SCANIA

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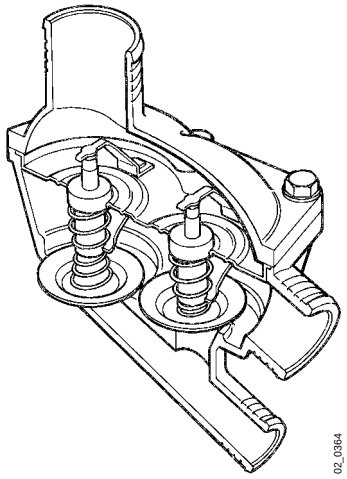
Issue 2 **en**

Cooling system

Description of operation



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Contents

General

The cooling system maintains the working temperature of the engine at the right level, which is of major importance for its operating economy and service life.

The cooling system operates at overpressure, which raises the boiling point of the coolant.

In order to attain working temperaturequickly and maintain it at the correct level, the system is thermostat controlled. Surplus heat is dissipated in a radiator through which air flows. The air flow is created by a fan driven by a hydraulic motor. A hydraulic pump, the flow rate of which varies with the temperature of the coolant, causes the fan to increase and decrease the flow of air through the radiator as necessitated by cooling requirements.

The system’s surplus heat is used for heating the driver and passenger areas.

Coolant system

1 Engine

2 Coolant pump

3 Drain union

4 Line for static pressure

5 Expansion tank

6 Engine venting

7 Thermostatic valve for controlling fan speed

8 Radiator venting

