Piston rings
Sealing under extreme conditions
Under pressure

Inertia and gas loads, as well as high temperatures, place high technical demands on piston rings. An optimum service life and adherence to emissions regulations are only achieved by tailoring piston rings precisely to the particular engine.

Kolbenschmidt piston rings. Controlled application of force.

Design, dimensions, material selection and a precise production process are essential for ensuring controlled contact pressure, which determines how well the rings function.

Molybdenum coatings
To protect the rings against burn marks, the sliding surface of the rings can be filled or coated on one surface with molybdenum. Flame spraying or plasma spraying procedures can be used for this. Thanks to its high melting point (2620°C), its porous structure and its lubricating effect, molybdenum provides more durable piston ring sliding surfaces.
Piston rings from Kolbenschmidt – more than just a seal

Continuous heat dissipation
Temperature management is a vital task of the piston rings. Most of the heat that is absorbed by the piston during the combustion process is dissipated by the piston rings to the cylinder. Without this continuous heat dissipation, the aluminium piston would melt within minutes.

Compression rings dissipate up to 70% of the piston temperature to the engine block.

Pressure is essential
Only the proper amount of combustion pressure will enable compression rings to fully perform their sealing function. The internal stress of the rings only performs the basic function, which is to create contact with the cylinder wall. The far higher pressure force – up to 90% of the total pressure force – is generated by the combustion pressure during the combustion cycle. The pressure is applied behind the piston ring (see illustration) and increases the pressure force on the cylinder wall.

Two are better than one
Two scraping lands on oil control rings ensure that the oil film thickness of 1 – 2 μm required for lubrication is always achieved, but never exceeded. Low oil consumption and mixture flow rate, as well as a long service life of the associated parts, are implemented in a virtually ideal manner.
Motorservice Group
Quality and service from a single source
The Motorservice Group is the sales organisation for the worldwide aftermarket activities of Rheinmetall Automotive. It is a leading supplier of engine components for the independent aftermarket. With the premium brands Kolbenschmidt, Pierburg, TRW Engine Components and the BF brand, Motorservice offers its customers a wide and comprehensive range of top quality products from a single source. As a problem solver for trade and repair shops, the corporation also offers an extensive service package. Motorservice customers benefit from the combined technical know-how of a large international automotive supplier.

Rheinmetall Automotive
Renowned supplier to the international automotive industry
Rheinmetall Automotive is the mobility division of the technology corporation Rheinmetall Group. With its premium brands Kolbenschmidt, Pierburg and Motorservice, Rheinmetall Automotive is a global leader in the relevant markets for air supply systems, emission control and pumps and in the development, manufacture and spare-parts supply of pistons, engine blocks and plain bearings. Low pollutant emissions, good fuel economy, reliability, quality and safety are the main driving forces behind the innovations of Rheinmetall Automotive.

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Piston rings
Function and design

Incorrect reconditioning

Piston impact on the cylinder head
If the sealing area of an engine block is not reconditioned and is stretched with increased compression height fitted, this may cause mechanical impact between the piston and the cylinder head in the case of diesel engines. The same occurs if cylinder head guides with the wrong thickness are fitted. Due to these hard impacts, the piston rings start to flutter and no longer seal properly.

Consequence: High oil consumption and high cylinder wear (see also “Fuel flooding”)
Remedy: Replace worn pistons and cylinder heads.

Piston ring joint clearance too small
The piston rings and clearance are comparable to the valve clearance. Warning up the parts causes thermal expansion of the components and a change in length. Thus, joint clearance when the machine is cold ensures that the piston rings in the cylinder will not get stuck when the machine is hot. If the joint clearance is too small when the machine is cold, there will be high piston ring wear, sealing problems and engine damage when the engine is hot.

Consequence: Premature piston ring wear, piston seizure and high oil consumption
Remedy: It is essential that the minimum joint clearance is guaranteed – a reduction of the joint clearance by the repair shop is not permitted.

Asymmetric piston wear pattern
Both connecting parts, which often cause as a result of engine damage, cause the piston to run as an ellipse in the cylinder. The piston rings consequently take on an elliptical form and no longer rotate in the piston. This results in uneven wear and ring flutter.

Consequence: High level of wear, ring fractures and excessive oil consumption
Remedy: The connecting rod rail for distortion and renewing before installing it should be checked.

Installing worn parts

Out-of-round cylinders
When matching the cylinder bores, it is essential that the parts are ground in perfectly. Piston rings can still seal slightly earlier on out-of-round cylinders. However, sealing becomes difficult for 3rd and 4th order out-of-roundness. These often occur due to tensile stresses from the cylinder head bolts. The centring shaped gaps caused by out-of-roundness between the piston ring and cylinder will result in leaks.

Consequence: Poor performance, excessive oil consumption and cylinder damage
Remedy: Replace worn pistons and cylinders.

Piston ring joint clearance too great
An excessive joint clearance on the piston rings causes pressure loss in the parts and piston rings. The joint clearance too great fits in the ring groove and is not enriched with the compression front. This results in excessive oil consumption between the piston rings and the ring grooves. The rings will become bent during use and start to flutter. If the rings are severely worn at the sides, they can break.

Consequence: High oil consumption and poor performance
Remedy: Regular air filter maintenance and use of engine oil with the right air specification for the engine

Worn cylinders
If new pistons and piston rings are installed in a worn cylinder, the piston rings often hit the upper wear edge of the cylinder. As a result, the piston rings start to flutter and no longer seal properly.

Consequence: High oil consumption and premature wear
Remedy: Replace worn pistons and cylinders.

Maintenance faults

Dirt in the intake air
Dirt that reaches the combustion chamber settles in the ring grooves where it causes abrasive wear in the ring grooves and at the piston ring flanks. This results in excessive ring height clearance and consequently to a deterioration of the guidance of the piston rings in the ring grooves. The rings will become bent during use and start to flutter. If the rings are severely worn at the sides, they can break.

Consequence: High oil consumption and poor performance
Remedy: Regular air filter maintenance, particularly in dusty areas

Blocked piston rings
Piston rings must be able to rotate freely in their ring grooves during operation (except for two-stroke engines). If the piston rings are blocked by carbon deposits or deposits, they will no longer be able to seal properly and will not wear uniformly in the ring groove. In the long term, the sealing effect is no longer guaranteed. This causes a blow-by of combustion gases on compression rings, and results in the passage of oil into the combustion chamber on oil rings.

Consequence: Piston seizure, high wear and high oil consumption
Remedy: Regular air filter maintenance and use of engine oil with the right air specification for the engine

Asymmetric piston wear pattern
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Remedy: Regular air filter maintenance and use of engine oil with the right air specification for the engine

Sound cannot be matched due to incomplete combustion of the blended fuel or the lack of a genuine fuel pump. This can be caused by the friction of the piston rings in the cylinder. The metal parts will tick against each other.

Consequence: High ring and cylinder wear, high oil consumption
Remedy: Correct function and adjustment of the fuel system

Further details on this subject can be found in our brochure “Piston Rings for Combustion Engines.”

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