TECH

TECH INFORMATION FROM MAHLE CLEVITE INC.

TB-2075

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ENGINE BEARING FUNDAMENTALS PART 6 'BI-METALS"

In part 5, (TB-2074) we discussed the common types of bearing construction, including "Bi-metal". Nearly all bi-metal bearings produced today use a steel backing. Various types of lining materials can be applied to suit a broad variety of applications. There are basically three families of lining materials used in the manufacture of bi-metal bearings. They are: babbitt, aluminum-based alloys and copper-based alloys.

BABBITT: Much of the description and properties of babbitt bearings were covered in part 5. Babbitts are considered to be light duty materials because of their limited strength in terms of fatigue resistance or the ability to stand up under load. In spite of this apparent shortcoming, babbitt is still the best choice for a bearing if it has adequate strength to handle the load. This is because babbitt displays the best combination of surface properties essential for successful bearing performance.

In the early 1940's a way was found to enhance the strength of babbitt bearings by reducing their lining thickness to a closely controlled range of .002" to .007". These are called "micro-babbitt" bearings (M-series). The reduction in lining thickness results in greater fatigue strength due to the closer proximity of the steel back to the bearing surface. Traditional bi-metal babbitt bearings (no longer used) by comparison had a lining thickness of approximately .020". Micro-babbitt's improvement in strength came as a trade-off in the areas of embeddability and conformability. Because of the thinner lining, micro-babbitt bearings will not embed quite as many large particles and cannot conform to misalignment as well as conventional babbitt did. The thinner lining does, however, provide slightly better temperature strength and thermal conductivity. M-series Clevite® micro-babbitt bearings are still quite popular in drag racing, especially in alcohol fueled dragsters.

ALUMINUM: There are many aluminum based bearing alloys. MAHLE Clevite recommends MAS19 (AlSn6Si2CuNiMnV) — one of the best and most modern. This material has an excellent range of performance and therefore can be recommended for all applications except the most severe. This advanced BiMetal™ gets its performance characteristics from micro-alloying, seen by the small but critical quantities of Nickel (Ni), Manganese (Mn) and Vanadium (V). These act as grain refiners and alloy strengtheners, while maintaining optimal conformability and compatibility with crank materials. MAS19 provides high wear resistance and debris tolerance, together with excellent fatigue resistance.

For further information contact:

MAHLE Clevite Inc. • 1240 Eisenhower Place • Ann Arbor, Michigan 48108-3388 U.S.A.• www.mahleclevite.com

COPPER-LEAD: As the name implies, these materials are made up of copper and lead with the addition of varying amounts of tin. Here again, strength falls off as lead content increases with an accompanying improvement in surface properties. Tin is used to aid in corrosion resistance and to control metallurgical structure. While lead content can vary from 8% to as much as 50%, tin content is generally from a fraction of a percent to a maximum of about 10%. The more tin the better the corrosion resistance and strength, but with less conformability.

Bi-metal copper-leads are typically used for bushing applications such as camshafts, wrist pins, and other highly-loaded applications. They are also the material for many thrust washer applications. Bi-metal copper-leads are classed as medium to heavy duty materials.