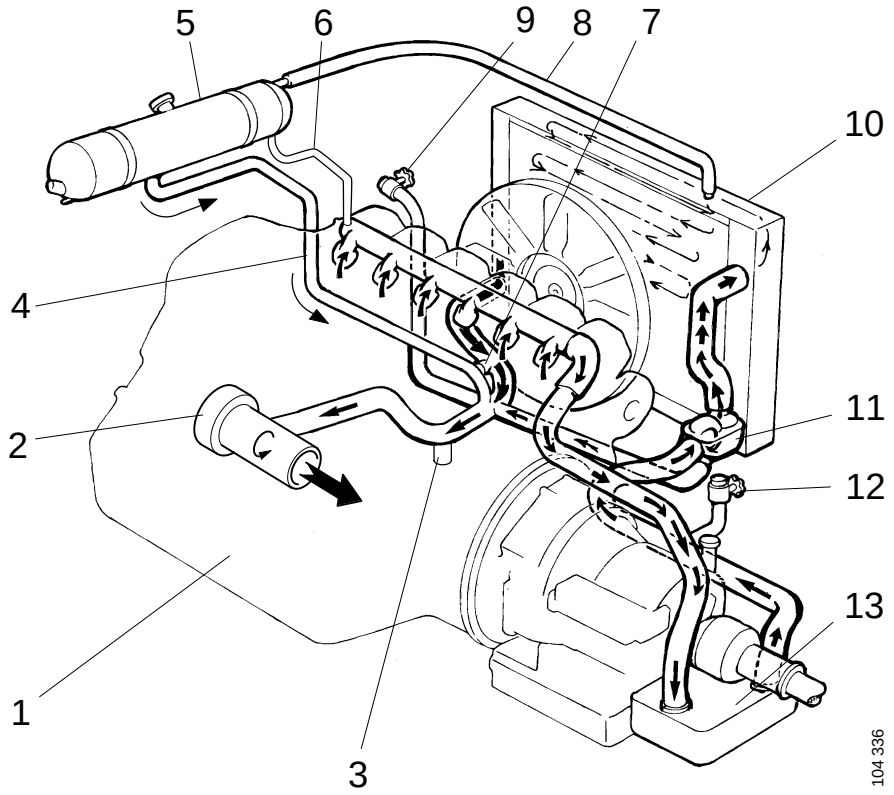
9 Return from bus heating circuit

10 Radiator

11 Thermostat housing

12 Outlet for bus heating circuit

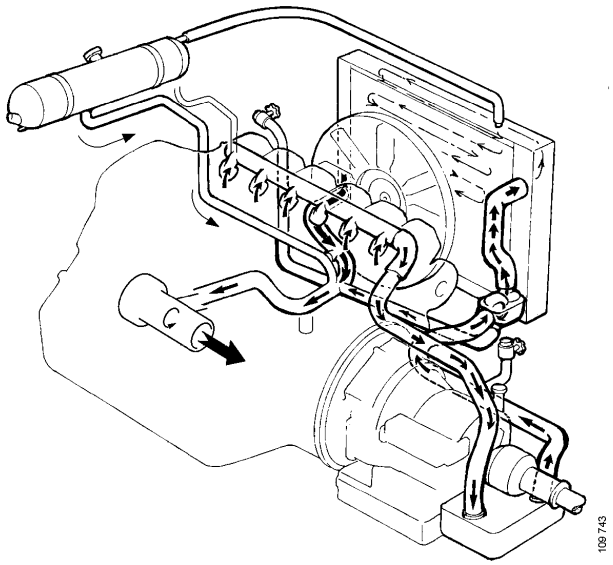
13 Cooler for the gearbox



Circulation in 9-series engine for K and L buses

The coolant pump forces coolant through the oil cooler and into the cylinder block. The coolant flows on through holes in the cylinder block, passes round the cylinder liners and flows on up in the cylinder heads.

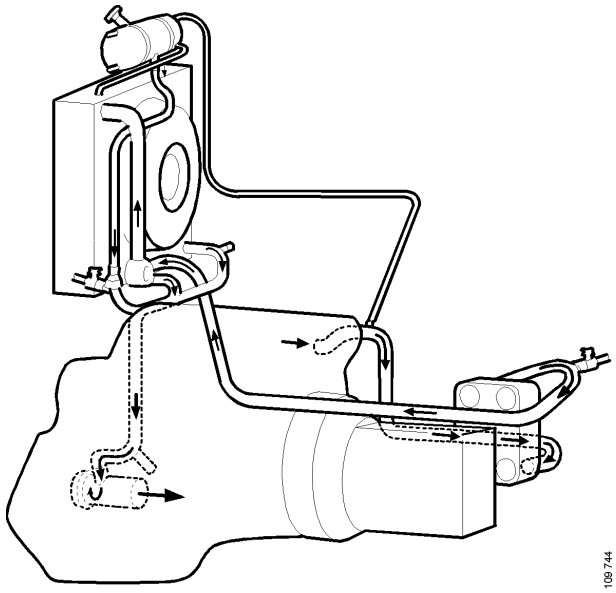
Coolant from the cylinder heads is collected in a pipe which carries it to an oil cooler for the gearbox and retarder, if fitted, and on to the thermostat housing, the radiator and back to the pump.



Circulation in 9-series engine for N bus

The coolant pump forces coolant through the oil cooler and into the cylinder block. The coolant flows on through holes in the cylinder block, passes round the cylinder liners and flows on up in the cylinder heads.

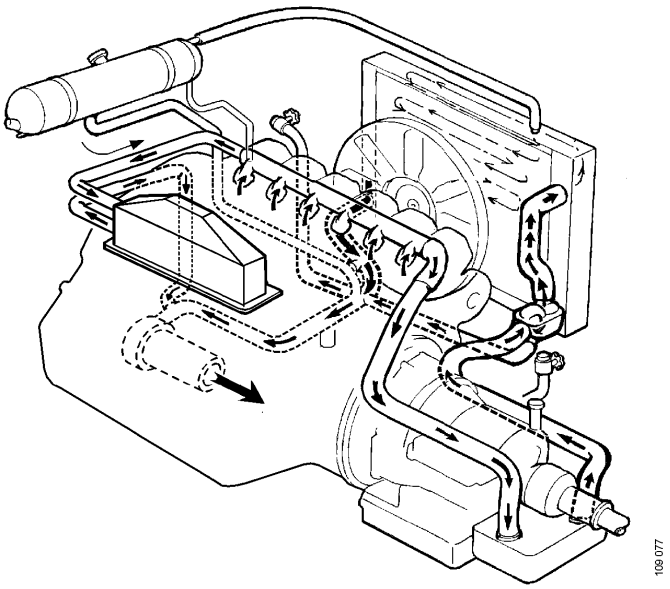
Coolant from the cylinder heads is collected in a pipe which carries it to an oil cooler for the gearbox and retarder, if fitted, and on to the thermostat housing, the radiator and back to the pump.



