Bearing Design Principles

PV Calculation

Calculate Sleeve Bearing PV Limit

Example: .750" Shaft @200rpm;
85.0 lb. total load, bearing length .750"

V = 0.262* x rpm x diameter
= 0.262 x 200 x .750 = 39.3 fpm

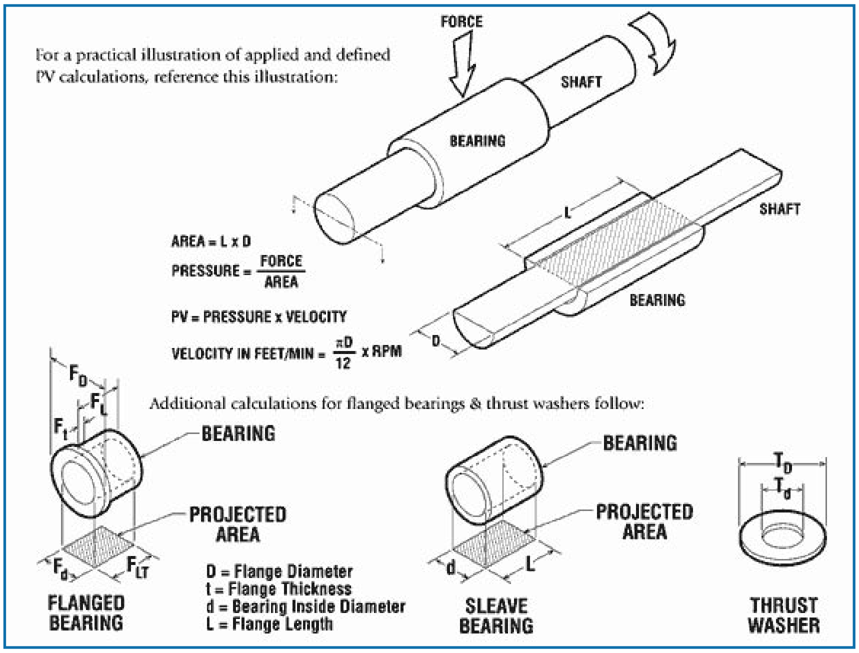
P = total load / projected area (A)**

A = .750(shaft) x .750 (bearing length) = .562 in^2

P = 85.0 lbs. / .562 in^2 = 151.2 psi

As a guideline, a 20,000 PV limit is specified for the Fiber-Lube™ bearings. Test results conducted at 15,000 PV gave only 0.002" wear after 10 million cycles, ±25° oscillation run at 60 cpm and 343 pounds radial load. For special applications 50,000 PV is possible.

PV (Pressure & Velocity) is the most common empirical tool to use when comparing and contrasting bearing performance. "P" is related to pressure or pounds per square inch on the projected bearing area, while "V" is velocity in feet per minute of the wear surface. Knowing the PV limit of a bearing, the designer can determine the loads and surface running speeds under which a bearing can safely operate. Since heat generated by friction is one of the major causes of degradation in liners, evaluation of the operating conditions of a fiberglass-reinforced, composite journal bearing requires that you know the approximate temperature generated on or near the actual wear surface. The temperature rise is also dependent on the running speed and is not a linear function of the PV product.

