SECTION 303-01C Engine — 6.0L Diesel

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DESCRIPTION AND 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 2 banks, the right bank numbered 1, 3, 5, 7 and the left bank numbered 2, 4, 6, 8.
- rated at 325 horsepower and 570 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) and glow plug control module.
- 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.

DESCRIPTION AND OPERATION (Continued)

The fuel injection system used on the engine:

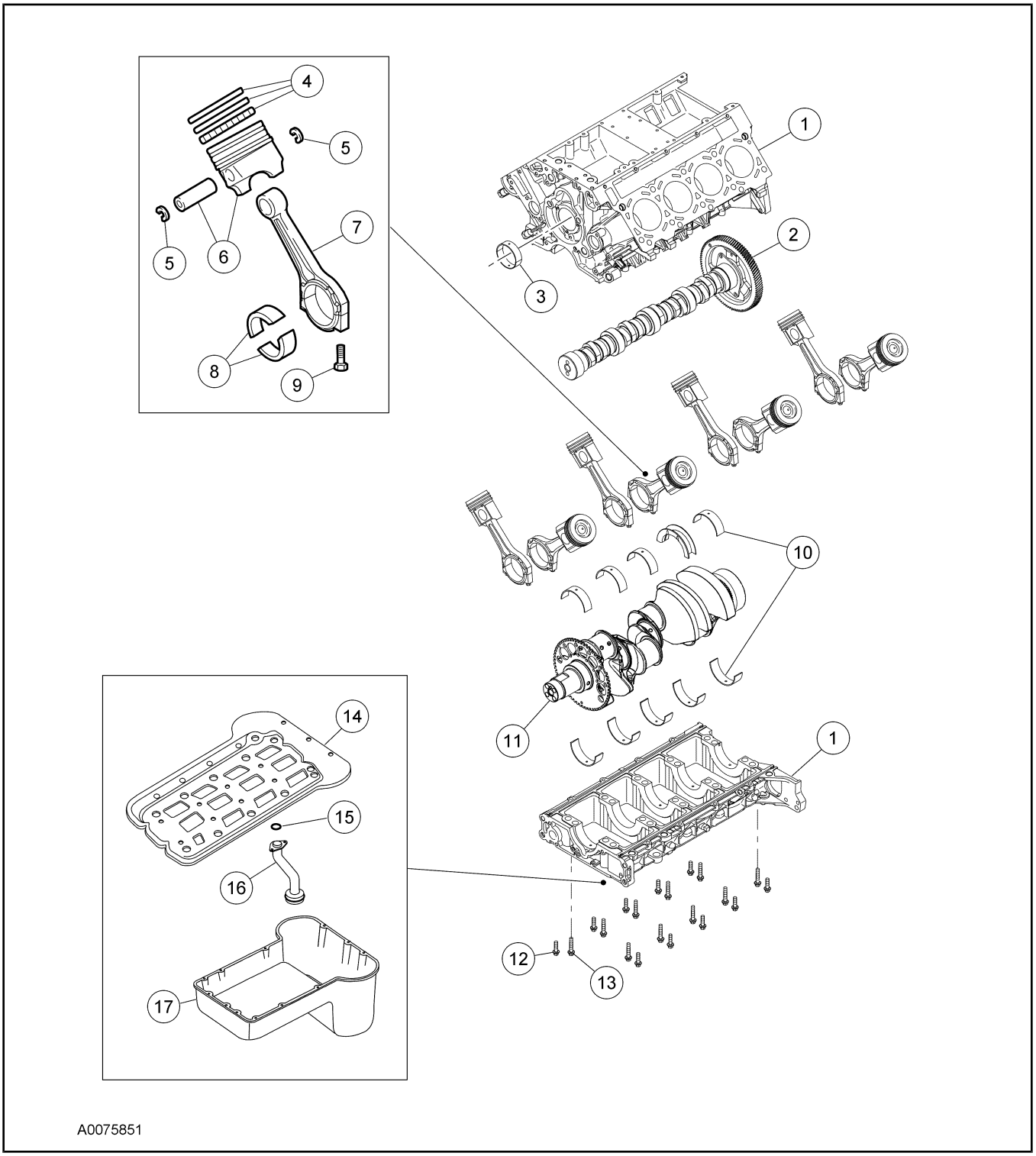
- is controlled by the powertrain control module (PCM) and fuel injector control module.
- utilizes a frame-mounted horizontal fuel conditioning module.
- circulates fuel through a combination fuel filter, fuel heater and water separator assembly.
- uses eight electrohydraulic fuel injectors.
- has a secondary fuel filter mounted on the engine.
- has a fuel pressure regulator mounted in the secondary fuel filter housing.

