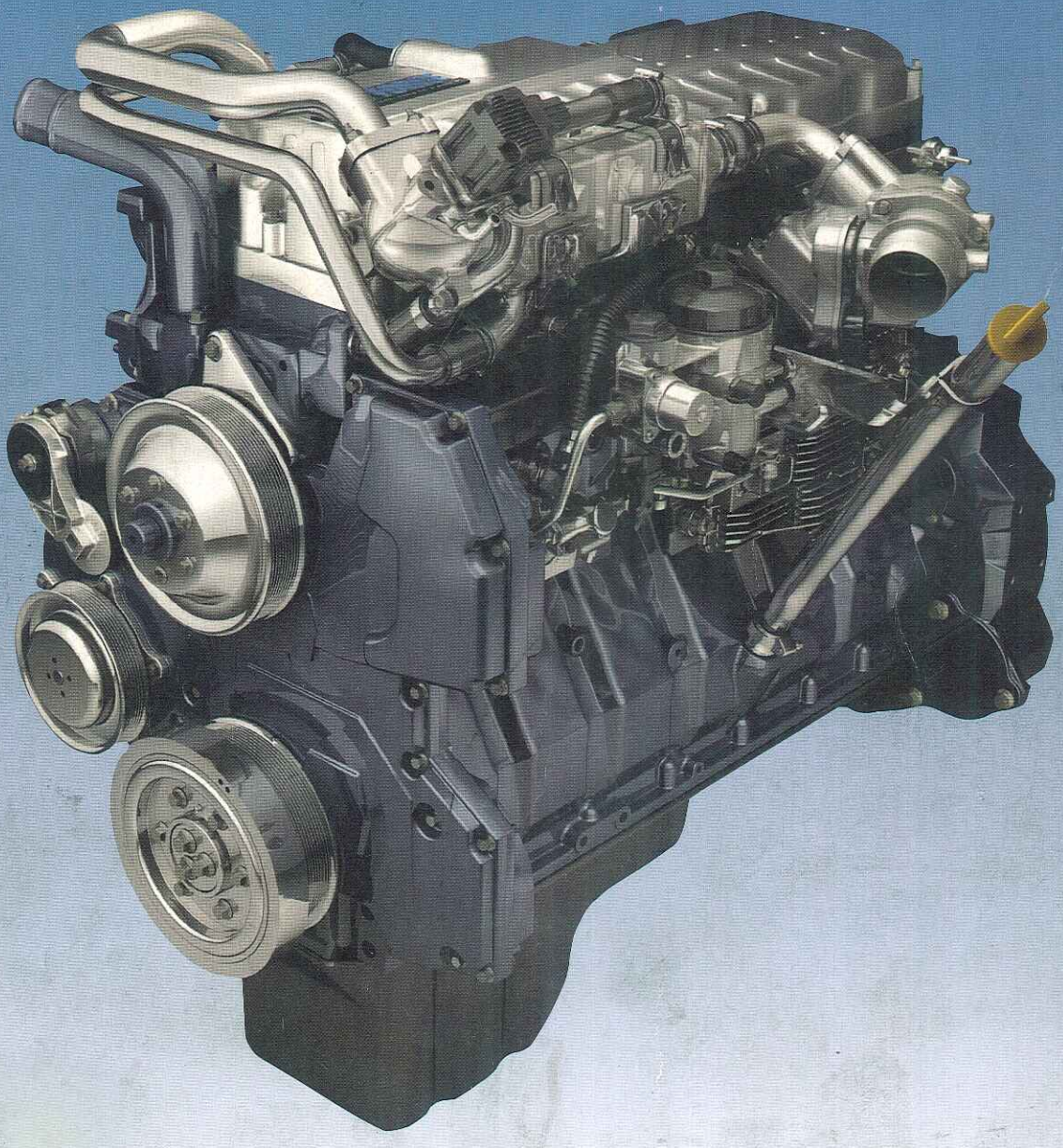
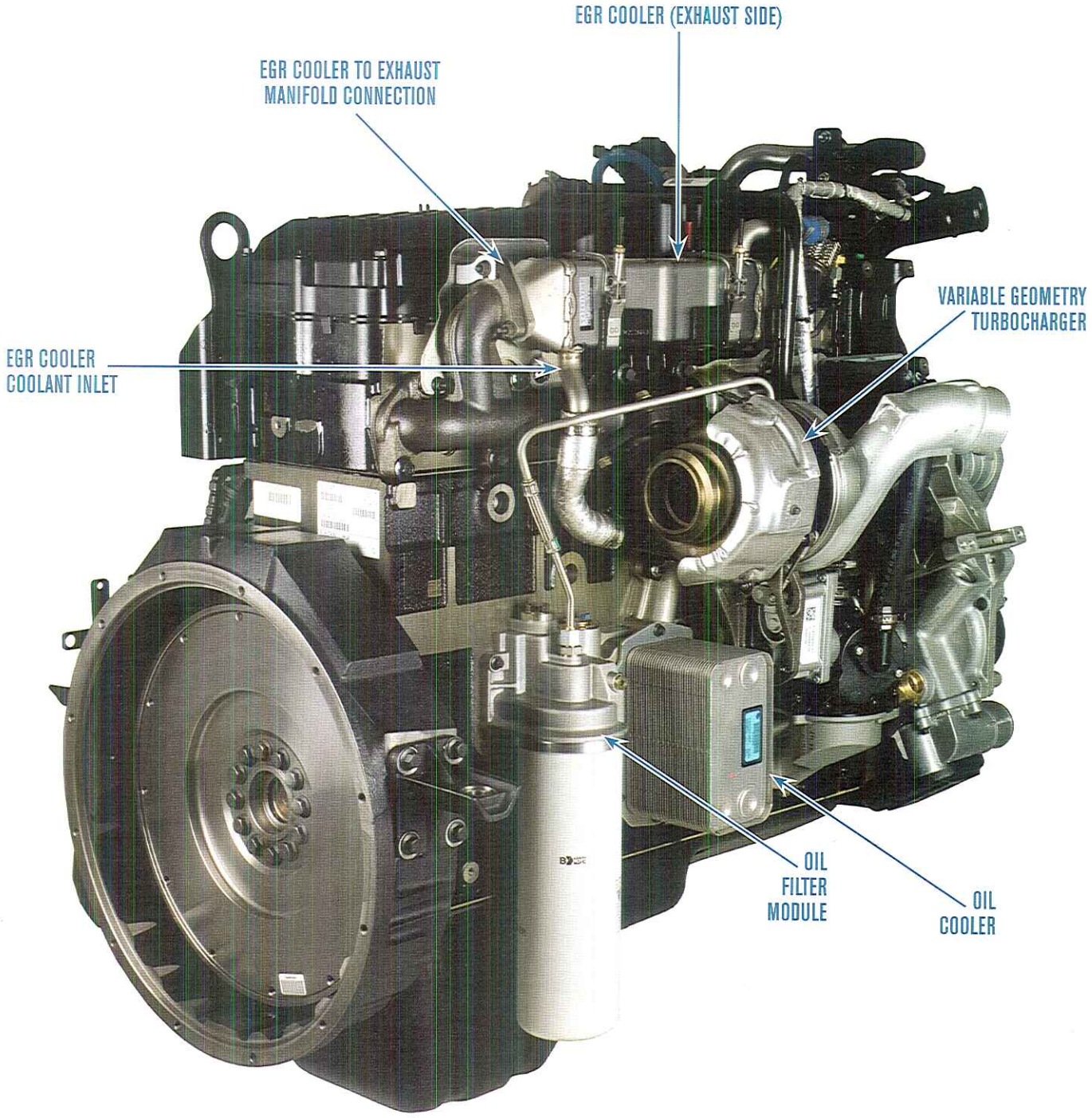
MAXXFORCE

