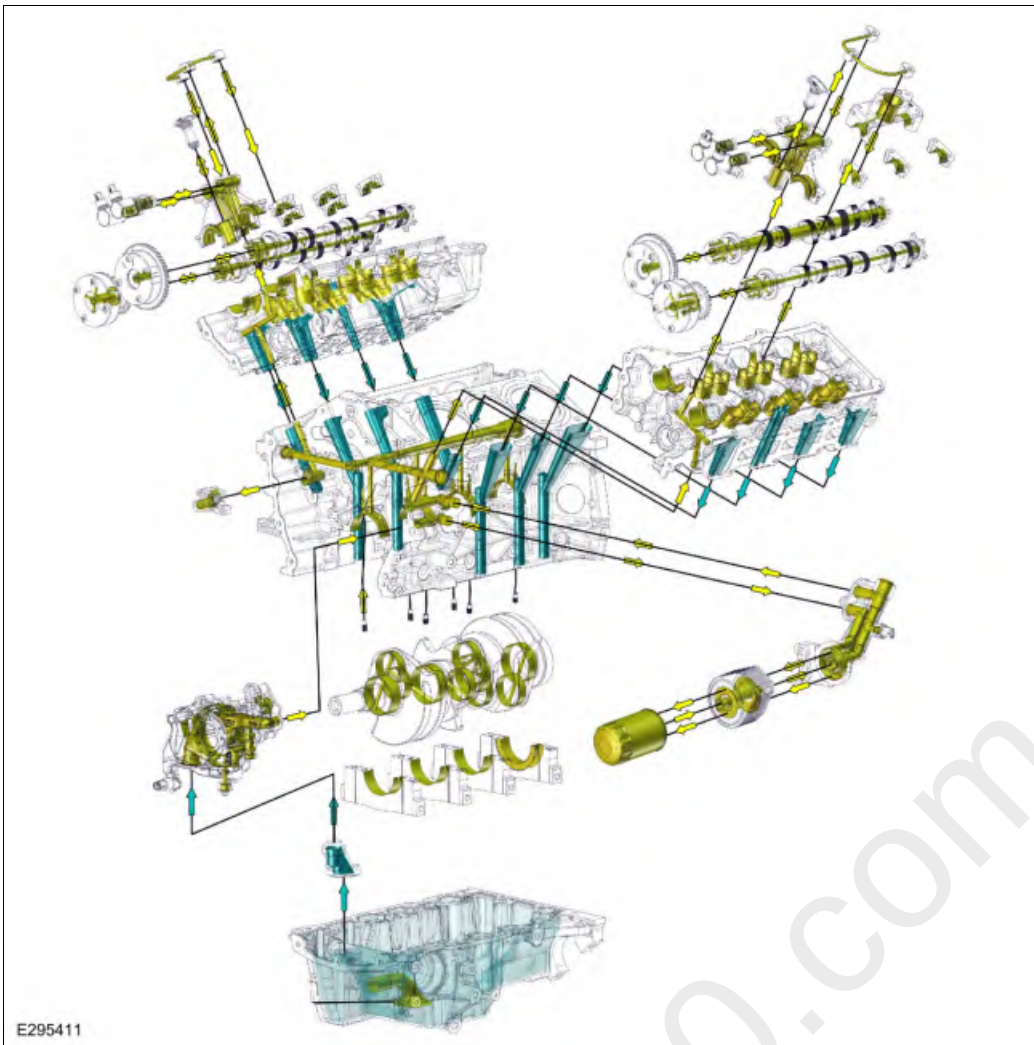




Item	Description
Yellow	High pressure oil flow
Blue	Oil return/low pressure oil flow

For more detailed information on oil flow diagram, [View](#)

System Operation

Oil Pump

The engine lubrication system is of the force-feed type in which oil is supplied in 2-stage pump, low and high mode pressure to the crankshaft, connecting rod bearings, timing chain tensioners, piston oil cooling jets and VCT oil control solenoids. The flow of oil to the valve tappets and valve train is controlled by a restricting orifice located in the cylinder head, front camshaft cap.

The lubrication system is designed to provide optimum oil flow to critical components of the engine through its entire operating range.

The heart of the system is a positive displacement internal vane pump.