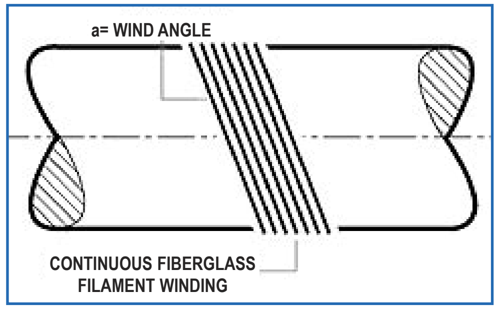


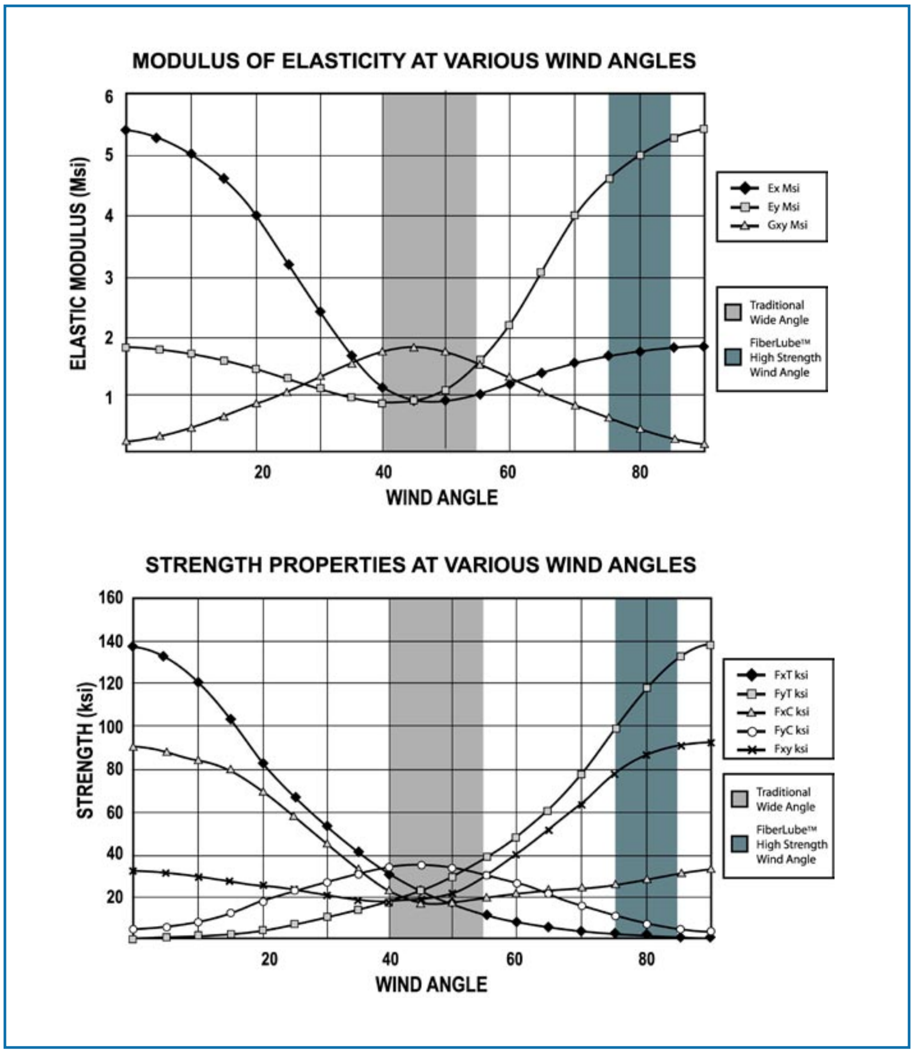
Length Ratio

Optimum performance can be achieved by specifying a length to inside diameter ratio (L/ID) ranging from 0.5 to 2.0. Below an L/ID of 0.5, highly stressed areas at the bearing's corner may cause premature cracking. If the L/ID ratio is higher than 2.0, a small shaft misalignment could cause cross-corning jamming. At this point, the unit's radial and/or longitudinal stresses could exceed 30,000 PSI. However, bearings constructed with the proper L/ID ratio can accept misalignment and shock loads without premature failure.

