eSelf Study Program 920163

Audi Third Generation 2.0l Engines

Audi Academy

Audi of America, LLC
Service Training
Created in the U.S.A.
Created 5/2016
Course Number 920163

Always check Technical Bulletins and the latest electronic service repair literature for information that may supersede any information included in this booklet.

eMedia

VIDEO

This eSSP contains video links which you can use to access interactive media.

Revision: 1 (5/2016)

This eSelf Study Program teaches a basic knowledge of the design and functions of new models, new automotive components or technologies.
It is not a Repair Manual! All values given are intended as a guideline only.
For maintenance and repair work, always refer to the current technical literature.

Note

Reference

Two new 2.0l engines - representing the next evolutionary step forward - are being introduced by Audi. They derive from the third generation EA888 engine family and are categorized as Generation 3 MLBevo engines.

The 2.0l engines are members of separate performance classes (a European rating system). The main difference between the two engines is in the charge cycle and combustion process.

The Performance class 1 engine is capable of operating on the Miller cycle. The Miller cycle was first patented in 1947. Audi premiered an engine based on the Miller cycle operating principles at the Vienna Motor Symposium in May of 2015. It was hailed as the most fuel efficient gasoline engine in its class.

You may also hear the performance class 1 2.0l engine referred to as the 2.0l Generation 3 BC engine. BC stands for B cycle. B cycle is the Audi term for its technological refinement to the Miller combustion cycle principles. The marketing term for this engine is the 2.0 T ultra engine.

The Performance class 2 is similar in operating principle to the current 2.0l TFSI engine used in the North American market on the 2016 Audi A4. This engine is not a B cycle engine.

Learning objectives of this eSelf-Study Program:

After completion, you will be able to answer the following questions:

- What are the differences in terms of the engine mechanicals compared with the third-generation engines?
- What are the new features of the lubrication, charging, fuel and injection systems?
- How does the Performance class 1 engine differ from the Performance class 2 engine?
- How does the Miller cycle work?

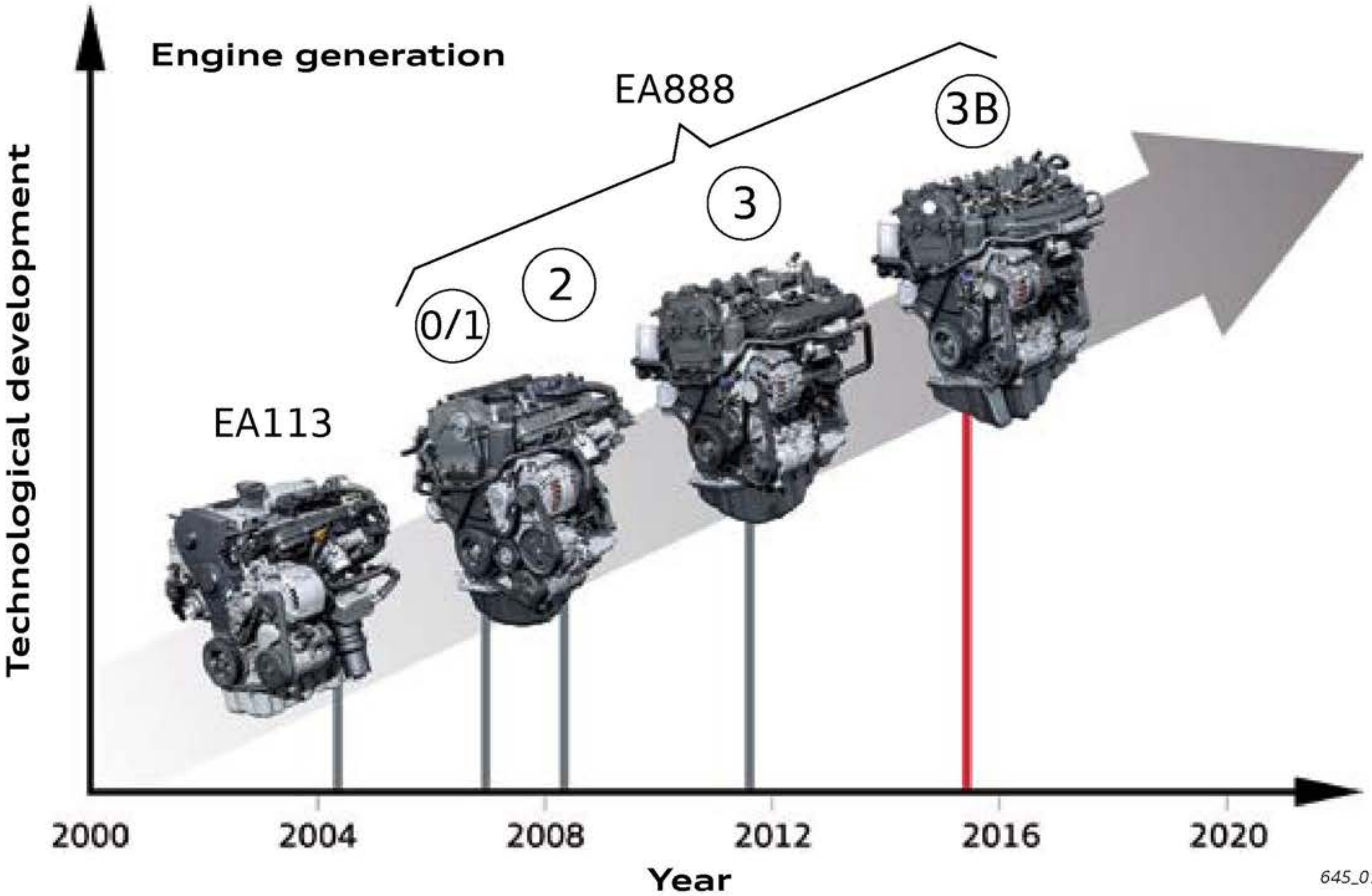
645_002

Development of the engine series

The EA113 or EA888 engine series has been used for many years in a number of Audi models and provides a broad basis for gasoline engine configurations. Development of this engine series was principally focused on improving fuel economy and reducing CO_2 emissions.

However, one of the engines from this series is also used in high performance models, such as the Audi S3.

Please note, not all of these configurations were used in the North American market.



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EA888 engine generation	Key characteristics and features	Further information
0/1	› Audi's first EA888 TFSI engine › 1.8l and 2.0l variants › Demand-controlled fuel system › Camshaft drive via timing chain › Variable valve timing on the intake side	eSelf-Study Program 921703 Audi 2.0 Liter Chain-driven TFSI Engine.
2	› On-demand oil delivery › Audi valvelift system (AVS) on the exhaust side › Secondary air system for SULEV engines	eSelf-Study Program 922903 The 2.0l 4V TFSI Engine with AVS.
3	› Exhaust manifold integrated in the cylinder head › Innovative thermal management (ITM) system with actuator for engine temperature control › Boost is provided by a turbocharger with electrical wastegate actuator	eSelf-Study Program 920243 Third Generation Audi 1.8L and 2.0l Engines from the EA888 Model Family.
3B	› New TFSI combustion process › Audi valvelift system (AVS) on the intake side › Supersedes the 1.8l variant	

↗ Refer to "Glossary" on page 26.

Design objectives for the new engines

Innovative engine technologies are selectively combined and configured in such a way that displacement, power output, torque, fuel consumption and operating conditions are optimally balanced.

The new engines have all the fuel economy advantages of a smaller engine in partial-load operation. At higher engine loads, they draw on the benefits of the high-displacement engine. This provides an optimal combination of efficiency and performance across the entire RPM range.

For the North American Region, this engine will be used first in the 2017 Audi A4. Audi also plans to employ these engines in a number of Group vehicles in both longitudinal and transverse configurations.

The descriptions in this eSelf-Study Program refer to the longitudinal engines in the 2017 Audi A4 at the start of production.

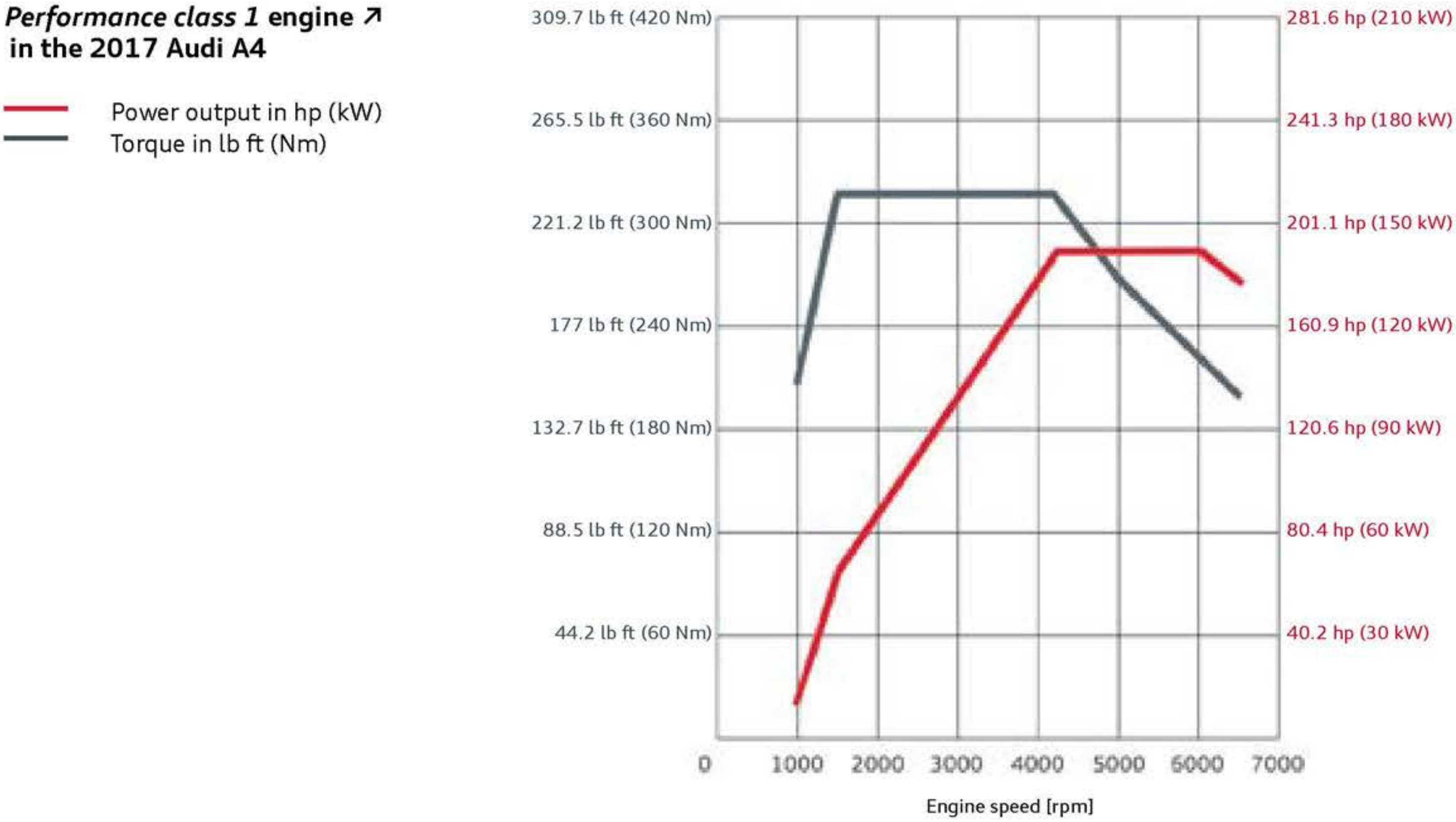
645_003

Reference

For further information about the first use of engines and the fuel system, please refer to eSelf-Study Program 990263, The 2017 A4 Introduction.