INTERNATIONAL DIESEL POWER™



MAXXFORCE® DT, MAXXFORCE 9, AND MAXXFORCE 10
MODEL YEAR 2007 FEATURES, DESCRIPTIONS, AND UNIQUE DIAGNOSTICS AND REPAIR PROCEDURES

COMPONENT LOCATIONS - RIGHT REAR

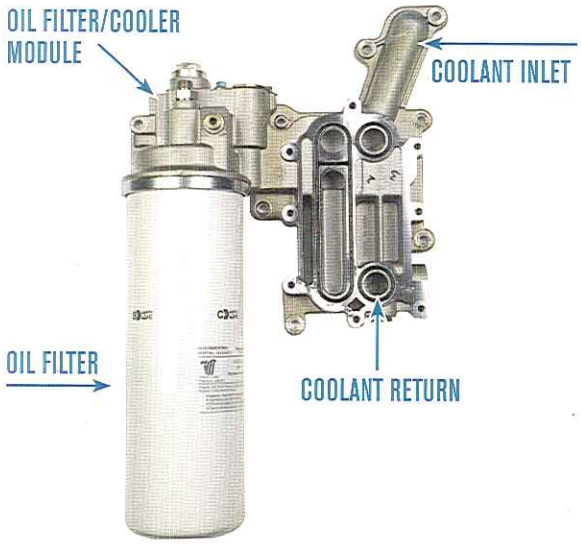


Oil Filter/Cooler Module

- The oil filter/cooler module is mounted to the right side of the crankcase. The module cools, filters, and regulates the flow of oil.