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 engine oil pressure (EOP) sensor and an oil pressure regulator.

DESCRIPTION AND OPERATION (Continued)

6.0L Crankshaft, Camshaft and Piston



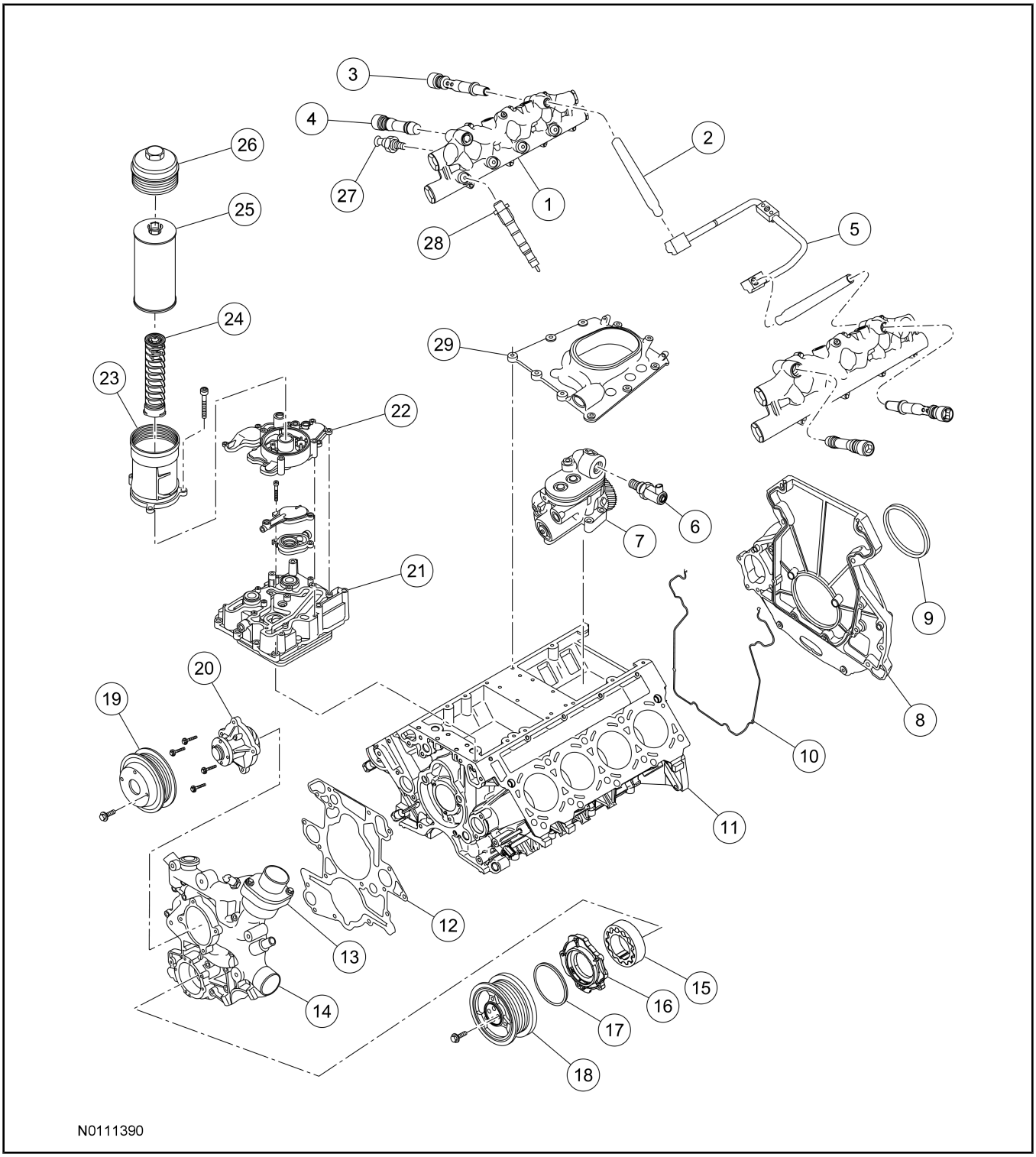
Item	Part Number	Description
1	6010	Cylinder block assembly
2	6250	Camshaft assembly
3	6A251	Camshaft bearing kit
4	6148	Piston ring kit
5	6140	Piston pin retaining ring

DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
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
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 O-ring seal
16	6622	Oil pump screen cover and tube
17	6676	Lower oil pan assembly

DESCRIPTION AND OPERATION (Continued)

6.0L Front Cover, Rear Cover and Oil Components



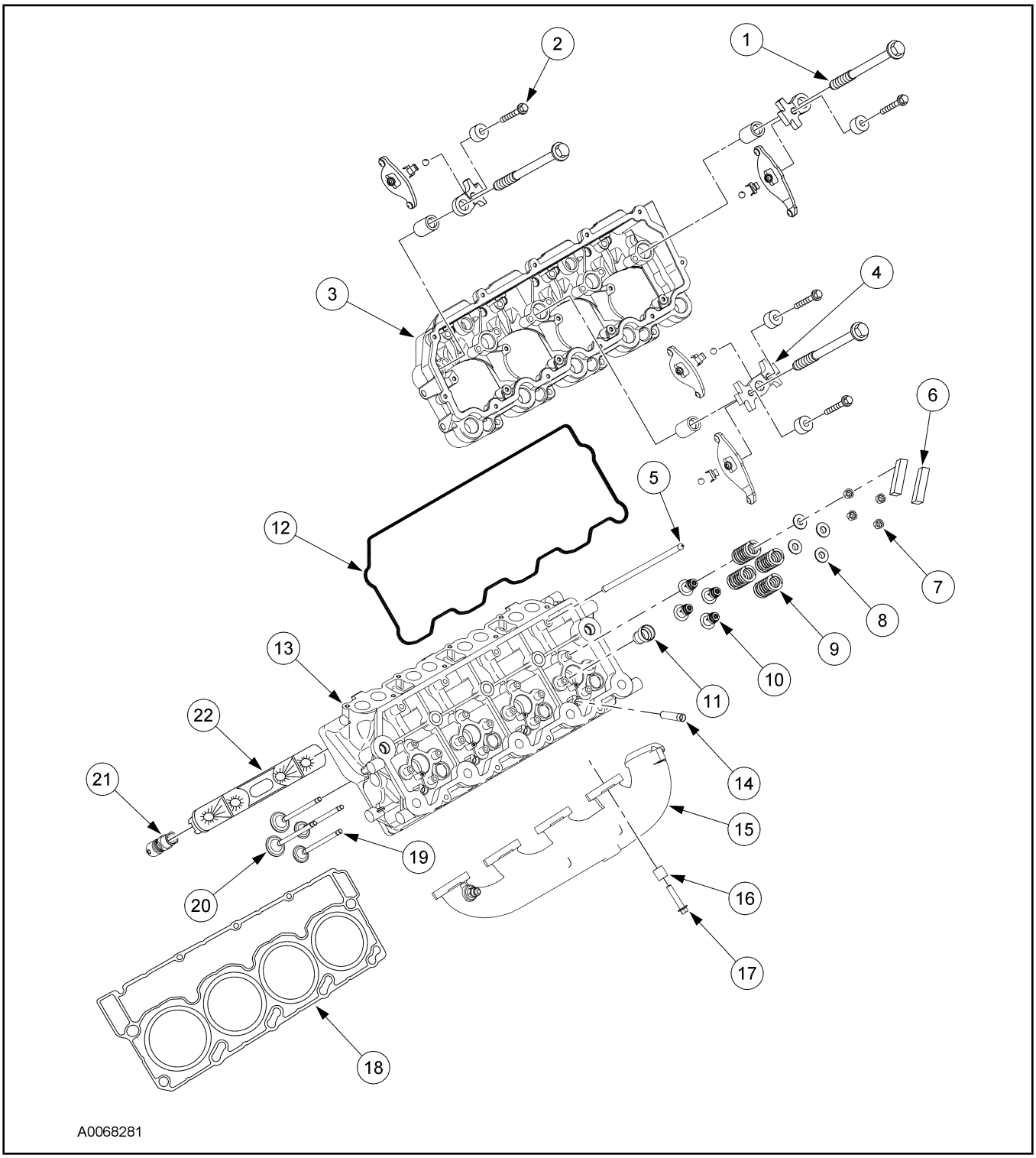
Item	Part Number	Description
1	9D280	High pressure oil rail
2	9A332	Crankcase-to-head tube assembly
3	—	Crankcase-to-head tube (part of 9A332)
4	W302195	Port plug
5	9J332	High-pressure oil branch tube

DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
6	9C968	Injection pressure regulator valve
7	9A543	High-pressure oil pump
8	6L080	Engine rear cover assembly
9	6701	Crankshaft rear oil seal assembly
10	6D083	Engine rear cover gasket
11	6010	Cylinder block assembly
12	6020	Cylinder front cover gasket
13	8575	Water thermostat assembly
14	6019	Cylinder front cover assembly
15	6608	Oil pump drive rotor and shaft assembly
16	6616	Oil pump body
17	6700	Crankcase front oil seal
18	6316	Crankshaft vibration damper
19	8509	Water pump pulley assembly
20	8501	Water pump assembly
21	6A638	Crankcase oil cooler cover with oil cooler
22	6881	Oil filter adapter assembly
23	6L625	Engine oil filter and adapter assembly
24	6718	Oil filter outlet tube assembly
25	6714	Oil filter assembly
26	6C631	Oil filter cap assembly
27	9F838	Injection control pressure (ICP) sensor
28	9E527	Fuel injector nozzle assembly
29	6095	Fuel pump cover

DESCRIPTION AND OPERATION (Continued)

6.0L Front Cylinder Head and Rocker Arm Carrier

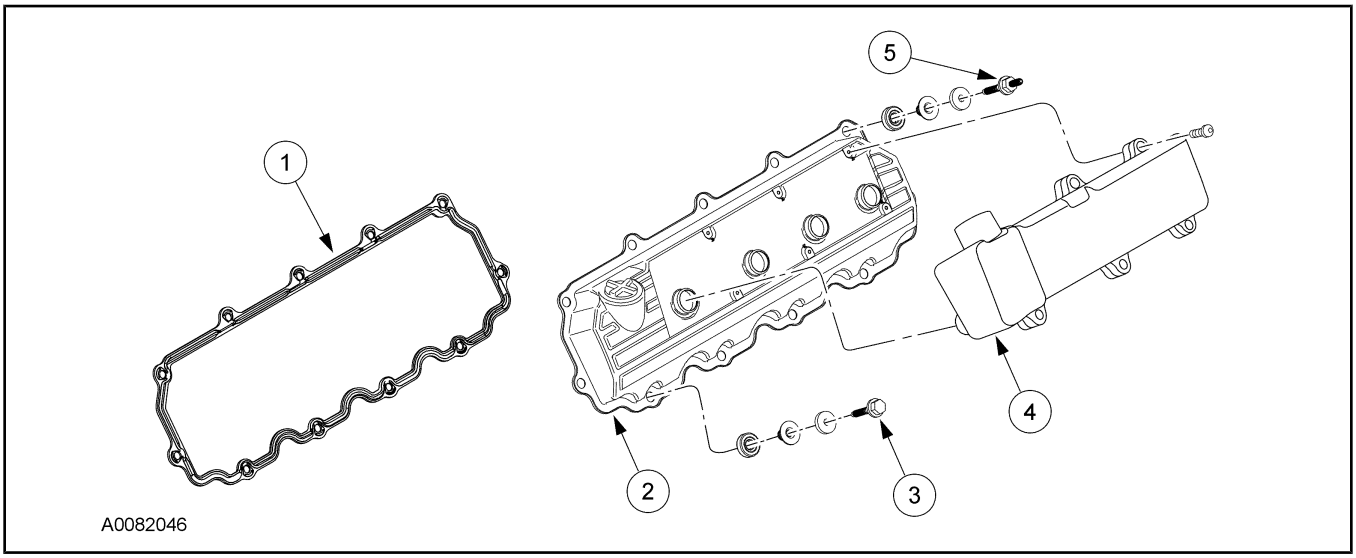


Item	Part Number	Description
1	6065	Cylinder head bolt
2	6A527	Valve rocker arm shaft support bolt
3	6C288	Engine rocker arm carrier
4	6A585	Valve rocker arm fulcrum assembly
5	6565	Valve push rod assembly

DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
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
13	6049	Cylinder head assembly
14	9F538	Glow plug sleeve
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

