RBC® BEARINGS

MAINTENANCE-FREE SELF LUBRICATING BEARINGS

Many factors affect the overall performance of Fiberglide®/Fabroid® bearings. Those of primary concern include applied load, surface velocity, operating mode, surface temperature, mating surface finish and running clearance.

All performance values referred to in this section are based on dry operation. When running in a fluid atmosphere, Fiberglide®/Fabroid® bearings may have limitations. Where application requirements exceed those shown, consult Transport Dynamics engineering department for specific recommendations.

Fiberglide®/Fabroid® lined bearings are designed to be used under oscillating motion, interrupted start-stop, impact loading or axial motion. They are recommended where high loads, are combined with low surface speeds.

DESIGN CALCULATIONS

(journals-oscillating motion) CPM=cycles per minute

Proj. Area (sq.in.) = Shaft Dia. Max (or Nom. I.D.) x length

P Pressure (psi) = Load (Lbf) ÷ by Proj. Area

$$V.\ Velocity\ (FPM) = \frac{Shaft\ Dia.\ Max \times \pi}{12} \times \frac{4 \times osc.\ Angle^\circ \times CPM}{360}$$

BEARING WEAR

Bearing wear is affected by many factors. For the most part, tests conducted by Transport Dynamics subject journal bearings to 20,000 psi loads with the bearing fixed and the shaft oscillating. The values shown in the charts on page 21 are representative of the normal wear rate range that can be expected when amplitude is ±45°, frequency is 10 CPM, and shaft finish is 16 RMS under room temperature conditions.

It will be noted that a wear-in period takes place during the first few thousand cycles. During this period some PTFE is transferred to the mating surface. In addition, the fibers are generally reoriented, the high points of the weave are flattened and adjacent fibers tend to blend together. After the break-in period, the bearing surface will become smooth and shiny.

Because of the many variables which influence wear, it is extremely difficult to project bearing life for all types of applications. For this reason, the Transport Dynamics engineering department should be consulted when questions of this nature arise. Wear life calculations are based on rubbing distance of travel.

BEARING LOAD LIMITS *(Standard Fiberglide®/Fabroid®)*

Static Pressure Limit (Constant pressure*)

10,000 (70Mpa) psi with phenolic backing
38,000 (262 Mpa) psi with steel backing

Dynamic pressure limits while oscillating

20,000 psi (140 Mpa) suggested maximum with steel backing.

VELOCITY LIMIT

Under dry running conditions, the maximum allowable surface velocity will depend on the applied load and other operating parameters. In general, surface speed should be kept below 35 FPM (Feet Per Minute) (11 m/min) at 10,000 psi (70 Mpa) load or 600 FPM (183 m/min) at 100 psi (.7 Mpa) load.

PV FACTOR

For plain, dry-running bearings, it is often helpful to reference a pressure-velocity (PV) factor as a guide in determining bearing capability. It should be understood that this factor is actually a variable which reflects the point where surface temperatures are at a maximum, but are still stable. The maximum PV established for Fiberglide®/Fabroid® is:

PV continuous-50,000
PV intermittent-150,000

TEMPERATURE LIMIT

Normal operating temperatures should be kept below 300°F (149° C) for standard Fiberglide®/Fabroid® bearings. An increase in wear rates may be experienced at temperatures above 350°F (177° C). Note that at elevated operating temperatures, the PV limit will be decreased in order to prevent the surface temperature from exceeding 300°F (149° C), (environmental temperature plus friction heat generated). When temperatures exceed 300°F (149° C) or fall below -200°F (-129° C), consult Transport Dynamics engineering department for specific recommendations.

COEFFICIENT OF THERMAL EXPANSION

When bonded to a metal backing, Fiberglide®/Fabroid®'s coefficient of expansion can normally be regarded as identical to that of the backing, with steel backing 8.4 x 10^{-6} in/in/°F.

MATING SURFACES

Fiberglide®/Fabroid®, being non-metallic, will operate against most metals, but better performance is obtained with the hardest available mating surfaces. Hardened steel, hard anodized aluminum, hard chrome or nickel plate are recommended. A surface hardness of 45-50 R_c is desirable, but satisfactory performance can also be obtained with softer materials. Generally, a surface finish on the mating components of 16-32 μ inch (0.4-0.8μm) should be provided. Shaft materials or surface treatments should be selected that will effectively resist corrosion.

