27).

Note: It may be necessary to remove the front engine lifting eye in order to gain access to number one high-pressure pipe nut.

21. Use Tooling (B) in order to disconnect fuel injection line (12) from fuel manifold (24).

22. Remove fuel injection line (12). **Discard the fuel injection lines.**

23. Use Tooling (A) in order to cap all open ports immediately in fuel manifold (24) and electronic unit injectors (27).

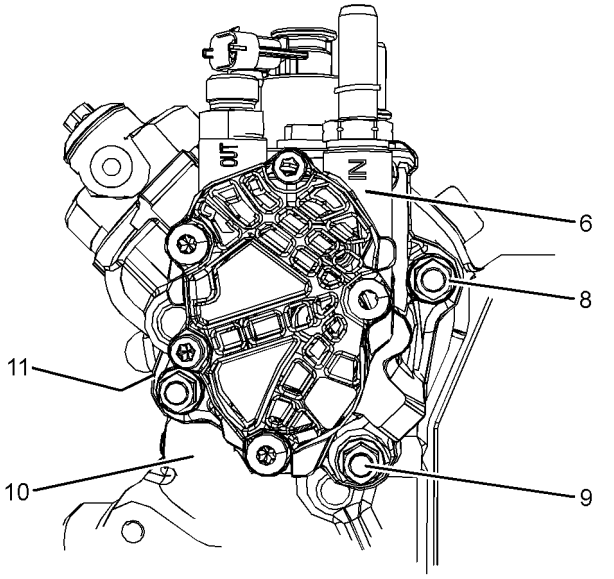


Illustration 44 g02709476

Fuel injection pump viewed from the rear

13. Remove nuts (8) from fuel injection pump (6).

Note: The fuel injection pump should be supported by hand as the nuts are removed.

14. Carefully remove the fuel injection pump from front housing (10).

15. Remove O-ring (11) (not shown) from the fuel injection pump.

16. If necessary, remove studs (9) from front housing (10).

i04876151

Fuel Injection Pump - Install

Installation Procedure

NOTICE

Ensure that all adjustments and repairs that are carried out to the fuel system are performed by authorized personnel that have the correct training.

Before beginning ANY work on the fuel system, refer to Operation and Maintenance Manual, "General Hazard Information and High Pressure Fuel Lines" for safety information.

Refer to System Operation, Testing and Adjusting, "Cleanliness of Fuel System Components" for detailed information on the standards of cleanliness that must be observed during ALL work on the fuel system.

NOTICE

Ensure that the wiring harness assembly is correctly routed and the cable straps are not over tightened. Over tightening of the cable straps will damage the wiring harness convoluting.

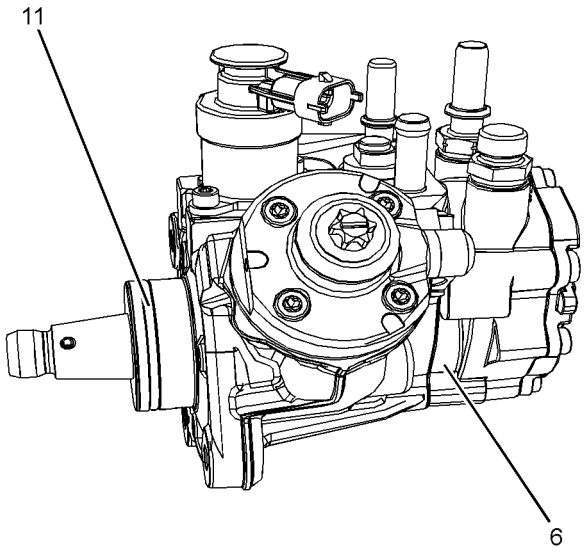


Illustration 45 g02937680

i04876191

Turbocharger - Remove (Side Mounted Turbochargers)

Removal Procedure

Start By:

a. Remove the flexible exhaust pipe from the turbocharger. Refer to Disassembly and Assembly, “Flexible Exhaust Pipe - Remove and Install” for the correct procedure.

NOTICE
Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

NOTICE
Care must be taken to ensure that fluids are contained during performance of inspection, maintenance, testing, adjusting and repair of the product. Be prepared to collect the fluid with suitable containers before opening any compartment or disassembling any component containing fluids.

Dispose of all fluids according to local regulations and mandates.

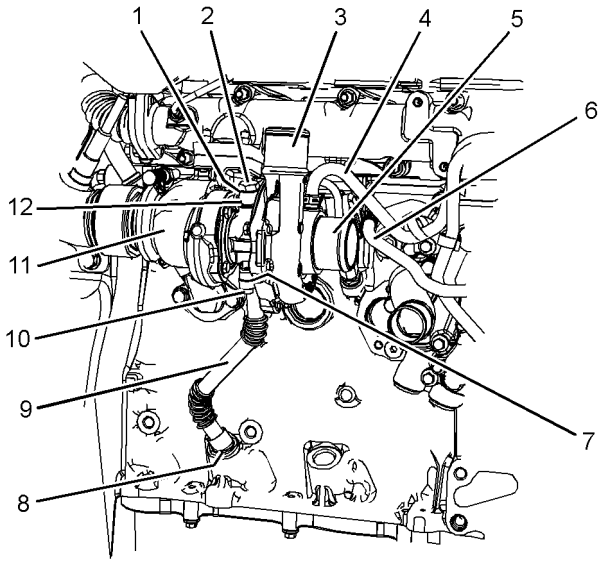


Illustration 63 g02859585

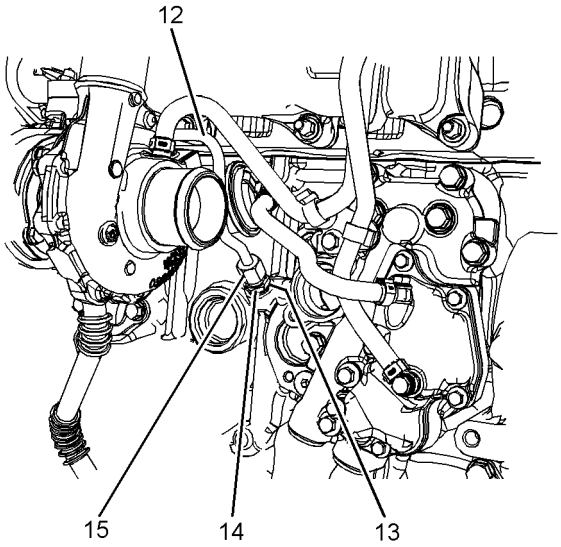


Illustration 64 g02859796

1. Loosen hose clamps and disconnect the hose assemblies from turbocharger inlet (5) and from turbocharger outlet (3).

2. Remove banjo bolt (2) from tube assembly (12). Remove sealing washers (1) (not shown).

3. Loosen nut (15) and remove tube assembly (12) from turbocharger (11) and the cylinder block.

4. If necessary, remove connection (14) from the cylinder block. Remove sealing washer (13) (not shown).

5. Loosen the hose clamp on hose assembly (4). Disconnect hose assembly (4) from the turbocharger.

6. Loosen the hose clamp on hose assembly (6). Disconnect hose assembly (6) from the wastegate actuator.

7. Remove bolts (10) from tube assembly (9).

8. Remove gasket (7) (not shown).

9. If necessary, remove tube assembly (9) from the cylinder block. Remove O-ring seals (8) (not shown).

i04876141

Flexible Exhaust Pipe - Remove and Install

Removal Procedure for the Flexible Exhaust Pipe as an Assembly

⚠ CAUTION

The ends of the bellows are very sharp. Injury could occur if the bellows are not handled properly. Handle the bellows by the convolutions.

NOTICE

The bellows must be supported at all times when the bellows are not installed in the application. Failure to support the bellows adequately could result in the failure of the bellows. Do not use power tools in order to disassemble or assemble any part of the flexible exhaust system.

The alignment of the bellows is important. Incorrect alignment may lead to premature failure of the bellows. Misalignment can be identified by visually inspecting the uniformity of the spacing between the convolutions on the bellows.

Inspect the bellows for damage prior to installation. If there is any damage to the convolutions, discard the bellows. If there is any difficulty in installation after the repair, discard the bellows.

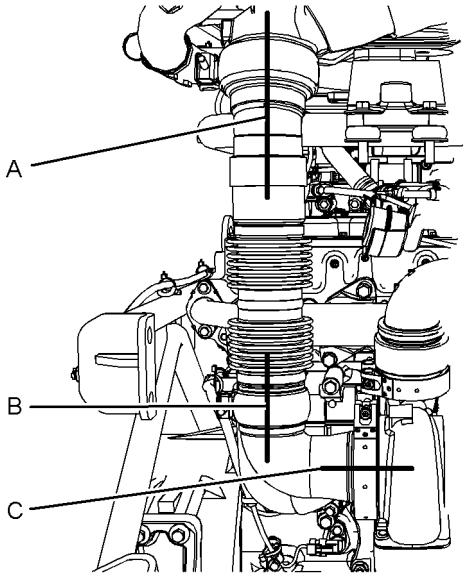


Illustration 84 g02354623

Typical example

1. The lateral alignment of the bellows is critical. All the components must be assembled in the same alignment as prior to disassembly. The components that require correct lateral alignment are shown at Positions (A, B, and C).

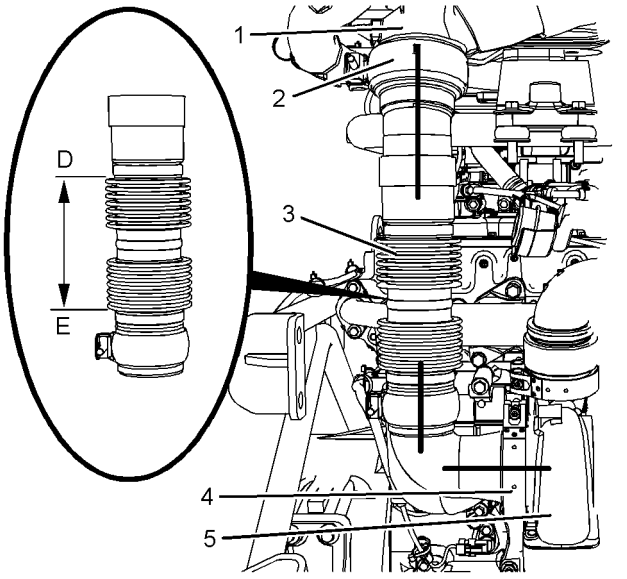


Illustration 85 g02354616

Typical example

2. Follow Steps 2.a through Step 2.d in order to remove the flexible exhaust as an assembly from the Clean Emission Module (CEM) and the turbocharger.

   a. Use suitable material in order to encase flexible exhaust pipe (3). Encasing the flexible exhaust pipe will prevent damage of the bellows. Encase bellows for the flexible exhaust pipe (3) between Position (D) and Position (E). Use cable straps in order to retain the suitable material.

Note: Ensure that the flexible exhaust pipe is supported at all times.

   b. Loosen ball clamp (2) from the flexible exhaust pipe assembly.

   c. Loosen the bolt for V-band clamp (4).

Note: If V-band clamp (4) remain tight on the flanges, apply releasing fluid on the V-band clamp. Lightly tap the bolt on the V-band clamp with a soft faced hammer in order to assist removal. **Do not use a prybar in order to remove V-band clamp.**

   d. Remove the assembly of the flexible exhaust pipe from the CEM (1) and the turbocharger (5).

Note: Ensure that the assembly of the flexible exhaust pipe is supported as the clamps are removed.

5. If necessary, tighten bolts (4) to a torque of 25 N·m (221 lb in).

6. If necessary, tighten bolts (8) to a torque of 25 N·m (221 lb in).

7. Tighten bolts (6) to a torque of 25 N·m (221 lb in).

8. Tighten bolts (7) to a torque of 25 N·m (221 lb in).

9. Tighten bolts (3) to a torque of 45 N·m (33 lb ft).

End By:

a. Install the DPF. Refer to Disassembly and Assembly, “Diesel Particulate Filter - Install ” for the correct procedure.

i04891273

Support and Mounting (CEM) - Remove and Install (Option 2)

CEM Assembly Removal Procedure

Start By:

a. Remove the DPF. Refer to Disassembly and Assembly, “Diesel Particulate Filter - Remove ” for the correct procedure.

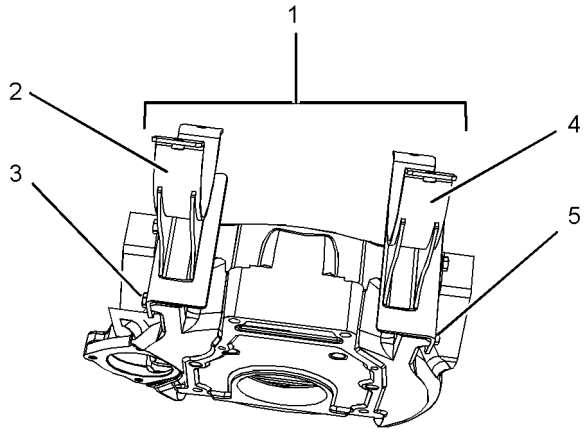


Illustration 105 g03017437

Make temporary marks on all components on both support assemblies (1) and all bolts, in order to aide alignment during installation.

1. Remove bolts (3) from bracket (2) and remove bracket (2) from the engine.

2. Remove bolts (5) from bracket (4) and remove bracket (4) from the engine.

CEM Assembly installation Procedure

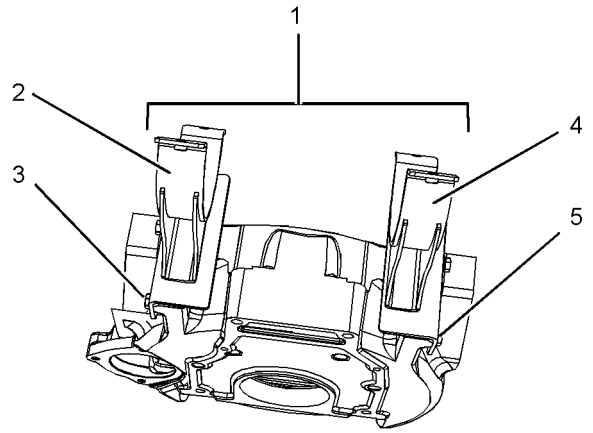


Illustration 106 g03017437

1. Position bracket (2) and loosely install bolts (3). Position bracket (4) and loosely install bolts (5).

2. Using temporary marks, align bracket (2) and tighten bolts (3) to a torque of 25 N·m (221 lb in)

3. Using temporary marks, align bracket (4) and tighten bolts (5) to a torque of 25 N·m (221 lb in)

End By:

a. Install the DPF. Refer to Disassembly and Assembly, “Diesel Particulate Filter - Install ” for the correct procedure.

⚠ WARNING

Personal injury can result from being struck by parts propelled by a released spring force.

Make sure to wear all necessary protective equipment.

Follow the recommended procedure and use all recommended tooling to release the spring force.

