UENR4490-01 (en-us)
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Perkins®
THE HEART OF EVERY GREAT MACHINE

Systems Operation Testing and Adjusting

1204F-E44TA and 1204F-E44TTA Industrial Engines

MT (Engine)
MU (Engine)
MW (Engine)

The connecting rods (4) are machined from forged steel. The connecting rods have bearing caps (6) that are fracture split. Two connecting rod bearings (5) are installed between the connecting rod (4) and the bearing cap (6). The bearing caps on fracture split connecting rods are retained with Torx bolts (7). Connecting rods with bearing caps that are fracture split have the following characteristics:

- The splitting produces an accurately matched surface on each side of the fracture for improved strength.
- The correct connecting rod must be installed with the correct bearing cap. Each connecting rod and bearing cap have an unique serial number. When a connecting rod is assembled the serial numbers for the connecting rod and bearing cap must match.

Crankshaft

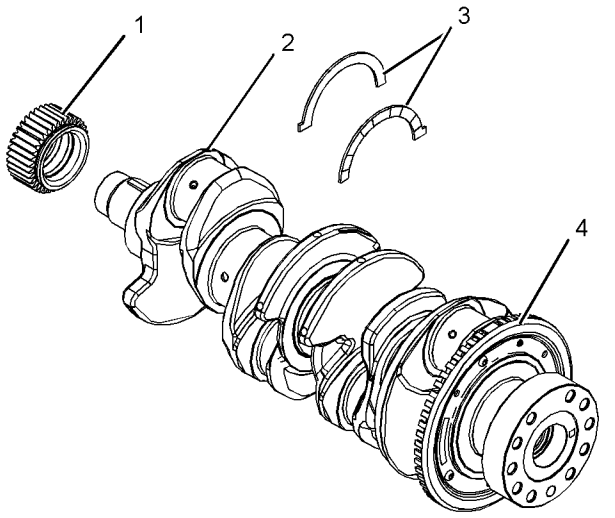

Illustration 8 g02155439

Typical example

(1) Crankshaft gear
(2) Crankshaft
(3) Crankshaft thrust washers
(4) Crankshaft timing ring

The crankshaft can be a spheroidal graphite iron casting or a steel forging.

The crankshaft has five main journals. Thrust washers are installed on both sides of number 3 main bearing in order to control the end play of the crankshaft.

The crankshaft changes the linear energy of the pistons and connecting rods into rotary torque in order to power external equipment.

A gear at the front of the crankshaft drives the timing gears. The crankshaft gear turns the idler gear which then turns the following gears:

- Camshaft gear
- Fuel injection pump and fuel transfer pump
- The idler gear is driven by the crankshaft gear which turns the gear of the lubricating oil pump.

Lip type seals are used on both the front of the crankshaft and the rear of the crankshaft.

A timing ring is installed to the crankshaft. The timing ring is used by the ECM in order to measure the engine speed and the engine position.

A ring gear for the balancer can be installed to the crankshaft. When a balancer is installed, the engine oil pump is an integral part of the balancer assembly. The ring gear for the balancer drives the balancer.

Gears and Timing Gear Case

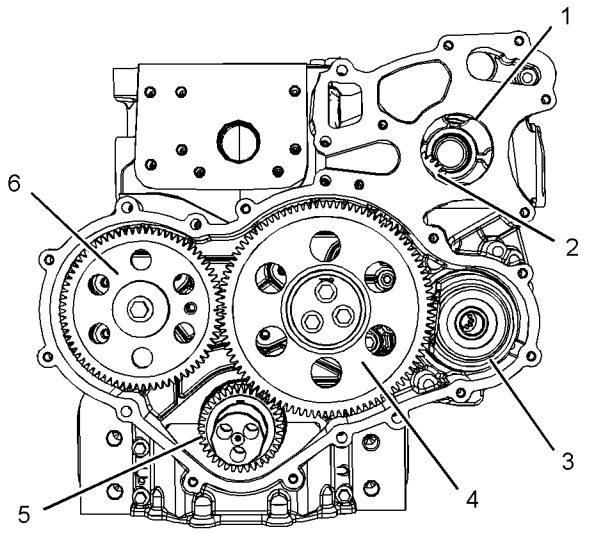

Illustration 9 g02212814

Typical example

(1) Hole for the water pump gear
(3) Position of the accessory drive gear

The crankshaft oil seal is mounted in the cover of the timing case. The timing case cover is made from sound-deadened steel or cast iron.

The timing gears are made of steel.

The crankshaft gear (5) drives an upper idler gear (4) and a lower idler gear. The upper idler gear (4) drives the camshaft gear (6) and the fuel injection pump gear (2). The lower idler gear drives the oil pump. The water pump drive gear is driven by the fuel injection pump gear.