To determine the approximate reduction in life for different values of shaft finish and hardness, see below.

SURFACE FINISH μ in. / μ m	LIFE FACTOR
8-16/0.2-0.4	1.00
32/0.8	0.55
63/1.6	0.20

HARDNESS Rockwell Reading	LIFE FACTOR
R_C 50	1.00
R_C 40	0.60
R_C 30	0.40

*Where repeated impact loading is applied, these values should be reduced to meet fatigue life requirements.

COEFFICIENT OF FRICTION

Coefficient of friction depends upon type of movement, finish of mating surface, ambient temperature, bearing pressure, velocity and other variables. Figs. 1, 2, and 3 were obtained from flat specimens and may be used as a guide. Note in Fig. 1 that the coefficient drops off as bearing load increases. This offers the advantage of using the smallest bearing sizes to obtain the least amount of friction. Fig. 3 shows the coefficient of friction increasing as surface velocity increases from 2-20 FPM (0.6-6.1m/min.)

CONTAMINATION

Fiberglide®/Fabroid® can tolerate small amounts of dirt, but reduced bearing life will result. Optimum life is achieved if dirt or abrasive particles are excluded. If a dirty environment is likely, we recommend installation of a simple seal.

RUNNING CLEARANCE

As a general rule, close running fits, and often slight interference fits (.0005 in., .013 mm) are selected for oscillating motion when minimum starting torque is less important than the elimination of free play. For constant rotation, a free-running fit is normally recommended, the exact amount depending on bearing bore size. A rule of thumb would be 0.0015 inches per inch (.038 mm) of bore (bearing installed).

BEARING HOUSING & SHAFT SIZING

Standard Fiberglide®/Fabroid® journal bearings (CJS/CJT/CJM/CJH/SJS Type) are installed into the housing bore using a press fit. Recommended housing bores should be held to the tolerance shown to insure the proper fit and size.

The LJS Type bearing is hand slip fit into its recommended housing bore to provide optimum fit-up. CJS/CJT/CJM/CJH types can also be provided for slip fits on special order.

Transport Dynamics offers a free service to properly recommend housing and shaft sizes for each new application. Contact Transport Dynamics engineering department for details.

FLUID COMPATIBILITY

Fiberglide®/Fabroid® can tolerate most fluids or contaminants found in bearing applications, although some reduction of dry bearing life will result. Fluids tend to flush PTFE solid particle lubricants out of the bearing. Grease tends to act as a magnet to attract and retain dirt. Following are some of the environments in which these bearings have operated successfully:

Hydraulic Oils	Ammonium hydroxide
Mild acids	Liquid Nitrogen
Greases	Seawater
Gasoline	Toluene
Lubricating oils	Kerosene
Detergent solutions	Water