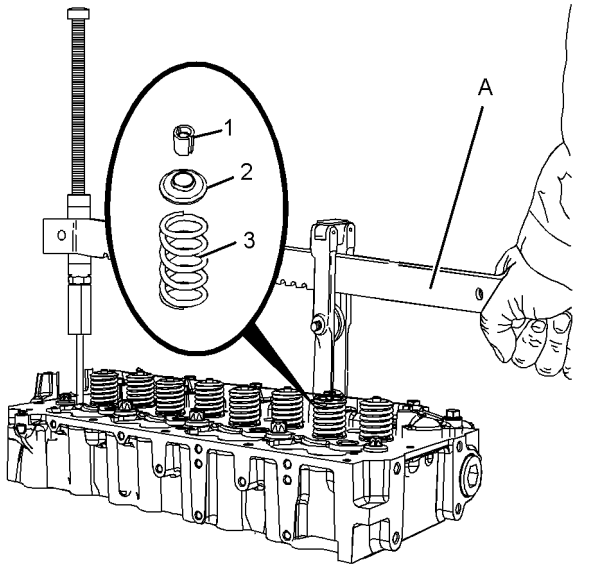


Illustration 124 g03003297

Typical example

7. Install Tooling (A) in the appropriate position on the cylinder head in order to compress valve spring (3).

NOTICE

Ensure that the valve spring is compressed squarely or damage to the valve stem may occur.

8. Apply sufficient pressure to Tooling (A) in order to install valve keepers (1).

Note: Do not compress the spring so that valve spring retainer (2) touches valve stem seal (4).

⚠ WARNING

The valve spring keepers can be thrown from the valve when the valve spring compressor is released. Ensure that the valve spring keepers are properly installed on the valve stem. To help prevent personal injury, keep away from the front of the valve spring keepers and valve springs during the installation of the valves.

9. Carefully release the pressure on Tooling (A).

10. Repeat Steps 6 to 9 for the remaining valves.

11. Remove Tooling (A) from the cylinder head.

End By:

a. Install the cylinder head. Refer to Disassembly and Assembly, “Cylinder Head - Install”.

i04876164

Inlet and Exhaust Valve Guides - Remove and Install

Removal Procedure

Table 22

Required Tools			
Tool	**Part Number**	**Part Description**	**Qty**
A	-	Valve Guide Driver	1

Start By:

a. Remove the inlet valves and the exhaust valves. Refer to Disassembly and Assembly, “Inlet and Exhaust Valves - Remove and Install”.

NOTICE

Removal and installation of the valve guide and valve seat must be carried out by personnel with the correct training. Also special machinery is required. For more information, refer to your authorized Perkins dealer.

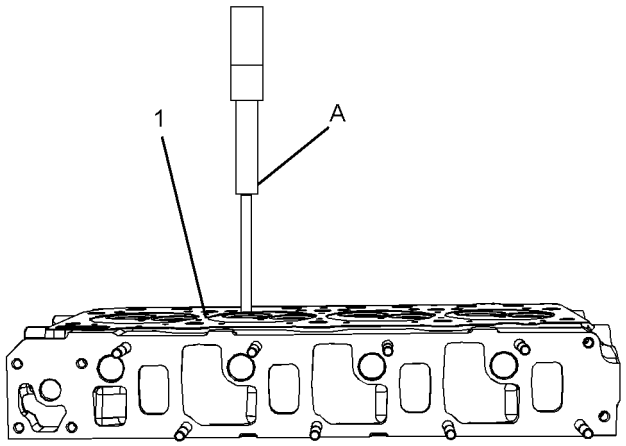


Illustration 125 g03003636

1. Use Tooling (A) in order to remove valve guides (2) from cylinder head (1).

End By:

a. Install the alternator belt. Refer to Disassembly and Assembly, “Alternator Belt - Remove and Install” for the correct procedure.

i04876198

Water Temperature Regulator - Remove and Install

Removal Procedure

NOTICE
Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

NOTICE
Care must be taken to ensure that fluids are contained during performance of inspection, maintenance, testing, adjusting and repair of the product. Be prepared to collect the fluid with suitable containers before opening any compartment or disassembling any component containing fluids.

Dispose of all fluids according to local regulations and mandates.

1. Drain the coolant from the cooling system to a level below the water temperature regulator, into a suitable container for storage or for disposal. Refer to Operation and Maintenance Manual, “Cooling System Coolant - Change” for the correct draining procedure.

2. Remove the wastegate regulator valve. Refer to Disassembly and Assembly, “Wastegate Solenoid - Remove and Install” for the correct procedure.

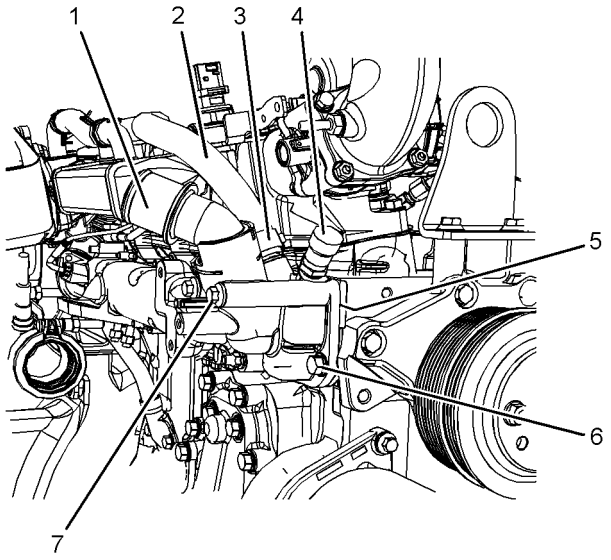


Illustration 144 g02829476
Typical example

3. Loosen the hose clamps from the upper radiator hose and disconnect the upper radiator hose from water temperature regulator housing (1).

4. Loosen clamp (3) and disconnect exhaust gas recirculation (EGR) cooler hose (2) from water temperature regulator housing (1). Position the EGR cooler hose away from the water temperature regulator housing.

5. Slide the locking tab into the unlocked position and disconnect the wiring harness from coolant temperature sensor (4).

6. Remove bolts (6) and remove bolts (7) from water temperature regulator housing (1).

7. Remove water temperature regulator housing (1) from the cylinder head.

8. Remove gasket (5) (not shown).

9. If necessary, remove the coolant temperature sensor. Refer to Disassembly and Assembly, “Coolant Temperature Sensor - Remove and Install” for the correct procedure.

Installation Procedure

NOTICE
Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

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End By:

a. Install the engine oil pan. Refer to Disassembly and Assembly, “Engine Oil Pan - Remove and Install” for the correct procedure.

b. Install the crankshaft rear seal. Refer to Disassembly and Assembly, “Crankshaft Rear Seal - Remove and Install” for the correct procedure.

i04876145

Flywheel Housing - Remove and Install (Non-Stressed Cylinder Block)

Removal Procedure

Table 33

Required Tools			
Tool	**Part Number**	**Part Description**	**Qty**
A	-	Guide Stud M8 by 100 mm	2

Start By:

a. Remove the crankshaft rear seal. Refer to Disassembly and Assembly, “Crankshaft Rear Seal - Remove and Install” for the correct procedure.

b. Remove the engine oil pan. Refer to Disassembly and Assembly, “Engine Oil Pan - Remove and Install” for the correct procedure.

NOTICE
Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

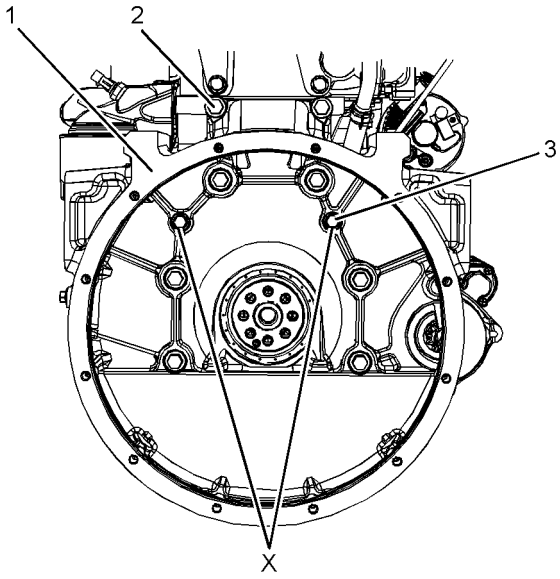

Illustration 167 g02659276

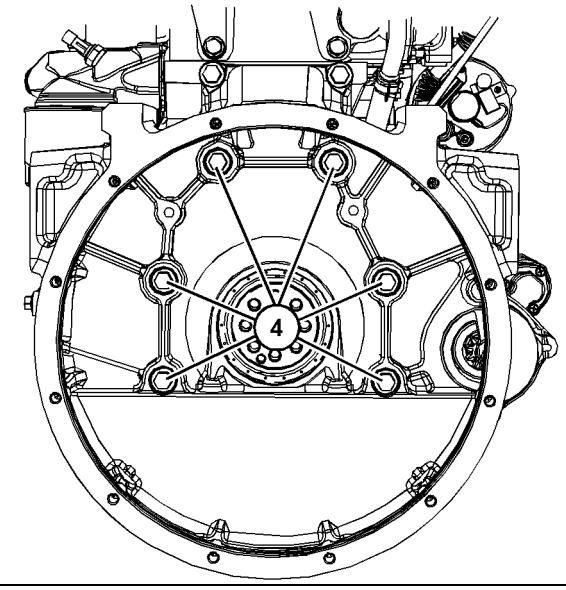

Illustration 168 g02659298

1. Remove the electric starting motor. Refer to Disassembly and Assembly, “Electric Starting Motor - Remove and Install” for the correct procedure.

2. If necessary install the diesel particulate filter supporting bracket. Refer to Disassembly and Assembly, “Support and Mounting (CEM) - Remove and Install” for the correct procedure.

3. Remove bolts (3) from Position (X) from flywheel housing (1).

4. Install Tooling (A) into Position (X) on flywheel housing (1).

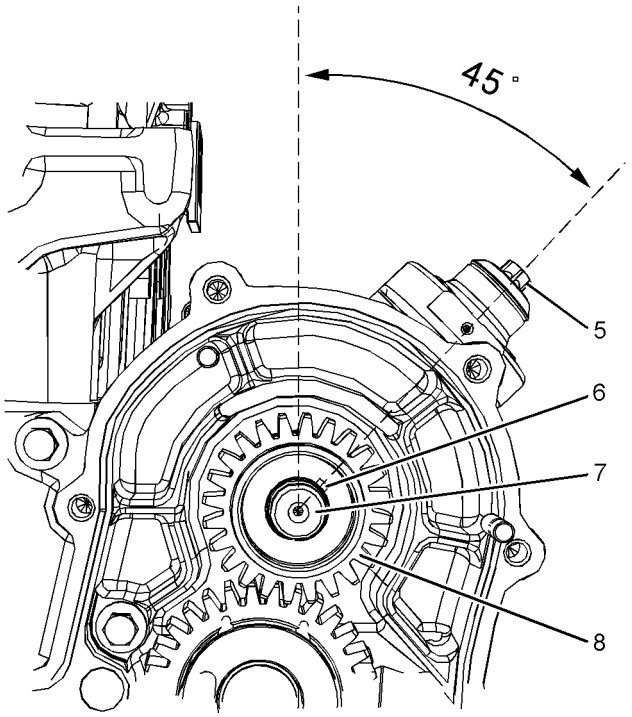

Illustration 190 g02937163

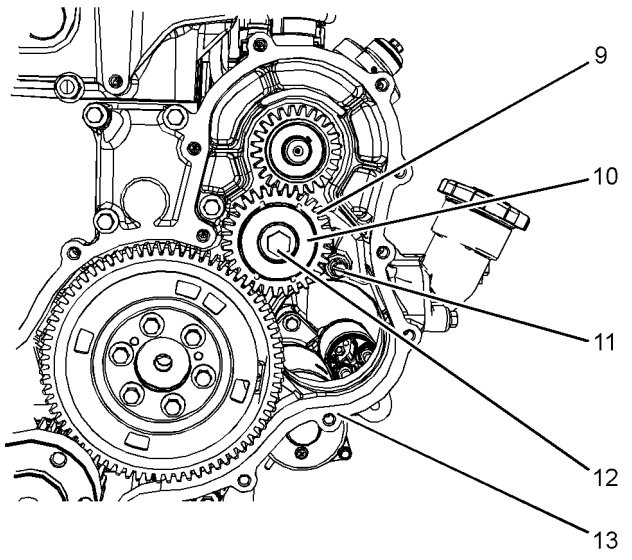

Illustration 191 g02939977

3. Before removing the idler gear ensure that alignment pin (6) on the fuel injection pump gear is 45 degrees from vertical and parallel to the center of Torx head plug (5), refer to Illustration 190.

4. Make temporary identification marks on idler hub (10) for installation purposes.

5. Remove bolt (12) from idler hub (10).

6. Remove the idler hub (10) and gear (9) from front housing (13).

7. Remove idler hub (10) from gear (9).

8. If necessary, remove lubricating jet (11) from front housing (13).

i04876161

Idler Gear - Install

Installation Procedure

Table 40

Required Tools			
Tool	**Part Number**	**Part Description**	**Qty**
A	T400086	Timing Pin (Crankshaft)	1
B	-	Timing Pin (Camshaft)	1
C	-	Loctite 506	1

NOTICE
Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

1. Ensure that all components are clean and free from wear of damage. If necessary, replace any components that are worn or damaged.

2. If Tooling (A) and Tooling (B) are not installed, install Tooling (A) and install Tooling (B). Refer to Disassembly and Assembly, “Idler Gear - Remove” for the correct procedure.

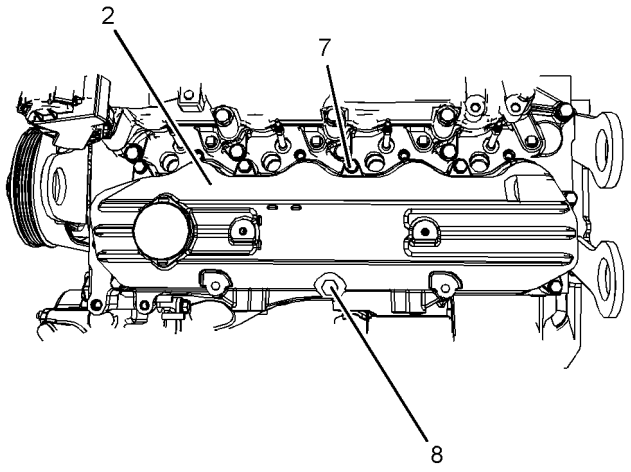

Illustration 212 g03010836
Typical example

1. If necessary, remove exhaust gas recirculation valve (1). Refer to Disassembly and Assembly, “Exhaust Gas Recirculation Valve - Remove and Install” for the correct procedure.