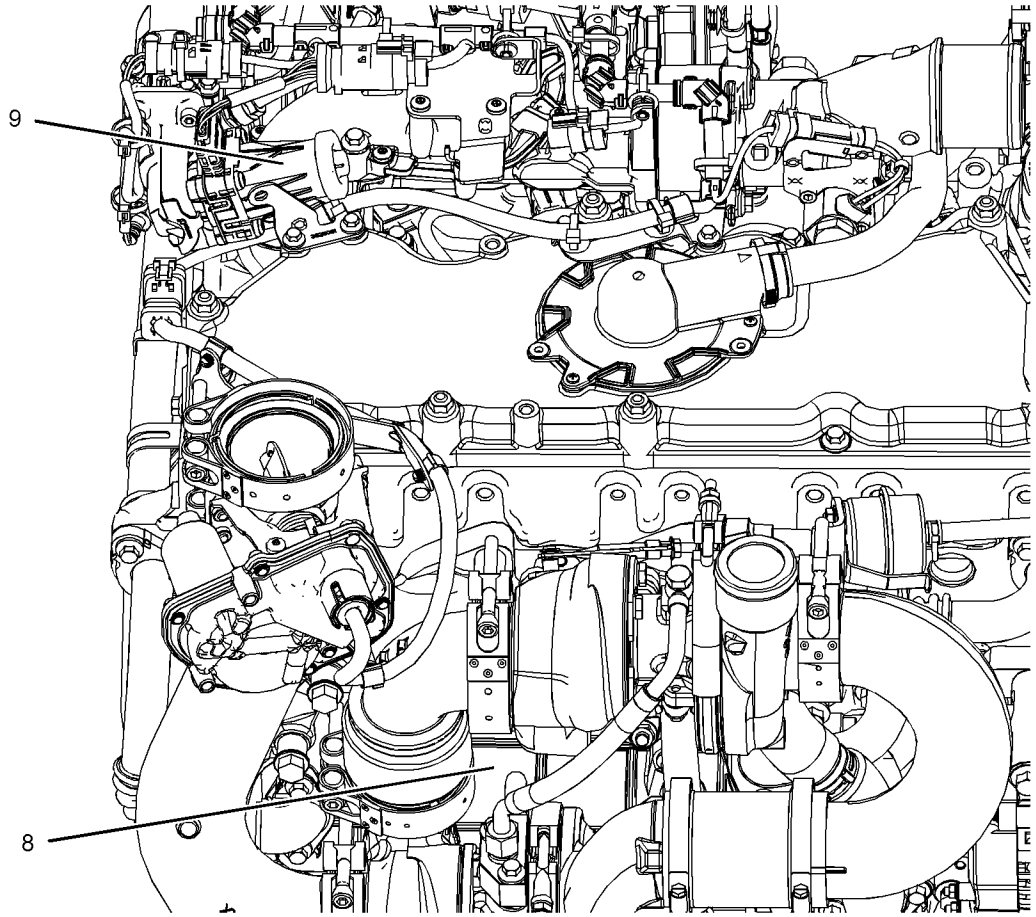

Illustration 17 g02467360
Typical example

The NOx Reduction System (NRS) operates with the transfer of the hot exhaust gas from the exhaust manifold to the exhaust cooler (8). The hot exhaust gas is cooled in the exhaust cooler (8). The now cooled exhaust gas passes through the assembly of the exhaust gas valve.

The reed valves that are located in the exhaust gas valve (NRS) has one main function. The one main function is to prevent the reverse flow of charge air from the inlet side of the engine to the exhaust side of the engine.

As the electronically controlled valve (9) starts to open the flow of cooled exhaust gas from the exhaust cooler (8) mixes with the air flow from the charge air aftercooler. The mixing of the cooled 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 cooled exhaust gas increases the electronically controlled valve opens further. The further opening of the valve increases the flow of cooled exhaust gas from the exhaust cooler. As the demand for cooled exhaust gas decreases, the electronically controlled valve closes. This decreases the flow of cooled exhaust gas from the exhaust cooler.

Exhaust gases from the exhaust manifold enter the inlet of the high-pressure turbocharger in order to turn the high-pressure turbocharger turbine wheel. The turbine wheel is connected to a shaft that rotates. The exhaust gases travel from the high-pressure turbocharger. The exhaust gases then travel through the duct on the turbine side into the turbine inlet of the low-pressure turbocharger in order to power the low-pressure turbocharger. The exhaust gases pass from the low-pressure turbocharger through the following components: exhaust outlet, back pressure valve, Clean Emissions Module and exhaust pipe.

Typical example

(1) Exhaust inlet from back pressure valve
(2) Selective Catalytic Reduction (SCR) system
(3) Exhaust out
(4) Ammonia sensor (if equipped)
(5) Nitrogen Oxide (NOx) sensor
(6) Diesel Exhaust Fluid (DEF) injector
(7) Diesel Exhaust Fluid (DEF) supply line
(8) Diesel Exhaust Fluid (DEF) pump and dosing control unit
(9) Coolant supply from engine line
(10) Coolant diverter valve
(11) Diesel Exhaust Fluid (DEF) tank
(12) Coolant supply connector
(13) Suction connector
(14) Backflow connector
(15) Coolant return connector
(16) DEF suction line
(17) Electronic Control Module (ECM)

Note: Illustration 24 is a schematic for illustrative purposes only. Ensure that the diesel exhaust fluid pump is installed to the application in the correct orientation. Refer to Disassembly and Assembly, “Diesel Exhaust Fluid Pump - Remove and Install” for the correct procedure.

