CHEMICAL PROPERTIES

The PTFE sliding layer is resistant to most chemical products, while the corrosion resistance of TH bushing depends on the steel backing which does not oxidize when:

- Immersed in water, alcohols or glycols;
- In the presence of mineral and synthetic oils;
- In acid substances with a pH level of > 5;
- In alkali substances with a pH level of < 9.

Corrosion is triggered off in the case of repeated wet/dry cycles, the presence of oxygen and when the temperature exceeds 90°C.

The chemical resistance of TH bushing is improved by tin-plating, but the problems of corrosion must be overcome by further protection such as special tin-plating, by sealing the bearings or by using the bronze-backed bearings (TH-B) or stainless steel-backed bearings (TH30).

THERMAL CONDUCTIVITY

During operation heat is generated by the friction between the bearing and the shaft. The heat is partly dissipated by the fluids present (gas or liquids) and partly absorbed by the mating parts. Under normal operating conditions, the bearing must be able to dissipate the heat generated and not give rise to thermal dilations that may compromise the working of the two parts. Under both aspects, TH bushing performs very well as it features:

Perpendicular thermal conductivity which is linked to the steel backing and the close contact of the bronze and the polymer layer. Both factors lead to a high level of thermal conductivity between the layers that enables the heat to be eliminated without causing a sharp rise in the temperature (on average + 20° to 25°C compared to the temperature of the environment).

Volumetric expansion: the increase in temperature gives rise to an expansion in the volume of the materials. Given the composition of the product, TH bushing expands in a way very similar to that of metals normally used for the housing and the counterpart. This similar behaviour prevents seizure during heating and movement of the bearing in the housing during cooling which sometimes arises when plastic bearings are used.

ELECTRICAL CONDUCTIVITY

TH bushing not only offers a high level of thermal conductivity, but also a high level of electrical conductivity that is perpendicular to the layers. However, this electrical conductivity only appears after the first running-in period, when the bronze starts to be exposed and comes into contact with the mating surface. The perpendicular electrical conductivity increases with the specific load applied on the bearing and with the degree of wear. Typical values of specific electrical resistance for units-surface are the following:

Perpendicular electrical resistance: R = 1 - 10W x cm^2

FRICTION

The TH bushing sliding layer has a PTFE base that gives an excellent slide quality due to the low coefficient of friction. The amount of friction cannot be defined exactly as it is influenced by the following parameters:

- Load factor p x v on the surface
- Operating temperature
- Presence of liquids and lubricants
- Material and finish of the mating surface

The load factor p x v is the result of the specific load p (N/mm^2) and the speed v (m/s) and represents the reference parameter for checking the performance of this type of bearing. p x v being equal, the coefficient of friction decreases as the specific load increases, while the coefficient of friction increases as the speed increases.

Sliding Speed v (m/s)	Specific Load p (N/mm^2)	Coefficient of Friction μ
up to 0.001	140	0.03
0.001 to 0.005	140 to 62	0.04 to 0.07
0.005 to 0.05	62 to 11	0.07 to 0.1
0.05 to 0.5	11 to 1	0.1 to 0.15
0.5 to 2	1	0.15 to 0.20

TEMPERATURE

The temperature has a very slight effect on the coefficient of friction if it remains within a range of 0º to 100ºC. Once these limits are exceeded, the coefficient of friction increases rapidly by 50% or more. It should be noted that very high temperatures reduce the useful life of TH bearings. Under equal load factors, the useful life is reduced by 80% at a temperature of over 200ºC compared to that noted at 25ºC.

LIQUIDS AND LUBRICANTS

TH bearings have been designed for dry operations, but despite this, the presence of clean fluids in the working area can facilitate the dissipation of heat and prolong the useful life of the bearing. The presence of liquids, whether lubricants or other, may lead to hydrodynamic operating conditions which enable a considerable increase in the sliding speed at the same specific load. Hydrodynamic operating conditions are influenced by the following parameters:

- Sliding speed
- Specific load
- Tolerance of the mating surfaces
- Viscosity of the liquid
- Operating temperature

OPERATION IN THE PRESENCE OF LIQUIDS AND LUBRICANTS

In practise, even the self-lubricated bearings (TH Series) can be used in the presence of liquids and/or lubricating fluids.

In these situations, the behaviour of the bearings are modified and the following considerations apply:

- The presence of a clean fluid on the bearing (whether lubricating or not) usually has a positive effect as it improves the dissipation of the heat caused by the friction and also improves the contact between the sliding surfaces.
- It is necessary to the check the compatibility of the bearing with the fluid. Most problems arise with THX bearings as the acetal co-polymer is not recommended for use in water, glycols or synthetic oils with phosphoric esters. The other TH Series does not have any particular contraindications in the presence of widely used liquids and lubricants.
  If in doubt and in case of special applications, it is advisable to carry out a simple test by immersing half of a sample bearing in the liquid in question. If, after two weeks, the bearing shows non signs of alteration in any part it can be considered to be compatible with the fluid.
- For the TH Series of bearings, the positive effects of the presence of fluids are confirmed only if alternating dry and wet cycles are avoided. In the presence of repeated cycles, the result is a premature decline in the product compared to dry operating conditions.
- For the bearings subject to lubrication, just the initial greasing may be sufficient as long as the application is subject to limited specific load and speed values.

LUBRICATION SYSTEMS

In the presence of fluids and under certain speed and specific load conditions, hydrodynamic lubrication occurs. This involves a thin film of fluid being generated permanently between the mating surfaces. During a hydrodynamic regime, the coefficient of friction and the wear of the parts falls to such a level that the life of the bearing depends more on the number of stop-start operations rather than the actual running time.
If a hydrodynamic operating regime is provided for during the design phase, steps must be taken to increase the clearance of the mating parts to facilitate the formation and maintenance of the separating film.

MATERIAL AND FINISH OF THE MATING SURFACE

The material of the mating surface, whether it is a shaft or a shoulder, has a considerable effect on the results of the application. The metals which may corrode in the presence of humidity or pollutants, accelerate the deterioration of the mating surface.
For applications with no protection, it is advisable to use stainless steel, chromium-plated steel or anodized aluminum mating surfaces.
Bronze, non-anodized aluminum, phosphated or nickel-plated steel mating surfaces are not suitable. The roughness of the mating surface must be quite low to permit a good operating life. The recommended value for the best performance is 0.4mm Ra.