Circulation in 9-litre ethanol engine for L bus

The coolant pump forces coolant through the oil cooler and into the cylinder block. The coolant flows on through holes in the cylinder block, passes round the cylinder liners and flows on up in the cylinder heads.

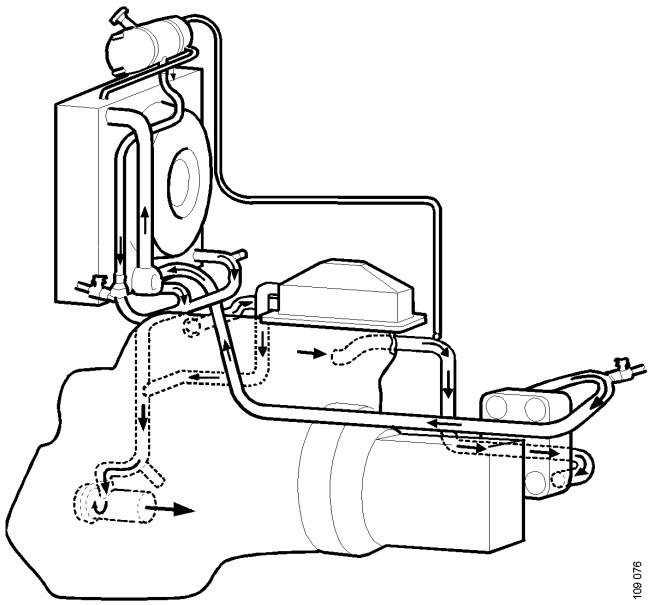
From there the coolant is collected in a pipe where some of it is diverted to the charge air cooler. The remainder goes to the oil cooler for the gearbox and retarder, if fitted, and on to the thermostat housing, the radiator and back to the pump.



Circulation in 9-litre ethanol engine for N bus

The coolant pump forces coolant through the oil cooler and into the cylinder block. The coolant flows on through holes in the cylinder block, passes round the cylinder liners and flows on up in the cylinder heads.

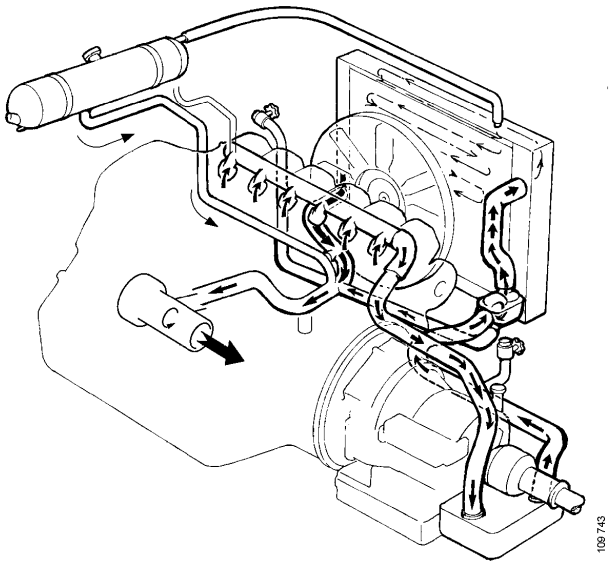
The coolant is then collected in a pipe from which some of it goes to the charge air cooler and back to the pump. The remainder goes to the oil cooler for the gearbox and retarder, if fitted, and on to the thermostat housing, the radiator and back to the pump.



Circulation in 12-series engines

The coolant pump forces coolant into the longitudinal distribution channel in the cylinder block. Coolant passes through the oil cooler and on through holes in the cylinder block, flows around the cylinder liners and then flows up into the cylinder heads.

Coolant from the cylinder heads is collected in a pipe which carries it to an oil cooler for the gearbox and retarder, if fitted, and on to the thermostat housing, the radiator and back to the pump.



