

DESCRIPTION & OPERATION

ENGINE

Engine Description

The 6.0L diesel engine is:

- a four-cycle turbocharged V-8 with overhead valves.
- 6.0 liter (365 cubic inch) displacement.
- separated into two banks, the right bank numbered 1, 3, 5, 7 and the left bank numbered 2, 4, 6, 8.
- rated at 325 horsepower and 560 lb-ft torque

The cylinder block has been designed to withstand the loads of diesel operations by using:

- a two-piece crankcase.
- internal piston cooling oil jets.
- a forged steel crankshaft.
- powdered metal, fractured connecting rods.

The piston is:

- made of an aluminum alloy.
- fitted with an upper keystone compression ring.
- fitted with a lower rectangular compression ring.
- fitted with oil control rings.

The piston pins are:

- a free-floating type permitting the piston pin to move/float freely in the piston pin bore.
- retained in the piston-by-piston pin retainers.

The camshaft is:

- supported by five insert-type camshaft bearings.
- of the roller camshaft design.
- driven by the crankshaft through the use of the crankshaft gear and the camshaft gear.

The hydraulic valve tappets:

- minimize engine noise.
- maintain zero valve lash.
- incorporate camshaft follower guides.
- incorporate a roller follower design that reduces camshaft wear.

The cylinder heads are designed:

- to incorporate electrohydraulic fuel injectors.
- to locate the fuel injectors in the center of the combustion chambers between the rocker arms.
- with external high-pressure oil galleries.

The glow plug system is:

- designed to preheat the cylinders for faster cold weather starts and smoke reduction.
- controlled by the powertrain control module (PCM).
- mounted directly into the cylinder heads.

The optional block heater is:

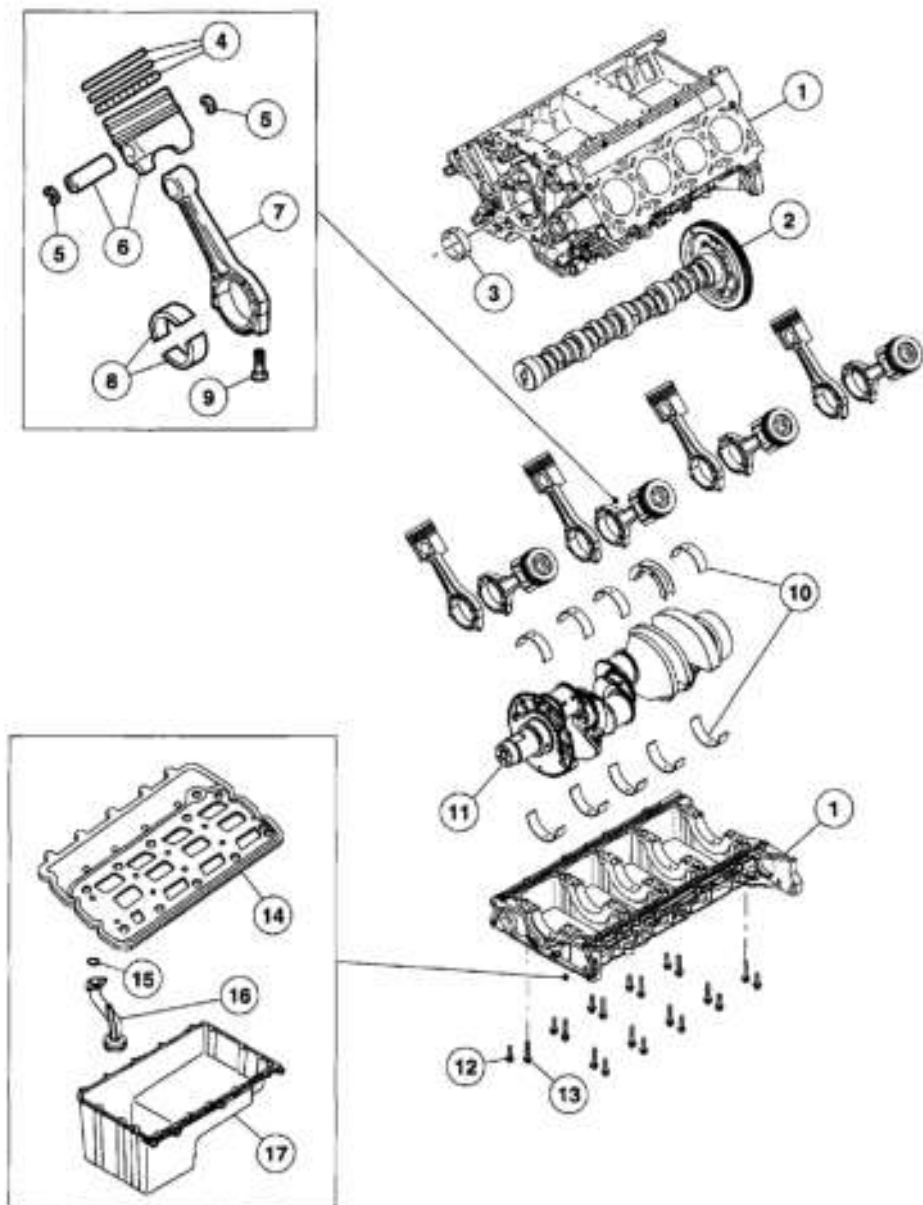
- designed to heat the engine coolant and oil for improved cold weather starts.
- located near the starter.
- powered by a 120 volt external power source.
- replaceable, but not repairable.