- Oil from the non-filtered oil gallery enters the oil cooler/ filter module through a port in the crankcase. After the oil is filtered and cooled the oil re-enters the crankcase at the filtered oil gallery.

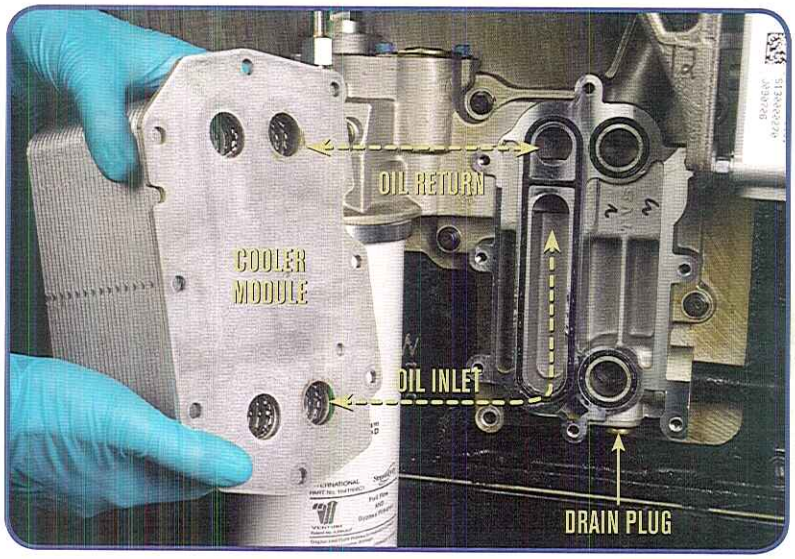
- All of the lubrication system control valves are mounted within the module. The valves control the flow of oil through the filter and cooler and regulate the pressure.



Cooler Module Oil Flow

- Oil entering the filter/cooler module is directed to either the filter or the plate style cooler depending upon the oil's temperature. Oil traveling through the cooler dissipates heat to the engine's coolant. Coolant input is through a port in the crankcase. Coolant return is through an external pipe to the back half of the front cover where the coolant is directed to the water pump.

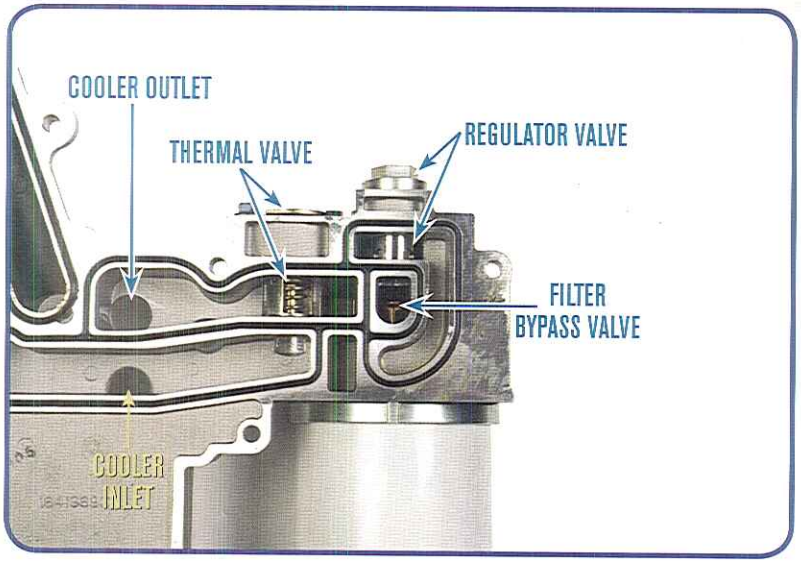
- A coolant drain plug is provided in the bottom of the filter/cooler module. This allows the coolant to be drained before the oil cooler is removed from the filter/cooler base. This feature protects the oil side of the cooler from possible contamination with coolant during removal.



