TECH

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ENGINE BEARING FUNDAMENTALS PART 5 "CONSTRUCTION & MATERIALS

In part one (TB-2070) of this series we discussed bearing properties. Here we will begin exploring how these properties are derived through the use of various metals and how bearings are constructed using a combination of materials. Bearing construction is typically described in terms which refer to the number of layers the bearing is made up of.

MONOMETAL bearings are made from a single material such as bronze or an aluminum alloy. These parts may be made from solid bar of tubing, but are most commonly formed from flat strip. Today we still see wrist pin bushings and thrust washers made from bronze with no steel backing, and occasionally we also see thrust washers and half shell bearings made of solid aluminum based alloys. The absence of a steel backing for support and rigidity limits monometal bearings to use where loads are not very high.

BIMETAL bearings are constructed of two layers. The backing is generally steel to which a layer of bearing metal is bonded. In this type of construction the steel back provides rigidity and allows a higher level of "press fit" or "crush" for better retention. The bearing lining however, must provide all of the bearing properties from a single layer. This requires that some properties are to be compromised in favor of others. Bi-metal copper-lead is typically used for light or medium loading. Bi-metal aluminum bearings are extremely popular today. The absence of lead in the manufacturing process along with the durability of silicon-aluminum alloys makes them a popular choice for OEM passenger cars and light trucks.

TRIMETAL bearings, like bi-metals, have a steel back with a layer of bearing metal bonded to it but tri-metal bearings also have a third layer which makes up the bearing's actual running surface. Each layer of a tri-metal bearing has a specific function. The steel back provides support; the middle or "intermediate" layer gives the bearing strength to withstand loads and resist fatigue, and the top or "overlay" layer provides the surface properties. Tri-metal bearings offer the best overall combination of bearing properties. This type of construction is used for premium and heavy duty applications where long life is required under heavy loads.

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Bearing lining materials are nearly all alloys. Alloys are made up by mixing two or more pure materials in specific proportions in order to obtain the desired combination of properties. In part one we mentioned that lead, tin and copper are used to make up some of the most commonly used bearing alloys. In addition aluminum, silicon, nickel and indium are also used. Individually these materials have limitations in their properties, but when combined together in the proper proportions as an alloy, the overall bearing qualities are better than those of the individual elements.

BABBITT does not define a single bearing alloy but rather, a family of alloys having similar properties. Babbitts, also sometimes referred to as “white metals”, are soft alloys made up of lead or tin with elements such as copper, antimony and arsenic added. These alloys have exceptionally good surface properties (slipperiness, embeddability and conformability), but low fatigue resistance and relatively poor temperature strength when applied in layers over about .001” in thickness.

Babbitt materials may be separated into two groups, “lead-based” and “tin-based”. This terminology defines the metal which makes up the major portion of the alloy. Lead-based babbitt is stronger and less expensive, but tin-based babbitt offers better corrosion resistance. The choice must therefore be made on the basis of the specific bearing application.

Babbitt may be bonded to steel or other bearing alloys by casting the molten alloy on to a pre-heated substrate or by electroplating. Generally, casting is used to produce thicker layers while electroplating is restricted to producing layers of about .002” or less. Although babbitt bearings are some of the oldest types of bearing materials, they are still in common use today.

In the next part of this series we will talk more about bi-metal bearings and the materials used to make them.