The fuel injection system used on the engine:

- is controlled by the powertrain control module (PCM).
- utilizes a frame mounted electric fuel pump.
- circulates fuel through a combination fuel filter, fuel heater and water separator assembly.
- uses eight electrohydraulic fuel injectors.

The engine lubrication system:

- is divided into two systems: the low-pressure system lubricates the engine, the high-pressure system actuates the fuel injectors.
- is cooled by an engine oil cooler.
- utilizes an oil pressure sensor and an oil pressure regulator.

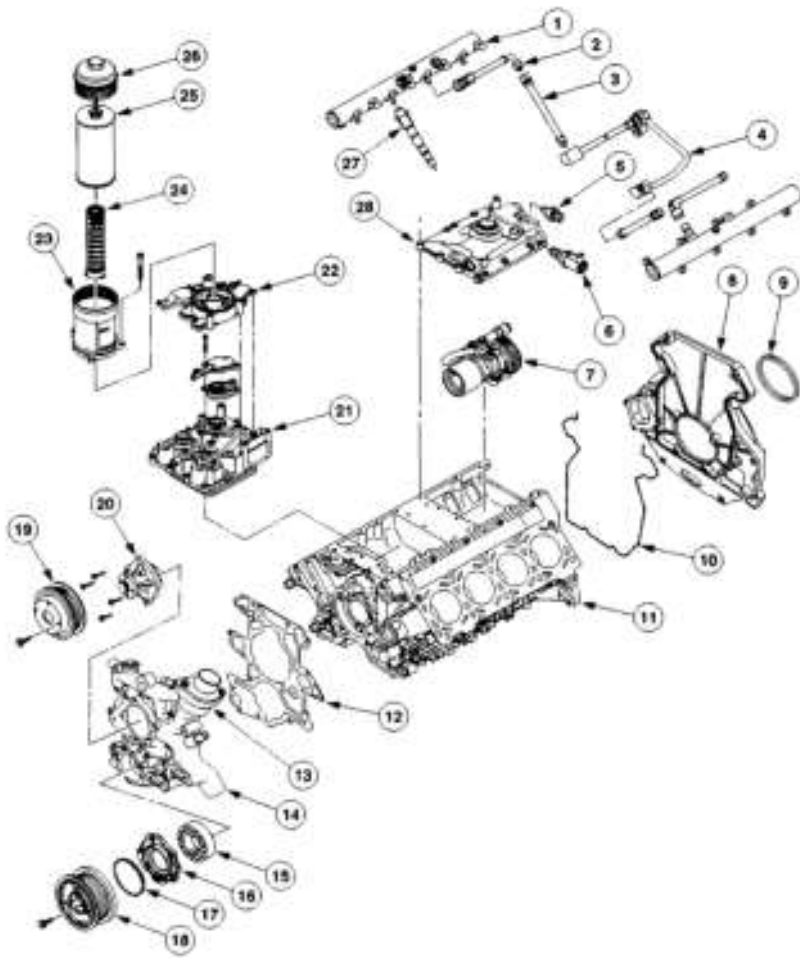


Item	Part Number	Description
1	6010	Cylinder block assembly
2	6250	Camshaft assembly
3	6A251	Camshaft bearing kit
4	6148	Piston ring kit
5	6140	Piston pin retaining ring
6	6102	Piston pin and piston
7	6200	Connecting rod and cap assembly
8	6B237	Connecting rod bearing kit
9	6214	Connecting rod bolt
10	6333	Crankshaft bearing kit

