POLYGON
COMPOSITES REVOLUTION

Pin Selection for use with Polygon Bearings

Herb Burnell
Polygon Company

PolyLube bearing wear is a function of the interaction between the wear materials in the liner and the pin. The majority of pins used in conjunction with PolyLube bearings are carbon steel. The grades range from 1018 to 4140. Pin selection is most important to designers ensuring the shear and tensile strengths are suitable for the specific application. The major properties of concern for Polygon are the surface finish, hardness, and corrosion resistance. Each of these pin characteristics contribute to the bearing wear.

Surface Finish

The optimum pin surface finish is a roughness average between 16 and 32 microinches. The mechanism allowing the bearing to operate in a dry condition is the transfer of the PTFE from the bearing to the pin. The peaks and valleys of the surface finish determine how much PTFE is transferred and if it will remain imbedded into the pin. During the break-in period, the bearing liner is shearing some of the peaks and filling the valleys with PTFE. The typical amount of bearing break-in wear running with a 16-32 µin Ra pin is approximately 0.001 inches. Following the PTFE transfer, the wear rate will stabilize to an approximate rate of 0.001 inches/35,000 cycles. The rate of wear given is intended to be a guide and will be affected based on load, speed, hardness, surface finish, contamination, and oscillation angles.

Polygon has many applications currently using pins outside the recommended surface finish range. Pins with surface finishes higher than recommended will experience both a higher coefficient of friction and a longer break-in period due to the additional PTFE needed to fill the deeper valleys. After the break-in period has been completed, the rate of wear and the coefficient of friction will behave similarly to the steady state experienced using the optimum pin finish. The trade-off to the cost savings for using a rougher pin is additional clearance after the break-in period.

Pins with too smooth a surface finish will adversely affect the bearing. The problem with using pins smoother than 16 µin Ra, is the inability for the surface finish to hold the transferred PTFE. The result is a continuous break-in period leading to a faster rate of bearing wear compared to joints using pins with the recommended surface finishes.

Hardness

Polygon recommends a pin surface hardness of 50 Rockwell C. PolyLube bearings are currently in use with cold drawn 1018 pins with a hardness of 71 Rockwell B. Pin hardness is most important for applications operating in contaminated environments. A hard surface will be less likely to score when contamination is rolled in the contact area between the pin and bearing. Softer pins will score and force the bearing to begin shearing the raised areas or become scored themselves.

Corrosion Resistance

Pin corrosion will affect the surface finish of the pin as well as the running clearance. As a pin corrodes, there are a number of consequences to the operation of the joint. The three main problems introduced into the joint are increased pin OD, rougher surface finish, and oxide material contamination. The increased pin diameter could result in an interference fit and increased force needed to turn the pin. The increased roughness of the pin surface will serve to additionally increase the torque required to operate the joint as well as increase the rate of wear. The addition of contaminates, in the form of the metal oxide, will further degrade the pin and bearing. Protecting the pin and bearing from contamination will lead to long term predictable wear regardless of the frequency of operation of the equipment.

Polygon recommends a corrosion resistant surface treatment for pins used in dry running applications. Many years of success have been experienced with customers using Hard Chrome, Electroless Nickel, and Nitrocarborization. Pins with these surface treatments will have hardness in excess of the Polygon recommendations. Thickness or depth of the treatment should be determined based on the chosen materials. Typical values are 0.0005 inches for both thickness and white layer depths. These values are not intended as recommendations, only as examples to allow designers a value to begin a conversation with pin suppliers.

Softer surface treatments are also in use with Polygon bearings. Yellow Zinc Dichromate (YZD) is a cost effective alternative to the previous treatments given. YZD can be thought of as metal paint. The coating will be removed in the contact area by the bearing very quickly. The break-in period between the bearing and the base material will begin after the YZD has been worn away. There will be some added wear resulting from worn away YZD acting as contamination. Equipment seasonal in nature will also have a possibility of pin corrosion at the contact area. The transferred PTFE will act as a corrosion inhibitor if a sufficient amount has been transferred during the first season operation. The main purpose most designers state when using YZD is corrosion protection for the surface not in contact with the bearing. The result is a decrease in the migration of oxide into the joint compared to an untreated pin.