BEARINGS

WHY Plastic or non-ferrous bearings:

Plastic materials offer the bearing designer virtually limitless opportunities to apply the "best material to the application." Plastic bearing materials can be

- Custom designed
- Self lubricating
- Low friction
- Resilient
- Corrosion resistant
- Light weight
- Low maintenance
- and easily fabricated to your requirements.

These features contribute to longer useful part life, and improved operating efficiencies benefiting you and your customers thru reduced operating costs, reduced maintenance costs, and improved overall quality.

Properly designed into machinery and equipment, plastic bearings improve operation and reduce downtime in those applications where maintenance and lubrication is often neglected. Plastic bearings are non-galling, so that in the event of failure, expensive polished shafting is not damaged. Resilient plastic bearings are ideal for high impact applications such as rollers or clam buckets where high impacts damage non-plastic liner or roller bearings.

When evaluating various materials for use in a specific application, a few important factors need to be considered, namely temperature, environment, speed and load (i.e. PV Value), desired service life, and relative cost.

Understanding P-V Value:

A critical element in the design of plastic bearings is the combined effect of Pressure (P) and Velocity (V).

- **Pressure** (P) is the load placed on a bearing assembly.
- **Velocity** (V) is the surface speed at which an object, such as a shaft, moves.
- P-V is defined as the combined effect of the pressure of the object and the velocity at which it moves on the bearing surface (P x V).

A direct relationship exists between the PV value and the amount of frictional heat generated within a bearing and thus the point of failure since plastics are thermal insulators AND typically have lower melting points than materials such as bronze, lead, or steel.

Determining the P-V Value of an application:
Consider this example:
A 2″ dia shaft turns at 100 rpm and exerts a total load of 140 lbs on a 2″ long bearing.

For a rotating shaft, **velocity (V)** is determined using the formula:
V = .262 x rpm _____ x D _____

where V = Velocity (in feet per minute, FPM)
rpm = Shaft Revolutions per minute
D = shaft diameter (in inches)
.262 = the constant for circumference of a circle in feet. (3.14 ÷ 12)

Therefore, in our example,

V = .262 x rpm 100 x D 2
V = 52.4 feet per minute (fpm)

Pressure (P) is determined in a sleeve bearing application by dividing the total load on the bearing by its bearing area. Bearing area (BA) is determined by multiplying shaft dia. x length of bearing.

BA = Shaft dia. _____ x Length of bearing _____
where BA = Bearing Area

In our example, the bearing area is as follows:

BA = 2″ Dia shaft x 2″ length of bearing = 4 in^2.

Pressure may be determined by dividing the total load of 140 lbs. by the bearing area of 4 in^2

P = 140/4 = 35 psi.

Total PV for this application can be quickly calculated now by multiplying the values P and V obtained above, or:

52.4 x 35 = 1834

Various ASTM and AMS tests are used to determine maximum PV Values. Different testing methods can produce different results.

Using P-V Value to design plastic bearings:

Maximum PV Values for various plastic materials are available in table "XX." By determining the PV Value of an application and comparing it to the maximum PV Value of a material, you can determine if a material meets the most important suitability criteria. While the PV Value of the application must not exceed the maximum allowable PV Value of the material under consideration, not all PV Values are alike. Pressure and Velocity are separate and distinct functions. Some materials excel at high load, low speed applications, while others perform best in low load, high speed applications.

Consider the following 2 applications:

2″ dia shaft at 150 rpm and 50 psi.
V = 2 x 150 x .262 = 78.6
PV = 78.6 x 50 = 3930

1.5″ dia shaft at 50 rpm and 200 psi.
V = 1.5 x 50 x .262 = 19.65
PV = 19.65 x 200 = 3930

As you can see, these 2 applications are very different, yet the PV is the same. In all new applications, testing the proposed material in an actual bearing installation is strongly suggested.

Ryerson's experienced staff can assist you with your bearing requirements from blueprint to on-time delivery. Our full service plastics machining center regularly services bearing customers nationwide in the following industries:

- Injection molding equipment
- Agricultural and farming equipment
- Steel mills
- Pulp and paper mills
- Off road construction and mining equipment
- Shipbuilding
- Conveyor and material handling
- Elevator and escalator manufacturers
- Food processing equipment

Call your Ryerson Plastics representative for additional information on any of our non-ferrous bearing options and to discuss the best alternatives for your application.

RYERSON PLASTICS STANDS READY TO SERVICE YOUR BEARING NEEDS!