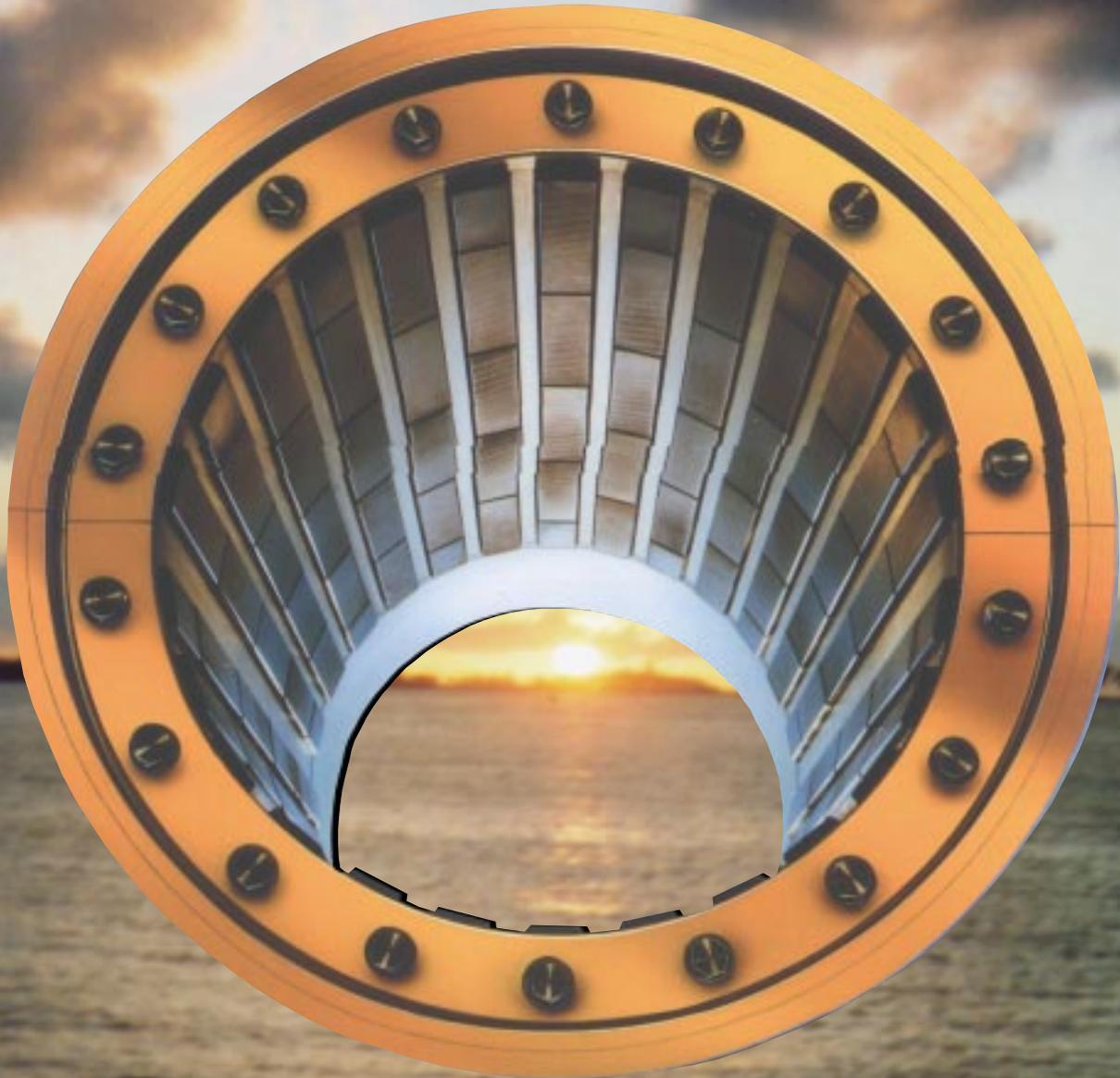


Simsite®
PERMALUBE®
BEARINGS



Sims

PERMALUBE® BEARINGS



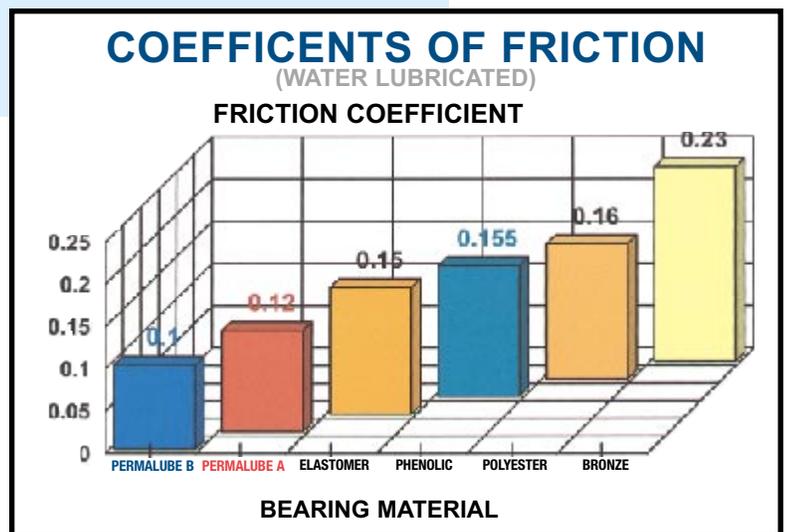
Permalube® High Performance Bearings

Permalube® is the name of a range of high quality, high performance, structural composite guide bearings. Permalube® Bearings are uniquely different from any other bearings on the market. They are significantly superior to other guide bearings because they are a structural composite offering rigidity to the rotating element as well as self-lubricating qualities without galling or seizing on the shaft. Permalube® Bearings are precision machined, which insures maximum longevity because the load of the shaft is equally distributed over the length of the bearing.

The following are just some of the highlights of Permalube bearings:

PERMALUBE® BEARINGS HAVE A LOW COEFFICIENT OF FRICTION:

Permalube® Bearings have an extremely low coefficient of friction, because they have graphite and PTFE embedded throughout the composite. Graphite and PTFE are excellent lubricants which gives Permalube® its self-lubricating qualities. When lubricated by water, oil, or grease, Permalube® is ideal for use as guide bearings, rudder bearings, stern tube bearings, oil seal bearings, and stabilizing bearings.