Item	Part Number	Description
11	6303	Crankshaft assembly
12	6345	Main bearing bolt, M14 x 2 x 114.5
13	6345	Main bearing bolt, M14 x 2 x 127.5
14	6675	Upper oil pan assembly
15	6626	Oil pump cover-to-inlet tube flange
16	6622	Oil pump screen cover and tube
17	6676	Lower oil pan assembly

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Fig. 6: Identifying Crankshaft, Camshaft & Piston
 Courtesy of FORD MOTOR CO.

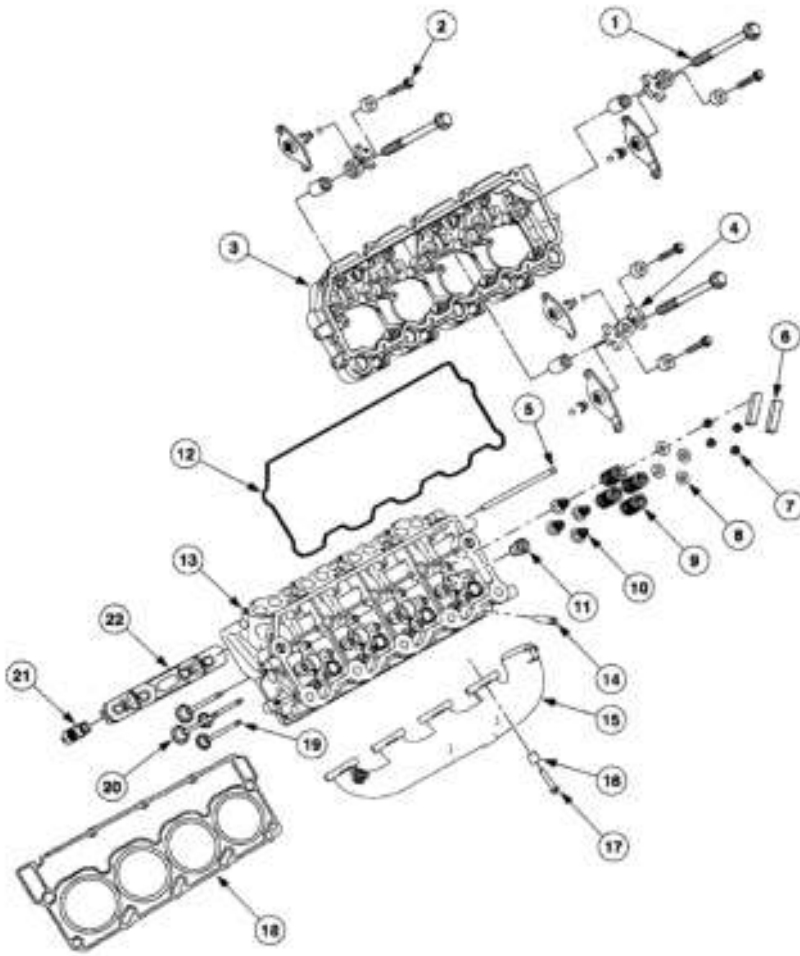


Item	Part Number	Description
1	9D280	Fuel injector fuel supply manifold assembly
2	9324	Fuel tube connector base
3	9A332	Fuel stand pipe tube
4	9332	Rear engine tube assembly
5	9F838	Fuel injector timing sensor assembly
6	9C968	Fuel pressure regulator assembly
7	9A543	Fuel injector pump assembly
8	6L080	Engine rear cover assembly
9	6701	Crankshaft rear oil seal assembly
10	6E683	Engine rear cover gasket
11	6010	Cylinder block assembly
12	6020	Cylinder front cover gasket
13	6575	Water thermostat assembly
14	6019	Cylinder front cover assembly

Item	Part Number	Description
15	6A08	Oil pump drive cone and shaft assembly
16	6610	Oil pump body
17	6700	Crankcase front oil seal
18	6316	Crankshaft vibration damper assembly
19	8509	Water pump pulley assembly
20	8501	Water pump assembly
21	6A638	Crankcase oil cooler cover
22	6881	Oil filter adapter assembly
23	4L625	Engine oil filter and adapter assembly
24	6718	Oil filter outlet tube assembly
25	6714	Oil filter assembly
26	6C631	Oil filter and cap assembly
27	9E527	Fuel injector nozzle assembly
28	6095	Fuel pump cover

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Fig. 7: Identifying Front Cover, Rear Cover & Oil Components
 Courtesy of FORD MOTOR CO.