Thermostat

The purpose of the thermostat is to keep the coolantentering the engine at the right working temperature. It does this by passing the coolant through or past the radiator to the coolant pump.

Cold engine

When the temperature of the coolant is below the thermostat's opening temperature, the coolant circulates via a line carrying it past the radiator so that the engine will warm up quickly.

Hot engine

When the coolant has reached working temperature the thermostat opens and the coolant starts to circulate through the radiator. The thermostat then regulates the working temperatureof the engine by allowing a smaller or larger proportion of the coolant to pass through the radiator, depending on the heat surplus.

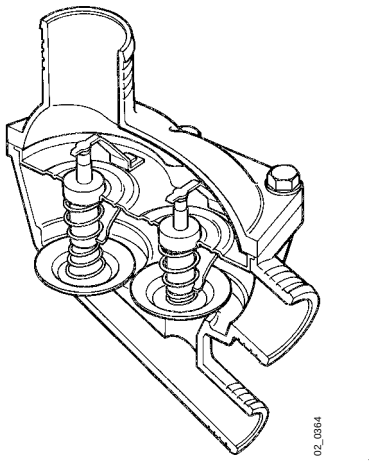
Radiator

The radiator consists of two tanks joined by a core of cells.

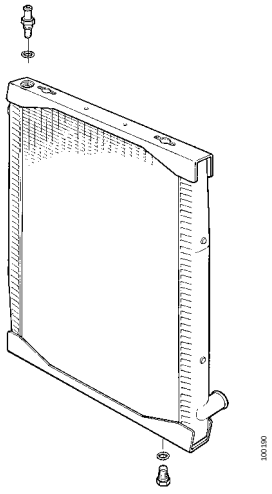
The core is constructed of rows of thinwall aluminium tubes between which is mounted thin corrugated aluminium sheet to ensure optimal heat dissipation.

The radiator inlet is connected to the thermostat housing and the outlet to the suction side of the coolant pump.

The radiator is mounted together with the charge air cooler and hydraulic fluid cooler. The radiator assembly is attached to the chassis at four points by means of vibration isolators.



Thermostat housing with thermostat



Coolant radiator

Radiator fan

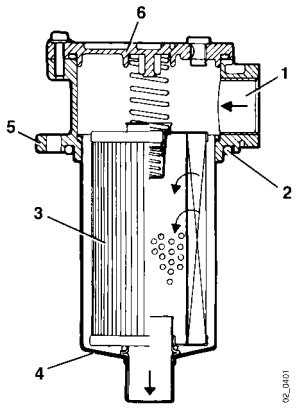
The radiator fan is driven by a hydraulic motor. The system consists of a hydraulic motor, oil cooler, return filter, fluid reservoir, pump and a control circuit for regulating pump flow and with it the fan speed.

The reservoir has a filler pipe for fluid and a venting outlet with filter. Attached to the filler cap is a dipstick for checking the fluid level.

The oil filter is of full-flow type with an integral by-pass valve. It is fitted inside the reservoir.

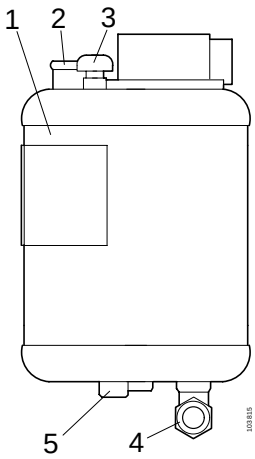
The hydraulic pump is mounted in the engine's power take-off. It is a variable piston pump the swept volume of which, and thus the flow rate, is regulated by a control circuit. The fan is mounted on the shaft of the hydraulic motor. The fluid is carried from the motor through a cooler, then back to the filter and tank,

The control circuit regulates the pump flow by means of a thermostatic valve in the coolant flow and a compensator on the pump. Fluid pressure for the circuit is obtained from the delivery side of the pump where a T-union with integral restriction is fitted. One connection on the T-union goes to the pump's compensator and the other to the thermostatic valve. After the thermostatic valve the fluid passes into the system's return line.



