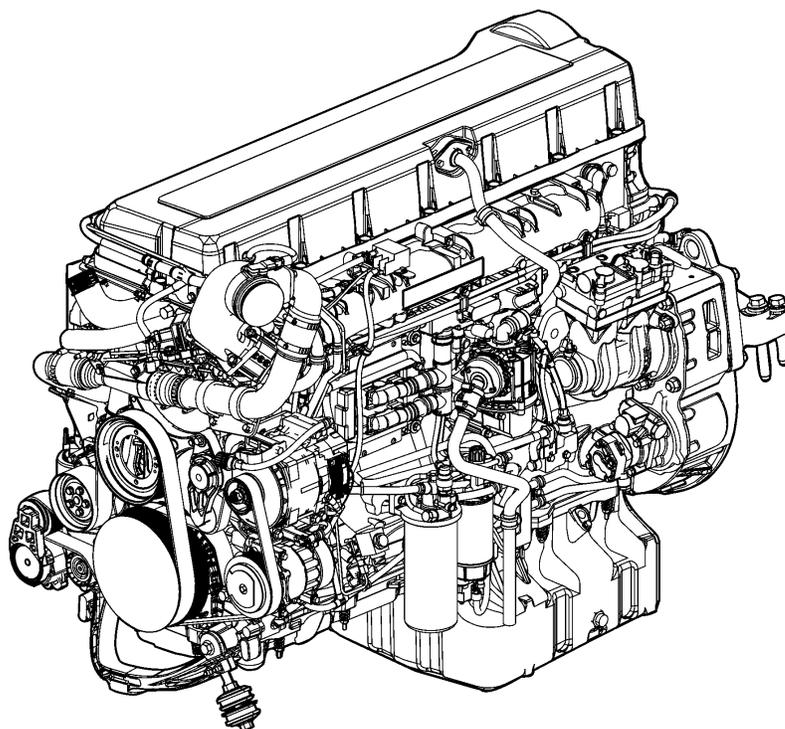


Intake and Exhaust System Design and Function D16F

Intake and Exhaust System



W2005773

This information covers the design and function of the intake and exhaust systems for 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.

Design and Function

Intake and Exhaust System

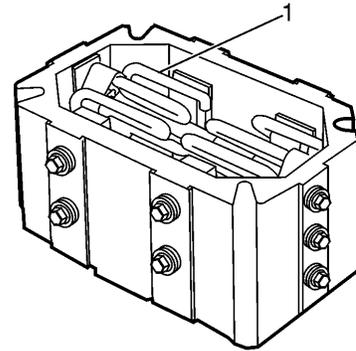
Preheater

The D16F may be equipped with a preheater. Its purpose is to warm air in the intake manifold when starting the engine. This heated air eases starting at very low temperatures and reduces engine smoking when starting a cold engine. The following conditions are required to engage the preheater:

- The parking brake must be applied.
- The power take-off must not be engaged.

The preheater does not engage at coolant temperatures over 10°C (50°F). At a coolant temperature of 10°C (50°F), the preheating time is 25 seconds. At coolant temperatures below -15°C (5°F), the preheating time is 55 seconds. Preheating time increases linearly between 10°C (50°F) and -15°C (5°F).

The post-heating time is always the same as the pre-heating time.



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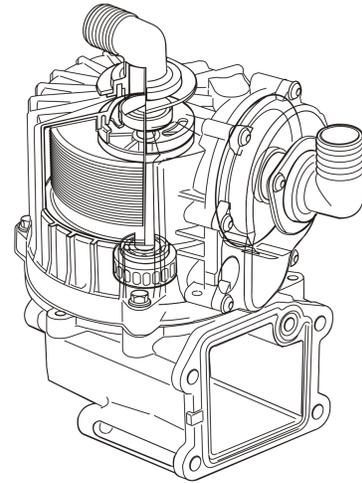
Preheater Element (1)

Engines without Preheater

On engines not equipped with a preheater, engine coolant temperature determines the point at which fuel injection begins while starting. The crankshaft rotates an extra number of turns to increase cylinder temperature before fuel injection begins. This gives more reliable starting and reduces exhaust emissions during cold starts at temperatures as low as -15°C (5°F). This means that the crankshaft may need to rotate approximately 3– 4 rotations before fuel injection begins and the engine starts.

Crankcase Ventilation (CCV)

To fulfill the 2007 environment requirements, a new component is being introduced called an open extended version of the crankcase ventilation. This component uses a spinning filter to separate engine oil molecules from the crankcase blow-by oil vapor and allow clean air to be vented back to the atmosphere. This CCV version directs clean gases from the separator to a pipe leading the gases down the side of the engine and out into the open air.



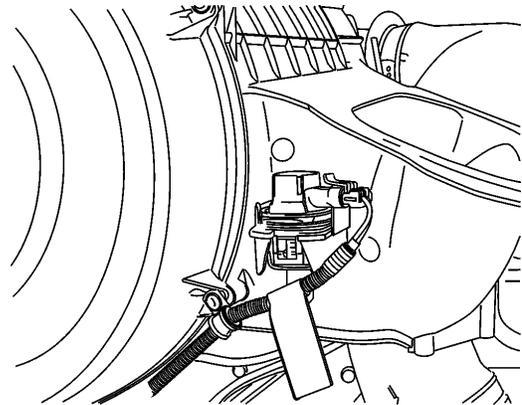
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Crankcase Ventilation (CCV)

Air Restriction Indicator

There are several types of restriction indicators which can be mounted in certain locations, such as on the air cleaner duct or on/above the instrument panel. The air restriction indicator mounted on the instrument panel permits continuous monitoring of the gauge.

