TECH

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ENGINE BEARING FUNDAMENTALS – PART 1 "PROPERTIES"

This is the first in a series of bulletins, which cover the various aspects of engine bearing function, design, construction and performance. Before getting into the detail of how bearings are made and operate, we should first review their functional requirements.

A bearing is a relatively inexpensive replaceable wear surface, which reduces friction between rotating shafts and fixed housings. The intent is for bearings is to protect more expensive parts, of an engine such as the crankshaft, camshaft, engine block and connecting rods. In addition, bearings must also support the moving parts. This requires that bearings be capable of withstanding very high loads which are constantly changing in magnitude and direction. These are commonly referred to as cyclic loads which may eventually result in bearing lining fatigue or flaking if the bearing material does not have adequate fatigue strength.

Bearings reduce friction by using dissimilar metals. Metals which are different will slide over each other with less friction than two surfaces made of the same metal. The most commonly used bearing metals are alloys containing lead, tin and copper, which are chosen for their low friction and alloys of aluminum known for their long wearing properties. In addition to the bearing's material composition, friction is also greatly reduced by the introduction of a lubricant between the bearing and shaft. An important feature of the bearing design is the ability to establish and maintain a film of oil in the loaded area between the moving surfaces.

Even in the most carefully designed and maintained bearing system a certain amount of wear will gradually occur. Wear takes place when there is an inadequate oil film such as at start-up or during certain severe operating conditions. Wear is also experienced when foreign particles or dirt pass through the bearing along with the lubricant. Bearings are designed to absorb or embed a certain amount of foreign contamination in order to protect the more expensive shaft. Bearings are made to take up wear from friction and abrasive action and are generally always replaced when an engine is rebuilt. They must therefore be easy to replace and offer a high degree of precision. When properly installed the modern replacement bearing will duplicate the original assembly specifications. Manufacturing and reconditioning tolerances dictate that bearings must be able to conform to minor degrees of misalignment and surface imperfections between the bearing, shaft and housing. This is generally considered to be part of the break-in process, and conformability is an important bearing characteristic.

Since engines operate at elevated temperatures and friction also causes heat, bearings must operate and maintain their strength at elevated temperatures as well as be able to conduct heat away from the running surfaces. A continuous flow of lubricant also aids in heat dissipation.

One last property, which bearings must exhibit, is a resistance to chemical attack. Corrosion by acids, which can occur from the combination of moisture and by-products of combustion, will result in long term deterioration of the lubricant. Bearings are weakened by the effects of corrosion making them more susceptible to deterioration from engine operating loads; consequently corrosion resistance is important to achieving long service life.