The Diesel Exhaust Fluid (DEF) Dosing Control System consists of the following components.

- Pump Electronics Unit (PEU)
- DEF injector
- DEF header
- Coolant diverter valve
- DEF System Heated Lines

Pump Electronics Unit (PEU)

The Pump Electronics Tank Unit (PEU) consists of the following components.

- DEF pump
- Dosing Control Unit (DCU)

The Dosing Control Unit (DCU) is mounted on the DEF pump assembly.

DEF Pump

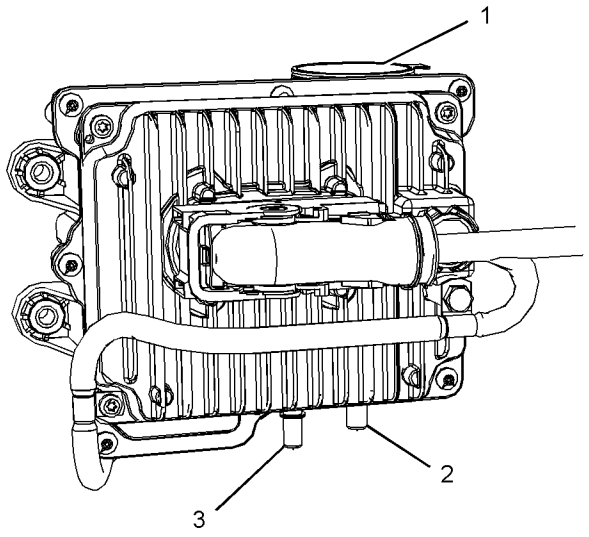

Illustration 25 g03708834

Typical example

(1) DEF filter
(2) Inlet
(3) Outlet

The pump supplies filtered DEF fluid to the DEF injector. The pump consists of inlet port (2) which is the suction side of the pump. The pump then pressurizes the fluid up to 550 kPa (80 psi) and supplies the fluid though outlet port (3). There is a fixed orifice within the DEF injector that governs the return flow from the DEF injector to the tank. This return flow will stabilize the temperature in the DEF injector when the DEF injector is exposed to the hot gases from the exhaust.

