



Service Information

2013 Technik Introduction

Cayenne Diesel (92A)

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The successful Cayenne model line is set to welcome a diesel version with the launch of the new Cayenne Diesel in 08/2012. This offer of a powerful and efficient 3.0 l V6 turbo diesel engine makes the Cayenne the first diesel in a Porsche we have offered on the North American market. The Cayenne Diesel thus follows on from the successful market launch of Porsche's first diesel vehicle in 2009.

With the Cayenne Diesel, this strategy is primarily designed to take account of the trend of reducing fuel consumption and emissions without negating performance as a core brand value. In Europe, the Cayenne diesel is a solid component of the Cayenne model range because of the high demand since 2009. Also in the North American market, a distinct increase in sales of diesel models is noticeable besides the general trend of downsizing and hybrid vehicles in the SUV segment.

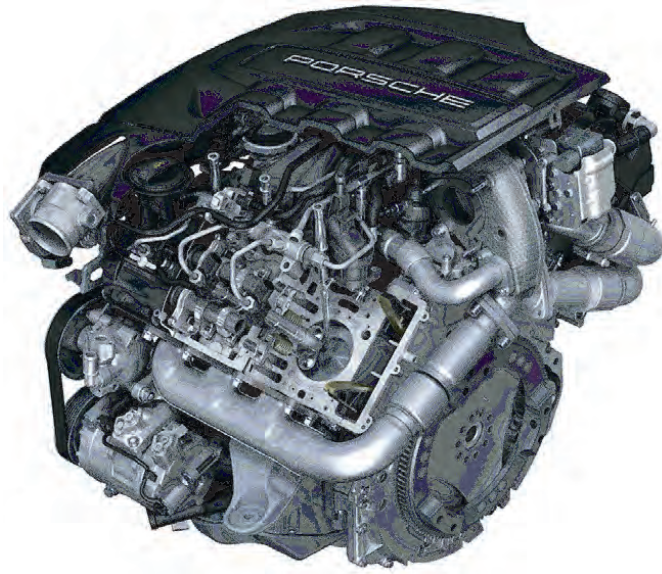
With the use of the turbo diesel engine in the Cayenne, the consumption in the US-Combined is 23 mpg. Together with the standard 26 gallon tank, this results in a maximum range of approx. 600 miles. The low fuel consumption and the associated economy of the Cayenne Diesel are above all an argument for drivers with a high annual mileage, particularly in view of rising fuel costs. The smaller displacement and the lower fuel consumption in comparison to the previous base engines of the Cayenne series do not mean compromises when it comes to sportiness. This is demonstrated by the high torque (max. 406 lb-ft), performance that will take the car from 0-60 mph in 7.2 s and a top speed of 135 mph.

Contents

- 1 **Engine**
- 2 **Fuel, Exhaust and Engine Electrical**
- 3 **Transmission**



Technical data is intended to provide an overview only. As it is subject to change during the course of the model year, refer to the Workshop Manual for up-to-date technical data.



Subject	Page
Cayenne 3.0 I V6 TDI Engine	.2
Technical Features	.2
Full Load Curve	.3
Technical Data	.3
Engine Block	.4
Crankshaft Assembly	.5
Chain Drive	.6
Cylinder Head	.7
Tooth Backlash Compensation on the Spur Gears	.8
Oil Circuit	.9
Oil Pump	.10
Engine Oil Cooler	.11
Cooling System/Thermal Management	.12
Thermal Management System	.13
Cooling System Operation Modes	.15
ATF Heat Exchanger	.17

Engine

Cayenne 3.0 I V6 TDI Engine

General Information



The Cayenne models represent the union of sportiness, day-to-day usability and off-road performance in a premium SUV. For the Cayenne Diesel to be added to the range of successful Cayenne models, the engine chosen for the Cayenne Diesel would have to meet very high requirements.

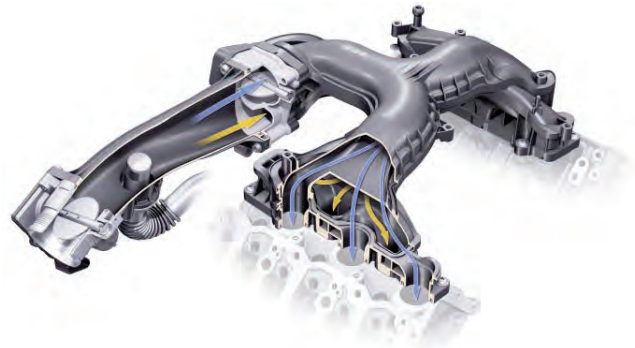
The following points were critical factors in the selection of the 3.0 I turbo diesel:

- High specific engine power with high engine torque
- Compact construction of the engine for low weight
- Low fuel consumption and low exhaust emissions
- Best engine acoustics and low vibrations for a smooth engine operating cycle.

The V6 turbo diesel engine of the Cayenne Diesel unites all the design features of modern diesel engines:

- Common rail injection system
- Piezo-controlled fuel injectors
- Turbocharger featuring variable turbine geometry with charge-air cooling
- Four-valve technology
- Throttle valve and intake port with swirl flap
- Efficient pre-glow system
- Modern engine management

Technical Features



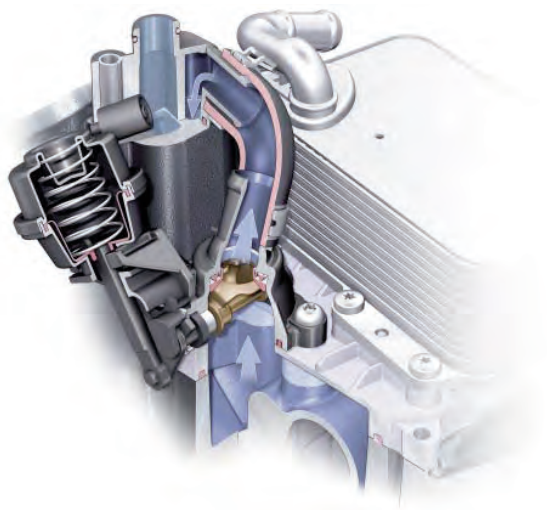
Intake manifold with a single swirl flap