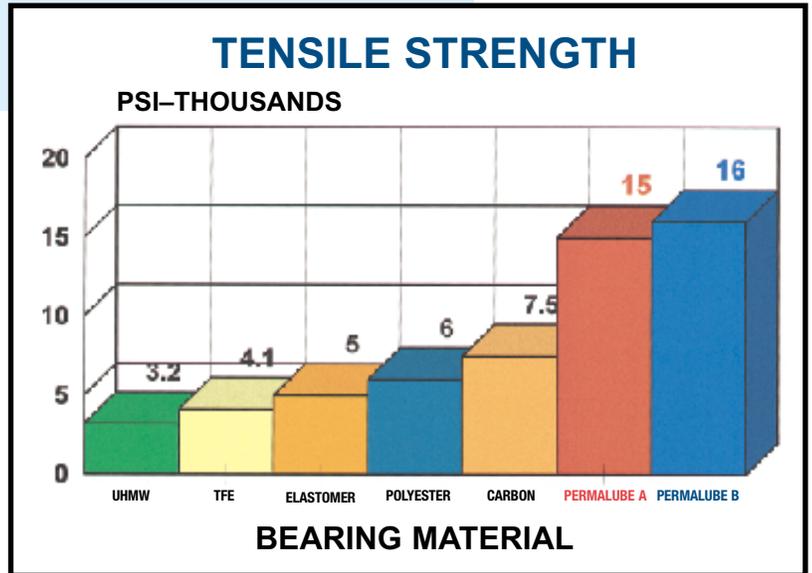
PERMALUBE® BEARINGS WILL NOT FAIL OR SEIZE ON A SHAFT:

In the event that lubrication is suddenly cut off from the bearings, Permalube® Bearings will not melt or seize on

the shaft like plastic or elastomer bearings. Permalube® Bearings can withstand dry running for a period of time before the clearances will start to open up, but the bearings will never completely fail. This has saved the life of many rotating elements.

PERMALUBE® BEARINGS HAVE HIGH MECHANICAL STRENGTH

The unusually high mechanical strength gives Permalube® Bearings many advantages over conventional bearings. Permalube® Bearings are not poured or molded, rather, they are precision machined from a solid bar of Permalube® material. Because the fibers in Permalube® are not chopped up or cut, Permalube® Bearings have a much higher shear strength, bond strength, flexural strength, and tensile strength. Permalube® Bearings will not crack or break like carbon bearings. The high mechanical properties enable the bearings to withstand higher loads and torque requirements.



