TIME FOR BEARINGS!

THE PERFORMANCE OF BEARINGS – IS A QUESTION OF MATERIALS, ALLOYS AND SLIDE LAYERS.

In addition to their actual function of supporting moving parts, bearings in engines have another important task: the accommodation and embedding of abrasion particles. These abrasive particles are generated during normal engine operation and are so small that they cannot be separated by the oil filter, and – if not embedded – can lead to increased wear. These key functions of bearings in achieving concentric running and low-wear operation of the engine require special design considerations.

Bearings in engines are subject to several different friction states. For this reason, they are designed to withstand the wear intensive mixed friction that exists during cold start as well as the high pressures of the combustion. Due to these different demands, bearings are generally made from several materials.

On the one hand a material has to be chosen that is highly wear resistant, on the other hand it must still provide sufficient embeddability.

IT IS THE MATERIAL THAT MATTERS

MAHLE bearings consist of a high-strength steel backing that is coated with different bearing metals depending on the particular application. The bearing materials are selected so that the different positive properties of the materials complement each other and the combination is optimal for the particular application. Material development takes therefore a key role in meeting today’s and future demands on bearings. Thanks to years of development activities and experience, MAHLE disposes over a large number of high-quality bearing alloys such as aluminium and bronze alloys.
MULTI-LAYER DESIGN

Strength, good close fit, good running quality – these are demands that are contradictory in terms of material technology. The solution: multi-layer bearings, designed according to the principle of work-sharing. This is because the basic performance of bearings, above all their dynamic load capacity, is not only influenced by the material, but also by the structure and thickness of the layers as well as design measures such as the bearing surface configuration. The base of a MAHLE bearing is a high-strength steel backing that is coated with different bearing metals depending on the particular application. Here is an overview of bearing designs.

Solid bearings are made completely from one kind of metal, mostly a hard bronze alloy. These bearings are often used in large engines, however, they are also used in passenger cars as piston pin bushings, thrust washers or camshaft bearings.

Two-material bearings consist of a steel backing, an intermediate layer and a layer of bearing metal. Aluminium alloys are used mainly for the bearing metal. Two-material bearings are used in petrol and naturally aspirated diesel engines under low to medium loads in passenger cars - depending on the alloy, as piston pin bushings, valve rocker bushings, thrust washers, camshaft bearings, main bearings or connecting rod bearings.

Three-material bearings consist of a steel backing, a bearing layer, a barrier layer and the slide layer. The bearing layer is mainly made from a type of lead bronze and is generally applied through an electro-plating process. Three-material bearings are predominantly used in engines subject to higher loads – as large piston pin bushings, connecting-rod bearings, main bearings and crankshaft bearings.

Sputter bearings belong to the bearing types of the highest quality. In terms of their structure, they are also three-material bearings and are made from the same materials. However, an extremely resistant aluminium layer is deposited onto the bearing material – by means of a special production method, the sputter process (see box “Sputter process”). Due to this coating, these bearings feature significantly greater hardness and wear resistance. The bearings are especially suitable for high-performance engines such as turbocharged engines in passenger cars and commercial vehicles and are then used especially in the connecting rod and crankshaft area.

SPUTTER BEARINGS: PERFECT WORK-SHARING

The sputtered slide layer is extremely hard and wear resistant, however, embeddability for the above mentioned abrasion particles is therefore low. In order to provide embeddability, only one half-bearing of a sputter bearing is sputtered. The other half of the bearing is a three-material bearing with conventional coating that can accommodate the abrasive particles perfectly.

IMPORTANT: TO KNOW WHICH IS UP OR DOWN

The sputtered half-bearing is always fitted to the side subject to the higher load. For example, the sputtered half-bearing has to be fitted to the upper half circle of the big end of connecting rods, as this is where the combustion pressure has its effect (see picture 1). At the crankshaft, however, the combustion pressure affects the half-bearing that is directed downwards. The sputtered half-bearing can be recognised by the labelling “Sputter” on the outside of the bearing. For safety reasons, the sputtered bearings are often packaged and sealed separately.

CAUTION, OIL HOLE!

An additional error source during fitting of bearings is the fitting position. For most half-bearing pairs, only one half-bearing has a hole. If the bearing site is lubricated via a lubrication hole (as for instance with crankshafts), it has to be assured that the hole in the half-bearing is positioned exactly over the hole of the corresponding seat. If the half-bearings are fitted the wrong way round, the bearing site is not at all or only insufficiently supplied with lubrication oil. The result: severe seizing, which can cause the bearing to weld to the journal due to the enormous heat that is generated. (Picture 2 shows such welding of the bearing to the crankshaft.)

Solid bearings
Consist of one bearing metal made from special alloys.

Two-material bearings
The steel backing is complemented by an intermediate layer and a layer of bearing metal – used for engines subject to low and medium loads.

Three-material bearings
Consist of steel backing, bearing layer, barrier layer and slide layer for sputter bearings with a special coating – used, for instance, in supercharged engines.

A safe indication for sputter bearings: the “Sputter” stamp on the back.

In the connecting rod, the sputtered half-bearing is fitted to the upper half circle, where the combustion pressure results in the higher load.

The result of a fitting error: As the half-bearings have been fitted the wrong way round, the lubrication hole was blocked – and this led to seizing with extreme heat generation, causing the bearing to weld to the crankshaft.

You can find an overview of the complete MAHLE bearing programme in the MAHLE bearing catalogue - and online at www.mahle-aftermarket.com.