Return filter

1 *Return connection*
2 *O-ring*
3 *Filter element*
4 *Filter retainer*
5 *Housing*
6 *Cover*



Hydraulic fluid reservoir

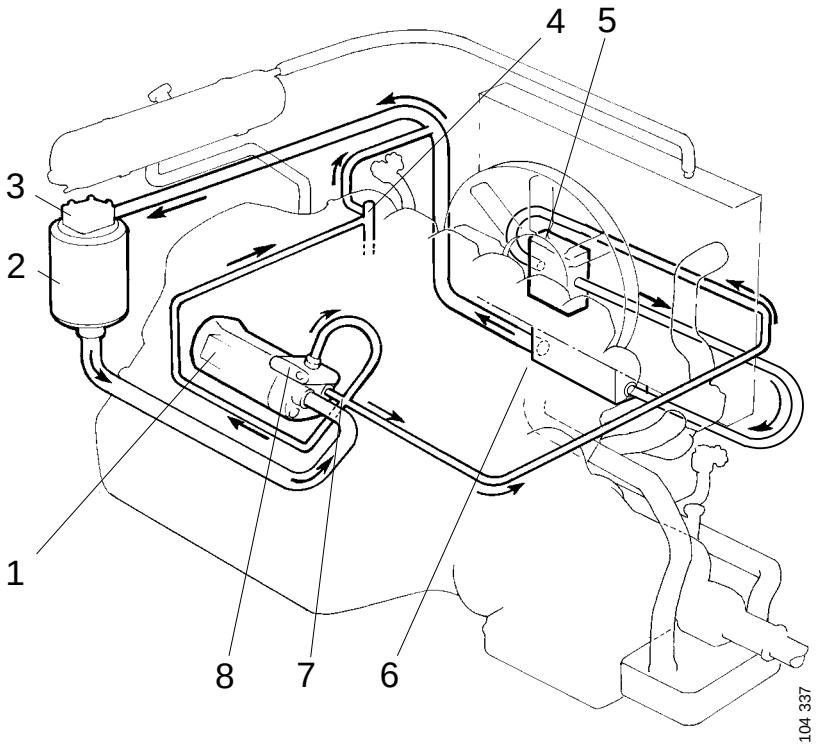
1 *Hydraulic fluid reservoir*
2 *Filler cap with dipstick*
3 *Air filter*
4 *Suction pipe*
5 *Drain plug*

Cold engine

While the temperature of the coolant is low, the thermostatic valve in the hydraulic system will remain open. This results in low fluid pressure in the control circuit, a low flow rate from the hydraulic pump and low fan motor speed. When the thermostatic valve is fully open the fan motor runs at 500-600 rpm, regardless of the speed of the bus engine.

Hot engine

When the temperature of the coolant after the radiator reaches 76˚C, the thermostatic valve in the hydraulic system will start to close. This causes the pressure in the control circuit to increase and with it the flow rate from the hydraulic pump and thus the speed of the fan. When the thermostatic valve is fully closed, the fluid pressure from the pump is at a maximum (135 bar), giving a fan motor speed of 1800-2000 rpm at a minimum bus engine speed of 1800 rpm.



The fan's hydraulic fluid system.

1 Hydraulic pump

2 Tank

3 Filter

4 Thermostatic valve

5 Fan motor

6 Fluid cooler

7 T-union

8 Compensator

There are variants with different locations of the hydraulic pump and hydraulic fluid reservoir.

Expansion tank

When it is heated, the coolant expands. An expansion tank, which also serves to vent the cooling system, is fitted in the system to cope with this increase in volume.

The expansion tank is located above the highest point on the radiator and engine. It is fitted with a filler cap.

The cap opens at an overpressure of 0.75 bar.

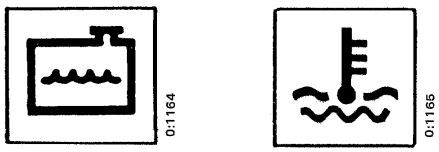
Two venting pipes are connected to the tank. One comes from the engine and the other from the radiator.