Bosch CRS 3.3 Common Rail Injection System



Chain Drive



Thermal Management System

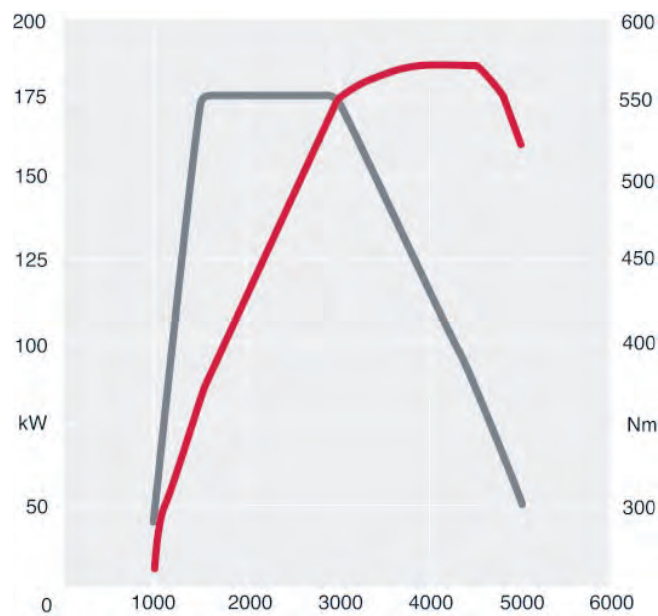


Turbocharger



Exhaust Gas Recirculation

Full Load Curve



— Power output in kW

— Torque in Nm

Technical Data

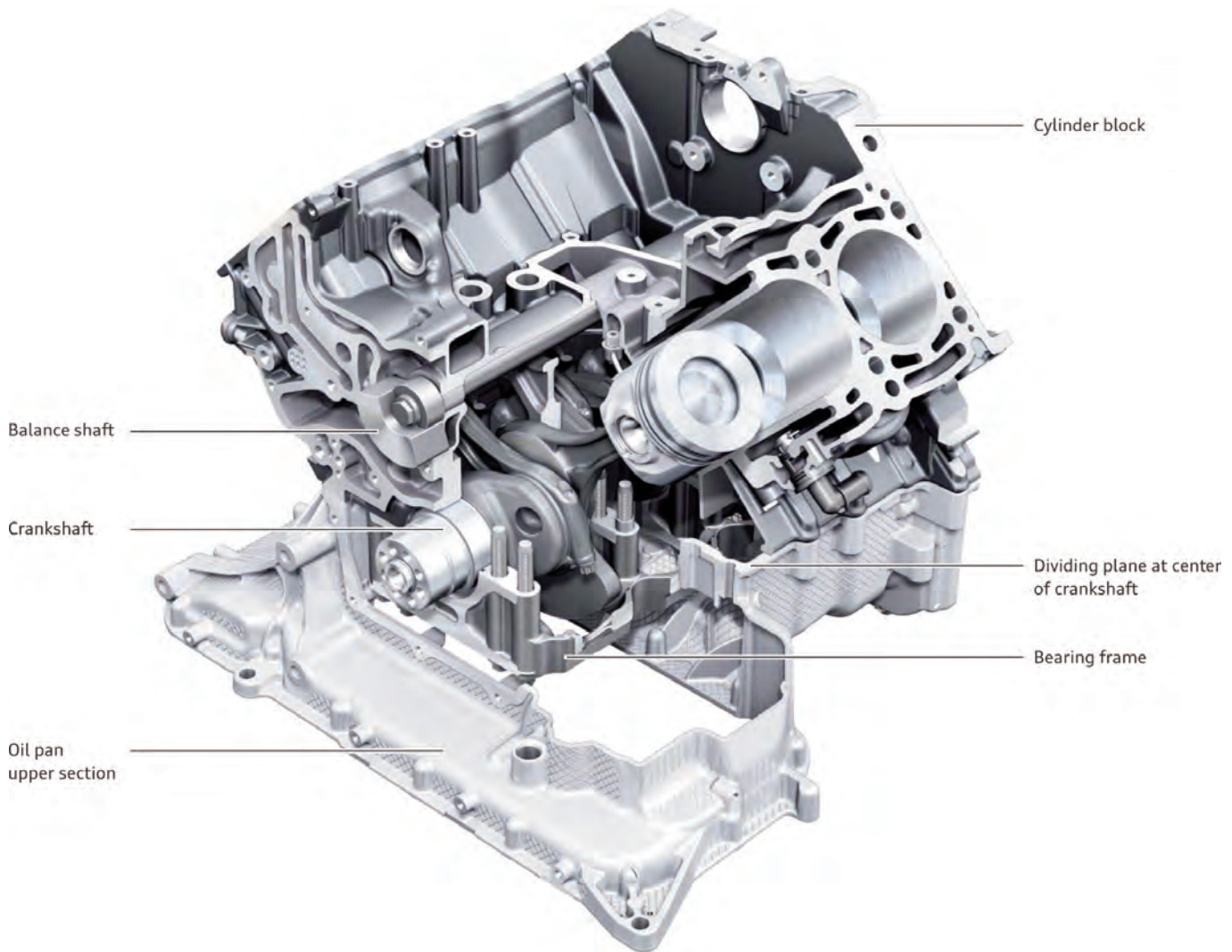
Engine code	CDTA
Type	Six cylinder V engine with 90° included angle
Displacement	2967 cm ³
Stroke	91.4 mm
Bore	83 mm
Cylinder spacing	90 mm
Number of valves per cylinder	..4
Firing order	1-4-3-6-2-5
Compression ratio	16.8 : 1
Power output at 4000 rpm	...247 hp (184 kW)
Torque at 1250 – 3000 rpm	..406 ft. lb. (550 nm)
Fuel	Diesel
Engine management	Bosch CRS 3.3

Engine

Engine Block

The cylinder block is made of compacted graphite cast iron (CGI), with its high strength and load capacity. To obtain the best possible cylinder shape, the cylinder block is plate honed. For this purpose, the mounted cylinder head is simulated during finish machining of the cylinder bores. The near perfectly round bore allows a substantial reduction in piston ring prestress, resulting in low blow-by values and less mechanical friction.

As the final stage of machining the cylinder bore, use is made of the UV photon exposure process. Therefore, a smooth cylinder surface is achieved without mechanical work by the piston.

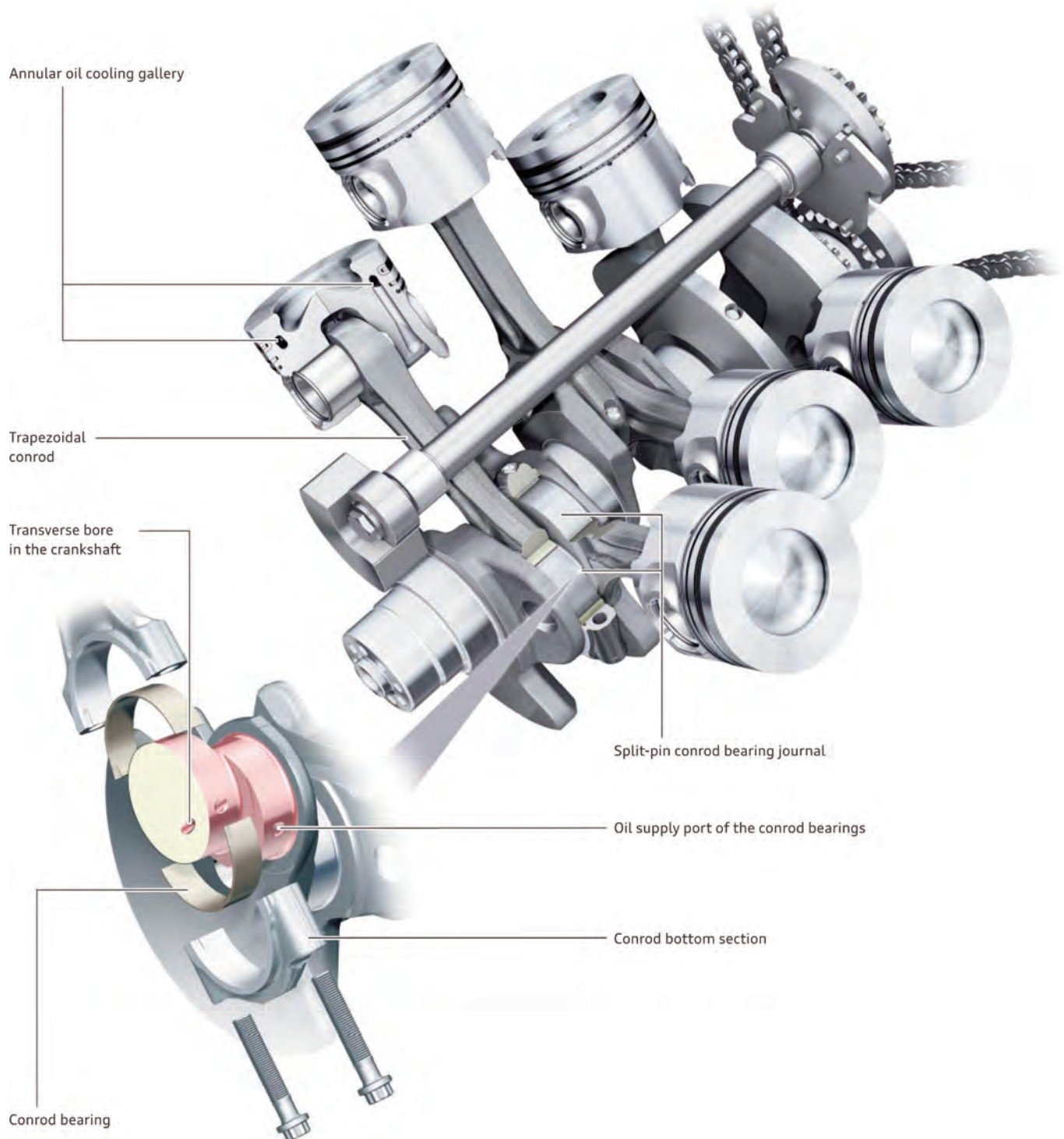


Notes:

Crankshaft Assembly

The forged 42 CrMoS4 crankshaft in the 90° V engine adopts a split-pin design to achieve identical firing intervals. Both the main and connecting rod bearing journals are induction hardened to provide mechanical strength, a special challenge being the split pin itself on account of the strong shear forces to which it is subjected.