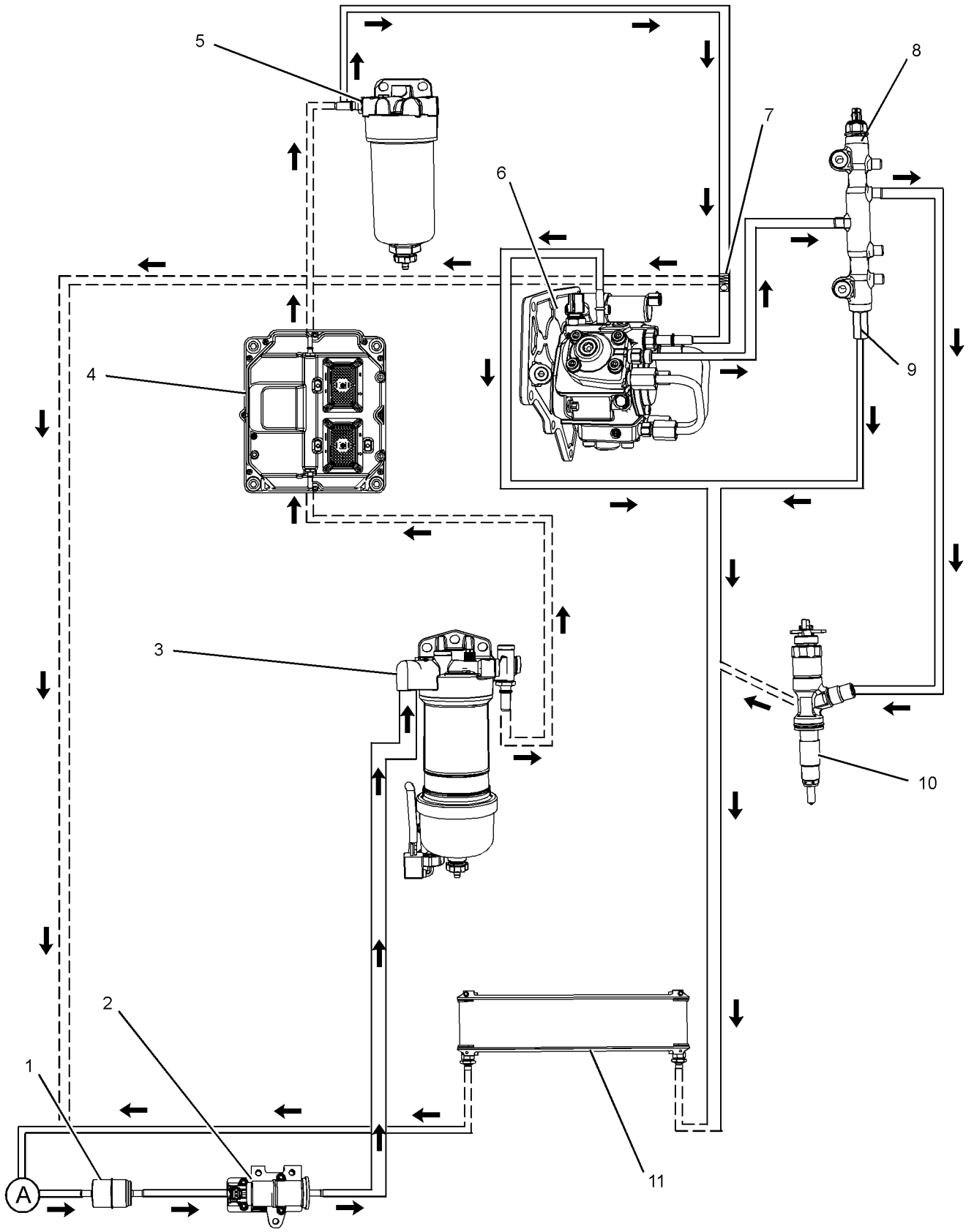

Illustration 33 g03723525

Aftertreatment System with a DOC, DPF, and DEF system

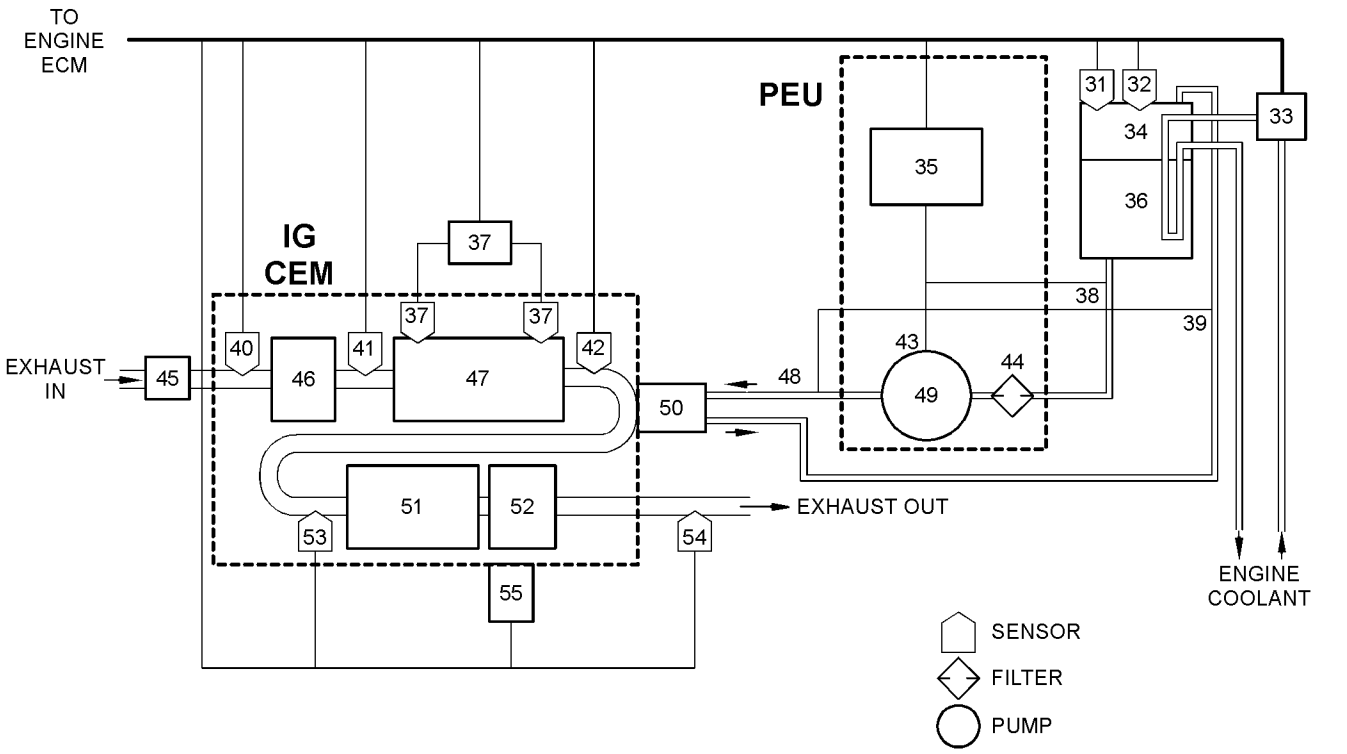

Illustration 43 g03694431

Block diagram for the aftertreatment system with a DOC, DPF, and DEF system

(31) Diesel Exhaust Fluid (DEF) level sensor
(32) DEF temperature sensor
(33) Coolant diverter valve
(34) DEF header unit
(35) Dosing Control Unit (DCU)
(36) DEF tank
(37) Soot sensor and antennas
(38) Heated DEF line
(39) Heated DEF line
(40) Diesel Oxidation Catalyst (DOC) inlet temperature sensor
(41) Diesel Particulate Filter (DPF) inlet temperature sensor
(42) DPF outlet NOx sensor
(43) DEF pump heater
(44) DEF filter
(45) Exhaust Back Pressure Regulator (EBPR)
(46) Diesel Oxidation Catalyst (DOC)
(47) Diesel Particulate Filter (DPF)
(48) Heated DEF line
(49) DEF dosing pump
(50) DEF injector
(51) Selective Catalytic Reduction (SCR) catalyst
(52) Ammonia Oxidizing (AMOX) catalyst
(53) SCR inlet temperature sensor
(54) SCR outlet NOx sensor
(55) Identification module