PERMALUBE® BEARINGS CAN WITHSTAND HIGH TEMPERATURES:

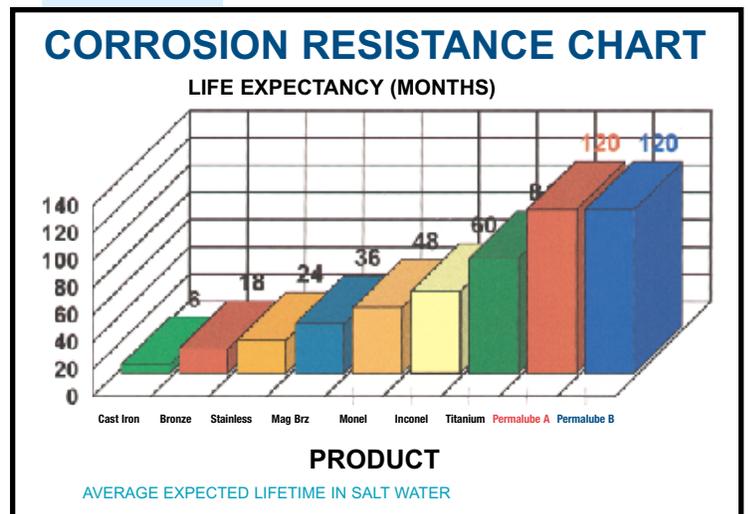
Permalube® Bearings can withstand extremely high flash temperatures (1000 Deg. F.) and continuous running temperatures of 300 degrees F. Because of this unique quality Permalube® will not melt, get spongy or soft, or seize on the shaft. Other bearing materials such as thermoplastics, rubber and elastomers cannot take flash temperatures and will literally melt on the shaft if they see any dry running at all.

LONGER LIFE FOR THE ROTATING ELEMENT WITH PERMALUBE® BEARINGS:

Because Permalube® Bearings hold the shaft more securely than conventional guide bearings, radial movement in the shaft is reduced. This increases the life of the entire rotating element, especially bearings, mechanical seals and wear rings. When Permalube® Bearings are installed with a Permalube® Impeller and Permalube® Casing Rings, the length to diameter requirement of the rotating element is substantially changed by lowering the impeller mass and by increasing the stability (support) of the rotating element.

CORROSION, EROSION & ELECTROLYSIS PROBLEMS ARE ELIMINATED WITH PERMALUBE® BEARINGS:

Since Permalube® is basically an inert composite, electrolysis is greatly reduced. Additionally, Permalube® Bearings seal against the casing or bearing housings, which prevents leakage and therefore eliminates corrosion and erosion damage. This is critical because it insures that the bearings will be secured properly in the casing or housing, eliminating the risk of severe damage to the entire rotating element.



PERMALUBE® BEARINGS REDUCE SHAFT WEAR:

Wear problems can be overcome by installing Permalube® bearings. Permalube® bearings have graphite as well as PTFE which substantially reduces frictional wear on the shaft. Additionally, the structural fibers in Permalube® offer extremely high anti-galling characteristics. The highly polished surface finish of Permalube® Bearings reduces unnecessary wear on the shaft as well as the bearings.

ABRASION RESISTANCE:

One of the many unique features of Permalube® Bearings is the outstanding resistance to abrasion and its low rate of wear even in adverse conditions. The bearing has the ability to pass abrasive particles across the surface of the bearing into the flushing grooves. The particles do not embed themselves into the bearing surface and therefore cause less shaft wear. Circular flushing grooves can also be machined into the bearings to help pass abrasive particles.

Applications:

Permalube® Bearings are excellent for all applications where bearings are submerged or partially submerged in a liquid or lubricant or where liquid can be piped for lubrication.

Marine:

Propeller shaft bearings for all blue water vessels in stern-tube form or in struts, rudder bearings, or shaft bearings for all vessels with inboard engines including pleasure, fishing, general work boats, dredgers, freighters, naval vessels, and icebreakers.

Permalube® Bearings should be used with all centrifugal pumps in salt-water applications.

