PISTON RINGS –
SEALING UNDER EXTREME CONDITIONS

OUR HEART BEATS FOR YOUR ENGINE.
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 (2,620°C), its porous structure and its lubricating effect, molybdenum provides more durable piston ring sliding surfaces.

Casting process for piston ring castings (die casting)
Grinding the piston ring sliding surface
Internal lathe – manufacturing the inner contours
Phosphate coating plant
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.
DAMAGE
DIAGNOSIS

PISTON RINGS

INCORRECT RECONDITIONING

Piston impact on the cylinder head

If the sealing area of an engine block is reconditioned and a piston with standard compression height fitted, this may cause mechanical impact by the piston on the cylinder head in the case of diesel engines. The name occurs if cylinder head gaskets with the rings Piston rings are blocked by carbon deposits or dirt in the ring grooves. The piston rings start to flutter and no longer seal properly.

Consequence: High oil consumption and high cylinder wear (see also “Fuel flooding”).

Remedy: Compliance with the correct piston-protocol, use of the correct cylinder head gaskets.

Piston ring joint clearance too small

The piston ring joint clearance is comparable to the value clearance. Warming up the parts causes thermal expansion of the piston rings. When the machine is cold, the joint clearance when the machine is hot. The piston rings 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 varnish and high oil consumption.

Remedy: It is essential that the minimum joint clearances are complied with – a reduction of the joint clearance by the repair shop is not permitted.

Asymmetric piston wear pattern

Bent connecting rods, which often occur as a result of engine damage, cause the piston to run at an angle in the cylinder. The piston rings consequently take an elliptical form and no longer rotate in the piston. This results in uneven wear and ring flutter.

Consequence: High level of wear, ring fracture and excessive oil consumption.

Remedy: Check the connecting rod for distortion and twisting before installing it.

MAINTENANCE FAULTS

Dirt in the intake air

Dirt that reaches the combustion chambers necessitates 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 a deterioration of the sealing ability of the piston rings. The rings will become bent and stuck in the ring grooves. If the rings are severely worn on 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. If the rings are blocked by carbon deposits or dirt in the ring grooves, they can no longer rotate freely and will not wear uniformly. If the rings get stuck in the grooves, the sealing effect is no longer guaranteed. This causes a blow-by of combustion gases as compression rings, and results in the passage of oil into the combustion chamber on all rings.

Consequence: Piston seizure, high wear and high oil consumption.

Remedy: Regular air filter maintenance and use of engine oil with the right oil specification for the engine.

INSTALLING WORN PARTS

Out-of-round cylinders

When matching the cylinder bores, it is essential to make sure that the geometry is perfect. Piston rings can still seal slightly oval cylinders. However, sealing becomes difficult for 3rd and 4th order out-of-roundness. These often occur due to thermal pressure from the piston rings or as a result of the piston rings create shaped gaps caused by set of numbers between the piston ring and cylinder will result in leaks.

Consequence: Poor performance, excessive oil consumption and engine damage.

Remedy: Observe cylinder head tightening specifications or elimination of out-of-roundness during cylinder machining.

Piston ring joint clearance too great

An excessive joint clearance on the piston rings appears after a long service life and high wear on the cylinders and piston rings. In extreme cases, the cylinder bore has doubled its size compared to its new condition. In consequence, clearance of up to 0.3 mm are negligible. They contribute neither to a valuable loss of engine power nor to high oil consumption. The significance of a slightly enlarged piston ring joint clearance is then overestimated.

See also “Piston ring joint clearance too small”.

Consequence: High oil consumption and high cylinder wear.

Remedy: Replace worn pistons and cylinders.

Worn cylinders

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

See also “Piston impact on the cylinder head” and “Dirt in the intake air”.

Consequence: High oil consumption and premature wear.

Remedy: Replace worn cylinders or re bore cylinders.

COMBUSTION DEFAULTS

Knocking combustion and glow ignition

Knocking combustion and glow ignition causes excessive pressure peaks in the cylinder and high mechanical stress on the parts. The piston rings start to flutter and can break. With multicylinder coated rings, the multicylinder paper can break away.

Consequence: Piston seizure, loss of engine power and high oil consumption.

Remedy: Use of high-grade fuels.

Fuel flooding

The fuel is washed out due to incomplete combustion of the injected fuel or too much injected fuel. This causes increased dry friction of the pistons in the cylinder. The inlet parts rub against one another.

Consequence: High oil and cylinder wear, high oil consumption.

Remedy: Correct function and adjustment of the fuel system.

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