6.0L Valve Cover

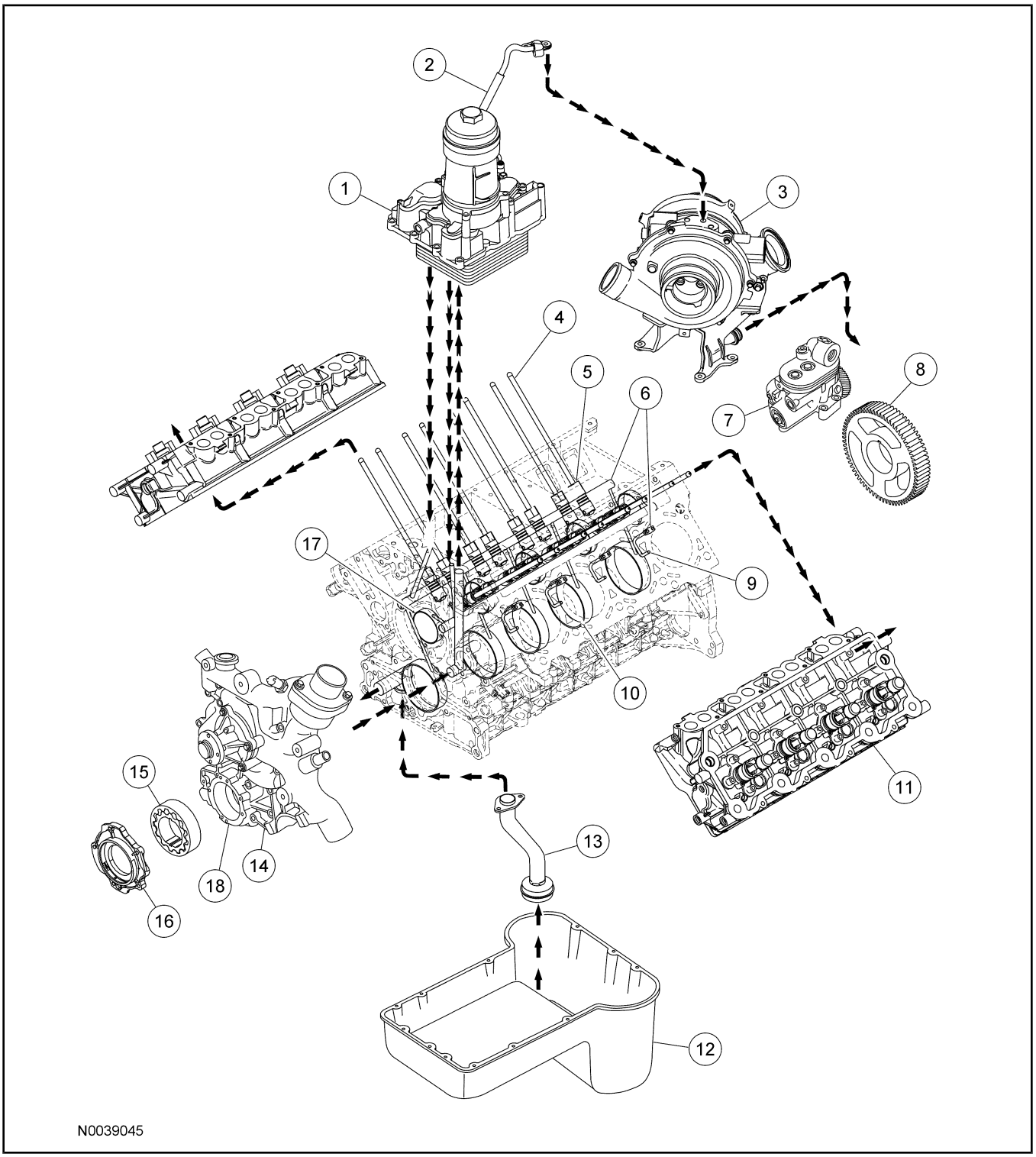


Item	Part Number	Description
1	6584	Rocker arm cover gasket
2	6A505	Valve cover assembly (LH)
3	W300034	Valve cover bolt assembly
4	6A665	Crankcase breather
5	W300035	Valve cover stud assembly

DESCRIPTION AND OPERATION (Continued)

Lubrication System — Low-Pressure

Low-Pressure Oil Flow



Item	Part Number	Description
1	6A638	Crankcase oil cooler cover with oil cooler
2	9G440	Turbocharger oil supply tube
3	6K682	Turbocharger
4	6565	Push rod

DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
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	Oil pump drive rotor and shaft assembly
16	6616	Oil pump body
17	6A251	Camshaft bushing
18	6B678	Oil pressure regulator valve assembly (part of 6019)

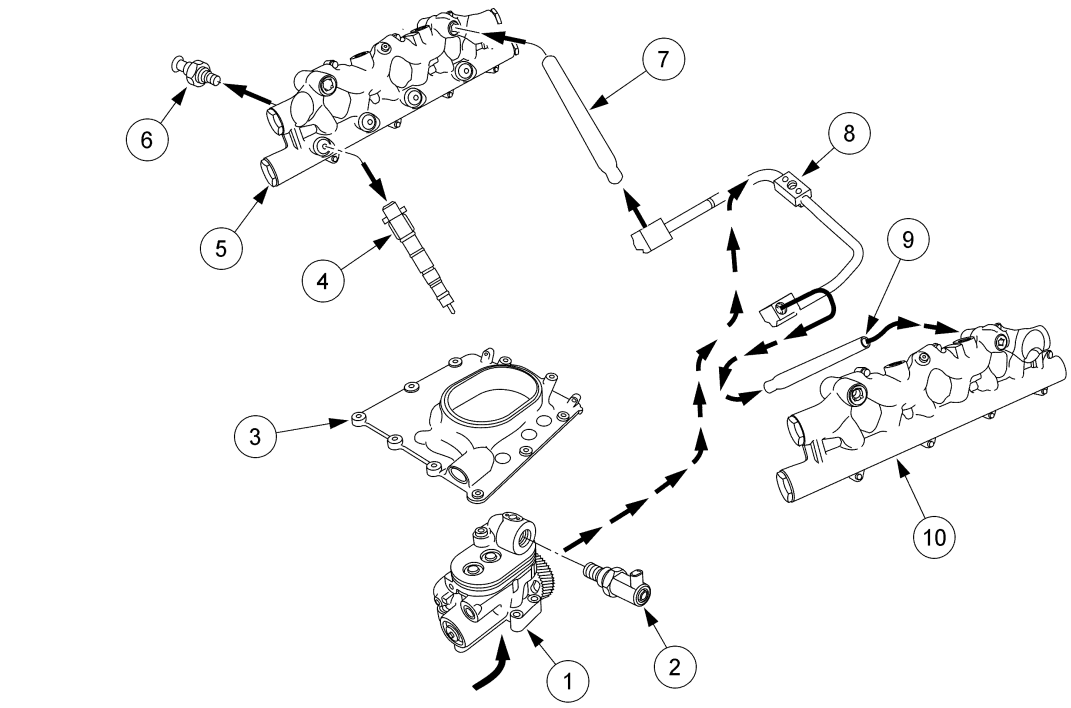
The lubrication system is pressure regulated, cooled, and full flow filtered. In addition to providing engine lubrication, it supplies oil to the high-pressure oil system to control fuel delivery in the fuel injectors.

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

1. Oil pan (sump).
2. Oil pickup 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 standpipe.
   - 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 variable geometry turbocharger 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).

DESCRIPTION AND OPERATION (Continued)

Lubrication System — High-Pressure



Item	Part Number	Description
1	9A543	Fuel injector pump assembly
2	9C968	Injection pressure regulator (IPR) valve
3	6095	Fuel pump cover
4	9E527	Fuel injectors (8 required)
5	9D280	Fuel injector manifold assembly (right side)
6	9F838	Injection control pressure (ICP) sensor
7	—	Crankcase-to-head tube assembly (right side)
8	9J332	Rear engine tube assembly
9	—	Crankcase-to-head tube assembly (left side)
10	9D280	Fuel injector manifold assembly (left side)

NOTE:
Late build shown, early build similar.

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
- Oil pump assembly (high pressure)
- Oil pump cover
- High-pressure tubes
- High-pressure rail assemblies

DESCRIPTION AND OPERATION (Continued)

- Injection control pressure (ICP) sensor
- Injection pressure regulator (IPR) valve
- Check valves

The high-pressure oil pump receives engine lube oil from a reservoir cast into the vee 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 oil 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 200-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 tubes and manifolds.

The high-pressure discharge tube is mounted to the pump and serves to connect the oil flow from the high-pressure oil pump to the rear engine tube assembly. This tube assembly divides oil flow into two tubes or branches, one for each side of the engine. Rigid tubes in each branch direct oil up into the high-pressure oil rail of each cylinder head. Oil from the rails enters 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.