At the bottom of the tank a pipe is connected to the suction side of the coolant pump. The water column in the pipe exerts static pressure on the pump to reduce the risk of cavitation damage.

Level and temperature alarm

A level sensor is fitted in the pipe for coolant pump static pressure. This sensor is located above the engine's highest point. If leakage occurs it sends a signal to a warning lamp on the dashboard.

A temperature sensor is fitted in the coolant collecting pipe adjacent to the cylinder heads. If the temperature of the coolant becomes too high it sends a signal to a warning lamp on the dashboard.



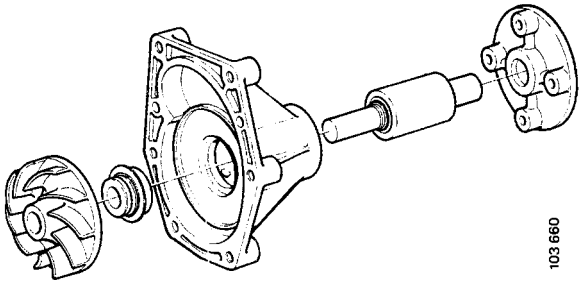
Level and temperature alarm

Coolant pump, 9-series engine

The coolant pump is mounted on the engine and is driven by a belt from the crankshaft pulley.

The pump is of centrifugal type and consists of a pump housing, pump cover and a shaft with impeller. The shaft runs in the pump cover and is lubricated for life.

The shaft bearing is sealed against the coolant by means of a sprung seal.

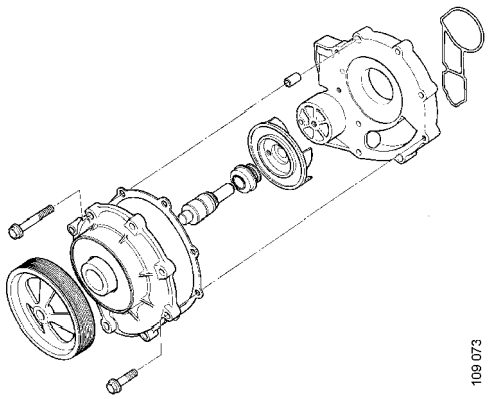


Coolant pump, 12-series engine

The coolant pump on the engine is driven by a multigroove belt from the crankshaft pulley.

The pump is of centrifugal type and consists of a spiral shaped pump housing with an impeller directly mounted on the drive shaft. The shaft is mounted in the housing and is permanently lubricated.

The pump shaft bearing is sealed against coolant by a sprung axial seal.



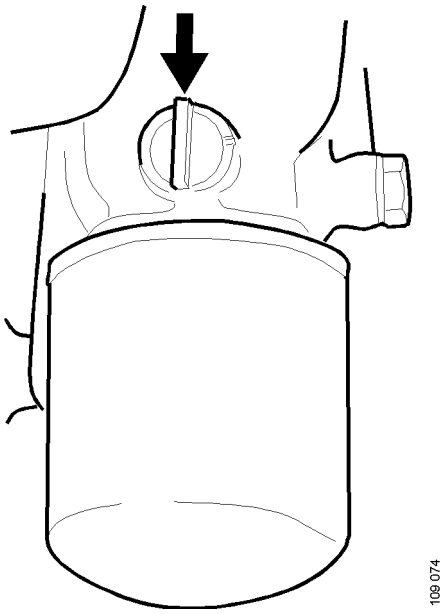
Coolant filter

The cooling system is equipped with a filter that cleans the coolant and supplies it with corrosion inhibitor.

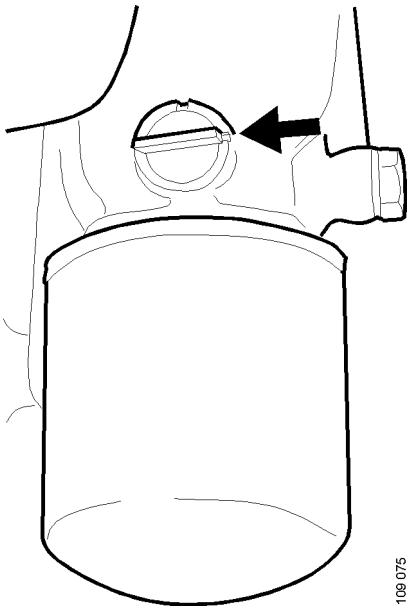
The filter consists of an outer casing, filter element and corrosion inhibitor.