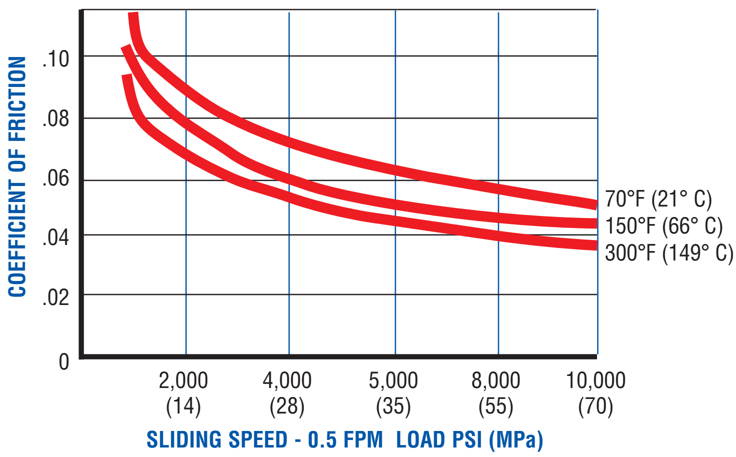


Fig. 1
Effect of load and temperature on Fiberglide® bearing

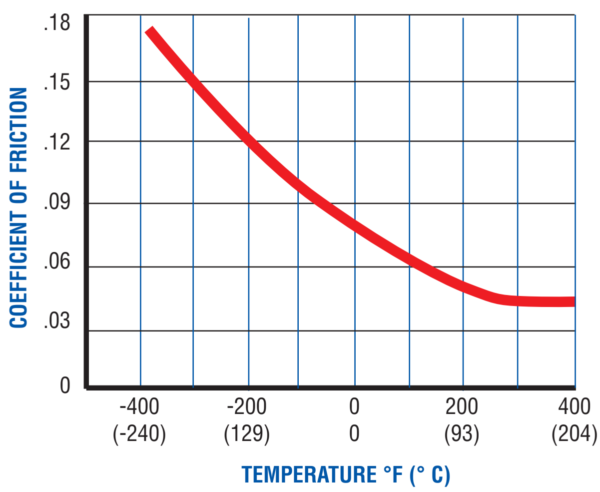


Fig. 2
Effect of temperature on coefficient of friction

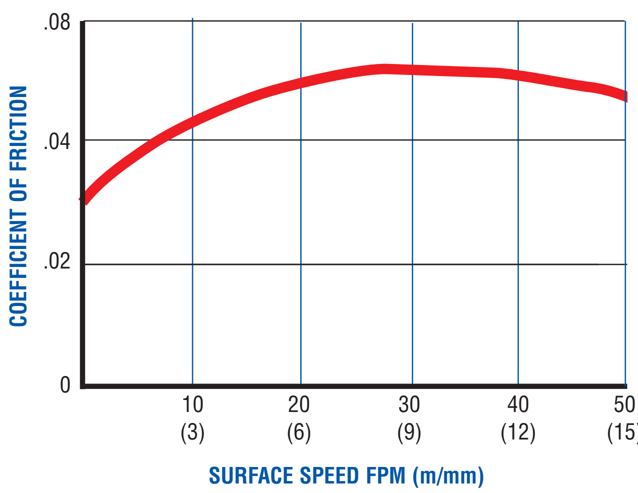


Fig. 3
Coefficient of friction at 10,000 psi. (70 MPa)
Normal unit load and 70°F (21°C) vs. surface speed