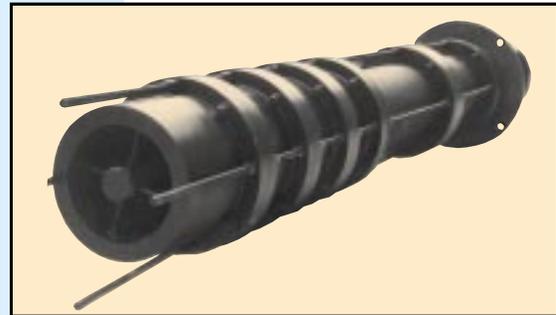
Hydro Bearings:

Stave bearings for water turbines are available in sheet form, strip form and in shorter strip pieces for ease of installation. These bearings can be vertical or horizontal. The precision machining and structural integrity of

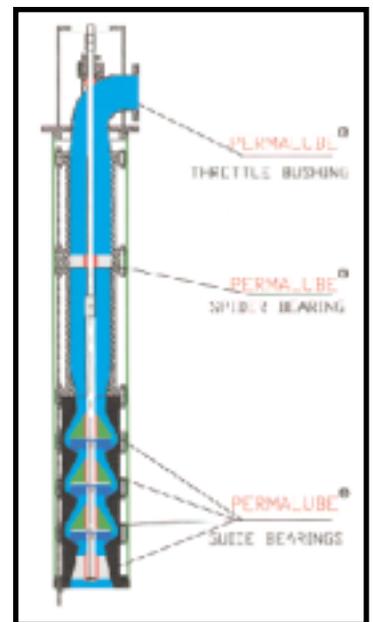
Permalube® Bearing enables high loads to be transmitted over the entire length of the bearing insuring minimum deflection/wear and maximum longevity.

Industrial:

Permalube® Bearings for use in all centrifugal pumps for main intake, river water cooling, water supply, cooling towers, circulation, irrigation, sewerage, crude oil, and water turbines. Additionally, Permalube® Bearings are excellent for bearing applications in conveyors, agitators, mixers, classifiers, and pulp mills.



The above vertical turbine screen wash pump is manufactured with Permalube® Spider Bearings, Throttle Bushing and Guide Bearings. One of the biggest advantages of the Permalube Bearing is its ability to take dry start up until the fluid reaches the bearing to lubricate the surfaces. Permalube® Bearings have graphite and PTFE built into the resin system



to enable these bearings to endure dry running on start-up. This pump was manufactured by the Sims Pump Company for a major power utility company in Maryland.

TECHNICAL DATA:

Load Capacity:

The maximum load, that can be supported by a Permalube® bearing will depend upon the type of loading on the bearing. The highest load capacity will be under steady loads and lowest under dynamic or oscillating loads which produce fatigue stresses on the bearing. Permalube® bearings have maximum load capacity for steady loads of 20,000 psi and 15,000 psi for dynamic or oscillating loads.

Bearing Length:

Bearing length influences the distribution of load along the length of the bearing. A bearing that is heavily loaded and has a long length will, because of shaft deflection have a disproportionately high unit loading at its ends. Therefore a length to diameter ratio (L/D) of greater than 2.0 is not recommended. Conversely, short bearings, those with a (L/D) ratio of less than .25 are not recommended because of potential problems.

Surface Velocity:

Permalube® Bearings can operate over a wide range of operating velocities. They can operate at speeds up to 550 sfpm with a maximum PV value up to and including 20,000 psi-sfpm. The excellent performance is due to the special lubricants built into the composite.

PV Factor:

The PV factor is the product of unit loading times surface velocity. This factor is used as a guide in determining the useful life of the bearings. The maximum PV factor for Permalube® Bearings is excellent with a 20,000 psi-sfpm rating.

Calculation of PV Factor:

PV is the product of “P,” the bearing unit load in psi, and “V,” the rubbing velocity in surface feet per minute (sfpm).

$$P = \frac{\text{Applied Load}}{\text{Projected Area}} = \frac{W}{L \times D}$$

The applied load, W, is the working load in pounds and is assumed to be uniformly applied along the length of the bearing. The projected area is the product of the bearing length, L, and the shaft diameter, D, in inches.