Coolant flows into the filter, through the corrosion inhibitor which dissolves in the coolant, and then out into the cooling system, protecting the engine against corrosion.

A shut-off valve is provided for changing the filter.



Coolant filter with open valve.



Coolant filter with closed valve.

Charge air cooler

Scania’s turbocharged engines are equipped with charge air cooling. Charge air cooling for DSC engines is described here.

The power that can be provided by an engine is to some extent determined by the quantity of fuel that can be efficiently burned in the engine.

Colder air is denser and contains more oxygen per unit volume than heated air. The temperature of the intake air rises when it passes the turbocharger. If the air is then cooled, its density increases (density of the air) and more oxygen is supplied to the engine. This enables more fuel to be burnt.

This gives higher output, lower fuel consumption, lower emissions and higher torque. The cooled air lowers the combustion temperature and the temperature of the parts affected by combustion, giving less thermal stress and increased output.

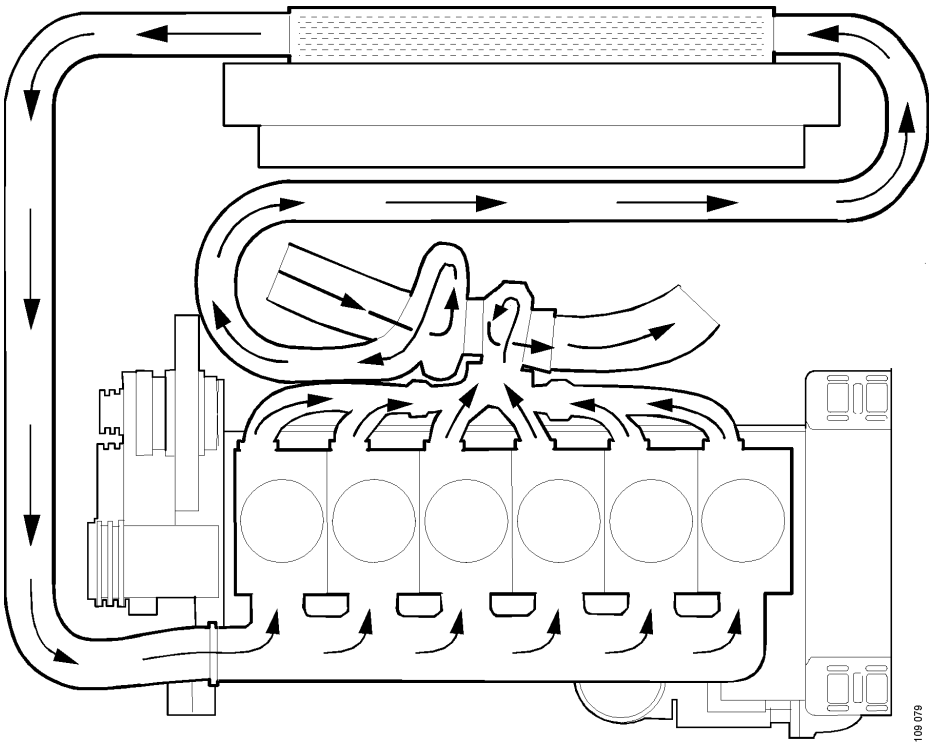
Cooler location

The charge air cooler is bolted to the same radiator assembly as the coolant radiator and the cooler for the fan drive hydraulic fluid.

Intake system

The intake system incorporates pipes which carry the air after the turbocharger up to the charge air cooler, which is located in front of the engine’s coolant radiator. The charge air is cooled by the airflow which then passes the engine’s coolant radiator. After cooling, the intake air is directed to the intake manifold which distributes the air to the cylinders.

Flow of charge air through the 9-series engine



Flow of charge air through the 12-series engine