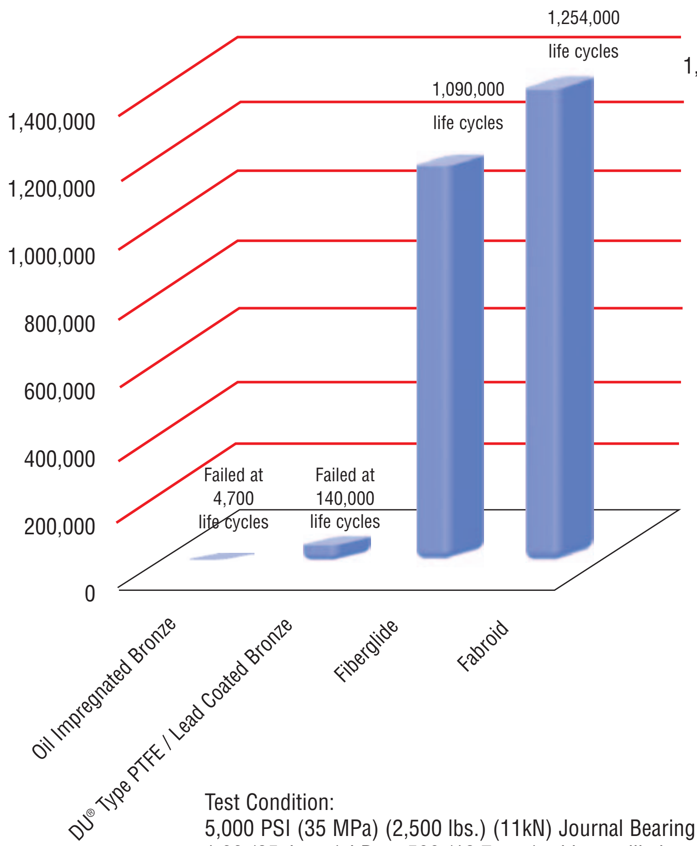
COMPARATIVE TESTING RESULTS

Tests were conducted to compare the load carrying capability and wear life of four standard self-lubricating bearing products. Transport Dynamics performed all testing on the same test machine and fixturing. Standard Fiberglide® and Fabroid® products are presented herein. Transport Dynamics offers other self-lubricating bearing products capable of dynamic loading to 40,000 psi (276 MPa) and ultimate static loading to 120,000 psi (827 MPa).

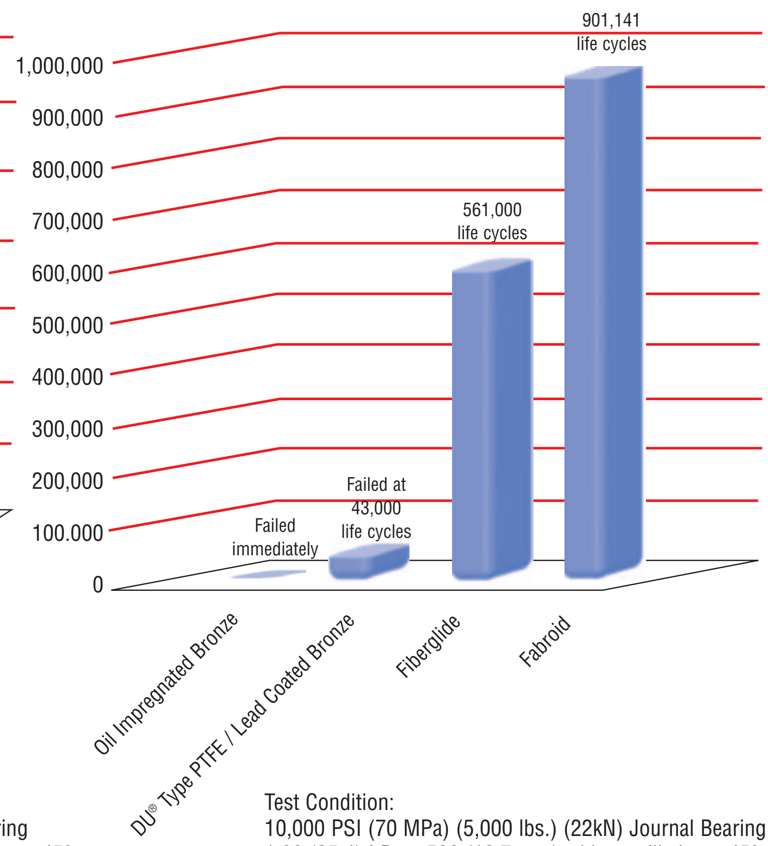
TEST CONDITIONS

The bearings were placed under a fixed load with an oscillating shaft. The test bearing size was 1.00 inch (25.4 mm) I.D. by .500 inch (12.7 mm) long. The test conditions were 10,000 psi (70 MPa) (5,000 lbs) (22kN) and 5,000 psi(35 MPa) (2,500 lbs) (11 kN) loads with an oscillation of ±45 degrees and 30 cycles per minute at room temperature. Approximately every 10,000 cycles, the bearings were removed and inspected for wear.

Industrial Bearing Life Testing
Cycles to Failure vs. Bearing Type



Test Condition:
5,000 PSI (35 MPa) (2,500 lbs.) (11kN) Journal Bearing
1.00 (25.4 mm) I.D. x .500 (12.7 mm) wide; oscillation ± 45°
30 CPM. Room Temperature.



Test Condition:
10,000 PSI (70 MPa) (5,000 lbs.) (22kN) Journal Bearing
1.00 (25.4) I.D. x .500 (12.7 mm) wide; oscillation ± 45°
30 CPM. Room Temperature.