Designing for Edge Loading

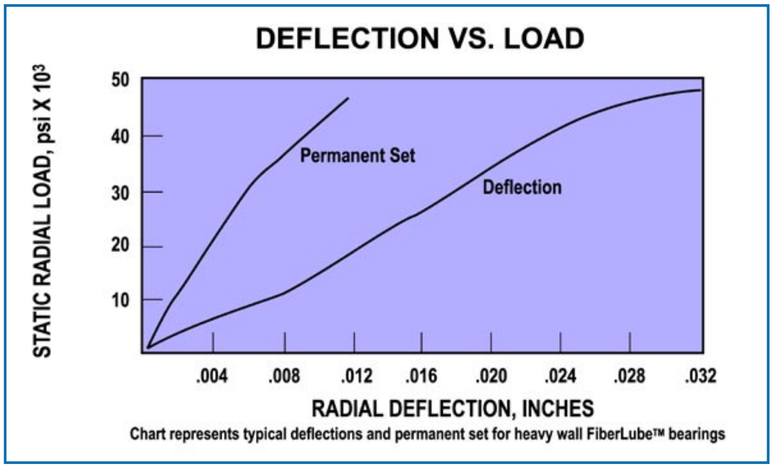
As with liner construction, in order to optimize a composite bearing's impact resistance, the bearing must also take advantage of the performance drivers that are related to the wind angle of the fiberglass backing. The fiberglass backing's orientation off of the neutral axis is a significant driver in the finished performance of the bearing itself. Most composite bearing companies utilize winding equipment that produces bearings between a 40 and 55 degree wind angle. For most applications this is acceptable; however, for applications where repeated high stress/strain is of concern, the backing can be further optimized by positioning the wind angle closer to a theoretical 90 degree wind angle. Our manufacturer's equipment is all precisely computer controlled and as a result, wind angles can be modified to accommodate higher impact resistance.





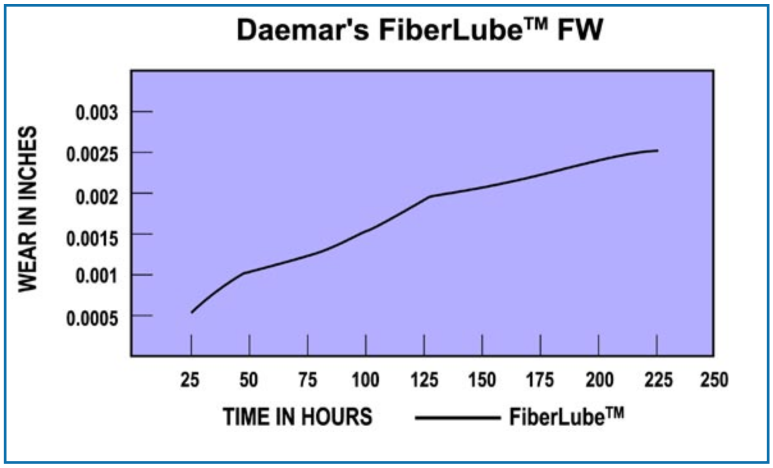
Load Capacity

Daemar's manufacturer has a proprietary process of fiberglass filament winding that results in exceptionally strong structures that can support the bearing surface more than adequately. Loading in excess of 30,000 PSI can be tolerated in many situations, provided the design and the conditions of service are fully outlined and analyzed by a Daemar bearing specialist. Fatigue is not a limiting factor in the use of Fiber-Lube™ bearings. Frequent laboratory test have shown that the bearing is often more fatigue-resistant than the shaft.



Bearing Wear

During the initial break-in period of a Fiber-Lube™ bearing, a transfer film is created on the mating surface. In some operations, as much as 0.001" of wear may occur during this period, while in other operations, break-in wear may be negligible. For more detail on the break-in period and the mechanism by which each bearing achieves sufficient film transfer, refer to the respective product inserts.



Test Conditions

Bearing: 1.5” Bore x 0.75” Wide
Wear Surface: 4140 Steel
5-8 Microinch Ra 50-55 Rc
Test Conditions: 22,500 lbs
Radial Load (20,000 lbs)
50 Degree Oscillation Angle
50 Cycles Per Minute