2. Disconnect the hose assembly (3) from fuel distribution block (4).

3. Use Tooling (A) in order to plug hose assembly (3).

4. Use Tooling (A) in order to cap fuel distribution block (4).

5. Remove bolt (6) from clip for hose assembly (3). Position the hose assembly away from the valve mechanism cover.

6. Remove bolts (7) and bolt (8) from valve mechanism cover (2).

7. Remove valve mechanism cover (2) from the cylinder head.

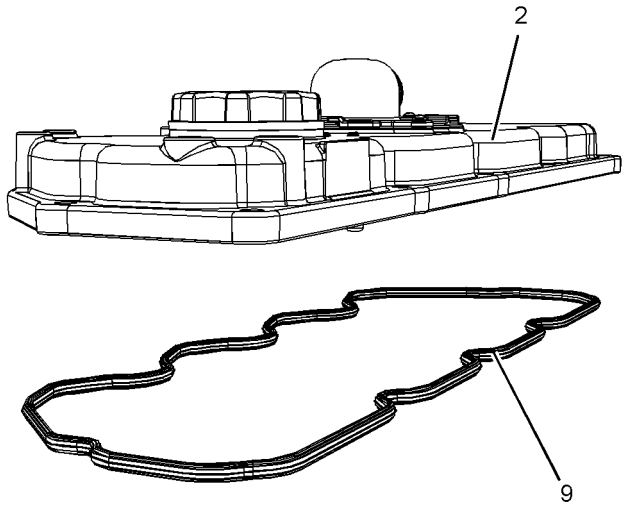

Illustration 213 g03010838
Typical example

8. Remove gasket (9) from valve mechanism cover (2).

Installation Procedure

NOTICE
Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

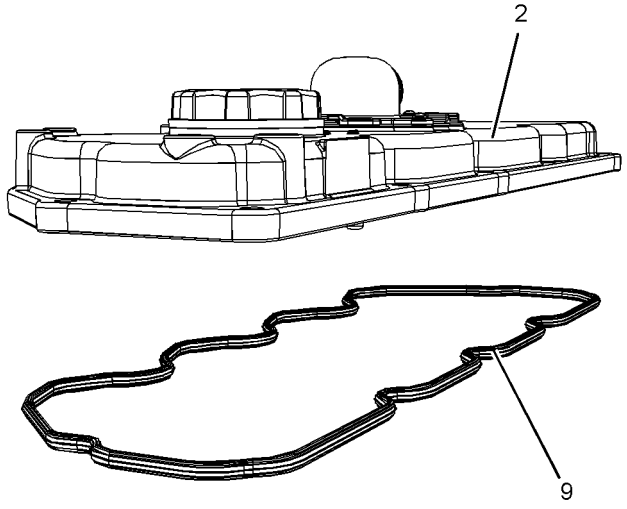

Illustration 214 g03010838
Typical example

1. Thoroughly clean all gasket surfaces of valve mechanism cover (2). Clean the gasket surfaces of the cylinder head.

24. If necessary, fill the engine oil pan to the correct level. Refer to Operation and Maintenance Manual, “Engine Oil Level - Check”.

i04876169

Lifter Group - Remove and Install

Removal Procedure

Table 50

Required Tools			
Tool	**Part Number**	**Part Description**	**Qty**
A	-	Telescoping Magnet	1

Start By:

a. Remove the camshaft. Refer to Disassembly and Assembly, “Camshaft - Remove and Install” for the correct procedure.

NOTICE
Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

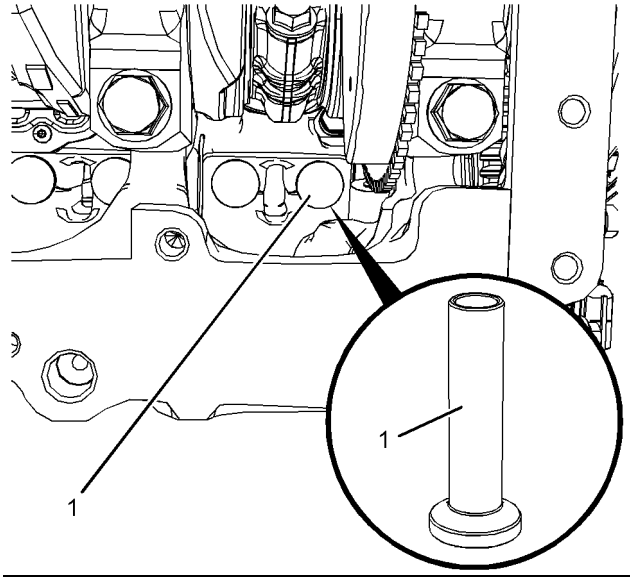

Illustration 237 g02729121

1. If the crankshaft is installed, rotate the crankshaft in order to gain access to the appropriate lifters.

2. Use Tooling (A) in order to remove lifters (1) from the cylinder block.

Note: Place a temporary identification mark on each lifter in order to identify the correct location.

Installation Procedure

Table 51

Required Tools			
Tool	**Part Number**	**Part Description**	**Qty**
A	-	Telescoping Magnet	1

NOTICE
Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

NOTICE
Replace all lifters when a new camshaft is installed.

1. Ensure that all components are clean and free from wear and damage. If necessary, replace any components that are worn or damaged.

2. Clean the lifters. Follow Step 2.a through Step 2.c in order to inspect the lifters. Replace any worn lifters or damaged lifters.

a. Inspect the seat of the pushrod in the lifter for visual wear and damage.

b. Inspect the shank of the lifter for wear and damage. Refer to Specifications, “Lifter Group” for more information.

c. Inspect the face of the lifter that runs on the camshaft for visual wear and damage.

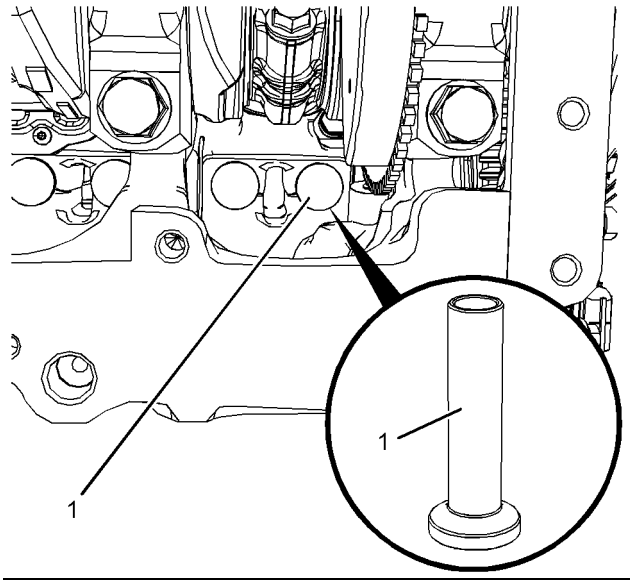

Illustration 238 g02729121

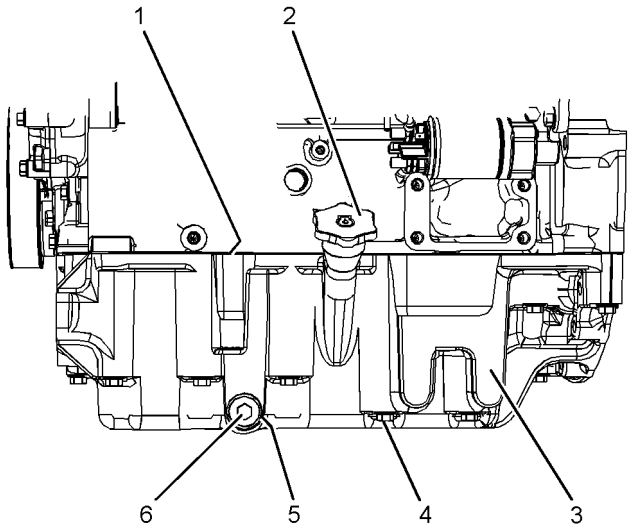

Illustration 257 g02835137

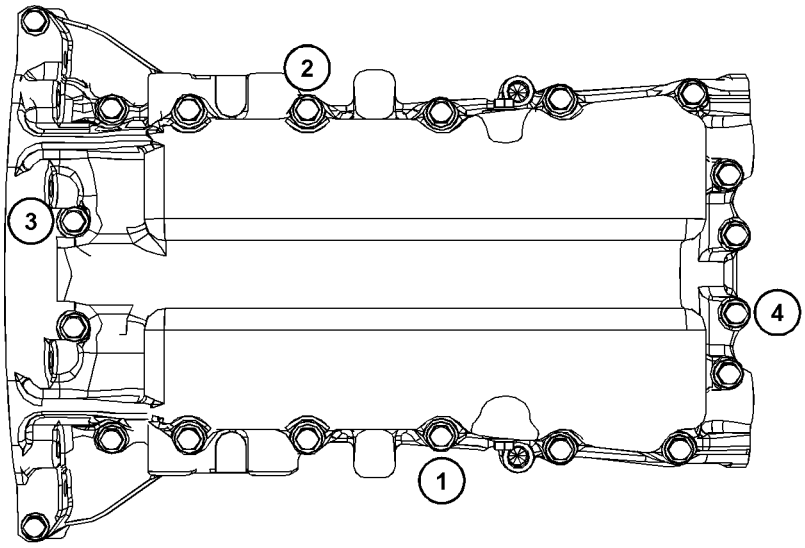

Illustration 258 g02835539

Initial tightening sequence

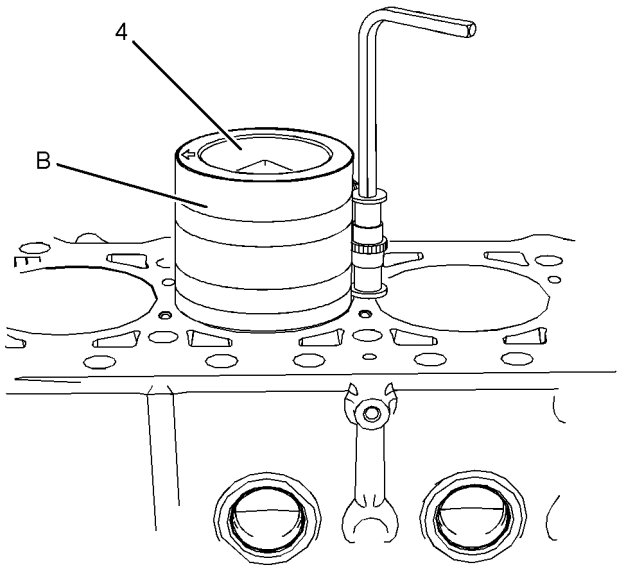

Illustration 274 g02999358

4. Lightly lubricate Tooling A with clean engine oil. Install Tooling (A) onto piston (4)

Note: Ensure that the piston assembly is installed into the correct cylinder. Also, ensure the correct orientation of the assembly, refer to Illustration 275.

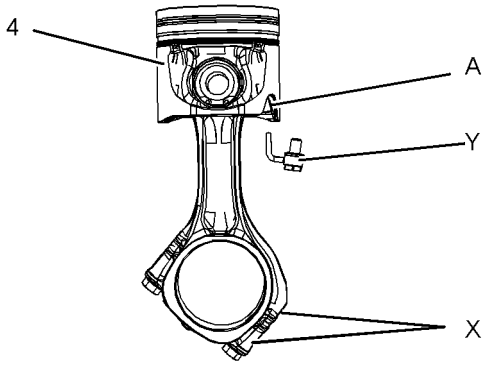

Illustration 275 g02999579

(4) Piston
(A) Cut out for piston cooling jet
(Y) Cooling jet
(X) Connecting rod identification marks

5. Ensure that Tooling (B) is installed correctly and that piston (4) can easily slide from the tool.

Note: Ensure alignment of the connecting rod assembly to the crankshaft journal.

6. Carefully push the piston and the connecting rod assembly into the cylinder bore and onto the crankshaft pin.

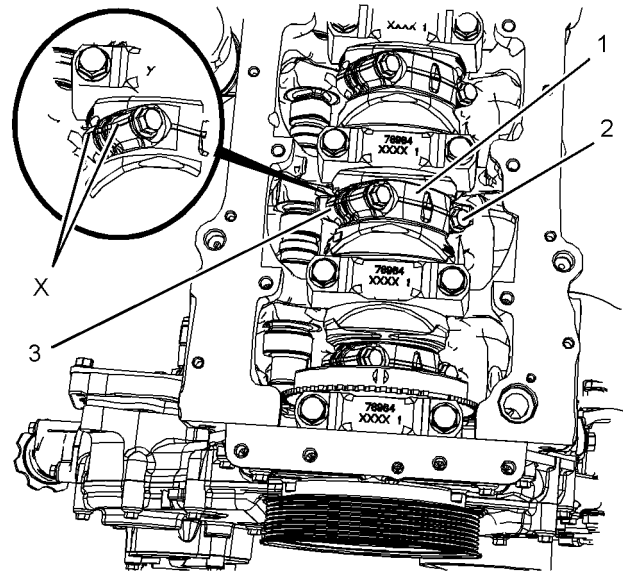

Illustration 276 g03001177

Typical example

7. Ensure that etched number in Position (X) on connecting rod cap (1) matches etched number in Position (X) on connecting rod (3). Ensure the correct orientation of connecting rod cap (1). The locating tab for the upper bearing shell and the lower bearing shell should be on the same side. Install the connecting rod cap (1) and install new bolts (2).

8. Tighten the new bolts to 50 N·m (37 lb ft). Turn the bolts for an additional 70 degrees in a clockwise direction. Use Tooling (C) in order to achieve the correct final torque.

9. Ensure that the installed connecting rod assembly has tactile side play. Rotate the crankshaft in order to ensure that there is no binding.

10. Repeat Step 1 through Step 9 in order to install the remaining pistons and connecting rod assemblies

End By:

a. Install the cylinder head. Refer to Disassembly and Assembly, “Cylinder Head - Install” for the correct procedure.

b. If necessary, install the balancer. Refer to Disassembly and Assembly, “Balancer - Install” for the correct procedure.

c. Install the oil suction pipe. Refer to Disassembly and Assembly, “Engine Oil Pan Remove and Install” for the correct procedure.

i02748526

Bearing Clearance - Check

Measurement Procedure

Table 69

Required Tools			
Tool	Part Number	Part Description	Qty
A	-	Plastic Gauge (Green) 0.025 to 0.076 mm (0.001 to 0.003 inch)	1
	-	Plastic Gauge (Red) 0.051 to 0.152 mm (0.002 to 0.006 inch)	1
	-	Plastic Gauge (Blue) 0.102 to 0.229 mm (0.004 to 0.009 inch)	1
	-	Plastic Gauge (Yellow) 0.230 to 0.510 mm (0.009 to 0.020 inch)	1

NOTICE
Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

Note: Perkins does not recommend the checking of the actual clearances of the bearing shells particularly on small engines. This is because of the possibility of obtaining inaccurate results and of damaging the bearing shell or the journal surfaces. Each Perkins bearing shell is quality checked for specific wall thickness.

Note: The measurements should be within specifications and the correct bearings should be used. If the crankshaft journals and the bores for the block and the rods were measured during disassembly, no further checks are necessary. However, if the technician still wants to measure the bearing clearances, Tooling (A) is an acceptable method. Tooling (A) is less accurate on journals with small diameters if clearances are less than 0.10 mm (0.004 inch).

NOTICE
Lead wire, shim stock or a dial bore gauge can damage the bearing surfaces.

The technician must be very careful to use Tooling (A) correctly. The following points must be remembered:

- Ensure that the backs of the bearings and the bores are clean and dry.
- Ensure that the bearing locking tabs are properly seated in the tab grooves.
- The crankshaft must be free of oil at the contact points of Tooling (A).

1. Put a piece of Tooling (A) on the crown of the bearing that is in the cap.

Note: Do not allow Tooling (A) to extend over the edge of the bearing.

2. Use the correct torque-turn specifications in order to install the bearing cap. Do not use an impact wrench. Be careful not to dislodge the bearing when the cap is installed.

Note: Do not turn the crankshaft when Tooling (A) is installed.

3. Carefully remove the cap, but do not remove Tooling (A). Measure the width of Tooling (A) while Tooling (A) is in the bearing cap or on the crankshaft journal. Refer to Illustration 293.