Features / specifications

***Performance class 1* engine ↗**
in the 2017 Audi A4



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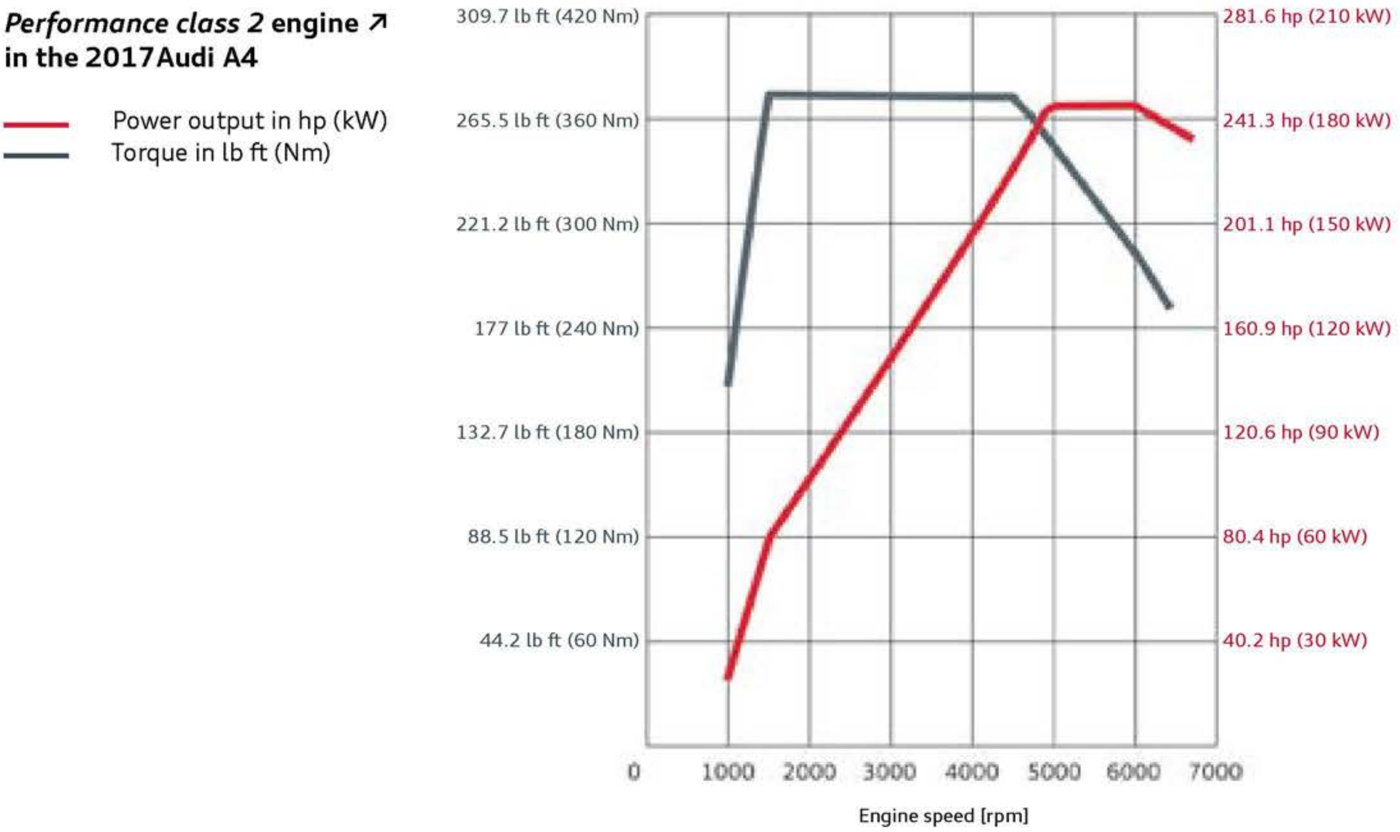
Features	Specifications
Engine code	DPBA
Type	4-cylinder inline engine
Displacement	121 cu in (1984 cc)
Stroke	3.65 in (92.8 mm)
Bore	3.24 in (82.5 mm)
Number of valves per cylinder	4
Firing order	1-3-4-2
Compression ratio	11.65 : 1
Power output at rpm	190 hp (142 kW) at 4200 - 6000
Torque at rpm	236.0 lb ft (320 Nm) at 1450 - 4200
Fuel type	Premium unleaded 91 AKI
Engine management	Bosch MED 17.1.10
Oxygen sensor/knock control	Adaptive oxygen sensor control, adaptive knock control
Mixture formation	Sequential direct injection (FSI)
Exhaust gas treatment	Close-coupled ceramic calatyst, oxygen sensors before and after catalytic converter
Emission standard	ULEV 125

↗ Refer to "Glossary" on page 26.

Performance class 2 engine ↗ in the 2017Audi A4



645_011

Features	Specifications
Engine code	CYMC
Type	4-cylinder inline engine
Displacement	121 cu (1984 cc)
Stroke	3.65 in (92.8 mm)
Bore	3.24 in (82.5 mm)
Number of valves per cylinder	4
Firing order	1-3-4-2
Compression ratio	9.6 : 1
Power output at rpm	252 hp (185 kW) 5000 - 6000
Torque at rpm	273 lb ft (370 Nm) 1600 - 4500
Fuel type	Premium unleaded 91 AKI
Engine management	SIMOS 18.4
Oxygen sensor/knock control	Adaptive oxygen sensor control, adaptive knock control
Mixture formation	Sequential direct injection (FSI)
Exhaust gas treatment	Close-coupled ceramic calatyst, oxygen sensors before and after catalytic converter
Emission standard	ULEV 125

↗ Refer to "Glossary" on page 26.

Performance class 1 engine
(2.0T ultra)

The basis for the third-generation MLBevo 2.0l TFSI engine is the 2.0l TFSI engine from the 2016 Audi A4.

On the next two pages is a summary of the key similarities and differences between the previous 2.0l engine and the MLBevo 2.0l TFSI engine of the 2017 A4.

Fuel system

- Pressure increase to 3626 psi (250 bar).
- Adaptation of the components in the high-pressure system.

645_021

Chain drive

- Longer guides.
- Non-circular sprocket for timing drive.
- Chain tensioner with lower tensioning force.
- Faster oil pump gear ratios, sprocket with 22 teeth (previously 24 teeth).

645_029

Engine management

- Bosch MED 17.1.10 system.
- New combustion process (B cycle).
- Use of a Mass Airflow Sensor.

645_020

Other modifications:

- Vacuum pump by Bosch.
- Smaller exhaust turbocharger, adapted thermodynamics.
- New engine oil 0W-20 (compliant with VW 50800 and VW 50900).

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645_013

Cylinder head

- Audi valvelift system (AVS) on the intake side.
- Re-designed intake ports.
- Re-designed squish zones in the combustion chambers.
- Valve guide housings designed for optimal heat dissipation.
- Double-lip exhaust valve stem seals.

645_024

Pistons

- Friction reduction measures.
- Pistons with modified crowns.

645_022

Crankshaft

- Reduced main bearing diameter.

645_025

Performance class 2 engine

Pistons

- The piston has the same geometry.
- The piston is made from the same material as in the 2015 Audi S3.
- 3-piece oil control ring.

645_016

EVAP system

- Increased air flow.
- Noise reduction measures.

645_015

Engine management

- Simos 18.4 system.
- Throttle valve with reduced air leakage.
- The throttle valve and the high-pressure fuel pump are supplied by Bosch.
- Engine Control Module communicates over the FlexRay bus system.

645_014

645_017

645_012

Modifications to ULEV 125 (USA)

- No multi-point injection (MPI).
- Diagnosable PCV system ventilation hose (mandatory).

Oil supply

- Modified to create room for the use of electromechanical steering (ESP) and the planned roll stabilization system.
- A non-return valve in the oil filter module allows maximum oil pressure to build up more quickly at all lubrication points, especially when the engine is cold. There is no non-return valve in the engine block or in the cylinder head.
- Increasing the oil volume between minimum and maximum oil levels ensures that a sufficient volume of oil is available at the intake end of the oil pump whenever the driver adopts an especially dynamic driving style.

Cylinder head

- Special alloys are used in order to allow for higher power output and the resultant higher levels of thermal stress.
- The coolant jacket is now thicker.
- The valve gear has been modified by using sodium-filled exhaust valves, which allow for higher power output and the resultant higher levels of thermal stress.
- The exhaust turbocharger has been upgraded for temperature stability up to 1743 °F (950 °C).

645_018

Engine block

- The crankcase ventilation system has been re-routed across the balancer shafts.
- The modifications to the crankcase ventilation system necessitated directional installation of the piston cooling jets (refer to the current electronic service information).

645_019

Engine mechanicals

Crankshaft

When work began on the development of the crankshaft, the focus was on reducing friction and weight.

There are several differences between the Performance class 1 and 2 engines. These are explained below.

Overview

645_040

↗ Refer to "Glossary" on page 26.

The main bearings of the Performance class 2 engine have the same diameter as in the third-generation EA888 engine. Also, they are the same size as in the previous 1.8l TFSI engine (used only in Europe).