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RBC® BEARINGS

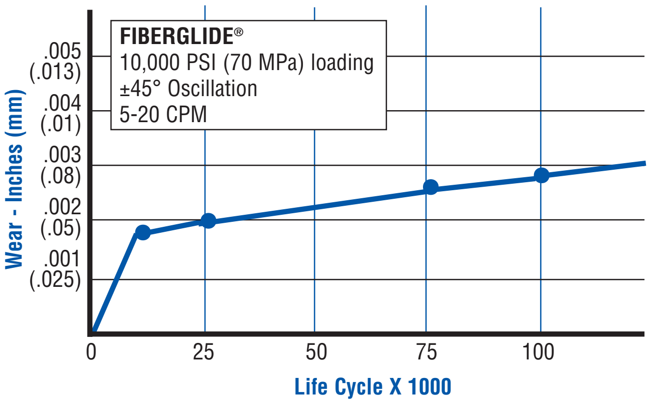
COMPARATIVE TESTING RESULTS

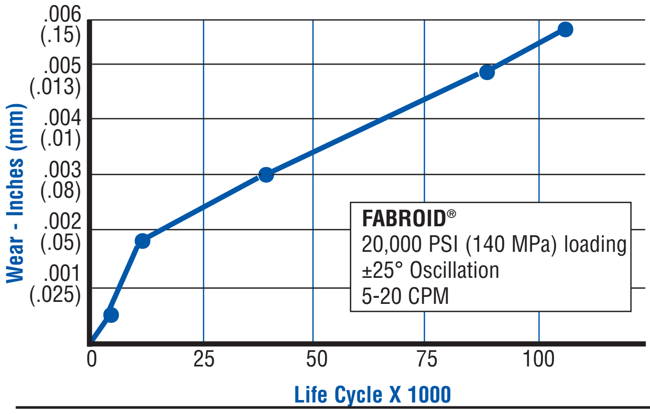
Fiberglide®/Fabroid®

The graph below depicts typical wear curves for two types of self-lubricating liner materials; Standard Fiberglide® and Fabroid®. The standard Fiberglide® material is suitable for most applications and significantly outperforms other bearing types. But, should your application include extraordinarily high static and/or dynamic loads, extreme temperatures, or chemical resistance requirements, Transport Dynamics manufactures a variety of liner materials and backing for critical service applications.

A Comparison of Fiberglide® and Fabroid® Bearings with Other Self-Lubricating Types

	METAL-BACKED Fiberglide®	METAL-BACKED FABROID®	FILLED PTFE	PTFE IMPREG-NATED BRONZE	OIL IMPREG-NATED BRONZE
TYP. DYNAMIC LOAD (psi)	2,000 TO 10,000 (14 TO 70 MPa)	5,000 TO 20,000 (34 TO 140 MPa)	0 TO 500 (0 TO 3.4 MPa)	500 TO 3,000 (3.4 TO 21 MPa)	100 TO 2,000 (.7 TO 14 MPa)
MAX. STATIC LOAD (psi)	38,000	60,000 (1)	10,000	20,000	11,000
MAXIMUM PV VALUE	50,000	60,000	10,000	50,000	50,000
TEMPERATURE RANGE (°F) (C°)	-320 (-195) +300 (145)	-320 (-195) +400 (204)	-400 (-240) +500 (260)	-320 (-195) +500 (260)	-65 (-54) +250 (121)
CHEMICAL RESISTANCE	GOOD	EXCELLENT	EXCELLENT	FAIR	POOR
MINIMUM COEFFICIENT OF FRICTION	.04	.03	.02	.03	.05





(1) FOR LOW SPEED OSCILLATING CONDITIONS - static loads over 38,000 PSI (262 MPa) or dynamic loads over 20,000 psi (140 MPa) require metal backing of high strength stainless steel or equivalent materials.

Transport Dynamics is the originator, innovator and leader in self-lubricating bearing technology with over fifty years of material development and application experience. The original Fabroid® Liner System was patented in 1958. Evolution in the development of materials has created three generations of self-lubrication liner technology.

Today's materials represent a significant advance in technology and their increased capabilities offer solutions in applications previously judged to be borderline or beyond material capability. **Contact Transport Dynamics engineering department for a detail publication of all our l iner systems. Request Engineering Bulletin #106, Bearing Design Guide.**