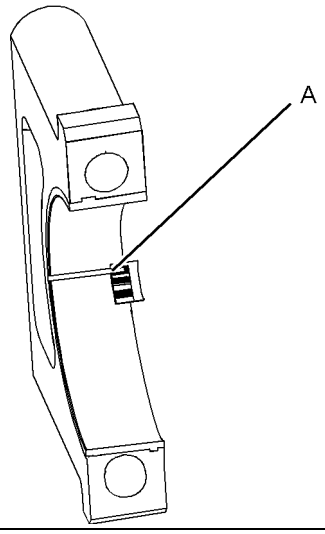

Illustration 293 g01152855
Typical Example

4. Remove all of Tooling (A) before you install the bearing cap.

Note: When Tooling (A) is used, the readings can sometimes be unclear. For example, all parts of Tooling (A) are not the same width. Measure the major width in order to ensure that the parts are within the specification range. Refer to Specifications Manual, “Connecting Rod Bearing Journal” and Specifications Manual, “Main Bearing Journal” for the correct clearances.

i04876177

Pressure Sensor (Exhaust Back Pressure) - Remove and Install

Removal Procedure

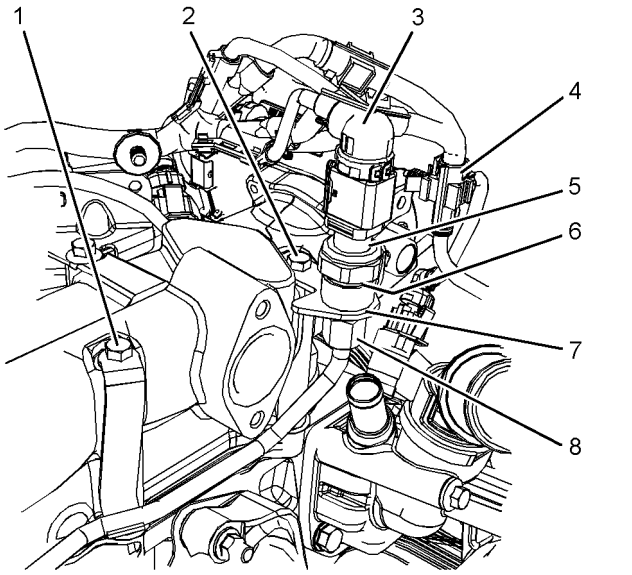

Illustration 312 g02917036

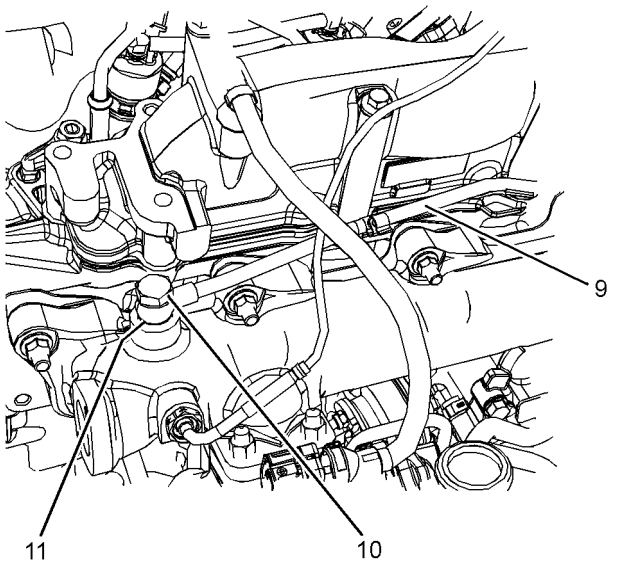

Illustration 313 g02915178

1. Slide the locking tab into the unlocked position and disconnect harness assembly (3) from exhaust back pressure sensor (5).

2. Using a deep socket in order to remove exhaust back pressure sensor (5) from adaptor bracket (7).

3. Remove O-ring (6) (not shown) from exhaust back pressure sensor (5).

4. If necessary, follow Step 4.a through Step 4.j in order to remove tube assembly (6).

   a. If necessary, remove the diesel particulate mounting bracket. Refer to Disassembly and Assembly, “Support and Mounting (CEM) - Remove and Install” for the correct procedure.

   b. If necessary, remove the exhaust gas recirculation cooler. Refer to Disassembly and Assembly, “Exhaust Cooler (NRS) - Remove and Install” for the correct procedure.

   c. If necessary, remove the exhaust gas temperature sensor. Refer to Disassembly and Assembly, “Temperature Sensor (Exhaust) - Remove and Install” for the correct procedure.

   d. Disconnect harness assembly (4) from the retaining clip.

   e. Loosen nut (8) and disconnect tube assembly (9).

   f. Remove bolt (2) and remove adaptor bracket (7) from the induction manifold.

   g. Remove banjo bolt (10) from tube assembly (9).

   h. Remove bolt (1) from the bracket for tube assembly (9).

   i. Remove tube assembly (9) from the exhaust manifold.

   j. Remove and sealing washers (11) (not shown).

Installation Procedure

1. Check all components for wear and damage. If necessary, replace any components that are worn or damaged.

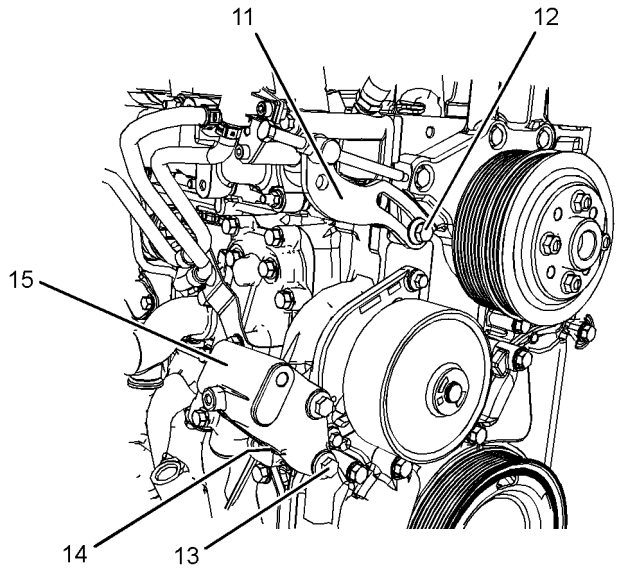

Illustration 334 g02815797

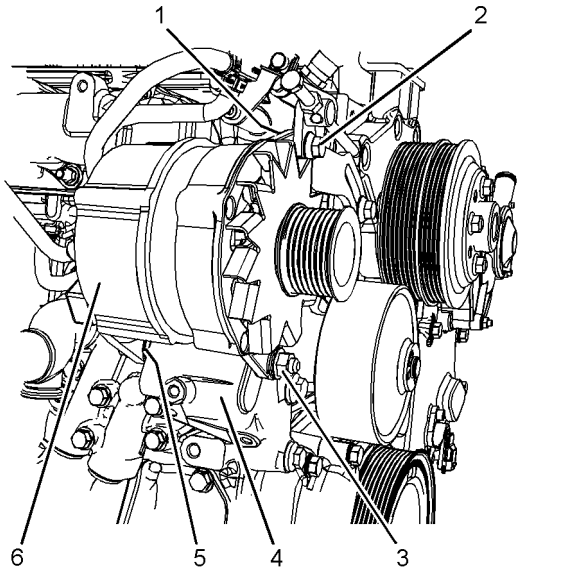

Illustration 335 g02673920

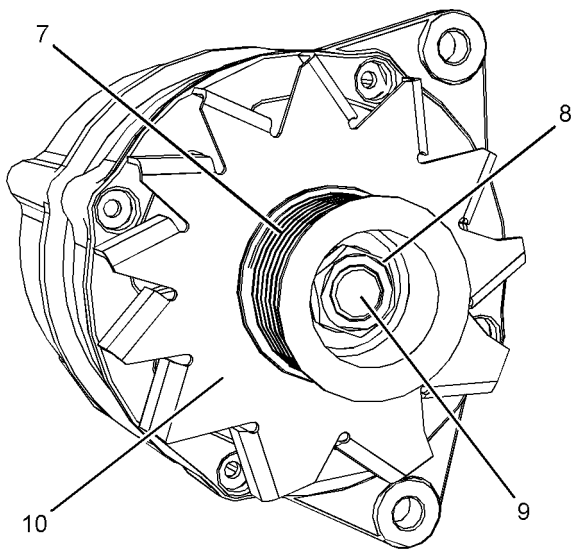

Illustration 336 g02815777

a. Position bracket (14) onto the cylinder block.

b. Install bolts (13) to bracket (14).

c. If necessary, install bolt (13) to the coolant tube assembly.

d. Tighten bolts (13) to a torque of 50 N·m (37 lb ft).

e. Position tensioner (11) onto the fan drive assembly.

f. Install bolt (12) to tensioner (11) finger tight.

3. If necessary, follow Step 3.a through Step 3.f in order to install pulley (8) to alternator (2).

a. Place alternator (6) in a suitable support.

b. Ensure that fan (10) is correctly oriented.

c. Install fan (10) to shaft (9).

d. Ensure that pulley (7) is correctly oriented.

e. Install pulley (7) and a new nut (8) to alternator shaft (9).

f. Position a cranked ring spanner onto nut (9). Use a suitable tool in order to turn the shaft of the alternator in a counterclockwise direction. Tighten the nut to the correct torque. Refer to Specifications, “Alternator” for the correct torque.

4. Position the alternator onto bracket (4) and tensioner (11).

5. Install bolt (5) (not shown) and nut (3) finger tight.

Troubleshooting Section

Electronic Troubleshooting

i04029108

Welding Precaution

Correct welding procedures are necessary in order to avoid damage to the Electronic Control Module (ECM) , to sensors, and to associated components. Components for the driven equipment should also be considered. When possible, remove the component that requires welding. When welding on an engine that is equipped with an ECM and removal of the component is not possible, the following procedure must be followed. This procedure minimizes the risk to the electronic components.

1. Stop the engine. Remove the electrical power from the ECM.

2. Ensure that the fuel supply to the engine is turned off.

3. Disconnect the negative battery cable from the battery. If a battery disconnect switch is installed, open the switch.

4. Disconnect all electronic components from the wiring harnesses. Include the following components:

- Electronic components for the driven equipment
- ECM
- Sensors
- Electronically controlled valves
- Relays
- Glow Plug Control Unit

NOTICE

Do not use electrical components (ECM or ECM sensors) or electronic component grounding points for grounding the welder.

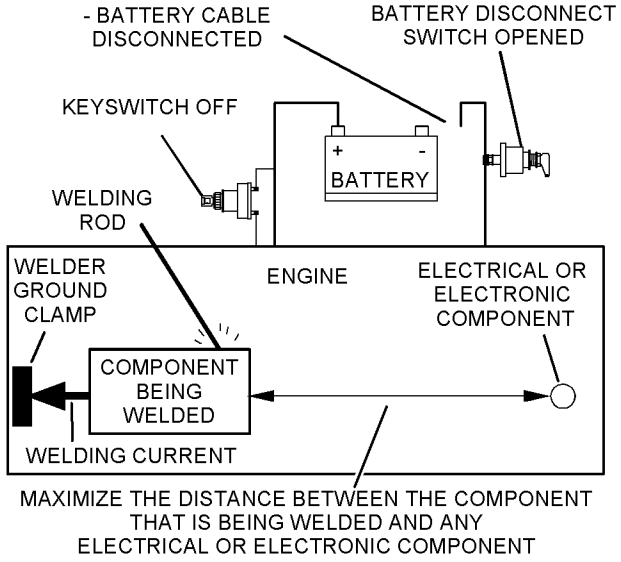

Illustration 1 g01143634

Service welding guide (typical diagram)

5. When possible, connect the ground clamp for the welding equipment directly to the engine component that will be welded. Place the clamp as close as possible to the weld. Close positioning reduces the risk of welding current damage to the engine bearings, to the electrical components, and to other components.

6. Protect the wiring harnesses from welding debris and/or from welding spatter.

7. Use standard welding procedures to weld the materials together.

i05277342

System Overview

The engine has an electronic control system. The system also monitors the Diesel Particulate Filter (DPF) and the NOx Reduction System (NRS).

The control system consists of the following components:

- Electronic Control Module (ECM)
- Software (flash file)
- Wiring
- Sensors
- Actuators

- Diagnostic tests
- Calibrations
- Programming of flash file
- Parameter programming
- Copy configuration function for Electronic Control Module (ECM) replacement
- Data logging
- Graphs (real time)

Table 3 lists the service tools that are required in order to use the Electronic Service Tool.

Table 3

Service Tools for the Use of the Electronic Service Tool	
Part Number	**Description**
-(1)	Single Use Program License
-(1)	Data Subscription for All Engines
27610251	Communication Adapter (Electronic Service Tool to the ECM interface)
27610164	Adapter Cable As

(1) Refer to Perkins Engine Company Limited .

Note: For more information on the Electronic Service Tool and the PC requirements, refer to the documentation that accompanies the software for the Electronic Service Tool.

Connecting the Electronic Service Tool and the Communication Adapter II

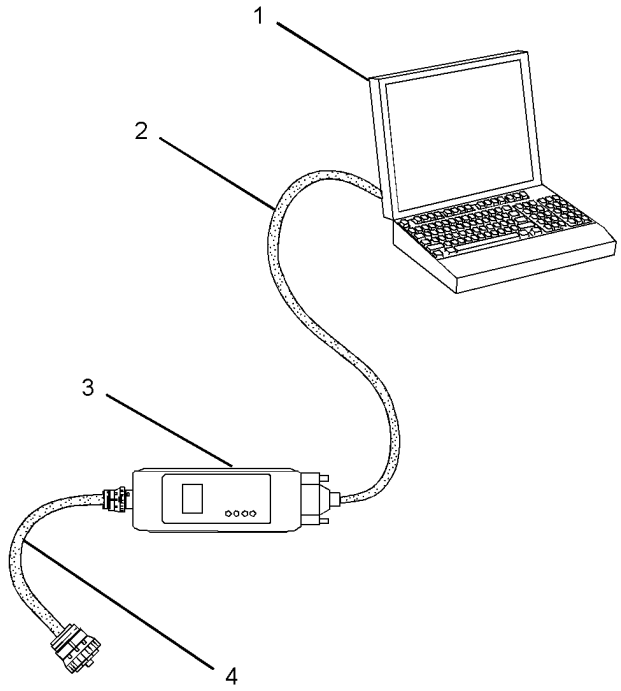

Illustration 8 g01121866

(1) Personal Computer (PC)
(2) Adapter Cable (Computer Serial Port)
(3) Communication Adapter II
(4) Adapter Cable Assembly

Note: Items (2), (3) and (4) are part of the Communication Adapter II kit.

Use the following procedure in order to connect the Electronic Service Tool and the Communication Adapter II.

1. Turn the keyswitch to the OFF position.

2. Connect cable (2) between the "COMPUTER" end of communication adapter (3) and the RS232 serial port of PC (1).

Note: The Adapter Cable Assembly(4) is required to connect to the USB port on computers that are not equipped with an RS232 serial port.