DOC, DPF, and SCR

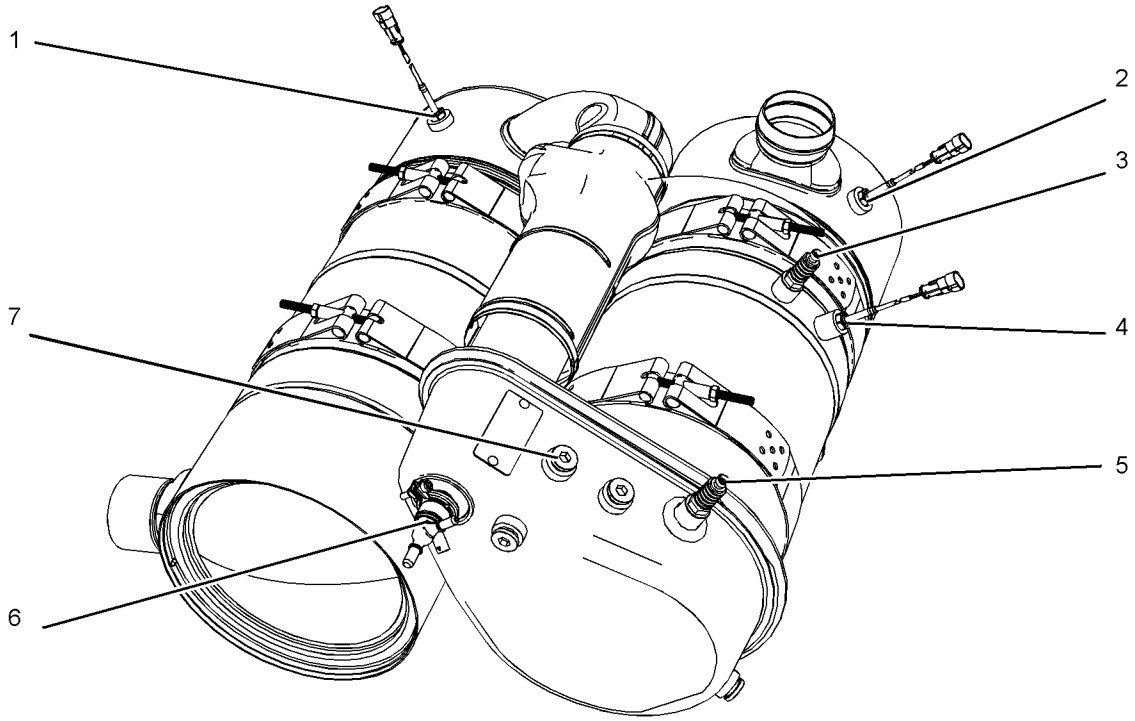

Illustration 54 g03421178

Typical example

(1) SCR Temperature Sensor
(2) DOC Temperature Sensor
(3) Soot Sensor Connection
(4) DPF Temperature Sensor
(5) Soot Sensor Connection
(6) DEF Injector
(7) NOx Sensor location

Note: The location of the soot sensor module will depend on the application.