Generically, this design is known as a 2-stage VDO pump, which operates as follows:

- The oil pump is mounted on the front face of the cylinder block.
- The inner rotor is piloted on the crankshaft post and is driven through flats on the crankshaft.
- Maximum system pressure is limited by an integral, internally-vented relief valve which directs the excess oil back to the oil pan.
- Oil pump displacement has been selected to provide adequate volume to make sure of correct oil pressure both at hot idle and maximum speed.
- The relief valve calibration protects the system from excessive pressure during high-viscosity conditions.
- The relief valve is designed to provide adequate connecting rod bearing lubrication under high temperature and high-speed conditions.
- 2-stage operation of the oil pump is controlled by an integral solenoid on the pump that switches the pump between high and low mode operation.
- The engine PCM sends a 12 volt signal to the oil pump solenoid to switch the pump to low mode. Default is no voltage or high mode operation.

- Both low and high mode maintain required oil pressure to protect and maintain engine function at their specified speeds, engine load (throttle position), and engine temperature.
- Low mode operation is designed to maintain oil pressure between 138-207 kPa (20-30 psi) at speeds from 1000 to 3000 rpm with low engine load and engine oil temperatures at normal operating conditions.
- High mode operation is at all other engine operating conditions.

Valve Train

The valve train uses Direct Acting Mechanical Buckets (DAMB). The camshaft lobes are positioned directly above mechanical buckets which are positioned on top of the valves.

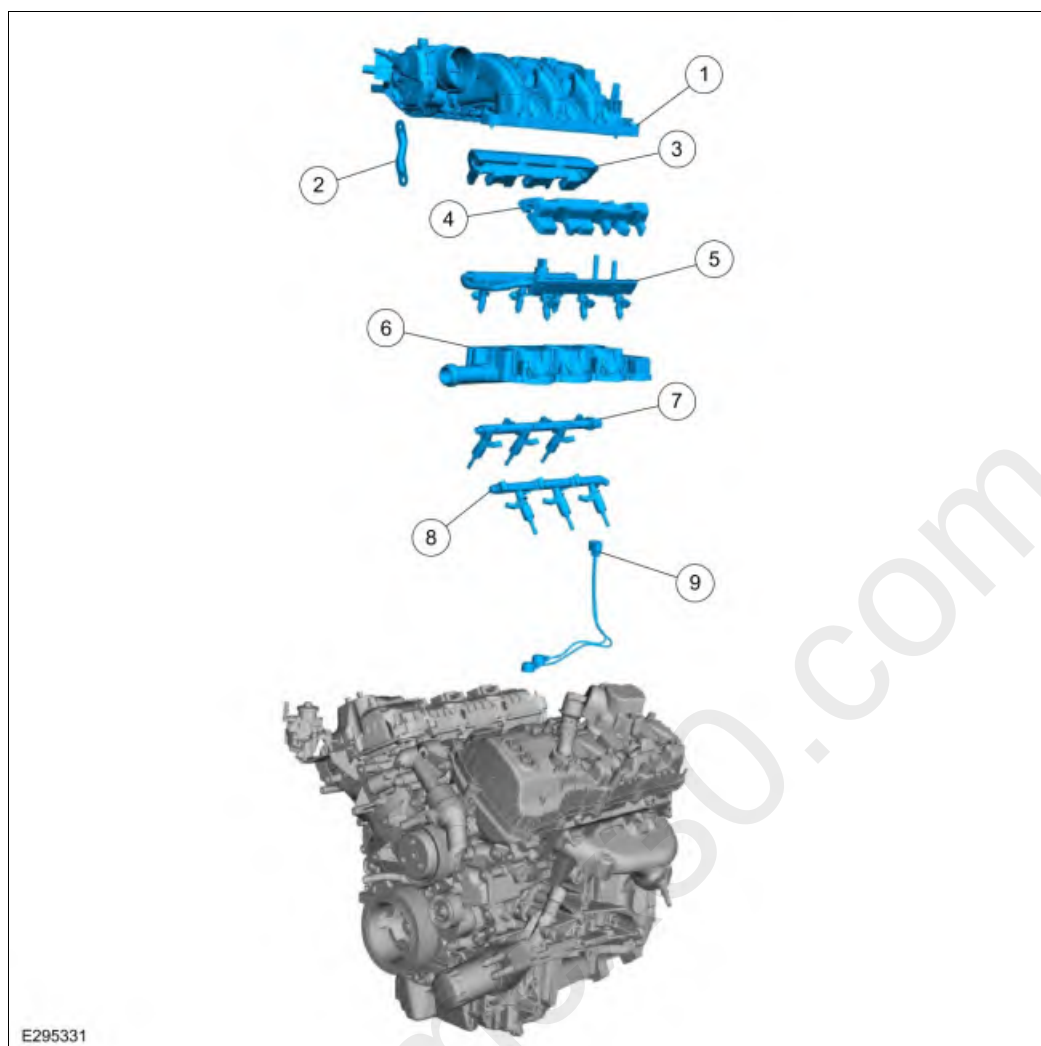
Twin Independent Variable Camshaft Timing (Ti-VCT)