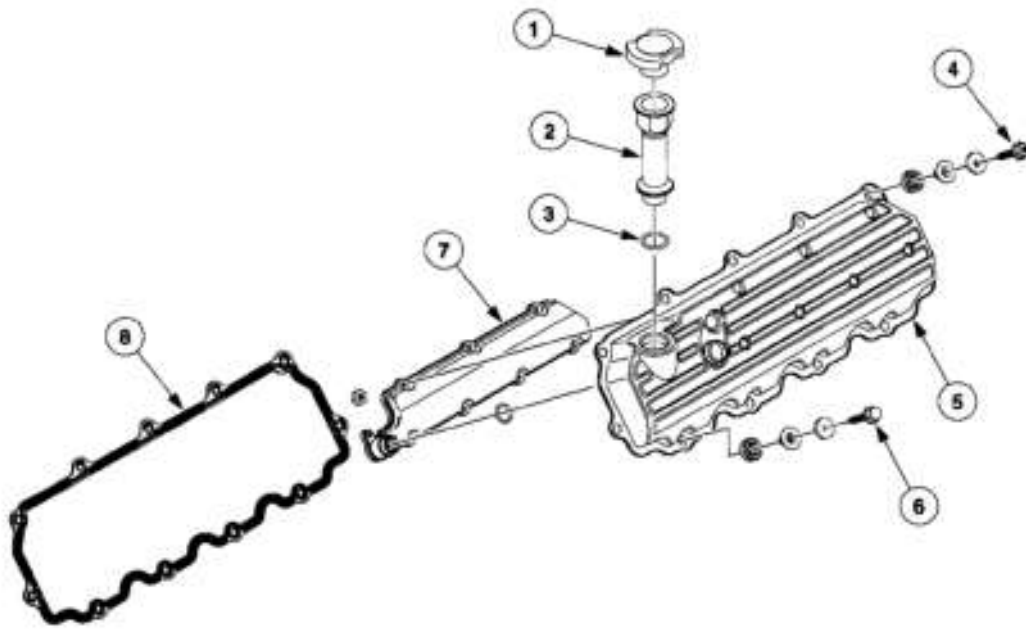


Item	Part Number	Description
1	6065	Cylinder head bolt
2	6A527	Valve rocker arm shaft support bolt
3	6C288	Engine rocker arm carrier
4	6A585	Valve rocker arm fulcrum assembly
5	6365	Valve push rod assembly
6	6C541	Valve rocker bridge
7	6518	Valve spring retainer key
8	6514	Valve spring retainer
9	6513	Valve spring
10	6571	Valve stem seal
11	9F538	Fuel injector nozzle sleeve
12	6584	Valve rocker arm cover gasket

Item	Part Number	Description
13	6049	Cylinder head assembly
14	9F538	Fuel injector nozzle sleeve (glow plug)
15	9431	Exhaust manifold
16	9A461	Exhaust manifold-to-cylinder head spacer
17	W300013	Exhaust flange bolt
18	6051	Cylinder head gasket
19	6505	Exhaust valve
20	6507	Intake valve
21	6500	Valve tappet assembly
22	6C329	Crankcase cam guide

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Fig. 8: Identifying Front Cylinder Head and Rocker Arm Carrier Components
 Courtesy of FORD MOTOR CO.



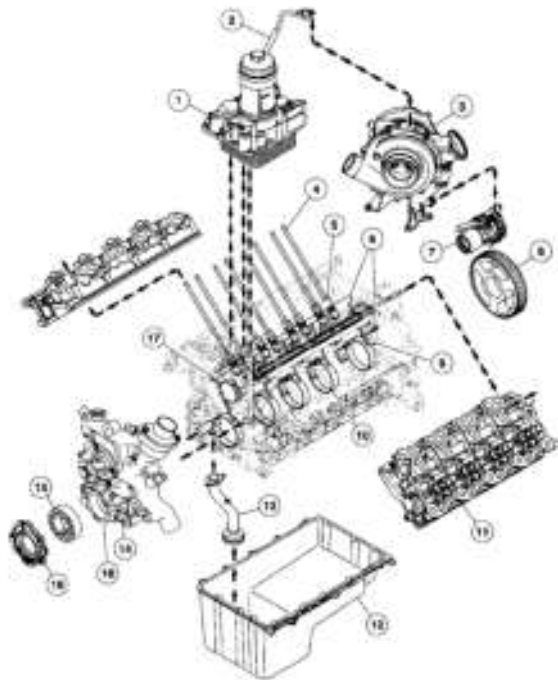
Item	Part Number	Description
1	6766	Oil fill cap assembly
2	6763	Oil fill extension assembly
3	6769	O-ring
7	6A665	Crankcase breather