3. Connect cable (4) between the "DATA LINK" end of communication adapter (3) and the service tool connector.

Clean Emissions Module (CEM)

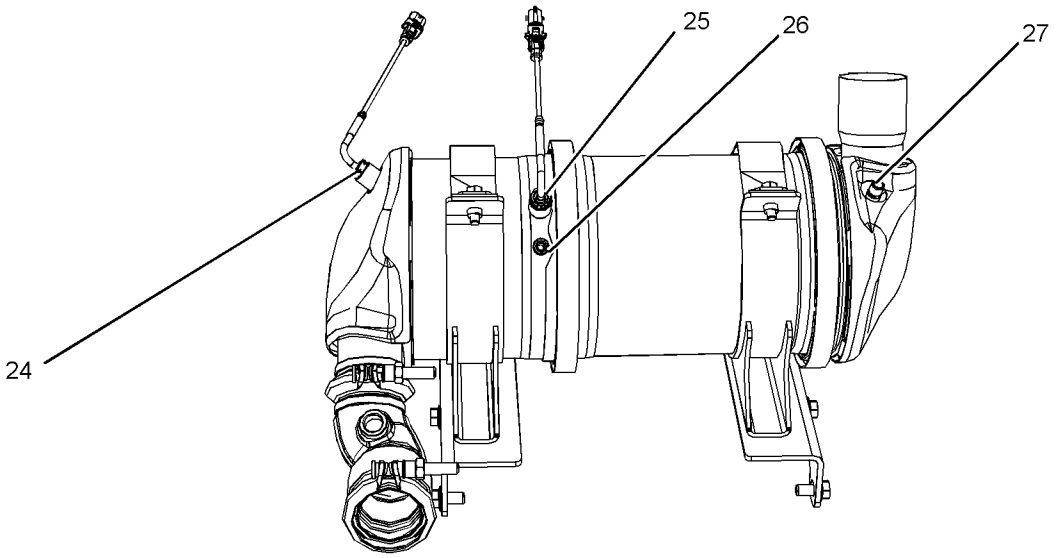

Illustration 14 g03356022

Typical view of the sensor locations on the CEM on the 854E-E34TA (model JR) engine and 854F-E34T (model JS) engine

(24) Diesel Oxidation Catalyst (DOC) inlet temperature sensor
(25) Diesel Particulate Filter (DPF) inlet temperature sensor
(26) Inlet connection for the DPF differential pressure sensor
(27) Outlet connection for the DPF differential pressure sensor

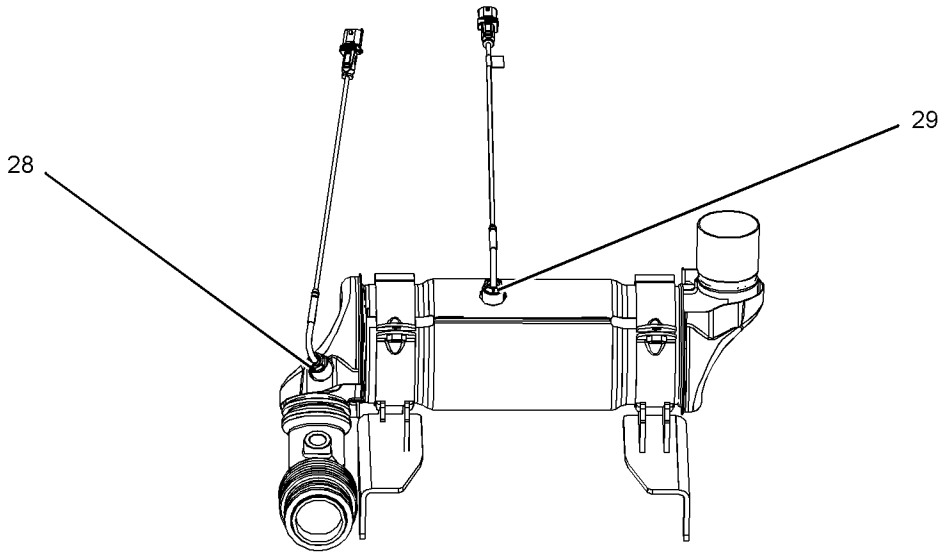

Illustration 15 g03356028

Typical view of the sensor locations on the CEM on the 854F-E34T (model JT) engine

(28) Diesel Oxidation Catalyst (DOC) inlet temperature sensor
(29) Diesel Particulate Filter (DPF) inlet temperature sensor

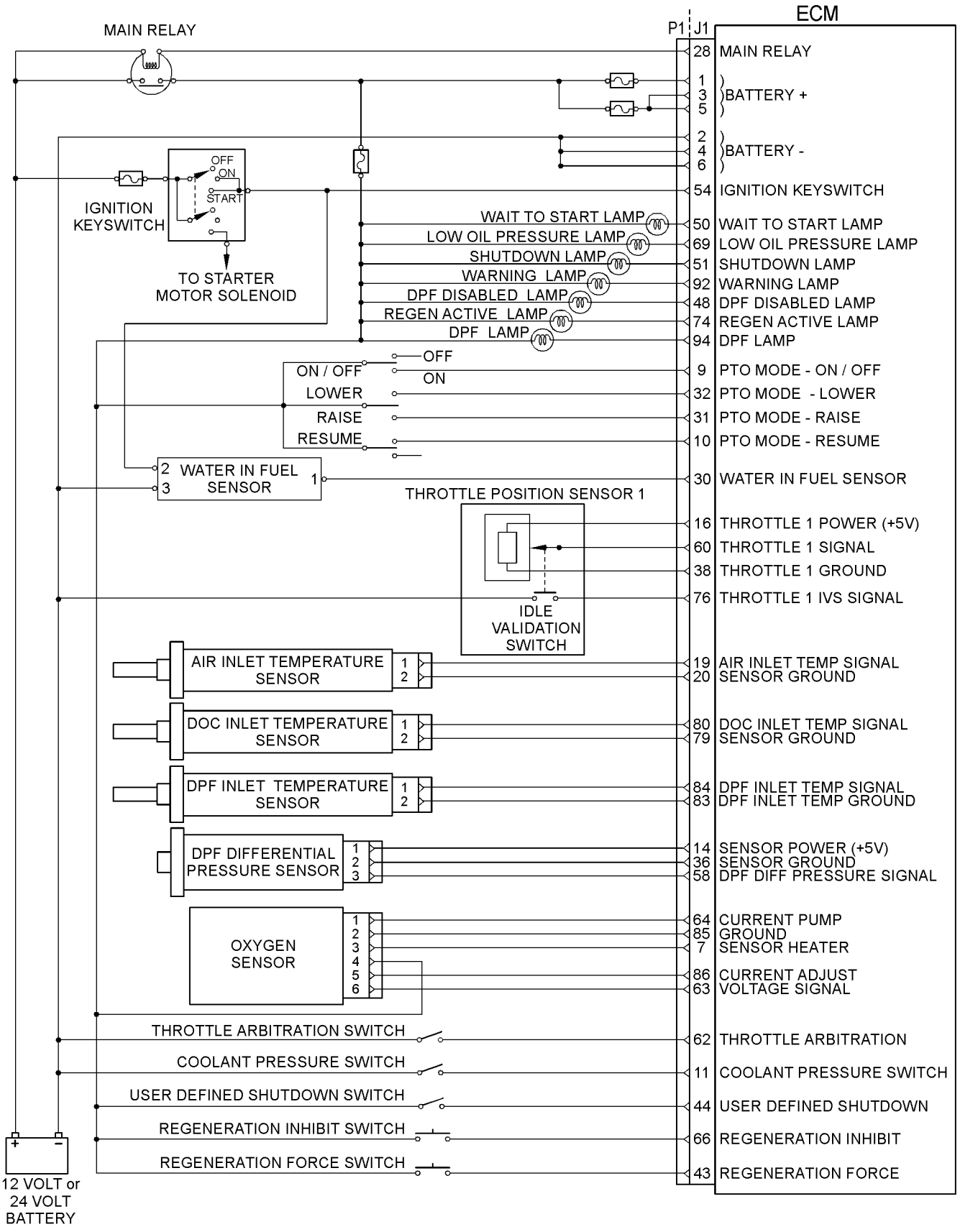

Illustration 20 g02855116

Schematic diagram for a typical application

Note: The DPF differential pressure sensor is not applicable to the 854F-E34T (model JT) engine

Table 51

Value
Enabled
Disabled

Throttle Configuration

Refer to Troubleshooting, “Throttle Setup” for more information on configuring throttles.

Throttle Arbitration Method

The “Throttle Arbitration Method” parameter is applicable to engines with more than one throttle input. This parameter defines which throttle has control of the engine speed.

Table 52

Value
Largest wins
Smallest Wins
Manual

Manual Throttle Arbitration Precondition Check

Table 53

Value
Enabled
Disabled

Recommended Actions

Alternator Drive Belt

Inspect the condition of the alternator drive belt. If the alternator drive belt is worn or damaged, check that the drive belt for the alternator and the pulley are correctly aligned. If the alignment is correct, replace the drive belt. Refer to Disassembly and Assembly, “Alternator Belt - Remove and Install”.

Charging Circuit

Inspect the battery cables, wiring, and connections in the charging circuit. Clean all connections and tighten all connections. Replace any faulty parts.

Alternator

Verify that the alternator is operating correctly. Refer to Systems Operation, Testing, and Adjusting, “Alternator - Test”. The alternator is not a serviceable item. The alternator must be replaced if the alternator is not operating correctly. Refer to Disassembly and Assembly, “Alternator - Remove” and Disassembly and Assembly, “Alternator - Install”.

i04077331

Battery Problem

Probable Causes

- Charging circuit
- Battery
- Auxiliary device

Recommended Actions

Charging Circuit

If a fault in the battery charging circuit is suspected, refer to Troubleshooting, “Alternator Problem”.

Faulty Battery

1. Check that the battery is able to maintain a charge. Refer to Systems Operation, Testing, and Adjusting, “Battery - Test”.
2. If the battery does not maintain a charge, replace the battery. Refer to the Operation and Maintenance Manual, “Battery - Replace”.

Auxiliary Device

1. Check if an auxiliary device has drained the battery by being left in the ON position.
2. Charge the battery.
3. Verify that the battery is able to maintain a charge when all auxiliary devices are switched off.

i04077432

Coolant Contains Oil

Probable Causes

- Engine oil cooler
- Cylinder head gasket
- Cylinder head
- Cylinder block

Recommended Actions

Engine Oil Cooler

1. Drain the coolant from the cooling system. Drain the lubricating oil from the engine oil cooler. Refer to the Operation and Maintenance Manual for more information.
2. Check for leaks in the oil cooler assembly. Refer to Systems Operation, Testing, and Adjusting, “Cooling System” for the correct procedure. If a leak is found, install a new oil cooler. Refer to Disassembly and Assembly, “Engine Oil Cooler - Remove” and Disassembly and Assembly, “Engine Oil Cooler - Install” for the correct procedure.

Cylinder Head Gasket

1. Remove the cylinder head. Refer to Disassembly and Assembly, “Cylinder Head - Remove” for the correct procedure.
2. Inspect the cylinder head gasket for faults and any signs of leakage.
3. Proceed to the recommended actions for the “Cylinder Head”.

Cylinder Head

1. Check the cylinder head for flatness. Refer to Systems Operation, Testing, and Adjusting, “Cylinder Head - Inspect” for the correct procedure.

(Table 59, contd)

3251-10	Particulate Trap Differential Pressure : Abnormal Rate of Change	The ECM detects the following conditions: The differential pressure across the DPF does not drop below 2.5 kPa (0.36 psi) after the engine has stopped. This code will be active when the defect has been detected for at least 6 seconds. The battery voltage is at least 10 VDC. If equipped, the warning lamp will flash. The engine will be derated.
3251-18	Aftertreatment #1 DPF Trap Differential Pressure : Low - moderate severity (2)	The ECM detects the following conditions: There is no differential pressure across the DPF for at least 100 seconds. The battery voltage is at least 10 VDC. If equipped, the warning lamp will flash. The engine will be derated. The fault will be cleared if the differential pressure is within the acceptable range for at least 10 seconds.

Probable Causes

- Diagnostic codes
- Exhaust leaks
- Connections to the DPF differential pressure sensor
- Incorrect installation of the DPF
- Faulty DPF differential pressure sensor

Recommended Actions

Diagnostic Codes

Use one of the following methods to check for active diagnostic codes:

- The electronic service tool
- The display on the control panel

In particular check for an active 3251-3 or 3251-4 diagnostic code.

Electronic Service Tool

1. Connect the electronic service tool to the diagnostic connector.

2. Check for active diagnostic codes on the electronic service tool.

3. If a 3251-3 or 3251-4 diagnostic code is active, refer to Troubleshooting, “Engine Pressure Sensor Open or Short Circuit - Test” before returning to this procedure.

4. If the fault has not been eliminated, proceed to “Exhaust Leaks”.

Display on the Control Panel

Note: The following procedure is only applicable if the application is equipped with a display on the control panel.

1. Check the display on the control panel for active diagnostic codes.

2. If a 3251-3 or 3251-4 diagnostic code is active, refer to Troubleshooting, “Engine Pressure Sensor Open or Short Circuit - Test” before returning to this procedure.

3. If the fault has not been eliminated, proceed to “Exhaust Leaks”.

Exhaust Leaks

Thoroughly inspect the exhaust duct between the engine and the DPF for leaks. Ensure that all connections are secure and no leaks are present.

If the fault has not been eliminated, proceed to “Connections to the DPF Differential Pressure Sensor”

- Restrictions
- Damage to lines or hoses

4. If the repairs do not eliminate the fault, proceed to "Fuel Supply".

Fuel Supply

1. Visually check the fuel tank for fuel. The fuel gauge may be faulty.

2. Ensure that the fuel supply valve (if equipped) is in the full OPEN position.

3. If the temperature is below 0 °C (32 °F), check for solidified fuel (wax).

4. Check the primary filter/water separator for water in the fuel.

5. Check for fuel supply lines that are restricted.

6. Check that the low-pressure fuel lines are tight and secured properly.

7. Check the fuel filters.

8. Check the diesel fuel for contamination. Refer to Systems Operation, Testing and Adjusting, "Fuel Quality - Test".

9. Check for air in the fuel system. Refer to Systems Operation, Testing and Adjusting, "Air in Fuel - Test".

10. Ensure that the fuel system has been primed. Refer to Systems Operation, Testing and Adjusting, "Fuel System - Prime".

11. Check the fuel pressure. Refer to Systems Operation, Testing and Adjusting, "Air in Fuel - Test".

12. If the repair does not eliminate the fault, refer to "Throttle Position Sensor".

Throttle Position Sensor

1. Use the electronic service tool and observe the signal for the throttle position sensor. Make sure that the throttle reaches the 100% raw position and the calibrated position.

2. If the signal is erratic, refer to Troubleshooting, "Analog Throttle Position Sensor Circuit - Test" .

3. If the application has a multi-position throttle switch, refer to Troubleshooting, "Throttle Switch Circuit - Test".

4. If the application has a mode selection switch, refer to Troubleshooting, "Mode Selection Circuit - Test".

5. If the repairs do not eliminate the fault, proceed to "Fuel Injection Pump".

Fuel Injection Pump

Note: The fuel injection pump that is installed by the factory is a nonserviceable item. If any fault occurs within the fuel injection pump, the fuel injection pump must be replaced.

1. Use the electronic service tool to select the correct screen in order to display any diagnostic trouble codes that relate to the fuel injection pump. Refer to Troubleshooting, "Troubleshooting with a Diagnostic Code".

2. If the fault is not eliminated, refer to "Low Compression (Cylinder Pressure)".

Low Compression (Cylinder Pressure)

1. Perform a compression test. Refer to Systems Operation, Testing and Adjusting, "Compression - Test".

2. If low compression is noted on any cylinders, investigate the cause and rectify the cause.

Possible causes of low compression are shown in the following list:

- Loose glow plugs
- Faulty piston
- Faulty piston rings
- Worn cylinder bores
- Worn valves
- Faulty cylinder head gasket
- Damaged cylinder head

3. Perform all necessary repairs.

4. Ensure that the repairs have eliminated the faults.

5. If the repair does not eliminate the fault, refer to "Electronic Unit Injectors".

Electronic Unit Injectors

Use the electronic service tool to check for active diagnostic codes that relate to the electronic unit injectors. Troubleshoot any active diagnostic codes before continuing with this procedure. Refer to Troubleshooting, "Diagnostic Trouble Codes".

Recommended Actions

Diagnostic Codes

Use one of the following methods to check for active diagnostic codes:

- The electronic service tool
- The display on the control panel

In particular, check for diagnostic codes that relate to the following components:

- The coolant temperature sensor
- The glow plug control unit
- The glow plugs

Electronic Service Tool

1. Connect the electronic service tool to the diagnostic connector.

2. Check for active diagnostic codes on the electronic service tool.

3. Investigate any active codes before continuing with this procedure. Refer to Troubleshooting, “Troubleshooting with a Diagnostic Code”.