Weight has been reduced by eliminating the center counterweights and by introducing main journal relief bores. The forged connecting rods are diagonally split. For optimal cooling of the recess rim and piston ring assembly at ignition pressures of up to about 2682 psi (185 bar) and, therefore, higher thermal load, the aluminum pistons have an annular cooling gallery and an oil spray cooling system.

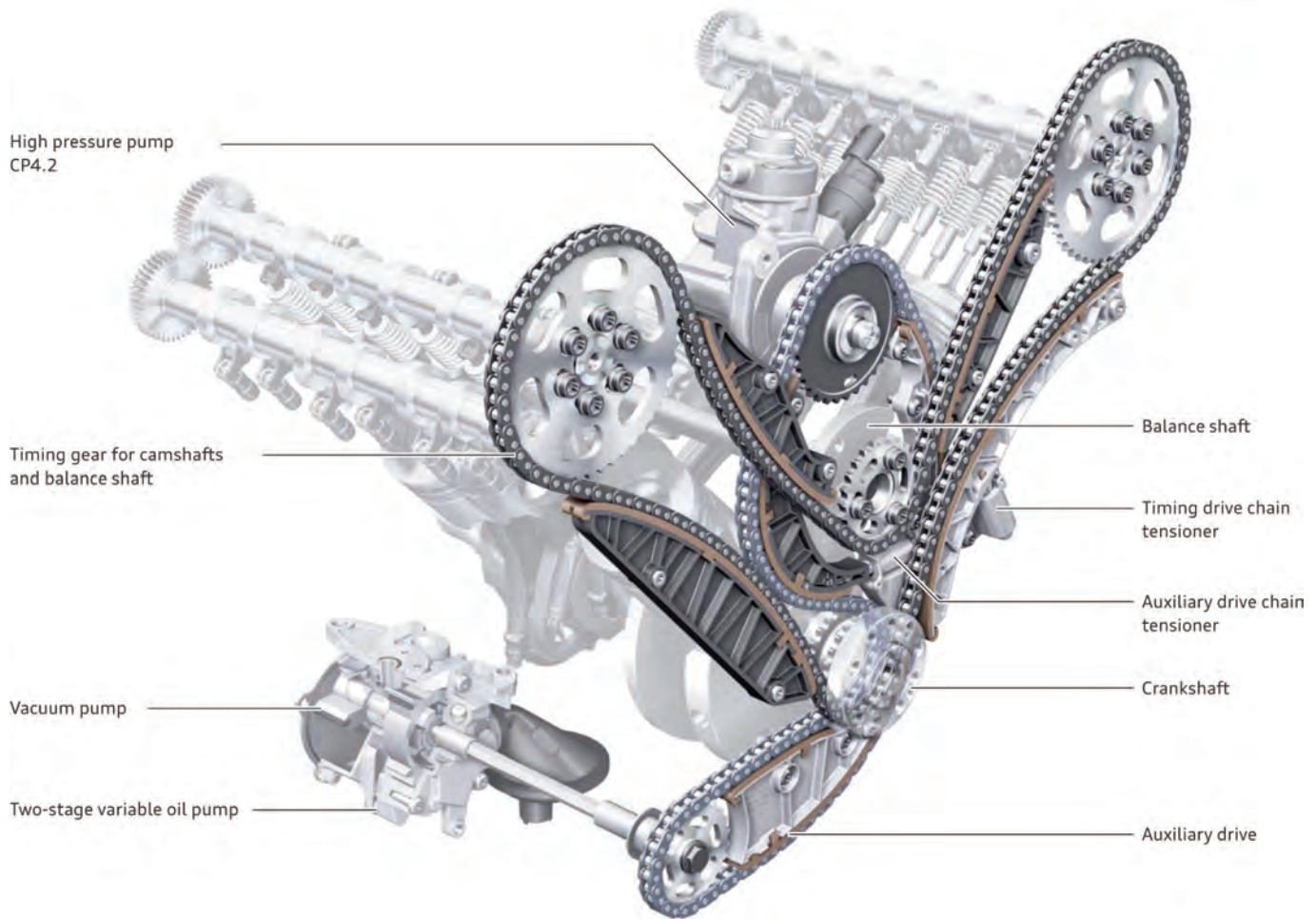


Engine

Chain Drive

One of the key features of the 3.0 I V6 Diesel engine is the double chain drive on the gearbox side. The chain layout has two chains and two chain tensioners and eliminates the need for idler sprockets. The timing gear uses a relatively long roller chain with 206 links to drive the twin intake camshafts and the balance shaft.

To counteract chain elongation over time in use, the chain pins have a wear-resistant coating. The auxiliary drive chain is also configured as a roller chain. It drives the high pressure injection pump in the rear inner vee and a combined oil and vacuum pump in a common housing.

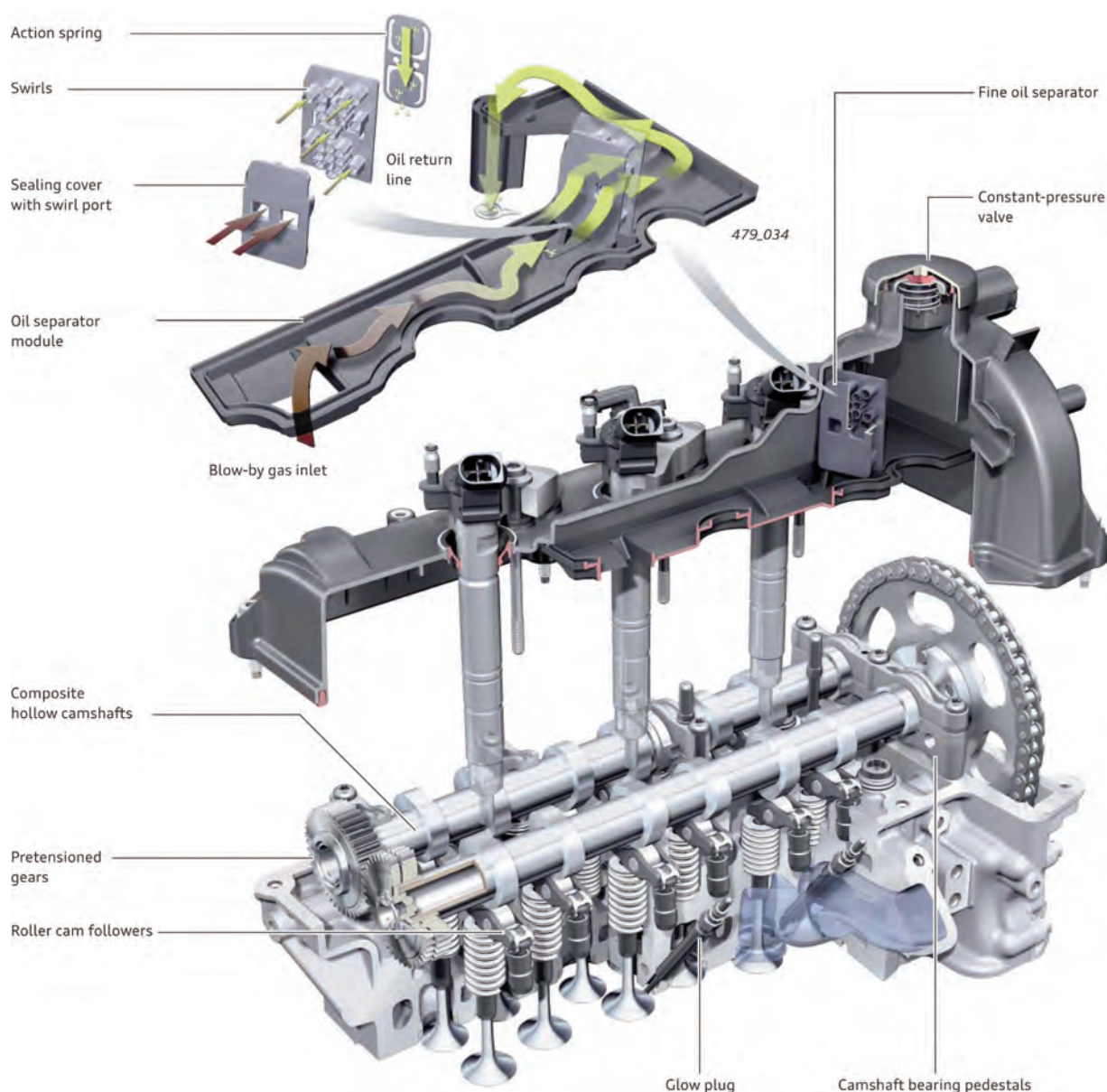


Notes:

Cylinder Head

The four-valve combustion system has tangential port and a charging port on the intake side as well as two exhaust ports merging into a Y-branch pipe. The intake ports are refined for enhanced swirl and through flow. The head cooling concept has been designed to reduce the component temperatures around the combustion chamber despite the increased power output. The exhaust valves size and placement are designed to reduce the coolant space. The cylinder head is designed for directional coolant flow with high flow rates and, thus, to ensure that optimal cooling is provided between the valves and the injector shaft in close proximity to the combustion chamber. Coolant is admitted on the exhaust side through three separate ports per cylinder.

