

# Service Bulletin Trucks

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Lubrication and Oil System D16F

# Lubrication and Oil System



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This information covers the design and function of the lubrication and oil system on the Volvo D16F engine.

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**Note:** Information is subject to change without notice. Illustrations are used for reference only and may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

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# **Design and Function**

# Lubrication and Oil System

## General

The engine has forced lubrication provided by a gear pump (1) positioned at the rear and driven by the crankshaft. The filter housing (2) is bolted to the right side of the engine and contains two full-flow filters (3) and a bypass filter (4). After passing through the full-flow filters, the oil moves to the cylinder block, where it is distributed through galleries to engine points in need of lubrication. The flat oil cooler (5) is assembled under a cast aluminum cover in the right side of the engine block.

The purpose of the lubrication system is to lubricate the movable engine parts in order to keep friction and wear to a minimum. The oil transports carbon and other residues stuck on the cylinder walls after combustion. The oil also functions as a sealer, for the cylinder liners have been projected in such a way that a thin layer of oil is always kept in its walls. This makes it easier for the piston rings to seal the combustion chamber. The oil also cools the engine and, at the same time, reduces the sounds produced by the engine.



The oil flow in the engine is controlled by seven valves located in the oil filter housing.

- A. Bypass valve for oil cooler
- B. Safety valve (marked violet)
- C. Reduction valve (marked blue)
- D. Control valve for piston cooling

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- E. Opening valve for piston cooling F. Overflow valve for the bypass filter
- G. Bypass valve for full-flow filter

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### **Operating Principles of the Lubrication System**

- A. Bypass valve for oil cooler
- B. Safety valve (marked violet)
- C. Reduction valve (marked blue)
- D. Control valve for piston cooling
- E. Opening valve for piston cooling
- F. Overflow valve for bypass filter
- G. Bypass valve for full-flow filter

The lubrication oil pump (1) forces the oil through the pressure pipe (2) to the drilled channels in the cylinder block. The oil is then channeled to the oil cooler (3) and the filter housing (4). After being filtered in both full-flow filters (5), the oil is channeled to the cylinder block main lubrication channel (6) for distribution to all engine lubrication points. The lubrication by the cylinder head is through a drilled channel up to the VCB valve (7).

The air compressor (8) and the turbocharger (9) are lubricated through external braided oil lines. The turbocharger oil is filtered by the bypass filter (10). The piston cooling oil is filtered by the full-flow filters and is forced into the cylinder block piston cooling channel. From the piston cooling channel, the oil is sprayed toward the underside of the piston through a piston cooling nozzle (11). T2020859

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#### Extreme Cold Start

Extreme cold start is considered to be when starting at temperatures below  $-20^{\circ}$ C ( $-4^{\circ}$ F). The safety valve (B) opens to protect the oil pump against the high pressure which occurs when the oil viscosity is too high. The reduction valve (C), bypass valve (A) and piston cooling valve (E) open due to the high viscosity.

#### Driving at Low Engine RPM

When driving at low engine rpm with an engine that is at operating temperature, the reduction valve (C) partly opens to maintain the oil pressure within the correct values. The piston cooling valve (E) is open. The piston cooling control valve (D) has begun to control the flow to the piston cooling channel.

#### Driving at High Engine RPM

When driving at high rpm with an engine running at operating temperature, valves (C) and (E) are open. In addition, the piston cooling control valve (D) is lifted and opened slightly by the increased oil pressure.

#### Blocked Oil Filters

If a full-flow filter becomes blocked, the bypass valve (G) opens and unfiltered oil is pumped into the engine lubrication system. If the bypass filter becomes blocked, valve (F) opens so that the turbocharger is supplied with oil filtered through the full-flow filters.

#### Idling, Hot Engine

At low engine rpm and with the engine at operating temperature, all valves are closed.



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A more detailed picture of the filter housing and valve locations is shown. The arrows in the channels show the oil flow direction between the oil filter housing and the cylinder block.

### **Oil Pump and Cooler**



The oil pump is located at the rear of the engine and is bolted to the cylinder block lower surface. It is driven by a gear directly from the crankshaft gear. The pump gear is beveled for low noise levels and the shafts are mounted in bearings directly in the pump housing, which is manufactured of aluminum.

The strainer (1) is made of plastic and is bolted on the engine stiffening frame. The suction pipe (2) is made of steel and is sealed at the ends with rubber seals. The pressure pipe (3) is manufactured of steel and is attached to the cylinder block with a fitting.

The oil cooler is bolted directly to the cylinder block under the oil cooler side cover and is completely surrounded by coolant. T2020860

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## **Piston Cooling System**



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Shown is the oil flow for the piston cooling system when the valve (E) has opened and valve (D) balances the oil flow to the piston cooling channel. The piston cooling nozzle is aligned so that the oil jet hits the under side of the piston crown.

By regulating the piston cooling flow using a control valve, an optimized piston cooling system can be achieved with a constant flow of oil independent of engine rpm.