Control Valves

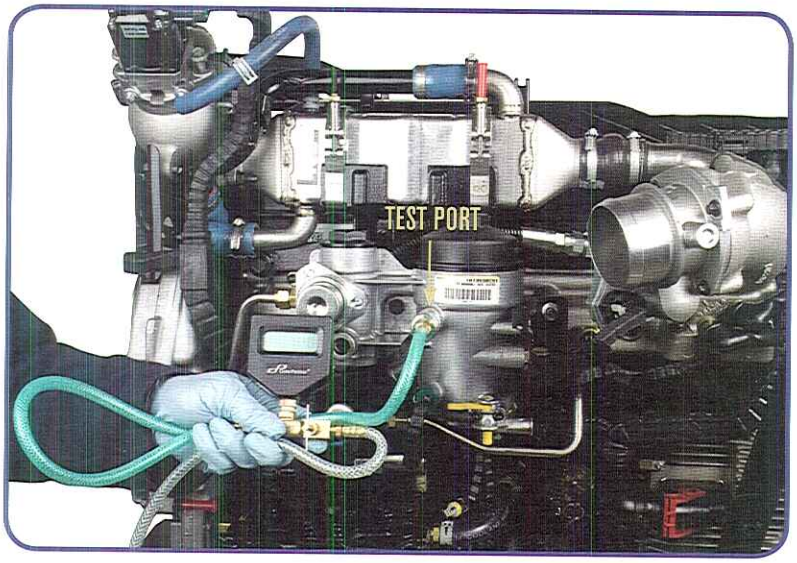
- The oil filter/cooler assembly has three valves: a thermal valve, a pressure regulator valve, and a filter bypass valve. The thermal valve allows cold unfiltered oil to bypass the oil cooler and flow directly to the oil filter. As the oil temperature increases, the thermal valve begins to open allowing unfiltered oil to flow through the oil cooler before entering the oil filter.

- If the oil filter is restricted and the pressure differential across the filter reaches 345 kPa (50 psi) the filter bypass begins to open and allow oil to bypass the filter to maintain engine lubrication. After the filter, oil travels past the oil pressure regulator. The regulator directs excess oil back to the crankcase in order to limit maximum oil pressure.



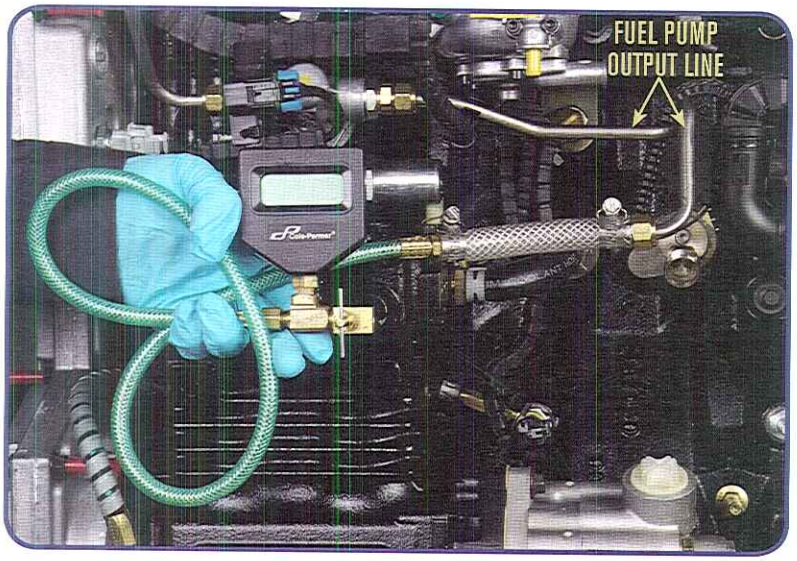
Checking for Aeration

- The fuel system can be checked for aeration through the test port on the front of the fuel filter module. Use fuel/oil pressure test coupler ZTSE4626 to adapt fuel pressure gauge ZTSE4681 to the test port. With the engine cranking or running, open the valve on the pressure gauge and take a sample of fuel into a clean container. If the fuel is aerated in the sample hose, the engine either has an air leak on the suction side of the system or compression or combustion gases leaking back into the system.