Power Supply for the Pressure Sensors

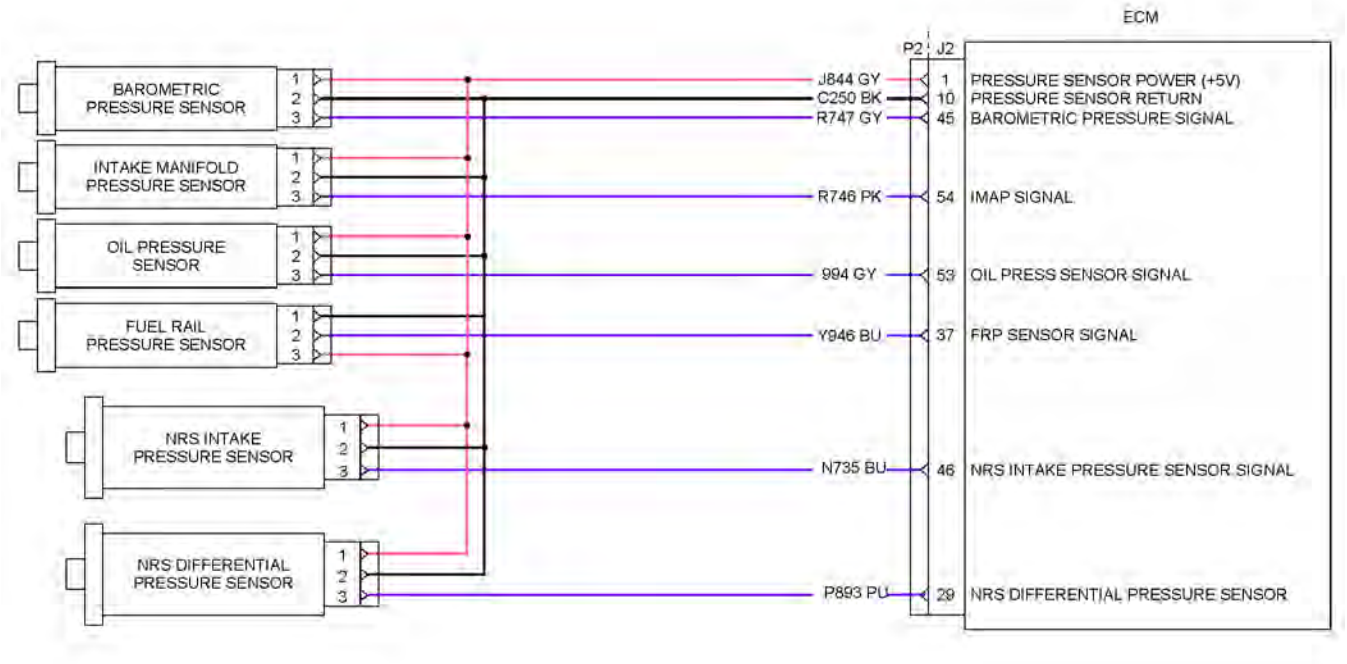

Illustration 65 g03710923

Schematic for the pressure sensors

The ECM supplies 5 VDC volts through the ECM connector to each sensor. The power supply is protected against short circuits. A short in a sensor or a wiring harness will not damage the ECM.

6. Stop the engine. Refer to Operation and Maintenance Manual, “Stopping the Engine” for the correct procedure.

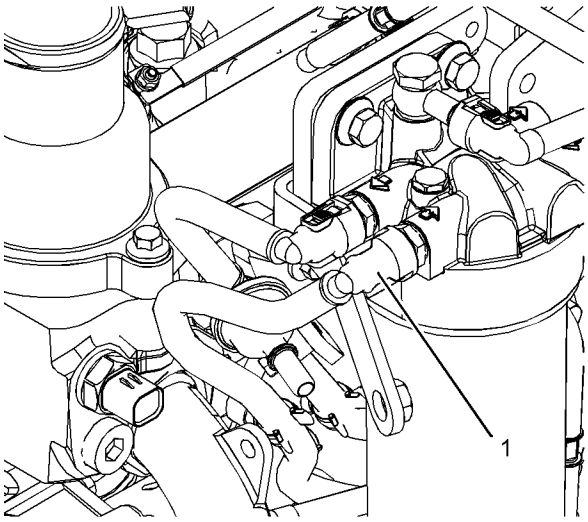

Illustration 69 g02305093
Typical example

7. If necessary, remove the low-pressure fuel line from the retaining clips. Remove the low-pressure fuel line from the inlet connection (1) of the secondary fuel filter base.

Note: Ensure that the low-pressure fuel lines are not deformed.

The following levels of boost pressure indicate a potential problem with the wastegate actuator or wastegate regulator:

- Too high at full load conditions
- Too low at all lug conditions

The boost pressure controls the maximum rpm of the turbocharger, which controls the position of the wastegate. The following factors also affect the maximum rpm of the turbocharger:

- The engine rating
- The power demand on the engine
- The high idle rpm
- Inlet air restriction
- Exhaust system restriction

Note: Check the operation of the wastegate regulator. Refer to Troubleshooting, “Solenoid Valve - Test”.

Check the Wastegate for Proper Operation

Table 4

Required Tools			
Tool	**Part Number**	**Part Description**	**Qty**
A	21825617	Dial Indicator Group	1

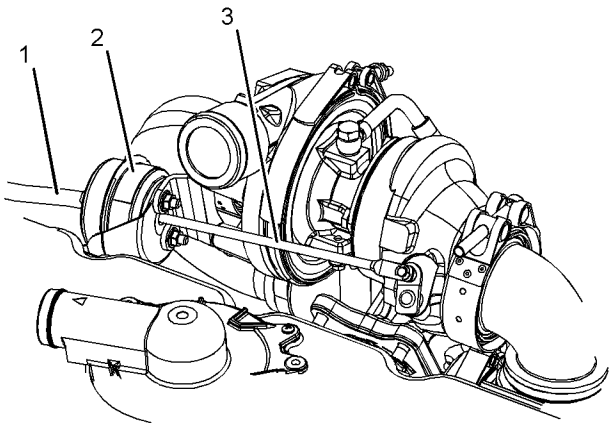

Illustration 79 g03706106
Typical example

Note: The wastegate actuator is installed to the high-pressure turbocharger.