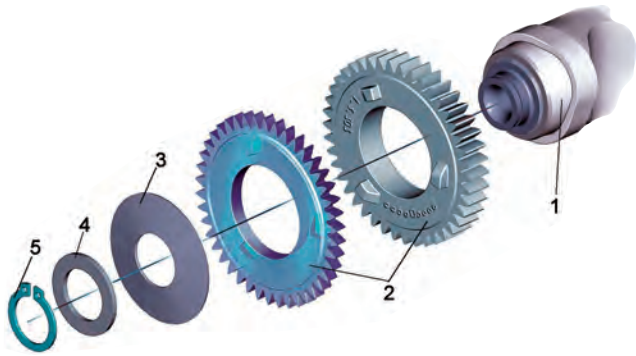
The main flow is directed between the exhaust valves and then distributed to the other valves. During assembly of the cylinder head, the composite hollow camshafts are mounted on the cylinder heads with split twin bearing pedestals in place of a ladder frame. This assembly sequence enables the camshafts to be designed without special clearances for fitting the cylinder head bolts while allowing the camshafts to be positioned very close together. To minimize friction in the valve gear, the diameter of the camshaft bearings is 24 mm. The crankcase ventilation system is in the cylinder head covers together with the coarse and fine oil separators. Both crankcase vents lead to the pressure control valve and from there to the intake side of the turbocharger.



Engine

Tooth Backlash Compensation on the Spur Gears

Design



- 1 Camshaft
- 2 Spur gears
- 3 Cup spring
- 4 Spacer
- 5 Snap ring

Purpose

The two-piece spur gears compensate the tooth backlash from the intake and exhaust camshaft in the two cylinder heads. The advantages are that the spur gears lock into each other quietly and there is less wear on the tooth flanks.

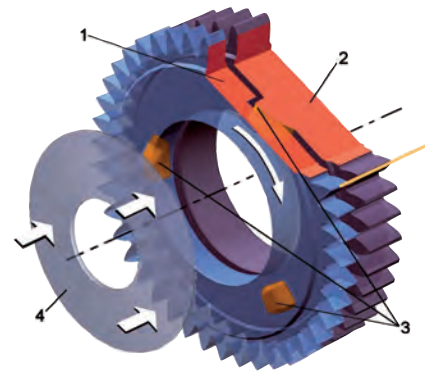
Description

In order to compensate the tooth backlash between the intake and exhaust camshaft in each cylinder bank

- The intake camshaft spur gear in the right-hand cylinder head and
- The exhaust camshaft spur gear in the left-hand cylinder head

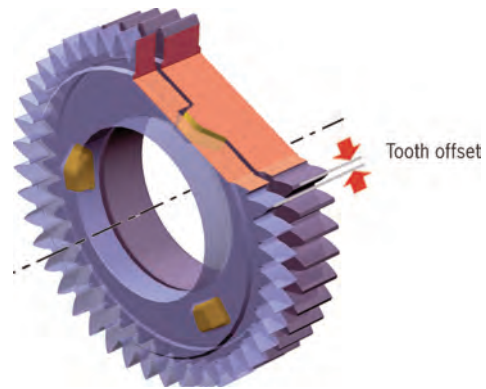
consist of two parts.

The exhaust camshaft is driven by the intake camshaft. The wider part is fixed securely onto the camshaft. There are 3 ramps on the front.



- 1 Moveable spur gear
- 2 Spur gear fixed to the camshaft
- 3 Ramps
- 4 Cup spring

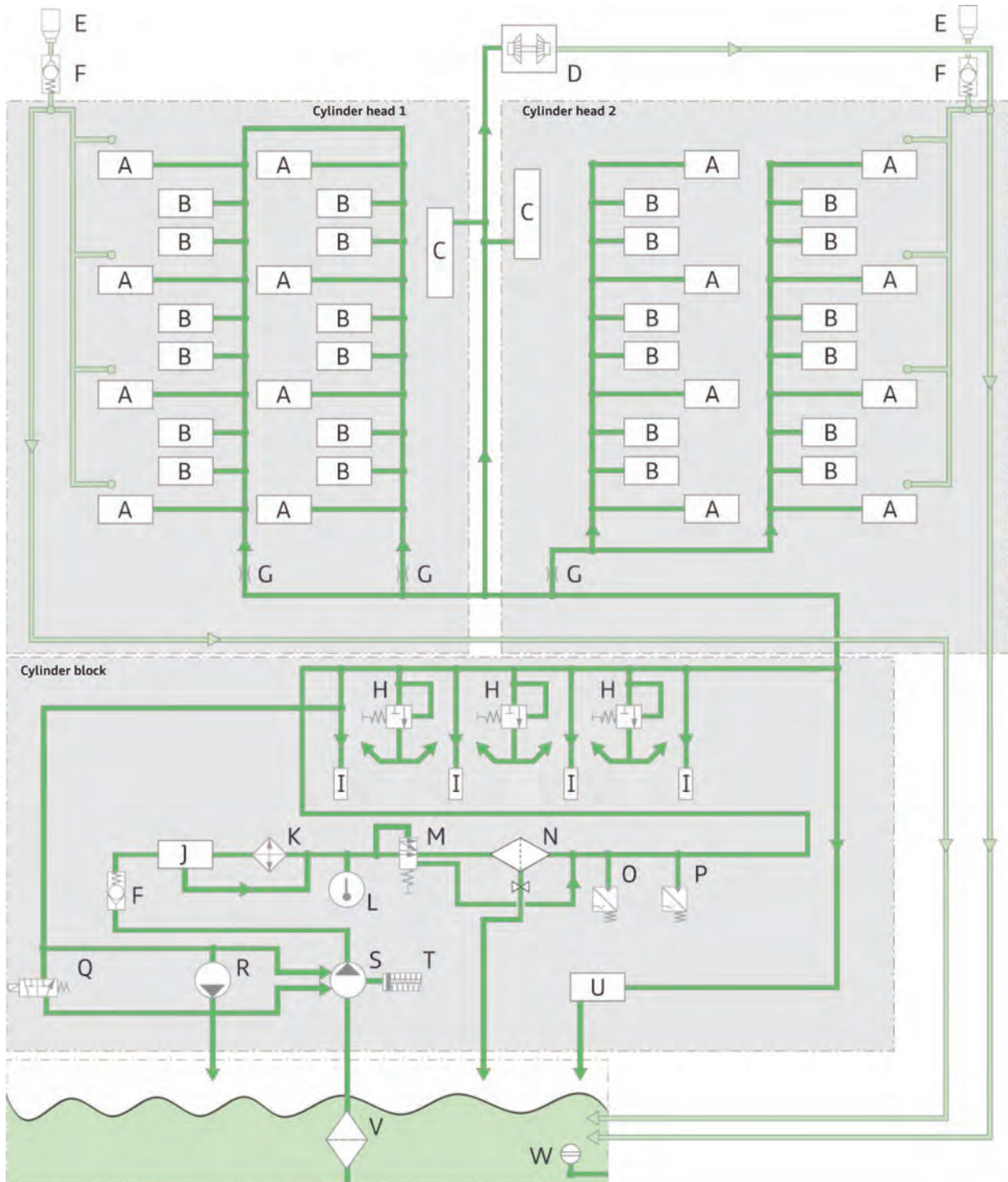
The narrow part of the spur gear can move on a radial and axial plane. Cut-outs are located on the back, which provide the space needed for the ramps on the stationary part. The force from a cup spring pushes the two parts of the spur gear together.