Fewer counterweights on the Performance class 1 engine results in further weight savings.

Performance class 1

645_025

Performance class 2

645_023

Pistons and valves

These components for the Performance class 2 engine have, to the greatest possible extent, been adopted from the predecessor engine. Only the piston rings have been modified. A 3-piece oil control ring is now used (refer to "3-piece oil control ring" on page 25).

Further modifications were made to the Performance class 1 engine due to the higher compression levels and the new B cycle combustion process.

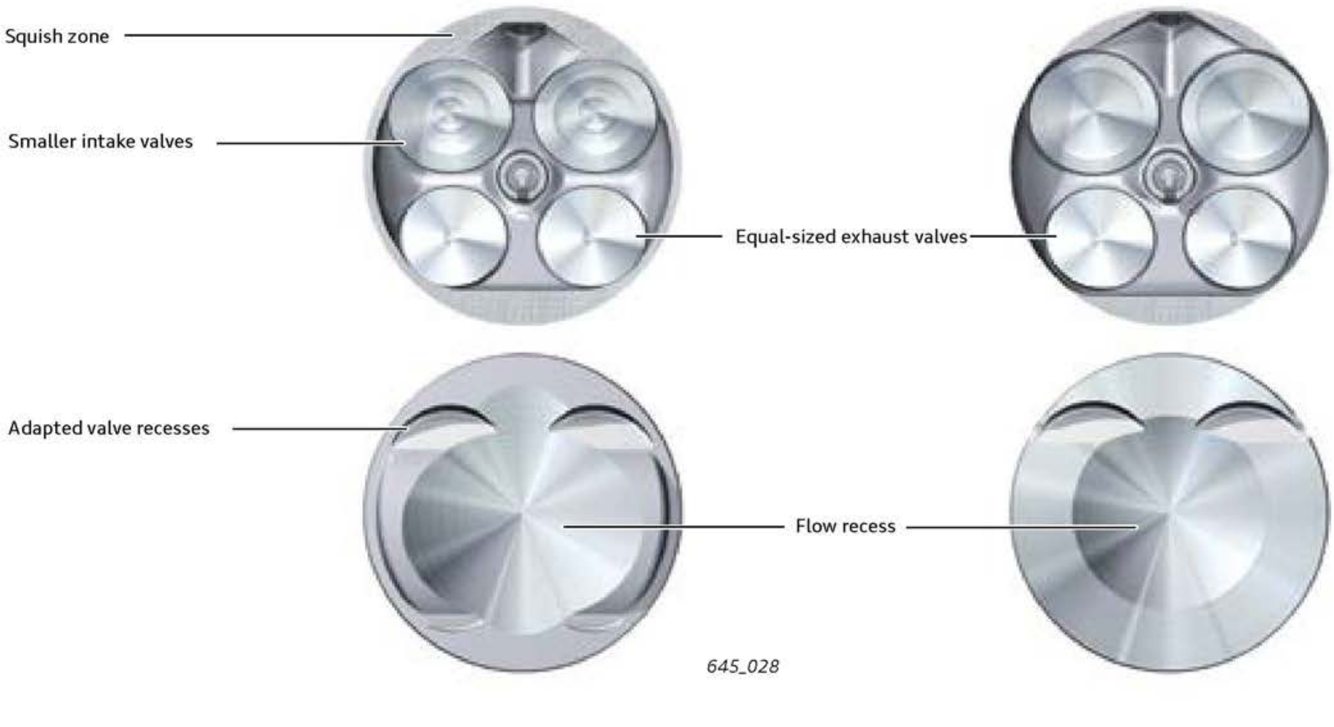
The combustion chambers have larger squish zones necessitating the use of smaller intake valves.

The enlarged squish zones enhance the swirling action of the fuel/air mixture inside the cylinder. Accordingly, use is made of shaped valve recesses in the piston crowns.

The intake and exhaust valves also have slightly longer stems. However, the diameter of the exhaust valves is unchanged.

Performance class 1

Performance class 2



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645_027

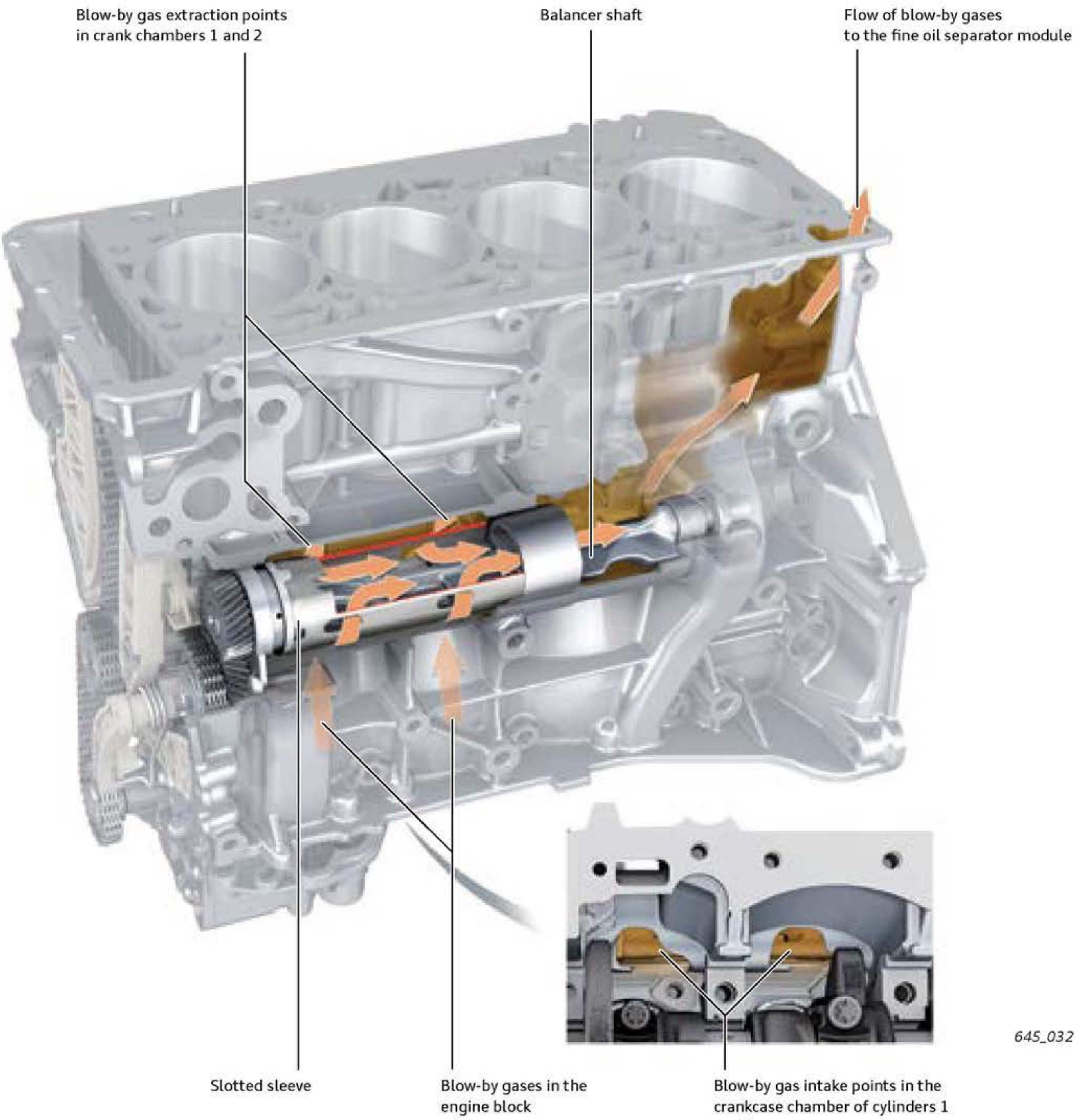
Engine block

Positive crankcase ventilation

Because the Audi valvelift system (AVS) was relocated to the intake side of the Performance class 1 engine, it was necessary to adapt the positive crankcase ventilation system. Instead of the previous extraction points in the crankcase chambers of cylinders 3 and 4, the *blow-by gases* ↗ are now extracted from the crankcase chambers in the area of cylinders 1 and 2. The blow-by gases flow from here into the housing of a balancer shaft.

A slotted sleeve which allows through-flow of the blow-by gases is integrated in the balancer shaft housing.

The rotation of the balancer shaft creates a centrifugal effect that ensures a large proportion of the oil is separated from the blow-by gases (coarse oil separator) and flows back into the oil pan. The flow path of the blow-by gases to the fine oil separator module on the cylinder head is identical to that of the third-generation 2.0l TFSI engine.



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↗ Refer to "Glossary" on page 26.

Reference

For more information about the fine oil separator module and how it works, please refer to Self-Study Program 920243, The Audi 1.8l and 2.0l Third Generation EA888 Engines.

Piston cooling jets

As shown, on the previous pages, the Performance class 1 engine uses a modified crankcase ventilation system where the blow-by gases flow around one of the balancer shafts. Because of this, it was also necessary to make changes to the manufacturing of the engine block.

Previously, a contact edge was used to position the piston cooling jets. For this reason, care must be taken to ensure that the piston cooling jets are exactly aligned during installation in the new engine.

Previous version

645_048

Contact edge for the piston cooling jet on the crank chamber

New version

645_026

Piston cooling jet requiring directional installation

Reference
For further information about installation of the piston jets, please refer to the electronic service information.

Note
All modifications and new features described below refer to the Performance class 1 (B cycle) engine only.

Engine oil 0W-20

To further reduce the friction and improve fuel economy, the Performance class 1 engine uses an engine oil with the 0W-20 specification in compliance with the VW 50800 and VW 50900 standards.

The new engine oil has the following properties:

- The lower viscosity enables the oil to reach the lubrication points more quickly. In addition, it is more cost-effective for drivers with a short distance profile because less friction loss occurs in the engine (lower oil resistance).
- A chemical marker has been added to the new oil (green coloration) so it can be identified more easily in a laboratory.
- The oil is not downwardly compatible, that is, it is only suitable for use in approved engines.
- Oil pressure builds up slightly more slowly due to the low viscosity of the oil. This is why the oil pump runs slightly faster in the Perfomance class 1 engine. In addition, a new non-return valve is integrated in the oil filter housing.

Note
Refer to the manufacturer's specifications with regard to the new engine oil. The oil viscosity and the oil standards specified in the current maintenance chart must always be observed.