1. Disconnect the pipe for the boost sensor (1) at the wastegate actuator (2). Connect an air supply to the wastegate actuator that can be adjusted accurately.
2. Install Tooling (A) to the turbocharger so that the end of the actuator rod (3) is in contact with Tooling (A). This will measure axial movement of the actuator rod (3).
3. Slowly apply air pressure to the wastegate so that the actuator rod (3) moves 1.0 mm (0.039 inch). Refer to Specifications, “Turbocharger” for the correct pressure for the wastegate. Ensure that the dial indicator returns to zero when the air pressure is released. Repeat the test several times. This will ensure that an accurate reading is obtained.
4. If the operation of the wastegate is not correct, the turbocharger will need to be replaced.
5. Repeat steps 2 to 3 in order to repeat the pressure test.
6. If the air pressure is correct, remove the air supply. Remove Tooling (A). Install the pipe for the boost sensor (1).

i05934751

Turbocharger - Inspect

(Single Turbocharger)

⚠ WARNING

Hot engine components can cause injury from burns. Before performing maintenance on the engine, allow the engine and the components to cool.

NOTICE
Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

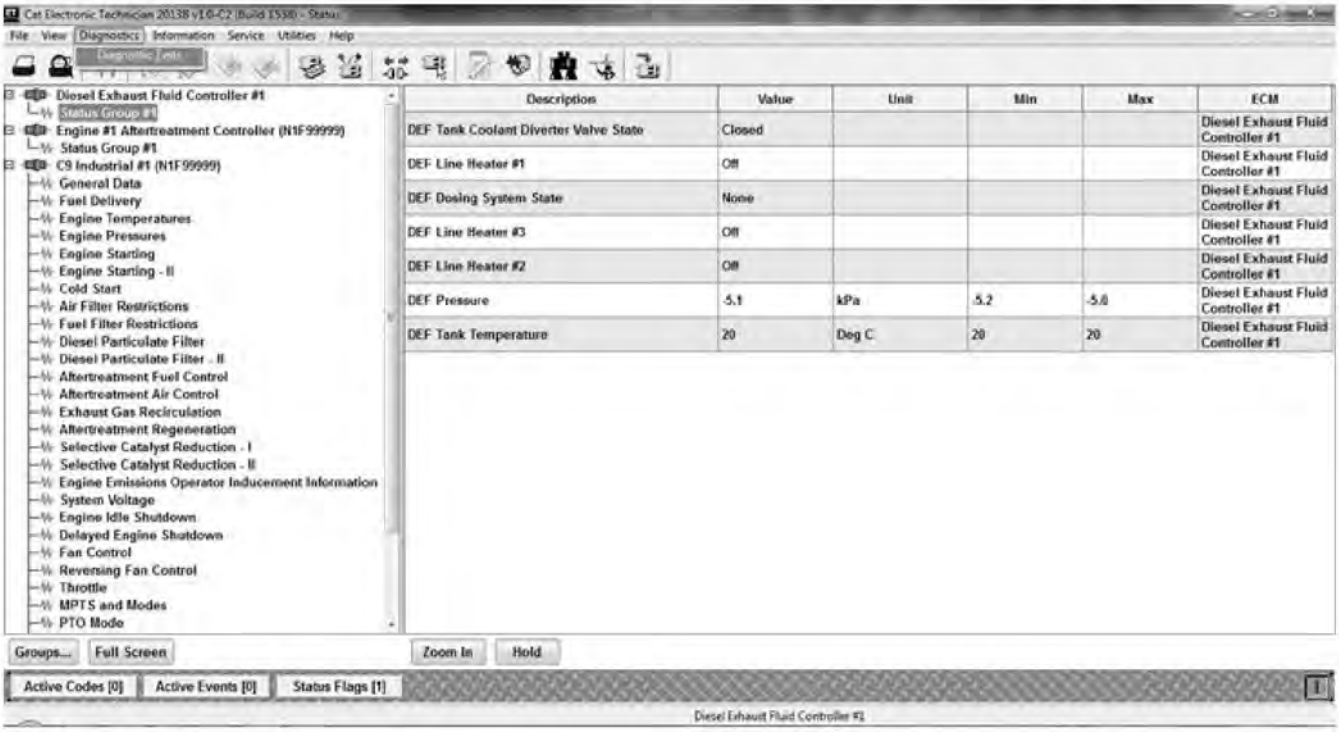

Illustration 94 g03370860

Typical example

5. Click “Diagnostics” in the main menu, then click “Diagnostic Tests” .

4. Inspect the drive belt for the fan.

5. Inspect the blades of the fan for damage.

6. Look for air or combustion gas in the cooling system.

7. Inspect the radiator cap for damage. The sealing surface must be clean.

8. Look for large amounts of dirt in the radiator core. Look for large amounts of dirt on the engine.

9. Shrouds that are loose or missing cause poor air flow for cooling.

i03577960

Cooling System - Test

Remember that temperature and pressure work together. When a diagnosis is made of a cooling system problem, temperature and pressure must be checked. The cooling system pressure will have an effect on the cooling system temperature. For an example, refer to Illustration 104 . This will show the effect of pressure on the boiling point (steam) of water. This will also show the effect of height above sea level.