Function

The sloping shape of the ramps causes the two spur gear halves to rotate in opposite directions. The rotating movement means that the teeth of the two spur gear parts become offset, therefore producing the tooth backlash compensation between the gear wheels of the intake and exhaust camshafts.

Oil Circuit

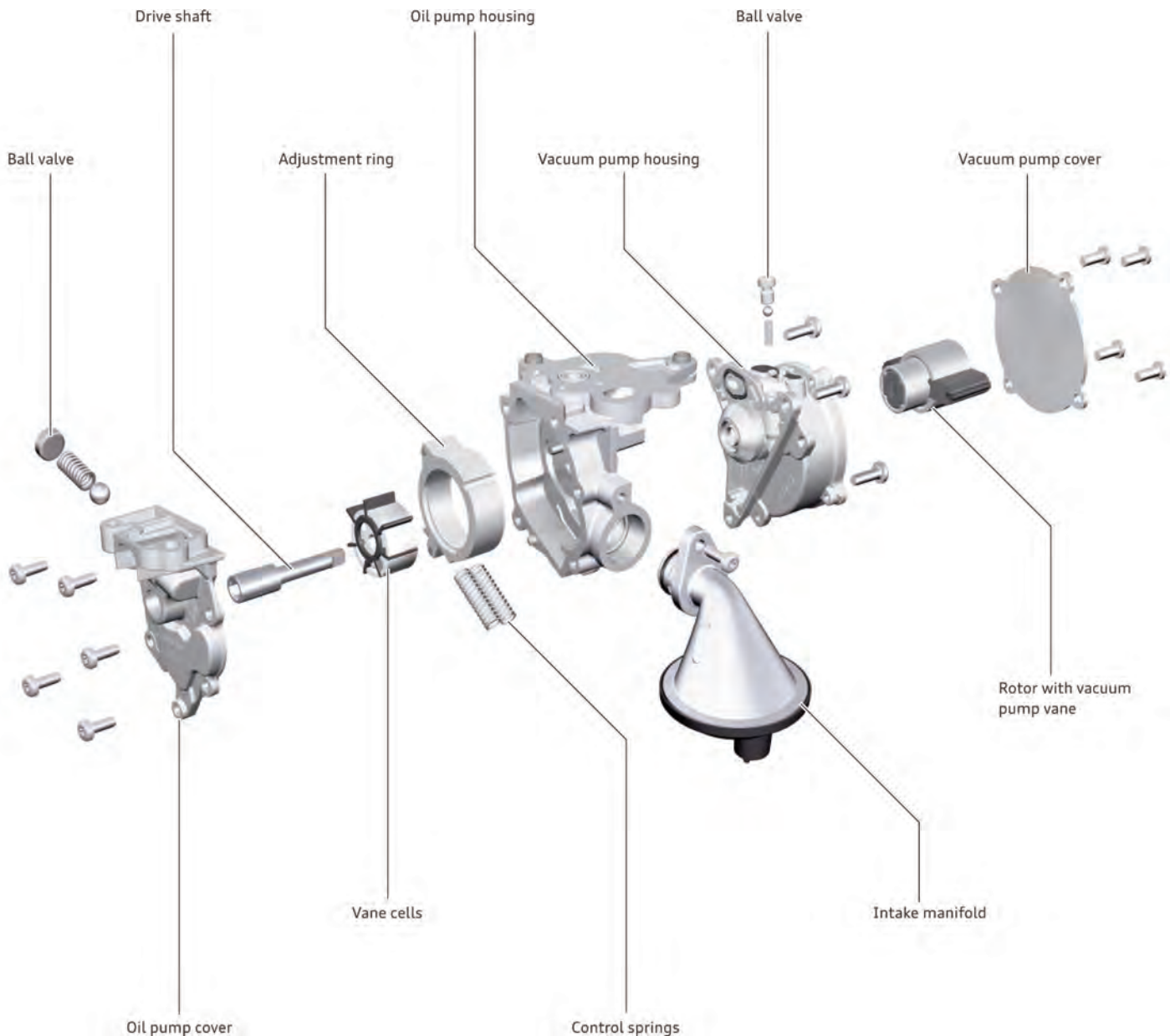


- | | | |
|---|---|-------------------------------------|
| A. Camshaft bearing | J. Thermostat | R. Vacuum pump |
| B. Balancer elements | K. Water-oil heat exchanger | S. Oil pump |
| C. Chain tensioner | L. Oil temperature sender | T. Pressure relief valve |
| D. Exhaust turbocharger | M. Filter bypass valve | U. Oil pump drive gear bearing bolt |
| E. Oil spray separator | N. Oil filter | V. Intake screw |
| F. Non-return valve | O. Oil pressure switch for reduced oil pressure | W. Oil level sensor |
| G. Flow restrictor | P. Oil pressure switch | |
| H. Injection nozzles with integrated valves | Q. Solenoid valve | |
| I. Main bearing | | |

Engine

Oil Pump With Integral Vacuum Pump

Oil is pumped by a vane-cell pump; its delivery characteristic can be adjusted via a pivoting adjustment ring. The result is a volumetric flow control system which helps to reduce the amount of drive power required depending on engine load. The lower pressure level is activated up to a maximum engine speed of 2500 rpm, depending on engine load, oil temperature and other operating parameters. In the vacuum pump, vacuum is delivered by a rotor with flexible vanes.



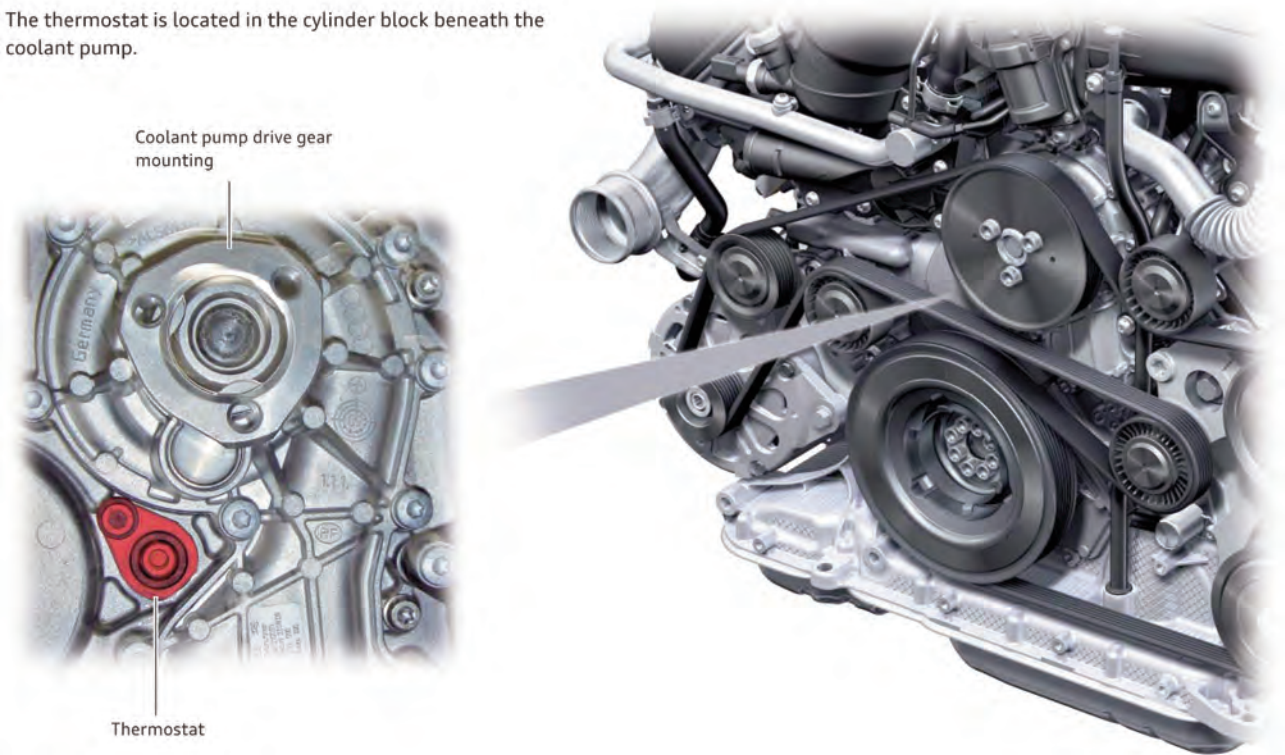
Notes:

Engine Oil Cooler With Thermostat-controlled Bypass Port

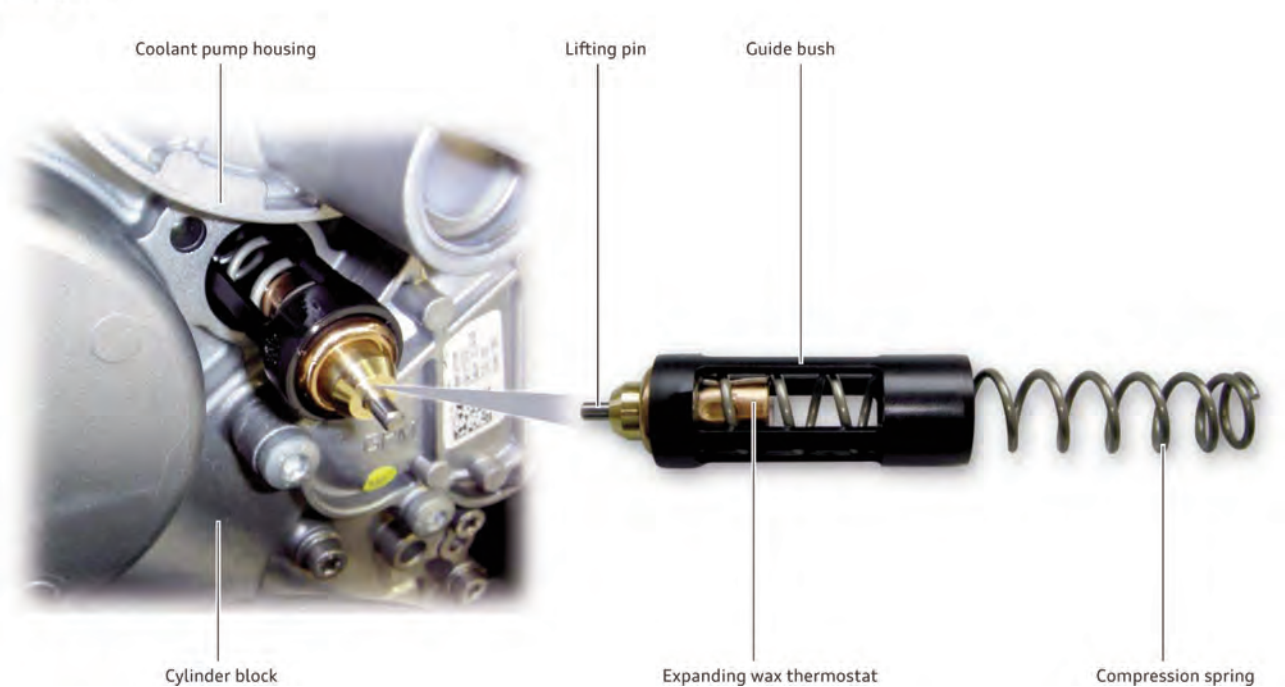
To assist the Thermal Management system, an oil cooler bypass is integrated in engine oil cooler on the oil side. A wax expansion element opens a bypass port at oil temperatures of below 217° F. (103° C.). The main volumetric flow oil bypasses the engine oil cooler.

Installation location

The thermostat is located in the cylinder block beneath the coolant pump.

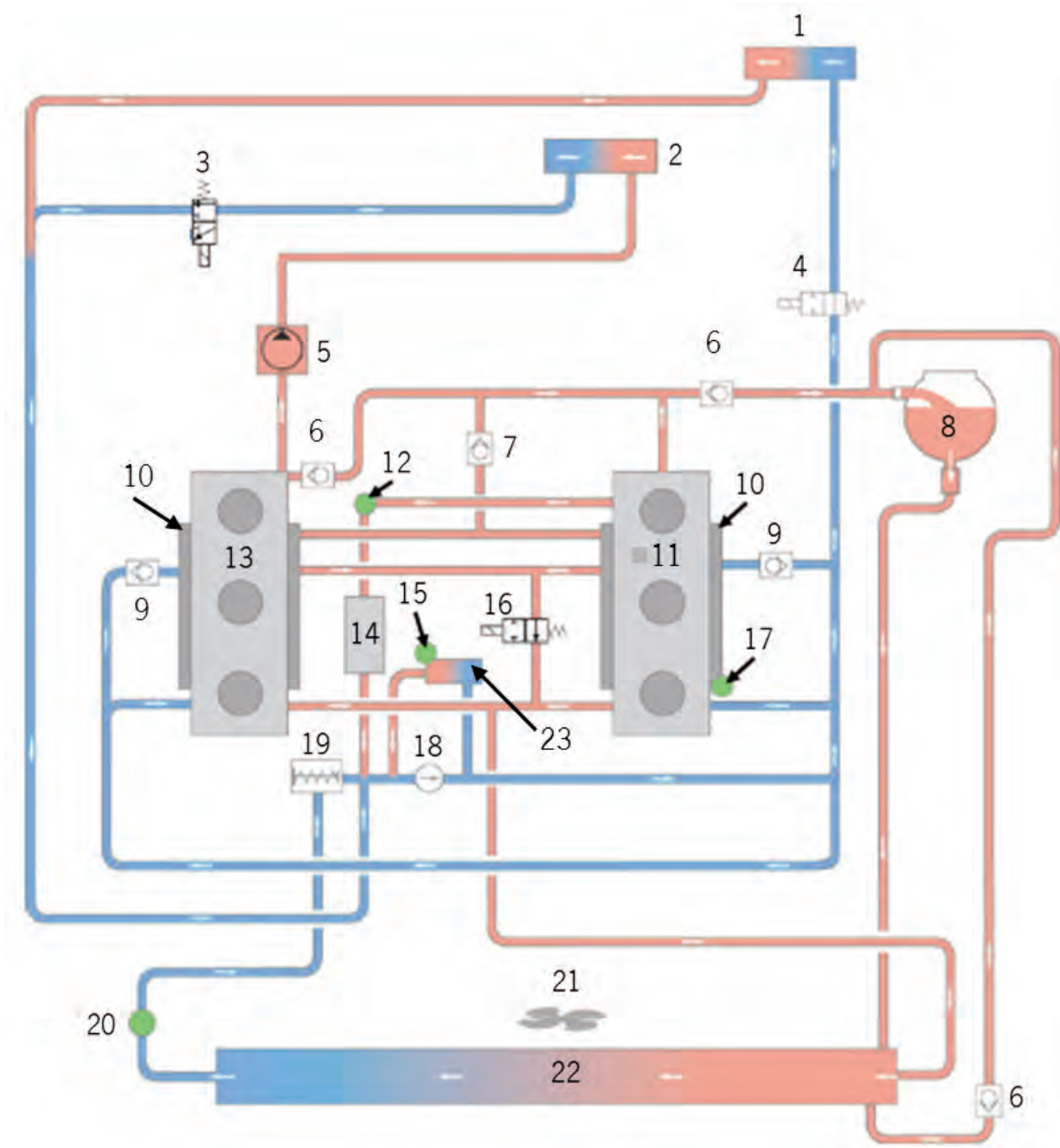


Design



Engine

Cooling System/Thermal Management



- 1 - ATF heat exchanger
- 2 - Heat exchanger
- 3 - Switch-over valve for auxiliary heating mode
- 4 - Shut-off valve for ATF heat exchanger
- 5 - Electric coolant pump for heat exchanger
- 6 - Check valve
- 7 - Check/bleeder valve
- 8 - Coolant expansion tank
- 9 - Check valve
- 10 - Engine block
- 11 - Cylinder head, bank 2
- 12 - DME coolant temperature sensor
- 13 - Cylinder head, bank 1

- 14 - EGR cooler
- 15 - Engine oil temp
- 16 - Coolant shut-off valve
- 17 - Coolant temperature sensor for thermal management
- 18 - Mechanical coolant pump
- 19 - Map-controlled thermostat
- 20 - Coolant temperature sensor, radiator outlet
- 21 - Radiator fan
- 22 - Coolant radiator
- 23 - Oil cooler

Thermal Management System

Diesel engines reach the required operating temperature more slowly than gasoline engines. Less heat is lost during combustion of the fuel in the combustion chambers than with gasoline engines for the specific aim of achieving low fuel consumption when the engine is at operating temperature. Getting the engine to warm up as quickly as possible offers huge additional fuel-saving potential.