Cylinder head

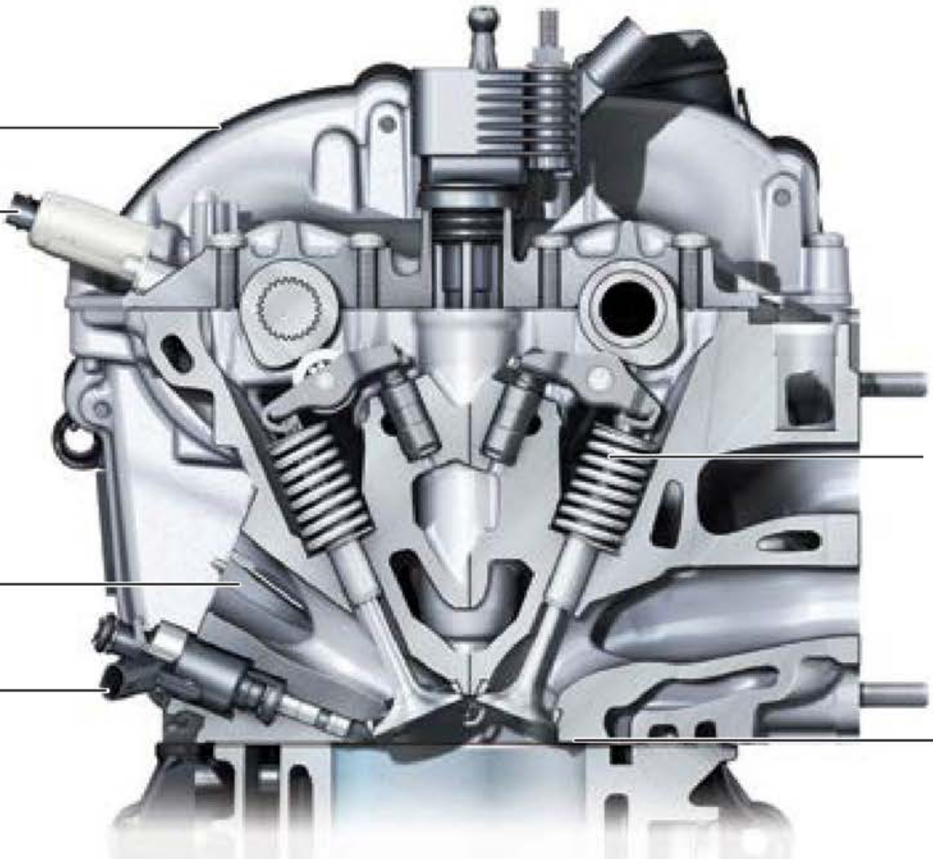
The cylinder head of the Performance class 2 engine is to a large extent a carry-over from the third-generation 2.0l. However, a number of modifications have been made to the cylinder head of the Performance class 1 (B cycle) engine.

This was necessary to implement the new B cycle combustion process. In addition, this has improved running refinement and reduced knock tendency.

The cylinder head of the Performance class 1 engine has the following modifications:

- The Audi valvelift system (AVS) has been moved to the intake side.
- The cylinder head cover has been adapted to accommodate the new installation position of the Audi valvelift system (AVS).
- The compression ratio has been increased from 9.6:1 to 11.7:1 by reducing the volume of the compression chamber.
  - Modified squish zones in the combustion chamber.
  - Lowering of combustion chamber ceiling by 9 mm.
  - Modified piston shape.
- FSI injectors are positioned closer to the combustion chambers.
- The intake ports have been redesigned, that is, made straighter, to optimize charging motion.
- The positions of the spark plug and high-pressure injector as well as the shape of the piston have been adapted to the new combustion chamber design.
- Valve guide housings, modified for better heat dissipation.
- Double-lip exhaust valve stem seals.

Performance class 1 (B cycle)



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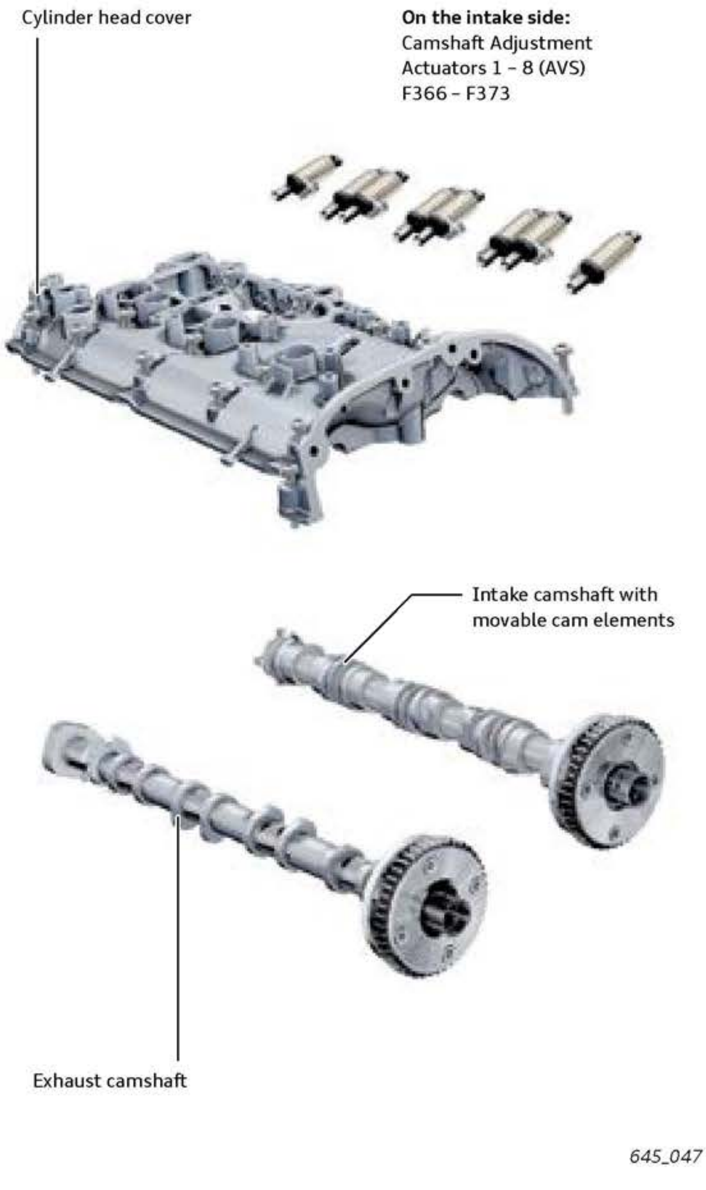
Cylinder head cover and camshafts

The B cycle engine uses an adapted cylinder head cover to suit the new installation position of the Audi valvelift system (AVS). As a result, the connections for the cam adjustment actuators of the Audi valvelift system (AVS) are located on the intake side of the cover.

Performance class 1 (B cycle)



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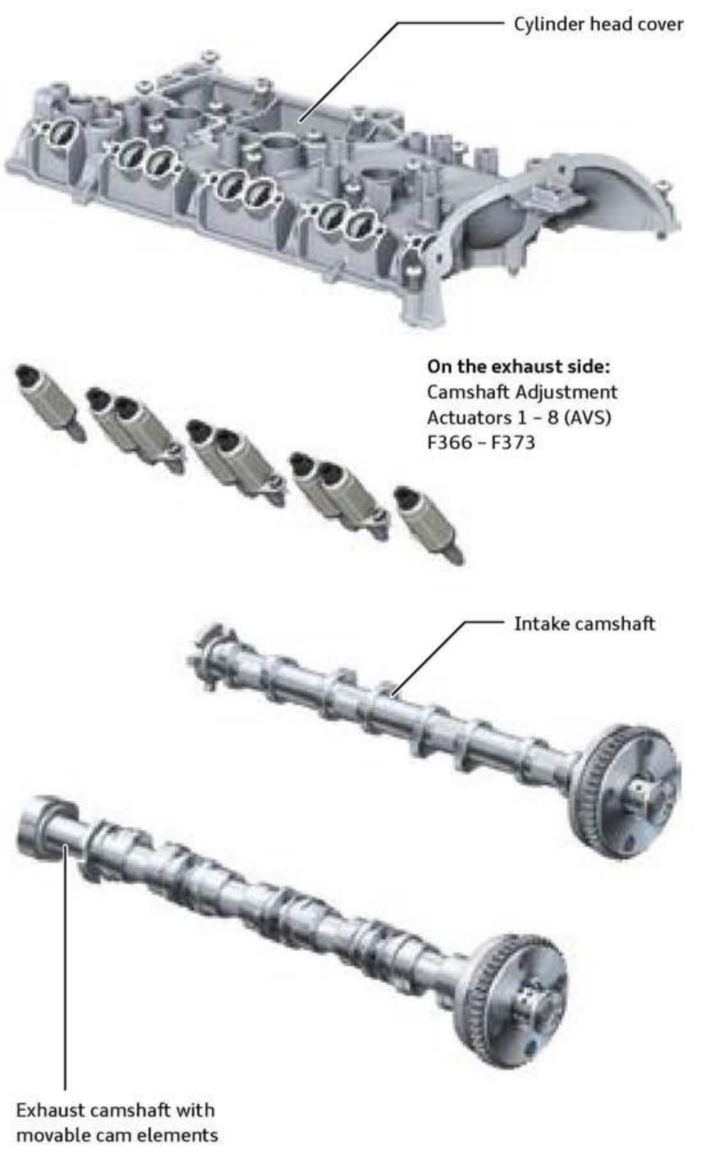
Performance class 2



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Reference

For more general information about how the Audi valvelift system (AVS) works, please refer to eSelf-Study Program 922903, The 2.0l 4V TFSI Engine with AVS.

