2.0 SINTERED-METAL BEARINGS

2.1 General Properties

Sintered-metal self-lubricating bearings are based on powder-metallurgy technology. They are economical, suitable for high production rates and can be manufactured to precision tolerances.

General properties of porous-metal bearing materials have been described in *Machine Design* magazine (Vol. 54, #14, June 17, 1982, pp. 131-132), with whose permission the following material is reprinted:

Sintered-metal self-lubricating bearings are widely used in home appliances, small motors, machine tools, aircraft and automotive accessories, business machines, instruments and farm and construction equipment.

Most porous-metal bearings consist of either bronze or iron which has interconnecting pores. These voids take up to 10% to 35% of the total volume. In operation, lubricating oil is stored in these voids and feeds through the interconnected pores to the bearing surface. Any oil which is forced from the loaded zone of the bearing is reabsorbed by capillary action. Since these bearings can operate for long periods of time without additional supply of lubricant, they can be used in inaccessible or inconvenient places where relubrication would be difficult.

Many variations are possible to meet specific requirements. From 1% to 3.5% graphite is frequently added to enhance self-lubricating properties. High porosity with a maximum amount of lubricating oil is used for high-speed light-load applications, such as fractional-horsepower motor bearings. A low-oil-content low-porosity material with a high graphite content is more satisfactory for oscillating and reciprocating motions where it is hard to build up an oil film.

Powder producers can control powder characteristics such as purity, hydrogen loss, particle size and distribution, and particle shape. Each of these properties in some way affects performance. In the bronze system, for example, shrinkage increases as particle size of tin or copper powder in the mix decreases. Graphite additions result in growth but always lower the strength of the bearings. Lubricants used in the mix have only a slight influence on dimensional change, but a more pronounced effect on the apparent density and flow rate.

After sintering, the bearing must be sized to the specific dimensions. Sizing reduces interconnected porosity and produces greater strength, lower ductility and a smooth finish.

Bronze: The most common porous bearing material. It contains 90% copper and 10% tin. These bearings are wear-resistant, ductile, conformable, and corrosion-resistant. Their lubricity, embeddability and low cost give them a wide range of applications from home appliances to farm machinery.

Leaded Bronzes: Have a 20% reduction of the tin content of the usual 90-10 bronze and 4% reduction in copper. Lead content is 14% to 16% of total composition and results in a lower coefficient of friction and good resistance to galling in case the lubricant supply is interrupted. These alloys also have higher conformability than the 90-10 bronzes.

Copper-Iron: The inclusion of iron in the composition boosts compressive strength although the speed limit drops accordingly. These materials are useful in applications involving shock and heavy loads, and should be used with hardened shafts.

Hardenable Copper-Iron: The addition of 1.5% free carbon to copper-iron materials allows them to be heat-treated to a particle hardness of Rockwell C65. They provide high impact resistance and should be used with hardened and ground shafts.