The Cayenne Diesel is equipped with an extensive thermal management system that is new for Porsche to speed up with process. The modern thermal management system increases efficiency.

The increase in efficiency is achieved by

- getting the diesel engine to heat up as quickly as possible and
- having a coolant temperature in the engine block of 221° F (105° C) when the engine is at operating temperature.

The requirements for the cooling system have been realized by way of the following measures:

- Using a cooling system with split-cooling concept
- Using a PTC preheater in the climate control system

The concept also includes an engine oil-side oil cooler bypass that is switched via a thermostat in order to further boost fast warm-up.

Split Cooling Concept

A cooling system with split-cooling concept is used. To realize the objectives specified above, i.e. coolant flows through the cylinder block (10) and the cylinder heads (11, 13) in two parallel, separate cooling systems. The continuously running coolant pump (18) located at the front end of the inner V pumps the coolant in the cylinder block (10) to the exhaust outlet sides of the engine unit.



Cylinder head cooling



Cylinder block cooling

Here, the volume flow is divided up between the cylinder heads (11, 13) and cylinder block (10), before it flows back to the intake side of the coolant pump (18) after passing through the two part systems.

Engine

Cylinder Head Cooling

The cylinder head cooling system consists of:

- Coolant chambers of the two cylinder heads
- Engine oil and EGR cooler
- ATF heat exchanger
- Heat exchanger with PTC preheater

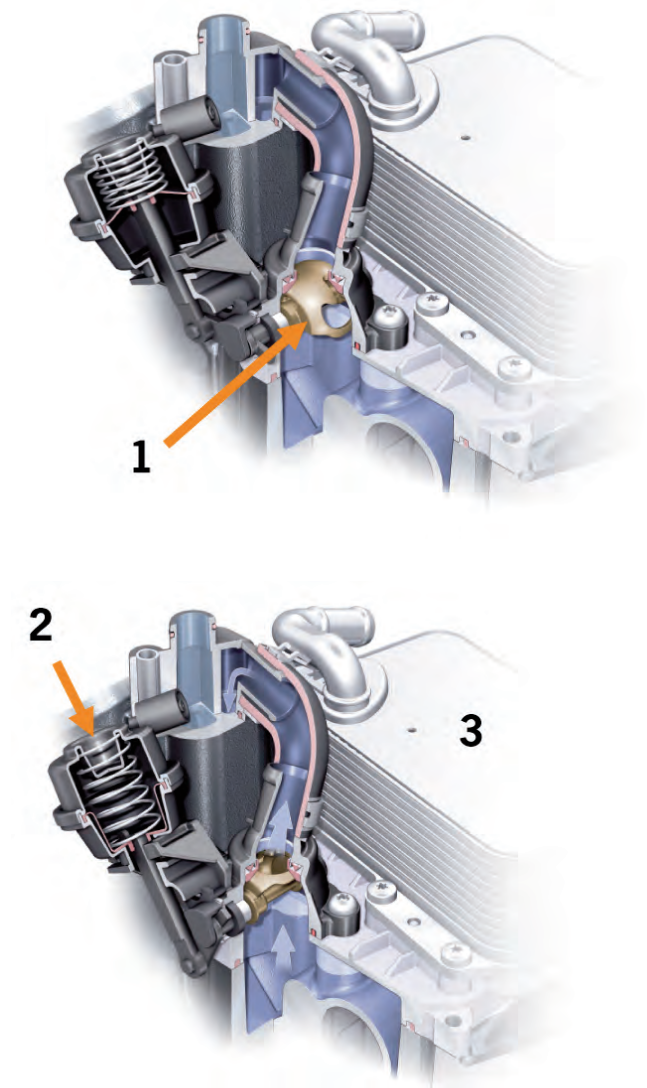
A single-stage, map-controlled thermostat with a heatable wax expansion element is available for controlling the cylinder head temperature.

Cylinder Block Cooling

The cylinder block can be supplied with coolant on the outer sides of the cylinder banks via one check valve on each side. The valves are activated by the DME control unit as a function of the temperature signal from the coolant temperature sensor for thermal management (17). The coolant can only flow through the cylinder block when the coolant shut-off valve is open. The coolant flows from the cylinder block to the coolant radiator when the coolant shut-off valve is open. When the thermostat is closed the coolant flows from there into the expansion tank, otherwise it flows back to the coolant pump via the cooler.

Check Valves

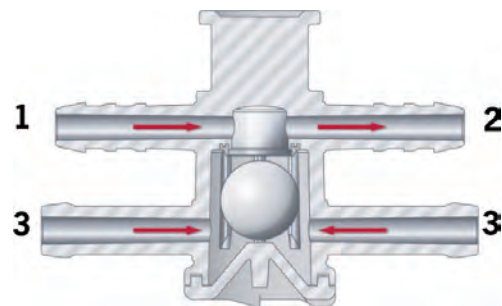
The check valves (9) prevent coolant backflow between the two cylinder banks, which would lead to undesired heat dissipation from the cylinder block (10). A faulty, open check valve can result in the operating temperature of the engine only being reached very slowly, or not at all.



- 1 - Ball valve
- 2 - Pulldown socket
- 3 - Engine oil heat exchanger

■ - Cylinder block cooling system
■ - Cylinder head cooling system

To get the engine block to heat up quickly, the cooling system is separated by an electro-pneumatically activated coolant shut-off valve (16) between the cylinder block and cylinder head cooling system.



- 1 - Coming from cylinder head, bank 1
- 2 - To coolant expansion tank
- 3 - From engine block (inner V)

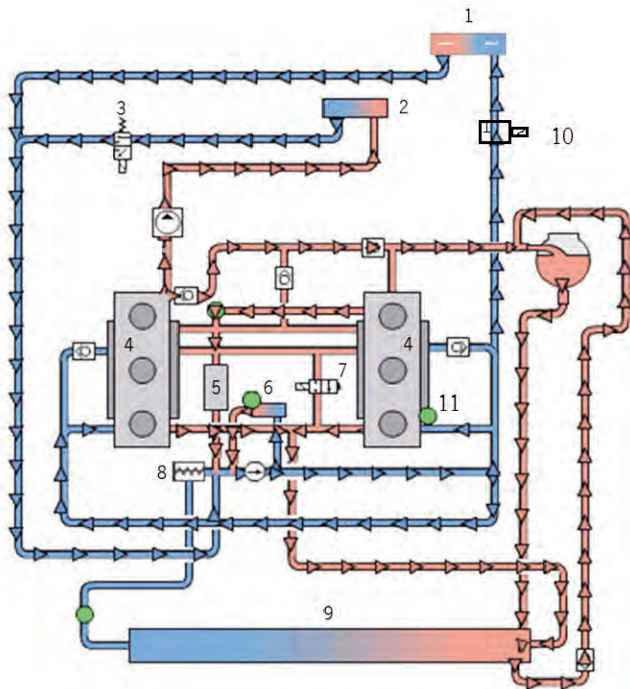
Check/Bleeder Valve

The water jackets of the cylinder banks are connected with a manifold in the cylinder heads via the cylinder head gaskets. This ensures that air bubbles can leave the cylinder block system at the highest point in the system – even with standing coolant. The vent lines lead from the manifolds to the bleeder valve (7 on page 1.12), which connects the permanent venting system of the cylinder head system and the venting system of the cylinder block system with each other.

The vent valve seals the two part system from each other by means of a floating ball. If the cylinder block system is vented, it is therefore also not possible for heat energy to be dissipated from the cooling system via the permanent vent. The valve simultaneously has the function of a check valve.

Operating Modes

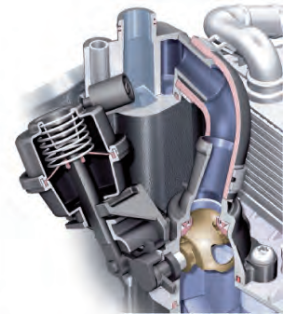
Cold start, warm-up < 149° F (65° C)



- 1 - ATF heat exchanger
- 2 - Heat exchanger
- 3 - Valve for auxiliary heating mode
- 4 - Cylinder head coolant chamber
- 5 - EGR cooler
- 6 - Engine oil cooler
- 7 - Coolant shut-off valve
- 8 - Map-controlled thermostat
- 9 - Coolant radiator
- 10 - Valve for ATF heat exchanger
- 11 - Temperature sensor for thermal management

221° F.