Chain drive

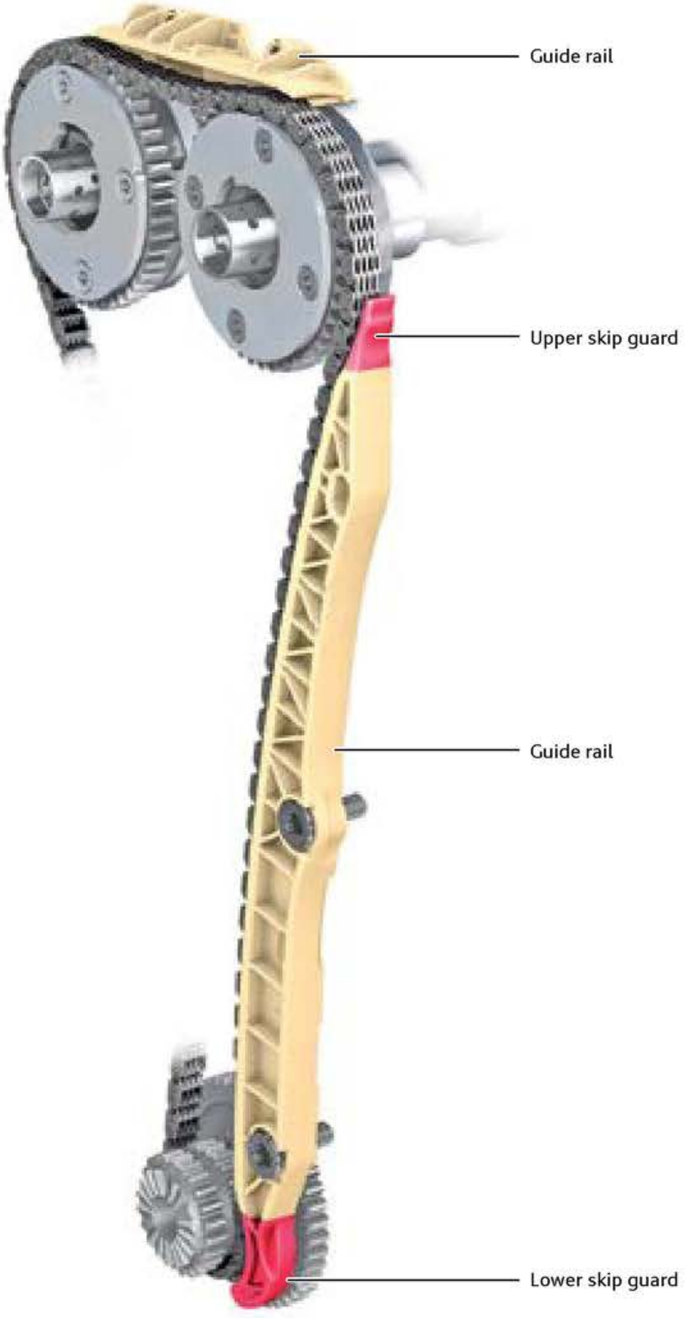
(Performance class 1 engine only)

The basic configuration of the chain drive has, to a large extent, been adopted from the third-generation engine. However, it too has been systematically improved. Due to the further reduction in friction loss, less power input is required to drive the chain drive.

Even more extensive modifications were made in the case of the Performance class 1 engine.Here is a summary of the various individual modifications.

Chain guide

The guide rail directs the chain between the two camshaft gears. It has very little contact with the chain. To provide skip protection, the guide rail has been extended and is bolted onto the cylinder head cover.



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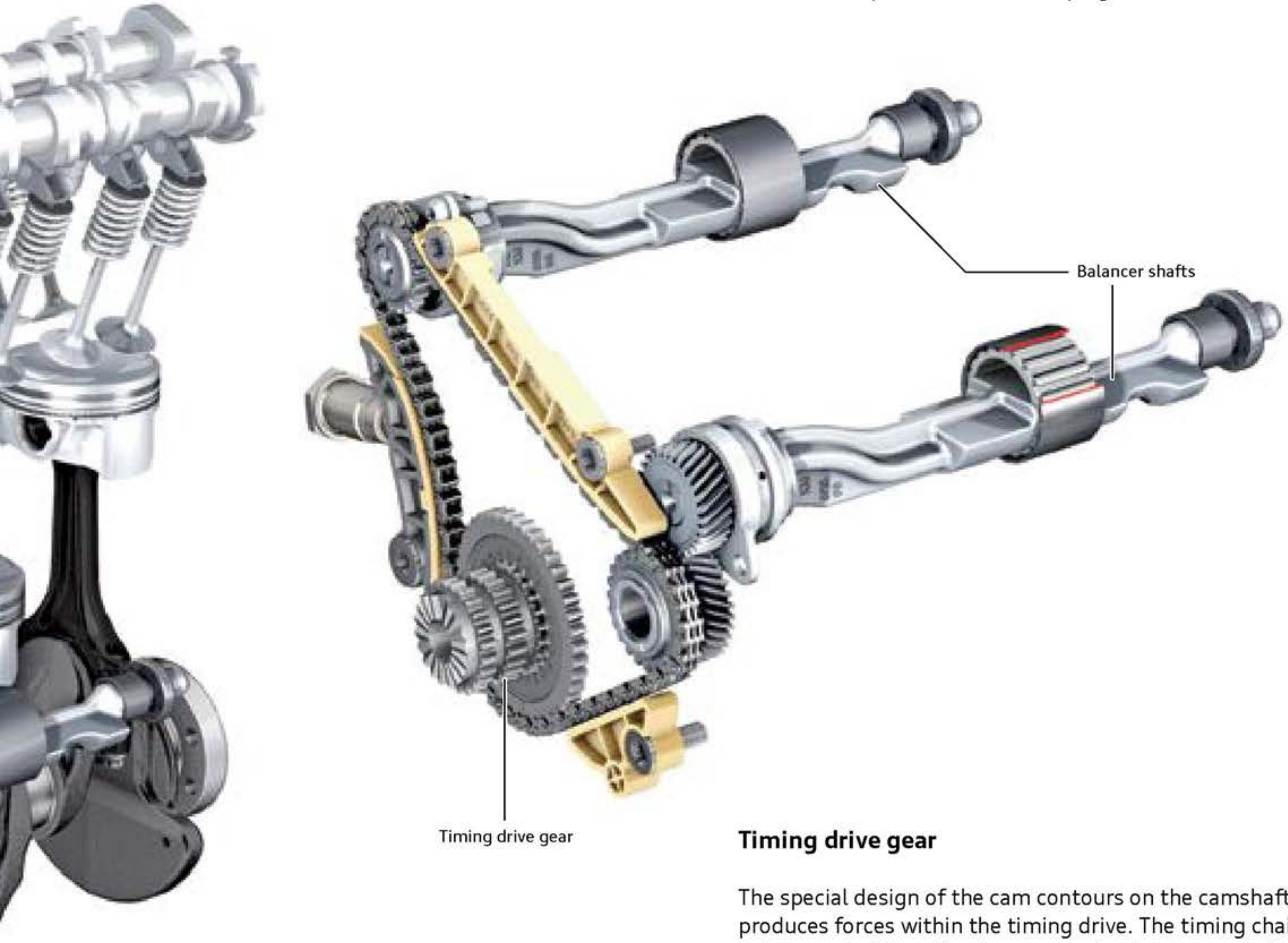
Guide rail

A skip guard is attached to both ends of the guide rail. This precaution has already been incorporated into series production of the third-generation 2.0l TFSI engine.

Balancer shaft drive

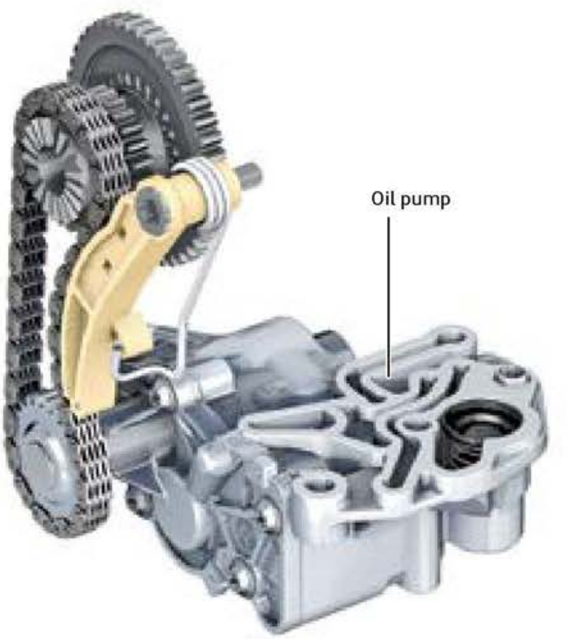
The balancer shaft drive incorporates the following friction-reducing modifications.

- Narrower chain design and reduction in number of chain links from 96 to 94.
- Layout with fewer deflections.
- New clamping rail and guide rails.
- New sprockets.
- Chain damper with softer damping.



Timing drive gear

The special design of the cam contours on the camshafts produces forces within the timing drive. The timing chain drive sprocket therefore has a non-circular shape, similar to that of a cloverleaf. This reduces both chain forces and movement within the chain tensioner, allowing a more simple chain tensioner design to be used (elimination of a pressure reduction valve).



Oil pump drive

The gear ratios have been modified so the oil pump now runs more quickly. The sprocket now has 22 teeth instead of the previous 24. This modification was necessary to ensure that all lubrication points are reliably supplied with the new 0W-20 specification engine oil.

Engine management

Mass airflow sensor

The MED 17.1.10 engine management system by Bosch is used in the Performance class 1 (B cycle) engine. In this system air intake is monitored by a mass airflow sensor. This is necessary because the throttle valve is open as far as possible during the active B cycle. As a result, a mass airflow sensor is needed to monitor the return flow in the air intake system.

645_034

Combustion process

For the first time in an Audi, the Performance class 1 engine (B cycle) utilizes a new combustion process. One of the primary objectives was to improve fuel economy. This is essentially accomplished by shortening the compression phase.

In the early years of combustion engine development similar efforts were undertaken to improve the efficiency of gasoline engines, resulting, for instance, in the Atkinson and Miller cycles.

Atkinson cycle

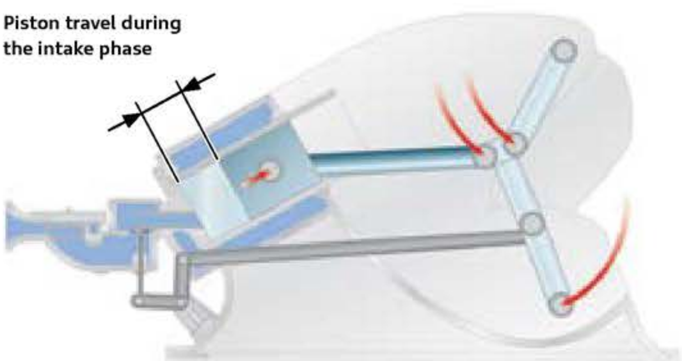
As early as 1882 James Atkinson unveiled an engine designed to significantly increase the thermal efficiency of the internal combustion engine while circumventing patents on the four-stroke engine by Nicolaus August Otto.