Checking Pump Pressure

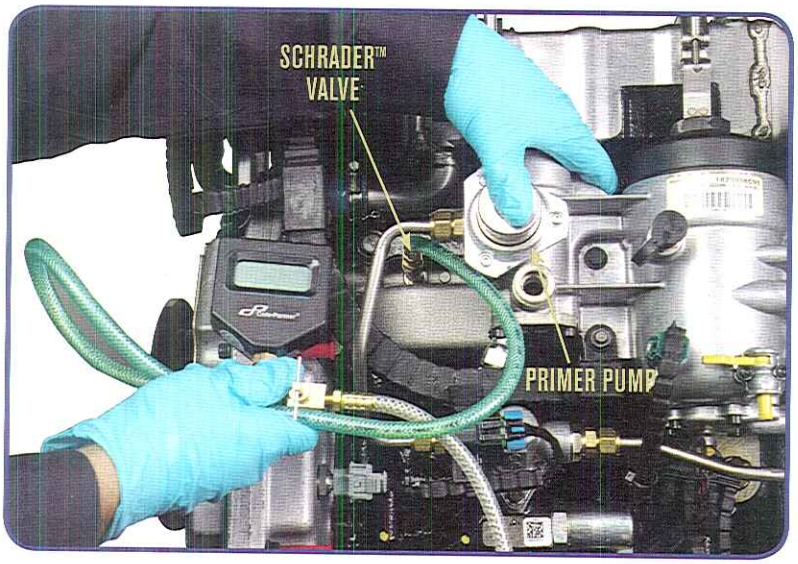
- The fuel pump can be deadheaded by removing the fuel line from the output side of the pump. Using a spare line, adapt a pressure gauge to the pump. Crank the engine and read the output pressure. If the dirty side pressure is low, the fuel is not aerated, the inlet restriction is not above specification, and the deadhead pressure is low, the pump is at fault. If all the conditions exist except that deadhead pressure meets the cranking specifications, a pressure regulator kit needs to be installed.



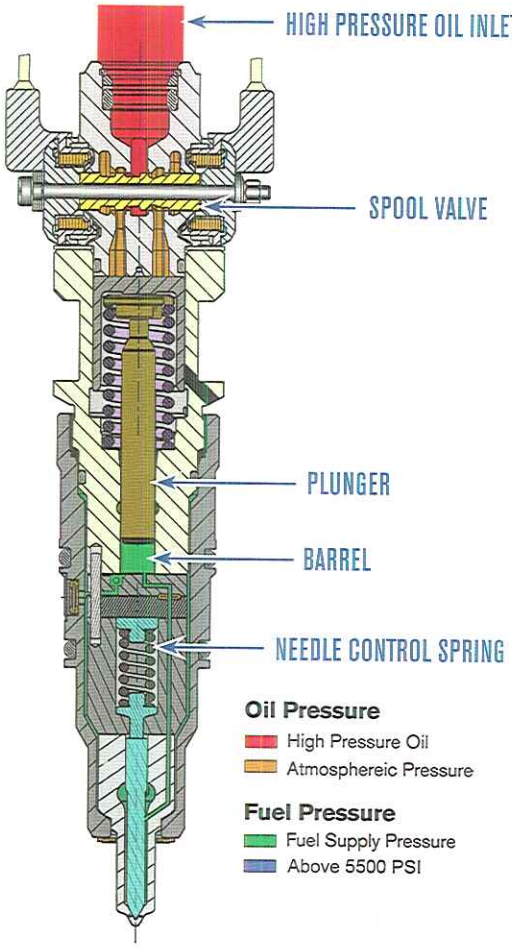
Priming the System

- If the engine runs out of fuel or the fuel filter header has been drained, it is important that the system be primed before attempting to start the engine. Starting the engine with air in the system can damage the injectors.

- Use fuel pressure test kit ZTSE4657 to adapt Pressure Gauge ZTSE4681 to the intake manifold test port. Insert the gauge hose into a container to catch the fuel. Open the shut-off valve and pump the primer pump until an air-free stream of fuel comes out the hose. Close the valve then start the engine and check for fuel leaks. Turn off the engine and remove the fuel pressure gauge and the adapter.