The twin independent VCT system allows variable control of the valves closing which optimizes combustion at full load. This improved power and low speed torque (broadening the torque curve) enables variable valve overlap which provides better fuel economy. The Ti-VCT system provides optimized cold start operation with improved exhaust emissions.

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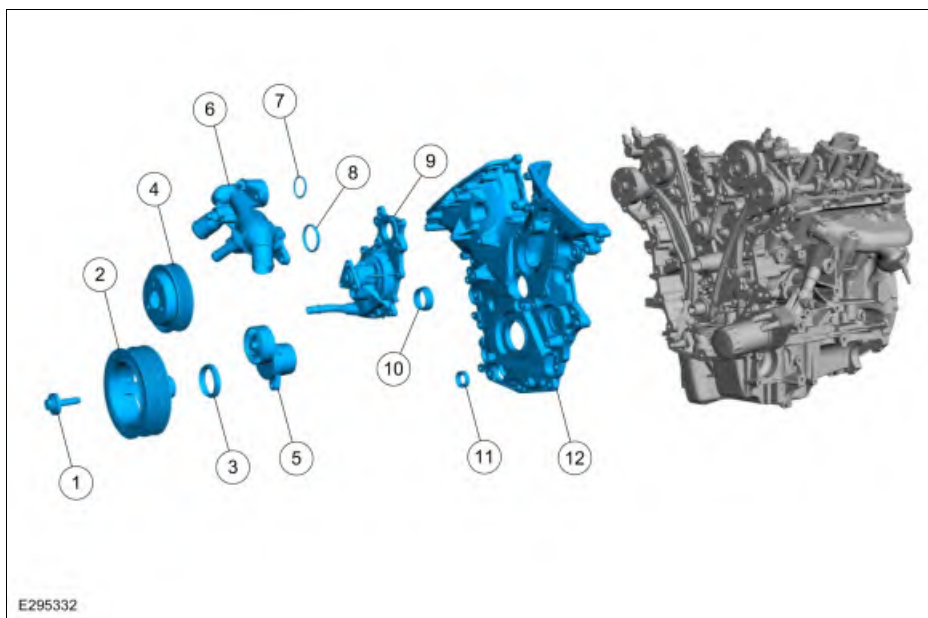
Engine Component View

Engine Upper



Item	Part Number	Description
1	9424	Upper intake manifold
2	9J444	Upper intake manifold support bracket
3	6P013	RH fuel rail noise shield insulator
4	6P013	LH fuel rail noise shield insulator
5	9H487	Port injection fuel rail
6	9J447	Lower intake manifold
7	9F797	Direct injection fuel rail RH
8	9F797	Direct injection fuel rail LH
9	12A699	Knock Sensor (KS)

Engine Front



Item	Part Number	Description
1	W701512/N806165	Crankshaft pulley bolt and washer
2	6316	Crankshaft pulley
3	6700	Crankshaft front seal
4	8A528	Coolant pump pulley
5	6B209	Accessory drive belt tensioner
6	8A586	Thermostat housing assembly
7	4E856	Thermostat housing assembly O-ring seal
8	8A571	Coolant pump O-ring seal
9	8501	Coolant pump
10	6020	Front cover to coolant pipe seal
11	6P251	Oil pump electrical connector seal
12	6019	Engine front cover

Timing Drive Components