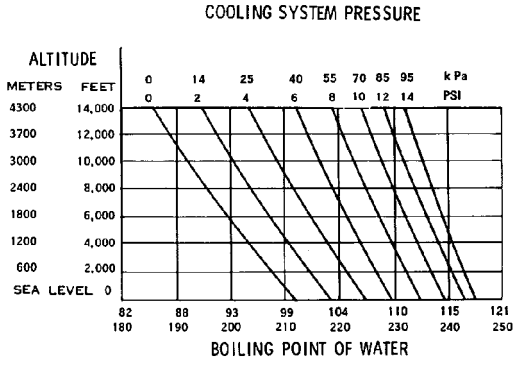

Illustration 104 g00286266

Cooling system pressure at specific altitudes and boiling points of water

⚠ WARNING

Personal injury can result from hot coolant, steam and alkali.

At operating temperature, engine coolant is hot and under pressure. The radiator and all lines to heaters or the engine contain hot coolant or steam. Any contact can cause severe burns.

Remove filler cap slowly to relieve pressure only when engine is stopped and radiator cap is cool enough to touch with your bare hand.

The coolant level must be to the correct level in order to check the coolant system. The engine must be cold and the engine must not be running.

After the engine is cool, loosen the pressure cap in order to relieve the pressure out of the cooling system. Then remove the pressure cap.

If the cooling system is equipped with a sight glass, the coolant should be to the correct level in the sight glass. On cooling systems without an indicator of the coolant level, fill the cooling system in order to be no more than 13 mm (0.5 inch) from the bottom of the filler pipe.

Making the Correct Antifreeze Mixtures

Do not add pure antifreeze to the cooling system in order to adjust the concentration of antifreeze. Refer to Operation and Maintenance Manual, “Refill Capacities” for the correct procedure. The pure antifreeze increases the concentration of antifreeze in the cooling system. The increased concentration increases the concentration of dissolved solids and undissolved chemical inhibitors in the cooling system.

The antifreeze mixture must consist of equal quantities of antifreeze and clean soft water. The corrosion inhibitor in the antifreeze will be diluted if a concentration of less than 50% of antifreeze is used. Concentrations of more than 50% of antifreeze may have the adverse effect on the performance of the coolant.

Checking the Filler Cap

One cause for a pressure loss in the cooling system can be a faulty seal on the radiator pressure cap.

⚠ WARNING

Personal injury can result from hot coolant, steam and alkali.

At operating temperature, engine coolant is hot and under pressure. The radiator and all lines to heaters or the engine contain hot coolant or steam. Any contact can cause severe burns.

Remove filler cap slowly to relieve pressure only when engine is stopped and radiator cap is cool enough to touch with your bare hand.

To check for the amount of pressure that opens the filler cap, use the following procedure:

1. After the engine cools, carefully loosen the filler cap. Slowly release the pressure from the cooling system. Then, remove the filler cap.

5. Measure the end play on idler gear (2). Refer to Disassembly and Assembly, “Idler Gear - Install” for the correct procedure. Refer to Specifications, “Gear Group (Front)” for the end play measurement.

i03910449

Crankshaft Pulley - Check

The crankshaft pulley is installed on the front of the crankshaft.

Replace the crankshaft pulley if any of the following conditions exist:

- There is movement of the crankshaft pulley.
- There is a large amount of gear train wear that is not caused by lack of oil.
- Analysis of the engine oil has revealed that the front main bearing is badly worn.
- The engine has had a failure because of a broken crankshaft.

Check the areas around the holes for the bolts in the crankshaft pulley for cracks or for wear and for damage.

Use the following steps in order to check the alignment and the runout of the crankshaft pulley:

1. Remove any debris from the front face of the crankshaft pulley. Remove any debris from the circumference of the crankshaft pulley.

2. Mount the dial indicator on the front cover. Use the dial indicator to measure the outer face of the crankshaft pulley. Set the dial indicator to read 0.00 mm (0.00 inch).

3. Rotate the crankshaft at intervals of 45 degrees and read the dial indicator.

4. The difference between the lower measurements and the higher measurements that are read on the dial indicator at all four points must not be more than 0.18 mm (0.007 inch).

If the reading on the dial indicator is more than 0.18 mm (0.007 inch), inspect the pulley for damage. If the pulley is damaged, use new parts for replacement.

5. Move the dial indicator so that the dial indicator will measure the circumference of the crankshaft pulley. Set the dial indicator to read 0.00 mm (0.00 inch).

6. Slowly rotate the crankshaft in order to measure the runout of the circumference of the crankshaft pulley. Use the highest reading and the lowest reading on the dial indicator. The maximum and the minimum readings on the dial indicator should not vary more than 0.12 mm (0.005 inch).

If the reading on the dial indicator is more than 0.12 mm (0.005 inch), inspect the pulley for damage. If the pulley is damaged, use new parts for replacement.