Item	Part Number	Description
4	W300035	Valve cover stud assembly
5	6A505	Valve cover assembly (LH)
6	W300034	Valve cover bolt
8	6584	Rocker arm cover gasket

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Fig. 9: Identifying Valve Cover Components
 Courtesy of FORD MOTOR CO.

Lubrication System - Low-Pressure



Item	Part Number	Description
1	6A638	Oil cooler
2	9G440	Turbocharger oil supply tube
3	6K682	Turbocharger
4	6565	Push rod
5	6500	Valve tappet
6	—	Main lube oil galleries (part of 6010)
7	9A543	High pressure oil pump
8	—	Camshaft gear (part of 6250)
9	6C327	Piston cooling jet
10	6333	Main bearings
11	6049	Cylinder head
12	6676	Lower oil pan
13	6622	Oil pickup tube
14	6019	Front cover assembly
15	6608	Gerotor assembly
16	6616	Gerotor housing cover
17	6A251	Camshaft bushing
18	6B678	Oil pressure regulator valve assembly

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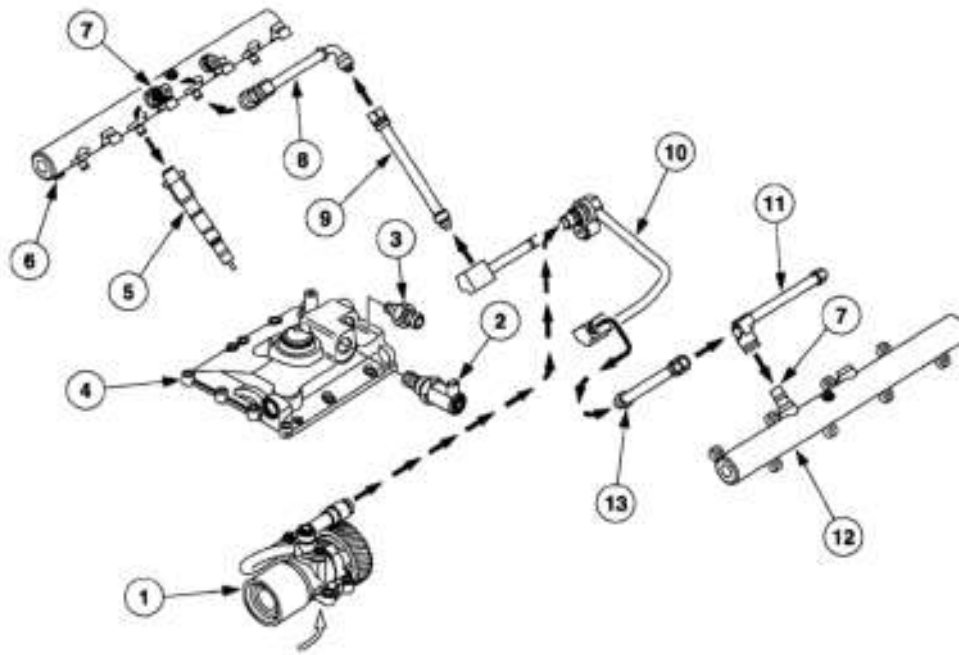
Fig. 10: Identifying Low-Pressure Oil Flow
Courtesy of FORD MOTOR CO.

The lubrication system is pressure regulated, cooled, and full flow filtered. In addition to providing engine lubrication, it supplies oil to the high pressure oil system to control fuel delivery in the fuel injectors.