INJECTOR OPERATION



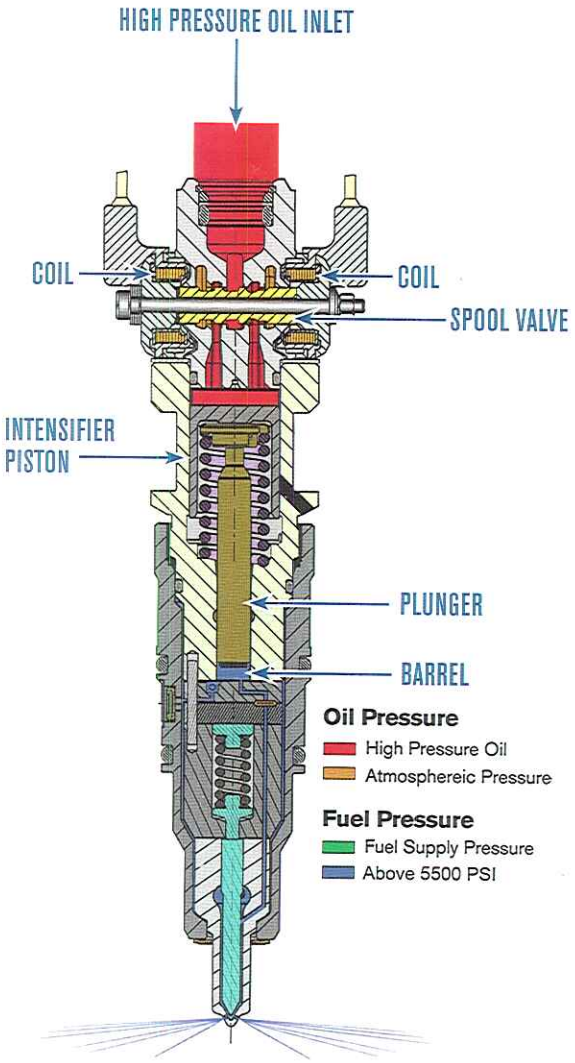
Fill Stage

- During the fill stage, the spool valve is in the closed position. High pressure oil from the High-pressure oil manifold cannot pass through the spool valve. The plunger is high in the barrel which allows low pressure fuel to pass through the fuel inlet check valve and fill the barrel and plunger cavity. The needle control spring holds the needle on its seat so fuel cannot enter the combustion chamber.

Injection

- The Engine Control Module (ECM) energizes the OPEN coil to move the spool valve. With the valve open, high pressure oil flows to the intensifier piston. Fuel pressure in the barrel builds when the plunger begins to move downward. This causes the fuel inlet valve to seat. As the intensifier piston continues to move downward the fuel pressure rises until it raises the nozzle needle off its seat.

- The injector also acts as part of the Aftertreatment system. During a regen the ECM commands the injectors to add fuel to the cylinder during the exhaust stroke. This causes unburned fuel to enter the Aftertreatment system. The fuel and catalyst produces high amounts of heat in the diesel oxidation catalyst and the diesel particulate filter. The higher exhaust temperatures causes soot particles in the DPF to be reduced to ash. This phase is called post injection.



Failed or Plugged DPF Diagnostics

When ever it is necessary to either replace or clean a plugged DPF, the technician should investigate possible reasons for failed or plugged DPF. The following are reasons why a DPF may be plugged:

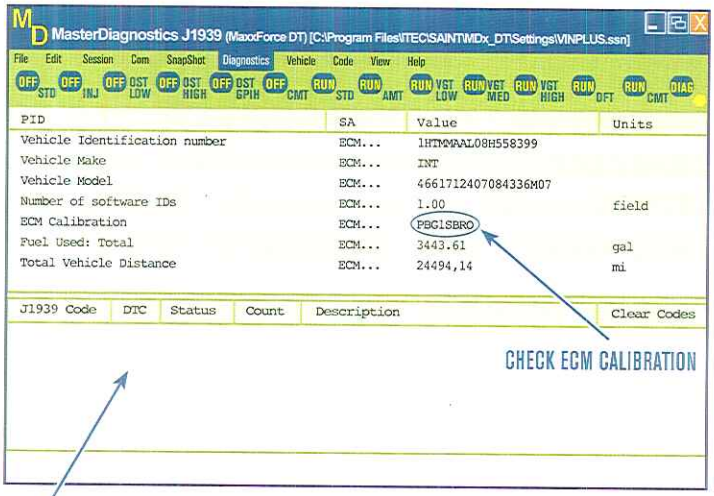
1. Loaded with ash
2. Loaded with soot caused by coolant, oil, or excessive fuel in the exhaust system that has caused the PDF to fail or prematurely plug-up
3. Operator failed to perform parked regeneration when required