In Atkinson's engine, all four strokes are performed by a specially designed crank mechanism within a single crankshaft cycle. The fact that the crankshaft must produce two upward movements of the pistons to achieve this allowed Atkinson to use piston strokes of different lengths. He took advantage of this difference to create a shorter compression stroke and a longer expansion stroke (working stroke). The crankshaft mechanism is designed in such a way that the compression ratio is smaller than the expansion ratio.

The piston travels less distance during the working and exhaust cycles than during the intake and compression cycles. Intake valve closing is retarded during the compression stroke. An advantage is that the higher expansion ratio increases efficiency. The working stroke takes longer thereby minimizing the amount of waste heat in the exhaust gases.

However, there is a drawback in that relatively little torque is available at low rpm. The Atkinson engine needs to be running at a relatively high speed before it can reliably deliver power. The Atkinson cycle (as originally conceived by Atkinson) is also very difficult to implement because of the complex crankshaft mechanism geometry.

Piston at BDC
between intake and compression cycles



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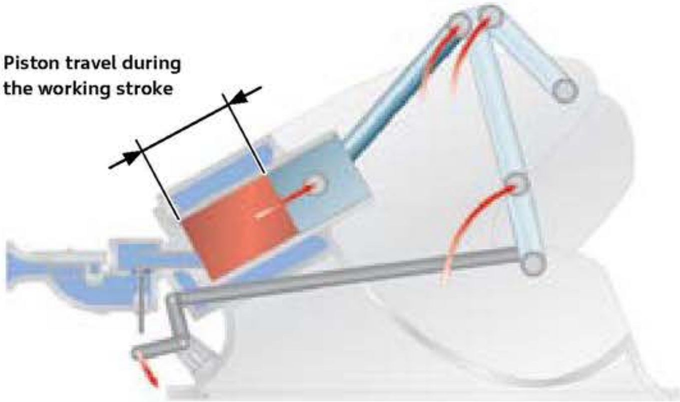
Piston at BDC
between working and exhaust cycles



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eMedia

Find out more about how the Atkinson cycle works.

Miller cycle

Another option for changing the compression and expansion ratios is the Miller cycle. The inventor Ralph Miller took out a patent on this principle in 1947.

His aim was to transfer the principles of the Atkinson cycle to conventional crankshaft engines in order to utilize the beneficial effects, while eliminating the complex crankshaft mechanism.

In the Miller cycle engine, the piston begins to compress the fuel-air mixture only after the intake valve closes. The intake valve closes after the piston has traveled a certain distance above its bottom-most position: at around 20% to 30% of the total piston travel of its upward stroke. The piston actually compresses the fuel-air mixture only during the latter 70% to 80% of the compression stroke. During the initial part of the compression stroke, the piston pushes part of the fuel-air mixture through the still-open intake valve, and back into the intake manifold.

To date, the Miller cycle has mainly been used in the engines of several Asian vehicle manufacturers.

Basic principle

A special valve gear control system is used in engines operating on the Miller cycle principle.

Its primary function is to close the intake valves earlier than a conventional gasoline engine at partial load operation and later at full load operation.

In the intake stroke in particular, this has the following effects:

- Less air intake.
- Compression pressure is roughly the same.
- Lower compression ratio.
- Higher expansion ratio.

Advantages

- Varying the valve opening times increases the expansion ratio, allows throttle-free load control and therefore significantly increases efficiency.
- A lower compression ratio means fewer Oxides of Nitrogen in the exhaust gases.
- The charging temperature is lower.
- Combustion is improved.

Drawbacks

- Less torque at low engine speeds. This can, for example, be compensated by turbocharging.
- Less efficiency due to the lower effective compression ratio. This can be compensated by turbocharging and charge air cooling.
- At least one camshaft phasing adjustment is required.

The new Audi B cycle combustion process

The new combustion process of the Audi B cycle engine is basically a modified Miller cycle. This provides better fuel economy than the equivalent third-generation 1.8l TFSI engine, although friction within the engine is higher due to the larger engine displacement.

The valve opening times on the intake side are controlled by the Audi valvelift system (AVS). The AVS switches to a camshaft profile that provides alternate valve opening times (earlier closing of the intake valves) and less valve lift.

This combustion process is known as a "combustion process with extended expansion phase" or "B cycle". Strictly speaking, it is not so much that the expansion phase is extended as that the compression phase is shorter.

The term "extended expansion phase" would only apply if one were to compare this combustion process with that of a low-displacement engine, which achieves a similar degree of fresh gas compression with a reduced overall stroke.

Comparison of the valve and piston positions

At partial load

- High basic compression.
- Intake valve closes early.
- Short valve opening times.
- Very low exhaust emissions.

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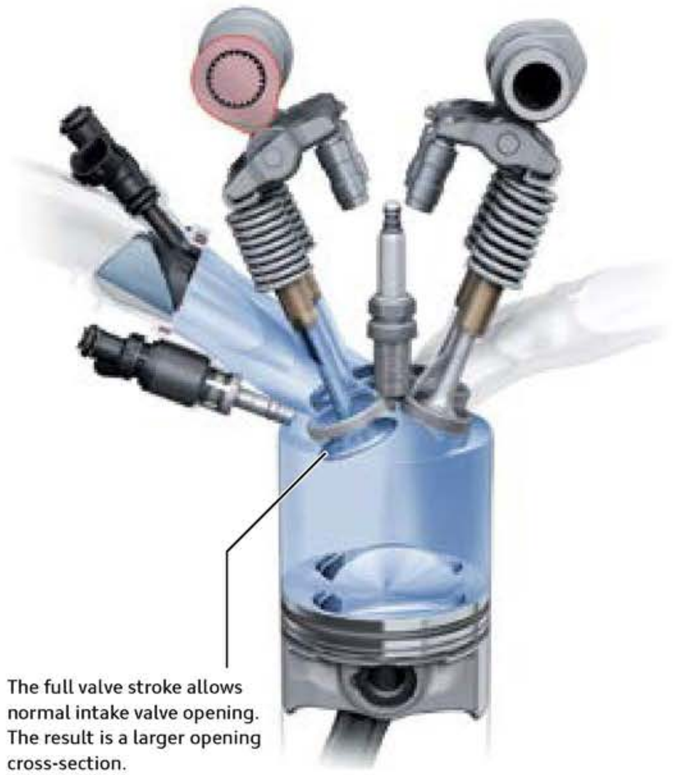
At full throttle

- Intake valve closes later.
- Long valve opening time.
- High torque.
- High power output.



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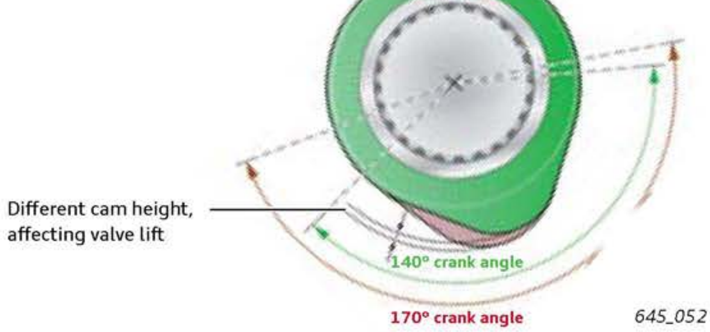
Valve lift adjustment with Audi valvelift system (AVS)

There are two cam profiles available for each intake valve. The cam profiles control the timing, lift and duration of the intake valve opening. They are adapted to the required operating characteristics of the engine.

When less valve lift is required, the shorter profile cam (highlighted in green) is used and the valve opening occurs at 140 degrees of crankshaft angle. When full valve lift is required, the longer profile cam (highlighted in red) is used and the opening occurs at 170° degrees of crankshaft angle.



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The new B cycle combustion process by Audi is characterized by the following features:

- Activation in the partial-load range of the engine.
- Shorter compression phase (similar to Miller cycle).
- Expansion ratio is higher than compression ratio (similar to Miller cycle).
- Higher geometric compression ratio.
- Modified combustion chamber design (squish zone, valve diameter, piston design).
- Modified cylinder head intake port (to create swirl).

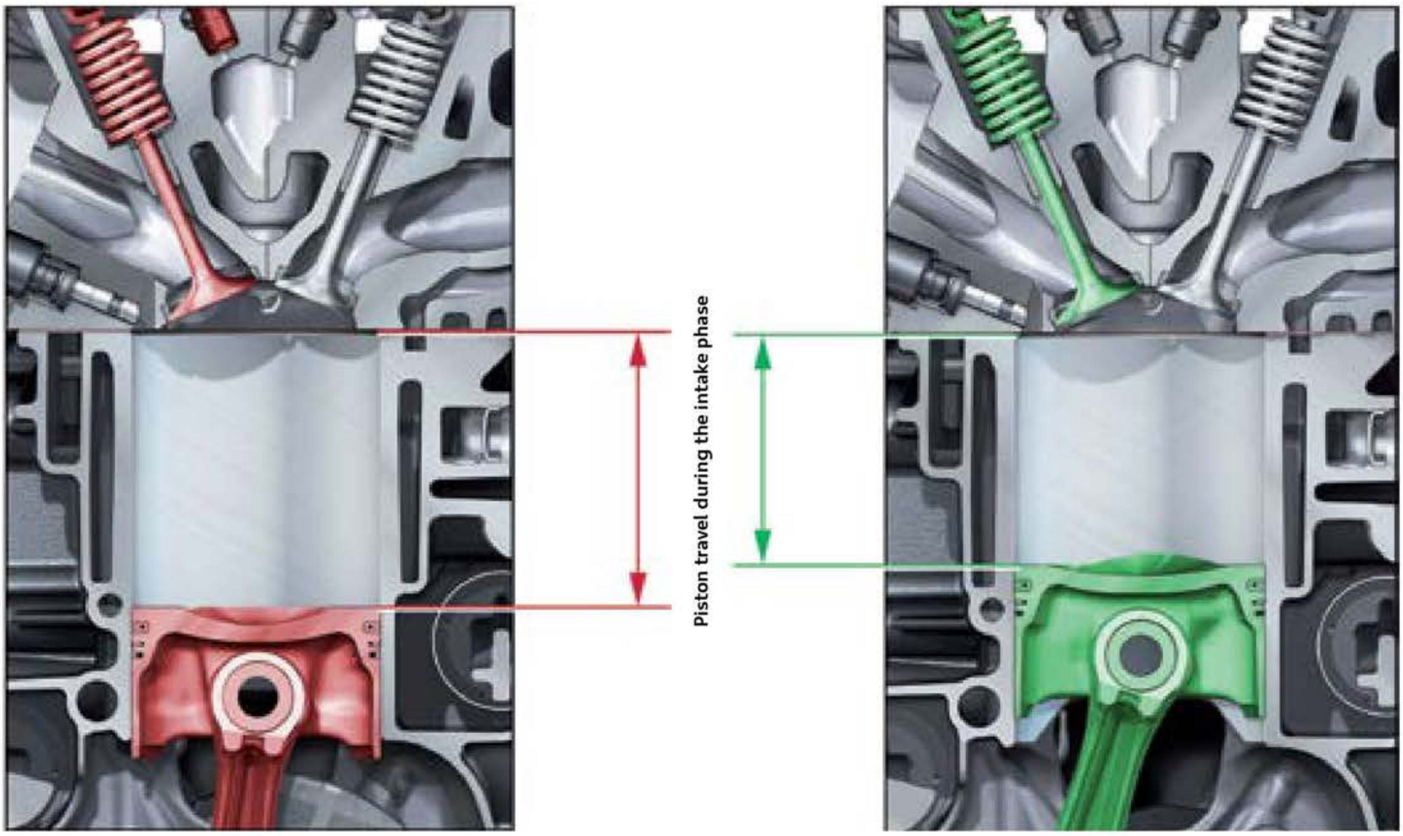
Comparison of piston positions in the compression stroke