Display on the Control Panel

Note: The following procedure is only applicable if the application is equipped with a display on the control panel.

1. Check the display on the control panel for active diagnostic codes.

2. Troubleshoot any active codes before continuing with this procedure. Refer to Troubleshooting, “Troubleshooting with a Diagnostic Code”.

Low Coolant Temperature

Check that the water temperature regulator is operating correctly. Refer to Systems Operation, Testing, and Adjusting, “Water Temperature Regulator - Test”.

If the water temperature regulator is operating correctly, refer to “Fuel Quality”.

Fuel Quality

1. Check the diesel fuel for quality. Refer to Systems Operation, Testing, and Adjusting, “Fuel Quality - Test”.

Note: Diesel fuel with a low cetane value is likely to cause white smoke.

2. If the repair does not eliminate the fault, refer to “Valve Lash”.

Valve Lash

1. Ensure that the valve lash is correct. Refer to Systems Operation, Testing, and Adjusting, “Engine Valve Lash - Inspect”.

2. If the repair does not eliminate the fault, proceed to “Low Compression (cylinder pressure)”.

Low Compression (cylinder pressure)

1. Perform a compression test. Refer to Systems Operation, Testing, and Adjusting, “Compression - Test”.

2. If low compression is noted on any cylinders, investigate the cause and rectify the cause.

Possible causes of low compression are shown in the following list:

- Loose glow plugs
- Faulty piston
- Faulty piston rings
- Worn cylinder bores
- Worn valves
- Faulty cylinder head gasket
- Damaged cylinder head

3. Perform all necessary repairs.

4. Ensure that the repair has eliminated the fault.

5. If the repair does not eliminate the fault, refer to “Individual Malfunctioning Cylinder”.

Individual Malfunctioning Cylinder

Table 64

Diagnostic Trouble Codes for High Intake Manifold Air Pressure		
J1939 Code	**Description**	**Notes**
1127-16	Engine Turbocharger 1 Boost Pressure : High - moderate severity (2)	The Electronic Control Module (ECM) detects that the actual intake manifold air pressure is greater than the desired intake manifold air pressure by 50 kPa (7.25 psi) for at least 10 seconds. If equipped, the warning lamp will flash. The engine will be derated. If the actual intake manifold pressure is within 25 kPa (3.6 psi) of the desired intake manifold air pressure for at least 11 minutes, the code will reset.

Probable Causes

- Diagnostic codes
- Air inlet and exhaust restrictions
- Wastegate regulator
- Wastegate

Recommended Actions

Diagnostic Codes

Use one of the following methods to check for active diagnostic codes:

- The electronic service tool
- The display on the control panel

Electronic Service Tool

1. Connect the electronic service tool to the diagnostic connector.
2. Check for active diagnostic codes on the electronic service tool.
3. Investigate any active codes before continuing with this procedure. Refer to Troubleshooting, “Troubleshooting with a Diagnostic Code”.

Display on the Control Panel

Note: The following procedure is only applicable if the application is equipped with a display on the control panel.

1. Check the display on the control panel for active diagnostic codes.
2. Troubleshoot any active codes before continuing with this procedure. Refer to Troubleshooting, “Troubleshooting with a Diagnostic Code”.

Air Inlet and Exhaust Restrictions

1. Check the air filter for damage. If necessary, replace a damaged air filter. Refer to the Operation and Maintenance Manual.
2. Check the air inlet and exhaust system for restrictions and/or leaks. Refer to Systems Operation, Testing, and Adjusting, “Air Inlet and Exhaust System - Inspect”.

Wastegate Regulator

Check the wastegate regulator for correct operation. Refer to Troubleshooting, “Solenoid Valve - Test”.

Wastegate

1. Check for correct operation of the wastegate. Refer to Systems Operation, Testing, and Adjusting, “Turbocharger - Inspect”.
2. If the wastegate or the wastegate actuator is faulty, replace the turbocharger. Refer to Disassembly and Assembly, “Turbocharger - Remove” and Disassembly and Assembly, “Turbocharger - Install”.

i04765889

Intake Manifold Air Pressure Is Low

This procedure covers the following diagnostic code:

If the fault cannot be eliminated, contact Perkins Global Technical Support.

i04765937

Valve Lash Is Excessive

Probable Causes

- Lubrication
- Valve train components

Recommended Actions

Lubrication

1. Ensure that the engine oil pressure is satisfactory. Low engine oil pressure can cause excessive component wear.

2. Remove the valve mechanism cover. Refer to Disassembly and Assembly, “Valve Mechanism Cover - Remove and Install” for the correct procedure.

3. Crank the engine and check the lubrication in the valve compartment. Ensure that there is adequate engine oil flow in the valve compartment. The passages for the engine oil must be clean.

Note: Do not run the engine without the valve mechanism cover.

Valve Train Components

1. Check the hydraulic lifters for correct operation. Refer to Systems Operation, Testing, and Adjusting, “Engine Valve Lash - Inspect”.

2. Inspect the following components of the valve train. Refer to Disassembly and Assembly for any components that must be removed for inspection.

- Rocker arms
- Pushrods
- Hydraulic lifters
- Camshaft
- Valve stems
- Rocker shaft

3. Check the components for the following conditions: abnormal wear, excessive wear, straightness and cleanliness. If necessary, use new parts for replacement.

Note: If the camshaft is replaced, new valve lifters must also be used.

- A short circuit in the harness
- A faulty sensor
- A faulty ECM

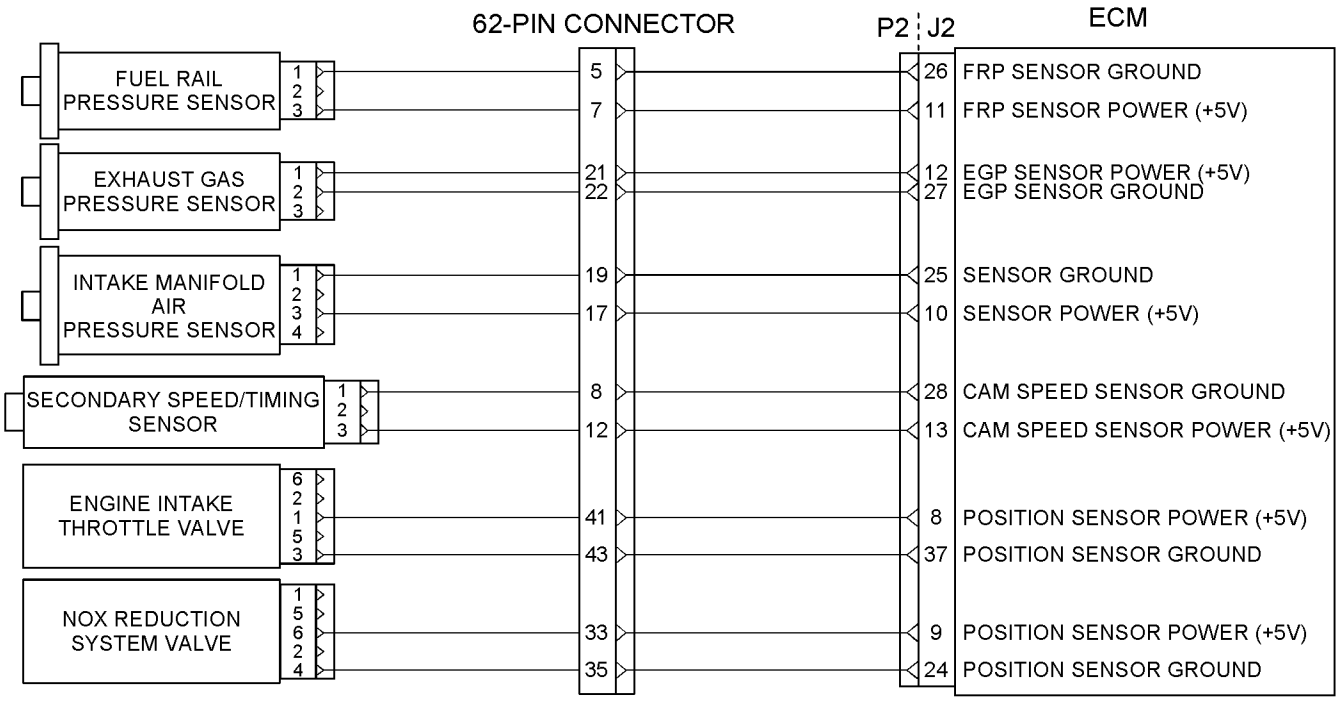

Illustration 31 g02862378

Typical example of the 5 VDC supply circuit supplied by the J2 connector. A 3509-2 diagnostic code applies to the 5 VDC supply in this illustration.

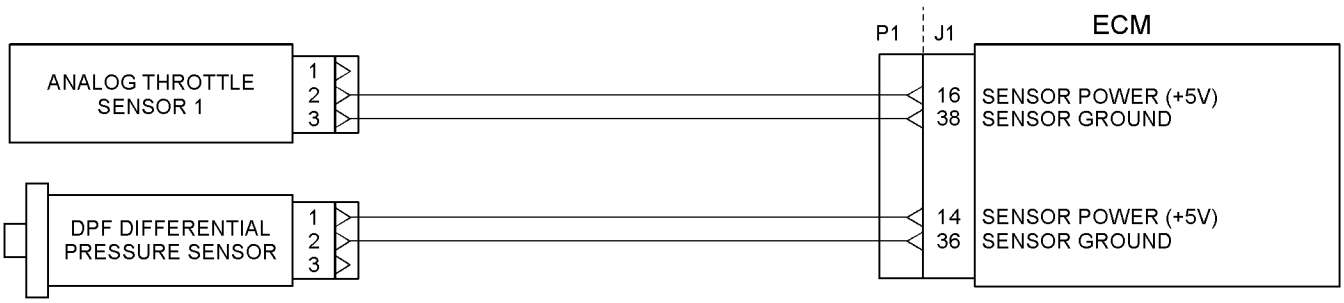

Illustration 32 g02727968

Typical example of the 5 VDC supply circuit supplied by the J1 connector. A 3510-2 diagnostic code applies to the 5 VDC supply in this illustration.

A. Turn the keyswitch to the OFF position.

B. Disconnect the connector for the throttle position sensor with the XX-4 diagnostic code.

C. Fabricate a jumper wire that is 150 mm (6 inch) long.

D. Insert one end of the jumper wire into the terminal for the 5 VDC supply on the harness connector for the suspect sensor. Insert the other end of the jumper wire into the signal terminal on the harness connector for the suspect sensor.

E. Turn the keyswitch to the ON position

F. Access the "Active Diagnostic Codes" screen on the electronic service tool and check for an active XX-3 diagnostic code for the suspect sensor.

G. Remove the jumper.

Results:

- An XX-4 diagnostic code was active before the jumper was installed. An XX-3 diagnostic code is active when the jumper is installed.

  Repair: Perform the following repair:

  A. Reconnect the connector for the suspect sensor.

  B. Turn the keyswitch to the ON position. Use the electronic service tool to check for active diagnostic codes.

  C. If the XX-4 diagnostic code returns, there is an open circuit in the sensor.

  D. Install a replacement sensor.

  E. Use the electronic service tool to clear all logged diagnostic codes and verify that the repair eliminates the fault.

  STOP.

- An XX-4 diagnostic code remains active when the jumper is installed. – The sensor is OK. Proceed to Test Step 10.

Test Step 10. Check the Sensor Signal Wire for an Open Circuit

A. Turn the keyswitch to the OFF position.

B. Disconnect the suspect throttle position sensor connector. Disconnect the P1 connector from the ECM.

Thoroughly inspect the P1/J1 connectors for corrosion and/or damaged seals. Repair if necessary.

C. Use a suitable multimeter to measure the resistance between the sensor signal terminal on the harness connector for the sensor and the sensor signal terminal on the P1 connector.

Expected Result:

The resistance measurement should be less than 2 Ohms.

Results:

- OK – The resistance measurement is less than 2 Ohms. There is not an open circuit in the wiring. Proceed to Test Step 11.

- Not OK – The resistance measurement is more than 2 Ohms. There is an open circuit or high resistance in the sensor signal wire between the sensor connector and the P1 connector.

  Repair: Repair the faulty wiring or replace the faulty wiring.

  Use the electronic service tool to clear all logged diagnostic codes and verify that the repair eliminates the fault.

  STOP.

Test Step 11. Check for Short Circuits in the Wiring Harness

Use a suitable multimeter to measure the resistance between the suspect sensor signal terminal on the P1 connector and all other terminals on the P1 connector.

Expected Result:

All resistance measurements should be greater than 100 Ohms.

Results:

- OK – All resistance measurements are greater than 100 Ohms. There are no shorts in the wiring harness.

  Repair: Perform the following repair:

  A. Make sure that the latest flash file for the application is installed in the ECM. Refer to TroubleshootingFlash Programming.

  B. Contact Perkins Global Technical Support.

Table 75

Diagnostic Trouble Codes for the ECM Main Relay		
J1939 Code	**Description**	**Notes**
1485-7	ECM Main Relay : Not Responding Properly	The Electronic Control Module (ECM) detects that the battery supply voltage is still present 0.5 seconds after the shut-off request from the ECM. If equipped, the warning lamp will come on. The ECM is receiving battery voltage after the keyswitch has been turned OFF, which will drain battery power.
1485-14	ECM Main relay : Special Instruction	The ECM requires battery voltage for up to 60 seconds after the keyswitch has been turned OFF. A fault is caused when the ECM has lost battery voltage before this period has elapsed. The fault is detected the next time the keyswitch is turned ON. The diagnostic code becomes active when the fault is detected for three consecutive starts. If equipped, the warning lamp will come on. This condition is most likely caused by shutting the engine down using the battery disconnect switch instead of the keyswitch for three consecutive shutdowns or using the battery disconnect switch immediately after the keyswitch has been turned OFF.
2840-14	ECU Instance : Special Instruction	The ECM was unable to write data to the internal memory. This condition is most likely caused by removing battery power from the ECM while the ECM was attempting to write data to the internal memory.

This engine uses the ECM main relay to supply battery voltage to the ECM. The ECM enables this relay when the “Ignition Keyswitch” signal is detected.

The ECM requires battery voltage for up to 60 seconds after the keyswitch has been turned OFF in order to save data to the memory.

The ECM will shut off the main relay after all data has been saved to the memory.

- The XXXX-4 diagnostic code for the suspect sensor is still active with the P2 connector disconnected.

  Repair: Perform the following repair:

  A. Reconnect all sensors and the P2 connector.

  B. Turn the keyswitch to the ON position and verify that the fault is still present.

  Proceed to Test Step 16.

Test Step 9. Create a Short at the Sensor Connector

A. Turn the keyswitch to the OFF position.

B. Disconnect the connector for the suspect sensor.

C. Fabricate a jumper wire that is 150 mm (6 inch) long. Install the jumper wire between the sensor signal terminal and the sensor ground terminal on the harness connector for the suspect sensor.

D. Turn the keyswitch to the ON position. Wait at least 10 seconds for activation of the diagnostic codes.

E. Use the electronic service tool to check for an active XXXX-4 diagnostic code for the suspect sensor.

F. Turn the keyswitch to the OFF position. Remove the jumper wire.

Results:

- An XXXX-3 diagnostic code was active before installing the jumper. An XXXX-4 diagnostic code was active with the jumper installed. – There may be a fault in the sensor.