The following sequence describes lube oil flow through the major oil system components:

1. Oil pan (sump).
2. Oil pick-up tube and screen.
3. The low pressure oil pump is a gerotor type contained in the front cover. The gerotor assembly consists of an outer and an inner gear. The inner gear is driven by the crankshaft. The pump inlet and outlet passages are through ports in the front cover.
 - Oil pressure regulator (bypass) controls lube oil pressure via a spring loaded plunger relieving oil back to the inlet of the pump once operating pressure has exceeded 517 kPa (75 psi).
4. The oil cooler cover receives oil from the oil pump and cools it in the oil cooler, which is located underneath the oil cooler housing.
 - The cooler bypass valves open in the event that the oil cooler base and/or cooler becomes restricted.
5. The oil filter housing contains a paper type element. Unfiltered oil flows up and around the outside of the filter and then down through the center stand pipe.
 - The oil filter bypass allows oil to pass directly to the main oil gallery should the filter become restricted.
6. Turbocharger and drive gears.
 - Cooled and filtered oil supplied from the oil cooler base lubricates the turbocharger bearings and provides hydraulic pressure for the Electronic Variable Response Turbocharger (EVRT) control valve. Oil drains from the turbocharger through a drain tube back to the high pressure hydraulic pump cover.
7. Main galleries. Cooled and filtered oil supplied from the oil cooler base fills the main galleries to distribute oil to the following components via passages machined within the crankcase.
 1. Hydraulic cam followers.
 2. Camshaft main journals.
 3. Crankshaft main journals.
 4. Connecting rod bearings receive pressurized oil from the main bearings via drilled passages within the crankshaft.
 5. Rocker arms receive their lube oil from the hydraulic cam followers via the push rods. Oil drains back to the sump through holes located in the cylinder head.
 6. Piston cooling tubes.
8. High pressure hydraulic pump oil reservoir.
 - This reservoir (below oil cooler) has a constant supply of oil for the pressure hydraulic oil pump. It has an approximate capacity of 0.9 L (0.95 qt.).

Lubrication System - High-Pressure



Item	Part Number	Description
1	9A543	Fuel injector pump assembly
2	9C968	Fuel pressure regulator assembly
3	9F838	Fuel injector timing sensor assembly
4	6095	Fuel pump cover
5	9E527	Fuel injectors (8 req'd)
6	9D280	Fuel injection fuel supply manifold assembly (right side)
7	—	Oil rail fitting with check valve (part of 9D280)
8	9324	Fuel tube connector hose (right side)
9	9A332	Fuel stand pipe tube (right side)
10	9J332	Rear engine tube assembly
11	9324	Fuel tube connector hose (left side)

Item	Part Number	Description
12	9D280	Fuel injection fuel supply manifold assembly (left side)
13	9A332	Fuel stand pipe tube (left side)

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Fig. 11: Identifying High-Pressure Oil Flow
 Courtesy of FORD MOTOR CO.

The high pressure oil system is composed of two subsystems:

- Injection Control Pressure (ICP) system
- Fuel injector assembly

The hydraulic force necessary to inject fuel into the combustion chamber is provided by the ICP system. The fuel injectors on the engine are hydraulically actuated and electronically controlled.

The ICP system is composed of the following components:

- Oil reservoir
- Hydraulic pump assembly (high-pressure)
- Hydraulic pump cover
- High-pressure tubes and hoses

High-pressure rail assemblies

- Injection Control Pressure (ICP) sensor
- Injection Pressure Regulator (IPR) valve
- Check valves

The high-pressure hydraulic pump receives engine lube oil from a reservoir cast into the "V" of the crankcase. This reservoir makes available a constant supply of engine oil from the pump. This reservoir is constantly refilled by the low-pressure lube oil system with filtered oil from a passage in the oil cooler housing.

The high-pressure hydraulic pump is mounted at the rear of the crankcase and is driven by the camshaft gear. Oil is drawn from the oil reservoir through a 150 micron screen and into a passage to the pump inlet port. High-pressure oil from the pump is distributed to the injectors through a series of pipes and hoses.

The high-pressure discharge tube is mounted to the pump and serves to connect the oil flow from the high-pressure hydraulic pump to the rear engine tube assembly. This tube assembly divides oil flow into two pipes or branches, one for each side of the engine. Rigid pipes thread into each branch and direct oil up into the rocker carrier of each cylinder head. Flexible hoses with quick disconnect ends connect the ridge pipes to check valves, which are mounted on each of the oil rails assemblies. Oil from the rails enter the injectors through O-ring sealed ports at the top of each injector. When the injector opening coil is energized, high-pressure oil is used to push fuel into the combustion chamber. After injection is complete, the oil inside the injector is vented through the top portion of the injector and allowed to drain back to the oil sump.