The surface velocity, V, is calculated by using the following formulas:

For Rotating Motion (Steady Loads):

$$V = .262 \times N \times D$$

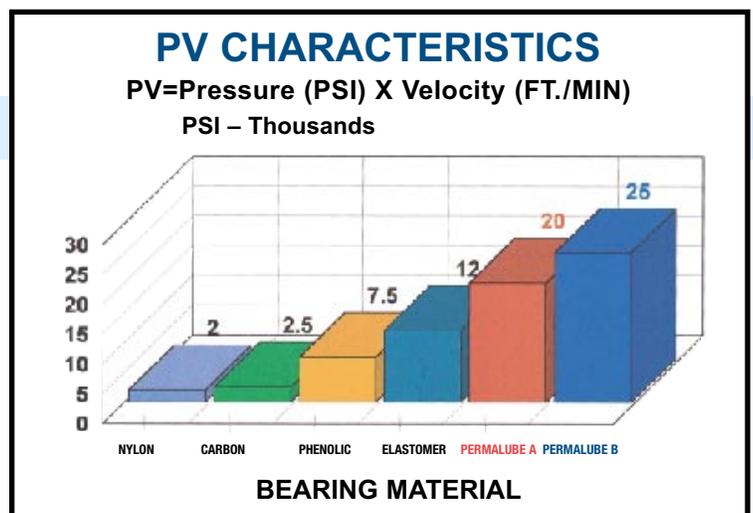
For Oscillating or Dynamic Loads:

$$V = .00291 \times a \times c \times D$$

a = Amplitude in degrees on either side of the mean position

c = Frequency in cycles per minute

n = revolutions per minute



Bearing Sizes:

Avoid thin wall bearings. Bearings with a wall thickness of less than .125 inches should be avoided since thin-walled bearings have reduced load capacity. (Approximately 50% less load capacity than normal rated bearings.)

Avoid long and short bearings. Bearings with a length to diameter ratio (L/D) of greater than 2.0 and less than .25 should be avoided.

Sufficient operating clearances: Proper running clearances are critical for good bearing performance. Dynamic applications involving continuous rotation at higher speeds or elevated temperature applications require additional clearance. All Permalube bearing clearances are set at the factory. (See Installation Instructions)

Shaft Material:

The shaft is an equal part of the bearing assembly. The importance of proper shaft material cannot be overemphasized. Most steel alloys are acceptable as shaft materials. Hardened steel shafts offer better performance in high load applications. Surface finish is also very important. The rougher the surface finish, the shorter the bearing life. A surface finish between 8 to 16 micro inches will insure the most effective bearing performance by assuring maximum bearing wear resistance and the lowest coefficient of friction.

Housing Material:

To insure maximum performance and longevity of the bearing, the bore of the housing should be machined and free of any burrs. It is imperative that the Bearing Housing be machined concentric. After assembly, make sure that the shaft is properly aligned with the motor or driver. All Permalube bearings will be pressed into the housing with an interference fit. (See Chart A)

Lubrication:

Permalube® Bearings can be lubricated with water, salt water, oil, grease, or the liquid being pumped. Liquid lubricants will reduce the coefficient of friction and bearing wear. To insure maximum longevity, the lubricant should be constantly maintained and kept free from abrasive contaminants if possible.

Oil lubricants and greases attract contaminating particles which may shorten bearing life. To minimize bearing contamination, the use of oil or grease seals are recommended.

Chart A

INTERFERENCE FITS

Diameter Of Permalube® Bearing	Recommended Diametrical Interference
1 Inch	.003 Inch
2	.003
3	.003
4	.004
5	.005
6	.006
7	.007
8	.008
9	.009
10	.010
11	.010
12	.010
Above 12 Inches	Consult Factory

Operating Clearances:

Proper running clearance is a critical factor in bearing performance. Clearances are necessary to accommodate swell, thermal expansion, and an adequate liquid lubrication film in the bearing. (See Chart B)

$$\text{Dry Clearance} = (\text{Running Clearance}) + (\text{Housing Interference Fit}) + (\text{Swell Factor}) + (\text{Thermal Expansion})$$