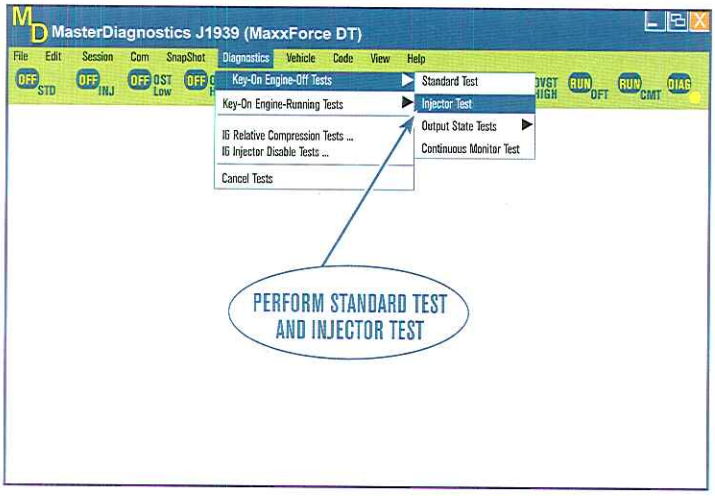
After replacement the technician should perform the following steps to avoid a repeat failure.

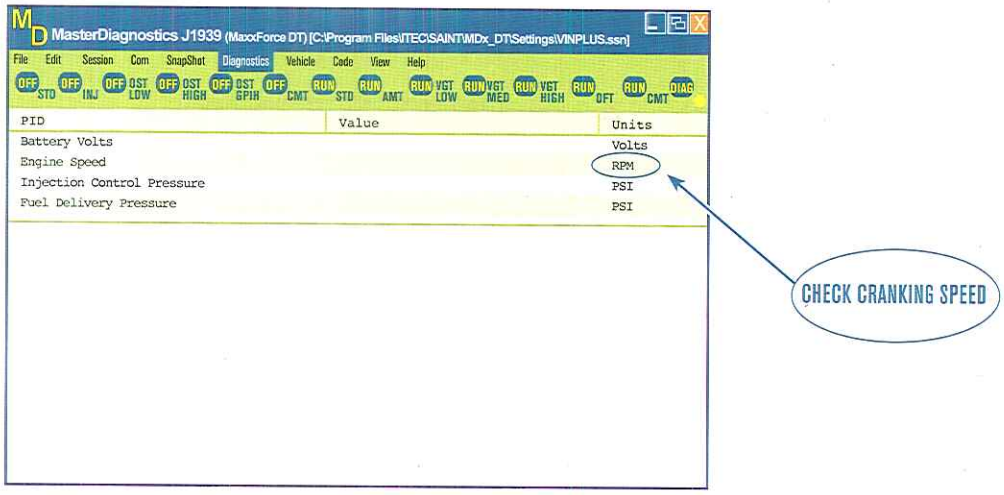
STEP	TEST POINT	CHECK	RESULTS	COMMENT
1.	Vehicle Operator	Does the driver understand the dash lamps and the required actions? How is the vehicle used?		Vehicle operator ignores Dash lights and fails to run a Stationary Regen. Vehicle may operate in a city environment, with no chance of a passive regen.
2.	Exhaust System	For external exhaust leaks prior to the DOC		Leaks may cause low exhaust temps and interfere with regeneration.
3.	DTC's	Check for current AMS, Fuel System, and AFT DTC's		Stuck EGR valve and/or ITV may cause DPF plugging.
4.	KOER Std test	Perform KOER Std test and check for DTC's related to ICP, ITV, and EGR		Failed EGR valve and/or failed ITV can reduce efficiency of the engine, resulting in a higher soot production.
5.	KOER AMS test	Perform KOER AMS test and check for DTC's related to EGR and VGT		Failed EGR can cause premature soot loading.
6.	AFT Cleanliness test	Perform Cleanliness test		Resets soot level data in the ECM.
7.	Inlet restriction	Check for restrictions in the Intake System		Restrictions may inhibit regeneration.
8.	DOC	Check DOC inlet pipe or turbo outlet for signs of coolant		Coolant from a failed EGR cooler can cause a DPF failure[1].
9.	DOC	Check DOC inlet pipe or turbo outlet for signs of oil		Excessive oil from a failed turbo or damaged cylinder can cause a DPF failure[2].