  Repair: Temporarily connect a new sensor to the harness, but do not install the new sensor in the engine. Use the electronic service tool in order to verify that the repair eliminates the fault and then permanently install the new sensor.

  If the DPF differential pressure sensor is replaced, use the electronic service tool to perform the “DPF Differential Pressure Sensor Replacement” .

  If the fuel rail is replaced, use the electronic service tool to perform the “Rail Pressure Valve Learn Reset” .

  Use the electronic service tool in order to clear all logged diagnostic codes.

  STOP.

- An XXXX-3 diagnostic code is still active with the jumper installed. Proceed to Test Step 12. Proceed to Test Step 10.

Test Step 10. Create a Short at the 62-Pin Connector

A. Turn the keyswitch to the OFF position.

B. Disconnect the 62-pin connector.

C. Fabricate a jumper wire that is 150 mm (6 inch) long. Install the jumper wire between the suspect sensor signal terminal and the sensor ground terminal on the 62-pin connector on the harness between the engine and the ECM.

D. Turn the keyswitch to the ON position. Wait at least 10 seconds for activation of the diagnostic codes.

Note: Diagnostic codes for all of the engine sensors will be active with the 62-pin connector disconnected. Ignore all other diagnostic codes. Only look for codes that relate to the suspect sensor.

E. Use the electronic service tool to check for an active XXXX-4 diagnostic code for the suspect sensor.

F. Turn the keyswitch to the OFF position. Remove the jumper wire.

Results:

- An XXXX-3 diagnostic code was active before installing the jumper. An XXXX-4 diagnostic code was active with the jumper installed. – The fault is in the wiring between the suspect sensor connector and the 62-pin connector.

  Repair: Replace the faulty wiring.

  Use the electronic service tool in order to clear all logged diagnostic codes.

  STOP.

- An XXXX-3 diagnostic code is still active with the jumper installed. Proceed to Test Step 11.

Test Step 11. Create a Short Circuit at the ECM

A. Turn the keyswitch to the OFF position.

B. Disconnect the P2 connector from the ECM.

C. Fabricate a jumper wire that is 150 mm (6 inch) long. Install the jumper wire between the suspect sensor signal pin and the sensor ground pin on the J2 connector.

The loss of signal to the primary sensor and/or the secondary sensor will result in one of the following faults:

- The engine will continue to run when only one sensor signal is present from either the primary sensor or the secondary sensor.
- Loss of signal from the primary sensor and the secondary sensor during operation of the engine will cause fuel injection to be terminated and the engine will stop.

Pull-up Voltage

The ECM continuously outputs a pull-up voltage on the circuit for the secondary speed/timing sensor signal wire. This pull-up voltage is required for correct sensor operation and diagnostics.

When the sensor is disconnected, this pull-up voltage can be measured at the harness connector for the sensor.

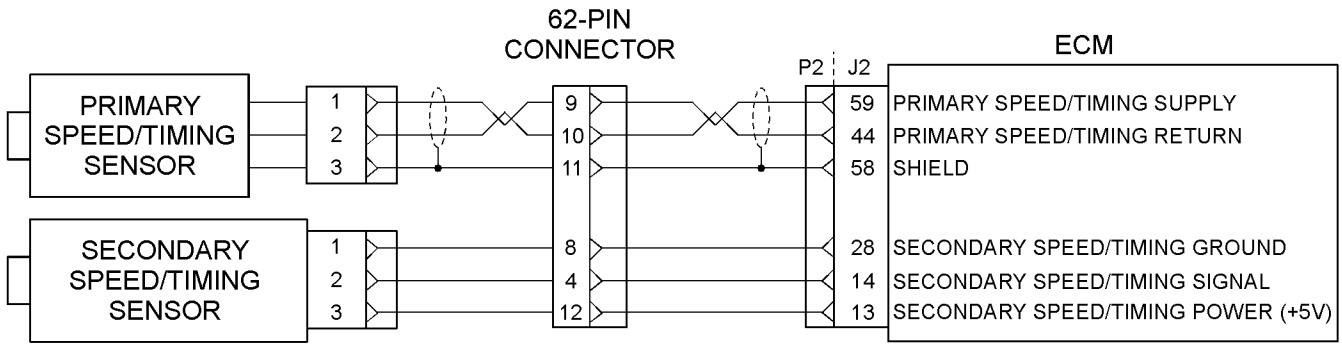

Illustration 52 g02259713

Schematic for the speed/timing sensors

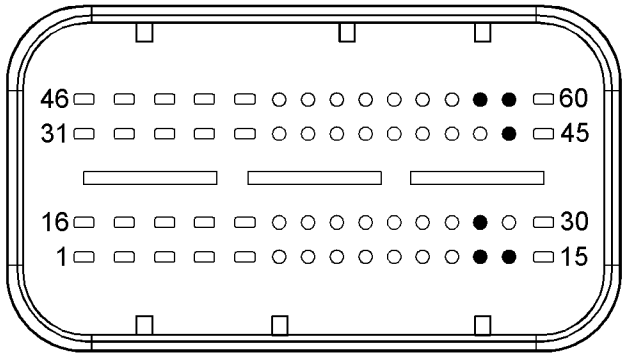

Illustration 53 g02648462

View of the pin locations for the speed/timing sensors on the P2 connector

(13) Secondary speed/timing sensor 5 VDC supply
(14) Secondary speed/timing sensor signal
(28) Secondary speed/timing sensor ground
(44) Primary speed/timing sensor return
(58) Shield
(59) Primary speed/timing sensor supply

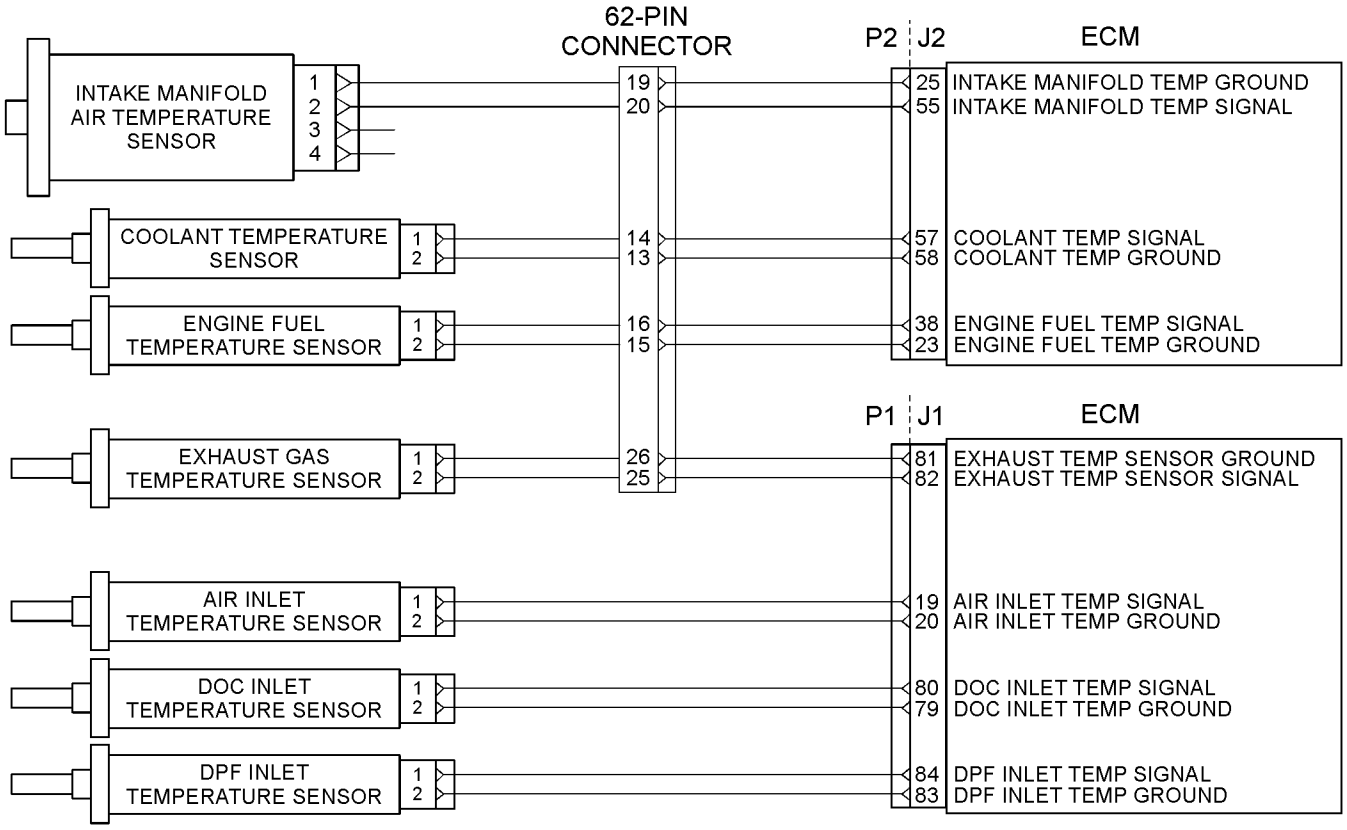

Illustration 57 g02868178

Schematic diagram for the engine temperature sensors on the 854E-E34TA (model JR) engine

- An active diagnostic code or a recently logged diagnostic code was not displayed. – There may be an intermittent fault.

  Repair: In order to identify intermittent faults, refer to TroubleshootingElectrical Connectors - Inspect.

  STOP.

Test Step 3. Check the Glow Plug for the Suspect Cylinder

A. Turn the keyswitch to the OFF position.

B. Disconnect the connectors for any suspect cylinders. Refer to Table 80 in order to identify which cylinders are suspect.

C. Use a suitable multimeter to measure the resistance between the connector on the suspect glow plug and a suitable engine block ground point.

Results:

- The measurement indicates that there is a resistance between the glow plug and the ground point. – The glow plug is OK. The fault is in the wiring between the GCU and the suspect glow plug.

  Repair: Repair the faulty wiring or replace the faulty wiring. Use the electronic service tool to override the glow plug start aid and verify that the repair eliminates the fault.

  Clear all logged diagnostic codes.

  STOP.

- The measurement indicates an open circuit between the glow plug and the ground point. – The glow plug is faulty.

  Repair: Replace the suspect glow plug. Refer to Disassembly and AssemblyGlow Plugs - Remove and Install.

  Use the electronic service tool to override the glow plug start aid and verify that the repair eliminates the fault. Clear all logged diagnostic codes.

  STOP.

Test Step 4. Check that the GCU is Receiving the Correct Voltage

A. Turn the keyswitch to the OFF position.

B. Disconnect the GCU.

C. Measure the voltage at pin 4 on the harness connector for the GCU and a suitable ground.

Expected Result:

The voltage measurement should be 10 to 14 VDC.

Results:

- OK – The GCU is receiving the correct voltage. Proceed to Test Step 5.

- Not OK – The GCU is not receiving the correct voltage

  Repair: Check the fuse for the GCU. If the fuse is blown, replace the fuse.

  If the fuse is replaced and the fault reoccurs, there is a short in the wiring between the battery supply and pin 4 on the GCU.

  If the fuse is not blown, there is an open circuit in the wiring between the battery supply and pin 4 on the GCU.

  Repair the faulty wiring or replace the faulty wiring. Reconnect the GCU. Use the electronic service tool to override the glow plug start aid and verify that the repair eliminates the fault.

  Clear all logged diagnostic codes.

  STOP.

Test Step 5. Check That the GCU is Grounded Correctly

A. Turn the keyswitch to the OFF position.

B. Disconnect the GCU.

C. Measure the voltage between pin 4 and pin 5 on the harness connector for the GCU.

Expected Result:

The voltage measurement should be 10 to 14 VDC.

Results:

- OK – The GCU is correctly grounded Proceed to Test Step 11.

- Not OK – The GCU is not correctly grounded. The fault is in the wiring between pin 5 on the harness connector for the GCU and P1:41.

  Repair: Repair the faulty wiring or replace the faulty wiring. Use the electronic service tool to override the glow plug start aid and verify that the repair eliminates the fault.

Table 82

Diagnostic Trouble Codes for the Ignition Keyswitch and the Battery Supply Circuit		
168-3	Battery Potential / Power Input 1 : Voltage Above Normal	This code indicates that the battery circuit to the ECM has excessive voltage while the engine is running. The ECM detects the following conditions: The battery voltage is high for at least 10 seconds. The keyswitch is in the ON position. The engine is not cranking. The ECM will log the diagnostic code. If equipped, the warning lamp will come on.
168-4	Battery Potential / Power Input 1 : Voltage Below Normal	This code indicates that the battery circuit for the ECM has low voltage while the engine is running. The ECM detects the following conditions: The battery voltage is low for at least 10 seconds. The keyswitch is in the ON position. The engine is not cranking. If equipped, the warning lamp will come on. The ECM will normally log the diagnostic code. If battery voltage disappears without returning, the ECM will not log this diagnostic code and the engine will shut down. The engine may experience changes in the engine rpm, and intermittent engine shut-downs or complete engine shutdowns while the conditions that cause this diagnostic code are present.

The ECM receives electrical power (battery voltage) through the wiring that is supplied by the manufacturer of the application. Battery+ voltage is supplied through P1: 1, 3, and 5. The battery- is supplied through P1: 2, 4, and 6. The ECM receives the input from the keyswitch at P1:54 when the keyswitch is in the ON position or in the START position. When the ECM detects battery voltage at this input, the ECM will activate the main relay. When battery voltage is removed from this input, after a short time (up to 60 seconds) the ECM will deactivate the main relay.

The cause of an intermittent power supply to the ECM can occur on either the positive side or on the negative side of the battery circuit. The connections for the unswitched battery+ may be routed through a dedicated protection device (circuit breaker).

Some applications may be equipped with an engine protection shutdown system or an idle timer shutdown system that interrupts electrical power to the keyswitch. The engine protection shutdown system can be an aftermarket device and the idle timer shutdown system can be external to the ECM. Some of these systems will not supply power to the ECM until one of the following conditions is met:

- The engine is cranking.
- An override button is pressed.

These devices may be the cause of intermittent power to the ECM. These devices may also shut down the engine.

Usually, battery power to the diagnostic connector is available and the battery power to the data link connector is independent of the keyswitch. Therefore, although the electronic service tool can be powered up, there may be no communication with the engine ECM. The engine ECM requires the keyswitch to be in the ON position in order to maintain communications. The ECM may power down a short time after connecting the electronic service tool if the keyswitch is in the OFF position.

Note: Wait at least 10 seconds for activation of the diagnostic codes.

E. Turn the keyswitch to the OFF position.

Results:

- An XXXX-6 diagnostic code was active with the lamp connected. The XXXX-6 diagnostic code is no longer active with the lamp disconnected – The lamp is faulty.

  Repair: Perform the following repair:

  A. Replace the lamp.

  B. Turn the keyswitch to the ON position. Ensure that the lamp comes on during the 2 second lamp test.

  C. Use the electronic service tool to clear all logged diagnostic codes and verify that the repair eliminates the fault.

  STOP.

- An XXXX-6 diagnostic code is still active when the lamp is removed. – The lamp is OK. Proceed to Test Step 7.

Test Step 7. Inspect the Lamp Connector

A. Turn the keyswitch to the OFF position.

B. Thoroughly inspect the connector for the suspect lamp. Ensure that the connector is free from corrosion and/or damage.

Results:

- The lamp connector is free from corrosion and/or damage. Proceed to Test Step 8.

- The lamp connector is showing signs of corrosion and/or damage. – There may be a short in the lamp connector.