When either the flag or piston-type restriction gauge is mounted directly on the air cleaner, the piston is usually drawn downward into view as the element loads with dirt. It locks into full view only after the restriction (caused by a dirty element) reaches the rated value of the indicator.

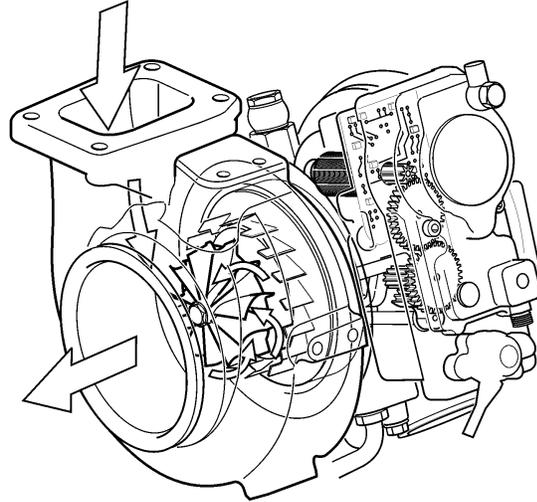


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Turbocharger

In order to be able to quickly regulate the charge air pressure and drive the EGR, a new type of turbocharger unit with variable geometry has been introduced. This turbocharger contributes to lower emissions, provides optimal fuel consumption and increases power output. The extent of turbocharger function can be varied by the speed of the gases entering the turbine. This is controlled by an electrically-operated actuator. The turbocharger bearing housing and the actuator are both liquid cooled.

The variable geometry turbocharger (VGT) has a set of vanes and a sliding nozzle ring that maintains sufficient backpressure in the exhaust manifold for proper operation of the EGR system. A certain amount of backpressure is required to push the exhaust gases into the pressurized intake air at the EGR mixer.



Turbocharger

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Turbocharger Operation

The turbocharger is driven by the exhaust gases from the engine passing through the turbine housing on their way out into the exhaust system.

The flow of exhaust gases causes the turbine wheel inside the turbine housing to rotate. On the same shaft as the turbine wheel is a compressor wheel. The compressor wheel is mounted in a housing which is connected between the air cleaner and the intake manifold.

When the compressor wheel starts to rotate, air is drawn in from the air cleaner, compressed and forced into the cylinders of the engine — but not before it has been cooled down after passing through the charge air cooler.

Engine Brake

The Volvo Engine Brake (VEB) consists of a very effective engine compression brake.

Compression Brake

During the engine compression stroke and combustion (operating) stroke, the controlled opening of the exhaust valves creates an overpressure in the combustion chamber. This, in turn, produces a braking effect on the crankshaft.

To better accomplish this task, the Volvo Engine Brake (VEB) is designed with an additional cam and rocker arm at each cylinder for operation of the VEB. To make sure the VEB cams open the exhaust valves, the VEB and exhaust rocker arms are arranged and valved in a manner that reduces valve clearance during the braking sequence.

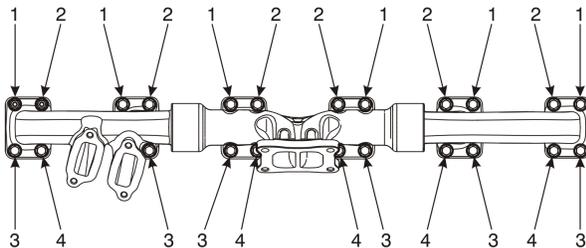
Additionally, the sliding nozzle ring of the turbocharger controls exhaust backpressure not only for proper operation of the EGR system, but also for enhanced braking.

For more information about the design and function of the Volvo Engine Brake, refer to Service Information, group 25.

Exhaust Manifold

The exhaust manifold has been modified slightly to accommodate the EGR system. The amount of exhaust gases being recirculated is controlled by two EGR valves mounted to the exhaust manifold. (For specific information on the design and function of the EGR system, refer to Service Information, group 25.)

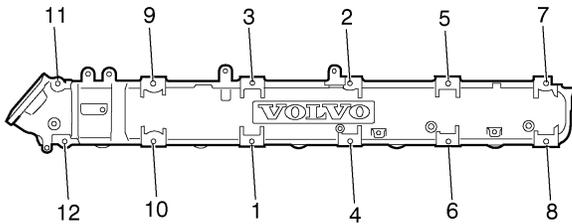
Tightening Sequence



Intake Manifold

The intake manifold is mounted on the left side of the cylinder head and routes inlet air from the charge-air cooler to the cylinders. Mounted on the manifold inlet is the EGR mixer where recirculated exhaust gases from the EGR system are introduced into the inlet air stream to reduce combustion temperatures.

Tightening Sequence



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For more specifications, refer to Service Information, group 20.