[1] Investigate for coolant leaks if there are dark soot rings on the outlet face of the DPF indicates excessive water concentration in the exhaust.
Investigate for coolant leaks or water intrusion into the exhaust system if there is visible water in the DPF.
Investigate for coolant leaks if there is a dark streak on outlet side of the filter

[2] Deformed or melted Cells within the DPF are caused by excessive fuel or oil in the exhaust.
Investigate for failed injectors, oil leaks (Turbo-Charger damage, worn piston rings, or scored cylinder liners).
Concentration of ash, with a dark wet surrounding ring and uneven soot streaks across the face of the inlet side of the DPF are caused by excessive oil in the exhaust.
Soot stains on the outlet side of the DPF are caused by fuel or engine oil in the exhaust.
Cracks across the face of the DPF are caused by excessive fuel or oil in the exhaust gas, creating high temperatures.







4. Calibration (Is the ECM calibration correct?)

Use the EST to check for the following:

- ECM calibration
- Diagnostic Trouble Codes (DTCs)

Verify that the engine has the correct calibration. Check for DTCs. With the ignition switch on, active indicates a DTC for a condition currently in the system. Inactive indicates a DTC for a condition during a previous key cycle. Correct any active DTC that will affect the ability of the engine to start.

5. EST Data List (Are the engine systems working correctly?)

Use the EST to check the following while cranking the engine for 15-20 seconds:

- Battery volts (VBAT)
- Engine speed (RPM)
- Injection control pressure (ICP)
- Fuel delivery pressure (EFP)

If VBAT readings are not in specification, check the ECM power relay and the ECM power and grounds. If RPM readings are not in specification, check vehicle starter system. If ICP readings are not in specification, perform the Low ICP Diagnostics.

If EFP readings are not in specification, perform the Low Fuel Pressure Diagnostics test.

6. KOEO Tests (are the electrical circuits free of faults?)

Use the EST to perform the following tests:

- KOEO Standard Test
- KOEO Injector Test

After the Standard test is completed, check for DTCs related to electrical components.

During the KOEO Injector Test the ECM tests the electrical portion of the injector by energizing them in order of cylinder position. Listen again for injectors to pre-cycle, cycle in cylinder numbering order. Listen for the spool valves cycling and check for DTCs when the test is completed.

DTC	SPN	FMI	MD DESCRIPTION	TEST SECTION	POSSIBLE CAUSES
3333	8492	0	ICP above desired level	ICP SYS	ICP was above the desired pressure by 3% –Biased ICP sensor or circuit –Trapped air in system (If set after system was open) –Incorrect oil level –Aerated, or contamination in engine oil –IPR circuit fault, or failed (sticking) valve
3334	8492	1	ICP below desired level	ICP SYS	ICP was below desired pressure by 3% –Biased ICP sensor or circuit –Incorrect oil level –Aerated, or contamination in engine oil –IPR circuit fault, or failed (sticking) valve –High pressure oil pump failure
3338	7129	17	KOER STD –EBP unable to build during test	AMS	I6(466): 10 psi below desired V8: 6 psi below desired –Exhaust or Intake system leaks –Biased EBP circuit or sensor –Turbocharger vanes sticking V8: 400 hPa
3339	7129	15	KOER STD –EBP too high during test	AMS	I6(466): 4 psi above desired V8: 3 psi above desired –Restricted Exhaust system –Biased EBP circuit or sensor –Turbocharger vanes sticking V8: 200 hPa
3341	1209	4	EBP signal out of range LOW	EBP	EBP signal OPEN or short to GND, or failed sensor
3342	1209	3	EBP signal out of range HIGH	EBP	EBP signal short to PWR, or failed sensor
3345	7136	0	VGT control over duty	VGT	VGT circuit fault, or failed VGT valve
3346	1209	0	AMT –EBP unable to build during EGR test	AMS	I6(466): 17 psi below desired V8:9 psi below desired –Restricted Exhaust system –Biased EBP circuit or sensor –EBP sensor or tube plugged –Sticking or inoperative EGR valve
3347	7136	1	VGT control under duty	VGT	VGT circuit fault, or failed VGT valve
3348	1209	1	AMT –EBP too high during EGR test	AMS	I6(466):3 psi above desired V8: 2 psi above desired –Exhaust or intake system leaks –Biased EBP circuit or sensor –Inoperative EGR valve –Failed turbocharger
3373	164	15	ICP too high during test	ICP SYS	ICP sensor above 8 MPa during first part of KOER Standard test –Biased ICP sensor or circuit –Trapped air in system (If set after system was open) –Incorrect oil level –Aerated, or contamination in engine oil –IPR circuit fault, or failed (sticking) valve