The diagrams below show the piston position at the intake closing point for the third-generation 2.0l TFSI engine using the conventional combustion process and the 2.0T ultra engine using the new B cycle combustion process.

They show the position of the piston at the intake closing point (hV = 1.0 mm) in a third-generation 2.0l TFSI engine compared with the 2.0T ultra engine at an engine speed of 2000 rpm and at an effective mean pressure (p_{me}) of approximately 87 psi (6 bar).

Third-generation 2.0l TFSI engine with conventional combustion process

2.0T ultra engine with new B cycle combustion process



Intake valve closes at 20° crank angle in advance of BDC

Intake valve closes at 70° crank angle in advance of BDC

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Find out more about the modifications to the cylinder head.

eMedia

Find out more about the modifications to the overall engine.

Processes inside the cylinder

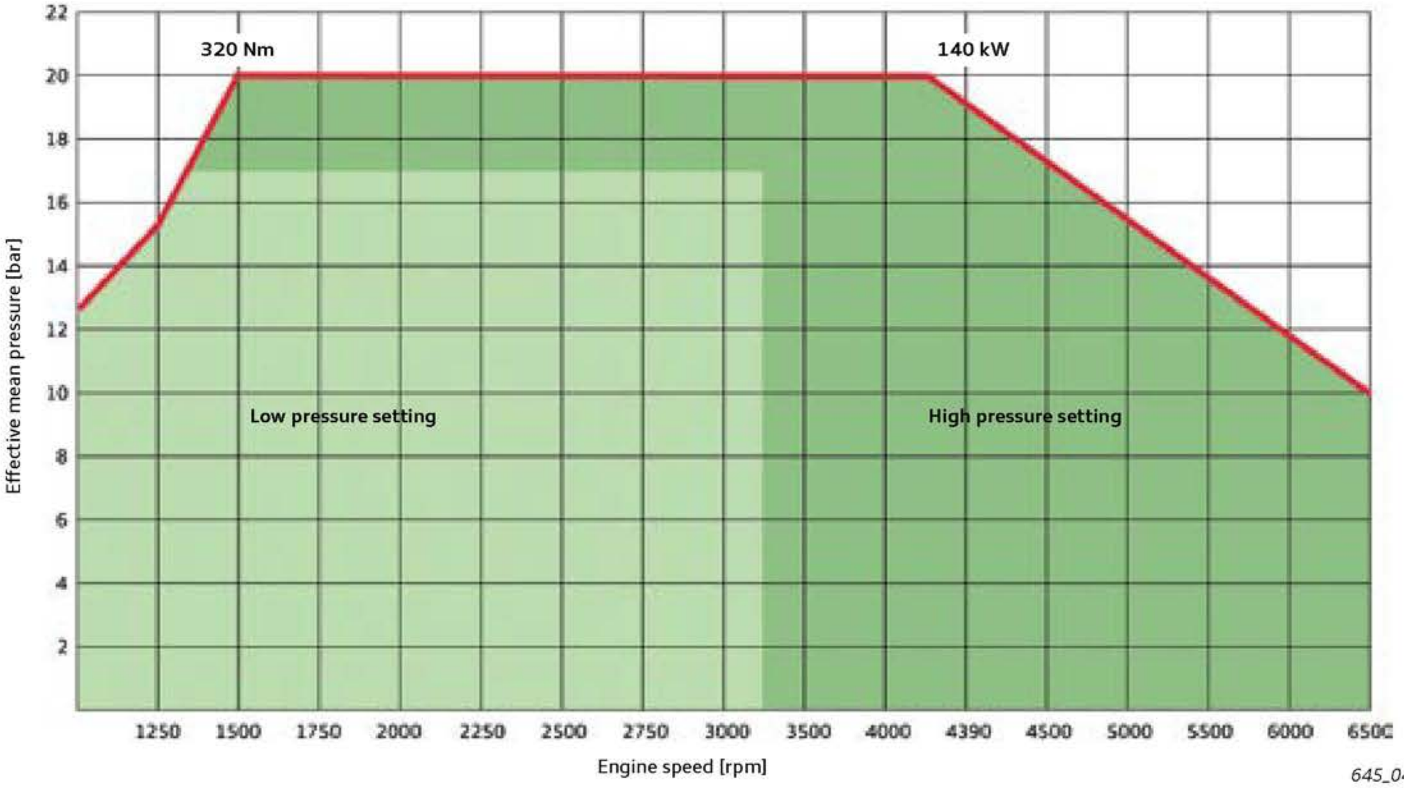
The conditions inside the combustion chamber are shown below in comparison with a conventional gasoline engine.

Working stroke	Conventional combustion process	New combustion process (BC = B cycle)
Intake The piston moves from TDC to BDC. The intake valve closes well in advance of BDC. After the intake valve closes, the pressure inside the cylinder drops because the piston is still moving downwards.		
Compression The piston moves from BDC to TDC. The decrease in pressure first has to be equalized. The pressure is again equalized with the pressure in the intake stroke at 70° crank angle in advance of TDC. In a conventional combustion process the pressure is already higher at this stage. The new combustion process allows a faster pressure increase due to the higher geometric compression ratio. The pressure at TDC is roughly equal (approximately 174 psi (12 bar). Overall, the new combustion process has a higher mean pressure level and, therefore, higher efficiency.		
Start of working cycle The piston moves from TDC to BDC. In the new combustion process the pressure level is higher during the expansion phase due to the lower combustion chamber volume.		
Exhaust The piston moves from BDC to TDC. The new combustion process brings a small gain in efficiency due to differences in air/fuel mixture mass and heat transfer.		

Operating strategies

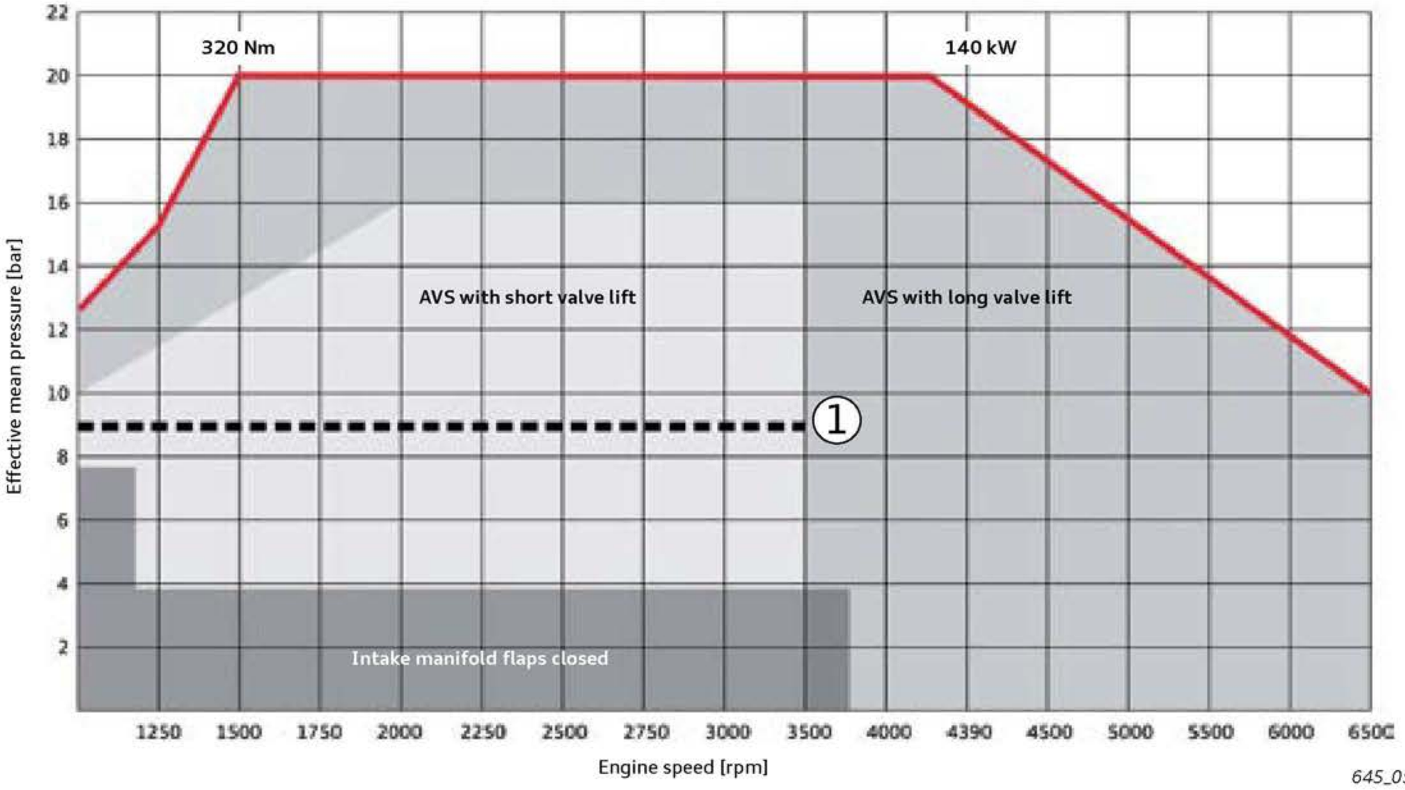
Engine start	The intake camshaft is operating with the short cam profile (represented in green on illustration 645_052 on page 20) that is, short lift and short intake phase with 140° crank angle as well as short intake valve opening time. Fuel is injected during the start phase in the compression stroke and/or intake stroke (single, multiple), depending on engine temperature.
Warm-up phase	Fuel straight injection (FSI) is carried out once or twice up to a coolant temperature of 158 °F (70 °C).
Engine running at normal operating temperature	Depending on load demand in the B cycle or the full throttle map.
In the B cycle	› The B cycle combustion process is active at idle and in the partial-load range. › The intake camshaft uses the smaller cam profile. › The intake manifold flaps are only activated in the low-load range. › The throttle valve is wide open. › Charge pressure is increased (up to 31.9 psi (2.2 bar) absolute). This allows optimal charging of the cylinders with fresh gas during the short intake valve opening time.
Full throttle map	› The intake camshaft is switched to the large cam profile by the Audi valvelift system (AVS). A 170° crank angle intake phase is now implemented. › The intake manifold flaps are open in the full throttle range. › Depending on the characteristic map, up to three injections are possible. The amount of fuel injected and the injection timings are variable. › The throttle valve now switches to normal operating mode.