149° F.



Shut-off valve closed

Cylinder Head Cooling

The thermal management system attempts to keep the temperature in the cylinder head cooling system at 149° F (65° C), but not more than 194° F (90° C), to achieve:

- sufficient valve cooling,
- optimum charging of the cylinders with oxygen,
- good cooling of the exhaust gases in the EGR cooler.

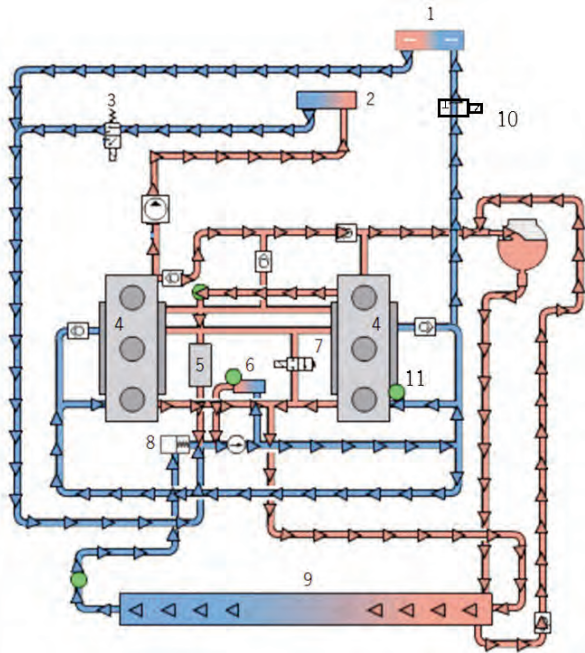
The thermostat is de-energized during the warm-up phase and remains closed with coolant temperatures < 149° F (65° C) in the cylinder heads; no heat energy is dissipated to the main coolant radiator. The coolant is circulated uncooled into the cylinder heads by the mechanical coolant pump. The coolant permanently flows through the oil cooler (6), even if the oil cooler bypass is active. The coolant shut-off valves (3, 10) upstream of the heat exchangers are opened when necessary to warm up the ATF faster and to heat the passenger compartment.

Cylinder Block Cooling

The vacuum-controlled shut-off valve for coolant positioned in the coolant outlet of the cylinder block is closed; there is no circulation of coolant in the engine block. The coolant warms up faster as a result. The setpoint temperature in the engine block is 221° F (105° C). It is recorded by the coolant temperature sensor for thermal management (11). The higher coolant temperature in the engine block shortens the engine's warm-up phase and reduces the friction in the engine. The result is less engine wear and reduced fuel consumption.

Engine

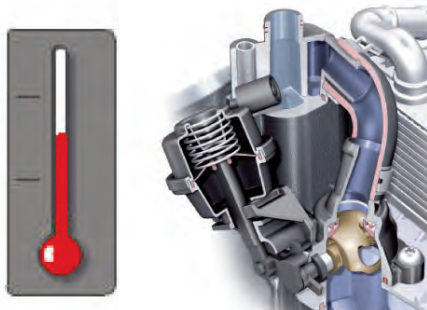
Warm-up 149° F - 221° F (65° C - 105° C)



- 1 - ATF heat exchanger
- 2 - Heat exchanger
- 3 - Valve for auxiliary heating mode
- 4 - Cylinder head coolant chamber
- 5 - EGR cooler
- 6 - Engine oil cooler
- 7 - Coolant shut-off valve
- 8 - Map-controlled thermostat
- 9 - Coolant radiator
- 10 - Valve for ATF heat exchanger
- 11 - Temperature sensor for thermal management

221° F.

149° F.



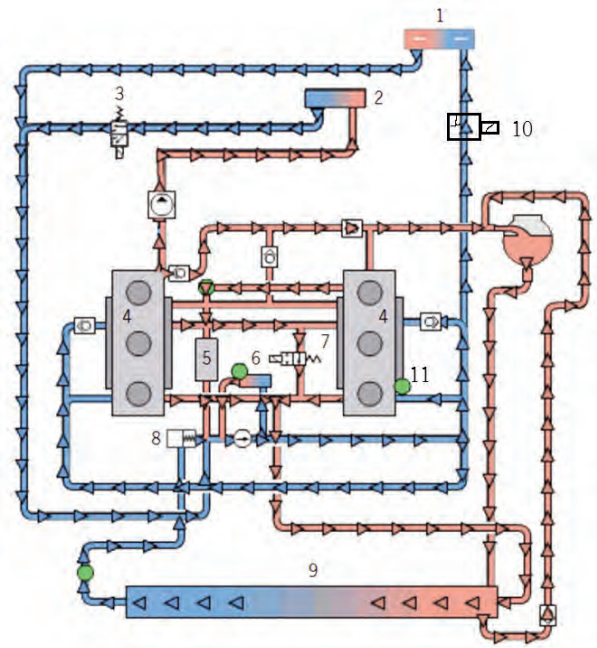
Shut-off valve closed

Cylinder Head Cooling

The thermostat is energized above 149° F (65° C) and starts to open. If the heating element in the thermostat is faulty, it will open even without being energized above approx. 194° F (90° C). The open thermostat establishes the connection between the cylinder head cooling system and coolant radiator. The coolant temperature in the cylinder heads is maintained at 149° F (65° C) for as long as possible; if the temperature can no longer be main-

tained, the DME control unit adopts a new setpoint temperature for the cylinder heads of 194° F (90° C). A thermostat located in the engine oil cooling system opens from approx. 217° F (103° C) and releases the engine oil flow so that the oil can be cooled by passing through the oil cooler. The shut-off valve remains closed, the coolant remains in the engine block as long as the coolant temperature < 221° F (105° C).

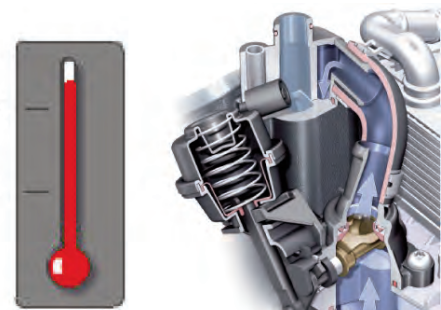
At operating temperature >= 221° F (105° C)



- 1 - ATF heat exchanger
- 2 - Heat exchanger
- 3 - Valve for auxiliary heating mode
- 4 - Cylinder head coolant chamber
- 5 - EGR cooler
- 6 - Engine oil cooler
- 7 - Coolant shut-off valve
- 8 - Map-controlled thermostat
- 9 - Coolant radiator
- 10 - Valve for ATF heat exchanger
- 11 - Temperature sensor for thermal management

221° F.

149° F.



The thermostat is fully open at a coolant temperature of 194° F (90° C).

Cylinder Block Cooling

When the engine is fully warm, the temperature level of the cylinder block cooling system is regulated to approx. 221° F (105° C) by opening and closing the vacuum-controlled ball valve. The ball valve is electro-pneumatically actuated by the DME control unit. The open shut-off valve for coolant establishes a link between the engine block and the cylinder head cooling system.

The warm coolant from the cylinder head and cylinder block cooling systems is mixed before being routed into the coolant radiator and cooled there. The radiator fans are additionally activated if necessary. The cooled coolant is routed from the coolant radiator via the open thermostat to the coolant pump. The coolant pump pumps the cooled coolant back into the cylinder block and the cylinder heads, the cooling system is closed. The cooling system features permanent venting.

ATF Heat Exchanger

There is also a thermal management function for the 8-speed Tiptronic S transmission. The specified vehicles have an activatable ATF heat exchanger. The shut-off valve for the ATF heat exchanger is opened at low ATF temperatures to transport some of the engine heat into the ATF heat exchanger via the coolant to help the operating temperature to be achieved in the transmission.

The shut-off valve for the ATF heat exchanger closes again once the required ATF temperature is reached. The heat exchanger is not only used to heat up the ATF quickly, but also to cool the ATF if necessary. For this purpose, the DME control unit opens the shut-off valve for the ATF heat exchanger if the coolant temperature in the combustion engine is below the temperature of the ATF. The shut-off valve for the ATF heat exchanger is closed again once the required ATF temperature has been reached or the coolant temperature is above the operating temperature of the ATF.

Notes:

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.