  Repair: Perform the following repair:

  A. Ensure that the connector is free from corrosion. If necessary, replace the connector.

  B. Turn the keyswitch to the ON position. Ensure that the lamp comes on during the 2 second lamp test.

  C. Use the electronic service tool to clear all logged diagnostic codes and verify that the repair eliminates the fault.

  STOP.

Test Step 8. Check the Wiring Between the Lamp Connector and the ECM for a Short Circuit

A. Turn the keyswitch to the OFF position.

B. Disconnect the suspect lamp. Disconnect the P1connector from the ECM.

Thoroughly inspect the P1/J1 connectors for corrosion and/or damaged seals. Repair if necessary.

C. Use a suitable multimeter to measure the resistance between the terminal for the suspect lamp on the P1 connector and all other terminals on the P1 connector.

Expected Result:

All resistance measurements should be greater than 100 Ohms.

Results:

- OK – All resistance measurements are greater than 100 Ohms. There are no short circuits in the harness.

  Repair: Perform the following repair:

  A. Make sure that the latest flash file for the application is installed in the ECM. Refer to TroubleshootingFlash Programming.

  B. Contact the Perkins Global Technical Support.

  Note: This consultation can greatly reduce the repair time.

  C. If Perkins Global Technical Support recommend the use of a replacement ECM, install a replacement ECM. Refer to TroubleshootingReplacing the ECM.

  D. Use the electronic service tool to recheck the system for active diagnostic codes.

  E. If the fault is resolved with the replacement ECM, reconnect the suspect ECM.

  F. If the fault returns with the suspect ECM, replace the ECM.

  G. Use the electronic service tool in order to clear all logged diagnostic codes and then verify that the repair eliminates the fault.

  STOP.

- Not OK – At least one of the resistance measurements is less than 100 Ohms. There is a

F. If the fault is eliminated with the replacement ECM, reconnect the suspect ECM.

G. If the fault returns with the suspect ECM, replace the ECM.

H. Use the electronic service tool in order to clear all logged diagnostic codes and then verify that the repair eliminates the fault.

STOP.

Test Step 6. Create an Open Circuit at the Injector Connector or Connectors

⚠ WARNING

Electrical Shock Hazard. The electronic unit injectors use DC voltage. The ECM sends this voltage to the electronic unit injectors. Do not come in contact with the harness connector for the electronic unit injectors while the engine is operating. Failure to follow this instruction could result in personal injury or death.

A. Turn the keyswitch to the OFF position. A strong electrical shock hazard is present if the keyswitch is not turned OFF.

B. Disconnect the connector for any suspect injectors.

C. Turn the keyswitch to the ON position. Wait at least 30 seconds for activation of the diagnostic codes.

D. Use the electronic service tool to check for active diagnostic codes.

E. Turn the keyswitch to the OFF position.

Results:

- An XXX-6 diagnostic code was active before disconnecting the suspect injectors. An XXX-5 diagnostic code is active with the injectors disconnected.

  Repair: Perform the following repair:

  A. Thoroughly inspect the electrical connectors on the suspect injectors and the harness connector for the suspect injectors. Ensure that the connectors are free from corrosion. Reconnect the connector for the injectors.

  B. Start the engine.

  C. If the fault is still present, replace the faulty injectors. Refer to Disassembly and AssemblyElectronic Unit Injector - Remove and Disassembly and AssemblyElectronic Unit Injector - Install.

  D. Use the electronic service tool to clear all logged diagnostic codes and verify that the repair eliminates the fault.

  STOP.

- An XXX-6 diagnostic code is still active with the injectors disconnected. – The injectors are OK. Proceed to Test Step 7.

Test Step 7. Create an Open Circuit at the 10-Pin Connector

⚠ WARNING

Electrical Shock Hazard. The electronic unit injectors use DC voltage. The ECM sends this voltage to the electronic unit injectors. Do not come in contact with the harness connector for the electronic unit injectors while the engine is operating. Failure to follow this instruction could result in personal injury or death.

A. Turn the keyswitch to the OFF position. A strong electrical shock hazard is present if the keyswitch is not turned OFF.

B. Disconnect the 10-pin engine interface connector.

C. Turn the keyswitch to the ON position. Wait for at least 30 seconds for activation of the diagnostic codes.

D. Use the electronic service tool to check for active diagnostic codes.

Results:

- An XXX-5 diagnostic code is active for every cylinder. – The fault is the wiring for the suspect cylinders between the injector connectors and the 10-pin connector.

  Repair: Repair the faulty wiring or replace the faulty wiring.

  Use the electronic service tool to clear all logged diagnostic code and verify that the repair eliminates the fault.

  STOP.

- An XXXX-6 diagnostic code is active for the suspect cylinders. – The engine harness is OK. Proceed to Test Step 8.

- OK – The voltage is within the expected range. The fault is in the 5 VDC supply wire or the ground wire between the suspect valve and the 62-pin connector.

  Repair: Replace the faulty wiring.

  Use the electronic service tool to clear all logged diagnostic codes and verify that the repair eliminates the fault.

  STOP.

- Not OK – The voltage is not within the expected range. The fault is in the 5 VDC supply wire or the ground wire between the ECM and the 62-pin connector.

  Repair: Replace the faulty wiring.

  Use the electronic service tool to clear all logged diagnostic codes and verify that the repair eliminates the fault.

  STOP.

Test Step 5. Create a Short Circuit at the Valve Connector

A. Turn the keyswitch to the OFF position.

B. Disconnect the connector for the suspect valve.

C. Fabricate a jumper wire that is 150 mm (6 inch) long.

D. Install the jumper between the PWM signal and return pins on the connector for the suspect valve in order to create a short circuit.

E. Turn the keyswitch to the ON position. Check for active diagnostic codes on the electronic service tool.

F. Remove the jumper wire.

Results:

- An XXXX-5 diagnostic code was active before installing the jumper. An XXXX-6 is active with the jumper installed.

  Repair: Perform the following repair:

  A. Reconnect the valve. Start the engine.

  B. Check for active diagnostic codes on the electronic service tool. Wait at least 30 seconds in order for the codes to be displayed.

  C. If the XXXX-5 diagnostic code returns, then replace the valve. Refer to Disassembly and Assembly for the correct procedure.
  If the NRS valve is replaced, use the electronic service tool to perform the "EGR Valve Learn Reset" .

  D. Use the electronic service tool to clear all logged diagnostic codes and verify that the repair eliminates the fault.

  STOP.

- An XXXX-5 diagnostic code is still active with the jumper installed. – The valve is OK. Proceed to Test Step 6.

Test Step 6. Create a Short Circuit at the 62-Pin Connector

A. Turn the keyswitch to the OFF position.

B. Disconnect the 62-pin connector.

C. Fabricate a jumper wire that is 150 mm (6 inch) long. Install the jumper wire between the PWM supply and return terminals for the suspect valve on the 62-pin connector on the harness between the engine and the ECM.

D. Turn the keyswitch to the ON position. Wait at least 30 seconds for activation of the diagnostic codes.

Note: Diagnostic codes for all of the engine sensors will be active with the 62-pin connector disconnected. Ignore all other diagnostic codes and only look for codes that relate to the suspect valve.

E. Look for an active XXXX-6 diagnostic code for the suspect valve.

F. Remove the jumper wire.

Results:

- An XXXX-5 diagnostic code was active before installing the jumper. An XXXX-6 diagnostic code is active when the jumper is installed. – The fault is in the PWM supply wire or the return wire between the suspect valve and the 62-pin connector.

  Repair: Replace the faulty wiring.

  Use the electronic service tool to clear all logged diagnostic codes and verify that the repair eliminates the fault.

  STOP.

- An XXXX-5 diagnostic code is still active with the jumper installed. – The engine harness between

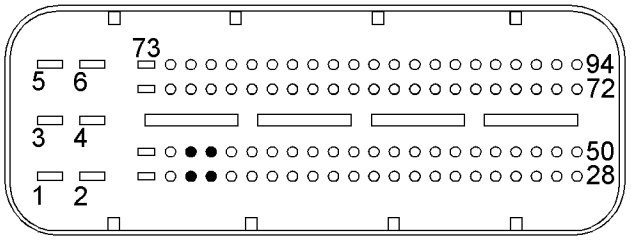

Illustration 87 g02690278

View of the pin locations on the P1 connector for the PTO switches

(9) PTO mode - OFF
(10) PTO mode - resume
(31) PTO mode - raise
(32) PTO mode - lower

Test Step 1. Inspect Electrical Connectors and Wiring

A. Turn the keyswitch to the OFF position.

B. Perform a 30 N (6.7 lb) pull test on each wire in the PTO switch connectors and on each wire in the ECM connector that is associated with the PTO switches. Refer to illustration 86 .

C. Check the harness for corrosion, abrasion, and pinch points from the PTO switches to the ECM and the battery supply.

Expected Result:

All connectors, pins, and sockets are correctly connected. The harness should be free of corrosion, abrasion, and pinch points.

Results:

- OK Proceed to Test Step 2.
- Not OK

  Repair: Repair the circuit.

  Use the electronic service tool in order to clear all logged diagnostic codes and then verify that the repair eliminates the fault.

  STOP.

Test Step 2. Check for Active Diagnostic Codes

A. Turn the keyswitch to the OFF position.

B. Connect the electronic service tool to the diagnostic connector.

C. Turn the keyswitch to the ON position.

D. Check the "Active Diagnostic Codes" screen. Look for an active or recently logged 976-2 diagnostic code.

Results:

- A 976-2 diagnostic code is active. Proceed to Test Step 3.
- A 976-2 diagnostic code is recently logged

  Repair: The logged code may be caused by operating the PTO switches in one of the conditions that are listed in Table 89 or an intermittent fault may exist.

  Refer to TroubleshootingElectrical Connectors - Inspect in order to identify intermittent faults.

  STOP.

- There is no active or recently logged 976-2 diagnostic code. – If the switches are not operating correctly, an open circuit may exist. Proceed to Test Step 3.

Test Step 3. Check the PTO Mode Switches on the Electronic Service Tool

A. Turn the keyswitch to the OFF position.

B. Connect the electronic service tool to the diagnostic connector.

C. Turn the keyswitch to the ON position.

D. Observe the status of the PTO switch on the electronic service tool while the PTO on/off switch is cycled.

E. Use the electronic service tool in order to observe the status of the PTO mode switch while the PTO lower/raise switch is cycled.

F. Use the electronic service tool in order to observe the status of the PTO switch while the PTO Resume switch is cycled.

Expected Result:

The status of each switch changes when the switch is operated.

Results:

- OK – The PTO switches operate correctly.

  STOP. STOP

Table 91

Diagnostic Trouble Codes for the Starting Motor Relay		
J1939 Code	**Description**	**Notes**
677-3	Engine Starter Motor Relay : Voltage Above Normal	The Electronic Control Module (ECM) detects the following conditions: A short circuit to battery in the circuit for the starting motor relay while no start request is detected. The battery voltage is between 9.5 and 16 VDC. If equipped, the warning lamp will come on. If the engine is running, the engine will be derated. The start relay circuit will be disabled.
677-5	Engine Starter Motor Relay : Current Below Normal	The ECM detects the following conditions: A low current condition (open circuit) in the circuit for the starting motor relay for 0.09 seconds while no start request is detected. The battery voltage is between 9.5 and 16 VDC. If equipped, the warning lamp will come on. The start relay circuit will be disabled.
677-6	Engine Starter Motor Relay : Current Above Normal	The ECM detects the following conditions: A high current condition (short circuit) in the circuit for the starting motor relay for at least 0.5 seconds. The battery voltage is between 9.5 and 16 VDC. If equipped, the warning lamp will come on. The engine may be derated. The start relay circuit will be disabled.
1041-2	Start Signal Indicator : Erratic, Intermittent, or Incorrect	This diagnostic code indicates that the start signal has remained active for too long. This condition may be caused by the keyswitch being held in the START position for too long. If equipped, the warning lamp will come on.

E. Use the electronic service tool to check for an active 100-2 diagnostic code.

Note: Diagnostic codes for all of the engine sensors will be active with the P2 connector disconnected. Ignore all other codes and only look for a 100-2 diagnostic code.

F. Turn the keyswitch to the OFF position.

G. Remove the jumper wire.

Results:

- A 100-2 diagnostic code is not active with the jumper installed. – The ECM is OK. The fault is in the wiring between the 62-pin connector and the P2 connector.

  Repair: Repair the faulty wiring or replace the faulty wiring.

  Use the electronic service tool to clear all logged diagnostic codes and verify that the repair eliminates the fault.

  STOP.

- A 100-2 diagnostic code is active with the jumper installed. – The wiring between the engine and the ECM is OK.

  Repair: Perform the following repair:

  A. Make sure that the latest flash file for the application is installed in the ECM. Refer to TroubleshootingFlash Programming.

  B. Contact Perkins Global Technical Support.

  Note: This consultation can greatly reduce the repair time.

  C. If Perkins Global Technical Support recommend the use of a replacement ECM, install a replacement ECM. Refer to TroubleshootingReplacing the ECM.

  D. Use the electronic service tool to recheck the system for active diagnostic codes.

  E. If the fault is resolved with the replacement ECM, reconnect the suspect ECM.

  F. If the fault returns with the suspect ECM, replace the ECM.

  G. Use the electronic service tool in order to clear all logged diagnostic codes and then verify that the repair eliminates the fault.

  STOP.

i04744433

Switch Circuits - Test

System Operation Description:

Use this procedure to diagnose electronic faults in the air filter restriction switch circuit.

This procedure covers the following diagnostic code:

(Table 98, contd)

Diagnostic Trouble Codes for the Valve Position Sensors		
J1939 Code	**Description**	**Notes**
27-4	Engine Exhaust Gas Recirculation Valve Position : Voltage Below Normal	The ECM detects that the signal voltage from the position sensor on the NRS valve is less than 0.2 VDC for at least 0.5 seconds. The battery voltage is at least 10 VDC. The ECM will set the valve to the default position while this code is active. The default position is 0 percent. If equipped, the warning lamp will come on. The engine will be derated.
51-3	Engine Throttle Valve 1 Position : Voltage Above Normal	The ECM detects the following conditions: The signal voltage from the position sensor on the intake throttle valve is greater than 4.75 VDC for at least 0.5 seconds. The battery voltage is at least 10 VDC. The intake throttle valve will move to the default position while the diagnostic code is active. The default position is 0 percent. If equipped, the warning lamp will come on.
51-4	Engine Throttle Valve 1 Position : Voltage Below Normal	The ECM detects the following conditions: The signal voltage from the position sensor on the intake throttle valve is less than 0.25 VDC for at least 0.5 seconds. The intake throttle valve will move to the default position while the diagnostic code is active. The default position is 0 percent. If equipped, the warning lamp will come on.

Use this procedure in order to troubleshoot the position sensors for the following valves:

- NRS valve
- Engine intake throttle valve

Each position sensor is an integral part of the associated valve. If the following procedure indicates a fault with the position sensor, then the entire valve must be replaced.

The following background information is related to this procedure:

The troubleshooting procedures for the diagnostic codes of each position sensor are identical. The ECM supplies 5 VDC to terminal “1” of the engine intake throttle valve connector and to terminal “6” of the NRS valve connector. The sensor common from the ECM connector goes to terminal “3” of the engine intake throttle valve connector and to terminal “4” of the NRS valve connector. The sensor supply is output short circuit protected. A short circuit to the battery will not damage the circuit inside the ECM. The signal voltage from terminal “5” of the engine intake throttle valve and from terminal “2” of the NRS valve is supplied to the appropriate terminal at the P2/J2 ECM connector.

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