Chart B

PERMALUBE® GUIDE BEARING CLEARANCES

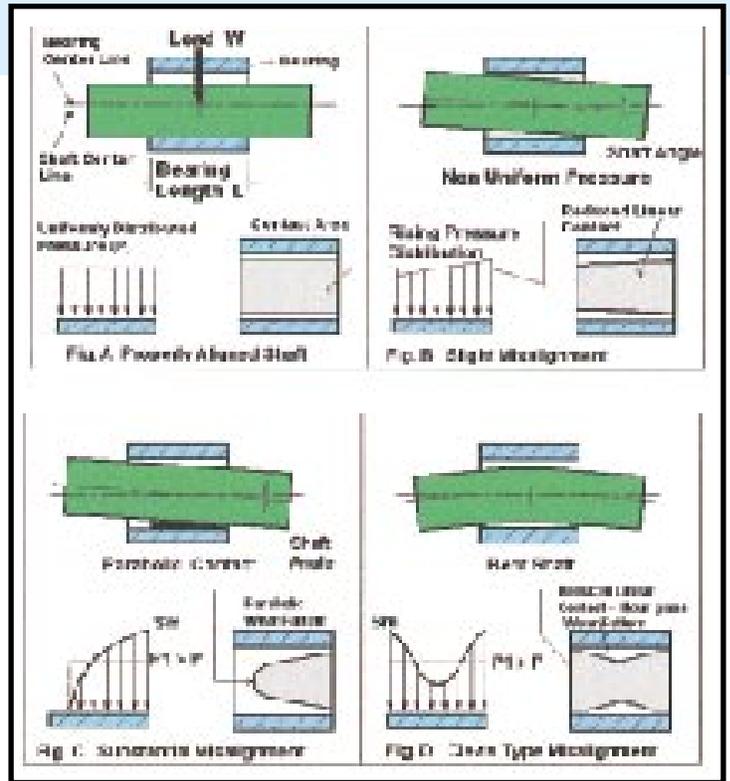
Shaft or Sleeve Diameter	Recommended Diametrical Dry Clearance
1 Inch	.010 Inch
2	.014
3	.016
4	.018
5	.020
6	.022
7	.024
8	.026
9	.028
10	.030
Above 10 Inches	Consult Factory

PHYSICAL PROPERTIES – COMPARISON CHART

Property	Permalube A	Permalube B	Thordon XL	Nylon 6/6	UHMW	TFE	Bronze
Tensile Strength (psi)	15,000	16,000	5,000	11,800	3,255	4,110	35,000
Shear Strength (psi)	10,000	10,500	6,551	10,500	--	--	28,000
PV (Pres. x Vel.)	20,000	25,000	12,000	3,500	2,500	10,000	50,000
Youngs Compressive Modulus (psi)	1,500,000	1,700,000	71,000	350,000	150,000	--	5,600,000
Impact Strength (ft-lbs/in)	3.0	3.0	3.0	6.0	12.05	4.4	40.2
Coefficient of Thermal Expansion (in/in/°C)	1.8 x 10 ⁻⁵	1.7 x 10 ⁻⁵	15 x 10 ⁻⁵	6.5 x 10 ⁻⁵	38 x 10 ⁻⁵	10 x 10 ⁻⁵	1.8 x 10 ⁻⁵
Water Absorption (%)	1.5	1.5	1.3	6.5	0.01	0.03	0
Hardness Rockwell (M)	90	95	73	83	64	60	96
Coefficient of Friction	.12	.10	.15	.18	.14	.22	.23
Maximum Operating Temperature (°F)	250	300	225	300	180	500	212
Specific Gravity	1.3	1.38	1.21	1.14	0.9	2.17	8.83

Misalignment:

Alignment is a critical factor in bearing longevity. Bearings operating with correct shaft alignment have a uniform loading distribution along the length of the bearing. Shaft misalignment reduces the contact area and shifts the bearing loading (pressure) distribution to one end of the bearing as seen in figure (b). When there is substantial misalignment, the contact area is reduced to one end of the bearing forming a parabolic wear pattern in the bearing as shown in figure (c). When the edge pressure produces stresses that approach or exceed the compressive strength of the material (30,000 psi) crushing will occur causing extreme wear of both the bearing and the shaft. Figure (d) shows the shaft deflection of a bent shaft and the hourglass wear pattern on the bearing.



SIMSITE® PERMALUBE® BEARINGS., another innovative product of **Sims Pump Valve Company**, specializes in marine and industrial guide bearings for rotating equipment.

A tradition of innovation continues

Sims has been delivering new ideas in pump and bearing technology for more than 75 years. From the invention of the original Sims Pump Valve in 1919 through the development of totally non-metallic Simsite Pumps today, Sims has been an innovator in marine and industrial pump applications. The Permalube/Sims' guarantee of customer satisfaction stands firmly behind each of its products and services.

Other outstanding Simsite Products include impellers, casing rings, complete pumps, and various structural and decorative applications. We are ready to help you save time, money and valuable equipment with Simsite Products. Contact our engineering department for full details. .. because you **can** achieve the ideal!

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