Oil pump control steps



645_049

Intake manifold flaps and Audi valvelift system (AVS)



645_051

① Threshold for switching back from long to short valve lift

Service

Three-piece oil control rings

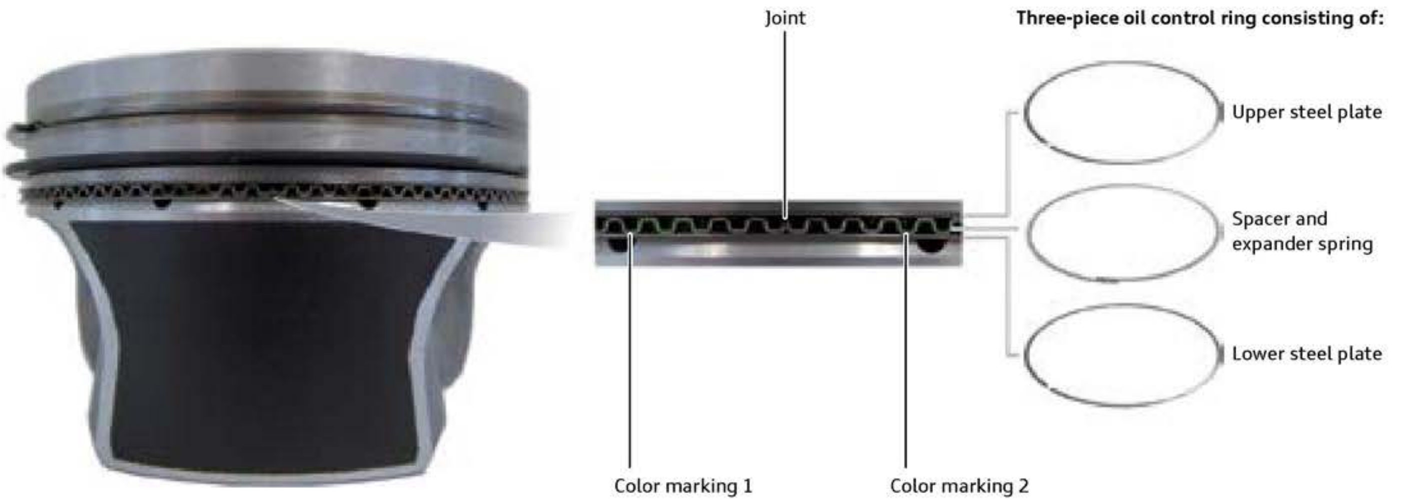
The three-piece oil control rings consists of two thin steel plates as well as a spacer and expander spring. This spring presses the steel plates (oil control rings) against the cylinder wall.

These oil control rings are highly adaptable to the shape of the cylinders despite their reduced pre-load. They have less friction and skim off the oil efficiently.

Assembly notes

Make sure that the expander springs are correctly positioned during assembly. This is particularly important when using pistons supplied with rings already installed. It is possible that the spring ends may have slipped over one another.

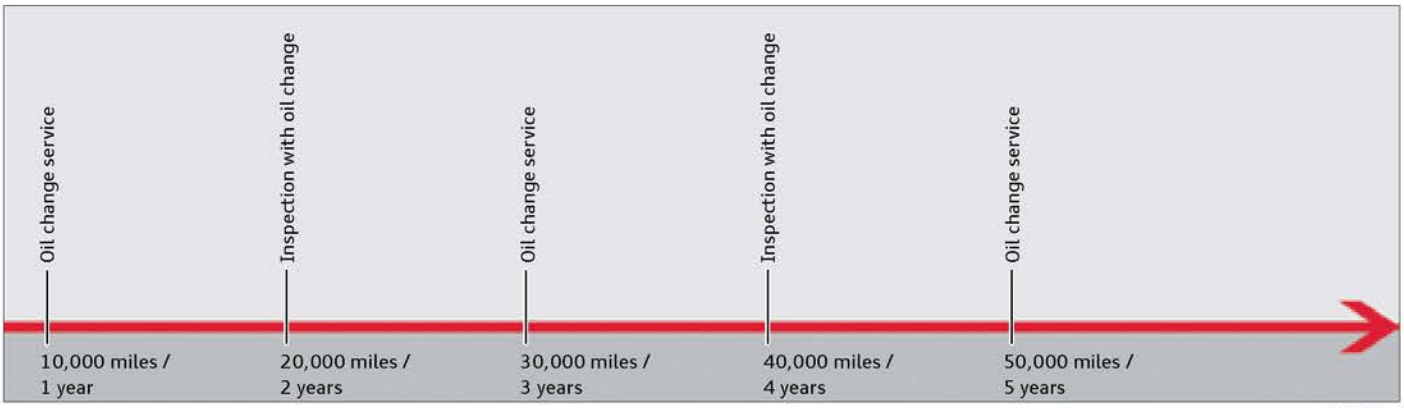
To simplify checking, both ends of the springs have color markings. The expander springs must not be overlapping as otherwise the oil control ring will not function properly. The joints of the three-piece oil control ring must be installed rotated through 120°.



645_045

Note
Always follow the instructions in the current electronic service information when installing the oil control rings on the piston.

Maintenance



644_034a

Note
The specifications in the current service literature apply and are market dependent.

Appendix

Glossary

This glossary explains to you all terms which are shown in italics and indicated by an arrow ↗ in this Self-Study Program.

↗ Blow-by gases

When the engine is running, blow-by gases flow from the combustion chamber and past the piston into the crankcase. This is due to the high pressure inside the combustion chamber and the normal leakage that occurs around the piston rings. Blow-by gases are extracted from the crankcase by the positive crankcase ventilation system and re-admitted into the combustion chamber.

↗ Cracked connecting rod

This term derives from the method by which the connecting rod is manufactured. The large end of the connecting rod is fractured in a controlled cracking process. The advantage of this process is that it provides an exact fit and a high degree of joining accuracy so only these two parts fit together perfectly.

645_054

↗ FSI

FSI is the abbreviation for Fuel Straight Injection, a technology used by Audi for direct fuel inejection into the combustion chamber in gasoline engines. Fuel is injected at pressures of up to 2900 psi (250 bar).

645_055

↗ Performance class

In the Federal Republic of Germany mobile working machines are subdivided into Performance classes according to the Federal Emission Control Act (regulations on emission limits for internal combustion engines) and the guidelines of the European Parliament.

Levels I, II, IIIA, IIIB and IV as well as Performance classes 19 kW – 36 kW, 37 kW – 55 kW, 56 kW – 74 kW, 75 kW – 129 kW and 130 kW – 560 kW are differentiated by variable and non-variable engine speed.

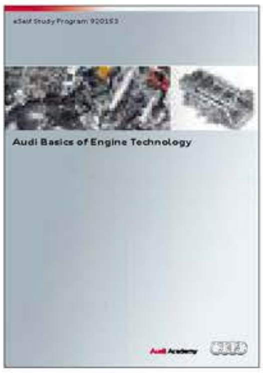
↗ MPI

MPI is the abbreviation for Multi Point Injection, an injection system for gasoline engines where fuel is injected into the intake manifold upstream of the injectors. In some engines it is used in combination with the FSI direct injection system.

645_053

Self-Study Programs

For more information about the technology of the EA888 series engines, please refer to the following:

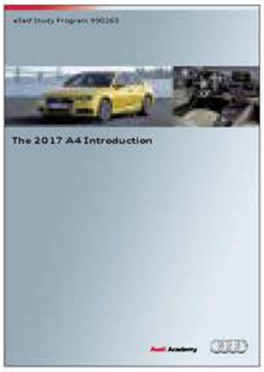


[SSP 920153](#)
[Audi Basics of Engine Technology](#)

- Basic information about the engine mechanicals and subsystems

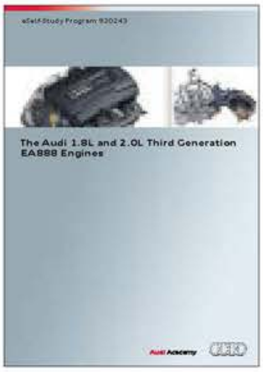
[SSP 922903](#)
[The 2.0L 4V TFSI Engine with AVS](#)

- Audi valvelift system (AVS)



[SSP 990263](#)
[The 2017 A4 Introduction](#)

- Fuel system



[SSP 920243](#)
[Third Generation Audi 1.8l and 2.0l Engines from the EA888 Model Family](#)

- Turbocharging
- Engine mechanicals
- High and low pressure fuel system

Knowledge assessment

An On-Line Knowledge Assessment (exam) is Available for this eSelf-Study Program.

The Knowledge Assessment is required for Certification credit.

You can find this Knowledge Assessment at:
www.accessaudi.com

From the accessaudi.com Homepage:

- Click on the "APP Links" tab
- Click on the "Academy site CRC" link

Click on the Course Catalog Search and select "920163 - Audi Third Generation 2.0l Engines"

Please submit any questions or inquiries via the Academy CRC Online Support Form which is located under the "Support" tab or the "Contact Us" tab of the Academy CRC.

Thank you for reading this eSelf-Study Program and taking the assessment.

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